THE PATENT TERM RESTORATION ACT OF 1981—S. 255

FILE COPY

HEARING

BEFORE THE

COMMITTEE ON THE JUDICIARY
UNITED STATES SENATE

NINETY-SEVENTH CONGRESS

FIRST SESSION

ON

S. 255

A BILL TO AMEND THE PATENT LAW TO RESTORE THE TERM OF THE PATENT GRANT FOR THE PERIOD OF TIME THAT NON-PATENT REGULATORY REQUIREMENTS PREVENT THE MARKETING OF A PATENTED PRODUCT

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THE PATENT TERM RESTORATION ACT OF 1981—S. 255

THURSDAY, APRIL 30, 1981

U.S. SENATE,
COMMITTEE ON THE JUDICIARY,
Washington, D.C.

The committee met, pursuant to notice, at 9:30 a.m., in room 2228, Dirksen Senate Office Building, Senator Charles McC. Mathias, Jr. (acting chairman of the committee) presiding.

Also present: Senators Thurmond, Specter, and Grassley.

Staff present: Ralph Oman, staff director, and Charles Borden, professional staff member, Subcommittee on Criminal Law; Peter Chumbris, chief counsel for antitrust; Eric Hultman, counsel for Senator Thurmond; Burt Wides, counsel for Senator Kennedy; Joel Mandelman, counsel for Senator Simpson; Ally Milder, counsel for Senator Grassley; and Linden Heck, counsel for Senator Laxalt.

OPENING STATEMENT OF SENATOR CHARLES McC. MATHIAS, JR.

Senator MATHIAS [acting chairman]. The committee will come to order.

Today the Judiciary Committee will be hearing testimony on the Patent Term Restoration Act of 1981, S. 255. This is a bill attempting to set straight a serious problem in the patent system by extending the life of a patent up to a maximum of 7 years to compensate for the time lost while the new product clears all tests required by the Federal Government.

Under current law, the Government grants a 17-year patent, but then in some cases prohibits the product from being marketed until all tests are completed. During this time, the life of the patent is ticking away, often over a period of many years.

The pharmaceutical drug industry and the chemical industry are particularly hard hit by this circumstance. I am pleased that we have representatives from both of them with us today to describe the problem.

Of course, we also wish to make the views of their regulatory counterparts a part of the record. Dr. Edwin H. Clark from the Environmental Protection Agency will speak on the first panel. I have asked the Food and Drug Administration, a part of the Department of Health and Human Services, to submit a written statement which will be included in the record as part of the testimony.

The FDA testified at the House hearings on patent restoration in Representative Waxman's Health Subcommittee hearing earlier

this month. I thought it would be useful to mention a development in this area, since that particular session.

Two weeks ago, Secretary Schweiker announced that he will endorse the objectives of the patent restoration bill to help innovative pharmaceutical companies to recover the investment they make in developing new therapies and to correct disincentives to innovative research.

In the past 15 to 20 years, we have enacted several important laws to require the thorough testing of products in the areas of public health and the environment.

Gradually, as tests became more and more sophisticated, the time needed to clear the review has grown. In 1962, for example, it took approximately 2 years and $6 million—if you want to translate 1962 dollars to 1980 dollars, that would be about $15 million today—to bring a new medicine from the laboratory to the American consumer.

It now takes an average of 7 to 10 years and about $70 million to complete this testing period. Some drug products lose up to half of their patent life before reaching the public. Similarly, the Environmental Protection Agency has estimated that the patent life for chemical products has been reduced to about 12 years.

While the testing periods have grown, unfortunately, the speed or tempo of the country's innovation has declined. In the 20-year period between the midfifties and the midseventies, expenditures on research and development in the United States more than quadrupled, while the frequency of new discoveries was actually cut in half—a paradox.

Between 1963 and 1975, the percentage of medicine and drug patents worldwide that originated in the United States declined from 66 percent to 54 percent. Although over 1,000 new chemical agents were submitted for testing in the United States between 1963 and 1975, only 59 were ultimately marketed.

The committee wants to hear today about the impact this prolonged testing period has had on innovation and investment. The proposal that we are examining could, I think, help restore some research incentives.

I think the committee will be particularly anxious to hear the testimony of the small businesses. It has been well-documented that small businesses are the most innovative segment of the economy and the most dependable source of new jobs for our workers. These companies are most in need of the full protection of the patent system, especially when they first enter the market with very little more than a promising idea.

To raise investment capital, they need full patent coverage.

This bill is intended to help these innovative companies provide the new products and jobs that are so desperately needed by the public.

Another issue that came up in the House hearings, and that we hope will be fully discussed, is the treatment of applications by drug companies for approval of generic forms of previously approved drugs.

When Secretary Schweiker announced support for patent restoration legislation on April 16, he also said by way of a trade off that the FDA will resume its policy of approving applications to

manufacture generic versions of already marketed drugs without requiring a repetition of the testing process that the original drug went through.

I am sure that the committee will be interested to hear the generic drug industry representatives discuss this change and to get their estimate of how it will affect their appraisal of S. 255.

I regret that the unavoidable time restraints have limited both the number of witnesses and the length of testimony. I want to assure everyone that even if you do not have an opportunity to read every word and every line of your statements, the statements will in fact be printed in full in the record.

The committee will keep the record open for a period of 2 weeks for the submission of additional information.

With that understanding, I want to remind all of the witnesses that the 5-minute rule is going to have to be in effect this morning. The lights will give you an indication.

When it is green, open the throttle all the way. When it is yellow, start applying the brakes. We will have to ask you to stop when the red light comes on. We will be very impartial on that.

My colleague on this committee, Senator Denton, who is a cosponsor of the bill, has asked me to convey his regrets that he is not here this morning. Of course, he is fully supportive of this bill.

We also have a slight change in the order of the printed witness list, which is necessary because of a prior commitment.

Lewis Engman, president of the Pharmaceutical Manufacturers Association, will begin. He will be followed by a panel of representatives from the Department of Commerce and EPA.

I will now yield to the distinguished chairman of the Judiciary Committee, the Senator from South Carolina.

OPENING STATEMENT OF SENATOR STROM THURMOND

Senator THURMOND. Thank you, Mr. Chairman.

I want to commend you for holding this hearing on S. 255, the Patent Term Restoration Act of 1981, introduced by yourself and of which I am a cosponsor.

The purpose of this legislation is to amend the patent laws to restore the term of a patent that is consumed by nonpatent regulatory requirements.

In recent years, it has become painfully obvious that America's incentive to innovate has been substantially reduced. This has had a significant and negative impact on our economy, forcing us to look beyond our shores for advances in science and technology.

The problems engendered by an antiquated patent application examination system, the enormous costs incurred by patent holders in defending their patents against infringement, as well as the added burden of regulatory requirements unrelated to the patent-seeking process, have all contributed significantly to this reduced incentive.

An increasing number of laws have been passed by the Congress to ensure that new products are safe for public use and consumption. Certain regulatory agencies have the responsibility for administering these laws. For example, new patented—as well as nonpatented—pharmaceutical and chemical products must undergo testing and examination by the Food and Drug Administration.

If there is an anticipated impact on the environment, then the Environmental Protection Agency must insure that health and safety requirements are met before commercial marketing.

Since the submission of a new product for testing and examination to a regulatory agency usually occurs after the issuance of a patent, the time required for review is running against the 17-year life of the patent. This time may be as much as 5 or 7 years, or even longer. The review, although necessary, is often unrelated to patent acquisition and severely limits the time available during the period of patent protection to market the product.

It is no wonder that American companies have been and continue to be reluctant to allocate funds necessary for the research and development of new products.

Fifteen years ago, the number of new pharmaceutical entities introduced into the marketplace averaged 42 per year. Today that number has fallen sharply to only 16 per year, down 62 percent.

While American companies continue to show a decline in new research funding, their foreign competitors are making great strides. For example, West Germany and Japan, which do not have intensive review procedures for patents, are increasing funds for research.

To further illustrate the seriousness of the overall decline in American incentive, consider that today U.S. patents issued to foreign inventors are approximately 35 percent of the total U.S. patents issued. Ten or fifteen years ago, foreign patentees received around only 20 percent of patents issued to foreign inventors.

Mr. Chairman, it is imperative that Congress take immediate action to remedy this situation and help restore the incentive to innovate which has made America the most technologically advanced Nation on Earth. This bill will go a long way toward reinstituting that incentive.

S. 255 restores to the life of a patent that amount of time, up to a maximum of 7 years, required for Government review of a new product. It in no way restricts the Government's ability to test the safety or suitability of a product. It does give the patent holder the full 17-year life of his patent within which to market the product after having undergone regulatory review and having received approval.

It goes without saying that increasing the incentive for American companies to invest in the research and development of new products results in many benefits to our ailing economy. More consumer dollars will be kept at home and the number of jobs available will increase.

This legislation is extremely important to America's capacity to not only keep pace with but restore us to our leadership role in the world in the advancement of science and development of new technology.

Mr. Chairman, I have another meeting. I will ask you to excuse me at this time. I thank you very much.

Senator MATHIAS. Thank you very much, Senator Thurmond, for your statement and the support you have given to this legislation already.

At this point, before we begin with the first witness, I will place S. 255 in the record.

[The bill along with agency views follows:]

II

97TH CONGRESS
1ST SESSION

S. 255

To amend the patent law to restore the term of the patent grant for the period of time that nonpatent regulatory requirements prevent the marketing of a patented product.

IN THE SENATE OF THE UNITED STATES

JANUARY 27 (legislative day, JANUARY 5), 1981

Mr. MATHIAS (for himself, Mr. ROBERT C. BYRD, Mr. THURMOND, Mr. PERCY, and Mr. DECONCINI) introduced the following bill; which was read twice and referred to the Committee on the Judiciary

---

A BILL

To amend the patent law to restore the term of the patent grant for the period of time that nonpatent regulatory requirements prevent the marketing of a patented product.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Patent Term Restoration Act of 1981".

SECTION 1. Title 35 of the United States Code, entitled "Patents" is amended by adding the following new section immediately after section 154:

"§ 155. **Restoration of patent term**

"(a)(1) Except as provided in paragraph (2), the term of a patent which encompasses within its scope a product, or a method for using a product, subject to a regulatory review period shall be extended by the amount of time equal to the regulatory review period for such product or method if—

"(A) the owner of record of the patent gives notice to the Commission in compliance with the provisions of subsection (b)(1);

"(B) the product or method has been subjected to a regulatory review period pursuant to statute or regulation prior to its commercial marketing or use; and

"(C) the patent to be extended has not expired prior to notice to the Commissioner under subsection (b)(1).

The rights derived from any claim or claims of any patent so extended shall be limited in scope during the period of any extension to the product or method subject to the regulatory review period and to the statutory use for which regulatory review was required.

"(2) In no event shall the term of any patent be extended for more than seven years.

"(b)(1) Within ninety days after termination of a regulatory review period, the owner of record of the patent shall notify the Commissioner under oath that the regulatory

review period has ended. Such notification shall be in writing and shall:

"(A) identify the Federal statute or regulation under which regulatory review occurred;

"(B) state the dates on which the regulatory review period commenced and ended;

"(C) identify the product and the statutory use for which regulatory review was required;

"(D) state that the regulatory review referred to in subsection (a)(1)(B) has been satisfied; and

"(E) identify the claim or claims of the patent to which the extension is applicable and the length of time of the regulatory review period for which the term of such patent is to be extended.

"(2) Upon receipt of the notice required by paragraph (1), the Commissioner shall promptly (A) publish the information noticed in the Official Gazette of the Patent and Trademark Office, and (B) issue to the owner of record of the patent a certificate of extension, under seal, stating the fact and length of the extension and identifying the product and the statutory use and the claim or claims to which such extension is applicable. Such certificate shall be recorded in the official file of each patent extended and such certificate shall be considered as part of the original patent.

"(c) As used in this section:

"(1) The term 'product or a method for using a product' means any machine, manufacture, composition of matter or any specific method of use thereof for which United States Letters Patent can be granted and includes the following or any specific method of use thereof:

"(A) any new drug, antibiotic drug, new animal drug, device, food additive, or color additive subject to regulation under the Federal Food, Drug, and Cosmetic Act;

"(B) any human or veterinary biological product subject to regulation under section 351 of the Public Health Service Act or under the virus, serum, toxin, and analogous products provisions of the Act of Congress of March 4, 1913;

"(C) any pesticide subject to regulation under the Federal Insecticide, Fungicide, and Rodenticide Act; and

"(D) any chemical substance or mixture subject to regulation under the Toxic Substances Control Act.

"(2) The term 'major health or environmental effects test' means an experiment to determine or evaluate health or environmental effects which requires at

least six months to conduct, not including any period for analysis or conclusions.

"(3) The term 'statutory use' means all uses regulated under the statutes identified in sections (c)(4)(A)–(D) for which regulatory review occurred for the product involved.

"(4) The term 'regulatory review period' means—

"(A) with respect to a food additive, color additive, new animal drug, veterinary biological product, device, new drug, antibiotic drug, or human biological product, a period commencing on the earliest of the date the patentee, his assignee, or his licensee (i) initiated a major health or environmental effects test on such product or a method for using such product, (ii) claims an exemption for investigation or requests authority to prepare an experimental product with respect to such product or a method for using such product under the Federal Food, Drug, and Cosmetic Act, the Public Health Service Act, or the Act of Congress of March 4, 1913, or (iii) submits an application or petition with respect to such product or a method for using such product under such statutes, and ending on the date such application or petition with respect to such product or a method

for using such product is approved or licensed under such statutes or, if objections are filed to such approval or license, ending on the date such objections are resolved and commercial marketing is permitted or, if commercial marketing is initially permitted and later revoked pending further proceedings as a result of such objections, ending on the date such proceedings are finally resolved and commercial marketing is permitted;

"(B) with respect to a pesticide, a period commencing on the earliest of the date the patentee, his assignee, or his licensee (i) initiates a major health or environmental effects test on such pesticide, the data from which is submitted in a request for registration of such pesticide under section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act, (ii) requests the grant of an experimental use permit under section 5 of such Act, or (iii) submits an application for registration of such pesticide pursuant to section 3 of such Act, and ending on the date such pesticide is first registered, either conditionally or fully;

"(C) with respect to a chemical substance or mixture for which notification is required under

section 5(a) of the Toxic Substances Control Act—

"(i) which is subject to a rule requiring testing under section 4(a) of such Act, a period commencing on the date the patentee, his assignee, or his licensee has initiated the testing required in such rule and ending on the expiration of the premanufacture notification period for such chemical substance or mixture, or if an order or injunction is issued under section 5(e) or 5(f) of such Act, the date on which such order or injunction is dissolved or set aside;

"(ii) which is not subject to a testing rule under section 4 of such Act, a period commencing on the earlier of the date the patentee, his assignee, or his licensee—

"(I) submits a premanufacture notice, or

"(II) initiates a major health or environmental effects test on such substance, the data from which is included in the premanufacture notice for such substance,

and ending on the expiration of the premanufacture notification period for such substance or if an order or injunction is issued under section 5(e) or 5(f) of such Act, the date on which such order or such injunction is dissolved or set aside;

"(D) with respect to any other product or method of using a product that has been subjected to Federal premarketing regulatory review, a period commencing on the date when the patentee, his assignee, or his licensee initiates actions pursuant to a Federal statute or regulation to obtain such review prior to the initial commercial marketing in interstate commerce of such product and ending on the date when such review is completed,

except that the regulatory review period shall not be deemed to have commenced until a patent has been granted for the product or the method of use of such product subject to the regulatory review period. In the event the regulatory review period has commenced prior to the effective date of this section, then the period of patent extension for such product or a method of using such product shall be measured from the effective date of this section.".

DEPARTMENT OF HEALTH AND HUMAN SERVICES
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

OFFICE OF THE GENERAL COUNSEL
LEGISLATION DIVISION

August 18, 1981

The Honorable Charles McC. Mathias, Jr.
United States Senate
Washington, D.C. 20510

Dear Senator Mathias:

In response to your request for our views on S. 255, your bill to extend the life of patents to allow for delays in marketing due to Federal regulatory requirements, enclosed is a copy of the report sent today by the Secretary to the Chairman of the House Committee on the Judiciary.

Sincerely yours,

Donald Hirsch
Assistant General Counsel

Enclosure



THE NATIONAL ASSOCIATION OF MANUFACTURERS
WASHINGTON, D.C. 20062

The Honorable Peter W. Rodino, Jr.
Chairman, Committee on the Judiciary
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

There is pending before your Committee S. 255, a bill "To amend the patent law to restore the term of the patent grant for the period of time that nonpatent regulatory requirements prevent the marketing of a patented product."

In summary, we support the bill. We believe that it corrects an inequity in the patent laws of the United States and is among the initiatives that will help to encourage innovative research and the development and marketing of important inventions pertaining to public health and safety.

The bill would extend the term of a patent grant by a period of time equal to the period during which major health or environmental testing and subsequent procedures before Federal regulatory agencies were undertaken, in accordance with Federal statutes or regulations, but in no event would the patent term be extended for more than seven years.

The patent system was devised by the founding fathers to promote science and the useful arts in a way that was perceived to be in the public interest. At present, the term of a United States patent is 17 years from the date the patent is issued. The patent provides an incentive for innovative research and for the investment of private risk capital to bring an invention to the marketplace by giving the developer and marketer a limited exclusive market position in which to recoup development costs and, if possible, make a profit. The patent incentive is particularly important in the case of new drugs which have a relatively limited market potential but which require extensive and expensive development and testing before the invention can be marketed, to document utility, safety, and efficacy in order to comply with the requirements of Federal statutes and regulations.

Private investors often are unwilling to make the risk capital investment required for the development and marketing of new products without the protection afforded by the patent system. This is particularly true with respect to inventions,

The Honorable Peter W. Rodino, Jr. -- Page 2

including some drugs, where the development costs and risk of failure both are high and the potential market is small. Anything that effectively reduces the term of patent protection reduces incentive for risk capital investment. As a result, some valuable inventions may not be developed and marketed, or their development may proceed slowly. Accordingly, this Department favors legislation that eliminates the inequities of the present system by extending the term of the patent grant to allow for regulatory review. S. 255 appears to effectively accomplish this result. We also believe that a time limit on the extension is appropriate.

In view of the foregoing, we recommend that S. 255 be favorably considered.

We are advised by the Office of Management and Budget that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely,

/s/ Dick Schweiker

Secretary

Senator MATHIAS. We will now proceed to our first witness, Mr. Lewis Engman.

Your entire prepared statement will be made a part of the hearing record, Mr. Engman, and you may proceed.

STATEMENT OF LEWIS A. ENGMAN, PRESIDENT, PHARMACEUTICAL MANUFACTURERS ASSOCIATION

Mr. ENGMAN. Thank you, Mr. Chairman.

My name is Lewis Engman. I am president of the Pharmaceutical Manufacturers Association, which represents some 149 companies which discover, develop, and produce prescription medicines and medical devices.

Our member companies are committed to improving health care by converting new knowledge into better therapy. We are naturally interested in legislation that would make us better able to conduct the increasingly costly and time-consuming research which is necessary to develop new medicines.

For that reason, I appreciate this opportunity to express our support for S. 255, which has been introduced by you and is cosponsored by Chairman Thurmond and 24 other Members of the Senate, both Republicans and Democrats, as well as many members of this committee.

NATURE OF DRUG PATENTS

Mr. Chairman, when a drug firm discovers a promising new chemical compound, the first thing it does before committing itself to the research and development process is to file for a patent. That patent is generally issued within 2 years and immediately begins to expire.

At the time the patent is issued, the innovating firm is far from sure it will ever have a marketable product. For that assurance, it must await final Government marketing approval, an event which may be, and indeed generally is, still some 7 to 10 years away.

For a pharmaceutical company, therefore, a 17-year patent has become merely a legislative figment. In reality, a drug patent has an effective life of roughly half that period. As a result, incentives to invest in pharmaceutical research and development have been substantially reduced.

DECLINE IN INNOVATION

Since 1960, average patent lives for drugs have been cut nearly in half. Inflation-adjusted research investment as a percentage of sales has been similarly reduced.

From the public's point of view, the bottom line is not patent lives. It really is not research investments. It is new medicines. Here, too, the record is disturbing.

In 1960, a $3.5 billion industry with effective patent lives averaging 16 years produced 50 new medicines. In 1980, a $22 billion industry with effective patent lives averaging less than 10 years, produced only 12 new medicines.

The public is the loser, Mr. Chairman. The sick—the people with diseases for which medicines have not yet been developed—have been the real victims of lost patent life.

We believe that the public interest is best served when new therapies become available as rapidly as possible, consistent with good scientific practice.

As I have suggested, for this to happen, incentives to invest in pharmaceutical research and development have to be adequate.

The record shows that scientific research expenditures relative to the volume of medicines sold have been declining.

After adjusting for inflation, the pharmaceutical R. & D. to sales ratio has declined from 12.6 percent in 1962 to 7.9 percent in 1979.

These unfortunate trends are due to several factors:

Risk: It is estimated that about 10,000 drug candidates are synthesized for every 1 that actually gets to market. For every 10 drugs that reach the very expensive and time-consuming clinical testing or IND stage, only 1 is ultimately marketed.

Cost: In 1962, the average cost of taking a new chemical entity from discovery to market approval was $6.5 million in 1962 dollars, or $16.5 million in 1980 dollars. Today that cost is up to $70 million.

Reduced patent life: After a company has taken the risk of investing in a new product, paid the high costs of R. & D., and complied with the lengthy regulatory requirements, the company's new product has a patent life which is only about half as long as Congress originally intended.

The decline in pharmaceutical research and development is a serious problem for society. What can we do to reverse the decline?

One obvious remedy is to reduce the time and cost of getting a new drug to market. Improvements in the approval process should be pursued vigorously.

Last year we recommended a number of changes specifically to FDA on how the drug approval process could be streamlined without compromising safety or efficacy.

NEED FOR PATENT RESTORATION

At the same time that we are proceeding along those avenues, we should be certain that the incentives for innovation are sufficiently attractive. This is what S. 255 addresses.

Patent restoration simply means more incentives for more new products which means more competition. Besides stimulating the discovery of better therapy, patent restoration should exert downward pressure on the prices of new and old products alike.

In the past, significant advances in drug therapy have either treated the previously untreatable or they have replaced much more expensive but less-effective technologies—anti-infectives rather than death or disability; antipsychotic medicines rather than mental wards; Tagamet rather than ulcer surgery; rifampin rather than tuberculosis sanitariums.

If patent restoration encourages the quicker introduction of just one of those types of drugs, it will have been worth it.

That concludes my oral comments. I would be happy to answer the questions of the committee.

Senator MATHIAS. Thank you, Mr. Engman.

RESEARCH-INTENSIVE NATURE OF PHARMACEUTICAL INDUSTRY

What is the characteristic of the pharmaceutical industry that makes patents so important.

Mr. ENGMAN. The pharmaceutical industry is highly research oriented. Substantial expenditures are made for research and development of new drugs, the very thing which the patent law is intended to encourage.

Senator MATHIAS. Let us be frank with each other. There is a public image here. The pharmaceutical industry is making a lot of money and ought to be able to afford research; in fact, it has a duty to do that—a duty to the public.

The last thing in the world you need is something which protects the profitability of the business. I don't say those are the facts, but I am telling you that that is the image, at least held by a certain part of the public.

Mr. ENGMAN. Mr. Chairman, I don't view this legislation as protecting the profits of the industry.

First of all, I think we have to recognize that your bill does not lengthen the patent life of any existing drug or medicine on the market. We are talking about future innovation.

What we are really talking about here is incentives. How do we provide incentives for research and development in our kind of economic system—a market economy.

The framers of the Constitution determined a long time ago that that was best done through a patent system.

The real question is this: Recognizing in inflation-adjusted terms that investment in R. & D. has been declining in the pharmaceutical industry, and recognizing that new medicines are sorely needed, both for currently uncurable diseases as well as to replace more

expensive means of treatment such as surgery and hospitalization, the real question is why should incentives for new medicine research and development be roughly half that afforded the R. & D. for other kinds of products in our economy?

EFFECT OF BILL ON DRUGS FOR RARE DISEASES

Senator MATHIAS. For common ailments, there is an enormous market for any kind of remedy that science has produced. For a headache, there is an almost unlimited market for painkillers of one sort or another.

What about the relatively poor sufferer from some unusual disease—a disease, happily, for which there is not a great incidence and, therefore, not a very large market for the remedies.

How will this legislation affect the availability of remedies for that poor patient who has difficulty in getting what may be a rather exotic medicine or drug because of the fact that there really isn't a very big market for it.

Mr. ENGMAN. That is a very good question, Mr. Chairman. It was the subject of hearings that Chairman Waxman held on the other side of the Hill just a month or so ago.

Basically, the short answer is that this bill will help encourage research and development for the so-called orphan diseases as well.

In those hearings, it was pointed out that very often at the beginning of the innovation and research process, it is not really possible to segregate out the specific ailments which may be addressed by a medicine which may be found down the road.

Initially, there may be general research regarding cardiovascular or other kinds of diseases or whatever, but often a drug which becomes obviously useful for a specific and, in the instance of your question, a so-called rare disease will not become apparent until later.

This legislation, by providing greater incentives for research and development, should improve the situation with respect to orphan drugs, as well as breakthrough drugs.

COMPLUSORY LICENSING

Senator MATHIAS. In that connection, there have been some suggestions by those who have commented on this legislation that it ought to include a compulsory licensing provision, requiring a company that does pioneer a new drug to license competitors with some compensation—perhaps a fixed royalty. What comment would you have on that suggestion?

Mr. ENGMAN. I think it is made without any real understanding of what the effect of the compulsory licensing provision is.

Compulsory licensing leads to exactly the opposite result of what this legislation is intended to do, which is to encourage research and investment and provide greater incentives.

Compulsory licensing provides disincentives.

It has been adopted from time to time in other countries throughout the world. I think the experience in these other countries is instructive. In those countries, it has generally been tied to an abuse of the patent or to nonuse of the patent by the individual originally holding the patent.

The United Kingdom experimented with a compulsory licensing provision specifically directed toward drugs for a number of years. Finally, in 1978—and, I might add parenthetically, before the advent of the Thatcher government—it determined that it wasn't working. On balance, it was hurting research and development and hurting the British public. The United Kingdom repealed this compulsory licensing provision relating to drugs 3 years ago.

Our neighbor to the north, Canada, today has compulsory licensing requirements. I think it is commonly agreed that there is little or no research with respect to new medicines going on there.

FOREIGN COMPETITION

Senator MATHIAS. One of the interesting aspects of life today, and in many ways one of the hopeful aspects of life, is that there is much more trade among nations than there used to be.

This difference in the volume of trade also requires adjustments by specific industries and can result in enormous dislocations in specific industries.

How serious is foreign competition in your history?

I ask that, recognizing that there are some countries that don't recognize patent rights and don't recognize that a patent right is a property right. And, therefore, they feel free to pirate the drugs.

What are the trends in the industry?

Mr. ENGMAN. This is an industry in which foreign competition is very stiff. It always has been so.

This industry, on balance, has provided a plus in terms of our balance of payments over the years. But there are some disturbing trends developing in this area which correspond with the reduction of proportional investment in R. & D. which has been going on in this country, as compared to that in West Germany, Japan, and the other nations.

Studies have indicated that there has actually been a decline in recent years in the number of new drug filings by U.S.-owned firms, and that the proportion of those which originated abroad has been increasing. That includes not only the historic leaders such as the Germans, the Swiss and other European nations, but, increasingly today, the Japanese.

DRUG FIRM INVESTMENT IN RESEARCH

Senator MATHIAS. Finally, Mr. Engman, I understand that 20 years ago the industry plowed back—which has gotten to be a favorite word on Capitol Hill—about 16 cents out of every dollar of sales. If true, that is a rather impressive figure. It went into research.

What is the plowback from the pharmaceutical industry today into research?

Mr. ENGMAN. That is approximately 12 percent of sales currently.

As my prepared statement indicates, in adjusting for inflation factors, there has actually been a decrease. We talk in real terms from something over 12 percent 10 years ago to something around 7.5 percent today.

Senator MATHIAS. So the Congress has to view the total national investment in research and development in a comprehensive way but as far as your segment of it is concerned, there is a serious decrease in the research area.

Mr. ENGMAN. That is correct.

The nature of the research has also changed because we have increasingly expensive research.

The companies are committed to research. If you look at how much is put into research as a percentage of net profits, let's say, it is very substantial in a number of cases.

The fact of the matter is that it is being directed at fewer and fewer projects because of the costs of R. & D. which constantly increase.

Senator MATHIAS. It is your view then that enactment of this bill will at least tend to reverse that trend.

Mr. ENGMAN. As the patent system has served us so well during the past 200 years, yes.

Senator MATHIAS. Thank you very much.

Mr. ENGMAN. Thank you.

Senator MATHIAS. Senator Grassley?

START OF RESTORATION PERIOD IN BILL

Senator GRASSLEY. I would like to ask questions of the panel for the record, because I have to leave soon. You can respond now or in writing.

I want to know each witness's reaction to the trigger provisions of the bill when the time extension starts and whether or not there is any consensus that this provision ought to be changed.

Do you have any comment you want to make on that?

Mr. ENGMAN. We believe that, for the pharmaceutical industry, the filing of the IND application, which is the beginning of the basic clinical research activity, is the appropriate time.

It is during that period that the testing procedures are monitored and basically dictated by the Food and Drug Administration. So that would be the appropriate time.

Senator GRASSLEY. Thank you.

Mr. Chairman, I have no more questions.

Senator MATHIAS. Thank you very much, Senator Grassley.

Thank you, Mr. Engman.

[Prepared statement and article by Mr. Engman follow:]

PREPARED STATEMENT OF LEWIS A. ENGMAN

My name is Lewis A. Engman. I am President of the Pharmaceutical Manufacturers Association, which represents 149 companies that discover, develop and produce prescription medicines and medical devices. Our firms account for more than 90% of the new chemical entity pharmaceuticals introduced in the United States and a substantial percentage of this country's medical device innovations.

Mr. Chairman, PMA member companies are committed to improving health care by converting new knowledge into better therapy. We naturally are interested in legislation that would make us better able to conduct the increasingly costly and time-consuming research necessary to develop new medical products. For that reason, I appreciate this opportunity to express our support for S.255, the Patent Term Restoration Act of 1981, which has been introduced by Senator Mathias, and is co-sponsored by Chairman Thurmond and twenty-four other members of the Senate, Democrats and Republicans.

The U.S. Patent System

Nearly two hundred years ago, Congress -- pursuant to the specific authority set forth in Article I, Section 8 of the Constitution -- created our patent system for the purpose of encouraging innovation. It has served this country well.

A patent system, to be successful, must balance several public interests. On the one hand are the benefits the public derives from the innovation stimulated by promising inventors temporary exclusivity, as well as from the disclosure of the nature of the innovation. On the other hand are the benefits to the public of allowing many producers to compete for each customer's business. Congress, in 1861, selected 17 years as the period that best achieved

the proper balance. Since 1861, the 17-year patent term has remained unchanged.

No one can prove empirically that 17 years was then, or is now, the perfect patent period. But no one can deny that the patent system, as it has existed for more than 100 years, has contributed enormously to innovation.

What occasions this hearing today is the fact that the 17-year period that has served so well has been inadvertently, but substantially, eroded for products that must be approved by the government before they can be marketed. Because the patent clock often starts before the testing and government review process, and ticks throughout, the effective patent life for regulated products has been reduced unintentionally -- and for no products more than for pharmaceutical products.

The Patent System and New Medicines

When a drug firm discovers a promising new chemical compound, the first thing it does before committing itself to the research and development process -- which these days costs, on average, $70 million per new drug entering the market -- is to file for a patent. That patent generally is issued within two years and immediately begins to expire. But at the time the patent is issued, the innovating firm is far from sure it will ever have a marketable product. For that assurance it must await final government marketing approval, an event which may be -- and indeed generally is -- still some seven to ten years away. (See Exhibit "A"). For a pharmaceutical company, therefore, the 17-year patent has become merely a legislative figment. In reality, a drug patent has an effective life of roughly half that period. As a result, incentives to invest in pharmaceutical research and development have been substantially reduced.

The erosion of effective patent life for pharmaceuticals began about twenty years ago. Since 1960, average patent lives for drugs have been cut nearly in half (Exhibit "B"), and inflation-adjusted research investment as a percentage of sales has been similarly reduced (Exhibit "C").

But from the public's point of view, the bottom line is not patent lives or research investments, it is new medicines. Here, too, the record is disturbing. In 1960, a $3.5 billion industry with effective patent lives averaging 16 years produced 50 new medicines; in 1980, a $22 billion industry with effective patent lives averaging less than 10 years produced only 12 new medicines.

The public is the loser. The sick -- the people with diseases for which medicines have not yet been developed -- they have been the real victims of lost patent life.

It should be emphasized, Mr. Chairman, that this situation is not the product of anyone's design. No one could have anticipated that a testing and approval process that took about two years in the early 1960's would take seven to ten years by 1980. Reduced patent protection for drugs has evolved by accident, and until recently with little notice. We have been living -- all of us who have an interest in the quality of health care -- with a very large and very expensive accident.

The bill we are here to discuss today will help correct that problem. By restoring to pharmaceutical patents the time consumed by the approval process, the bill will help reverse the decline in research incentives. It will help make investment in drug therapies more competitive with alternative uses of corporate resources. It will help stimulate discovery and introduction of more and better new medicines. And it should produce consumer savings in two ways -- by encouraging

more rapid entry of new competing products, and by promoting the development of new drugs that displace far more expensive therapies, such as surgery.

One need only look at the savings that have resulted from new drug introductions to appreciate how better therapy and lower cost can arrive in the same package. Tagamet, SmithKline's new ulcer drug -- if used by all those who would benefit from it -- could save some $250 million a year in foregone surgery and physician visits.[1/] Anti-psychotic medicines for the control of mental illness have reduced the need for expensive hospitalization and shortened treatment periods. In 1973, only 35% of mental illness patients required in-patient service, down from 77% in 1955. Thanks largely to anti-infective pharmaceuticals, death rates from once dread diseases such as tuberculosis and meningitis have declined dramatically since the early fifties.

How tragic it will be if the flow of new cures such as these is unnecessarily restricted in the future!

Patent Term Restoration Act of 1981

S. 255 is intended to restore to patent owners up to a maximum of seven years of the patent protection lost due to government requirements which must be complied with before the product can be marketed. Although not limited to drugs or any other class of products, the bill would have the greatest impact on those products which are subject to the most rigorous and time-consuming regulatory requirements.

Upon application to the Patent and Trademark Office, the owner of a patent subject to one of the regulatory review periods specified in the bill would receive a limited extension of patent term. For a new drug, the extension would generally equal the time from the IND (Investigational

New Drug) filing with the Food and Drug Administration to NDA (New Drug Application) approval, up to a maximum of seven years. If the patent had been issued after the IND was filed, the extension term would be measured from patent issuance to NDA approval. And for products undergoing regulatory review at the time of the legislation's enactment -- the so-called "pipeline" drugs -- the extension would be calculated from the bill's effective date to the time of product approval. Thus, the bill provides no retroactive benefits.

Mr. Chairman, this approach should allay the fears of those who are concerned about higher prices for existing drugs. No drug product on the market today will be affected whatsoever by this bill. And future products will be developed in a new climate of restored incentives for innovation. Indeed those future products may well owe their very existence to those incentives.

The Need to Improve Incentives for Research & Development

We believe that the public interest is best served when new therapies become available as rapidly as possible, consistent with good scientific practice. As I have suggested, for this to happen, incentives to invest in pharmaceutical research and development have to be adequate. The record shows that scientific research expenditures relative to the volume of medicines sold has been declining. After adjustment for inflation, the pharmaceutical R&D to sales ratio has declined from 12.6% in 1962 to 7.9% in 1979. In addition the number of independent firms adding new chemical entities to the U.S. market has declined from 51 during the 1954 through 1958 period to 41 over the 1972 through 1976 period.[2/] (Exhibit "D").

These unfortunate trends are due to several factors:

- Risk: It is estimated that about 10,000 drug candidates are synthesized for every one that actually gets to market. For every ten

drugs that reach the very expensive and time consuming clinical testing (IND) stage, only one is ultimately marketed.3/

- Cost: In 1962 the average cost of taking a new chemical entity from discovery to market approval was $6.47 million in 1962 dollars, or $16.4 million in 1980 dollars. Today, the cost is up to $70 million.
- Reduced Patent Life: After a company has taken the risk of investing in a new product, paid the high costs of R&D, and complied with the lengthy regulatory requirements, the company's new product has a patent life which is only about one-half as long as Congress intended.

Mr. Chairman, the decline in pharmaceutical research and development is a serious problem for society. What can be done to reverse this decline?

One obvious remedy is to reduce the time and cost of getting a new drug to market. Improvements in the approval process should be pursued vigorously. Last year PMA recommended to the FDA several ways to streamline the drug approval process without compromising safety or efficacy.

At the same time, we should be certain that the incentives for innovation are sufficiently attractive. Restoration of patent life would help encourage greater investment in research and development. Greater investment and reinvestment will lead to an increase in the flow of improved medicines.

Mr. Chairman, some critics of this legislation may argue that an effective patent life of 8 or 9 years is plenty long enough and that the best way to save consumers money is to encourage generic competition at the earliest possible stage.

This is a shortsighted view. It ignores the fact that Congress long ago decided that a 17-year period of exclusivity is the proper incentive to stimulate innovation in all fields. It ignores the evidence that investment in drug research has been declining at a disturbing rate under a system of devalued patents. It ignores the fact that this research is vital to our national health. Most fundamentally, it ignores the basic economic fact that competition from new products generates downward pressure on the price of other products.

Patent restoration means more incentives for more new products which means more competition. Besides stimulating the discovery of better therapy, patent restoration should exert downward pressure on the prices of new and old products alike.

In the past, significant advances in drug therapy have either treated the previously untreatable or replaced much more expensive but less effective technologies -- anti-infectives rather than death or disability; anti-psychotic medicines rather than mental wards; Tagamet rather than ulcer surgery, rifampin rather than tuberculosis sanitaria. If patent restoration encourages the quicker introduction of just one of these types of drugs, it will have been worth it.

Mr. Chairman, this concludes my prepared testimony. I would be happy to answer the Committee's questions.

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FOOTNOTES

1/ Robinson Associates, Inc., "The Impact of Cimetidine on the National Cost of Duodenal Ulcers," (Bryn Mawr, Pa., 1978).

2/ John R. Virts and J. Fred Weston, "Returns to Research and Development in the U.S. Pharmaceutical Industry," Managerial and Decision Economics, Vol. 1, No. 3, 1980, p. 109.

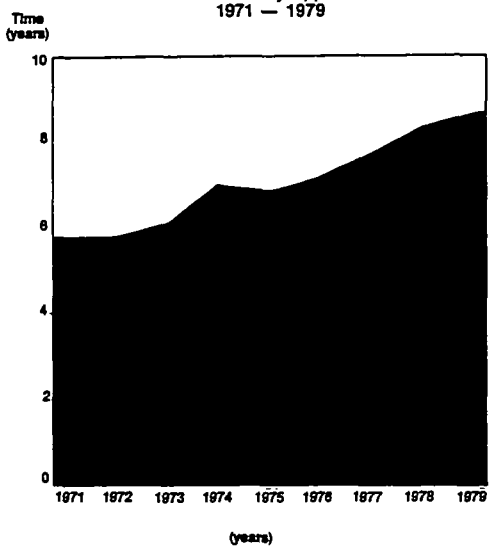
3/ William M. Wardell, "The History of Drug Discovery, Development and Regulation," in Robert I. Chein, Issues in Pharmaceutical Economics at 10, 11 (1979)

EXHIBIT "A"

The Time Factor in New Drug Development

Even after a new drug has been discovered, it takes 7-10 years to develop it and get it approved for sale.

New Chemical Entity Approval Times*
1971 — 1979



*Approval Time = time from IND filing to NDA approval by the Food and Drug Administration

Source: Martin M. Eisman, Ph.D., "Components of the Decline in Patent Protection for New Drugs," CSDD, 1980.

EXHIBIT "B"

Declining Patent Protection

These 7-10 years are, in effect, deducted from a drug's patent life. Thus, instead of having 17 years in which to recover its investment like firms in most other industries, the pharmaceutical innovator has only about half that time.

Patent Life Erosion

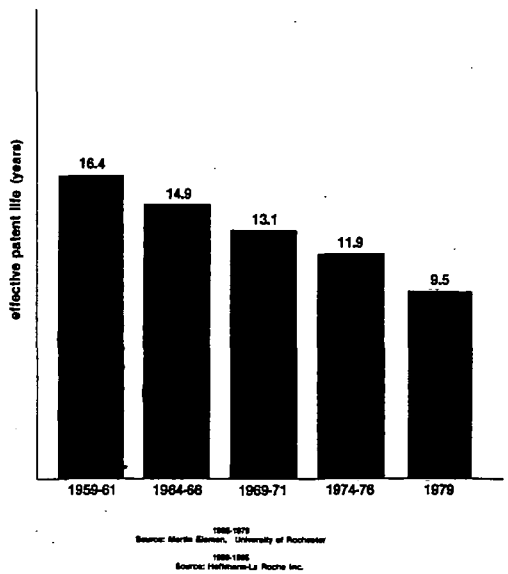
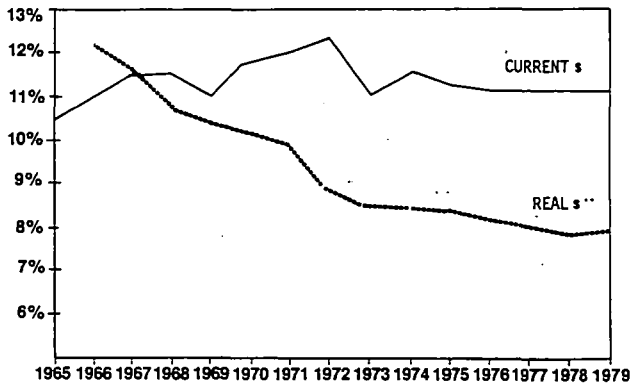


EXHIBIT "C"

Drug research is lagging behind the industry's growth rate.

Although drug companies continue to reinvest a steady 12% of their sales in research, real levels of effort have not kept pace with industry sales growth because research costs have soared in relation to drug prices.

US Pharmaceutical R&D Expenditures as a Percentage of US Pharmaceutical Sales, 1965-1979*

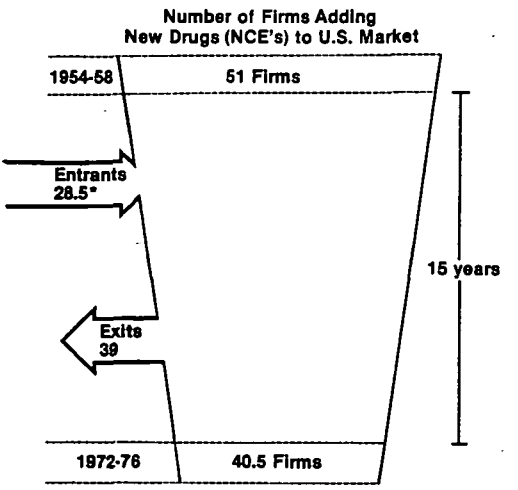


*R&D as a percentage of sales is computed by dividing human and veterinary R&D expenditures in the United States by domestic production, i.e., domestic sales and exports (including subsidiaries abroad), times 100.

**Sales Deflator: Producer Price Index for Ethical Pharmaceuticals, Bureau of Labor Statistics; 1967 = 100.
R&D Deflator: Biomedical R&D deflator used by the National Institutes of Health, Department of Health, Education, and Welfare; 1967 = 100.
Source: *PMA Annual Survey* (various years).

EXHIBIT "D"

Many of the companies responsible for past breakthroughs are cutting back on scientific exploration, or getting out of the business. During the 1954-58 period, 51 independent firms introduced at least one new drug. During the 1972-76 period, that number had declined about 19 percent to 40.5 firms.



Net Loss 9.5 Firms (19%)

* The ".5" firm is accounted for by a 50/50 joint venture, one of whose partners had added a new chemical entity in its own right.

Source: John R. Virts, Ph.D., "New Pharmaceutical Product Development: Reward Versus Risks and the Public Interest", paper delivered at the 22nd Annual Canadian-American Seminar, "Pharmaceuticals in North America — the Public Interest", Institute for Canadian American Studies, University of Windsor, Ontario, November 14, 1980.

THIRD WORLD NEEDS MEDICINES

(By Lewis A. Engman, President, Pharmaceutical Manufacturers Associations)

Medicines—not doctors or hospitals—are the reason people don't go to tuberculosis sanatariums, children don't die of smallpox and the populations of mental hospitals have shriveled across our land.

Though I had thought myself a well-informed citizen, I was unaware—as I suspect most Americans are—of the fact that in the United States today expenditures on medicines account for less than 7 cents of the health-care dollar. Prices for medicines have for a long time been falling relative to almost everything else our consumers purchased. While Americans were spending lower and lower fractions of their incomes for medicines, medicines were providing an ever increasing fraction of their therapies—in effect, doing more of the job for less of the total cost. Smith Kline's new ulcer medicine is estimated to save consumers in my country alone $250 million a year.

Looking back 25 years, the U.S. pharmaceutical industry in 1976 could point to a 92-percent decline in the death rate from measles, a 99-percent decline in the death rate from whooping cough, a 62-percent decline in the death rate from tuberculosis, a 80-percent decline in the death rate from typhoid fever, and a 61-percent decline in the death rate from meningococcal infections. And all largely as the result of vaccines and anti-infectives the cost of which, in most instances could have been measured in pennies a day.

These facts, and others like them, are, in the aggregate a textbook illustration of cost-effective resource deployment—the channelling of purchasing power away from relatively high-cost, low-yield therapies such as hospitalization and surgery, and its redirection toward low-cost, higher-yielding pharmaceutical therapies that produce better health while leaving consumers with more money in their pockets.

Moreover, direct savings are only part of the story. In addition, improved medical therapies produce indirect savings in the form of healthier work forces, reduced absenteeism, higher productivity—not to mention unquantifiable benefits such as longer life expectancies and reductions in pain and suffering.

Estimates of overall savings are difficult to make. But one respected research service in our country has calculated that, in the year 1975, the total direct and indirect savings from U.S. biomedical research—most of it for drugs—was in the area of $34 billion, nearly one and one-half times the total research investment and profits of our industry for the preceding 45 years. And those were savings for one single year.

These figures are impressive. The evidence that purchases of medicines have been cost-effective to the consumer is overwhelming. But optimal cost-effectiveness on a society-wide scale depends on more than wise decisions by consumers and health professionals. It depends at bottom on cost-effective deployment of the capital investment that provides the consumer his range of choice. Which, in turn requires identifying and encouraging investment in that sector or those sectors where available evidence suggests the yield of benefits will be greatest.

Here, too, the facts speak eloquently, the vast majority of new medicines come not from the government or from university laboratories; the vast majority of new medicines come from the pharmaceutical companies. And they come only after very large investments in research. Today it costs a firm in an average of $70 million for each new drug that reaches the market.

These investment costs may be dwarfed by the public benefits I enumerated a moment ago. But they are not small to the companies which must bear them in order to provide those benefits. Nor will they long be assumed by companies obliged to operate in a regulatory environment where returns on invested capital have been rendered unattractive.

Which brings me to my second subject; namely, the role of market incentives in the whole process of therapeutic evolution.

For a number of years now, the United States has had, among major developed nations, the least-fettered market in our industry. And for a number of years the United States had led the world in new discoveries.

This has not been coincidence. A decade ago the U.S. lead in development might have been explained as being attributable to the country's general economic vigor and industrial health. But that argument no longer is persuasive. Today, other countries are outperforming the United States in production of automobiles, steel, electronics and a host of other products.

Why are not more heavily regulated pharmaceutical industries doing likewise?

I submit that it is precisely because they are more heavily regulated from an economic point of view, because they have been operating under restraints on innovation which we in the United states only now are starting to see. As evidence

to support this view I would point out that as U.S. market incentives have been eroded in recent years by government regulation, the U.S. lead in the development of medicines has begun to shrink.

Every government would do well to review its regulatory policies in light of this experience. For I suspect that no government has been so wise in the exercise of its authority that there are not substantial cost-savings and health benefits to be gained from reform in the direction of greater reliance on market forces.

All the health problems we face in the United States and Europe are faced by the developing nations in magnified form: limited resources and the need to restrain costs, the difficulty of delivering health services to remote populations, the inability or unwillingness of the poor to reach hospitals or to submit to hospitalization.

Happily, by the same token, the benefits potential which medicines hold for third world countries is also magnified. Medicines are cheaper than surgery or hospital therapies, they are easily transported—can be taken to the sick instead of vice versa, and they can be introduced sooner, with less capital investment.

Over the last five years, the World Health Organization and its allied U.N. agencies such as UNCTAD and UNIDO have made it quite plain that they appreciate the advantages of pharmaceutical therapies and the benefits they offer the developing world.

But these agencies have not always shown equal appreciation for the incentives on which an assured flow of those benefits depends. While exalting our product, they have spent nearly equal time vilifying the system that produces and distributes them.

The chorus is not unfamiliar, because it is not peculiar to the developing world, or the agencies speaking on their behalf.

Governments the world over seem to be constitutionally skeptical of the free market system. Even in countries where the free market is official religion politicians and bureaucrats seem incurably infected with an itch to interfere. The industry is told it makes too many medicines and that it spends too much to promote them. We are told that our research and development is misdirected, that we are developing redundant medicines while ignoring others that are badly needed. And we are told to get on with the business of discovering useful medicines while governments more and more seek to control distribution and pricing.

The litany of complaints is familiar: much of it is well-intentioned and, in some instances, perhaps justified as well.

I would argue, however, that too often governments in their eagerness to ordain a result become heedless of the dynamics of the process by which wish comes to fruition. Too often they succumb to the temptation to cut open the goose to get at the eggs.

As I have said, these attitudes are not unique to the third world. But their consequences could be particularly tragic for the third world for the reason that it is in those countries that medicines at the moment offer one of the greatest potentials for good.

All governments should recognize that just as modern pharmaceutical therapies produce favorable economic effects, favorable economic conditions are required to produce modern pharmaceutical therapies. It is not sufficient for a country to acknowledge the importance of new medicines; a country must create the environment that makes their development and delivery possible.

This, in turn, requires understanding of two facts.

The first is that the vast majority of the world's new medicines have been developed by private companies in a handful of market economies. You can count on your fingers the number of important medicines discovered in non-market economies in the last several decades. Moreover, it has been corporations, not government or the academic community which have spawned most new therapies. In the period of 1963-70 in the U.S. for example, pharmaceutical companies accounted for 82 percent of important new discoveries. Moreover, distribution of those medicines has followed economic demand as iron filings follow magnetic lines of force.

The second fact to be understood is that profit-seeking corporations respond far more readily to incentives than to strictures, controls, regulations or rules. "Thou shalt not" is not the siren song that will lure many multinational firms to a developing nation's shores.

In too many countries this seemingly simple and obvious fact is imperfectly understood. Witness the national plan for development of the pharmaceutical industry enacted this year by one Latin American country. Its goals are lofty: expanded exports, local research and development, increased local pharmaceutical raw material production, greater transfer of technology, new investment, cheaper medicines for the poor. Who can quarrel with such objectives?

But there is little chance these goals will be met. The plan contains only disincentives: rigid price controls are to be maintained, and patent and trademark protection is weak.

Every nation, it seems, wants to export pharmaceuticals, and to export more than it imports. But, if exports are the overriding objective, there are proven steps a government can take. The tax exemptions offered by Ireland and Puerto Rico, for example, have made these the sites of the most concentrated pharmaceutical manufacturing in the world. Absent them, both would have been net importers.

Local research and development also is in vogue among less developed countries, encouraged by WHO. Countries which set this as a goal can best achieve it by creating fiscal incentives to stimulate multinationals to invest in research and development facilities. As an example, I cite Brazil's tariff and tax incentives which encouraged some firms to establish tropical disease research centers there.

One can understand the concerns of developing nations, indeed all nations, over a strong foreign corporate presence. From a political point of view, no prudent government can be expected to throw open the doors to its economy incautiously.

But there is a distinction to be made between political caution and economic xenophobia. In fact, the profit seeking corporation is an easily controlled and highly tractable animal. With positive incentives, private firms can be willingly led—and led, within limits, in whatever direction the host country's trail of incentives dictate. Those same firms, however, do not respond favorably to pushing in the form of prohibitions and negative incentives.

I can point to my own country as evidence of what occurs even in a domestic industry when the burden of governmental action becomes weighted toward disincentives. Since 1962, when amendments to our law greatly increased the length and cost of our approval process, the costs of developing new medicines have risen more than fourfold after adjustment for inflation. Simultaneously, the length of our patient lives has been shortened—from almost the full 17 year term allowed by law to slightly more than half that. The result—which government did not foresee—is that in real terms the percentage of revenue reinvested in research as a percentage of sales has declined—declined by nearly 50 percent.

The companies of our industry have a great deal to offer the people of the world. They offer health efficiencies that stretch scarce resources; they offer mobility which surgery and hospitalization cannot, they offer productivity gains from a healthier work force; and they offer the quality of life improvement that accompanies any reduction in suffering.

But these benefits are not in a warehouse somewhere waiting to be distributed. Someone must decide it is worth his while to produce them. And that "someone" is not a syphon which, once started, provides a continuous flow without further encouragement; that someone is a corporation, constrained by the laws of survival to re-evaluate regularly its return on investment.

In such corporations, the developing countries especially have scores of potential allies in the battle for better health.

But even corporations cannot fight on empty stomachs.

Senator MATHIAS. We will now proceed to our first panel, Mr. Tegtmeyer, the Acting Commissioner of Patents and Trademarks of the Commerce Department; and Dr. Edwin H. Clark, Acting Assistant Administrator for Pesticides and Toxic Substances in the Environmental Protection Agency.

Your entire prepared testimony will be made a part of the hearing record and you may proceed to summarize.

STATEMENT OF RENE D. TEGTMEYER, ACTING COMMISSIONER OF PATENTS AND TRADEMARKS, DEPARTMENT OF COMMERCE; AND DR. EDWIN H. CLARK II, ACTING ASSISTANT ADMINISTRATOR FOR PESTICIDES AND TOXIC SUBSTANCES, ENVIRONMENTAL PROTECTION AGENCY

Mr. TEGTMEYER. Good morning, Senator.

My name is Rene Tegtmeyer. I am presently Acting Commissioner of Patents and Trademarks.

We have submitted a statement for the written record, which I will abbreviate at this time.

I am please to present the views of the Department of Commerce on S. 255. This bill would amend the patent laws by restoring that portion of a patent term during which the marketing or use of a patented invention was prevented, due to Federal regulatory review.

For too many years, American industrial innovation has not kept pace with our foreign competitors. We are losing our traditional technological leadership, and the symptoms of this decline are obvious to economists, Government planners, industrialists, and the public.

For 15 years, the percentage of GNP annually invested in research and development has decreased. Our share of the world's export markets for high-technology goods is dropping. Our own markets are flooded with imports. Our greatest resources, scientific and production expertise, have failed us.

There is no single answer. One thing, however, must immediately begin to be done: Large and small businesses must be encouraged to channel a larger share of profits, manpower, and investment capital into research and development of commercial products.

The pharmaceutical and agricultural chemical industries are particularly dependent on the patent system. They are research-intensive and face keen foreign competition. Large commitments of capital and technological expertise are required to develop and bring new products to the market with far more failures than successes.

Few, if any, other industries come close to these in terms of risks, uncertainties, and amount of innovation needed to recover research and development investments and return a reasonable profit.

A number of facts were presented by industry and Government representatives earlier this month to the House Committee on Energy and Commerce's Subcommittee on Health and the Environment.

These facts, I think, clearly establish that the pharmaceutical and agricultural chemical industries are research intensive and risky.

Ironically, these industries, while especially needing the patent system, do not receive its full benefits. Even when patented, their products often cannot automatically be commercially marketed.

The invention must first be approved by a Government agency charged with administering the applicable health and environmental protection law.

Typically, most of the regulatory approval process takes place after a patent is issued. This, of course, has the practical effect of decreasing the effective patent term.

Statistics provided by the affected industries show the extent to which patent terms may be curtailed. The effective term of pharmaceutical patents, as a consequence of regulatory reviews, dropped from 16 years in 1960 to 13 years in 1970 to about 9 years today.

The agricultural chemical industry can expect an effective patent term of only about 12 years. This is far less than the 17-year

patent term available since 1861 to scientists and industries involved in other technologies.

Regulatory review laws are needed to safeguard public health and safety and to protect the environment. When enacted, however, their effect on the commercial life of many valuable patented products and processes was not foreseen. There was absolutely no intention to penalize particular industries by shortening the patent terms available to them.

The House Subcommittee on Health and the Environment was shown a direct relationship between significantly shortening the effective patent term for new pharmaceutical and agricultural chemical products and the innovation rate in these industries.

Of course, significant shortening of a patent term is not the only reason why research and development has declined in the drug and agricultural chemical industries. But these industries have identified the lack of an adequate patent term as a major factor.

Artificially short patent terms make it difficult for high technology, research-intensive industries to recoup research costs and make a fair profit commensurate with the risks and capital requirements involved.

There is absolutely no reason why these industries should receive patents with a shorter effective life than is available to other industries.

The Department of Commerce urges Congress to enact S. 255 to restore the full incentives of the patent system to those industries whose new technology must be subjected to regulatory approval.

Support for S. 255 is widespread. Its underlying concepts were recommended for enactment, both by a majority of the Interagency Task Force on Patent and Information Policy and by the Public Advisory Committee, as part of the past administration's Domestic Policy Review on Industrial Innovation.

This bill has the support of concerned bar and industry organizations. It was not hastily conceived and contains every safeguard needed to protect the public interest.

Before offering our support, however, we carefully reviewed and considered alternatives, such as shortening of the regulatory review period, delay in the filing of patent applications, delaying the issuance of a patent until completion of the regulatory review procedure, and establishing a predetermined extension of the patent term. We concluded that all of these alternatives were inadequate.

In conclusion, I point out again that a patent owner will not receive from S. 255 any special or unfair competitive advantage or any right not available to other patent owners.

This bill does no more than allow a patent owner to stop infringement or license his patent for up to 17 years. It does not lengthen the practical effect of the patent term, and it assists only those industries needing regulatory approval for the marketing of their new processes or products.

I would be pleased to answer any questions and offer any assistance that we can to the committee.

Senator MATHIAS. Thank you very much.

Dr. Clark, you may proceed.

Dr. CLARK. Thank you, Mr. Chairman.

We have prepared a longer statement, which I will submit for the record and summarize.

Senator MATHIAS. It will be included in full.

Dr. CLARK. I am Edwin Clark, Acting Assistant Administrator for the Office of Pesticides and Toxic Substances of the Environmental Protection Agency.

My office has responsibility for implementing the Federal Insecticide, Rodenticide, and Fungicide Act—FIFRA—and the Toxic Substances Control Act—TSCA. Both of these would be affected by S. 255.

We welcome the opportunity to discuss your proposed legislation with you.

We view this bill as a way of making the patent clearance process consistent with full-term patent protection. We also believe it will encourage innovation.

For these reasons, we support the principles which underlie the bill. We recommend, however, some changes which we feel would improve it.

The bill would complement other activities which we already have underway in EPA to create and improve incentives for innovation.

Under FIFRA, we are attempting to accelerate the registration process for safer chemicals and for experimental uses. Under TSCA, we are also attempting to create incentives to industry to stimulate innovation of safer chemicals.

We are considering possible changes in the agency's patent policy, along the lines of Public Law 96-517, passed last year which would serve to increase the rate of commercialization of innovative products produced under EPA funding.

We join you and the other cosponsors in underlining the importance of the changes sought by the proposed legislation

Restoration of the full patent term of 17 years to inventors and innovators would eliminate an unnecessary and unintended side effect of the premarket testing process and would encourage innovation by industry, particularly in the areas of pesticides and other chemicals.

We do have some suggestions to offer which we feel would improve the bill, both from the standpoint of EPA and the affected industry. These suggestions fall into three areas—some general suggestions, some which are specific to FIFRA and some to TSCA.

We are including some specific suggestions with our testimony. I would only like to comment briefly on a few of these.

With respect to general comments, first we would suggest that you clarify the situation for chemicals which are under review when the bill becomes effective.

Second, we would recommend that the catchall provision in lines 6 through 15 on page 8 be deleted because it is so broad that it may have widespread but unanticipated effects and that any extensions should be done specifically rather than through a general section such as this.

Third, we would suggest that you consider only extending the patent life for the actual time the chemicals are under testing, assessment, or review. Our concern is that companies may attempt to extend the patent period for no good reason by doing a simple

test as soon as the product is patented and then delaying attempts to market the product. To avoid such nonbeneficial trade constraints, we would suggest that the compensable period equal the amount of time spent in testing, assessment, and review.

With respect to the FIFRA, we generally favor all of the provisions of the proposed legislation but have some technical suggestions relating to the commencement of the review period and clarification of the relationship between provisions concerning FIFRA and those concerning the Federal Food, Drug, and Cosmetic Act, for which we are also responsible for parts of.

With respect to TSCA, we have no testing requirements for new chemicals. The review period is very short compared to other programs. It is usually no more than 90 to 180 days. Therefore, the patent time loss for chemicals as a result of TSCA is not likely to be significant.

However, we would like to encourage testing of new chemicals before they are manufactured and would like to reward firms who do voluntarily undertake such testing. We would, therefore, like to suggest some modifications to the proposed legislation to provide these incentives and these rewards.

First, we would recommend allowing credit for any prenotification health or environmental tests, not simply for major tests. For our purposes under TSCA, usually short-term tests are quite adequate.

Second, while TSCA, section 5, provides for at most a 180-day notice review period, we have found that in some cases companies have voluntarily stopped the clock to take more time to discuss with EPA particular issues we have found and problems that may have been raised in our review. We would suggest that the regulatory review period, for purposes of this bill, run until either the end of the notice review period or one year after submission of the notice, whichever comes first; therefore, giving firms incentive to cooperate with us in reviewing the chemical.

Finally, we strongly recommend modifications in the bill where it involves actions the agency may take after completing the premanufacturing review process. In its present form, the proposed legislation would extend the patent life while these actions remain in effect. However, in many—probably most—cases, we will allow the company to market its product while these actions are in effect. We believe it will be inappropriate to extend the patent life while the product can be marketed. In some cases, the action may have permanent effects; for instance, requiring the substance to be labeled. We think it would be inappropriate and would actually provide reverse incentives to extend the patent life for another seven years just because the label is required. It would cause the companies to prefer our regulating them so they would get the extra seven years, rather than taking voluntary action.

Finally, we have recommended some changes of a technical nature.

I appreciate very much the opportunity to testify on this bill. I would be happy to answer any questions and to work with your staff.

Senator MATHIAS. Thank you, Dr. Clark.

Let me start with Mr. Tegtmeyer and ask him to try to give us some sense of the volume of patents that we are dealing with here. Are we dealing with just a handful or is this going to be a massive change, as far as the pharmaceutical and chemical patents are concerned?

Mr. TEGTMEYER. Senator, I don't think the volume is going to be very large nor are the processing requirements, at least for the Patent and Trademark Office, going to be of any significance.

There are, apparently, about 500 new chemicals that are approved by EPA each year, somewhere around 70 for NDA's at the Food and Drug Administration and somewhere around 3,500 medical devices that might be involved. Not all of these are going to be patented, particularly in the medical devices area.

These represent what might be the maximum volume of patents that might be affected on an annual basis. I don't think it is going to be unusually large.

Dr. CLARK. May I comment on that?

Senator MATHIAS. Yes, please.

Dr. CLARK. The numbers there refer to both our total chemical program and the pesticides program. The pesticides program has relatively few new products a year. The total under the TSCA program we expect to get up to is about 1,000 to 1,200 a year.

Senator MATHIAS. In addition to the pesticide program?

Dr. CLARK. That's right.

Senator MATHIAS. Is there any serious disagreement on that?

Mr. TEGTMEYER. No, sir. I defer to EPA in that respect.

COST TO THE CONSUMER

Senator MATHIAS. Let me address this question to both of you, because it is one of great concern when we deal with drugs.

What would the impact of this bill be on the cost to the consumer, the person who has to go down to the drugstore with the prescription?

Mr. TEGTMEYER. I think the question of the impact of the legislation on the cost to the consumer is a debatable issue.

Obviously, S. 255 is intended to increase the income to the patent owner and stimulate or encourage the patent owner to put that income into additional research and development to create or develop additional new drugs. This is desirable and is the main purpose of S. 255. Whether that is done because of maintenance of market volumes or because of prices is a question we will leave to experience and the economists when the bill comes into effect.

Whatever effects it might have, in terms of increasing drug prices, if that does occur to any extent, I think would be more than offset by a return in the form of making available to the public many new drugs or pharmaceuticals, many new pesticides, and other new products.

It would certainly be worthwhile to save lives by creating new drugs and to reduce medical costs in other areas, even if there were a small increase in drug prices or the maintenance of a market share by a patent owner.

Dr. CLARK. May I answer that as an economist and not as an Assistant Administrator of EPA?

My expectation would be—and I have not considered this in any detail—that, in fact, it might initially lower prices to the consumer, because it will allow companies a longer time to recoup their research investments.

Senator MATHIAS. Dr. Clark, I believe some of those in the back are having some trouble hearing you if I can judge from the strained faces. So maybe if you could talk directly into the microphone.

Dr. CLARK. My apologies.

My expectation would be that the effect of the bill would be to initially reduce prices to the consumers, because it would allow companies a longer time to recoup their large investments in research and testing. It would, of course, extend the period on which they could get the monopoly rents for a little while in the future. So in the longer run, it might increase it slightly.

Senator MATHIAS. But that kind of effect could be 6, 8, or 10 years into the future.

Dr. CLARK. That's right.

But I think the initial effect would be, in fact, to reduce the prices.

BRAND LOYALTY

Senator MATHIAS. Human beings are creatures of habit and develop strange kinds of loyalties, among them to a product brand.

One of the suggestions that has been made by the critics of this legislation is that because this is such a strong human habit, that you don't really need this. Once you get a drug on the market and people find it helps them, they will continue to use it. There is, in effect, a kind of natural patent.

Is there any validity to that argument?

Mr. TEGTMEYER. Senator, the same habits, to the extent that they exist now, existed back 15 or 20 years ago when the effective patent term was much longer than it is now. What we are looking at and addressing in S. 255 is the fact that the patent term over the last 15 or 20 years has been effectively reduced, and there is less incentive to undertake the risks in investments involved in developing new drugs, pesticides, and the like.

What we are trying to do is merely to restore the incentive of the patent system to where it existed 15 or 20 years ago.

The question of brand loyalty can also be addressed in several other ways. There is much more emphasis now on compendiums that identify generic drugs which will make more readily available other options once a patent expires.

There have been, as I recognize, some examples cited where market shares or prices remain up even after a patent has terminated. There are also examples that go in the other direction that show this is not always the case. I don't think there are facts that would lead anyone to a conclusion that brand loyalty or other habits would compensate for the loss of the effective patent term that has occurred because of the requirements for regulatory review.

Dr. CLARK. I would have two responses to that.

One is that I don't know what the answer is. If that view is wrong, that bill will help. If that view is right, this bill won't hurt. So you are in a no-lose situation if you enact the bill.

My second observation would be that in the areas we deal with, there are substantial efforts made to destroy such product loyalty in substantial advertising.

We are dealing mostly with businesses—either farmers or businessmen themselves. I don't think the product loyalty issue is very germane here.

Senator MATHIAS. Let me address a question particularly to Dr. Clark, perhaps in your role as economist.

It is sometimes claimed that the existence of a patent encourages the manufacturer to artificially increase prices. It gives him a leg up on the market.

What about the industries that you regulate under the Pesticides and Toxic Substances Act? Do you think that this is a case in that segment of the industry? What do you see as market forces that might operate in the other way to hold prices down?

Dr. CLARK. I think there is no question that patents do allow firms to charge higher prices than they otherwise would. If patents didn't allow this, there would be no purpose in having the patents.

However, again in the areas I am dealing with, there are no complete monopolies. There are always some substitutes and some competitors. They may have slightly less efficacy. They may be slightly different in price, but they do create competition. Therefore, they restrict the amount that anybody can charge for a patent product.

Senator MATHIAS. In your statement, Dr. Clark, you raise some question that perhaps patents should be extended only during actual testing, if I heard you correctly, and that therefore you would only look to specific extensions. Wouldn't this create——

I go back to the question on volume a little bit. This means that you would have to—both you and the patent office—look at each of these applications for an extension. That creates a serious kind of bureaucratic problem.

Dr. CLARK. Yes. I recognize that that suggestion creates problems. In fact, I was trying to figure out a solution to these problems last night.

We suggest that you might consider that proposal only because in some instances it might create the problem. People might do testing just in order to get an automatic 7-year extension.

It would only be a problem if you accept our suggestion to only allow short-term testing to be covered as well, which we think is important under TSCA.

What I believe you have now is a situation where you only get credit as soon as long-term tests begin. This is something like 6 months, at least for pesticides.

I don't think it is a problem if you are only going to allow long-term testing and not the short-term testing.

Senator MATHIAS. Wouldn't an attempt on the part of a manufacturer to obtain the extension by fudging the testing process only be shooting himself in the foot because he is denying himself the market during that early period too?

Dr. CLARK. That is why I mentioned it would. I think that is right. It would only be an unusual case where this might happen.

DECLINING LEVEL OF RESEARCH AND DEVELOPMENT

Senator MATHIAS. Let me ask both of you this final question.

I have been concerned for some time about the declining level of research in this country. I am concerned by the declining Federal participation in research. I think the Federal Government has very serious responsibilities in this area. What is your observation? How would you compare the R. & D. costs and problems faced by the industries that you deal with, say, as against 20 years ago?

Dr. CLARK. To be quite honest, I have a very difficult time making that comparison. I wasn't involved in this industry 20 years ago. Therefore, I can't make a comparison.

Senator MATHIAS. Of course, that is supposed to be the most important attribute of an economist—that he is at least a hundred years old and has an active memory over that whole time. [Laughter.]

Dr. CLARK. Particularly when you are talking about things we don't know about.

I think the problem of reduced innovation is one that is a serious problem in this country. It is one that we are particularly concerned about under TSCA. We are trying to develop a better understanding of what the innovation process is and how we can implement the law so as to reduce any undue impacts we may have on it and, even more, to stimulate innovation and safer chemicals.

I think there is no question that firms do have to do more research now. It is a delayed process. But we are seeing some encouraging results. We are seeing changes by firms, saying that they are going to start investing more money in research and more money in innovation and developing more new chemicals, rather than concentrating on process changes, which has been quite prevalent over the past decade or so.

So I can't give you an answer, but the signs are not all bad.

Senator MATHIAS. What will be the effect of this legislation?

Dr. CLARK. I think this legislation will help.

Senator MATHIAS. Mr. Tegtmeyer?

Mr. TEGTMEYER. I agree, Senator.

In my testimony, I pointed out the fact that we were quite concerned about declining research and innovation in all industries. We are especially concerned about stimulating research in the drug and pesticide industries that would be covered by this legislation. We are meeting stronger foreign competition in most industries.

As has pointed out in the testimony by others already, we are meeting very stiff foreign competition in the pharmaceutical area and in the agricultural chemical area. We need the strongest incentives to research and development and to maintaining our competitive position as we can get.

Senator MATHIAS. Thank you very much, gentlemen. We appreciate your presence here today.

[Prepared statements of Mr. Tegtmeyer and Mr. Clark follow:]

STATEMENT OF R.D. TEGTMEYER, ACTING
COMMISSIONER OF PATENTS AND TRADEMARKS,
BEFORE THE SENATE COMMITTEE ON THE JUDICIARY
APRIL 30, 1981

My name is Rene D. Tegtmeyer. As Acting Commissioner of Patents and Trademarks, I am pleased to present the views of the Department of Commerce on S. 255. This bill would amend the patent laws by restoring that portion of a patent term during which the marketing or use of a patented invention was prevented due to federal regulatory review.

For far too many years, American industrial innovation has not kept pace with our foreign competitors. We are losing our traditional technological leadership, and the symptoms of this decline are obvious to economists, government planners, industrialists and the public. For fifteen years, the percentage of GNP annually invested in research and development has decreased. Our share of the world's export markets for high-technology goods is dropping. Our own markets are flooded with imports. Our greatest resources, scientific and production expertise, are failing us.

There is no single answer. One thing, however, we must immediately begin to do. Large and small businesses must be encouraged to channel a larger share of profits, manpower and investment capital into research and the development of commercial products.

The inducements of the patent system cannot be over-estimated. The last Congress, in enacting P.L. 96-517, took a major step toward strengthening and modernizing the patent system, and making it more meaningful for inventors and investors. This new law's patent reexamination procedures will enhance patent validity; it puts the Patent and Trademark Office on a sounder financial basis; and its government patent policy provisions will encourage greater participation in government research and development programs. This last feature will bring to the public more inventions made by small businesses and non-profit institutions with government funds. More is needed, however, including enactment of S. 255.

The pharmaceutical and agricultural chemical industries are particularly dependent on the patent system. They are research-intensive, and face keen foreign competition. Large commitments of capital and technological expertise are required to develop and bring new products to the market, with far more failures than successes. Few, if any other, industries come close to these in terms of the risks, uncertainties and amount of innovation needed

to recover research and development investments and return a reasonable profit.

A number of facts were presented by industry representatives earlier this month to the House Committee on Energy and Commerce's Subcommittee on Health and the Environment. While we cannot verify the accuracy of any of these facts, they fall within generally accepted ranges. According to the House testimony, only about one of 10,000 compounds tested for medical use actually reaches the market. Only one out of every ten drugs that reaches the clinical testing stage is ever marketed. The average cost of converting a new chemical discovery to a drug ready for marketing rose from $6.47 million in 1962 to an estimated $70-80 million today, according to witnesses.

The agricultural chemical industry is similarly research-intensive and risky. Several thousand chemicals are usually tested over an average of three to four years before a potentially marketable one is identified. The selected chemical is then tested for about six to eight years. The cost of bringing a new agricultural chemical to the market is estimated to be $20 to 25 million.

Ironically, these industries, while especially needing the patent system, do not receive its full benefits. Even when patented, their products often cannot automatically be commercially marketed. The invention must first be approved by a government agency charged with administering an applicable health or environmental protection law. Typically, most of the regulatory approval process takes place after a patent is issued. This, of course, has the practical effect of decreasing the effective patent term.

Statistics provided by the affected industries show the extent to which patent terms may be curtailed. In the early 1960's, for example, it took an average of about two years to carry out testing and development procedures to fulfill approval requirements of the Food and Drug Administration for the marketing of a new drug. Two years have been found inadequate, however, to allow proper assessment of health risks associated with the new drug. Today, the average regulatory review procedure takes somewhere between 7 to 10 years.

The effective term of pharmaceutical patents, as a consequence of regulatory reviews, dropped from 16 years in 1960 to 13.1 years in 1970, to about 9 years today. The agricultural chemical industry

today can expect an effective patent term of only about twelve years. This is far less than the seventeen-year patent term available since 1861 to scientists and industries involved in other technologies.

Regulatory review laws are needed to safeguard public health and safety, and protect the environment. When enacted, however, their effect on the commercial life of many valuable patented products and processes was not foreseen. There was absolutely no intention to penalize particular industries by shortening the patent terms available to them.

The House Subcommittee on Health and the Environment was shown a direct relationship between significantly shortening the effective patent term for new pharmaceutical and agricultural chemical products and the innovation rate in these industries. A decade and a half ago, for example, new pharmaceuticals were introduced at an average rate of 42 annually. Today, this rate has decreased by 62 percent; only 16 new pharmaceuticals are introduced annually. From 1954 to 1958, new drugs were introduced to the U.S. market by 51 different companies. During the period between 1972 and 1976, however, only 41 companies introduced new drugs.

Of course, significant shortening of the patent term is not the only reason why research and development investments have declined in the drug and agricultural chemical industries. But these industries have identified the lack of an adequate patent term as a major factor. Artificially short patent terms make it very difficult for high technology, research intensive industries to recoup research costs, and make a fair profit commensurate with the risks and capital involved. There is absolutely no reason why these industries should receive patents with a shorter effective life than is available to other industries.

The industries involved are among our nation's most cost-effective in terms of public benefits received for research and development expenditures. A Merck scientist and executive, Dr. Lewis H. Sarett, provided to the House Subcommittee on Health and the Environment dramatic examples of the savings patients, hospitals and the taxpayers receive from pharmaceutical research. The substituting of medication for surgery, minimizing hospital stays, treating diseases effectively, and alleviating suffering also provide valuable social benefits even more important than any cost savings. The same is true for increased agricultural productivity.

Among President Reagan's priorities is the intention to make federal regulations less burdensome on the public. The President's Memorandum of January 29, 1981 stated:

> "Among my priorities as President is the establishment of a new regulatory oversight process that will lead to less burdensome and more rational federal regulation. ... This review is especially necessary in the economic climate we have inherited."

We do not suggest in this case that any unjustified reductions of these review periods be pursued; this could endanger public health, safety, or the environment. Enactment of S. 255 would, however, significantly compensate for the burdens, costs and delays regulatory review places on a few industries.

The Department of Commerce urges Congress to enact S. 255 to restore the full incentives of the patent system to those industries whose new technology must be subjected to regulatory approval.

Under the bill, the patent term for a new product or method of using it would be extended by a period equal to the time required for regulatory pre-market testing and review. There is a seven-year limit on any extension, however, to avoid any possible argument that the bill would encourage delay in pursuing patent rights. Even with the full seven-year restoration period, the effective patent term will sometimes be less than seventeen years.

The bill also protects the public with respect to technical fields where regulatory review is not required, as, for example, when the invention has both non-medical and medical uses. Patent restoration will be available only in regard to products or methods subject to federal regulatory approval as a requirement for marketing. To the extent the patent covers uses of the invention not subject to pre-marketing federal review, the term for those uses will not be restored. If the patented product or process is not ultimately approved for marketing, there will be no restoration of the patent term.

The mechanics of applying for and receiving a restoration of the patent term are administratively simple and will not impose undue costs or burdens either on the Patent and Trademark Office or on

patent owners. To obtain an extension, the patent owner must notify the Commissioner of Patents and Trademarks that the patented product or process has just undergone and successfully completed pre-marketing testing and regulatory review (the bill refers to this time as the "regulatory review period"). The patent owner's notice must inform the Commissioner how long the regulatory review period lasted. The Commissioner will then issue a certificate (which, of course, will be publicly available) extending the patent term for the specific invention involved by a period equal to the regulatory review period. If the patent has expired before the regulatory review is completed, no restoration will be made.

While we see no difficulties with the procedure, we have some suggestions for improving it.

Proposed section 155(B)(2) now requires the Commissioner of Patents and Trademarks to issue automatically to the patent owner a certificate of extension of the patent term. We believe, however, that the Commissioner should, where a notice contains an obvious and significant discrepancy, be able to question whether a patent owner has met all of the conditions for receiving an extension, and not just be a rubber stamp. The Commissioner should have the authority to deny a request for restoration in such circumstances. In the vast majority of cases, however, the Commissioner would simply accept the notification and issue the certificate of extension.

The bill certainly does not contemplate any patent term restoration unless the regulatory process concludes with a determination that the product or process under review is suitable for marketing. Nevertheless, this is at best implied in the bill and should be clarified.

I have spoken only about the pharmaceutical, medical devices and agricultural chemical industries, because these are the most affected. But the bill is not this limited. It applies to any product or process that cannot be marketed or used without the authorization of a federal regulatory agency. We have no evidence, however, that such open-ended relief is needed, and defer to the judgment of Congress.

The bill has no retroactive effect. The term of any patented product or process now on the market or in commercial use cannot be extended. Only new products and processes will benefit from the bill.

Support for S. 255 is widespread. Its underlying concepts were recommended for enactment both by a majority of the Interagency Task Force on Patent and Information Policy and by the Public Advisory Committee, as part of the past Administration's Domestic Policy Review on Industrial Innovation. The bill has the support of concerned bar and industry organizations. It was not hastily conceived, and contains every safeguard needed to protect the public interest. Before offering our support, however, we carefully considered the alternatives and found them inadequate.

The most obvious is the shortening of the regulatory review period. Of course, it varies from product to product and process to process, but is almost always long enough to impair the patent incentive significantly.

We have been informed, however, that while some shortening of these regulatory review procedures might be achieved by the involved agencies, it cannot be nearly enough to eliminate the problem S. 255 addresses. In any case, the bill can never endanger the public interest. Any restoration available under the bill decreases as delays are removed from the regulatory review process. If there were no delay resulting from regulatory review, restoration of the patent term would not be necessary at all.

The opportunity to delay the filing of a patent application, and accordingly delay the beginning of the patent term, is not an acceptable answer either. Patent applications for pharmaceutical and agricultural chemical inventions are usually filed promptly after their discovery. Such early filing allows researchers to present their findings to professional colleagues, obtain patent rights with a reasonable assurance that expensive and unpredictable litigation over inventorship won't be necessary and obtain patent rights in foreign countries--in general, to serve the patent law's basic aim of revealing new technology to the public as soon as possible. Delaying the filing of patent applications would risk the loss of rights and deter the public dissemination of new technology.

Another possibility we considered was delaying the issuance of the patent until completion of the regulatory review procedure. This is administratively easily accomplished and would accord full patent terms to affected patents. This possibility would, however, delay publication of the technology involved, and encourage wasteful duplicative research and development. Competitors' efforts to develop improved products and processes in non-regulated fields would also be postponed or stifled. The patent system need not and should not tolerate these consequences.

A predetermined extension of the patent term is almost as bad. It would provide too long a patent term for some inventions and too short a term for others. Also, the predetermined period would need continual adjustment to take into account new testing techniques and possibly lengthier testing periods that new products may need. The extension of up to seven years authorized by S. 255 is fair both to the public and the affected industries. Many restorations will be for lesser periods, but none will be unduly long.

In conclusion, I point out again that a patent owner will not receive from S. 255 any special or unfair competitive advantage or any right not available to other patent owners. This bill does no more than allow a patent owner to stop infringement or license his patent for up to seventeen years. It does not lengthen the practical effect of the patent term and it assists only those industries needing regulatory approval for the marketing of their new processes or products.

I would be pleased to answer any questions, and offer the assistance of the Patent and Trademark Office for any amendments to the bill which the Committee may request.

STATEMENT OF
EDWIN H. CLARK II
ACTING ASSISTANT ADMINISTRATOR FOR
PESTICIDES AND TOXIC SUBSTANCES
US ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
COMMITTEE ON THE JUDICIARY
UNITED STATES SENATE

April 30, 1981

Good morning, Mr. Chairman. I am Edwin Clark, Acting Assistant Administrator for Pesticides and Toxic Substances of the US Environmental Protection Agency. My office has responsibility for implementing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Toxic Substances Control Act (TSCA). I welcome the opportunity to meet with you to discuss S. 255, the "Patent Term Restoration Act of 1981."

This bill is designed to restore to patented products the patent protection time lost during the Federal government review period which precedes introduction of products into the market. We view this bill as a way of making the pre-market clearance process consistent with full term patent protection. It will also encourage innovation. For these reasons, we support the principles which underlie this bill; we recommend, however, some changes which we feel would improve the bill.

This bill would complement other activities we have underway to create and improve incentives for innovation. For example, we are considering a possible change to the Agency's Patent Policy. Under PL 96-517 passed last year, small businesses and non-profit organizations receive title to any patents resulting from government-funded research. EPA is considering additional actions along these lines which should serve to increase the rate of commercialization of innovative products.

We join Senator Mathias and others in underlining the importance of the changes sought by this proposed legislation. Restoration of the full patent term of 17 years to inventors and innovators would eliminate an unnecessary and unintended side-effect of the pre-market testing process, and would encourage innovation by industry--particularly in the areas of pesticides and other chemicals. Permit me to outline how the current pre-market testing process affects patent holders, who are seeking to market the patented products.

Experience has shown, for example, that the pre-market testing to which many pesticides are subject, and the reviews of that testing which we must conduct, can decrease the effective patent term of an individual product by as much as seven years. In all but a few cases, however, the time required for testing and review is substantially shorter. A shorter effective patent term reduces potential return on patented products, and may reduce a company's incentive to spend

funds on research and development. This may in turn slow the rate of industrial growth and reduce innovation. Yet innovation is essential if safer products are to be developed and introduced. Enactment of this bill will help to avoid these unintended side-effects of pre-market regulation and will be an important step to improve the climate for industrial innovation.

We do have the following suggestions to offer which we feel would improve the bill both from the standpoint of EPA and affected industry. Those suggestions fall into three areas: general, FIFRA-related, and TSCA-related. I have attached our specific suggested language changes to this statement and I will now offer some general comments on those suggestions and the reasons for them.

As to the general provisions of the bill, we offer a technical suggestion which would clarify the applicability of the bill to products for which regulatory review has already commenced when and if the bill becomes effective. We also recommend that the "catch-all" provision in lines 6 through 15 on page 8 of the bill be deleted, because it is so broad that it may have widespread but unanticipated effects. If coverage of other pre-market review programs is desired, this should be done specifically rather than through a section which is this general in nature.

We would also like to point out one final general point which relates to the calculation of the regulatory review period. Our concern is that companies might attempt to extend the patent period for no good reason by doing a simple short-term test as soon as the product is patented, and then delaying any attempt to market it. To avoid such non-beneficial trade constraints, we would suggest that the compensable period

equal the amount of time spent in testing and analysis plus the amount of time spent in the actual Agency review period, rather than a period which runs from the initiation of any testing to the end of the review period. Under this proposal any dormant time between testing and analysis and the actual Agency review would not be compensable. We recognize that this comment does not directly affect our programs, and only in unusual cases would the suggested change have any health or environmental impacts. However, we believe that such a modification could further the beneficial purposes of the bill. We have not submitted any specific language in keeping with this recommendation but would be happy to assist the Committee in drafting such language if you would like to follow up on this issue.

With respect to FIFRA, we generally favor all the provisions of the proposed legislation but have general technical suggestions relating to the commencement of the review period and the clarification of the relationship between provisions concerning FIFRA and those concerning the Federal Food, Drug and Cosmetic Act.

With respect to TSCA, there are no testing requirements for new chemicals and the review period is very short compared to other programs--usually no more than 180 days. Therefore, the patent time lost for chemicals as a result of TSCA is not likely to be significant. However, we would like to encourage testing of new chemicals before they are manufactured, and would like to reward firms who voluntarily test. We would suggest some modifications in the proposed legislation to provide these incentives and these rewards.

First, we recommend allowing credit for any prenotification health or environmental tests, not simply for 'major' tests. In many cases the tests recommended under TSCA take only a short period. Accordingly, we have proposed a new definition

for the term "health or environmental study" specific to TSCA, and we have proposed allowing the regulatory review period to begin upon the commencement of any health or environmental study of a chemical substance subject to Section 5(a) notification requirements.

Second, while TSCA section 5 provides for, at most, a 180-day notice review period, we have found that, in some cases, companies have voluntarily suspended the review period to "stop the clock" and allow EPA and the company more time to discuss issues or problems raised by a particular chemical substance in a notice. Accordingly, we recommend that the regulatory review period for purposes of the bill run until either the end of the notice review period or one year after submission of the notice, whichever comes first. We believe that a one-year period is a reasonable time for concluding actions on the notice without leaving an open-ended loophole.

Third, we recommend that, except for one instance, the references to section 5(f) of TSCA be eliminated from the bill. Section 5(f) provides for regulation of chemical substances subject to section 5 notification. Action under section 5(f) would not be part of the "regulatory review" of a chemical substance but rather would be the actual regulation of the substance after the regulatory review. Since the purpose of the bill is to compensate for the period of time that the chemical substance is delayed from market entry by the regulatory review, generally eliminating the reference to section 5(f) is consistent. In addition, if action were taken under section 5(f) of TSCA which prevented the marketing of a chemical substance, that action would be permanent. Consequently, the substance would not later be likely to

ever enter the market. However, in the instance where an order under section 5(f)(3), which prohibits all manufacture and use of a chemical, is subsequently overturned by the courts, the time lost should be compensable. Accordingly, we have proposed language which would allow such time to be included in the regulatory review period.

Fourth, we recommend a change in the reference to section [illegible] of TSCA in the bill. As stated previously, TSCA's goal is to encourage industry to test new chemicals, where appropriate, before submitting them for section 5 review. A section 5(e) action would be taken only if the company had not provided sufficient information for EPA to evaluate the health and environmental risks of the chemical substance. Any delay in market entry from action under section 5(e) would result from the company's own decision not to test its chemical prior to the regulatory review. We do not believe that this approach should be encouraged and would like to limit the amount of time compensable due to time loss under section 5(e). We recommend therefore that, in general, there be a maximum of one year of compensable time for any chemical which is prohibited from the marketplace due to a 5(e) order or injunction. However, in many cases, we will allow a company to begin producing and selling a product even while it is under a 5(e) order, so the issue of patent extension disappears. In addition, we recognize that in some situations, EPA may take action under section 5(e) which is later not upheld by the courts. In that event, we believe that the notice submitter should be entitled to an extension of patent rights to make up for any resulting delay in those instances where the 5(e) order has banned all manufacture and use of a substance. Accordingly, we have also proposed language which would include in the regulatory review period time during

which the chemical substance is subject to a total prohibition under section 5(e) when a court later finds that the prohibition was not appropriate.

Finally, we have also recommended some minor changes of a technical nature.

I appreciate very much the opportunity to testify on and endorse this commendable idea. I would be happy to respond to any questions you may have.

ATTACHMENT A

General Suggestions

1. p. 8, lines 6 through 15

Delete entirely.

2. p. 8, line 20

After "commenced", add "on a product for which a patent has been granted".

ATTACHMENT B

FIFRA

1. p. 3 line 13

After "test", add "required by the regulatory agency."

2. p. 6, line 15

After "in", strike "a" and add "an initial".

3. p. 4, line 8

After "additive" and before the comma, add "(other than a pesticide)".

4. p.5, line 8

After "additive" and before the comma, add "(other than a pesticide)".

ATTACHMENT C

TSCA

1. p. 4 lines 19-21:

"(D) any chemical substance under the jurisdiction of the Toxic Substances Control Act."

2. p. 5, Insert between lines 2 and 3:

"(3) The term 'health or environmental study' means a test or study to determine or evaluate health or environmental effects of a chemical substance."

3. p. 5, lines 3 and 7:

Change number 3 and 4 to 4 and 5 respectively.

4. p. 6, lines 23 and 24; p. 7 lines 1-24; p. 8, lines 1-5:

"(C) with respect to a chemical substance for which submission of a notice is required under section 5(a) of the Toxic Substances Control Act--

(i) which is subject to a rule requiring testing under section 4(a) of such Act, a period commencing on the date the patentee, his assignee, or his licensee has initiated the testing required in such rule and ending on the expiration of the notice period for such substance or on the expiration of one year from the date of submission of the notice, whichever comes first;

(ii) which is not subject to a testing rule under section 4 of such Act, a period commencing on the earlier of the date patentee, his assignee, or his licensee--

(I) submits a notice, or

(II) initiates a health or environmental study on such substance, the data from which is included in the notice for such substance,

and ending on the expiration of the notice period for such substance or on the expiration of one year from the date of submission of the notice, whichever comes first.

(C)(2)(a) If EPA issues an order, prohibiting all manufacture and use of a chemical, under section 5(e) of the Toxic Substances Control Act, or a United States District Court issues an injunction based on such order, prohibiting all manufacture and use of a chemical, the regulatory review period will be treated as ending on the date such order or injunction is vacated or set aside. Provided, however, that in no case shall the additional credit to the regulatory review period determined under this subsection exceed a period of one year.

(C)(2)(b) In the event an action is brought in a United States District Court under section 5(e) or 5(f) of the Toxic Substances Control Act prohibiting all manufacture and use of a chemical, the Court grants preliminary injunctive relief prohibiting the manufacture, importation, or use of such substance which is encompassed within the scope of the patent; and either the Court denies permanent injunctive relief or an appeal to the court on review reverses the grant of injunctive relief, the regulatory review period will be treated as ending on the date of such court action;"

Senator MATHIAS. We will now ask panel No. 2 to come to the table. We have Dr. Edwin Yates, Office of Patent Management, Johns Hopkins University, which the Chair will note is a distinguished Maryland institution; Dr. Lewis Sarett, the senior vice president for science and technology of Merck & Co.; and Mr. Arthur A. Smith, who is general counsel to the Office of Sponsored Programs at MIT.

We will ask Dr. Sarett to begin for this panel.

Your entire prepared statements will be made a part of the hearing record, and you may proceed.

STATEMENT OF DR. LEWIS H. SARETT, SENIOR VICE PRESIDENT FOR SCIENCE AND TECHNOLOGY, MERCK & CO., INC., ACCOMPANIED BY RUDOLPH J. ANDERSON, ASSOCIATE GENERAL COUNSEL AND DIRECTOR OF PATENTS, MERCK & CO., INC.; ARTHUR A. SMITH, JR., GENERAL COUNSEL, OFFICE OF SPONSORED PROGRAMS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY; AND EDWIN T. YATES, PH. D., OFFICE OF PATENT MANAGEMENT, JOHNS HOPKINS UNIVERSITY

Dr. SARETT. Thank you, Mr. Chairman, and members of the committee.

I am Dr. Lewis H. Sarett, senior vice president for science and technology of Merck & Co., Inc. I am accompanied by Mr. Rudolph J. Anderson, who is our associate general counsel and the director of patents.

Like its industry, Merck is a highly research-intensive company in a research-intensive industry.

Senator MATHIAS. Dr. Sarett, again, I see some strained faces in the back. I would ask all the members of the panel to keep the mike close.

Dr. SARETT. Thank you.

We have over 2,500 Merck scientists and personnel who are employed by the company's research division. Our research and development budget is $280 million in this year.

The development phase, as you pointed out Mr. Chairman, in new drug discovery and development, is becoming lengthy and costly.

I would like to illustrate what has happened by two drugs in the anti-inflammatory area, which we have developed.

These two drugs were developed 15 years apart. The first of them was Indocin, and the development work on it took only 4 years. The development work on Clinoril, 15 years later, took twice that long—8 years.

I think most dramatic is the size of the new drug application in the two cases. The new drug application for Indocin went 10,800 pages and the Clinoril NDA had 122,000 pages.

Unfortunately, the patent incentive for pharmaceutical innovation has been reduced by the patent life lost to safety and efficacy testing. That is quantitated on page 13 of my testimony, when applied to certain Merck products.

As you can see, we have less than 11 years of effective patent life remaining on our most recent products. Those products still in the FDA pipeline will have less than 8 years of effective patent life.

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Enactment of S. 255 is badly needed to restore this important incentive for pharmaceutical R. & D. The bill represents a very balanced and reasoned response to the erosion of the patent term. In effect, the bill gives back that period of the patent term which is lost because of Federal safety and efficacy review requirements.

It is important to note that the bill is drafted so that it does no more than that.

Although S. 255 is highly important to the future viability of the pharmaceutical industry, the committee should not be misled into believing that it will immediately generate new sales revenues which can be dedicated to research and development, nor should the committee expect an immediate increase in new drugs. Pharmaceutical innovation, as we well know, is a long-term process, requiring a continuing commitment of funds as well as predictability and continuity of future revenue streams.

S. 255 does promise to provide pharmaceutical companies with the necessary certainty that their new products will have sufficient patent lives to justify the substantial investment in R. & D. to bring future products to market and to justify maintaining our ongoing research efforts.

In the usual case, increased sales revenues from patent restoration will not be realized for 10 to 15 years. This is so because S. 255 does not apply to patented products currently on the market, even though these products have also suffered a substantial loss of patent life.

S. 255 does not restore a full patent term to those products already undergoing regulatory review.

Indeed, recent action by the Department of Health and Human Services, which you referred to earlier this morning, will exacerbate the diminution and unpredictability of near-term revenue streams for many innovative drug firms, including Merck. This action will insure a rapid onset of generic competition for existing drugs whose eroded patent terms are about to expire.

Although it is scientifically correct to allow the generic houses to rely in part on the extensive health and safety testing done by the original innovator, this action will more rapidly diminish revenues which can be returned to R. & D.

I recognize that the members of this committee must look at patent term restoration from a broad perspective. Obviously, you have an obligation to weigh concerns about possible economic effects on consumers from delays and potential generic price competition.

I address this legitimate concern on page 22 of my written testimony, asking you to balance such delays against the substantial consumer benefits, both economic and lifesaving, from the innovations which will be encouraged by patent term restoration.

Innovative drugs do result in significant consumer medical cost savings. Treating glaucoma by surgery costs $590 for the operation plus several hundred dollars per day for hospitalization. In contrast, treatment of glaucoma with timoptic, our beta blocker, costs only 22 cents per day to the pharmacist.

Similarly, with pneumococcal vaccine, in an elderly person hospitalization with a bout of pneumococcal pneumonia will cost him on the average of $3,300. Our vaccine, on the other hand—which

prevents this disease in most cases—costs, together with the doctor's charge for administration, only $11.

The pharmaceutical industry faces exciting challenges developing new drug therapies for heart disease, stroke, diabetes, cancer, and other illnesses for which no satisfactory drug exists today.

Sufficient incentives must exist if the medical challenges of the 1980's and 1990's are to be met.

S. 255 will help to provide such incentives.

Thank you.

Senator MATHIAS. Thank you very much, Dr. Sarett.

Gentlemen, who will be next?

Mr. SMITH. Mine is very brief, so I will start, Mr. Chairman.

Senator MATHIAS. Would you identify yourself for the benefit of the reporter.

Mr. SMITH. I am Arthur Smith, the general counsel for the office of sponsored programs at Massachusetts Institute of Technology.

In that capacity, Mr. Chairman, I am responsible for the patent licensing program at that institution.

I wish to thank you for this opportunity to express my thoughts on S. 255.

PATENTEES—INEQUALITY OF TREATMENT

As you know, Mr. Chairman, the patent system was viewed by the Founding Fathers of this country as important enough to be protected within the Constitution.

Specifically, article I, section 8, states, in part:

> The Congress shall have the power to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.

In order to achieve the goals of technology transfer established within this constitutional article, while securing limited rights to inventors, the life of a utility patent has been established at 17 years.

Unfortunately, however, certain fields of endeavor appear to be less equal than others when it comes to the term of a patent's life. I specifically refer to those inventions which require approval of regulatory agencies within the U.S. Government; for example, the pharmaceuticals, assays, and other inventions directly or indirectly impacting the health and the environment of the Nation.

Because of the time and money involved in securing such regulatory approval, the effective lifespan of such patents is considerably less than 17 years.

Accordingly, there has evolved a pattern which, in practice, discriminates against one class of patentholders by insuring that they will not receive the benefits of the full 17-year patent life, which is available to other patentholders, in keeping with the constitutional and congressional imperatives.

This lack of equal treatment tends, I believe, to dampen early technology transfer in precisely those areas of scientific development that should be emphatically encouraged.

The proposed act should minimize these inequities. This is the reason why I believe such a bill should receive the support of the Congress and ultimately should be of benefit to the public at large.

TECHNOLOGY TRANSFER AT UNIVERSITIES

The Patent Term Restoration Act will be of considerable value to universities throughout the country and of specific value to universities engaged in biomedical and biotechnological research areas, since it meets a pressing need in those areas.

At the present time, much of the research conducted at universities is funded by agencies of the U.S. Government. Most of these agencies are committed to the encouragement of technology transfer through the various Presidential memorandums, as well as their own statutory statements.

Consequently, most of these agencies have established procedures under which qualified universities are encouraged to transfer technology to the commercial sector through licensing programs. Technology transfer by universities is even more encouraged by the recent passage of the Uniform Patent Act.

Although the Uniform Patent Act continues to require universities and other nonprofits to limit the term of exclusive licenses, it does allow time lost in the regulatory process to be excluded from the term of the exclusive features of any such license.

Obviously, that particular law, however, does not address itself to the problem of the time which is lost from the patent life itself because of the regulatory procedures.

Consequently, I believe that the Patent Term Restoration Act is a necessary adjunct to the Uniform Patent Act itself as a means of insuring that inventions in the area of health and environment which are made at universities are actively encouraged and treated fairly.

As all of us who are involved in technology transfer at universities are painfully aware, most of the inventive concepts developed on the campuses throughout this country are not readily capable of being utilized commercially or by the public at large.

The inventions are usually basic and at the forefront of the technology, but they require considerable further development and investment to make them commercially feasible and, hence, available to the public.

Such further development and investment is not realistically or properly the function of a university but rather is the role of industry.

Within this context, it is imperative that universities be able to offer prospective industrial licensees incentives for investing the required time, manpower, and money to make the university's invention a viable and useful contributor to the country's economy and mode of living. The proposed bill should act, and I believe does and will act, as an incentive in this respect.

SUMMARY

The Patent Term Restoration Act represents an increasingly more affirmative view of the value of the patent system in the eyes of the public, as well as the Congress.

This act, if passed, will redress the existing inequities between patentholders, as reflected by the differing technological areas. It will increase the incentive for industrial concerns to work with universities in order to transfer the technology invented on the

Nation's campuses. It will insure that all inventors will have a better chance of obtaining the full benefit of a patent term in a way that does not impede or discourage the necessary regulatory processes.

The act is also reasonable in that it is not openended and imposes a 7-year time maximum limit, which should we believe, in most cases, be adequate to meet the patentholders needs under the various regulatory processes.

In conclusion, I endorse this bill as proposed and believe that it will be of benefit to universities in their licensing programs.

Thank you, Mr. Chairman.

Senator MATHIAS. Thank you.

Dr. Yates?

Dr. YATES. Thank you, Mr. Chairman.

My name is Edwin Yates. I am the patent management officer at Johns Hopkins University.

It is an honor and pleasure for me to appear before this committee to present testimony on the Patent Term Restoration Act of 1981.

While my comments will focus on the general need for a law restoring the life of a patent, as contemplated by the act, they will be from my perspective as the patent management officer of the Johns Hopkins University.

The Constitution provides for a patent system under which an inventor is granted a limited, 17-year monopoly on his invention in exchange for its disclosure to the public.

As it turns out, after having kept his part of the bargain in disclosing his invention in the form of an issued patent, the inventor often does not get to enjoy the full 17 years of his monopoly.

Federal regulations require that new drugs, certain chemicals, and certain classes of medical devices be subject to governmental regulatory review and approval prior to being placed on the market.

In the case of new drugs, and to a lesser extent subject medical devices, the review process can commonly take 5 or more years and require the expenditure of literally millions of dollars.

Often, a patent on an invention has issued but the invention cannot be practiced because the patented product has not been cleared for marketing. The effective life of the patent is, therefore, reduced by the amount of time after the patent issues that marketing is delayed by regulatory review.

Universities and colleges have a unique set of problems. The nature of research done at colleges and universities almost inevitably result in inventions that are on the leading edge of the pertinent technology. Moreover, the need of the academic researcher to publish his work often requires a patent application to be filed at a very early stage in order to avoid a statutory bar of publication.

The result is a patent that issues before the invention is fully developed and, in many cases, before a market for the product even exists.

It is not unusual for a patent on an invention made at a university to have 3 to 9 years of its life expired before a manufacturer becomes sufficiently interested to take a license. Add to this the time that must be spent getting regulatory approval, and it be-

comes apparent that the royalty-bearing life of the patent is only a relatively few years by the time the invention gets on the market.

Clearly, if the time spent obtaining regulatory approval were added back onto the life of the patent, it would be of great benefit to the academic community. The recovered period for producing royalty income would be particularly significant today when the usual sources of research support are drying up.

Let me give a chronology of events relating to one of the patented inventions made at Johns Hopkins. The invention, a medical device, was described in a paper published in May 1968. A U.S. patent application was filed in May 1969, within a year of the publication date, to avoid a statutory bar. The patent issued in May 1972.

In the spring of 1974, shortly after having joined Johns Hopkins, I began extensive efforts to license the patent.

Many companies expressed an interest in the invention, but it was not until July 1980 that the invention was licensed.

It is my opinion that earlier efforts to license the invention were unsuccessful because there were technical problems that could not be solved at the time and a market for the device just did not exist.

We now anticipate that it will be 3 to 4 years before a commercial device is developed and approved for marketing by the Food and Drug Administration.

Assuming that commercial sales begin in May 1984, our licensee will have patent protection and the university will receive royalties for only the 5 years remaining in the life of the patent.

If the Patent Term Restoration Act were to become law, the life of the patent would be extended by the amount of time during which market approval was delayed because of regulatory review. Depending on the length of the review period, the term during which the patent would generate royalty income for the university could be extended significantly.

In summation, passage of a law to restore to the life of a patent the period of time lost to premarket testing and regulatory review is felt to be beneficial, not only to the patent owner but ultimately to the public. Such a law would give the industrial patentee a greater opportunity to recover his considerable investment in making, developing, and obtaining approval to market his invention and to obtain a reasonable profit. Without the chance to make a reasonable profit, there would be little if any incentive to conduct future research to make new inventions, and the public would be the loser.

I have mentioned the problems peculiar to inventions made at colleges and universities. Restoration of the term of patents would make licenses on inventions made at colleges and universities more attractive to industry. Without licenses, the public would not receive the benefit of these inventions, since universities are not in a position to actually commercialize them.

As mentioned earlier, restoring the royalty-bearing life of a patent would generate additional income for research to make future inventions, again to the benefit of the public. Moreover, passage of the Patent Term Restoration Act would in no way reduce the effectiveness of Federal regulatory agencies in protecting the public.

For the foregoing reasons, I feel strongly that it would be in the public interest to have a law which restores to the life of a patent that period of time up to the contemplated maximum of 7 years that is now lost because of regulatory review.

Mr. Chairman, thank you for the opportunity to appear today. I will be happy at this point to answer any questions.

Senator MATHIAS. Thank you very much, Dr. Yates.

Let me start with Dr. Sarett.

I was very much struck by your example of glaucoma as a disease in which the existence of some innovative drug could result in a very substantial economic benefit to the consumer, leaving aside the questions of recovery and avoiding pain and suffering and hospitalization and all those subjective factors.

How long have you been with Merck?

Dr. SARETT. Just about 40 years, sir.

ECONOMIC FACTOR OF RESEARCH PROJECTS

Senator MATHIAS. Out of that experience, could you tell us one or two examples of where you have had to defer research in a product that you might otherwise have considered promising because of the economic factors within the industry?

Dr. SARETT. Yes, sir.

Our research and development budget is put together every year by looking first at technical feasibility, the needs of patients, the market, and other inputs. Out of that we winnow what we feel is the best research program every year.

Needless to say, there are some research projects which don't get funded but must be deferred. Indeed, at times there may be ones which are postponed indefinitely.

I can recall from my personal experience a project, for example, on cystic fibrosis which, as you know, is a very severe and, indeed, fatal hereditary disease of children. Both from the point of view of technical feasibility which is a difficult problem and also from the point of view of finances, we had to shelve that.

The problem of deterioration of bone is a very serious one, particularly for elderly women. We have wanted to work on that.

Again, because of a combination of limitations on budget and technical problems to overcome, we deferred that. I am sure I could give you others.

Senator MATHIAS. What would be the effect of this legislation on those decisions? I understand that they are complex decisions, but what would be your feeling had you had the opportunities presented by this legislation?

Dr. SARETT. The effect of S. 255 would be to give all of us in management the conviction that the research and development expenditures of today would be justified by an adequate lifetime in the market of the products resulting therefrom.

I feel that the research expenditures we make with that expectation and with that confidence could gradually be increased.

Senator MATHIAS. In any society, there has to be some point at which we balance out all the factors—the positive and negative. I suppose in American society, Congress is the place where that happens. I wish we had a better ability to do it more accurately and more comprehensively.

One of the things we have to worry about in this country today is our balance of trade. For example, if we are to be able to buy and pay for all of the energy we expect to have to acquire from oversees between now and the end of the century, we will have to increase our export trade by a factor of ten, which is a pretty frightening challenge.

The only alternative to that is to expend our capital, and we are already in trouble on that.

Would you explore a little bit what is already in your written statement about the declining position of the American pharmaceutical industry in foreign trade? Is there any twist to this that will adversely affect us? Your foreign competitors will get some advantage from this bill too; will they not?

Dr. SARETT. Yes.

The beneficial impact of S. 255, I think, can be looked at in two different ways. Most obviously, S. 255 will provide a more attractive domestic market in the United States. It will provide an encouraging environment for a new, young aspiring pharmaceutical company, both as to startup and, once started up, to continue and grow.

They will be making mistakes. They will be exploring. They will be staffing up with new people. As a result, it will be a rather protracted period of time for them before they get their first product to market perhaps.

Therefore, S. 255 will help us to startup with innovative, young new companies.

Beyond that, there will be a favorable effect also for R. & D. on many U.S.-based companies. Of course it will also affect our foreign competitors who do business here. But because of the fact that the U.S. market has more U.S.-based companies which are successful and large here, it will provide more encouragement for those U.S.-based companies than for our foreign competitors.

Senator MATHIAS. Let me turn to Dr. Yates and Mr. Smith.

I was pleased that Mr. Smith's memory extended back to the passage of the University Act. I sometimes think what we do around here is like a stone thrown into a well. After you hear that first plunk, you don't hear about it any more.

How will patent restoration complement the patent policy embodied in the university's patent act?

Let me expand that question a little bit to ask you to speculate on how it will affect university research.

Dr. YATES. Mr. Chairman, I feel, as I said in my testimony, that extension of the term of a patent would make licenses more attractive to industry and, therefore, enhance the technology transfer and bring to the public these inventions that might not otherwise have been licensed.

Of course, there is always the question of additional royalty income being generated to support future research.

Senator MATHIAS. Mr. Smith?

Mr. SMITH. Mr. Chairman, for a moment I thought that you were referring to my memory going back to the Constitution. [Laughter.]

I am not an economist.

Senator MATHIAS. I hope your memory does embrace the Constitution. I think it is a great thing and more Americans' memories should embrace the Constitution.

Mr. SMITH. To basically follow along with what Dr. Yates has said, the problem we have at the university is that we are in a position of trying to transfer technology, which means that we must take advantage of the patent system in order to be able to have the incentive factor for inducing companies to invest and so forth.

On the other hand, because we are universities, we are free and open institutions and we are very much aware of the need to publish early.

What happens is that we get caught almost between a rock and a hard place. We publish early, which means therefore that it is often difficult to get a full patent position within a reasonable time period. We lose a certain amount of time there.

Up until the Uniform Patent Act, we were also in a problem area in terms of the time of the exclusive license, because we are limited by Government regulations as to how long we can license exclusively. That was always a problem.

Now that we have solved that, we are looking toward the Patent Restoration bill in order to add back on the term of years. What this bill will do is help us in discussing with industry the need for taking a license to the technology at an earlier stage.

Likewise, by doing that, as Dr. Yates pointed out, it will give us an opportunity to secure some royalty income which is very necessary for the universities today. It is general, unrestricted funding which can be used for research and educational needs.

So balancing both of those factors, we feel that this act, coupled with the Uniform Patent Act, goes a long way toward meeting our needs.

Senator MATHIAS. Gentlemen, thank you very much.

[Prepared statement of Dr. Sarett follows:]

STATEMENT OF DR. LEWIS H. SARETT

Mr. Chairman and members of the Committee, I am Dr. Lewis H. Sarett, Senior Vice President for Science and Technology of Merck & Co., Inc. It is a pleasure to be here today to testify in support of S. 255.

My testimony will discuss current trends in pharmaceutical research and development to illustrate why patent restoration is needed. I will discuss specifically the substantial increases in dollars and time required to develop a new drug today compared with twenty years ago. I will share my thoughts as to the reason for these increases and also what the consequences may be in terms of future innovations in drug therapies. In this context, I will then discuss why I believe increased incentives in general, and patent restoration in specific, are needed.

For the past 39 years, I have worked as a research scientist and then as a research administrator for Merck. Seven of those years were as President of the Merck Sharp & Dohme Research Laboratories. During that time I have witnessed profound changes. Our understanding of the human body has vastly improved, our research techniques have become both more refined, more versatile, and more complex, and our expectations for drug performance and safety have markedly increased.

The pharmaceutical industry is highly research intensive, much more so than most other industries. Our research involves a partnership with government research institutes and universities, with the government providing essential basic research and the industry developing practical therapeutic applications. The Federal contribution to pharmaceutical industry R & D expenditures is, however, much less than in other industries. Less than 1 percent of the pharmaceutical industry's R & D funds is provided by the Federal government. In contrast, 42 percent of the R & D for all American industry is provided by the Federal government. Pharmaceutical manufacturers in the U.S. have

traditionally allocated about 11 percent of their net pharmaceutical sales to pharmaceutical R & D, a figure five times greater than the 2 percent for U.S. industry as a whole.

DESCRIPTION OF MERCK & CO., INC.

Merck is a research intensive company in a research intensive industry. In total dollars spent on R & D, Merck is a leader within the industry. Our research and development expenditures have increased steadily over the years. In 1966 Merck spent $43.2 million on research and development. Our 1980 R & D budget was $233.9 million, and we have budgeted $280 million for 1981. We have increased our research budget at a compounded annual growth rate of 14% since 1975, and we expect our R & D budget through 1985 to grow at a compounded annual rate of 17%.

Merck's commitment to research has resulted in important medical innovations. The first patient to receive penicillin in the United States received Merck penicillin. In my days as a Merck research scientist, I was the first person to synthesize cortisone. As a result of this and later efforts of many of our scientists, Merck was the first to market cortisone, opening up a new era in the treatment of rheumatoid arthritis and other inflammatory diseases.

Other early accomplishments of our laboratories include the practical synthesis of riboflavin and vitamin B_6; "Benemid" for gout; Vitamin B_{12}, life-saving in pernicious anemia; and "Diuril", which revolutionized the treatment of congestive heart failure and high blood pressure. "Aldomet", introduced seven years later, represented another major step in the treatment of high blood pressure. Unlike previous therapies which acted on the kidneys, "Aldomet" acted on the central nervous system, thus enabling doctors to treat patients who did not achieve an optimal antihypertensive response from earlier therapies.

In the 1960's, we introduced "Indocin", the first breakthrough non-steroidal anti-inflammatory product and for many years the most widely prescribed drug in the field. "Clinoril", a more recent product, has further improved arthritis treatment. Our "Timoptic" has vastly improved the treatment of glaucoma, the leading cause of blindness in the United States. Merck's research in viral and bacterial vaccines has led to the development of vaccines against a broad range of infectious diseases, including measles, rubella, and mumps. We have recently developed a vaccine for the prevention of pneumococcal pneumonia which claims the lives of thousands of Americans each year. We expect to market a vaccine to protect against hepatitis-B virus within the next year, and we are working on vaccines to protect against hepatitis-A virus, gonorrhea, herpes simplex virus 1 and 2, and chicken pox. We expect FDA approval later this year to market Blocadren in the United States, a breakthrough drug expected to substantially reduce the mortality risk from a second heart attack.

INCREASING R & D COSTS

As a scientific organization profoundly committed to biomedical research, we see the potential for advances. As a business organization, we are all too aware that our continuous increase in expenditures for R & D does not represent a net gain in the number of research projects we can support. This is due to significant increases in the cost and time required for research and development in the last two decades. The cost of developing a new drug has increased sharply since 1962, going from $4 million to more than $54 million in 1976, according to the Center for the Study of Drug Development, University of Rochester. In 1962 the average development time for a new drug was two years. In 1976 the time from IND filing to NDA approval rose to nearly nine years, a figure that does not include, of

course, the development testing done before the IND can be filed.

A number of factors have contributed to these increases. Perhaps most significant are the tremendous scientific advances in medical technology for safety and efficacy testing. Today, we can ask many more questions about new drug candidates and we can expect to get the answers to those questions. Our science is more versatile and probing, inevitably takes longer, but is better able to find potential hazards. Accordingly, we do much more intensive and lengthier testing today to satisfy ourselves and FDA that a product is ready to be marketed.

DESCRIPTION OF THE R & D PROCESS

It might be useful for me to explain briefly how the R & D process works at a firm like Merck to fully illustrate the implications of these trends. Although we usually speak of R & D in a single breath, research and development are two distinct processes. Research is broad ranging and is aimed at finding a new compound with sufficient novelty and promise in the laboratory to warrant clinical trials. (On the way to this goal, we sometimes do some rather fundamental research such as working on disease mechanisms and related biochemistry.) Development, on the other hand, is focused on the specific compound which emerges from the preceding research phase. It is aimed at thoroughly exploring how the compound works pharmacologically, how it is metabolized, what dosage levels may be needed, and its toxicological characteristics. If the compound passes these tests, it continues development into clinical studies in humans which ordinarily take several years.

Let me now characterize the early research and discovery stages in more detail. During the research stage we may seek new testing methodologies which can open up entirely new approaches and, thus, entirely new classes of drugs. Teams of Merck

scientists are doing basic research, for example, on mental health, on cardiovascular and renal disease, on bacterial and viral diseases, on immunology and inflammation, and on opthalmic problems. Groups of researchers are looking at specific medical problems within these broad areas. For example, within the cardiovascular area, researchers are tackling the problem of hypertension with the objective of finding new ways to lower blood pressure. In regard to bacterial and viral diseases, we are seeking to develop antibiotics which will act against organisms resistant to today's drugs. All told, over 700 of our 2500 Merck scientists are engaged in research.

If one of these efforts identifies a compound which shows promising characteristics, this compound serves as a point of departure or "lead" from which to develop analogs with superior properties. As many as 500 analogs may be made and submitted to biological testing in animals before one is selected as a candidate for development. It should be added parenthetically that often this long search leads to no candidate suitable for development. In that case the whole process has to start all over again with a search for a new lead.

In spite of the complexities and risks associated with this research phase, it is the next phase -- the development phase -- which is responsible for the major increases in both costs and time. It is at this stage that a major commitment of scientific personnel -- scientists, physicians, engineers, and pharmacists -- becomes necessary.

It is also during this phase that our efforts become subject to regulation by the Food and Drug Administration. Tests that we had no capability of doing twenty years ago are now considered an essential part of our development work. They are necessary to satisfy both ourselves and FDA that the product is useful in treating a disease and that it is safe.

Illustrative is Merck's experience with two non-steroid

anti-inflammatory drugs, "Indocin" and "Clinoril", brought to market 15 years apart. Both provided marked therapeutic advantages, with "Indocin" being the original breakthrough in the non-steroidal anti-inflammatory field. Let me preface my remarks by noting that what I will be describing are development, not research, costs and time. The nature of the basic research process makes it difficult if not impossible to ascribe dollars and time to individual products subsequently developed.

We began development work on "Indocin" in 1961 and were able to market the product 4 years later. Approximately 80 work years of scientific effort were involved. Our development work on "Clinoril" began in 1970, and we introduced it 8 years later. During those 8 years, our development costs were more than five times greater than the development costs for "Indocin". Approximately 240 scientific work years were involved in the product's development.

The major increases in the development time are primarily due to increases in toxicology, drug metabolism, and clinical testing. The increased toxicology testing for "Clinoril" included mutagenic studies, carcinogenic studies, and a greater number and type of reproduction studies. For "Indocin", our laboratory safety assessment and drug metabolism work required approximately 338 research personnel months, compared to 540 for "Clinoril".

The clinical testing for "Indocin" consumed 62 research personnel months compared to 1409 for "Clinoril". These increases reflect much greater emphasis on placebo-controlled clinical trials, more advanced pharmacokinetic studies, and more extensive bioavailability drug interaction studies.

All told, the NDA submission for "Clinoril" was more than 11 times lengthier than the submission for "Indocin". For "Clinoril", our NDA contained 122,657 pages, compared to 10,800 pages for the "Indocin" NDA. Once the NDAs were submitted, it

took the FDA 12 months to approve "Indocin" and 28 months to approve "Clinoril".

The increases in testing illustrated with "Indocin" and "Clinoril" have substantially increased our costs and have had a direct effect on our research efforts. Because our R & D budget is not limitless, some projects have to be deferred and ultimately possibly even dropped. Compounding this situation is the fact that our research teams must be much larger than in the past, requiring more diverse skills in order to make progress. The predictable results are fewer ongoing projects and a growing backlog of projects waiting to be undertaken. Indeed, in one five-year period, I observed a 10% decrease in the number of basic research projects in our laboratories.

I have been describing the process of discovering and developing new drugs. But one must keep in mind that this is science conducted in a corporation and subjected to rigorous business judgement. As a scientist who has spent the balance of his working life in industry, perhaps I might provide some insights into the process by which scientific potential is balanced against business concerns.

Each year, we put together our R & D budget by rationalizing a number of considerations. First, the scientists in the research laboratories recommend the projects they want to pursue and the ones they believe have reached a dead end and should be dropped. These proposals are winnowed by our top research management to determine which projects they believe are the most promising and feasible. In addition, the views of the marketing and management people are solicited to determine the therapy needs identified by physicians and patients. Although we try never to say no to a promising project, there are always more projects than can be undertaken in one year. Sometimes we say no, and sometimes we proceed at a less than optimum pace.

Understandably, as the development of a new drug becomes

more costly and time consuming, our research programs have to be aimed at markedly superior projects. As a result, I have seen us defer work in important areas. Work on cataracts of the eye and cystic fibrosis are two that come readily to mind. Each is a worthy and important therapeutic goal but, through a combination of limited technical feasibility and limited resources, each had to be deferred.

UNCERTAINTIES OF PHARMACEUTICAL R & D

I mentioned earlier that not all research leads end up successfully with a product candidate. Similarly, not all product candidates make it through development to the market. The potential pitfalls are numerous. Although our predictive powers have vastly improved, they are still relatively weak. The full pharmacologic and therapeutic value of a compound cannot be foretold at the time of its discovery. Indeed, it may not be discernible even at much later stages of its development. Moreover, adverse toxicological characteristics may not be discovered until several years into the development process. Finally, even if a compound survives the testing process, a company may find that one of its competitors has beaten it to the market with a product that provides more therapeutic gains.

Every pharmaceutical company knows that its dead ends will be far more numerous than its ultimate successes. Each NCE tested in animals but dropped prior to the IND stage represents a loss of approximately $1 million. Nearly 90 percent of the new chemical entities studied in man were dropped prior to NDA submission.

Thus, the pharmaceutical company knows that there may be a long period of time when no new products emerge but over which research and development must be sustained if there are to be any new drug therapies tomorrow. Research conducted in one decade may lead to several new products in the next, or it may not. One cannot predict with any surety which will be the case.

Merck has just recently committed itself to a major new research program in the area of immunology. This represents a commitment of several million dollars over the next few years. It represents an outlay of $6.3 million in 1981 alone. This new program involves 120 scientists, half of whom are new additions to our staff. The decision to undertake such a major new project was not an easy one. As you can see, it represents a tremendous commitment of resources. Obviously, Merck believes the area is promising, but we are undertaking the research commitment with no assurance of success. I think you can more fully appreciate our decision when you consider that we spent more than a decade on research in renal pharmacology before we had a major success, "Diuril". Our diabetes research program has been ongoing for 20 years without a single commercial success. We have devoted substantial resources over the last 20 years to as yet unsuccessful efforts to discover a substance to induce interferon development within the human body.

It is not surprising then that more and more pharmaceutical companies are increasingly unwilling to undertake long term investments in research for uncertain returns. As a result, we are witnessing a relative shift of dollars away from research to development. A recent survey of U.S. firms by the Organisation for Economic Cooperation and Development has revealed they are reducing the research share of their R & D budgets.

IMPORTANCE OF THE PATENT AS AN R & D INCENTIVE

The rewards must be high to justify the costly and time-consuming effort that goes into new drug development. As I have noted, we are a corporation which must measure its performance not only in terms of scientific contributions but also on the return we get from our innovations. In the last analysis we must succeed as a business to justify and sustain our scientific commitment. Traditionally, the rewards have been sufficient to provide the incentive for drug innovation. Unfortunately, this

is increasingly not the case. Indeed, industry outlays for R & D indicate a loss of incentive. Although in actual dollars the industry consistently spends about 11% of its sales on R & D, the proportion in constant dollars is declining. In 1961, the industry devoted 15.1 percent of its sales in deflated dollars to research and development. In 1979, the industry spent only 7.9 percent of its sales in deflated dollars on research and development.

If you simply isolate that part of the industry which is responsible for research innovations, between 1954 and 1958, 51 firms introduced one or more new chemical entities to the market. Between 1972 and 1976, 41 firms introduced one or more NCE's to the market. Between 1958 and 1972, there were 28 new entrants to the field and 39 exits.

The predominant incentive for pharmaceutical R & D -- the patent -- has been eroded by a loss of effective patent life. A recent study by the University of Rochester shows that on average a company can expect about 9.5 years of patent life when a new drug receives FDA clearance to be marketed. This compares to 13.6 years in 1966. Merck's own experience reflects this. Following is a table showing the effective patent life on significant products marketed by Merck in recent years.

Marketed Drugs	Date of NDA Approval	Effective Patent Life
"Diuril"	1958	16.8 years
"Indocin"	1965	16.5
"Edecrin"	1967	16.4
"Sinemet"	1975	15.5
"Flexeril"	1977	8.9
"Clinoril"	1978	10.5
"Mefoxin"	1978	patent application pending*
"Timoptic"	1978	10.6

*Interference proceeding underway.

Merck drugs for which FDA approval is still pending also reflect this substantial loss of patent life. The following table illustrates.

Drug	Patent issued	FDA approval
"Blocadren"	1972	Pending
"Midamor"	1967	Pending
"Moduretic"	1973	Pending
"Dolobid"	1972	Pending

This loss of effective patent life stems from factors I have already discussed. Patent applications must be filed shortly after a compound is discovered. Yet, the length of time required to complete the safety and efficacy testing necessary before we can market a drug has increased dramatically. There are two underlying causes. First, as I described, there are the important advances in our testing capabilities. Second, new and additional proofs concerning health benefits and safety risks are now required in order to obtain FDA approval.

Restoration of the effective patent life to compensate for the period of patent life devoted to complying with Federal safety and efficacy requirements will help restore an important incentive for pharmaceutical R & D. As a scientist turned manager, I can attest to the importance of the patent.

The research budget authorized by Merck's Board of Directors is directly related to the rewards dependent upon our patent system. Indeed, an underlying part of Merck's willingness to commit funds to research and development is the extent to which the fruits of our work can and will be protected by a patent. As soon as our researchers identify a compound and its potential therapeutic utility, our patent lawyers are asked to determine whether the compound can be patented. If the answer is no, there would be a strong reluctance to proceed with development efforts on the compound. We are also becoming much more sensitive to the years likely to remain on the patent when a candidate for development is finally ready to be marketed. Other things being equal, a development candidate which may take an inordinate amount of development time, with a resultant loss of effective patent life, is going to be less attractive than one with a shorter projected development period.

It would be naive to suggest that restoration of the patent term is the sole means of encouraging increased pharmaceutical research and development. There are obviously many ways the government can induce companies to invest in R & D. Tax incentives and improving the efficiency of the regulatory process are two important examples that come to mind. A full patent term is, however, surely the single most important incentive for the pharmaceutical innovator, and moreover, one which requires no investment of tax dollars. Only through a full and secure patent term can the historically proven incentive of the patent system operate effectively.

A patent term that is reduced by seven or more years is not a sufficiently strong investment incentive for a management concerned about the increasing costs of R & D. On the other hand, a full patent term on the products of our research will provide the assurance of future revenues which make it feasible for management to risk its resources in research and in the costly and time-consuming development of promising new compounds. It must be remembered that the R & D process is both continuing and long-term. It cannot be turned on and off at will. To commit the substantial funding necessary for R & D, management must be assured of a continuous flow of revenues over the long term which S. 255 would provide.

COMPETITION FROM FOREIGN COMPANIES

Improving the incentives for pharmaceutical research and development is important not only for health and domestic economic reasons, but also for international economic considerations. In 1979, the pharmaceutical industry contributed $1.15 billion to our trade balance. However, the United States is losing its dominant position in the pharmaceutical field, and our share of the international market is declining.

The position of U.S. pharmaceutical firms relative to their

Western European and Japanese competitors has deteriorated with regard to research efforts and innovational output since 1960. The annual growth rate for R & D in the U.S. from 1973 to 1979 was 11%. In the United Kingdom it was 25%; West Germany's was 20% and Japan's was 22%. This is a highly disturbing finding when one considers that sales and production in the pharmaceutical industry depend significantly on innovations made possible through R & D.

Measured in terms of patents, the decline in the U.S. competitive position is further revealed. In 1963, 66% of the patents on new drugs originated in the U.S. In 1975, only 54% of the patents originated in this country.

A forthcoming study by the National Research Council and the National Academy of Engineering reviews the current position of the U.S. pharmaceutical industry. The preliminary draft of the study concludes that the U.S. has suffered a steady deterioration in its international competitive position. Even more troubling, the study predicts that, in light of the declining rate of growth in this country's R & D, this deterioration will probably continue.

A full patent term is particularly important to those smaller U.S. firms that do not yet compete in international markets. Unless the U.S. firm has the incentive to innovate, it may never grow into a multinational competitor. In contrast, its counterparts in Japan and Western Europe, enjoying the benefits of recent lengthening of patent term in their countries and other R & D incentives in their domestic markets, may well be more likely to develop into formidable international competitors.

Fortunately, the domestic pharmaceutical industry is still strong and will be able to respond vigorously to new incentives for innovation. It would be tragic, however, if the warning trends I have mentioned are ignored. The patent restoration legislation offers Congress the opportunity to provide the

incentives we need before the industry eventually becomes debilitated to the point of needing massive governmental intervention and aid such as we are witnessing in the automobile and steel industries.

CONSUMER BENEFITS FROM NEW DRUGS

Earlier in my testimony, I cited several examples of important new drugs which provide major health benefits to the consumer. Health benefits are not, however, the only benefit to the consumer. In many instances, innovative drugs result in significant medical cost savings. Although it is difficult to quantify the cost savings from new medicines, let me use 2 or 3 drugs to illustrate the kind of potential savings which may be achieved. For example, the average hospitalization cost for a case of pneumococcal pneumonia in an elderly person is approximately $3300. Our vaccine to prevent this disease, together with the doctor's charge for administration, costs only about $11. Due to the efforts of several members of this Committee last year, Medicare now covers the vaccine, with significant long-term savings projected for Medicare from this precedent-setting preventive measure.

A recent study estimated that the vaccine for rubella (German measles) has produced savings in health care costs and lost working time 47 times that of the price of the vaccine.

Abbott Laboratories' sodium valproate, a new medicine to treat epilepsy, has been estimated to save $612 million yearly, quite apart from the number of distressing epileptic convulsions it saves the victims of this disease.

Merck's "Timoptic", the breakthrough drug in the treatment of glaucoma which I mentioned earlier, represents both a significant qualitative advance over previous drug therapies and a quantitative cost reduction from the surgery and hospitalization previously necessary in many cases. Treating glaucoma by surgery cost $590 per procedure in 1976 and $172 per

day of hospitalization in 1977. "Timoptic's" per day treatment cost to the pharmacist is about 22¢. At a time when hospital costs are escalating, new drugs which shorten or eliminate hospital stays may be one of our most effective cost containment weapons.

New drugs may produce economic savings for the consumer in another way as well, that is by competing with other patented products in the same therapy area. Again, let me provide an example from the Merck experience. "Indocin", the anti-inflammatory drug I described earlier, is still under patent, yet its share of the arthritic drug market has fallen from a high of 63% in 1968 to 17% in 1980. Obviously, improvements in the therapeutic value of new anti-inflammatory drugs are a significant determinant of market share. Economic studies on the pharmaceutical industry have shown that competition from other drugs within the same therapeutic class is a major factor considered by companies in setting prices. Thus, drugs still under patent face significant competition from other patented drugs in the same therapeutic class.

ANALYSIS OF S. 255

Enactment of S. 255 is badly needed to reverse the trends I have described. The bill represents a balanced and reasoned response to the erosion of the patent term. In effect, the bill gives back most of that period of the patent term which is lost because of Federal safety and efficacy review requirements. It is important to note that the bill is drafted so that it does no more than this.

The bill's precise definition of the restoration period means that the early R & D process, which typically begins years before the filing of the IND, and which is analogous to the research period in other unregulated industries, will not be subject to restoration. In the case of pharmaceuticals, the

restoration period begins on the earlier of the date a company initiates its first major test or files its Investigational New Drug application with the FDA. As a practical matter, the period will begin when a company files its IND. Rarely does any single test prior to the IND filing take six months. The restoration period ends when FDA permits the new drug to be marketed. The clear-cut beginning and ending dates for the restoration period provide objectivity and administrative convenience for the FDA (or other relevant agency) and the Patent and Trademark Office. As a result, S. 255 provides certainty to the patentee and will minimize potential litigation over the length of a restoration period.

As a safeguard against intentional dilatory action, the bill contains a maximum 7-year period of restoration. Of course the major safeguard against dilatory action is an economic one -- the possibility that a competitor will beat us to the market with a therapeutically equivalent or superior drug. The bill contains other safeguards as well. Restoration will apply only to the specific purpose or use subject to regulatory review, not to the entire range of products resulting from the original patent grant. Moreover, only products which successfully complete the regulatory review process will be eligible for restoration.

Although S. 255 is highly important to the future viability of the pharmaceutical industry, the Committee should not be misled into believing that it will immediately generate new sales revenues which can be dedicated to research and development or that it will result in an immediate increase in new drugs. Pharmaceutical innovation is a long-term process requiring a continuing commitment of funds, as well as predictability and continuity of future revenue streams. S. 255 does promise to provide pharmaceutical companies the necessary certainty that their new products will have sufficient patent life to justify the substantial investment in R & D to bring future products to

market and to justify maintaining on-going research efforts.

In most cases, increased sales revenue from patent restoration will not be realized for ten to fifteen years. This is so because S. 255 does not apply to patented products currently on the market, even though these products have suffered substantial loss of patent life, nor does it restore full patent term to those products already undergoing regulatory review. Indeed, recent action by the Department of Health and Human Services designed to insure a rapid onset of competition for drugs whose shortened patent lives are about to expire will exacerbate the diminution and unpredictability of near term revenue streams for many innovative drug firms, including Merck.

CONCLUSION

I recognize that the members of this Committee must look at the issue from a perspective which is different from my own as a research scientist and manager. Obviously you have an obligation to weigh concerns about possible economic effects on consumers if patent term restoration legislation is enacted. As I previously noted, however, enactment of S. 255 will have no immediate price effect on consumers, and any eventual effect will be phased in over a period of years as patents expire in the normal course of events. Of course, some potential price competition on a specific drug may then be delayed. This is a legitimate concern. However, such a limited delay affecting future competition must be balanced against the benefits from the innovations which will be encouraged by patent term restoration. As I have already mentioned, these benefits are substantial. They may include lives improved and extended from therapeutic gains, health care cost savings, and heightened market competition among pharmaceutical products. Indeed, the continued existence of manufacturers of generic drugs depends ultimately on our innovation and the introduction of new drugs to the marketplace.

The pharmaceutical industry faces exciting challenges in developing recent significant advances in areas such as immunology, neurobiology, and recombinant DNA technology into practical applications to treat and cure disease. Heart disease, cancer, stroke, schizophrenia, arthritis, kidney failure and other degenerative diseases of aging are among the health problems which these new advances may enable us to address more fully. However, sufficient incentives must exist to encourage the high commitment of funds and resources necessary for such an undertaking. Enactment of S. 255 is one important way to provide such incentives.

Senator MATHIAS. Our next panel consists of Nicholas Reding of the National Agricultural Chemicals Association; Thomas Duerden of the Health Industry Manufacturers Association; and Dr. Albert Zettlemoyer of the American Chemical Society.

Your entire prepared statements will be made a part of the hearing record, and you may proceed in any order you wish.

STATEMENT OF NICHOLAS REDING, GROUP VICE PRESIDENT, MONSANTO CO., AND CHAIRMAN OF THE BOARD OF DIRECTORS, NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION, ACCOMPANIED BY DR. JACK EARLY, PRESIDENT, NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION; DR. ALBERT C. ZETTLEMOYER, PRESIDENT, AMERICAN CHEMICAL SOCIETY, ACCOMPANIED BY DR. WILLARD MARCY, IMMEDIATE PAST CHAIRMAN, COMMITTEE ON PATENTS AND RELATED MATTERS, AMERICAN CHEMICAL SOCIETY; AND THOMAS A. DUERDEN, CHAIRMAN OF THE BOARD AND CHIEF EXECUTIVE OFFICER, ELECTRO-BIOLOGY, INC., APPEARING FOR HEALTH INDUSTRY MANUFACTURERS ASSOCIATION

Mr. REDING. Thank you, Mr. Chairman.

My name is Nicholas Reding. I am a group vice president of Monsanto Co. I am chairman of the board of directors of the National Agricultural Chemical Association, also referred to as NACA.

NACA is an association of 115 companies, both small and large, I might add, that essentially manufacture and formulate all of the agricultural chemicals used in this country.

I have with me Dr. Jack Early who is the president of NACA.

I am here to testify in support of S. 255. I would request, Mr. Chairman, respectfully, that our full statement go into the committee record.

Senator MATHIAS. Your full statement will appear.

Mr. REDING. Thank you.

I think our statement adequately documents our support. In the interest of brevity, I would make three key points contained in the statement.

First, the absolute, essentiality of increased agricultural productivity in this country for the good of our people and for the good of the people of the world.

American agriculture is truly a modern-day miracle. In the last 30 years, our farmers have increased their productivity by 50 percent. Three percent of the American population feed all of our country and many countries around the world. The cost of food to the American housewife is the lowest of any country in the world.

Experts predict, however, that the productivity of American agriculture——

Senator MATHIAS. Mr. Reding, I am sorry to interrupt you. I am advised that the Governor of Maryland is here in the committee—Governor Harry Hughes.

In honor of the Governor's presence, I am going to declare a 3-minute recess.

[Recess taken.]

Senator MATHIAS. The committee will come to order.

We will ask Mr. Reding if he will resume at precisely the point that he was interrupted by the Governor's arrival.

Incidentally, I think we perhaps have all benefited. We owe the Governor some thanks for a seventh inning stretch, which is always useful.

I want to assure Mr. Reding that the time taken for the Governor's recess will not be charged against him. [Laughter.]

Mr. REDING. Mr. Chairman, I hope to leave some time over.

I mentioned in the interest of brevity, I am going to make only three key points that are documented in our statement. The first is the absolute essentiality of increased agricultural productivity of the American farmer, both for the good of the American people and for the good of the people of the world.

I mentioned that our agriculture is a modern-day miracle. Our farmers have increased their productivity by 50 percent over the last 30 years. Three percent of our population feeds our country, plus many of the people of the world. The food costs in the United States are the lowest of any country in the world of the housewife's dollar.

Experts predict that we will have to further increase that productivity by 100 percent over the next 30 years in order to feed an estimated 8 billion people.

In fact, the rate of productivity increase has been declining in the last two decades.

My second point is that technology is absolutely pivotal to that enhanced productivity. Agricultural chemicals are an acknowledged, important factor in that technology.

Our research is a very high-risk research, like that of the pharmaceutical industry. For every 10,000 new compounds that we synthesize, we commercialize an average of one.

From the point of synthesis, it costs us some $20 to $25 million to develop a commercial compound. In addition, we then have to invest somewhere between $40 and $70 million to manufacture that compound.

In fact, due to the regulatory process, from the time of synthesis it takes us 8 years to commercialize a new product.

The number of new products being commercialized is on the decline, as documented in my statement. In fact, only four such new active ingredients were registered for use in 1980 for agricultural purposes.

My third point is that the loss of patent life is a disincentive to our technology. It was the original intention of Congress that there would be a 17-year patent life. In fact, for nonregulated innovation, the 17 years is in effect.

In our case, we have lost an average of 5 to 7 years in our patent life because of the regulatory process.

In a recent survey of our industry, which is included in my statement, we have documented and verified the importance of proper patent protection to innovation for our industry.

Mr. Chairman, the bottom line is that we think S. 255 will help restore the intent of Congress on patent life. It will help provide a proper incentive for our innovation. It will help bring more new environmentally acceptable products to the marketplace, and it will provide hope for feeding the world's masses at reasonable costs.

I thank you for holding these hearings, Mr. Chairman, and for giving me the opportunity to testify.

At your pleasure, I would like to respond to Senator Grassley's question about the triggers in the bill.

Senator MATHIAS. We will give you an opportunity to do that after the other members of the panel have testified.

Mr. REDING. Thank you, sir.

Senator MATHIAS. Who would like to go next?

Dr. ZETTLEMOYER. Mr. Chairman, my name is Al Zettlemoyer. I am president of the American Chemical Society, and I appear before you today with the authorization of the society's board of directors.

Accompanying me is Dr. Willard Marcy to my left with the research corporation and immediate past chairman of the society's Committee on Patents and Related Matters.

The ACS welcomes this opportunity to comment upon S. 255, the Patent Term Restoration Act of 1981.

The society views this bill as a positive step to enable the patent laws to keep pace with the progress of science and technology and to adjust for new, externally imposed constraints, specifically those of the regulatory process.

Although the proposed legislation does not treat the often-overriding factor of the high cost of compliance for these regulations, it does address the time delays associated with the regulatory process.

The corresponding restoration of the patent term could provide a logical and vital means to foster innovation.

The ACS believes that investment in fundamental research, the foundation of innovation, would be encouraged by changes in the U.S. patent laws, as proposed in S. 255, which would make more definite the period during which the investment might be recouped and a reasonable return on the investment might be realized.

Chemistry has evolved from a science dealing largely with laboratory curiosities into one of the major technology-based enterprises in the Nation.

It has made untold contributions to the quality of our lives, such as new compositions for contact lenses and transistors, biologically active compounds to prevent or treat diseases, agricultural chemicals that have helped make U.S. agriculture a major supplier to the world, as our recent speaker stated, and all of the advances in photography, lasers, spectroscopy, solid and liquid fuels, and so many other things undreamed of a 100 or even 50 years ago.

A vast industry has grown around the technological applications of chemical science, providing employment for several million people and contributing to the technological leadership of the United States.

As our knowledge has increased, scientists have become aware of problems associated with some chemical products. Our ability to address these problems has greatly improved and we now can detect chemical residues undetectable a few years ago.

The American Chemical Society has continually supported appropriate legislation and regulations designed to enhance human health and safety and to protect the environment.

The society recognizes the importance of maintaining reasonable controls over substances entering our environment. It also is important, however, that the regulatory process not unduly reduce the incentive to invest in and conduct the research that will lead to useful new discoveries.

Incentives to innovation which helped make this country preeminent in technology must be preserved.

To the extent that the regulatory procedures have diluted these incentives, they must be restored where possible, so they can continue to fulfill the objective of promoting progress and science and the useful arts, as our Constitution states.

The United States patent system was provided for in the Constitution, and the first patent law was enacted in 1790, almost 200 years ago.

While chemical science has evolved beyond man's imagination, the patent system has been remarkably stable, not only in its philosophical basis but also in its basic legal aspect.

The American Chemical Society urges passage of S. 255 so that the patent laws may keep pace with the progress of technology and in order for the patent system to adjust to externally imposed constraints that are inherent in many regulatory procedures.

This ends our oral statement.

Senator MATHIAS. Thank you very much.

Dr. Duerden?

Dr. DUERDEN. Thank you, Mr. Chairman.

My name is Tom Duerden. I am the chairman and the chief executive of Electro-Biology, Inc., a small single-product organization based in Fairfield, N.J. I am here this morning testifying on behalf of the Health Industry Manufacturers Association, HIMA, which represents some 260 manufacturers of medical devices. Many of these manufacturers are small companies like my own.

Since the Federal Food Drug and Cosmetic Act was amended in 1976, new medical devices have been subject to FDA premarket approval. Regulations to implement the amendments are still in their formative stages.

So far, the time taken to obtain device approval, while considerable, has been less than that taken to obtain Government approval for some other products.

Nevertheless, HIMA believes that regulatory review will lengthen as more applications are filed and as the FDA finalizes and formalizes the premarket approval regulation required to fully implement the amendments.

This regulation will institute procedure for device approval much like those which are applied to new drugs. We are concerned that the device industry may follow in the path of the drug industry, where a regulation-induced drug lag has contributed to substantial reduction in commercial patent life.

HIMA, therefore, supports patent term restoration and S. 255 as sound preventive medicine. It would prevent loss of commercial patent life to the extent that a device lag develops. Preventing the loss of patent life would encourage innovation and assure neutral application of the patent laws.

Perhaps I could demonstrate how restoration would encourage innovation by drawing on the experience of my own company.

THE BI-OSTEOGEN SYSTEM®

Electro-Biology manufactures a single product, the Bi-Osteogen System.®

This device heals recalcitrant bone fractures by generating highly specific electromagnetic fields which cause bone fragments to grow together in a process resembling normal healing.

The treatment heads are applied to the surface of the skin over the fracture site. No surgical procedure is required. After the initial fitting by an orthopedist, the patient can continue the treatment at home, usually while sleeping.

Thanks to the fact that surgical procedures and hospitalization are avoided, treatment is less expensive—some $3,000 as compared to at least $6,000 for a straightforward surgical procedure.

Given the annual incidence of these problem fractures—it is estimated at 100,000—you can see that the potential cost savings of $300 million a year are very significant.

Perhaps I should add that our success rate for treating these recalcitrant problems over the 1,000 cases that have reached conclusion approaches 80 percent, certainly comparable to that achieved by the most highly skilled surgeons.

To date, 2,000 of the country's 10,000 orthopedists have already used our device at least once. This number is increasing by perhaps 200 each month.

THE INCENTIVE TO INNOVATE

This system is available to patients today because of our past investment in product R. & D. That investment was substantial for a small company like Electro-Biology which had three employees when it was founded in 1975.

For the next 4 years, EBI's investment in R. & D. alone almost exceeded its total revenues. It was not until 1980 that this position was reversed.

In 1980, by which time we had created 140 new jobs, our R. & D. expenditure was slightly more than a million dollars. It still represented some 20 percent of our revenue.

Without patent protection, we would not have made the investment needed to develop the Bi-Osteogen system. We could not have justified that investment without knowing that we would have exclusive marketing rights to our product. I believe other device manufacturers feel the same way about the patent incentive.

To the extent that a device lag develops, restoration to prevent loss of patent life will thereby encourage innovation.

NEUTRAL APPLICATION OF THE PATENT LAWS

HIMA also believes that restoration would, as has been said several times this morning, assure neutral application of the patent laws. Without such restoration, device firms subject to premarket approval requirements, would lose some commercial patent life while firms not subject to this type of regulation would continue to enjoy the full 17 years.

Investments in new medical technologies would, therefore, be less attractive. It is particularly anomalous this society would suffer, since many important products, such as medical devices and drugs, are subject to premarket approval.

Thank you, Mr. Chairman.

Senator MATHIAS. Thank you very much, Dr. Duerden.

Dr. Duerden has suggested some examples which supplement Dr. Sarett's testimony that by new and innovative chemical or drug treatment you can avoid expensive and debilitating surgical treatment.

Let me turn to another aspect of this problem. That is the positive side. Let me look at the other side of that question.

In the area of agricultural chemicals, some years ago we had an unfortunate experience with a new agricultural chemical called heptachlor. Heptachlor was highly recommended to deal with the problem created by the spittle bug. As a farmer, I am well aware of the problem created by the spittle bug. It will ruin a field of alfalfa as fast as anything I know.

Heptachlor was a systemic chemical. It got down into the roots of the alfalfa plant. The following year when the alfalfa came up, it carried with it a substantial amount of heptachlor. When the cows were fed the alfalfa, they in turn carried a dose of heptachlor into the milk. That went into the bottle and into the baby. We had all kinds of problems with heptachlor and getting rid of it.

It ended up as devastating to farmers who in some cases had to slaughter whole herds of very fine dairy cattle. It was devastating from the Government's point of view, because the Department of Agriculture had not only approved this chemical but it had actually urged farmers to use it.

Would you see that with extending the life of the patent during the testing period you might be able to avoid that kind of experience?

In other words, the economic incentive to get a product on the market should be a little less urgent if you know that you are going to be able to be protected and that your patent isn't ticking

away and that you can really assure yourself that you are dealing with a safe product.

Mr. REDING. I think, in fact, it would, Mr. Chairman.

I should also say that if our regulatory system works, that problem shouldn't happen. In fact, it exemplifies the complexities of our research, because we have to be absolutely sure that is not going to be the case in the future. It makes the research even more complex and more expensive.

We have that obligation as an industry to make sure those kinds of problems don't happen. Of course, the regulatory people have the equal responsibility.

It does add to the complexity of the research, and appropriately so. We need things that are of benefit to our farmers, but that do not involve an unacceptable risk in terms of the environment.

Dr. ZETTLEMOYER. May I add, that the scientist has gone a long way from that compound you were talking about. We now know that we have to be very cautious about chlorinated or halogenated compounds. We didn't know that before.

Senator MATHIAS. Again, let me address a question to Mr. Reding.

Looking at the kind of comprehensive problems that the Congress must face, the demographers project for us a 50 percent increase in world population in the next 20 to 25 years, a growth of global population from 4.5 billion to maybe 6.5 billion.

Even supposing they are half right, it is a pretty frightening prospect.

We have gotten as far as we have with the vastly increased world population because of the remarkable ability of the agricultural sector of our society, particularly the American agricultural sector, to increase productivity.

What is the level of research today as against 20 years ago?

Mr. REDING. I think we are facing a real dilemma, Mr. Chairman, as I indicated earlier; because we have to double our rate of productivity increases over the next 20 to 30 years to fulfill those sorts of demands.

There are two factors, in terms of the technology. First, there is Government funding of R. & D. On a constant dollar basis, that Government funding of R. & D. has declined over the last 15 years.

I hope that you will permit me to say that from an industry standpoint sometimes we have some question in our minds about the validity of some of that R. & D. in terms of its identification of targets.

From the agricultural chemical industry's standpoint, while our actual expenditures in dollars are increasing, it is important to note that today our companies—these 115 companies—spend some 40 percent of their research dollar on what we call defensive R. & D. That is R. & D. that is designed either to defend a product that we now have in the marketplace and to accumulate additional data as required by the regulators or to develop the toxicological requirements in order to get a new product registered.

So only 60 percent of it is now being spent on what I would call the wave of technology that has to benefit agriculture 10, 20, or 30 years from now.

I think we have a real dilemma. I think it is a very important issue. I think that this bill will be very helpful, but I would also submit that at some point there needs to be a proper look at the sphere of our total technology versus our outlook for productivity and the needs for productivity and our needs for feeding the world to see if we are in tune with what we have to do. I think we will find that we are not.

Senator MATHIAS. I think that is very serious advice. But as far as the question before us here, you think this is at least one step forward.

Mr. REDING. Absolutely.

Senator MATHIAS. Let me turn to Dr. Duerden.

We have had some of the giants of the industry here today. By comparison, you are a smaller business. If not small, smaller.

Dr. DUERDEN. Small. Unashamedly small so far.

Senator MATHIAS. You have to compete against some pretty heavy hitters.

How important is a 17-year patent to a company of your size? And, conversely, if you have an abridged patent life because of the delays, what is the result here?

Dr. DUERDEN. Setting aside for a moment duration, which is clearly the major issue here, but addressing just for a moment the existence of a patent per se, I think that a patent is absolutely vital. The kind of novel product we have introduced has captured the attention of the major companies in the marketplace who are obviously, by definition, very much bigger than we.

If they had the product available, they would bury us in the marketplace. We would be comparing sales forces of 400 or 500 on the one hand with the 25 that I have.

If the product were freely available, there is no question that the distribution system would bury us. Patents are absolutely essential.

We know these other companies are beginning to do research and sponsor research in the development of similar products.

As to the life, I think the 17 years—I don't know that it is a necessarily well-chosen time—but if it has been decided that 17 is appropriate, I certainly feel we should enjoy it just like everybody else.

We certainly need to enjoy continued access to the marketplace so that the revenues and the profits from our present product can feed the R. & D., which is absolutely central so that we continue to stay ahead.

We are not imagining that the patent we presently enjoy will keep us happy forever. We continue to invest, as I say, over a million dollars a year. Part of that, we imagine, will lead to products requiring patent protection.

Today's cash capital is feeding tomorrow's innovation. That's the way it goes.

I believe it is very important.

Senator MATHIAS. I will turn to Dr. Zettlemoyer.

In your testimony, you ask the question really that is the underlying theme of this hearing. The question you pose for us is whether the patent law is keeping up with the progress of technology.

One of the early advocates of patents was Thomas Jefferson who felt that patents would actually encourage innovation, inventiveness, and creativity.

Are we maintaining the Jeffersonian tradition in an adequate way?

Dr. ZETTLEMOYER. I think we are hurting, in the present state of affairs. S. 255 would do a lot to restore the confidence in the system and produce more R. & D. which would encourage students to enter the field. Some of it would spill over into research in the universities.

A lot of different little things would add up to great big things.

Senator MATHIAS. I don't know that the chemical industry, any more than the automobile industry or the electronics industry, has any guardian angel which is going to protect it from foreign competition.

How would this bill affect, in your judgment, the position of the American chemical industry with respect to what we can anticipate, which is a greater and greater degree of sophistication on the part of foreign competitors all over the world?

Dr. ZETTLEMOYER. The thing that I fear most is that, unless we have S. 255, we will be putting aside R. & D. because of an inability to recover its cost, since the time patent protection is available may be substantially reduced.

It seems to me that it is essential to get out of the posture we are in now.

Senator MATHIAS. Thank you.

Senator Specter?

Senator SPECTER. Thank you, Mr. Chairman.

With this proposed legislation being directed to take into account the time that the patented invention was delayed due to Federal regulatory review, in setting this 7-year limit are we inviting Federal regulatory review to now take 7 years?

Mr. REDING. I don't think so, Senator. Of course, there are three triggers in the bill.

The one that from my industry would be most frequently invoked is the trigger of initiating a major toxicological test. That would generally give us an additional 4 to 6 years, in terms of our patent life.

I don't think that it would encourage the additional lengthening of the review period.

I should add that Mr. Grassley asked a question in that regard earlier about the triggers. My own view is that a better trigger than any of these would be the first authorization by the regulatory body for commercial use, because we then clearly get a full 17 years, as do the nonregulated innovations.

I know that is deviating a little bit from your question, but it does come to the trigger question.

EIGHT-YEAR REGULATORY REVIEW

Senator SPECTER [acting chairman]. What is the average time, if you know, for Federal regulatory review?

Mr. REDING. In our particular case, the review process is part of the whole sequencing of developing the data required for that review. The whole period from the date of first synthesis until we

get a commercial use authorized, typically for our industry, is 8 years.

The review period can vary anywhere from 1 to 3 years as part of that, with the rest of it primarily being designed to develop the data required for that review.

Senator SPECTER. So that there is a substantial amount of time you say required for you to develop the data for submission to the Federal regulatory agency?

Mr. REDING. Yes. That is a big part of the 8 years.

In my statement, we have a sequencing of this whole process that shows how the 8 years are spent.

Preparation of the requirements for regulatory review takes up a very big part of that 8 years. I would say, typically, that preparation, plus the review period itself, would last anywhere from 5 to 7 years.

Senator SPECTER. If you are dealing with an 8-year delay, then the 7-year cap is really insufficient to give you the full 17 years under the patent rights?

Mr. REDING. That is why I say that I think it is a definite improvement, and we support the bill; but, more appropriately, from my standpoint, would be to begin the patent life from the date of authorization for first commercial use. Then we have a full 17 years, like a nonregulated innovation.

Senator SPECTER. Do you think at the present time that there is any additional pressure on Federal regulatory review to be completed earlier to give you more of the span of the 17 years?

Mr. REDING. I would like to hope that there is constant pressure. I know that our industry is involved in that pressure.

I think with some of the attitudes now about regulatory reform that there would be that pressure brought to bear.

Even if we get the review process down to, say, 1 year, we still have the problem of the development of the data that is required to trigger that process to meet the regulatory demands.

In effect, we would still be significantly diluting the 17 years that are available for patent life without this bill.

Senator SPECTER. Why does it take so long to develop that factual information?

Mr. REDING. To give you an example, if in year one we synthesize the compound, in year two we would go to our own greenhouses and small-scale tests to test the compound for commercial efficacy. In year three, we would go to academic cooperators. If we now feel that the product looks like it has commercial potential, we will begin to develop toxicological data, the most lengthy of which is a lifetime feeding study—such things as rats, hamsters, mice, and so forth.

Those tests will typically take 2½ years. We have to accumulate the data and analyze it so that by the time we would be ready to submit that sort of data, it is typically 3½ and sometimes 4 years in order to do it.

But those are requirements of the regulatory process.

Senator SPECTER. Thank you very much, gentlemen. We very much appreciate your testimony here today.

[Prepared statements of Messrs. Reding, Zettlemoyer, and Duerden follow:]

STATEMENT OF
NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION
BEFORE THE
SENATE JUDICIARY COMMITTEE
APRIL 30, 1981

I am Nicholas Reding, a Group Vice President of Monsanto Company and appear here today in my capacity as Chairman of the Board of Directors of the National Agricultural Chemicals Association (NACA). I am accompanied by Dr. Jack Early, President of the Association.

The National Agricultural Chemicals Association is a nonprofit trade association representing a total of 115 companies which manufacture or formulate virtually all of the agricultural pesticides produced in the United States. We use the word "pesticides" to include various kinds of agricultural chemicals, such as insecticides, fungicides, bactericides and herbicides or, in other words, those chemicals used to protect crops from destruction by various insect, disease and weed pests.

Mr. Chairman, we appreciate this opportunity to contribute NACA's views and indicate our support for S. 255. We believe the Patent Term Restoration Act would help to maintain the incentive needed for pesticide research and development. It will help to restore to pesticide patent holders a portion of their patent rights which are lost as a result of the federal registration process. Importantly, it is not a broad or automatic extension of patent rights. It doesn't give companies any unusual or unfair advantage. It does not require additional government bureaucracy.

Congress intended that a seventeen-year patent be awarded to promote the development of new technology, thereby encouraging the early disclosure of an invention while affording protection for the inventor. Since the adoption of the patent incentive system in 1790, there have been tremendous changes in scientific knowledge in general and in the field of agriculture specifically, and developments will continue to be made.

Pesticide chemicals require scientific evaluation of potential toxic effects to assure public health and safety to the consumer, worker and the environment. As a result, there has been an ever-increasing review of pesticides. Regulatory review is certainly proper for the protection of our citizens. However, the regulatory review process has caused an unforeseen erosion of the patent system. A recent study over a six-year period, conducted by the industry, has determined that the average time for registering a pesticide is five to seven years from initiating a major health test until first registration of a label. During that time, the patent term continues to run. By the time that a company has obtained its registration and enters the market, a significant portion of the patent term has been lost. An imbalance has been created, and clearly the time has come when the incentives of the patent system need to be restored.

During the past forty years, the agricultural pesticide industry, through chemical and field research, has been very creative and innovative. For example, the invention of pre-emergence herbicides has created a technical revolution in the production of corn, soybeans, cotton and many other grain crops throughout the world. Yield increases resulting from weed control with these chemicals can range from as little as ten percent to as much as fifty percent or more, depending on the weed intensity in the production area. A high percentage of the U.S.-grown corn and soybeans are treated with pre-emergence herbicides for weed control. This technology is utilized on almost 150 million acres of cropland. If the value to the farmer is calculated (yield, quality, dockage discounts, mechanical efficiency, etc.), the total dollar improvement to the U.S. farm economy from this one concept would be in excess of $5 billion per year ($35/acre x 150M ac.).

Continued innovation, however, must be supported by adequate return on investment in research and development from sales of

patented products. On an average, it now takes over eight years and some $20 to $25 million to bring a new product from discovery through registration. Normally, the construction of new and unique chemical plants to produce the technical grade chemical is also required, at a cost of an additional $40 to $70 million.

Only a limited number of companies in our industry are able to invest this kind of long-term and high-risk capital and resources necessary for the major discovery and development of entirely new technical grade pesticide chemicals.

The technical grade pesticide is the chemical which is processed into formulated retail products for application to specific crops under specified environmental conditions. Each use of a given chemical must be separately registered with the Environmental Protection Agency (EPA), and extensive test data must be submitted to the agency to demonstrate its safety to man, animals and the environment. A single pesticide chemical may have a wide variety of crop or pest uses when formulated, and each use requires review and approval by the EPA based in part on test data specific to that use.

The Federal Environmental Pesticide Control Act of 1972 (FEPCA) and its 1978 amendments dramatically increased the time and cost of developing new chemical products for agriculture. The time from discovery of pesticidal properties of a compound to full commercial registration increased on an average from fifty-eight months in 1967 to ninety-two months in 1979, and is still increasing.

To assist the Committee in developing an even greater appreciation of the problem, we have included a diagram and explanation (see Appendix A) depicting the chronological development of a herbicide from initial synthesis and discovery of biological activity to the first commercial sales.

Because the process is rather complex, we have included with the diagram an explanation of the scientific and regulatory steps

which must occur between discovery of a new pesticide and its entry into the marketplace. Rather than take the Committee's time now to review the chronology outlined in the diagram, we would encourage you and members of your staffs to study it carefully at your convenience. However, at a glance, you can see why many years of a new product's patent life are absorbed during the federal regulatory process.

Below is an example of the schedule for an actual chemical candidate, which demonstrates the time constraints imposed by federally required pre-market testing and regulatory review and which erode the benefits of the patent. If everything goes right and there are no unforeseen delays, the following timetable is anticipated:

1. Discovery of biological activity - 1979
2. The patent is applied for - May 1981
3. The domestic patent issues - May 1983
4. Long-term health studies begin - September 15, 1982
5. Earliest completion date of long-term studies - February 1986
   The two major studies, mouse and rat, require 24 and 30 months, respectively, to complete. At least an additional 12 months is required for analysis of the animals; e.g., histopathology, sectioning, review of data by toxicologists, preparation and auditing of report to be submitted to EPA and submission of the report.
6. Full registration package to be compiled and submitted to EPA for review by June 1986 (includes both mouse and rat studies).
7. Scientific review and regulatory actions within EPA from twelve to twenty-four months from submission date - June 1988.
8. First tolerance and approved label allowing commercial sales by June 1988. If too late for seasonal use, then first sales will be delayed until spring of 1989.

In the above actual example, it is highly possible that first commercial sales would not take place until at least six years

following the issuance of the patent. The loss of patent life (six years) allows the owner of the patent only eleven years to enjoy the fruit of his innovation. The six-year period of regulatory testing and review disallows earlier market development and delays the time when the consumer can benefit from the product. It then takes many years after first commercial use to reach the full market penetration and total product utilization that result in maximum sales benefits. These years of market development use up an additional part of the patent life. As a consequence of the regulatory process, the last several years of patent protection that is available for non-regulated products - a time of maximum sales - have been cut off for the regulated product.

If the company has an extremely unique and innovative product concept, it has only the remaining time of the patent life to develop market strategy, develop environmental compliance procedures, recoup the invested capital and regain all other costs and expenditures, and generate sufficient return to continue in the business. In contrast, with a simple non-regulatory controlled patented product, the patentee enjoys the fruits of his patent from the first day the patent is issued.

In 1979, NACA surveyed members who manufacture pesticides on questions relating to the impact of patents and government regulation on their research and development (see Appendix B). Nearly all companies indicated that a favorable patent position was a critical factor in determining whether to invest in new product development. The survey also indicated that availability of patent protection is a highly important element in long-range research planning and funding. Respondents reported that the uncertainties, cost and delay caused by government regulations have forced a reduction in research efforts. These companies favored restoring to patent owners the term of patent protection set by Congress. Without fully adequate patent protection, our member companies cannot continue to undertake the increasingly costly and time

consuming research involved in discovering and developing new pesticide products and still compete with other companies who can copy their successes without the heavy cost of research and development. And copiers provide the public with nothing new.

The unchecked erosion of patent protection can only serve to discourage continued innovation. When protection is devalued, much of the incentive to invest long-term high-risk capital in innovative pesticide research goes with it. This is, perhaps, best illustrated by Appendix C which shows the trend of increasing research and development cost, yet a decreasing number of pesticides being registered.

The accomplishments of American agriculture comprise one of the most gratifying success stories in the annals of world history. Food production has increased in this country by 200-fold since the turn of the century. Today only three percent of the U.S. popuulation feeds us and much of the rest of the world. In 1980, exports of agricultural products contributed almost $40 billion to our balance of payments.

Let me remind the Committee that throughout the world, losses of food to pests are enormous. Estimates of loss (U.S. Department of Agriculture, Agricultural Research Service, Handbook No. 291) have ranged as high as forty-five percent of production in countries where pesticides are not readily available. Even when pesticides are readily available, insects, disease and weeds are major contributors to the destruction of food and fiber. Agricultural pesticides significantly reduce but do not eliminate pest losses. The use of pesticides not only increases the quantity of our food, but also improves its quality, reduces disease to humans, increases the farmer's profits, aids in solving his labor problems and improves his cash flow. These achievements are due in large measure to the agricultural chemicals industry's long-term commitment to innovation.

Nobel prize winner, Dr. Norman E. Borlaug (who received the

Nobel Prize for Peace for his outstanding contribution to alleviation of world hunger through the development of improved wheat varieties) warns that food production must double by the year 2030 to feed a world population of eight billion. "We can't feed the world with old technology. And we can't feed it without insecticides, fungicides, herbicides, and good machinery," says Borlaug.

A recent study (Department of State Bulletin, Fall 1978) pointed out that increased productivity, not increased land, is key to augmenting the world's food supply. Most of the increases in food required to meet the projected increases in demand over the remainder of this century must come from raising the productivity of land already in cultivation. Achieving significant increases in land productivity requires capital inputs and use of technology on a massive scale. Pesticides, fertilizers, improved seeds, farm implements and user education are major factors in increasing crop productivity for the foreseeable future.

Obviously, doubling food production -- the need identified by Dr. Borlaug -- will require sustained incentive and innovation on a scale never before seen in worldwide agriculture. The U. S. pesticide industry, to remain a dynamic contributor to development of such new technology, must be encouraged to retain its position of worldwide preeminence. We cannot afford through patent devaluation to risk the loss of innovation through government institutionalized interference with American ingenuity, whether intentional or inadvertent.

The innovative organizations in our industry regard the patent system as a prime motivator for undertaking costly programs in the high-risk area of new pesticide research and development. Thus, we are understandably concerned whenever these important incentives, provided by that system, are eroded.

There is an obvious need to reconcile the patent system with the federal regulatory process. We believe S. 255 will effectively meet this need.

Thank you.

APPENDIX A

Chronology of Pesticide Development

The following explanation of scientific and regulatory steps indicates the time frame required to bring a potential pesticide candidate from synthesis to commercial sale (diagram attached).

Point I identifies the time of synthesis. Point II shows the time for bioevaluation. As will be related below, after the initial bioevaluation (II), and if biological activity is of sufficient interest, patent actions may be initiated at Point III. Bioevaluation screening tests are designed to reveal activity of a compound. It could have commercial potential as a herbicide, plant growth regulator, fungicide, insecticide, etc., any of which activity may be useful in solving a problem in agriculture.

When the kind and degree of biological activity of a compound is sufficient to suggest commercial utility, a broader and more intensive testing program is carried out, usually followed by limited, small-scale outdoor field tests. Obviously, these require a full growing season; i.e., one crop year. If results of the first year studies are promising, small field tests across wide geographic ranges are carried out during the second growing season. If results from this broader testing still appear favorable, a decision is made to continue toward commercialization of the compound.

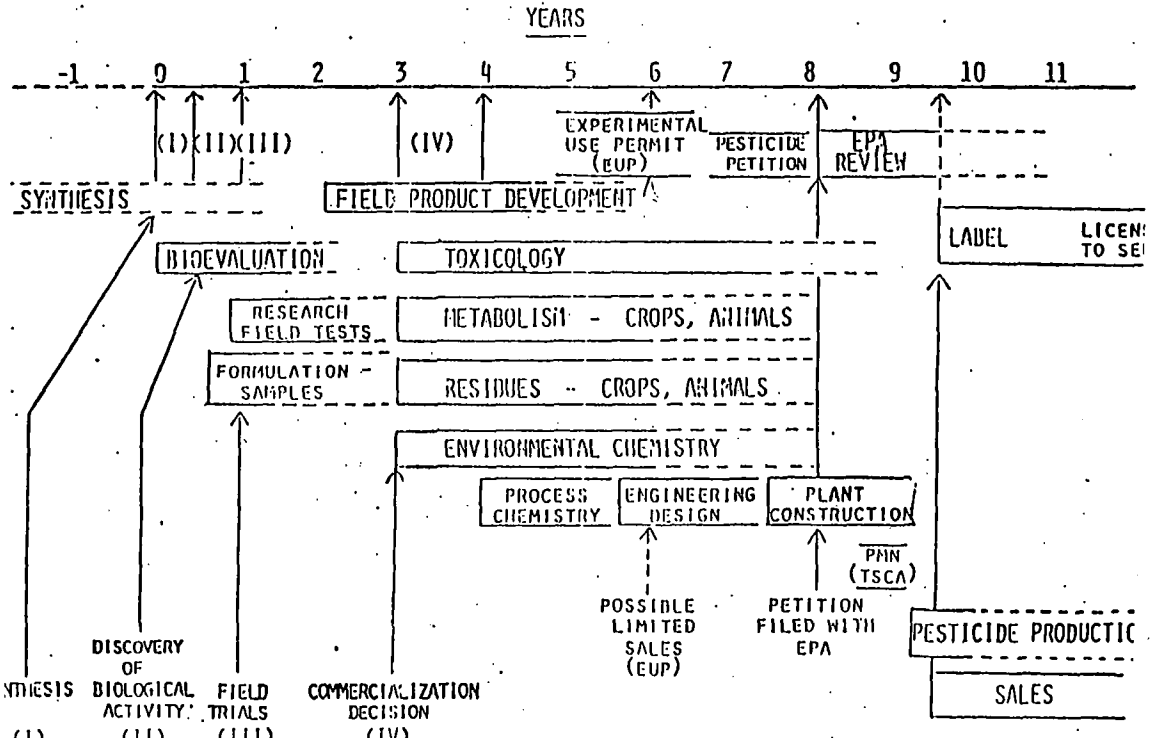
At that time, indicated by Point IV, a very lengthy and expanded research and development effort is launched. This includes generation of technical data which ultimately are used to support the registration of that commercial candidate chemical (IV). General kinds of information are depicted in rectangles. The longest run of time is five years minimum, a period now dictated by the toxicology testing requirement. The latter is a test series in prescribed sequence to define dose-response levels for the chemical in laboratory animals. After the feeding phase of a chronic study (1.5 - 2.5 years), about one year is required to complete full examinations of all animals and to prepare the final report. Therefore, the toxicology sequence requires about five years elapsed time for completion. And the trend now is for an even longer time.

All of the other kinds of information identified in the rectangles of the diagram can be obtained within that five years. However, this is the minimum accelerated time for a well-resourced organization. The small developer cannot afford to take a risk of that magnitude. At commercial decision time (start of Point IV), toxicology, metabolism, and environmental chemistry studies are initiated. The extended field studies and other major programs are started at the onset of the next growing season. Ancillary programs such as formulation, process chemistry, process/environmental are started as resources become available. The steps leading to a manufacturing plant are carried out in that five-year period encompassing the toxicology sequence. Final manufacturing plant construction, start-up, and actual production will normally coincide with the EPA review time of 1.5 years. Ideally, sufficient inventory of the proposed new product can be prepared to meet first year market sales by the time the label is granted by EPA, provided, of course, that premanufacturing notice (PMN) requirements for the manufacturing process have been satisfied under the Toxic Substances Control Act. The new candidate pesticide cannot be sold until a conditional or full registration is granted and an acceptable label has been approved by EPA.

Patent activities normally commence whenever significant biological activity of a given compound is projected to have commercial utility in agriculture (III). This initiation of patent action can follow observations in greenhouse studies and a patent covering the compound and/or use of this compound may issue within 2-3 years after the initiating action. As is apparent from the diagram, this can result in loss of five or more years in the 17-year patent life.

APPENDIX A

PESTICIDE DEVELOPMENT CHRONOLOGY FROM DISCOVERY TO SALES



APPENDIX B - 1

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION

PATENT QUESTIONNAIRE

TOTAL NUMBER OF RESPONSES: 35	Yes	No	No Answer
1. Do you have a research program which includes the synthesis of novel compounds and the screening of the compounds for utility as pesticides?	29	6	
2. Is a favorable patent position a mandatory element in making the decision to commit capital to new products ("new products" includes new uses of compounds)?	22	13	
Always		7	
Generally		6	
3. If your company commits research funds primarily with the aim of developing a superior product or to fulfill a gap in consumer need, is a secondary aim to develop patented procedures?	32	1	
Did not understand question.			1
If the word "procedures" means processes for manufacture, the answer is	1		

Brief Statement if answer is "no":
"We are primarily interested in R & D efforts toward establishing product position."

Statement with a "yes" answer:
"We consider patented chemicals and procedures to be automatic in our research, i.e. we don't debate if we should try - we expect it".

4. If research expenditures constitute a commitment of capital for your company:

A. To what extent are patent considerations weighed in long-range research planning and funding?

Always	28
Generally	6
Seldom	1

B. If patent protection is sought on "basic" products being developed, do you also consider expanded patent positions to enlarge the parameters of research (i.e.,cost reducing process patents, novel formulations)? 35

5. How important is a favorable patent position at the following stages in a research program?

	Essential	Major Importance	Slight Importance
A. Early Idea	7	14	13
B. Bench Development	11	18	6
C. Pilot Plant	19	14	1
D. Plant Design	23	11	

Note: One responded only to question "B"

APPENDIX B - 2

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION

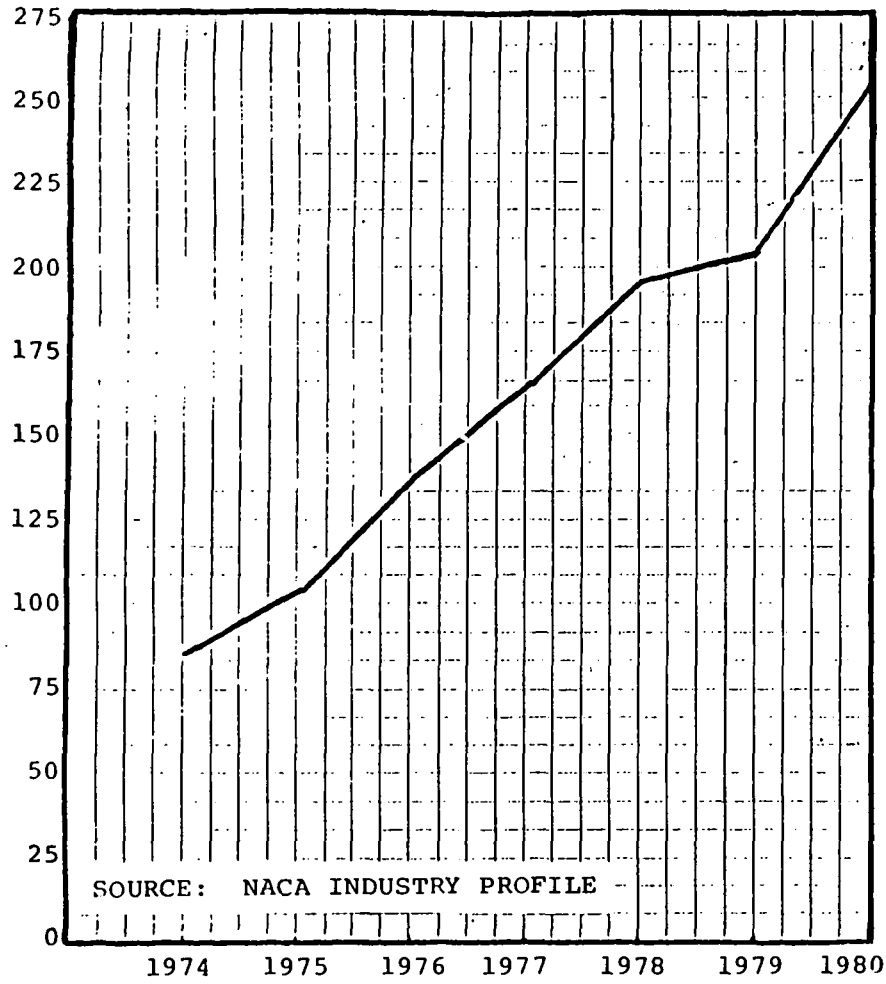
PATENT QUESTIONNAIRE

	Yes	No	No Answer
6. Do you consider foreign patent protection when committing capital for:			
A. New Products	33	2	
B. New Processes	33	2	
7. Does the discovery of the existence of third party patents tend to direct research into areas which:			
A. Are chemically related, but patently distinct?	33	2	
B. Entirely chemically unrelated?	19	14	2*
*no relevance to third party patents			
8. Do you know of instances where your patents have spurred competitors to further research?	30	5	
9. Do you know of specific instances where the existence of government regulations has reduced research efforts in a specific area?	33	2	
10. If the answer to question 9 is yes, is the reduced effort substantially the result of regulations causing long delays to obtain product registration?	29*	4	2
*Comments "but also give much weight to the uncertainty of getting product registration". "but also due to expanded test requirements".			
11. If the answer to question 10 is yes, do you favor a patent term for a new agricultural product to commence at time of product registration for a stated period of time, rather than the present term of 17 years from time of patent issuance?	29	3	3*
*Comment: Extend patent life by number of years needed to get registration.			
12. If the answer to question 11 is yes, but there is the possibility of providing the first opening to compulsory licensing after the following number of years, how would you answer?			
All blanks accounted for			
Five Years	1	16	18
Ten Years	8	14	13
Fifteen Years	23	3	9
	32	33	40

Explanation for 32 Yes replies to only 29 Yes answers in question 11:

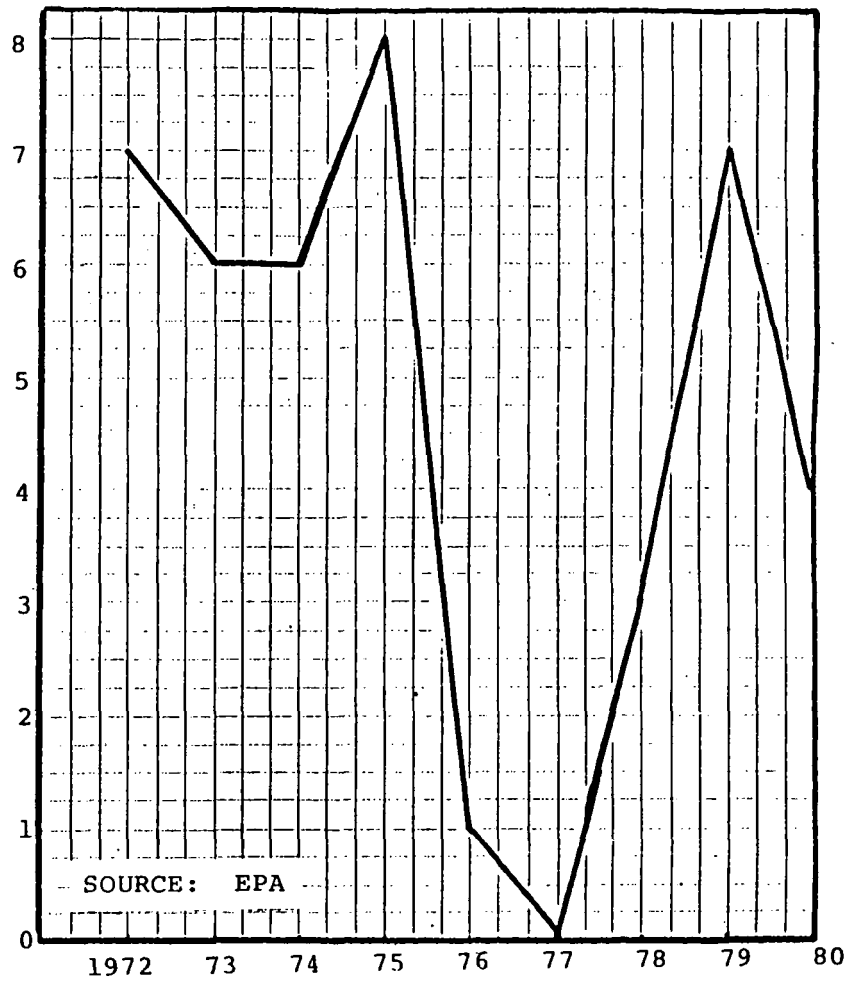
2 Yes answers checked both 10 and 15 years
1 No answer checked 5 and 10 years as Yes
1 Yes answer checked No for 5, 10 and 15 years

R&D COSTS OF NEW PRODUCTS IN MILLIONS OF DOLLARS (TOTAL PER CALENDAR YEAR)



81-860 O—81——8

NUMBER OF NEW AGRICULTURAL
CHEMICALS REGISTERED ANNUALLY*



*First registrations for products containing new active ingredients never before registered and available on the market to agricultural producers for use on either food, feed, fiber crops and tobacco but excluding uses on ornamental crops, forests, and rangeland.

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION
THE MADISON BUILDING
1155 Fifteenth Street, N.W., Washington, D. C. 20005
202 • 296-1585 Cable: NAGRCHEM

May 14, 1981

The Honorable Charles McC. Mathias
United States Senate
Washington, D. C. 20510

Dear Senator Mathias:

During the April 30, 1981, Senate Judiciary Committee hearing on S. 255, someone suggested that a patent holder is at liberty to indiscriminately establish the market price for his patented product.

On behalf of the National Agricultural Chemicals Association, I hasten to clarify the record insofar as pesticides are concerned.

Today's farmers are sophisticated, highly cost-conscious business-people. Many manage numerous cash crops on thousands of acres of farmland often valued in the millions. Many rely upon their own computers to reach cost-effective decisions. Like any other business-person, the farmer must realize a profit on his investment.

When it comes to pesticides, the farmer is looking for two things: (1) a product that will control his specific insect, weed or disease problem; and (2) one that will provide him with a return of $3 to $4 for every dollar invested. If a pesticide product falls short of either goal, he will choose competitive chemicals or non-chemical methods to control pests. Rarely, if ever, is a farmer limited to the choice of a single control option. Whether a particular pesticide happens to enjoy patent protection is not nearly so critical to the farmer as its cost in relation to competitive chemicals or less expensive non-chemical pest controls.

In short, pesticide manufacturers cannot price their products so high that the benefit to growers is ultimately erased by forced uncompetitive pricing of their food and fiber commodities in the marketplace.

The competitive pricing which occurs in the agricultural chemical industry is illustrated by Table 649 of Agricultural Statistics, 1980, published by the U. S. Department of Agriculture (copy attached) which shows that since 1967 the price of agricultural chemicals has increased only 50%, while the prices of other farm necessities such as seed and fertilizer, have increased 186% and 96%, respectively.

Yours truly,

N L Reding

Nicholas L. Reding, Chairman
NACA Board of Directors

STATEMENT

OF

DR. ALBERT C. ZETTLEMOYER

on behalf of the

AMERICAN CHEMICAL SOCIETY

to the

COMMITTEE ON THE JUDICIARY

UNITED STATES SENATE

on

S.255, PATENT TERM RESTORATION ACT OF 1981

Mr. Chairman and Members of the Committee:

My name is Albert C. Zettlemoyer. I am President of the American Chemical Society, and I appear before you today with the authorization of the Society's Board of Directors. Accompanying me is Dr. Willard Marcy, immediate past Chairman of the Society's Committee on Patents and Related Matters. The American Chemical Society welcomes this opportunity to comment upon S.255, the "Patent Term Restoration Act of 1981".

The patent system has served our country well. The basic principles supporting a patent system continue to apply in the modern world, and are ever more forcefully recognized by technologically advanced countries throughout the world. Yet the progress of science and technology has, inexorably, diminished the originally contemplated incentive value of the patent system. The legislation before us, S.255, is designed to compensate for the changes in the patent incentive for chemical science and technology by the simple method of restoring some of the incentive which has been lost. It seems quite logical that the patent laws keep pace with the progress of science and technology and adjust to new externally imposed constraints - specifically those of the regulatory process. The American Chemical Society believes that this bill is a positive step in that direction.

Although the proposed legislation does not treat the often overriding factor of the high cost of compliance with these regulations, it does address the time delays associated with the regulatory process. A corresponding restoration of the patent term could provide a logical and vital means to foster innovation. The American Chemical Society believes that investment in fundamental research - the foundation of innovation - would be encouraged by changes in the U.S. patent laws which would make more definite the period during which the investment might be recouped and a reasonable return on the investment might be realized. This belief is based on observations which concern the ACS, namely that R&D resources are being diverted from new products, that small chemical enterprises are disappearing, and that students are seeking careers in fields other than chemistry.

Until the recent advent of prolonged regulatory procedures for chemical products, especially in the health and environmental areas, the 17-year period of exclusivity afforded under the present United States patent law appeared to provide a workable balance between investment incentives and the public interest in access to technology. This balance is skewed where the lack of government approval significantly delays the chemical inventions. In effect, the federal government is shortening its own grant of patent rights.

It is important to the nation, and to society as a whole, that the chemical research structure in this country retain its strength and vitality. Applied science and basic science go hand in hand, each supporting the other, each leading the other to further insights and useful applications. The ACS believes that S.255 is a necessary corrective measure to an ever-growing problem - the diminished incentive to innovate in this country.

The growth of chemistry and its impact on society has reached extraordinary fruition only recently. From a science dealing largely with laboratory curiosities, chemistry has evolved into one of the major technology-based enterprises in the nation and has made untold contributions to the quality of our lives. Chemistry and chemists have contributed in large measure to such progress as:

- new compositions for new applications not previously known or imagined, such as in contact lenses and transistors, to other practical applications, such as fabrics to clothe an increasing population;
- new structural materials, including high strength metal alloys, polymers, adhesives and heat resistant ceramics such as those used for reentry vehicles in space exploration;
- complex biologically active compounds, to prevent or treat diseases of humans and animals;
- agricultural chemicals that have helped make U.S. agriculture a major supplier to the world; and,
- all of the advances in photography, lasers, spectroscopy, solid and liquid fuels, and so many other things the public now takes completely for granted, but were undreamed of 100 or even 50 years ago.

The enormous diversity and challenge of chemistry is such that there are more scientists in the United States engaged in chemistry than in any other scientific discipline. A vast industry has grown around the technological applications of chemical science. This industry not only provides employment for several millions of people, but also contributes to the technological leadership of the United States. Chemical science, while enhancing the material qualities of life, continues to lead the human mind and spirit into new and challenging areas.

Most products of the chemical industry are new compositions not occurring in nature; thus, the full range of their properties is largely unknown without experimentation. Recent experience has shown that our environment has a limited ability to tolerate many such chemicals, either because they do not decompose under ordinary conditions, or because the very properties which make them useful for certain purposes may cause them to be detrimental under other circumstances. Scientists now can detect residues that would have been undetectable only a few years ago; they know that low-level ingestion of some substances may have long range harmful effects, and that the release of certain materials into the environment may have undesired consequences. Chemists have been in the forefront in developing much of the knowledge that has made it possible to have this information.

The American Chemical Society has continually supported appropriate legislation and regulations designed to enhance human health and safety, and to protect the environment. However, the Society is acutely aware that the advent of new technology, the safety requirements aimed at employees and consumers, and the implementation of the three major laws enacted to ensure the safety of chemical products - the Toxic Substances Control Act (TSCA); the Fungicide, Insecticide and Rodenticide Act; and the Food, Drug and Cosmetic Act - have led to requirements for complex, expensive, time-consuming testing, and a very thorough review of data and claims. Much of this testing and

review is carried out after any patent protecting the product or its use has been issued, and the clock measuring its term has started to tick.

New technology, coupled with these laws, has changed the way chemicals are handled, developed, and used. While these laws have increased the cost of new developments, it also appears that they have reduced the commercial introduction of those products which cannot bear the increased costs. The impact of new technology and these laws, in general, goes far beyond that which can be reached by a change in the patent incentive. However, there appears to be some areas of chemical progress where a significant portion of the diminished incentive can be recovered by the simple expedient of restoring that portion of patent life which is lost due to self-imposed restraint and to the regulatory process, both requiring extensive testing for the safety of humans and animals, and review by government agencies. There is sufficient experience with these regulations, as applied to pesticidal and pharmaceutical products, to document the time and cost involved in compliance. For other chemicals, which are subject to TSCA, there is still insufficient experience to assess the full impact of the law. It appears, however, that to the extent that a regulatory agency may require proof that a certain chemical is safe in a human environment, the time and cost associated with compliance to TSCA may be extensive.

The importance of maintaining reasonable controls over substances entering our environment is recognized. It also is important, however, that the regulatory process not unduly reduce the incentive to invest in and conduct the research that will lead to useful new discoveries. It is important that the incentives to innovation which helped make this country preeminent in technology be preserved. To the extent that they have been diluted by evermore time-consuming regulatory procedures, these incentives must be restored, where possible, so that they can continue to fulfill the objective of promoting "progress in science and the useful arts," as stated in the Constitution of the United States.

It is argued by some that, since the problem results from delays arising associated with the regulatory process, the solution should lie in making the regulatory process more efficient, not in restoring to the patent term the time lost in this regulatory process. The ACS certainly favors improvements in regulatory procedures that would minimize delays. To the extent that such improvements are achieved, there would simply be a corresponding shortening of the period that needs to be restored to the patent term under this legislation. There is nothing in the concept of patent term restoration that precludes seeking and implementing ways to make the regulatory process more efficient. However, it should be recognized that not all of the present delays result from inefficiencies on the part of the regulatory agencies; a chronic toxicity study will still consume approximately three years or more, no matter how efficient the agency.

The United States patent system was provided for in the Constitution, and the first patent law was enacted in 1790, almost 200 years ago. While chemical science has evolved beyond man's imagination, the patent system has been remarkably stable, not only in its philosophical basis, but also in its basic legal aspects. The American Chemical Society urges passage of S.255 so that the patent laws may keep pace with the progress of technology, and in order for the patent system to adjust to externally imposed constraints that are inherent in many regulatory procedures.

To acquaint you with the American Chemical Society, we would like you to note that ACS is an individual membership organization composed of approximately 120,000 chemists and chemical engineers reflecting a broad spectrum of academic, governmental, and industrial professional pursuits. Approximately 60 percent of the membership is employed by industry, 25 percent by academic institutions, and 15 percent by governmental and nonprofit insitutions. The Society's interest encompasses both the basic science aspects and the many practical applications of chemistry.

The ACS, founded in 1876, was chartered as a nonprofit scientific and educational organization by an act of Congress signed into law on August 25, 1937. Under its National Charter, the Society is charged with the responsibility to encourage in the broadest and most liberal manner the advancement of chemistry and the promotion of research in chemical science and industry, "thereby fostering the public welfare and education, aiding the development of our country's industries, and adding to the material prosperity and happiness of our people."

The Charter imposes an obligation on the Society to provide assistance to the government in matters of national concern related to its areas of competence. Since one of the objectives of the ACS Federal Charter is the promotion of research, the Society appreciates the opportunity that has been given it today to comment upon S.255, the "Patent Term Restoration Act of 1981."

SUMMARY

of

STATEMENT OF THE AMERCIAN CHEMICAL SOCIETY ON S.255

The American Chemical Society is an individual membership organization of more than 120,000 chemists and chemical engineers reflecting a broad spectrum of academic, governmental, and industrial professional pursuits. The Society believes that S.255 is a positive step in the direction of allowing patent laws to keep pace with the progress of science and technology, and to adjust to new externally imposed constraints.

The ACS has continually supported appropriate legislation and regulations designed to enhance human health and safety, and to protect the environment. However, we are acutely aware that the advent of new technology, the safety requirements aimed at employees and consumers, and the implementation of the three major laws enacted to ensure the safety of chemical products - the Toxic Substances Control Act; the Fungicide, Insecticide and Rodenticide Act; and the Food, Drug and Cosmetic Act - have led to requirements for complex, expensive, and time-consuming testing, and a very thorough review of the data and claims. Much of this testing and review is carried out after any patent protecting the product or its use has issued, and the clock measuring its term has started to tick.

New technology, coupled with these laws, has changed the way chemicals are handled, developed, and used. While these laws have increased the cost of new developments, it also appears that they have reduced the commercial introduction of those products which cannot bear the increased costs. The impact of new technology and these laws, in general, goes far beyond that which can be remedied by a change in the patent incentive.

Although the proposed legislation does not treat the often overriding factor of the high cost of compliance with regulations, it does address the time delays associated with the regulatory process. Until the recent advent of prolonged regulatory procedures for chemical products, the seventeen-year period of exclusivity afforded under the present United States patent law appeared to provide a workable balance between investment incentive and the public interest in access to technology. However, this balance is skewed where the lack of government approval significantly delays the marketing of chemical inventions. In effect, the federal government is shortening its own grant of patent rights. A corresponding restoration of the patent term could provide a logical and vital means to foster innovation. The American Chemical Society believes that investment in fundamental research - the foundation of innovation - would be encouraged by changes in the U.S. patent laws which would make more definite the period during which the investment might be recouped, and a reasonable return on the investment might be realized.

TESTIMONY

OF THE

HEALTH INDUSTRY MANUFACTURERS ASSOCIATION

PRESENTED BY

THOMAS A. DUERDEN
CHAIRMAN OF THE BOARD
ELECTRO-BIOLOGY, INC.

Senator Mathias and members of the Committee:

My name is Thomas A. Duerden. I am Chairman of the Board and Chief Executive Officer of Electro-Biology, Inc., a small company in Fairfield, New Jersey, which manufacturers an electromagnetic device for treating bone fractures. I am testifying on behalf of the Health Industry Manufacturers Association (HIMA), which represents 260 manufacturers of medical devices. Many of these manufacturers are small companies like my own. Accompanying me is the President of the Association, Harold O. Buzzell.

To promote worthwhile public objectives, the Federal government regulates many products which are important to society. For example, the Food and Drug Administration (FDA) evaluates medical devices -- which treat illnesses and save lives -- for safety and efficacy. Unfortunately, legitimate Federal regulatory activities may unintentionally create disincentives to the development of important new products for society. We believe one such disincentive is the erosion of commercial patent term which accompanies lengthy regulatory review.

HIMA therefore supports patent term restoration and Senator Mathias' bill, S. 255. We believe that restoration for devices - properly provided in S. 255 by use of explicit language -- would be sound preventive medicine. Because our support for S. 255 derives from a perspective unlike that of the drug industry and other industries that have long been subject to extensive Federal regulation, I will briefly describe FDA regulation of devices and the relationship of that regulation to the structure of our industry.

Federal Regulation of the Medical Device Industry

Since May 28, 1976, the Federal government has regulated device manufacturers under authority of the Medical Device Amendments to the Federal Food, Drug, and Cosmetic Act. The device amendments provide FDA with broad regulatory power, including authority to prohibit manufacturers from bringing new products to market until FDA grants premarket approval.

To date, manufacturers apparently have not experienced protracted delays in obtaining premarket approvals under the device amendments. However, there has been little experience under the amendments, and, based on past experience, the future is potentially troublesome.

The industry experienced substantial premarket approval delays for some devices which, before enactment of the device amendments, were regulated under the drug laws. Furthermore, FDA has yet to finalize a major regulation required to implement the device amendments -- a regulation similar to that which governs drug approvals. Published as a proposed rule on December 12 of last year, this regulation detail procedures manufacturers would be required to follow to obtain premarket approvals. It would supplant ad hoc procedures FDA currently employs to evaluate and approve products. HIMA believes this regulation, combined with an expected increase in the FDA workload resulting from more premarket approval applications, will lengthen the review process.

Device firms are concerned by the experience of the drug industry, where a regulation-induced "drug lag" has contributed to a substantial reduction in commercial patent lives. If a device lag proceeds at the same rate as the drug lag has, firms will lose over four months of commerical patent protection yearly, amounting to a loss of nearly seven years by the turn of the century. A lag would have a pronounced effect on our industry, especially on small companies.

Nature of the Medical Device Industry

While the device industry has a few large firms, it is by and large a cottage industry composed of small- and medium-size companies. For example, more than 200 of HIMA's 260 members do less than $20.0 million in annual sales.

Lengthening regulatory review would aggravate the substantial regulatory burdens device companies, especially small companies, already confront. Unlike large firms, small companies are often less experienced in dealing with regulation and may lack resources to retain expert assistance. As a consequence, small companies often need more time to satisfy regulatory requirements. This is particularly burdensome for single-product companies, like my own, that do not have funds generated by sales of other products to support the costs of regulatory delay.

The cumulative effect of a substantial device lag could alter the structure of our industry. Increased development costs caused by such a lag could prevent some small firms from remaining in the market and bar others from entering. This would lead to increased industry concentration.

Patent Term Restoration As Preventive Medicine

HIMA believes there is a strong likelihood that regulatory review periods for devices will lengthen, thus eroding commercial patent term. We support patent term restoration as sound preventive medicine. It would prevent loss of commercial patent life to the extent a device lag develops but would have no effect in the absence of such a lag. I will explain our position by discussing how patent term restoration, in preventing loss of patent life, would encourage innovation and assure a patent policy that is neutral across and within industries.

The Incentive To Innovate

While one cannot prove that restoration will lead to innovation, available information strongly suggests that it will. We believe it will because of the nature of the incentive to innovate. I will explain this incentive by drawing from my own company's experience and making observations about the device industry generally.

My company, Electro-Biology, Inc., manufacturers a single product: the Bi-Osteogen System®, commonly known as the bone growth stimulator. The device heals recalcitrant bone fractures by generating electromagnetic signals which cause bone fragments to grow together in a process resembling normal healing. Since the device is applied to the skin over the fracture area, no incision is required. Patients typically apply the treatments to themselves at home. The electromagnetic signals are painless, permitting the device to be used while sleeping.

This deceptively simple device has successfully treated 77 percent of the fractures where it has been applied, many of them severe fractures where other procedures had failed. For example, a 22-year-old man who suffered a broken tibia as the result of a baseball injury underwent nearly four years of unsuccessful attempts to treat the fracture surgically. Despite the severe nature of the injury, our device healed the fracture in two months. Because of this and other successful applications, 2,000 of the nation's 10,000 orthopedists now use the Bi-Osteogen System, and this number is increasing by two hundred additional orthopedists each month.

The Bi-Osteogen System is available to patients today because Electro-Biology invested in product research and development in past years. That investment was substantial for a small company like Electro-Biology, which had three employees when it was founded in 1975. In 1978, the year the company obtained a patent on the System's electromagnetic signal, we invested $500,000 in R & D while only receiving $340,000 in revenues. In 1979, the year FDA granted premarket approval for the System, R & D investment totaled $855,000 and revenues were $915,000. And in 1980, the first full year we marketed the device, R & D investment was nearly 20 percent of revenues - $1,000,030 in R & D, $5,345,000 in revenues.

Without patent protection, Electro-Biology would not have made the substantial R & D investment needed to produce the Bi-Osteogen Sytstem. I believe other device manufacturers feel the same way about the patent incentive. The exclusive marketing right provided by a patent is especially important for small companies and individual entrepreneurs. They simply cannot afford to make a substantial investment in a product on the mere hope that another company will not market it. By minimizing the risk of another company marketing the product, patents give companies the incentive to innovate.

A device lag would create a disincentive to innovation by increasing development costs and delaying the receipt of revenues. Moreover, in the absence of patent term restoration, a device lag would reduce commercial patent life. Restoration would help to offset the second disincentive by preventing loss of patent life. Companies and individuals contemplating new product development would know that while regulatory delays will increase costs, the delays at least will not shorten commercial patent life. As such, restoration, in our view, will encourage innovation and help to preserve competition in the device industry.

Patent term restoration could lead to reduced health care costs by encouraging the development of alternative, less expensive therapies which either replace or improve upon those already available. For example, the Bi-Osteogen System can be administered at an average cost of $3,300 - $3,500 per patient, including physicians' fees. The alternative treatment for a fracture is a surgical procedure which requires 7-10 days of hospitalization and costs, on average, $6,500 - $7,200.

Patent Protection That Is Neutral Across and Within Industries

HIMA believes patent term restoration would assure neutral application of the patent laws. Without restoration, manufacturers of devices and other products subject to premarket approval lose some measure of commercial commercial patent life while firms not subject to this type of regulation enjoy patent protection for the full 17 years provided by law. Aside from the question of whether 17 years is the optimum term for inducing innovation, HIMA believes Congress did not intend patent laws to treat industries subject to premarket approvals differently from other industries.

Different patent treatment handicaps industries subject to premarket approvals in competing for capital. A rational investor seeking to maximize his return is more likely to choose an investment in an industry with 17-year commercial patent protection than a comparable investment in an industry which lacks that protection. Particularly anomalous is this: the disadvantage accrues to industries making some of society's most important products. This is because these products -- medical devices, drugs and others -- are the very products often subject to premarket approvals. For example, to the extent there is a device lag, an investor may not invest in the device industry because of the reduced commercial patent life of devices. Yet, the same investor would have no such inhibition about investing in, say, computerized games. This same effect would obtain intracompany, inducing a firm with interests in devices and computerized games to invest more funds in the latter.

Restoration would also assure neutrality within industries which have premarket approval requirements. In the device industry, the premarket approval requirement is principally directed at products representing technological advances -- the products for which the patent incentive is most important. Restoration would assure that manufacturers of these devices would have the same patent protection as manufacturers of other devices.

This concludes my prepared statement. I would be happy to answer any questions the Committee may have.

Senator SPECTER. We would like to call the next panel at this time. We have Mr. Kenneth Larsen, Mr. William Haddad, and Dr. Sidney Wolfe.

We will hear first from Mr. Kenneth Larsen who is the chairman of the Generic Pharmaceutical Industry Association.

We will receive your written statements. It is a practice of the subcommittee, as I think you know, to request that you summarize, leaving as much time as possible for questions.

Your written statements will be made a part of the record.

STATEMENT OF KENNETH N. LARSEN, CHAIRMAN, GENERIC PHARMACEUTICAL INDUSTRY ASSOCIATION, PRESIDENT, ZENITH LABORATORIES, INC.; WILLIAM F. HADDAD, MEMBER OF THE BOARD OF DIRECTORS, GENERIC PHARMACEUTICAL INDUSTRY ASSOCIATION; AND SIDNEY M. WOLFE, M.D., DIRECTOR, PUBLIC CITIZEN HEALTH RESEARCH GROUP, ACCOMPANIED BY BENJAMIN GORDON, STAFF ECONOMIST

Mr. LARSEN. Thank you, Mr. Chairman.

We are pleased to have this opportunity to participate in the hearing on behalf of our organization.

As a frame of reference from which to consider my comments, the first 30 years of my career were spent in a multinational major pharmaceutical company and the last 2½ years in a generic company—Zenith Laboratories.

The bill seeks to extend patent life to provide a longer period of exclusivity to adequately compensate innovators. We are not satisfied that the rationale and justification for the extension have been thoroughly analyzed.

Further, the bill because of its broad, nonspecific language, can and will create situations in which it would be possible for a company through a serialization of product, process, and use patents, in conjunction with FDA product and use applications, keep patent coverage perennially green.

To illustrate our concerns, if you would refer to the last page of the copy of my testimony that you have there are four examples of products which are in the market today for which extended term patents exist: Aldomet—the generic name, methyldopa—was first filed in 1959. The expiration date of the last patent covering that product is 1981. The product was NDA-approved in 1962, the result was 19 years of patent-protected coverage in the marketplace; Chlorpropamide—diabinese—16 years; Zyloprim, which is allopurinol, 20 years; and Darvon series of compounds, 23 years.

The composite value of these products in today's marketplace is approximately $300 million. If we assume a shift to 20 percent generics for these products, the estimated annual savings to the consumer would be approximately $24 million annually.

It is further interesting to note of the top 50 prescribed drugs, 23 are covered by patents in the United States, while only 10 of them are covered by patents in other countries with similar patent systems.

Patent coverage of the other 13 products in the other countries lapsed 4 to 5 years ago. Consumers in these countries are the beneficiaries of lower cost drugs as a result of competition.

The Generic Pharmaceutical Industry Association did not have the opportunity to participate in the drafting of a bill. If we had been given the opportunity, we would have sought answers to the following points which we feel must be clarified.

Senator SPECTER. Before you proceed, Mr. Larsen, what is the short answer to how these various products were able to have these extra years?

Mr. LARSEN. There are three types of patent coverage basically—a product patent, a process patent, and use patent.

In the case of Aldomet, the first one—and we'll just pick two of them out of that list of four—the product was patented. Followed subsequently by a use patent the terminal point of the last patent, the use patent, which is 1981.

Zyloprim, the basic patent was issued and then followed by a series of process patents. The last process patent expires in 1986.

Process patents are very difficult, I might say, to trace, so you are never really quite sure that you have identified the last one. This is our best picture of it as it stands today.

Senator SPECTER. Legislatively, how could that be cured, if at all?

Mr. LARSEN. A point I planned to bring out is the entire process and patent needs be analyzed. If we take a look at this process, we question the need for both product and usage coverage under the bill.

The restoration bill, as it is written, does not cover process patents. However, process patents could still exist and create extended coverage as illustrated by Zyloprim.

We question the need for both product and usage coverage under the bill. We would give favorable consideration to the concept of product patent extension for the indications covered in the NDA application for the product but exclusion of the usage provision under the bill to prevent multiple extensions on the same product.

Perhaps another consideration that might be taken under consideration is the cap on the maximum number of years of coverage allowable on any product to prevent parlaying product, process, use and extension of patents.

An opportunistic company, the way the bill is presented now, could obtain a product patent, file for a process patent a little later and then come back and get a use patent. Subsequently, as additional identification, uses of the product are identified to apply for an extension.

We feel that to have the bill state both product and usage is a mistake.

Really, we are looking to benefit the consumer. The consumer does benefit by new products in the marketplace, but the consumer benefits today also by competition in the marketplace which this bill, as it is presently set up, restricts.

There is the example I cited to you; $300 million is represented by those products which have market periods covered by patents for anywhere from 16 to 23 years. Through generic competition consumers could see $24 million annually. That is a lot of money!

Senator SPECTER. But how would you cure that? That was my question.

Mr. LARSEN. First of all, I would remove the usage provision from the bill, so that you are speaking strictly to the product.

Second, I would put an overall cap on the amount of patent coverage that could exist for a product.

Senator SPECTER. What do you suggest?

Mr. LARSEN. I don't think that in terms—and this is my personal view—that I have any problem with the innovator getting a patent coverage of 17 years from the NDA filing date.

To go back to the IND date, the filing of the IND, leaves too big an opening gap. When an IND is filed, the question is how expeditiously will the company move ahead.

One of the things possible under the bill, if a company wanted to really be opportunistic, would be to rush out and get an IND as quickly as possible and then sit back and develop the product slowly, particularly if the company has a product in the market for indication—the new drug is intended. Taking this step would stretch out the patent coverage possible under the restoration bill.

We would welcome the opportunity to sit down and cover these points in detail with staff and provide positive suggestions that would support both the innovator and consumer interest.

We think that there are two interests to be served through such a bill. The innovative company needs to have a period of compensation. But the public interest has to be recognized.

We have to be careful, because it is like a pendulum. The pendulum may be over here now, but let's be careful how much push we give to the pendulum as the inertia caused by pushing the pendulum the opposite way could adversely effect consumers and to the cost of drugs to the Government.

Competition should exist in the marketplace on generic drugs.

The question was asked on post-1962 drugs if we would respond as to where the issue stands after the Secretary lifted the stay. Nothing is happening right now because the issue is back in court. The matter is before the courts as to whether or not the FDA acted properly in issuing the policy.

We would like to see the courts pass on the issue and approve the FDA's position. We, as an organization, have entered as intervenors in support of the FDA position.

You have my comments in front of you, and they summarize the points which I would make.

There is one other point which concerns me. If the patent does not issue within 3 years, or some reasonable number of years, the extension period should be based on a date which is 3 years after the initial application date. So if something gets stuck in the Patent Office for a long, long time or it gets stuck in a jurisdictional question competition can be restricted for a long period of time.

Elovil is a good example of this. Two of the major companies had a conflict as to which was entitled to a patent; 1958 was the date the patent was filed but it did not issue until 1968 The NDA approval was somewhere in the early 1960's.

I leave you with that as a thought.

Senator SPECTER. Thank you very much, Mr. Larsen.

Mr. LARSEN. Perhaps if there are other questions, they might wait until Mr. Haddad has made his comments.

Senator SPECTER. Fine. Why don't we do that.

Mr. HADDAD. Thank you, Senator.

My name is William F. Haddad. I am a member of the board of directors of the Generic Pharmaceutical Industry Association. My work with generic drugs extends back to the days when I was an assistant to the late Senator Estes Kefauver and dates to a recent 3-year period of investigation of the pharmaceutical industry, using the State of New York's subpena power.

Senator, I understand that this hearing is premised on the fact that the industry does not receive enough patent protection to protect innovation. I offer a chart to you which would seem to dispute some of the facts that you have received. [Chart on display.] [1]

If you will, permit me a moment of total candor and a little impertinence.

My reaction to these hearings, Senator, can be summed up in the thought that came to me when I was writing this testimony. If the late Senator Kefauver could hear of these proceedings, he would turn over in his grave.

You are being blandly presented with the identical, discredited arguments that Senators Kefauver and Long effectively fought 5 years ago, 10 years ago, 15 years ago, and 20 years ago.

Over the 20 years since the Congress last acted, all attempts to help the small entrepreneur to keep drug prices reasonable have been swept aside with a force that is difficult to understand or comprehend.

After all these long years, the many congressional hearings and the comments of Senators Long, Nelson, Kennedy, Mathias, and others, when contrasted to the economic commercial reality of the generic industry today, I can only tell you that this legislation, along with what I am about to say, is forcing competition and innovation out of the marketplace, exactly the opposite of what you are trying to do.

Actually, you should have Defense Secretary Caspar Weinberger here as a witness, not Bill Haddad. He did more to end the myths of the pharmaceutical manufacturers association than anybody else. He put an end to some of the nonsense that went on previous to his tenure at HEW.

The hard truth today, Senators, is that 9 out of every 10 Americans—conservatively 8 out of every 10—is paying 4 to 10 times as much for prescription drugs as they should or could pay. Price was and is a major prohibition to good medical care.

There are three reasons for this tragedy and travesty. First, the Congress has yet to act on a national formula of interchangeable drugs which now exists administratively, largely the result of State initiative.

Second, the continued ability of the major pharmaceutical houses to use a restricted channel of information, dominated by "bought" magazines and a radio network to funnel deceptive information to doctors, who as both Senators Kefauver and Long reported many times control how a drug is prescribed, but are not required to pay for it.

Third, the continued attack by some in the pharmaceutical industry on the safety and effectiveness of generic drugs, creating the impression—the false impression—that there is a difference be-

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[1] Chart can be found on page 137.

tween drugs produced under their generic as their trade names. There is none.

The use of the New York subpena in public and executive session uncovered a network of academics and physicians who under the guise of their neutrality produce self-serving surveys for the pharmaceutical industry, surveys often reaching the level of congressional decisionmaking.

The truth is that patents, rather than ending at the end of 17 years, are frequently kept "evergreen." That is what scares us about this proposed legislation.

Generics are kept out of both the Government's and consumer's hands long after the patent expires. Eighty to ninety percent of a market is still controlled by the innovator company a decade later. Through the use of a series of techniques and procedures to extend patent life.

One current technique of extending a patent is to keep already-approved drugs off the market by claiming that size, shape, and color are, in effect, proprietary items, while simultaneously propagandizing the doctors that these are important factors to be used in deciding what drug to prescribe.

Doctors and drug manufacturers know how patients take drugs—certain categories of patients—by their color.

Part of your patent concern could be an amendment which assures that when a drug reaches the end of its protected monopolistic life, it really ends and is not pulled into another decade by a series of clever techniques, such as the issue of size, color, and shape.

You have the ability to do that here and now. You can mandate, as a part of this legislation, a national formulary of interchangeable drugs. You can statutorily require the FDA to select the innovators' colors with some descriptive number or design to separate them from generic products and prevent the confusion and protect the national health when a patent ends.

The evergreening of patents doesn't end there. Mr. Larsen has touched on the post-1962 drugs. The fact of the matter is that, with one minor exception, no post-1962 drug is yet in the generic market. The result is that millions of your constituents—and the Government itself—are trapped into paying the higher price for off-patent prescriptions.

These drugs, as you know, are not only safe but effective. They have been in the marketplace for many years.

They should be easier to approve than the 3,000 drugs which were developed in pre-1962 era.

I want to make two final points—I see my time is running out, but I am very anxious to get this across to you.

I wish you would give some attention to why we have a drug lag. Senator, in the sixties and the seventies, the marketers took over the drug companies. They combined drugs for no therapeutic change and marketed the hell out of them, a clever technique for quick profits because they have a fixed asset base and an inplace sales force which need to be constantly supplied with new products. They also maintained control of information flowing to doctors. This caused, in large part, the drug lag from which we all suffer.

The final point is this: ironically, if you use—as we were discussing a moment ago—the IND patent dating method, you will be stifling innovation in new drugs and blocking competition, the reverse of what you are really setting out to do. You are hurting the small companies and helping the large companies, precisely what Senator Mathias is seeking to avoid.

Once an IND is filed, Senator, nobody is going to touch that product. It is going to sit there as long as the drug company wants it to sit there. Under your proposed legislation they control this timeframe, not the Government.

Most of the time that is lost, or used, is not at the FDA. GAO says FDA takes 23 months. The real time complaints, then, refer to the IND period. The time period in which companies exercise maximum control.

Your legislation has to find a way to prevent that from happening.

We also urge you to give this administration a chance. President Reagan has promised an end to redtape. This Congress has promised an end to redtape. Let's see what happens when Secretary Schweiker zooms in with his FDA commissioner and slashes redtape. Let's see what happens to patent life and then come back here and review those results and see if we really have a problem.

Finally, thank you for your willingness to hear my somewhat strident statements, which I hope you will understand are underlined by 20 years of frustrating experience with the pharmaceutical industry and watching them time after time pervert the truth, turn fact into fiction, and frighten great and courageous men into silence.

Thank you.

Senator MATHIAS. Thank you, Mr. Haddad.

Dr. Wolfe?

Dr. WOLFE. Thank you, Mr. Chairman.

With me is Ben Gordon, who is currently the staff economist with Public Citizen Health Research Group. Before that, for 20 years he was the staff economist for the Monopoly Subcommittee of the Senate Small Business Committee. He has conducted extensive research and many hearings on patent policy, marketing and promotion of drugs, and many other topics related to the drug industry.

He has told me over and over again pretty much what Mr. Haddad has said that those who have fought against these kinds of change for so many years would be very upset to see the drug industry once more coming forth, hopefully not successfully but possibly with some success to change things around.

I just want to summarize briefly what is in the written statement.

Most of the drugs being marketed in this country which make up the bulk of the profit margin of this industry which is right at the top of the most profitable industries are not thought by the Food and Drug Administration to represent important therapeutic advances.

They have done study after study on this and have concluded that most of the drugs which get approved are really in some way

or other a copy with a slight molecular modification of drugs that are already on the market.

What we have is an industry that is perfectly content to make record kinds of profits without necessarily pushing for innovation.

We obtained several years ago a statement from a Wall Street stock analyst who looked at the drug industry and said: "It is entirely possible that the economic winners would come from drugs which FDA estimates to be of either moderate or little or no therapeutic gain."

What is being said is that the industry, for other reason, independent of the patent life, is interested in making money, understandably, and is content to do it by putting a 10th or 11th version of Valium on the market or a 15th tetracycline or a 10th or 11th cephalosporin.

I doubt seriously that their minds are going to be changed by that.

Another element which has not really been discussed today is the fact that a number of the most important and biggest selling drugs in this country were developed in other countries by other foreign companies and then licensed in this country so that they could be sold.

The American company, such as Ayerst, a division of American Home Products for propranolol, a very important drug discovered in Britain, is perfectly content to take the drug through the testing process and get it marketed here, relatively quickly in the case of that drug, and make a lot of money from it.

What is particularly of interest though is that all of these foreign companies that seem to be very innovative in most cases are in countries where they have mandatory or compulsory licensing of the drugs.

I will read you what we have learned very recently in terms of the system in Great Britain where propranolol was developed by Imperial Chemical Industries.

According to the Patents Act of 1977, which went into effect in June of 1978, compulsory licensing for drugs is handled like any other product.

Three years after the grant of the patent any person may apply to the Comptroller of Patents for license if:

(*a*) The patent is not being worked in the United Kingdom or not being worked to the fullest extent as reasonably practicable;

(*b*) Where the patented invention is a product for which the demand is not being met on reasonable terms as well as for other reasons—section 48—the inventor shall receive reasonable remuneration—section 50; and

(*c*) If the Monopolies Commission has found that the patent is being used or may be expected to be used against the public interest.

Particularly relevant to drugs is section 55 which authorized the Government to set aside any patent so that the innovation may be used for the benefit of the State, which pays for 90 percent of the drugs in the United Kingdom. In most cases, compensation is paid to the patentee.

I think there is a curious anomaly here. In other countries the company develops an innovative drug and is forced, in a sense, to

undergo competition, even before the patent expires because of the compulsory licensing and yet the company still has the incentive to be innovative.

We have an industry, which like the oil industry, is already at the top and wants to have even greater profits. Certainly, I don't think anyone would argue with the fact that the profit margin would go up, independent of whether there was innovation, just by virtue of extending the patent.

Mr. Larsen has pointed to something that no one else has discussed—the ability to make various modifications in use, et cetera, on a drug and thereby parlay the patent well beyond 17 years.

We summarize in the testimony examples of some drugs that have had, even without the use patent kinds of deals, functional extensions of their patent lives simply because of the brand name monopoly which extends far beyond the patent period.

At the top of page 3, we list four big selling drugs which have been off patent, respectively, 7 years, 3 years, 13 years, and 15 years, by 1979. Yet in 1979, that far-off patent, they still retained 90 percent, 90 percent, 86 percent, and 95 percent of the market. The drugs are Darvon, Librium, Apresoline, and Gantrisin.

In summary, again, I would agree with Mr. Larsen's notion that one of the ideas in the bill, to give fair patent life, not beginning with the IND but beginning with the NDA filing, may make sense. In and of itself we strongly oppose it. We think that it needs to be accompanied by other ways in which competition can be increased.

We thereby recommend the following changes:

First, limit the rights to the trademark or brand name of a drug to the life of the patent. The examples I just cited, I think, are mainly due to the fact that doctors can easily learn the short brand name and not the long generic name. So the second the patent expires, anyone would have a crack at using the brand name.

Second, ANDA's for post-1962 drugs to stop unnecessary Government regulation of generic drugs. As has just been pointed out, we believe the FDA has the authority and is even required to do this, but explicit language in any legislation affecting patents, I think, would be important.

Third, compulsory licensing at a reasonable royalty, as is now going on in the United Kingdom, Canada, and a number of other countries.

Fourth, making the results of safety and efficacy testing a part of the patent.

Fifth, elimination of the provision expanding patent life for drugs already in the regulatory process.

Without these changes, we strongly oppose the legislation. With them, the public rather than just the drug industry will benefit.

Thank you.

WOULD BILL RESULT IN LOWER DRUG PRICES?

Senator MATHIAS. Thank you very much.

Earlier today, Dr. Clark testified—I think he said as an economist—that he would anticipate that the passage of this bill would result in lower drug prices, at least initially. Is there disagreement on that?

Mr. HADDAD. Senator, economists are like psychiatrists at a murder trial. You can find three who say one thing and three who exactly the opposite. Three whisper into one ear of President Reagan and three into the other.

It is not going to reduce prices. That is absurd.

Senator MATHIAS. As to your comment on economists, I recall Harry Truman's old expression of a wish that he could find a one-armed economist who wouldn't say that on the one hand this and on the other hand that. [Laughter.]

Mr. HADDAD. You had testimony over in the House which refutes that claim. What you have to really deal with, Senator, is the reality of the marketplace. Drugs are not there, selling in a monopolistic marketplace after a patent expires. Some are selling like hell, after 17 years of patent.

You have to review each case, not only for the actual number of years selling in the marketplace but for comparative volumes.

I think general statements by economists about future events are not particularly helpful in the science of drafting legislation when real factual evidence is available. The legislation you propose is vital to us. We are on the verge of being run out of business by the series of events which we spoke about today. This is just one more nail in our coffin, the coffin of small business, unless we do as Dr. Wolfe has indicated and not only purify this legislation, but clear up the other related patent problems as well.

As for economists, we will bring in three who will tell you exactly the opposite, if you give us the time or hold the record open.

The fact of the matter is that in my New York State investigations, we found that prices on monopolistic drugs were rising out of proportion to the rate of inflation. But that information is now a couple of years old.

Mr. LARSEN. I would just supplement in terms of—I disagree with what he said, I might add. I think you can look at the record——

Senator MATHIAS. What Dr. Clark said.

Mr. LARSEN. Yes. Not with Bill.

You can look at the record we put before the House. There is a product called Dipyridamole. The generic version was introduced in 1979. In 1977 the originator's price, the redbook price was $95.40 for bottles of 1,000; in 1978, it was $99.75; in 1979, enter generic competition, the generic price at $44.50. The originator's price did not go down but went up to $105. Currently, the product is selling in the generic form at $18.95 for a bottle of 1,000 while the originator's price is $108.

The consumer interest has to be served. Competition, I have always felt, is healthy. I think it stimulates the economy. I do think that companies need to have time to recover their investments, but I do not see this ability to parlay various forms of patent extensions in conjunction with FDA time to be left totally open, which the bill does at this point.

I think the bill should be refined. Then, you would find that we would be supportive as we are supportive of the basic concept.

DRUG INDUSTRY WILL CHARGE WHAT TRAFFIC WILL BEAR

Mr. GORDON. Mr. Chairman, as Dr. Wolfe mentioned, I was on the Hill here for about 20 years and spent a lot of time in the field of patents, as well as investigating the pharmaceutical industry, both with Senator Russell Long and with Senator Nelson.

One point which came out very, very clearly in our hearings was this:

The drug industry will charge what the traffic will bear. If they can get away with charging higher prices, no matter how long the patent period is, they will do so. There is nothing in the bill which protects the public at all against that type of situation.

The fact that an economist said this or that really doesn't mean anything, because he has no evidence.

Senator MATHIAS. Let me put this to you, though. The generic industry, which I have been very much interested in over a period of years, historically has been successful because it produces drugs comparable to the brand drugs as they are coming off patent.

If the pharmaceutical industry's witnesses are right, and you may not agree with them, but assuming they are right, that conditions in the industry have changed to the extent that numbers of new drugs will be dropping off, and therefore over a period of years fewer will be coming off patent, then won't this ultimately work to the prejudice of the generic drug industry.

Mr. LARSEN. I think that the point you make is a good one.

I think if you take a look at the generic industry today, as compared with what it was many years ago, there are fewer companies involved today than there were before and its character is different.

The generic industry per se is not saying that the innovators should not be protected. We are questioning the reasonableness of the presentation as it is incorporated within the proposed bill.

Senator MATHIAS. I think you have been very fair in making it clear you think that the innovators ought to be compensated for their costs and their risks.

Mr. HADDAD. It also takes money to go into the generic business. You have generic firms in your State that are state of the art firms. It requires capital and investment and lengthy processes before the FDA, which we would like to cut down.

It is a different kind of business, but it is a business. It requires high interest capital. It has performed a great service to this country. It has made money and performed a service.

We considered your point very carefully at our board of directors meeting. We felt that even though we do benefit from drugs coming off patent, we felt there was a major effort underway to get us off the street.

If you will read my testimony, which I did not spell out because of the time, we said in that testimony that we cannot understand what is happening. It is a $4.5 billion industry—generics. We have $400 million. What are they worried about with the little boy like us on the street.

What they are trying to do by the combination of things I carefully outlined is to get this competition out of sight and to get it away. That's what we think is happening.

We only see your legislation, Senator, as part of that patent. Unfortunately, we are dealing out there in the marketplace every day. Firms are closing up. This is not in isolation. It is part of something else.

We are urging you to take a look at our industry, because you have been a supporter of it in the past and I have heard some of your comments in previous hearings. See what we are doing, take a look at your legislation and let this Reagan administration try to cut some of that bureaucratic redtape, and then look at some of the amendments we propose that provide equity—size, color, and shape and national form—things that need to be done.

If that is right, then they don't need any more protection than they have. If that is wrong, let's give them the protection from something like the NDA, which is definable, and not the IND, which is in their power to manipulate unscrupulously if that is their intention. I am not charging them with that.

Dr. WOLFE. I would just like to comment briefly.

The very real measurable fall in the number of new drugs which have been approved is a little misleading. If you look at the number of important new drugs that have been approved, according to the head of the Bureau of Drugs at the FDA, the numbers stayed pretty much the same for 20 years with 3, 4, or 5 a year—important new molecular entities being approved a year.

So the question is really what is different now from 20 years ago. The difference is that some less-important drugs which don't offer any therapeutic advance, are not getting to market as readily, which is an advantage in a sense, to consumers because consumers don't benefit from a 10th or 15th version of something that has already been around.

Again, I think that if anything is to be done, it should be a package that includes benefits to consumers, such as the ones I outlined—compulsory licensing, end of the brand name monopoly, and so forth—in conjunction with the benefit limited to the NDA period to the manufacturers. Otherwise, I think nothing is better than just the extension of the patent, because things really aren't any worse in a sense than they were 20 years ago.

Perhaps a larger proportion of these four or five new drugs coming to market are coming from foreign countries, but the companies in this country who market them for the foreign countries are perfectly happy to do that and make a large amount of money from it.

Thank you.

Senator MATHIAS. Mr. Gordon, you look like you have a pregnant thought.

Mr. GORDON. Well, I have a thought. Whether it is pregnant or not I don't know. Though it may be. But I'm not pregnant with the thought either.

You may be interested to know that there were studies that came out of your committee—the Judiciary Committee—way back in 1958 which are quite interesting and really relevant to this particular subject.

One is a study, No. 15, of the Patent Subcommittee, which is no longer in existence. It is called an "Economic Review of the Patent System." The study was done for the Patent Subcommittee, now

defunct, by Prof. Fritz Machlupe who was at Johns Hopkins and subsequently at Princeton University and was a great authority on this particular subject. He has since retired.

The "Impact of the Patent System on Research" was study No. 11 by Dr. Seymour Melmon, professor of engineering and management at Columbia University.

They are quite interesting. They come to conclusions which are quite different from those of the industry and university patent representatives, as given to you today.

I wasn't here to hear it, but I understand that Mr. Engman stated that the compulsory licensing provisions in the United Kingdom patent law have been eliminated. I am happy to tell you that that is absolutely inaccurate. They are still in existence. Their very existence makes them effective.

IS RESEARCH BEING DONE

Senator MATHIAS. I have a number of questions. I am going to submit some of them in writing to you, because we are running out of time today. But I do have one last question generally.

Is there any original research being done by the generic industry?

Mr. HADDAD. Some of that information is proprietary but maybe Ken can address that question.

Mr. LARSEN. I think original research, as I know it, coming from a major pharmaceutical company and having spent the first 30 years of my life in this industry in a major company, the answer would probably have to be no. Yet I know of companies in our organization who are conducting basic research and looking for new compounds.

A lot of this is private matter that I wouldn't be privileged to.

I think it should be pointed out though, when you raise that question, that to bring a generic drug to the marketplace—and we'll just talk about the pre-1962 drugs for a moment—it probably takes a minimum of 1 year to 1½ years to develop the drug inside in terms of formulas, internal testing, and biostudies before FDA submission. The drugs that have been approved of late by the FDA's ANDA area using chlorothaladone and hydroxyzine hydrochloride as example took over 2 years.

So we are talking not about a short period of time to get a generic product to the marketplace and generate competition. We are looking at periods of time today from the point of inception of generic product research of a 3-year period.

This holds true for post-1962 drugs. Companies that are in the generic industry, because of peculiar situation involving post-1962 drugs, started work on these drugs as much as 4 and 5 years ago because some of the patents covering these products have expired but the companies are blocked from bringing in generic competition because of the status of the post-1962 approval system.

We too are faced with time crunches. We too have problems.

My own particular company has been in serious financial trouble. As I came to it, the role was to try to turn it around, and we are trying to do that.

To do that means a continuing stream of new generic products.

Companies like ours often have a high percentage minority work force. In our particular company, 80 percent minorities. We are talking about 80 percent of the work force of Zenith as minorities being in a very shaky position. I use this only to dramatize another concern I have for the generic sector of the industry.

Mr. HADDAD. Something that has been introduced in public testimony before is this.

When the generic company is formulating its product, it frequently formulates it, to use a layman's word, in a better way and a more effective way than the innovator product.

In other words, there are generics. If you could get somebody from the FDA to sit up here and say what generics have come in that are better or more potent or more effective or we have to use less which have been produced by the generic companies, you would get a list of them. You would find that some of that has to do with the fact that the innovator company has not moved ahead with its product and some has to do with something you talked about earlier and some of your witnesses talked about—new technology.

Mr. LARSEN. I would supplement that by giving you one example, without naming a drug.

My particular company developed a generic formulation of a product. That product, against a standardized solution, and tested as the Government recommended in biostudies, showed 80 percent availability against a standardized solution. The innovator's drug showed 28 percent.

Our product was, therefore, not equivalent. We were told it could not be approved. We deformulated the product, and it was suggested there was some question as to whether we should approve the deformulated product because we had already demonstrated the ability to produce a superior product. The question we understand was asked of the innovator if they were going to change their formula. I don't know what that answer is.

We have a third formula for the product that we haven't submitted to the Government that reduces the concentration of the active components and gives the same degree of availability as the product being marketed by the innovator, but because then it would be inequivalent for another reason—a lesser amount of drug present than the innovators—we have not submitted. Ideally the lower concentration formula would be preferred as the patients would receive less drugs and probably the cost would be less.

Mr. HADDAD. It is called Catch-22.

Mr. LARSEN. The problems facing the generic industry are real.

The super bioavailability question will become one of great consideration. The American Pharmaceutical Association has addressed itself to this. The FDA is very concerned about it. It is the generic companies that have brought focus on this particular issue.

We got off on a technical side, for which I apologize.

Senator MATHIAS. No; it is useful.

Mr. GORDON. Mr. Chairman, I want to bring up the fact that the patent is a two-edged sword.

A considerable amount of "fencing in" is done with patents. They don't nececessarily use every single patent. Very frequently, they patent something to prevent others from using it.

Senator MATHIAS. Preemptive patents.

Mr. GORDON. They used to call it "fencing in."

As a matter of fact, some of the consequences of that activity on our economy were brought to light during the TNEC hearings, which of course was a long time ago but I think that that activity is still going on.

I urge you to have somebody do some studies—intensive and objective studies—by nonindustry people on the consequences of the kinds of provisions that you are proposing.

Just having people come up here and give their opinions—they are only opinions though.

Senator MATHIAS. Let me give you some encouragement with that thought.

I am a member of the Board of Governors of the Office of Technology Assessment. OTA at this very moment is making such a study.

Mr. HADDAD. In a nutshell, what we are asking of you is to give us a chance to support your legislation.

There are many issues which worry us. It is not as simple as merely changing a word or two in this legislation.

Senator MATHIAS. We are happy to have your suggestions and want to work with you.

I am glad that that chart is included as a part of your statement, so that it can appear in the record and the record will be complete.[1]

I have some questions in writing which were submitted by the chairman of the committee, Senator Thurmond. They will be presented to you, and I will appreciate your answers within 2 weeks.[2]

Thank you.

[Prepared statements of Messrs. Haddad, Larsen, and Wolfe follow, along with other pertinent material:]

PREPARED STATEMENT OF WILLIAM F. HADDAD

My name is William F. Haddad. I am a Member of the Board of Directors of the Generic Pharmaceutical Industry Association. My work with generic drugs extends back to the days when I was an assistant to the late Senator Estes Kefauver and dates to a recent three-year period of investigation of the pharmaceutical industry using the State of New York's power of subpoena. For the New York Herald Tribune, I uncovered the Latin American documents which led to a $200,000,000 fine against the major drug companies for engaging in a cartel to prevent competition in the sale of the life-saving Tetracycline. The "green book" we prepared for New York State was the first compilation of interchangeable drugs, which led to the repeal of anti-substitution laws throughout the country and after nine failed attempts the green book provided, the basis for a unanimous vote by the N.Y. Legislature—which has a Republican Senate and a Democratic Assembly—to enhance the use of generics.

My reaction to these hearings is best summed up by a thought that occurred to me in preparing this testimony. If the late Senator Kefauver could hear of these proceedings, he would turn over in his grave.

You are being blandly presented with the same discredited arguments which he and Senator Long so effectively fought some ten and twenty years ago. It is as if time has rolled back to the era when the Pharmaceutical Manufacturers Association could roam these halls and threaten the re-election of powerful Senators. That organization has changed, but the falsehoods presented as truth persist.

Kefauver was used to Democrats cornering him in the hallways saying, "Senator, I just can't go along with you on this." Ironically, with their philosophical belief in the free enterprise system, Republicans were his greatest allies.

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[1] Chart can be found on page 137.

[2] Aforementioned questions and answers may be found on page 149.

Over the twenty years since the Congress last acted, all attempts to help the small entrepreneur keep drug prices reasonable have been swept aside with a force that is difficult to comprehend. That, after all these long years, and all those many hearings and comments by Senators Long, Nelson, Kennedy and others, what emerges is legislation which when combined with the commercial reality of what is happening in the pharmaceutical world today, begins to signal the death of the generic industry, the one courageous small business which along with the states, has helped to turn back the price onslaught and bring to the U.S. government, to the states and to the consumers, lowered prescription prices. Now that you have permitted my impertinence, let's deal with the hard, cold facts:

The hard truth is that today eight or nine of every ten American consumers are paying from four to eleven times more for prescription drugs than they could or should pay. There are three reasons for this costly tragedy: (1) the Congress has yet to act to institute a National Formulary of interchangeable drugs which now exists as an administrative matter, the result of state initiative, a formulary now in use by the military and a formulary in use by most hospitals, military and non-military; (2) the continued ability of the major pharmaceutical houses to use a restricted channel of information, dominated by "brought" magazines, to funnel information to doctors who, as both Senators Kefauver and Long have said many times, control how a drug is prescribed; and (3) the continued attack by the pharmaceutical companies on the safety and effectiveness of drugs prescribed generically. The use of the New York subpoena uncovered a network of academics and physicians, who, under the guise of their neutrality, produce self-serving surveys for the pharmaceutical industry: surveys often reaching the level of Congressional decision-making.

The truth is that patents, rather than ending at the end of seventeen years, often remain "evergreen." Generics are kept out of both the government's and the consumers' hands at great expense because 80 to 90% market share, after a patent expires remains in the control of the majors. As businessmen, the hard inescapable fact is there: the end of the official patent life does not mean the end of the monopoly situation.

One current technique of keeping generic drugs off the market is to declare that the size, color and shape of a drug are proprietary, while simultaneously propagandizing doctors to use these factors in prescribing their brand name drugs to patients. You know how your mother takes her pills: by their color.

Now that the states have substitution laws, doctors will be urged to return to trade names because of size, color and shape. This effort is a strategically planned, industry-led attempt to restrict the sale of drugs currently on the generic market because the states (led by New York, I might add) have adopted laws which make it more difficult to prescribe the higher priced drugs for patients who receive government reimbursement. Part of your patent concern should be an amendment which assures that when a drug reaches the end of its protected monopolistic life, it really ends and is not pulled into another decade by a series of clever techniques, such as color, size and shape. You can do that here and now. You can mandate, as part of this legislation, a National Formulary of interchangeable drugs. You can, statutorily, require the FDA to select the innovators color, size and shape as pre-requirement for generic companies and, thus, end confusion, and protect the national health. No matter how successful the industry is in its battle on size, color and shape, poor, elderly and sick people who want government assistance in paying for prescriptions, will use lower priced generics. If size, color and shape is not uniform, you enhance the possibility that an elderly woman with heart disease takes the wrong pill because of habit, or failing eyesight, may die.

But, the "evergreening" of patents does not end there. A recent effort, which continues today, prevents off-patent post 1962 drugs from entering the generic market. A solid wall remains in force, costing this nation more than it proposes to save from contemplated Medicaid and Medicare cuts in prescription drug reimbursements. Here again absurd logic extends patent life.

The Kefauver-Harris legislation, enacted in the emotional wake of the thalidomide tragedy, provides that drugs not only be safe, but effective. Some 3,000 safe, *pre*-1962 drugs were approved for generic use by a formalized process which includes the assurance that the product is being manufactured to the safety and quality standard required of all drug companies.

In the post-1962 situation, the drugs are not only proven, at the outset, to be safe and effective, but have had up to 17 years of marketplace use. There is no reason that either the scientific literature, the on-line experience, or even the ANDA program used for pre-1962 drugs should not be used for post-1962 approval. It is not happening. So, new drugs coming off-patent today cannot be manufactured by generic firms, continuing the monopoly. Struggling, small companies who must allocate resources, plan their marketing strategy, and borrow money at extraordi-

nary interest rates while waiting for this absurd impass to change. Watching what is happening in the marketplace and in the Congress, we wonder what happened to the President's philosophy of rewarding initiative, innovation and hard work. The GPIA considers President Reagan its greatest ally in reducing medical costs and cutting red tape, and have said so before today.

We see this current legislation as part of a plan to force the generic boy off the block, especially when patent legislation is coupled with the eighty percent of the market share that continues after patent expiration, when it is combined with the efforts use size, color and shape to extend patents, and when added to the fact that off-patented post-1962 drugs cannot be marketed, your legislation, if not carefully redrafted, or reconsidered can be the straw which and dramatically raises the price of prescription drugs. It can make twenty years of difficult progress meaningless.

I keep asking myself why is there so much pressure on these small companies? Some $4.5 billion of generics are sold in this country, but only about $400,000,000 are marketed by our companies. The remainder are sold by the so-called innovator firms as branded generics. Why should such a small segment of such a large market be of such concern to the majors? The answer becomes obvious. They are frightened of us. But why? Not our political clout. We have none. Certainly not our size. I think it must be the competitive prices which causes others to reduce theirs to remain competitive, which, is, after all, the name of the American game. It was the pricing formula which enabled one a tough old Admiral, in the 1960s, to tell the high-priced pharmaceutical firms to get lost and bought low-priced generics for the military; it was the formula of the hard-nosed, clear thinking Casper Weinberger who single-handedly changed U.S. policy to purchase generics: he insisted HEW should only purchase generically when federal funds were involved. And, it was men like Senator Laxalt, who, in his own state, made sure that the sale of generics was made possible when state funds were used.

We hear a great deal about the so-called drug lag and, once again, the government became the convenient whipping boy. There are, of course, scientific reasons why the influx of new drugs has slowed. But the current drug lag, gentlemen, was caused in large measure because the marketing men took over the drug companies. Wall street will tell you that the drug companies earn twice as much on invested capital as other major American companies and remain one of the most profitable industries in the history of American business, paying consistently increasing dividends to sophisticated investors. Nothing wrong with that. But, Wall Street will tell you that instead of putting these increased profits into the laboratory, they put them into promotions, sales and dividends.

These medical hucksters in these critical developmental years combined *known* drugs into *new* combinations and, using their fixed asset base, their in-place sales force, and the medical press they dominated to market the hell out of useless combinations, temporarily tricking doctors into believing these were new products when, in fact, they were not. In the end, both the HEW Task Force, and even the American Medical Association, called their bluff. That's why you don't have new drugs. That is why these hucksters are so desperately trying to extend their patents.

It is very much like Chrysler coming here and asking help to repair their own mistakes. But, unlike Chrysler, these are healthy companies, making hugh profits which should be reinvested in basic long term research and not be used to inflate quarterly reports. Further, to be even more blunt, your legislation protects their failures as well as enhancing their successes. You are being asked to make their business "risk free."

Ironically, if you use the patent dating IND route, you will be stiffling innovation in new drugs and blocking competition not the reverse. Once an IND is filed, what company is going to compete? Your current proposal will not only restore the bureaucratic period, now accurately estimated at 23 months, but will protect the fall period between IND filing and NDA clearance, the period when clinical testing and other industry safety and effectiveness tests take place. Most of that is company controlled time, not government controlled time. You reward companies for self induced delay, the very issue you are attempting to correct.

Senators, you also have yet to be provided with the accurate life on-line sales life of a patent. We have taken the liberty of showing you what that research would demonstrate on thirteen top drugs. Senators, you have yet to be provided with the hard, cold facts of what it costs to develop a drug. You are still using self-serving numbers generated by industry. In executive session, and under oath, detailmen told New York State they were required to charge their expenses to research and development. What was the research cost of Tagamet or Valium as opposed to profit from sales minus losses on other R&D? What is the accurate ratio of marketing to research? We are asking you, in effect, to take a deep breath to give this critical legislation a good hard look.

A recent Harris poll revealed that 64 percent of consumers now think generics are not only safe, but less expensive. That's a dramatic increase over recent years, and in part is reason for the major pharmaceutical efforts to change the name of the game.

We urge you to give this administration a chance to prove what it promises: a reduction of regulation, which we all welcome; to give this Cabinet a chance to cut red tape under the watchful eye of the Congress. And, in the meantime, draft legislation which really will help innovation and reward initiative for both large and small companies.

Senators, I have been privately told not to wage this fight. It is over. The PMA has the skids greased. That we have little chance of winning. The big companies were there early and well prepared. We were not even consulted on this vital legislation which would kill off the generic industry. But, having walked these halls with the late Senator Kefauver, and having watched Senators Long and Nelson, and listening to Senators Laxalt and Mathias over the years, I know that hopeless causes are championed by honest men like yourselves, who, for a moment cannot find the time in a hectic schedule, to pause, to questions, to probe and to learn.

Thank you for your willingness to hear my comments which, I hope you will understand, are underlined by twenty years of frustrating experience standing toe-to-toe with the pharmaceutical industry and watching them, time after time, pervert the truth, turn fact into fiction, and frighten great and courageous men.

WILLIAM F. HADDAD
280 Park Avenue
New York, New York 10017

May 12, 1981

Honorable Charles McC. Mathias, Jr.
United States Senate
Committee on the Judiciary
Washington, D.C. 20510

Dear Senator Mathias:

The exhibit introduced as part of may April 30th testimony on S. 255, The Patent Term Restoration Act, showed that the actual commercial patent protection for the 13 top selling prescription drugs still on patent averaged 16.4 years. (Attachment "A") Kenneth Larsen, President of Zenith Laboratories and Chairman of the Generic Pharmaceutical Industry Association, presented specific examples of how the serialization of product patents, process patents and use patents, in conjunction with FDA product and usage applications, often extends patent coverage well beyond the patent life already authorized by law.

In response to a comment by another witness that our list of 13 drugs might be too selective, GPIA has examined the commercial patent protection of the next 11 top selling drugs still on patent. The attached exhibit No. 1 shows that these drugs are protected from price competition for an average of 15.1 years.

In exhibit No. 2, we have shown that the 24 leading patented drugs products are protected in the marketplace for an average of 15.8 years. These drugs have an annual sales volume of $1.9 billion.

It was also suggested by witnesses that patent life for new drugs approved in the 1970's has been reduced to an average of 9.5 years and that the GPIA exhibit showed longer patent life only because of the inclusion of drugs approved and marketed in earlier decades. In the attached exhibit No. 3, we have shown that for the same top selling drug products, average market protection for drugs approved in the 1970's is actually 13.7 years -- a reduction of only 3.3 years from a full 17 year term.

As Mr. Larsen has pointed out, development and marketing approval for pre-1962 generic drugs commonly takes 3.0 to 3.5 years. The time expended on post-1962 products, which are still barred from the competitive market, has been even longer.

Any product extension beyond the 17 year statutory period carries with it enormous costs to both individual consumers and government purchasers. If, for example, we assume that in a free, competitive market, there would be a 20% shift to generics and a 40% reduction in price (as suggested in a recent Stanford Research Institute Report), annual savings for just these 24 drugs would be approximately $151 million.

I hope that the three exhibits enclosed can be included in the record of testimony on S. 255. The members of GPIA will be very gladd to respond in writing to any further questions that you, other Committee Members, or staff may have.

Sincerely,

William F. Haddad

ATTACHMENT "A"

16.4 YEARS COMMERCIAL PATENT PROTECTION

TOP RANKING, PATENTED PRESCRIPTION DRUGS

DRUG PRODUCT	1980 SALES * (millions)	NDA APPROVAL	PATENT EXPIRATION	TOTAL YEARS OF MARKET PROTECTION
Tagamet	$233	1977	1993	16
Valium	220	1968	1985	17
Inderol	179	1967	1984	17
Motrin	135	1974	1983	9
Aldomet	133	1962	1981	19
Keflex	131	1971	1987	16
Clinoril	115	1978	1989	11
Indocin	75	1965	1981	16
Naprosyn	75	1976	1989	13
Aldoril	58	1962	1981	19
Diabinese	53	1968	1984	16
Mellaril	50	1959	1983	24
Zyloprim	49	1966	1986	20

TOTAL SALES VOLUME, 1980: $1,506,000,000

AVERAGE YEARS OF MARKET PROTECTION: 16.38 YEARS

* IMS DATA

EXHIBIT NO. 1

THE NEXT 11 TOP RANKING PRESCRIPTION DRUGS STILL ON PATENT

DRUG	1980 SALES (millions)	NDA APPROVAL	PATENT EXPIRATION	TOTAL YEARS OF MARKET PROTECTION
Dalmane	$47	1970	1989	19
Ovral	47	1968	1982	14
Timoptic	45	1978	1988	10
Tranxene	40	1972	1987	15
Minipress	38	1976	1987	11
Haldol	35	1967	1986	19
Sinequan	35	1969	1986	17
Nalfon	32	1976	1988	12
Bactrim DS	23	1978	1993	15
Valisone	21	1967	1984	17
Septra DS	20	1976	1993	17

TOTAL SALES VOLUME, 1980: $383,000,000

AVERAGE YEARS OF MARKET PROTECTION: 15.1 YEARS

EXHIBIT NO. 2

24 TOP RANKING PRESCRIPTION DRUGS STILL ON PATENT

TOTAL SALES, 1980: $1,889,000,000

AVERAGE YEARS OF MARKET PROTECTION: 15.8 YEARS

EXHIBIT NO. 3

1950-1960'S NDA APPROVALS AND PATENT PROTECTION VS. 1970'S NEW DRUGS

1950-1960'S	YEARS PATENT PROTECTION	1970'S	YEARS PATENT PROTECTION
Valium	17	Tagamet	16
Inderol	17	Motrin	9
Aldomet	19	Keflex	16
Indocin	16	Clinoril	11
Aldoril	19	Naprosyn	13
Diabinese	16	Dalmane	19
Mellaril	24	Timoptic	10
Zyloprim	20	Tranxene	15
Ovral	14	Minipress	11
Haldol	19	Nalfon	12
Sinequan	17	Bactrim DS	15
Valisone	17	Septra DS	17
AVERAGE MARKET PROTECTION:	17.9 YEARS		13.7 YEARS
	+.9 YEARS		-3.3 YEARS

April 30, 1981

STATEMENT OF KENNETH N. LARSEN, CHAIRMAN GENERIC PHARMACEUTICAL INDUSTRY ASSOCIATION AND PRESIDENT OF ZENITH LABORATORIES, INC. ON PATENT RESTORATION ACT OF 1981 (S.255).

We are pleased to have the opportunity to participate in this hearing and discuss with you on behalf of the generic drug manufacturers and distributors our view on this Bill.

Philosophically we support the rights of innovator companies to realize a return on their investment and adequate compensation to encourage ongoing research. We recognize the cost and time of drug development has increased as new and more sophisticated new generation drug entities are studied and developed.

At the time the current patent law was passed, innovators were not faced with the same complex drug development challenges as today. Previously the innovators had a longer period in which to recover a much lower investment.

The Bill before you seeks to extend patent life to provide a longer period of exclusivity to adequately compensate innovators. We are not satisfied that the rationale and justification for the extension has been thoroughly analysed. Further the Bill because of its broad non specific language can and will create situations in which it would be possible for a company through the serialization of product, process and use patents in conjunction with FDA product and usage applications keep patent coverage perennially evergreen.

To illustrate our concerns we would like to share with you just four examples of many examples where the innovators have extended coverage which far exceeds seventeen years. (See Exhibit I.)

If we assume a 20% shift to generics for these products and generic prices are used as suggested in a recent Stanford Research Institute Report the annual saving to consumers would be approximately $24,000,000.

It is interesting to note, of the top fifty prescribed drugs, twenty three are covered by patents in the United States while only ten of them are covered by patents in other countries

with similar patent systems. Patent coverage on the other thirteen products in the other countries lapsed four to five or more years ago. Consumers in these other countries are the beneficiaries of lower cost drugs as a result of competition.

The Generic Pharmaceutical Industry Association (GPIA) was not consulted nor did it have the opportunity to participate in the drafting of the Bill. If we had been given the opportunity, we would have sought answers to the following points which we feel must be clarified:

- Specific analysis of drug development costs and return on investment under the existing patent coverage.
- Clarify retroactivity coverage for drugs for which IND's have been filed prior to the enactment of the Bill. We believe the legislation should apply only to those products for which IND's are filed after passage.
- Question the need for both product and usage coverage under the Bill. We could give favorable consideration to the concept of product patent extension on the initial application filed with the FDA for the product and recommend the exclusion of "usage patents" under the Bill.
- Careful definition of the requirements that have to be satisfied to constitute a proper IND filing. As the Bill is written an opportunistic company could take advantage of the Bill by filing an IND application at the earliest possible opportunity, before they are prepared to actually move into the IND phase, to maximize the resident time at the FDA.
- If the patent does not issue within three years the extension period should be based on a date three years after the initial application date.
- The Bill needs to provide for some system of notification to all interested parties as to the extension period for any product.

Innovators need an adequate period in which to recover their investments but if the cost of drugs are to be reduced to the consumer and government, competition is essential. Consumer interests must be carefully weighed in making a decision on the Bill.

EXHIBIT 1

PATENTED DRUG PRODUCT ANALYSIS

PRODUCT	PATENT First Filing	PATENT Last Expir.	PATENT Years	Initial NDA	Market Years Covered by Patent	Annual Sales $MM
Aldomet (Methyldopa)	1959	1981	22	1962	19	120
Chlorpropamide (Diabinese)	1959	1984	26	1968	16	60
Zyloprim (Allopurinol)	1956	1986	30	1966	20	50
Darvon/Darvocet (Propoxyphene)	1955	1980	25	1957	23	75

TESTIMONY OF

SIDNEY M. WOLFE, M.D., DIRECTOR ACCOMPANIED BY
BENJAMIN GORDON, STAFF ECONOMIST,
PUBLIC CITIZEN HEALTH RESEARCH GROUP

BEFORE

U.S. SENATE COMMITTEE ON THE JUDICIARY

APRIL 30, 1981

Mr. Chairman & Members of the Committee:

Thank you for the invitation to present testimony at this hearing. With me is Benjamin Gordon, currently the Staff Economist of Public Citizen's Health Research Group, who was for 20 years the Staff Economist of the Monopoly Subcommittee of the Senate Small Business Committee. He has conducted extensive research and numerous hearings on patent policy, marketing and promotion of drugs and many other topics related to the drug industry.

S.255 seeks to extend the patent period for drugs so that the time required to determine that the product is safe and effective (prior to marketing) does not count as part of the seventeen year patent, with seven years as the maximum extension.

THE ISSUE RAISED BY S.255 IS HOW WILL THE PROPOSED CHANGE IN THE PATENT LAW BENEFIT THE PUBLIC?

Because of the tremendous costs of drugs in this country, paid to a large extent by the elderly on reduced incomes or by the government through Medicaid and Medicare, it is important to foster the manufacture and use of generic drugs. To encourage the use of generics with lower prices can greatly benefit the public by creating competition in the marketplace and help control health costs.

The large drug companies have opposed the entrance of generics for obvious reasons and have some powerful tools with which to maintain market control beyond the period afforded by the patent.

The companies argue that they should be compensated for the time required for FDA approval because (1) it is equitable to restore the marketing time lost while the FDA insures that the drug will do what it is supposed to do; and (2) additional time would provide an incentive for more research and development of important new drugs.

DRUG INDUSTRY PROFITS

The economic health of the drug industry is very good. For many years, it was the most profitable industry in the country, and in 1980 its 20% return on equity was surpassed only by oil, tobacco and certain service industries.[1]

Consistently high profits in the industry are due, we believe, to the absence of effective price competition in the sale of many products. These high profits belie industry's claims that the industry is getting an "unfair deal" in the marketplace.

There are additional important tools besides the patent which help the proprietary manufacturer maintain an effective monopoly control of the market:

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1 Corporate Scoreboard, "Business Week," pp. 66-100 (March 16, 1981).

THE BRANDNAME

For many drugs, even after a number of years off patent the brand name manufacturer has a stranglehold on the product. Drug firms expend great sums of money to inculcate the brand name in the minds of the practicing physicians, thus extending the monopoly period far beyond the life of the patent. A recent report from the FTC Bureau of Economics[2] concluded that the unlimited life of a trade name extracts unreasonably high social costs because it discourages competition. The report recommended that trade names, like patents, be given a limited life. We believe that a sensible approach would be to require that the patent life and trademark life coincide.

EVIDENCE THAT THE EFFECTIVE MONOPOLY PERIOD FOR DRUGS IS ALREADY MUCH LONGER THAN THE ACTUAL PATENT PERIOD

Using data from 1979--based on prescriptions filled in retail drug stores (National Prescription Audit, IMS, Inc., 1979)--it can be seen that the original patent holder continues to have a stranglehold on the market long after patents expire, despite the fact that the generic version is sold at a lower price:

Drug (Generic Name)-Type*	Years Off Patent (By 1979)	Share of Market In 1979 (% of Retail Rx's Filled)
Darvon (propoxyphene)--Painkiller	7 years	90%
Librium (chlordiazepoxide)--Tranquilizer	3 years	90%
Apresoline (hydralazine)--Antihypertensive	13 years	86%
Gantrisin (sulfisoxazole)--Antibiotic	15 years	95%

ANDAS: ELIMINATION OF UNNECESSARY REGULATION

Government regulation assists the trade-name companies in extending their monopoly beyond the period protected by the patent laws. Once the patent has expired, a competitor should be free to market the product with minimal government interference. In particular, there is no need to require generic drug companies to submit animal and human tests to show that their products are safe and effective. Those tests simply consume unnecessary resources and impede the ability of the generic companies to compete.

With respect to drugs first sold prior to 1962, the Food and Drug Administration (FDA) has recognized that further testing of generics is unnecessary, and the Agency allows the generic company to file an abbreviated new drug application (ANDA). The ANDA is abbreviated by not requiring studies of safety and effectiveness for drugs which have already been tested and have been on the market a long time and which are the major and most expensive element of the new drug application.

The FDA, however, has not yet extended the ANDA system to drugs first marketed after 1962. In this category are many big selling drugs which are off patent or are about to come off patent. There is no good reason why the policy used for pre-1962 drugs should not be applied to post-1962 drugs. Small businesses and consumers are being injured by this unnecessary and unjustifiable delay, and although we believe that the FDA now has the authority and is now required to

2 FTC, Bureau of Economics: Staff Report on Sales, Promotion and Product Differentiation in Two Prescription Drug Markets, p. 80, February 1977.

* See Exhibit 1, pg. 7 for additional information on generic drug prices vs. brand name drug prices.

adopt an ANDA system for drugs which have already been proven to be safe and effective, we urge that any legislation which concerns the economics of the drug industry contain a provision explicitly requiring the FDA to adopt an ANDA system for all drugs which are off-patent. There is simply no justification for requiring generic companies to delay marketing their products until the FDA has evaluated studies on safety and effectiveness, where the FDA has already approved an identical product which differs in name only. Whatever the appropriate patent term is, it seems to us that once the drug, or any product, comes off patent, it should be available for immediate competition without any interference by the federal government.

CUMULATIVE IMPACT OF MONOPOLISTIC DEVICES

The patent, unlimited trademark, and limiting of the ANDA to the pre-1962 period have combined to give the brand-name drug industry a virtual monopoly in the marketplace. The addition of fantastically high advertising and promotion expenditures make the market share even more secure.

The patent laws should not be altered to help a healthy industry in a climate of high inflation when there is a tremendous price to be paid by low income and elderly consumers. It does not benefit the public to compensate the drug industry for mythical inequities at such a high price.

COMPULSORY LICENSING

It is ironic to us that Senator Charles Mathias has claimed his legislative proposal will help small businesses which have lost some patent protection as a result of delays by Federal agencies.[3] With respect to drug marketing, it is the small drug companies that suffer from the monopoly power of the larger, trade-name companies. Extending the period of patent protection will extend that monopoly, and hurt the small, generic companies. In order to promote competition, help small business and reduce drug prices, serious consideration should be given to a compulsory licensing law. Compulsory licensing would require the pioneer drug company to license a competitor at a fixed and reasonable royalty. The royalty fee is paid to the innovator firm, and acts as an incentive to invest in research. A limit on the royalty protects the public from excessive profits. The law could also provide for a short period, perhaps 3 years of marketing, during which the pioneer firm would not be required to license the product.

The United Kingdom, Germany, France, Canada, New Zealand and Australia have all adopted some form of compulsory licensing. Italy does not currently allow drugs to be patented, although a patent bill with a compulsory licensing requirement has been proposed in Italy. We are not familiar with the details of the compulsory licensing laws in other countries, but this is certainly a subject which should be explored in considering legislation in this area.

United Kingdom

According to the Patents Act of 1977, which went into effect in June 1978, compulsory licensing for drugs is handled like any other product. Three years after the grant of the patent any person may apply to the comptroller of patents for a license:

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3 127 Cong. Rec. S.674 (daily ed., January 27, 1981).

(a) if the patent is not being worked in the U.K. or not being worked to the fullest extent that is reasonably practicable, or

(b) where the patented invention is a product, for which the demand is not being met on reasonable terms, as well as for other reasons, (Sec. 48) the inventor shall receive reasonable remuneration (Sec. 50).

(c) if the Monopolies Commission has found that the patent is being used or may be expected to be used against the public interest.

Particularly relevant to drugs is Section 55, which authorizes the government to set aside any patent, so that the innovation may be used for the benefit of the State which pays for 90% of the drugs in the U.K. In most cases, compensation is paid to the patentee.

France

A drug or process patent license can be granted at the request of the Health Ministry in the interests of public health when the medicine is available to the public in insufficient quality or quantity or at unusually high prices. The compulsory license involves not only the drug compound, but also the raw materials and the manufacturing process(es) necessary for the manufacture of the drug. In addition, if three years have elapsed after it was filed without the patent having been worked, then any interested party may apply for a compulsory license.

Germany

There is no compulsory working or use of patents. A compulsory license may be granted if it is vital to the public interest and the patentee will not permit the use of the invention by another person. Some sources claim that the "public interest" condition is difficult to fulfill and compulsory licenses have been issued only in a few exceptional cases.

INCENTIVES FOR RESEARCH

The second argument advanced by the proponents of S.255 is that a longer patent life will provide necessary incentives for research and development of important new drugs. However, no real evidence has been advanced to support this contention. Because the R and D involved in this field is always riskier than development of "me too" drugs, it is the latter that drug companies naturally spend a much greater proportion to develop and market.

The prosperity of the industry and the resulting stranglehold which brand name manufacturers have in the marketplace challenge the assumption that an even greater economic gain will mean more meaningful, expanded R & D.

Even if this assumption were true, however, that does not explain why S.255 should include those drugs already in the regulatory process. These drugs have already been researched and developed and do not require any economic bonus to be created. The claimed purpose of S.255 is to stimulate new research.

RECOMMENDATIONS

We recommend the following changes with respect to S.255. Provisions to:

1. Limit the rights to the trademark (or brand name) of a drug to the life of the patent.

2. ANDAs for post-1962 drugs to stop unnecessary government regulation of generic drugs.

3. Compulsory licensing at a reasonable royalty.

4. Making the result of safety and efficacy testing a part of the patent. This will serve two purposes: it will demonstrate the utility of the drug, and it would supply the information necessary for anyone skilled in the art to enter the market promptly when the patent expires.

5. Elimination of the provision expanding patent life for drugs already in the regulatory process.

Without these changes, we strongly oppose the legislation. With them, the public, rather than just the drug industry, will benefit.

SALES DATA FOR FOUR OFF-PATENT DRUGS

Drug	Manufacturer	Years Off-Patent as of 1979[1]	Market Share in 1979	# Rx Filled in 1979[2]	Retail Sales 1979[2]	Cost of Brand Name Drug[4]	Cost of Cheapest Generic Version[4]	Price Ratio
Darvon (propoxyphene)	Lilly	7	90%	22,400,000[3]	-	$41.70[5]	$ 6.80[5] (Spencer-Mead)	6.1
Librium (chlordiazepoxide)	Roche	3	90%	8,200,000	$57,700,000	$87.63[6]	$ 5.50[6] (Interstate)	15.9
Apresoline (hydralazine)	Ciba	13	86%	2,900,000	$23,200,000	$98.48[7]	$11.65[7] (Henry Schein)	8.5
Gantrisin (sulfisoxazole)	Roche	15	95%	2,900,000	$15,900,000	$52.78[8]	$14.95[8] (Wolins-Pharmacal)	3.5

1 Merck Index, ninth ed., 1976.

2 National Prescription Audit, IMS America, 1979.

3 All Darvon products.

4 1981 Redbook.

5 Wholesale price per 500 65 mg.

6 Wholesale price per 500 25 mg.

7 Wholesale price per 1000 50 mg.

8 Wholesale price per 1000 500 mg.

QUESTIONS SUBMITTED BY SENATOR THURMOND
AND
RESPONSES BY PUBLIC CITIZEN HEALTH RESEARCH GROUP

Question 1. A: On page 2 of your statement, you give market share data for four well-known drugs. You use the data to support your contention that the original patent holder continues to have a "stranglehold" on the market. I have some problems with your numbers. They are drawn from the National Prescription Audit, IMS, Inc., 1979. It is my understanding that this National Prescription Audit shows how the physician wrote the prescription. It does not show whether the pharmacist then exercised his right to substitute a generic drug. In other words, this data does not reflect whether substitution occurred. All it shows is that doctors continue to write their prescriptions using the brand names. It does not prove anything as far as what is actually happening in the market, does it?

Response 1. A: The only figures available for 1979 were prescriptions written, and various reports in pharmaceutical publications indicated that substitution by the pharmacist was not as prevalent as originally thought. These conclusions were confirmed by the 1980 figures which include figures for prescriptions both written and dispensed and show an unquestionable stranglehold by the trade name companies of the market for the drugs cited in our statement.

Drug	1979 Figure	1980 Rx Written	1980 Rx Dispensed
Darvon	90%	94.3%	91.2%
Librium	90%	89.6%	83.0%
Apresoline	86%	80.0%	77.2%
Gantrisin	95%	94.2%	89.5%

Column 1 includes figures from our testimony based on 1979 NPA data.

Column 2 includes 1980 NPA figures based on the way the prescription was written by the doctor.

Column 3 includes 1980 NPA data reflecting the way the prescription was actually dispensed. 1980 is the first year NPA presented data showing prescriptions written as well as dispensed.

Although most states have substitution laws, they do not assure that the patient gets the less expensive generic medication, and pharmacists are likely to fill a prescription the way it was written.

Question 1. B: Your definition of the market is very limited -- you use only the market for the specific generic chemical entity. Yet each of the products you cite competes in a much broader market. For example, Darvon is not the only nonnarcotic, noninjectable analgesic painkiller. If one examines this market, Darvon compounds share is only 9%. Doesn't this figure more truly reflect the competitive situation in the market?

Response 1. B: The relevant market at issue is not painkillers but particular drugs. The reason is that while a doctor may be able to choose from among a variety of drugs in deciding on the best therapy for his/her patient, the patient has no choice as to the generic chemical entity s/he receives when s/he has the prescription filled. If the doctor prescribes Librium, the patient can only get chlordiazepoxide. The manufacturer can vary but not the chemical. The relevant question, then, from the patient's standpoint is how to get chlordiazepoxide most cheaply.

It would be nice if doctors also considered price and, for example, prescribed chlordiazepoxide instead of Valium (diazepam)-- the latter being unavailable generically. These two drugs have many of the same indications. This is a separate problem involving an attempt to make doctors more aware of the economic costs of their decisions.

Incidentally, Darvon is not a non-narcotic drug as stated in the question. It is related to methadone and is definitely a narcotic, being included in the International Single Convention for Narcotics and scheduled under the Controlled Substances Act in the U.S. as a narcotic.

Question 2. A: You suggest that the rights of the trademark be eliminated when a drug product comes off patent. Are you suggesting that we eliminate the rights of trademark in all industries or just in pharmaceuticals?

Response 2. A: No. The role of the trade name in the drug industry different from that in any other industry. There is no question about what a Ford "Escort", a Dodge "Omni" or a Chevrolet "Chevette" is. Their relative qualities and characteristics can usually be determined by the consumer before purchase. Not so with drugs! The drug has to be consumed first and then the effect--in many cases subjective--may not be attributable to the drug at all. Neither the physician nor the patient is in a position to test the relative merits of the different versions of the same chemical compound or of different chemicals that purportedly perform the same function.

In addition, the large number of trade names for the same drug is confusing for doctors as well as patients. Thalidomide, for example, was sold alone or in combination under at least 50 or more different names.[1] When the rumor was spread throughout the world about the dangers of this drug, there was no reason to suspect that Contergan, Distaval, Kevadon, Slip, Sedalis, etc. were really thalidomide. One drug with one name would improve medical practice considerably, according to Dr. John Adriani, an eminent medical educator and former chairman of the AMA's former Council on Drugs.[2]

Question 2. B: The basic function of a trademark is to indicate the origin or manufacturer of a product. Are you suggesting that consumers should be deprived of this information?

Response 2. B: Not at all. A better form of identification is by actually using the name of the manufacturer or distributor on the container that is sold to the patient by the druggist. If desired, some sort of identifying mark could be placed on each pill, although it seems that the manufacturer's name on the container would be enough.

In addition, the doctor can identify a particular product by writing the name of the drug plus the name of the manufacturer or distributor on the prescription. For example, tetracycline--Squibb, or tetracycline--Lederle.

The trade name does not identify the manufacturer or distributor. There are very few patients--or doctors, for that matter--who are aware that Sumycin is a product of Squibb, or Inderal is marketed by Ayerst, or Ilotycin is a product of Dista (a division of Lilly).

Wouldn't it be easier to use the manufacturer's or distributor's actual name--if identification of source is the real purpose?

Question 3: You claim that the pharmaceutical industry is highly profitable compared to other industries. Are you aware of the FTC 1978 Office of Policy Planning report which states the following about the pharmaceutical industry:

> While past performance as reflected in profitability compares favorably with other industries, recent trends cast doubt on whether such performance can be expected in the future.

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1 Competitive Problems in the Drug Industry Hearings before the Monopoly Subcommittee, U.S. Senate Small Business Committee, Part 4, pp. 1497 ff., 1523.

2 Competitive Problems, note 1 above, Part 12, p. 5087 ff.

Doesn't this indicate we may need to increase the incentive for pharmaceutical R & D?

Response 3: Yes, we are aware of this report and the statement you quote. The same report, however, states that:

> The average rate of return on shareholders' investment during 1970-77 was 18.3% for the drug industry, compared with 12.2% for all *manufacturing*. . . . If the rate of return is adjusted to reflect capitalization of R & D, the return is lower but still is about six percent above other industries. (page 25)

Footnote 62 (page 25) of the same report states that:

> But profits vary significantly from firm to firm among major firms, with some firms' earnings representing more than 25% of stockholder equity.

The report you referred to is dated 1978. Since that time, profits have increased from 18.3% in 1977 (quoted in the report) to 20.4% for 1978,[3] 20.8% in 1979,[4] and 20.1% in 1980.[5]

The "recent trends" which the FTC staff referred to were apparently reversed. There is no indication that the prosperity of the drug industry is in danger. This conclusion would be reinforced if the drug industry were to improve the quality of its research.

The best way to increase incentives for pharmaceutical research--or any other type of research--is competition. But do we really need more research at present? The results of drug industry research are the best indicator of the quality of research, and the figures given by the FDA tell an interesting story: during the almost six-year period from January 1, 1974 through September 30, 1979, only 3 or 4 drugs approved for marketing per year were considered "Important Therapeutic Gains," which amounts to 15.2% of the new molecular entities. If we were to add to this category new salts, new formulations, and duplicate drugs, we find that over 80 percent of the drugs approved for marketing during this six-year period contributed "Little or No Therapeutic Gain" to our health needs.

Of those drugs which were in the clinical stage during that period, the record shows that 785 drugs were new molecular entities, of which only 22, that is 2.8%, were considered important. If all categories are included, only 2% are considered important, 8.58% were considered as contributing modest therapeutic gain, and 87.9% offered little or no therapeutic gain.[6]

There is no reason to believe that increasing R & D will necessarily produce a larger number of important drugs. On the basis of what we see today, more R & D could well mean more unimaginative, second-rate and unnecessary drugs with more confusion for doctors and patients, and a waste of scarce resources. As the respected pharmacologist Dr. Walter Modell stated:

> We must add only those new drugs that really add something more than their mere presence... . . Yet, our present trend of increasing the number of drugs without adding real therapeutic qualities tends to dilute experience to a low and sometimes hazardous level, and makes substantial and unbiased

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3 Business Week, "Corporate Scoreboard", March 19, 1979.

4 Op. Cit., March 17, 1980.

5 Op. Cit., March 16, 1981.

6 FDA: New Drug Evaluation Project--Briefing Book, October, 1979 Chapter IV Tables.

knowledge through teaching and reading even more difficult to acquire.[7]

Question 4: You cite figures showing the price difference between the brand name drug and the lowest priced generic. Yet the price of the generic substitutes for a particular drug may vary widely. For example, the generic substitutes for Gantrisin range in price from $14.95 to $30.97. This range of figures suggests that the overall savings to consumers from generics for Gantrisin may be substantially less than we would assume if we looked only at the prices in your table. Do you have data to show how much of the market this lowest priced generic actually occupies?

Response 4: The table submitted with our statement of April 30, 1981 compares the wholesale trade name price with the lowest generic version. One example is sulfisoxazole, sold under its trade name Gantrisin for $52.78 per 1000 500 mg. tablets compared with the generic version which can be secured as inexpensively as $14.95.

The least expensive price of $14.95 shows that this drug is available at this price. Since the generic firm is making a reasonable profit selling it at this price, it also shows the tremendous mark-up added on by Roche to the actual cost of production.

The public is obviously not receiving the full benefit of lower generic prices because of the very large share of the market still maintained by the trade name drug many years after the patent expired. This is one of the points we made in our presentation before the Juciciary Committee. We are, therefore, urging that a provision be added to S255 to limit exclusive use of trade name to the life of a drug patent.

Question 5: Someone who invents an energy-saving carburetor or a better mouse trap enjoys almost 17 years of exclusive marketing rights. Yet the company that invents a life saving hypertension drug gets less than 10 years of market exclusivity. Why should the inventor of the life saving drug have such a reduced effective patent life? Isn't this the kind of innovation we should try to encourage the most?

Response 5: The assumption that all patents give 17 years of marketing monopoly to the patent holder is not correct. For many new products, plants or buildings have to be erected, capital equipment may have to be designed, ordered and manufactured, markets have to be developed. In many cases, it takes time to raise capital, etc.

Evidence has been presented that a marketing monopoly in many cases has been maintained long after a drug patent has expired, and it is fair to say that trade name drug manufacturers have had an advantage in this area over practically all other areas of economic activity.

It is ridiculous to think that a trade name will play as important a role in marketing an energy-saving carburetor or a mouse trap, the examples you cite.

Question 6: In your discussion of industry competition, you note that "with respect" to drug marketing, it is the small companies that suffer from the monopoly power of the larger, trade-name companies and hurt the small generic companies." It seems to me that we are now seeing a burgeoning of small, innovative entrepreneurial companies in bio-technology. Isn't it important to encourage these small, innovative companies? Won't extending the period of patent protection stimulate the growth of these companies? Where do you think they are going to get the funds to undertake the massive research and develop-

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7 Drug Industry Antitrust Act--Hearings before the Subcommittee on Antitrust and Monopoly of the U.S. Senate Judiciary Committee, July 20, 1961, p. 320.

ment and capital construction and manufacturing which will be required for their industrial development if they do not have patent protection and if their products are subject to compulsory license?

Response 6: With respect to compulsory licensing, it should be noted that most of the significant drugs coming on the world market are invented in the U.K., France, and Germany. These countries have compulsory licensing systems as described in our statement. In fact, for the years 1919-1949 England did not grant product patents on drugs and the evidence provided by the 1961 Report of the Committee on Judiciary of the U.S. Senate states that: "Drugs discovered in foreign countries without product patents outnumber those discovered in countries with such protection in the order of 10 to 1."[8] The inevitable conclusion is that neither compulsory licensing nor even the absence of drug product patents has deterred the invention of important drugs.

The rest of the questions (in question 6) are really assumptions phrased like questions but which have no evidence to support them.

There is no evidence that extending the period of patent protection will stimulate the growth of the companies.

Patent protection is not a sine qua non for raising capital or taking risks. In most areas of our economy, patents play a minor or no role. Department stores with large investments open up in new areas without protection. Food, automobiles, clothing--large areas of our economy don't need a monopoly period.

We believe that the desire for monopoly protection and the reluctance to compete as manifested by these stated assumptions reveal the serious problems in our society today, such as a lack of dynamism, decline in growth and the rate of productivity increase.

Question 7: I understand Canada now has a compulsory licensing system for drugs of the type you propose here and that no Canadian-based company is doing basic research on drugs. Doesn't the prospect of a similar result in the United States concern you? (Note, only the Canadian government-owned Connaught Laboratories and branches of some U.S. firms do any research in Canada.)

Response 7: If, as you say, "no Canadian-based company is doing basic research on drugs," it is no different from the United States. The amount of basic research done by the U.S. drug firms is so small as to be negligible. Practically all drug industry research can be considered product development. Basic research in this country is conducted or financed largely by the United States Government and universities. As Dr. William Wardell stated: "When you look at the stock of basic biomedical research, a very large proportion of the world's resources in knowledge actually comes from the National Institutes of Health here and it's made freely available to all countries of the world,"[9] and that any division of NIH is coming out with enormous discoveries.[10] Drug companies all over the world, then, use this knowledge to produce drugs.

The obvious purpose of this question is to try to connect causally Canada's lack of drug development with the presence of a compulsory licensing system. Now, it is a fact that most of the really signifi-

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8 Administered Prices--Drugs, Report of the Committee on the Judiciary, U.S. Senate Subcommittee on Antitrust & Monopoly, 1961, p. 119.

9 The Food & Drug Administration's Process for Approving New Drugs--Hearing before the Subcommittee on Science, Research and Technology, June 19, 1979, p. 84.

10 Ibid.

cant drugs on the world market were invented in the U.K., France and Germany, and these countries have compulsory licensing provisions. Can these facts in these countries be causally connected?

There is no reason to believe that there is any connection in Canada, the U.K., or any other country--nor would there be in the U.S.

Senator MATHIAS. Our final panel for the day is Mr. Thomas D. Kiley, vice president and general counsel of Genentech, and Dr. Henry Grabowski, Department of Economics at Duke University.

Your entire prepared statements will be made a part of the hearing record, and you may proceed.

STATEMENT OF DR. HENRY GRABOWSKI, PROFESSOR OF ECONOMICS, DUKE UNIVERSITY, AND THOMAS D. KILEY, VICE PRESIDENT AND GENERAL COUNSEL, GENENTECH, INC.

Dr. GRABOWSKI. Thank you, Mr. Chairman.

My name is Henry Grabowski, and I am professor of economics at Duke University.

Due to the lateness of the hour, I am going to summarize my written testimony.

Most of my testimony is addressed to the question of what evidence exists from the research of economists that patent restoration will lead to increased R. & D. investments and to increased innovation in the form of new drug therapies.

I believe there is considerable evidence in this regard.

First, if you take a theoretical perspective, the proposed patent restoration legislation under discussion here should operate to increase the expected returns from new drug innovation and also should provide firms that are successful in introducing major new products with added cash flows to finance research activities.

Both of these effects should stimulate greater R. & D. investments.

One of the studies which is discussed in my written testimony and which I have attached as appendix A-3 to my testimony, involves the statistical analysis of the factors that influence firm R. & D. investment decisions in the pharmaceutical industry.

This is a study performed by John Vernon, a colleague at Duke, and myself under an NSF grant.

Our study of the determinants of R. & D. expenditures indicates firm outlays on R. & D. are sensitive to both expected returns and the availability of internal funds.

In particular, we find that firms do respond to higher or lower returns from R. & D. in the expected way, but the adjustment process is a gradual one. Our results further indicate a statistically significant relationship between firm R. & D. outlays and the availability of internally generated funds.

For the firms in our sample, and this was a sample of 10 large research-intensive drug firms, a $1 million increase in cash flow was associated on average with a quarter-million-dollar increase in R. & D. expenditures. This relation was quite robust over the 12-year period that we analyzed. That was the period 1963 to 1975.

This is essentially evidence that is based on a backward historical look at the behavior of the industry.

I think if you take a more future-oriented perspective, there are strong reasons to expect that patent protection will become an increasingly important incentive for R. & D. investment activity in this industry.

The emerging environment for research-oriented firms combines higher R. & D. costs, longer development times, and increased generic competition after patents expire. The latter phenomenon is occurring as a result of a growth of State substitution laws and the Government's maximum allowable cost program.

The expected marketing environment of 8 to 10 years from now when patent restoration would first become commercially operable—that is, the late 1980's and the early 1990's—is likely to be a quite different environment from the present one. We have already begun to see marked increases in the extent of generic competition occurring through the substitution laws in particular States, in comparison with only a few years ago.

One of the articles I have appended, as appendix A-1, involved a supplementary study for the FTC's model drug-product-selection law project which documents some of the data with regard to substitution that is occurring presently.

Finally, another study which I think provides insights into the expected effect of patent restoration on R. & D. incentives involves the sensitivity analysis of the profitability of 37 U.S.-discovered new drugs introduced between 1970 and 1976. This is an NSF-supported study just completed by John Vernon and me and is attached as appendix 4-2 to my statement.

For each of the 37 new introductions during this period, we calculated a profitability index which is defined as the ratio of the present value of the projected revenues to the present value of R. & D. costs. Current and historical data in revenues were used to extrapolate to future periods, using a number of assumptions discussed in our paper.

A major finding of this analysis is that if the real interest rate is 10 percent, the product life must be 19 years for this sample of 37 drugs before the mean profitability index reaches one in value. Stated another way, it takes 19 years for firms to cover average R. & D. costs and earn a 10 percent real rate of return on their invested capital. At an 8-percent real rate of return, the required product life must be 12 years in value.

Another major finding of our analysis is that the rate of return distribution for drug therapies is highly skewed. We found that even if one assumes a 20-year lifetime for all the 37 drug introductions, only 13, or roughly one-third, had a profitability index of one or more in value.

This indicates that the majority of the new introductions do not cover the present value of their R. & D. investment costs when one allows for both discovery costs as well as a large attrition rate on new product candidates or "dry holes."

In effect, firms are dependent on a relatively few big winners to cover their full costs and generate the required return on their R. & D. investment portfolio.

I think these results underscore the importance of patent restoration and the competitive environment that is likely to hold in the final two decades of this century.

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The research-intensive firms are increasingly dependent on a relatively small number of major new drugs—those capable of winning relatively large market shares here and abroad to finance and provide the returns on their overall portfolio of R. & D. investment projects.

These major products, however, also provide the most attractive markets for generic producers. The degree of competition provided by these latter firms is bound to substantially increase in the new market environment characterized by drug substitution laws and the MAC program.

I think that covers the main points in my written testimony.

I would just like to append a few remarks about the chart prepared by Mr. Haddad because I think it illustrates some of the points made here.

If you look at this chart, and you consider just the drugs that were introduced in the decade since 1971, the average patent life for those five drugs—and there are only five of them, and at least one of them was a foreign-licensed drug—was 13 years in length. The 16-year average for the full sample comes primarily from drugs that were introduced in the sixties and even earlier.

The second point which I think is particularly interesting is that the patents on 8 of these 13 drugs will expire within the next 4 years. That is, 8 of the 13 major drugs will have patent expirations before 1985.

If one aggregates the current sales, for these eight drugs, this comes to $900 million.

Traditionally, the drug firms have financed their research through cash flow, and you can see that there is a very large amount of cash flow associated with drug products that will be coming off patent in the near future.

I think this points up the importance of patents in a situation in which the market environment is rapidly changing and the significant role that patent restoration will play in the future.

Thank you.

Senator MATHIAS. Thank you, Dr. Grabowski.

Mr. Kiley?

Mr. KILEY. Thank you, Mr. Chairman.

My name is Tom Kiley. I am vice president and general counsel of Genentech.

Our company is just barely 5 years old, and yet already three products of our research are undergoing the clinical testing that is required before marketing approval can be given: human insulin, human growth hormone, and interferon, all made by genetically engineered microorganisms.

We are here today to emphasize the importance of patents and the importance of a strengthened patent incentive to the small high-technology company.

Under the umbrella of a patent, when a small company can compete on the strength of its innovative capabilities with larger, older, and more entrenched concerns, then we think that the patent system operates to best purpose as an essentially procompetitive mechanism.

I am no graybeard of the pharmaceutical industry, nor an expert in it, but I do know something about innovation.

For 16 years, my experience has had to do with patents, as an examiner of patents, then in a large multinational concern, for 10 years in the patent trial courts, and finally in the small company context of a startup concern.

Nothing in my experience has been more instructive as to the vital role that patents play in this society than the opportunity I have had to look at the world from the vantage point of the small concern.

Although surrounded by trees that cast great shade, we aim to find our place in the Sun. We think that continued availability of meaningful patent protection will help us to do it.

We strongly endorse the legislation before the committee.

Our thesis is straightforward. Innovation is important. It arises most frequently in the small company context of the entrepreneurial company.

The legislation before this committee will make patent protection more meaningful. More meaningful patent protection will permit small companies like ours to flourish and grow.

Conditions that encourage the growth of small, high-technology, innovation-oriented companies will encourage investment in them and, therefore, investment in innovation.

I think that the formation of small innovation-intensive companies can only enhance competition, both by the downward pressure that the new products of innovation exert on older products with which they compete and by the creation of conditions that overcome barriers to entry and let small companies enter in and compete in industries that have grown concentrated in the past.

The genius of the legislation before this committee immediately follows from those precepts—and I think from the commonsense notion that what Government gives with its left hand it ought not to take away with its right.

What does the small company need? The small startup company needs capital. It is not ordinarily available from banks. It has to be gotten from the investors and the risk takers.

But the risk that one must take if the product of the innovation he funds becomes too soon available to others who need not carry the same research and development costs is a risk too dear or too great to be borne.

After all, what farmer will invest in seed if the law permits others to take his crops.

So patents are important to the attraction of venture capital. The availability of meaningful patents are part of a young company's survival kit. This is especially so where the products of its innovation are subject, as are ours, to long periods of regulatory review before dollars can be gotten from first sales.

We have been in business for 5 years now and have yet to sell an ounce of end product to a user of that product.

During these dry years, the money we raise to sustain ourselves and our life-giving research comes from capital that is attracted by the availability of patent protection and from the opportunity we have to license a portion of our technology to others to raise revenues to meet interim cash needs. Both of those sources of capital are influenced, I think, by perceptions of the ultimate value of the patents that may come to us.

To the extent the protection of patent is made more meaningful, our ability to raise money in these several ways is enhanced.

I have indicated my belief that I think the availability of meaningful patent protection will enhance competition. Certainly it does so when the new products of innovation exert, as they do if they are better, downward pressure on the price of the competing but older products that they meet in the marketplace.

Competition is also greatly influenced by the number of companies competing within a particular marketplace.

Since 1962, many studies have shown that the number of new entrants has markedly declined in the pharmaceutical industry. The number of companies in that industry has grown smaller.

Yet what is beginning to be known as the biotechnology revolution has created a spate of new companies that need patents and the protection they offer if they are to sustain themselves and enhance competition in the pharmaceutical and related fields.

I have one final observation, Mr. Chairman, that springs in part from perhaps the special nature of biotechnology, although I think it has a much larger reach.

The most meaningful products arising from our technology in its early days have not been new but rather old products.

Yet the innovation that we have inspired, and others like us, is very, very significant. Until Genentech could provide large quantities of human insulin from genetically engineered microorganisms, that material was never before available in quantities sufficient for the treatment of diabetics.

Until the organisms we produced could create large quantities of human growth hormone, that substance was never before available in anywhere near the quantities needed for the treatment of dwarf children.

Until genetically engineered microorganisms arising from our innovation created copious quantities of interferon, that was not available in the quantitites that might be required for the treatment of cancer patients.

The bill before this committee makes no provision for the extension of patents on new and patentable methods that are used for the first time to make available meaningful quantities of old and, therefore, unpatentable products.

I think we ought to encourage innovation in new and more economic ways of making valuable things to the same extent we encourage innovation in the creation of new things.

I think this can be solved by a minor clarifying amendment. I would be happy to work with the committee staff in devising appropriate language.

Following the conclusion of my remarks, which I assure the chairman is imminent, I would invite questions relating to, among other things, Mr. Larsen's concern over the parlaying of patents.

Thank you, Mr. Chairman.

Senator MATHIAS. Thank you, Mr. Kiley.

I hope that what you referred to as the dry years will turn out to be the seminal years.

Mr. KILEY. A consummation devoutly to be wished, sir.

Senator MATHIAS. Just as a matter of personal curiosity, is there a market price of interferon yet?

Mr. KILEY. No, because no market exists for interferon. It won't until——

COST OF INTERFERON

Senator MATHIAS. What is the cost of production of a given unit of interferon?

Mr. KILEY. That also remains to be seen, although I can assure you that it will be several orders of magnitude less than the cost of production that has existed in the past.

Senator MATHIAS. I would certainly hope so.

Mr. KILEY. I have heard the number $5 billion per pound, or perhaps that was per gram, for interferon gotten in the old way.

It will be affordable; I will assure the chairman of that.

Senator MATHIAS. I have heard estimates like $500,000 an ounce, so that is not too far off the order of magnitude of your figure.

Mr. KILEY. One of the marvelous things about the drug is that it appears to exhibit activity in millionths of a gram.

Senator MATHIAS. As I remarked earlier, I am involved with the Office of Technology Assessment here on Capital Hill. OTA has just advised us that the genetics industry is going to create, in their judgment, major changes in the drug, chemical, and food industries. And over the next 20 years, they may be responsible for producing $14 to $15 billion of goods and creating somewhere between 30,000 and 70,000 new jobs. That is a substantial contribution to economic growth in this country.

How important are patent rights to new companies, particularly small new companies, in the seminal period in which you find yourself?

Mr. KILEY. I think they are indispensable, Mr. Chairman.

At a time when we are spending virtually 100 percent of our outlay on research and development and selling nothing, we must look forward to a future in which we can recoup that investment in research and development, and earn the money we need to spend in other ways so that our company can attain its full maturity and compete with the larger factors in the pharmaceutical and other industries.

There is little incentive for planting wheat if the other fellow can harvest your field. If we get to eat some of our product for a time, I think we will be encouraged to continue our investment.

I think that where the product of our research, once laid open to the world and once described to the world, can be readily duplicated, then patents are essential; because we give the gift of knowledge and in return require the gift of limited exclusivity so that our company can sustain itself.

I think that will prove true throughout our young industry.

Senator MATHIAS. Let me turn to Dr. Grabowski.

You have been willing to take on some of the views your predecessors expressed here today.

There have been differing views as to the patent life lost due to regulation and due to the cost of developing new drugs. Can you shed any light on why we are getting this wide range of estimates from different witnesses? Have you looked at the same data and come to any conclusions that would reconcile the variations?

Dr. GRABOWSKI. I think one basic factor is the sample one looks at. The chart prepared by Mr. Haddad has as its sample the top 13 drugs ranked by sales in the United States.

As I mentioned earlier, eight of those drugs are drugs that were introduced first in the sixties which are going to be coming off patent within the next 5 years and correspondingly have on the average a longer life.

What we have is a trend over time.

If instead one looks at the sample of all new drug introductions over the last 3 years, one has an average effective patent life of a little less than 10 years. I think that data is readily confirmable.

Within similar samples, there is also sometimes a question of more than one patent. This can get into fairly complicated issues concerning which patent is the key one. But I don't think that is the typical case. In principle, the firm may be able to maintain generic competitors off the market through processed use, and product patents. In most cases, however, I think the product patent is governing.

Mr. KILEY. I would like to make one observation with regard to the multiple patent question.

We ought not to lose sight of the fact that when the first patent given expires, the competitor is free to practice the invention embraced by that patent. It is only the later, second generation product of the innovator's efforts that is still denied him for a term.

On the method of use question, the chemical DDT was an old compound whose patent had expired long before it was recognized by another inventor that DDT could kill the anopheles mosquito that gave rise to the scourge of malaria.

A new method of use patent issued for that.

Now would we wish to deny the reward of patent and, therefore, disincent workers from discovering that an old chemical compound could be used to so good a purpose?

In the interferon case——

Senator MATHIAS. That would be a rediscovery patent.

Mr. KILEY. It was a discovery of a new use for an old compound that theretofore had only a middling use of little significance to society. So I think the second innovator made the greatest contribution.

I think we want to accent those great contributions.

Senator MATHIAS. It would sort of be on the Columbus theory—that the Vikings may have discovered America first but Columbus got the credit.

Mr. KILEY. I happen to believe the Irish discovered America. [Laughter.]

Or at least the best part of it.

Senator MATHIAS. Gentlemen, we thank you both very much for being here.

I think it is an interesting addition, without which this hearing would not have been complete.

We are very grateful for it.

I have been asked by the Senator from Delaware, Senator Biden, a member of this committee, to add his name as a cosponsor of S. 255. That brings the total to 13 out of the 18 members of this committee as cosponsors.

To those of you who have suggested changes in the bill and those of you who are critical of it in its present form, I want to say that we are still anxious to have your continued views and your continued cooperation in trying to perfect the legislation.

At this point I want to put in the record statements by Senator Simpson and by Senator East, both members of this committee.

The committee will stand adjourned, subject to the call of the Chair.

[Whereupon, at 1:05 p.m., the hearing adjourned, subject to the call of the Chair.]

[Prepared statements by Professor Grabowski, Mr. Kiley, Senators Simpson and East follow:]

PREPARED STATEMENT OF HENRY GRABOWSKI

PROFESSOR OF ECONOMICS, DUKE UNIVERSITY

SUMMARY

Recent economic analyses of the pharmaceutical industry are broadly supportive of the concept of patent restoration as proposed under S255. Patent protection in this industry now averages less than 10 years in length and has been declining over time. This decline has not been the result of conscious policy decisions, but rather has been the indirect result of longer clinical development and longer regulatory approval times. Given the significant costs and risks of R and D activity in pharmaceuticals, and the potential for significant social benefits from the discovery and development of new drug therapies, shorter patent protection terms for pharmaceuticals would not appear to be in the public interest.

There are strong reasons to expect that patent protection will become an increasingly important incentive for R and D investment activity over future periods. The emerging environment for research oriented firms combines higher R and D costs, longer development times, and increased generic competition after patents expire. The latter phenomena is occurring as a result of the growth of the state substitution laws and the government's Maximum Allowable Cost Program. In a sensitivity analysis of the mean profitability of new drugs inntroduced in the period 1970-1976, performed by John Vernon and myself, we found an average product life of 12 to 19 years is now needed by firms to cover R and D costs and provide a real rate of return on investment of 8 to 10 percent. Average effective patent life is therefore currently considerably less than average product life necessary for profitable operation. In the emerging environment of increased competition from generic products after patent expiration, the length of patent protection will necessarily become an increasingly critical factor underlying the willingness and ability of research oriented firms to undertake long term R and D activity of a risky and costly nature.

Thank you Senator Mathias, and other members of the Committee, for inviting me to speak on S. 255.

I would like to direct my comments specifically to the expected effects of patent restoration on the incentives for R and D and innovation in the pharmaceutical industry. Over the past six years my colleague, John Vernon,

and I have been studying various aspects of the drug innovational process under grants from the National Science Foundation. In addition, three years ago, we prepared for the staff of the Federal Trade Commission an analysis of the effects on the returns to drug R and D of increasing generic substitution in an environment of shortened patent lives. This analysis was commissioned as part of the FTC's model drug product selection law project and an expanded version of our study for the FTC subsequently has been published in the journal Law and Contemporary Problems (see A1)*. During the academic year 1979-80, I was also on leave from Duke University to the Health Care Financing Administration where one of my principal tasks involved a study of competition in the pharmaceutical industry.

Based on my own analysis of the pharmaceutical industry and those of other researchers, I believe there is a strong case at the present time for patent restoration as called for in S255.

There is currently considerable excitement about the scientific possibilities for significant new drug therapies based on many important advances in basic science in recent years. At the same time, however, the drug innovational process has been subject to several adverse economic trends over recent years. These adverse trends raise uncertainties and doubts about whether recent advances in basic science will be translated into new therapies as rapidly as good science permits.

From an economic standpoint, the process of discovering and developing new drugs has become a long and costly business investment subject to high levels of uncertainty. Over the past two decades, R and D costs per new drug introduction have accelerated much faster than the rate of inflation. Economic analyses indicate that the present value of R and D costs for producing a new drug introduction is now over 70 million dollars (more than an order of magnitude increase since the early Sixties) (A1). The process usually takes over 10 years from initial synthesis to actual commercial introduction. Furthermore, many promising drug candidates fall by the wayside during the R and D process. More than 90 percent of the drugs tested clinically in man fail to be commercially introduced (A2). Several academic studies have found the more stringent regulatory

*References cited in this paper are from items contained or listed in Appendices A1-A4 which provide reprints and drafts of previously completed papers bearing on this issue.

climate for new pharmaceuticals which has evolved during the past two decades to be a major factor driving up the cost and development times for new drugs and in lowering R and D productivity in this industry. (A1, A2).

Longer development and regulatory approval times also have meant shorter real terms of patent exclusivity on new pharmaceuticals. Average patent life for the new drug therapies introduced during the past three years have been under 10 years in length. Furthermore, at both the federal and state levels, government officials have been enacting various programs designed to promote the use of generic drugs after patents expire and imitative drugs come on the market. These include the Maximum Allowable Cost program for Medicaid and Medicare reimbursements and the various state drug substitution laws. (A1).

Although all of these policy efforts may be characterized as well intentioned and addressed to valid social goals, taken in combination, they have the effect of adversely affecting the incentives and capabilities of many firms to invest in pharmaceutical R and D. The collective signals sent to the innovative firm by various government agencies cannot have been very encouraging in recent years. The uncertainties arising from increased regulation, shorter patent lives, and the various government programs to encourage generic competition add significantly to the technical uncertainties surrounding long term R and D investment projects.

In an economy characterized by double digit inflation and scarce capital funds, these costly R and D investments are becoming increasingly difficult for many firms to sustain. My own research shows there are now substantially fewer domestic independent industrial sources of pharmaceutical innovation than was the case earlier in the past World War II period (A2). Smaller U.S. firms in particular have dropped out of the business of discovering and developing new drugs. These activities have become increasingly concentrated in the larger U.S. and foreign multinational firms. Even the latter firms have increased their degree of diversification across other industrial fields in recent years. (A2, A3)

The proposed patent restoration legislation under discussion here should operate to increase the expected returns from new drug innovation and also provide firms that are successful in introducing major new products with added cash flows to finance future research activities.

In order to gain some insights into whether patent restoration would have a significant quantitative effect on the expected returns from pharmaceutical R and D, my colleague John Vernon and I have recently performed a sensitivity analysis

bearing on this issue. In particular we examined the relation between drug profitability and product life for the 37 U.S. discovered new drugs introduced during the period 1970-76. For each of these 37 new drug introductions, we calculated a profitability index which is defined as the ratio of the present value of projected revenues to the present value of R and D costs. Current and historical data on costs and revenues were used to extropolate to future periodsusing a number of assumptions discussed in our draft paper.(A4) I would like to briefly highlight here some of our main results.

A major finding of our analysis is that if the real interest rate is 10%, the product life must be 19 years for our sample of 37 drugs before the mean profitability index reaches one in value. Stated another way, it takes 19 years for firms to cover average R and D costs and earn a 10% real rate of return on their invested capital. At an 8% real rate of return, product life must be 12 years in value. These results are displayed graphically in Figure 1 of the paper attached as Appendix A4.

Economic analysis indicates that historically, investors have received a rate of return of approximately 9 percent for investment in a general portfolio of stocks on the New York stock exchange. Given that investments in pharmaceutical R and D appear more, or at least as risky as, a general portfolio of common stocks, a real rate of return in the range of 8 to 10 percent would appear warranted here to sustain long term reinvestment of cash flows in drug R and D activity.

Another major finding of our analysis is that the rate of return distribution for new drug therapies is highly skewed in character. We found that even if one assumes a 20 year lifetime for all of the 37 new drug introductions in our sample, only 13, or roughly 35 percent, had a profitability index of 1 or more in value. This indicates that the majority of the new drug introductions do not cover their full R and D investment costs (i.e. when allowing for both discovery costs as well as the large attrition rate on new product candidates or "dry holes"). In effect, firms are dependent on a relatively few "big winners" to cover their full costs and generate the required return on their R and D investment portfolio.

This last point is reinforced by a forthcoming analysis performed by Professor Lacy Thomas of the University of Illinois. His analysis shows there is a significant concentration of pharmaceutical revenues in a small number of products for most of the major U.S. firms. In particular he found the

leading three products currently account for a large fraction of sales (frequently over 50 percent) for several of the major firms in the industry.

These results underscore the importance of patent restoration in the competitive environment that is likely to hold over the final two decades of this century. The research intensive firms are increasingly dependent on a relatively small number of major new drugs, those capable of winning relatively large market shares, here and abroad, to finance and provide the returns on their overall portfolio of R and D investment projects. These major products however, also provide the most attractive markets for generic follow-on producers. The degree of competition provided by these latter firms is bound to substantially increase in the new marketing environment characterized by drug substitution laws and the MAC program (A1). If patent terms are insufficient to provide significant premia on these research winners, there will in turn be insufficient investment funds forthcoming to exploit all the scientific opportunities for developing socially beneficial new drugs.

In another recently completed paper, we have analyzed the determinants of pharmaceutical R and D investment expenditures (A3). Our statistical analysis indicates that firms do respond to higher or lower returns from R and D in the expected manner but the adjustment process is a gradual one. Our results also indicate a statistically significant positive relation between firm R and D outlays and the availability of internally generated investment funds. For the firms in our sample, a 1 million dollar increase in cash flow was associated on average with a quarter million dollar increase in R and D expenditures. This relation was quite robust over the 12 year period (1963-1975) analyzed by our study. Our study of the determinants of R and D expenditures in pharmaceuticals therefore indicates firm outlays are sensitive to both expected returns and the availability of internally generated funds.

Since restoration of patent life increases the expected returns from new drug innovation and also provides firms that are successful in new product introduction with increased profits and cash flow, it should lead to a significant increase in R and D investments on both these grounds.

The effect of patent restoration on the character of R and D investment and firm research strategies is more difficult to predict. However, patent restoration can be expected to increase R and D on "breakthrough" type drugs to the extent that these drugs are subject to above average riskiness and also to the extent they have longer product lives before they are made obsolescent

by competitors' new products. If a drug has a relatively short product life before being made obsolete by rival introductions, it will essentially be unaffected by patent restoration. Patent restoration will provide maximal incentives for drugs expected to have a high degree of "durability" over time and many breakthrough drugs appear to fit into this category.

As a final point, it should be observed that patent restoration, while providing a significant positive incentive for new drug investment outlays, will not be a perfect substitute or offset (at least on a one for one basis) for time and resources used up in the regulatory process. Patent restoration influences only the latter years of product life. Many products will be supplanted by rival firm introductions before the period of patent restoration comes into play. Furthermore, the value in economic terms of time added on to the end of the patent period will be worth much less than time restored at the front end of product life (through for example, reduced regulatory approval time). This is because of the time value of money. (A4)

In our sensitivity analysis, for example, we found that a 1 and 1/2 year reduction in the time it takes for a new drug application to be approved would reduce the time it takes for a drug company to recoup its R and D investment by a full 5 years--from 19 years to 14 years (see appendix A4, Figure 6). While it may not be possible to reduce the new drug approval time by this amount of time, this finding points up the continued importance of making the drug regulatory process as efficient as possible, consistent with societal objectives in drug safety. Hence regulatory reform should continue to be a high priority matter even if patent restortation is enacted.

Appendicies

A1 "Substitution Laws and Innovation in the Pharmaceutical Industry" by Henry Grabowski and John Vernon, Law and Contemporary Problems, Winter Spring 1979, p. 43-66.

A2 "Consumer Protection Regulation in Ethical Drugs" by Henry Grabowski and John Vernon, American Economic Review, February 1977, p. 359-364.

A3 "The Determinants of Research and Development in the Pharmaceutical Industry" by Henry Grabowski and John Vernon in Robert Helms, editor, Drugs and Health, American Enterprise Institute, Washington, D. C., 1981.

A4 "A Sensitivity Analysis of Expected Profitability of Pharmaceutical R and D" by Henry Grabowski and John Vernon, Draft, Duke University Department of Economics, April 1981.

Appendix A1

SUBSTITUTION LAWS AND INNOVATION IN THE PHARMACUETICAL INDUSTRY

By

HENRY G. GRABOWSKI AND JOHN M. VERNON

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SUBSTITUTION LAWS AND INNOVATION IN THE PHARMACEUTICAL INDUSTRY

HENRY G. GRABOWSKI AND JOHN M. VERNON*

I
INTRODUCTION

The pharmaceutical industry has been among the most innovative while being one of the most highly regulated industries in the United States. Government regulation of pharmaceutical product quality started in 1906[1] and has evolved into a stringent system of premarket controls over new drug development and introduction. Several recent studies have examined the effects of these regulatory controls on the costs and development periods for new drug entities, the quantity of drug innovation, and delays in new drug therapies available to consumers.[2]

Government laws and regulations indirectly affect the innovation process through the distribution and marketing of pharmaceuticals. In contrast to other products, drugs can be dispensed to an individual only with a physician's prescription. This is true unless the Food and Drug Administration (FDA) has approved the drug for self-medication (i.e., over-the-counter usage). Historically, state antisubstitution laws for prescription drugs have prohibited pharmacists from dispensing a different brand of a drug than the one prescribed by the physicians.

A major structural change taking place in the pharmaceutical industry today is the repeal of state antisubstitution laws. Over forty states have passed product selection or drug substitution laws.[3] While the state-enacted laws have significant differences, essentially all enable pharmacists to substitute generic products (some mandate substitution) unless a physician prevents substitution

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1. The Pure Food and Drugs Act was passed in 1906 primarily to deal with food abuses. *See* W. Wardell & L. Lasagna, Regulation and Drug Development 6 (American Enterprise Institute for Public Policy Research, 1975) [hereinafter cited as W. Wardell & L. Lasagna].

2. *See, e.g.* W. Wardell & L. Lasagna, *supra* note 1; H. Grabowski, Drug Regulation and Innovation (American Enterprise Institute for Public Policy Research, 1976) [hereinafter cited as H. Grabowski]; D. Schwartzman, *Innovation in the Pharmaceutical Industry* (1976) [hereinafter cited as D. Schwartzman]; Grabowski, Vernon & Thomas, *Estimating the Effects of Regulation on Innovation: An International Comparative Analysis of the Pharmaceutical Industry*, 21 J. LAW ECON. 133 (1978) [hereinafter cited as Grabowski, Vernon & Thomas].

3. *See* Table 1.

by checking a preprinted box or writing "dispense as written" (DAW) on the prescription form.

Drug substitution laws give rise to a number of interesting medical, economic, and legal questions that are the subject of much discussion and debate.[4] These include the quality and therapeutic equivalence of various manufacturers' products, the anticipated behavior of physicians and pharmacists under the new drug substitution laws, the economic savings to consumers utilizing generic products, and the question of liability in the event of a drug substitution mishap.

This article will focus on the effects of drug substitution laws on innovation incentives. New laws alter the terms of competition between the innovator's brand and imitative drug products. By lowering the barriers to imitative products, substitution laws reduce the expected return on drug innovation.

The effects of drug substitution laws on innovation incentives must be considered in light of government patent or regulatory policies. Since substitution laws alter the expected revenues of a new drug only after the patent expires and alternative suppliers enter the market, their impact on innovational returns depends on the patent protection. The effective patent life for new pharmaceuticals is typically much shorter than the legal life of 17 years due to the long gestation period that is required to develop and gain regulatory approval for a new drug entity. Hence, drug substitution, patent and regulatory policies have potentially significant interactive effects on the incentives for drug innovation investment.

From a normative or policy perspective, these public policies are also obviously interrelated. If changes in drug substitution laws were seen as leading to suboptimal incentives for drug innovation, policymakers have the option of adjusting patent life to increase incentives. It would not be necessary to maintain substitution restrictions on all pharmaceuticals in order to maintain sufficient incentives with respect to drug innovation. This latter objective could be accomplished by changing the patent life on new drugs. This point is developed later in the article. See the Appendix for a theoretical model of the optimal patent life.

In Section II we consider how substitution laws, along with other government policies, affect the private returns to drug innovation. Section III reviews the current status of drug substitution laws and the current evidence concerning their impact on pharmaceutical sales. In Section IV we perform a sensitivity analysis *of the effects of substitution laws on the expected returns to innovation using representative data* on research and development (R&D) costs, revenues, and other parameters. Section V is a brief summary and conclusion.

4. *See* Bureau of Consumer Protection, Federal Trade Commission, Drug Product Selection 7-9 (1979) [hereinafter cited as Bureau of Consumer Protection].

II

THE EFFECT OF GOVERNMENT POLICIES ON THE PRIVATE RETURNS TO PHARMACEUTICAL INNOVATION

This Section examines how FDA regulatory policy, patent policy, and drug substitution laws affect the private returns to pharmaceutical innovational activity.

Decisions to develop new drug entities are investment decisions. The decision making environment presumably compares the expected returns from these projects with alternative investment opportunities. Accordingly, we employ a similar conceptual framework to indicate the joint effects of these government policies on innovation decisions. Using this framework we summarize some of the empirical work on the effects of innovation regulation.

A. The R & D Investment Decision

Consider a hypothetical investment project involving the development of a new chemical entity (NCE). Suppose the NCE is expected to be introduced in year t. It will involve R&D and investment costs over m years and earn positive profits for n years after introduction, p of which are subject to patent protection. Then the rate of return, r, for this particular product introduction is found by solving the standard discounted present-value equation:

$$\text{I.} \quad \sum_{i=1}^{m} C_{t-i}(1+r)^{i} = \sum_{j=0}^{p} \frac{R_{t+j}}{(1+r)^{j}} + \sum_{j=p+1}^{n} \frac{R_{t+j}}{(1+r)^{j}}$$

where

$C_{t-1}, C_{t-2}, \ldots, C_{t-m}$ are R&D costs and other investment expenditures;

$R_t \ldots R_{t+p}$ = net income stream before patent expiration;

$R_{t+p+1} \ldots R_{t+n}$ = net income stream after patent expiration.

This expected rate of return abstracts from potential differences in risk associated with specific development projects. The expected return from each project would have to be adjusted for such risk differentials across projects (unless the firm is risk neutral). The firm's decision to invest in a particular development project would depend on whether its adjusted rate of return exceeds or falls below the firm's capital cost, which reflects the opportunity cost of alternative investments for the firm and its shareholders.

B. The Effects of Regulation

Let us consider how FDA regulations influence the factors in this return calculation rate. The most direct effects of regulations are on expected costs. FDA regulations have increased the number of tests and the amount of evi-

dence on safety and efficacy that must be accumulated before a drug is marketed. In addition, the regulatory approval process on a new drug application is usually quite lengthy and averages about two years for successful applicants.[5] Regulation tends to increase both development costs (the C_t's) and the gestation time, m, required to produce a new innovation. Both effects increase the present value of costs of an NCE introduction.

In an earlier empirical analysis,[6] we analyzed the effects on R&D costs of the more stringent regulatory environment emanating from the 1962 Kefauver-Harris Amendments.[7] These Amendments expanded FDA controls to include the clinical development process and required firms to provide evidence on drug efficacy as well as safety. Using a comparative international approach, we estimated that increased regulation more than doubled the R&D costs of obtaining NCE during the first decade after the law was passed.

Recently, Ronald Hansen has estimated the value of R&D costs that a firm might expect to have to discover, develop and gain regulatory approval for an NCE introduction.[8] Using detailed cost data on over 100 drug entities tested in human beings, he estimated the present value of R&D costs for a typical NCE introduction to be $54 million (adjusted to reflect 1975 dollar rates). This high value reflects the long gestation period for new drugs and the high attrition rate on unsuccessful R&D projects. Furthermore, Hansen's estimates on R&D costs are at least an order of magnitude greater than estimates available for the immediate pre-1962 amendment period.[9]

It is also appropriate to consider the effects of FDA regulations on the expected revenues from a new NCE. There are a number of possible impacts here, some of which have conflicting implications for expected revenues.

First, regulatory controls will reduce the probability of commercialization for many compounds and lower expected revenues. One of the primary benefits of regulation is the extent that the regulatory agency screens out and deters drug entities that present risks that the majority of consumers would not knowingly and willingly undertake. Evaluating whether the FDA has been too conservative in its risk/benefit decisions is one of the most difficult and controversial areas of regulatory analyses.[10]

Regulation also affects the effective patent life, p, for a new drug entity.

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5. Hansen, *The Pharmaceutical Development Process: Estimates Of Development Costs and Times and the Effects of Proposed Regulatory Changes*, in ISSUES IN PHARMACEUTICAL ECONOMICS 151, 154 (R. Chien ed. 1979).

6. Grabowski, Vernon & Thomas, *supra* note 2.

7. Pub. L. No. 87-781, § 76 Stat. 780 (1962) (codified in scattered sections of 21 U.S.C.). *See generally* Kelly, *The Drug Amendments of 1962*, 18 FOOD DRUG COSM. L. J. 145 (1963).

8. Hansen, *supra* note 5, at 180.

9. For an analysis of R&D costs in the pre-amendment period *see* Baily, *Research and Development Costs and Returns: The U.S. Pharmaceutical Industry*, 80 J. POLIT. ECON. 70 (1972). *See also* Sarett, *FDA Regulations and their Influence on Future R & D*, 17 INTER. J. RESEARCH MNGMNT. 18, 19 (1974).

10. *See* W. Wardell and L. Lasagna, *supra* note 1, at 37–44, 161–65.

Since the average time to develop an NCE and gain regulatory approval now far exceeds the time necessary to obtain a patent,[11] regulatory-derived increases in development or approval times will operate to lower the effective life of a drug patent. While the length of patent protection has been of secondary import historically in the drug industry, this situation could change dramatically with the repeal of antisubstitution laws. This question will be considered in detail later.

There are also several ways that regulation can operate to *increase* the expected revenues of drugs approved for marketing by the FDA. First, regulations serve a certification function. Stringent regulatory processes provide physicians and patients with confidence in a new drug's safety and efficacy, thereby facilitating rapid market diffusion and penetration for new drugs. Second, drugs that are approved in a stringent regulatory regime face less actual and potential competition than in an unregulated market. This is true for two basic reasons. First, many marginal drugs will be undeveloped, given the greater costs of developing drugs under regulation. Second, the minimum scale at which R&D can be profitably undertaken will tend to increase under regulation, lowering the number of firms engaged in pharmaceutical innovation. This latter phenomenon was investigated by us and our findings indicate that pharmaceutical innovation has become more concentrated.[12]

How do these effects balance out and what is their net impact on the rate of return to pharmaceutical innovation? While there is no definitive answer to this question, several studies have examined developments in pharmaceutical innovation in the United States and other countries that provide some insights into this question. The facts concerning innovation in the United States indicate, first, that as regulation has become more stringent, R&D costs have risen dramatically, compared to revenues, causing average innovation returns to decline over time.[13] Second, the annual number of new product introductions has declined significantly.[14] Third, total industry R&D for pharmaceuticals has grown little, if at all, in real terms in recent years. Significantly, drug firms have increased their diversification rate across other industrial fields.[15] A number of factors other than regulation have been advanced in the literature as possible explanations for these developments in pharmaceutical inno-

11. *See* D. Schwartzman, *supra* note 2, at 163, 166.

12. *See* Grabowski & Vernon, *Structural Effects of Regulation on Innovation in the Ethical Drug Industry*, in ESSAYS ON INDUSTRIAL ORGANIZATION IN HONOR OF JOE S. BAIN 181, 191–93 (R. Masson and P. Qualls eds. 1976). *See also* Grabowski & Vernon, *Consumer Protection Regulation in Ethical Drugs*, 67 AM. ECON. REV. 359 (1977).

13. *See* D. Schwartzman, *supra* note 2, at 159–160. *See also* J. Virts & J. Weston, Returns to R&D in the U.S. Pharmaceutical Industry (1978) (unpublished report). *See also* Clymer, *The Economics of Drug Innovation*, in THE DEVELOPMENT AND CONTROL OF NEW DRUG PRODUCTS 109 (M. Pernarowski and M. Darrach eds. 1972).

14. For a discussion of these trends and a related discussion on alternative quality adjusted measures of drug innovation, *see* H. Grabowski, *supra* note 2, at 17.

15. *See id.* at 44. *See also* J. Virts & J. Weston, *supra* note 13.

vation.[16] However, the current evidence, especially from comparative international studies, suggests that increased regulation has been at least one important factor underlying the adverse trends in pharmaceutical innovation.[17]

C. The Effects of Drug Substitution Laws

Changes in drug substitution laws affect the income stream of a new drug innovation in the period after patent expiration (i.e., the second term on the right in equation 1). It is clear from this formula that the effect of increased substitution on the returns to drug innovation will depend on: (a) the effective patent life, p; and (b) how net revenues, R_j, are shifted in the postpatent period.

With antisubstitution laws in effect, an innovator's product was able to maintain a favored market position by maintaining the "brand loyalty" of physicians. There are many documented cases where the original product retained a dominant market share at premium prices.[18] How the passage of substitution laws will change this situation remains to be seen. It depends on the behavioral response of physicians, pharmacists, and consumers under these new laws. Initial experiences of various states are discussed in the next Section.

If substitution laws foster increased competition between alternative manufacturers' products, then the degree of patent protection assumes a critical role in the appropriability of drug returns. A shorter effective patent life shifts the impact of drug substitution forward in time, amplifying the impact of revenue losses on the expected return to innovation, r, in equation 1. We present data below to show the effective patent life for pharmaceuticals has been declining and is in the range of nine to twelve years.

The prospect of increased substitution rates after patents expire combined with the relatively short, and declining, effective patent periods could have significant negative implications for innovation returns. This is of course an empirical question.

A principal objective of this article is to perform a sensitivity analysis of the effect of the new state substitution laws on the expected returns to innovation using plausible values for the various parameters in equation 1. To do

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16. *See* Grabowski, Vernon & Thomas, *supra* note 2, at 137–140 for a discussion of these alternative hypotheses. They include factors such as a depletion of research opportunities, scientific advances in the ability to detect toxicology and increased concerns about product liability.

17. *See* H. Grabowski, *supra* note 2, at 24–37 for a survey of relevant work as well as the analysis in our more recent paper: Grabowski, Vernon & Thomas, *supra* note 2, at 140–43.

18. *See* the discussion on this point by Brownlee, *The Economic Consequences of Regulating Without Regard to Economic Consequences*, in ISSUES IN PHARMACEUTICAL ECONOMICS 215, 226–27 (R. Chien ed. 1979). *See also* D. Schwartzman, *supra* note 2, at 256–58. *See also* Bureau of Consumer Protection, *supra* note 4, at 38–54.

this, we will take some representative R&D costs and revenues data and investigate how a range of assumptions on patent lives and the degree of drug substitution influence the expected return to pharmaceutical R&D. In the case of the effective patent life parameter, it is fairly easy to develop a range of plausible values because we can compute the effective patent life for NCE introductions that have come on the market over the past several years. On the other hand, projecting the long run effects of substitution laws on drug industry competition is more difficult. The next Section considers several characteristics of these new laws and available evidence concerning their impact on industry sales revenues in several states.

III
DRUG SUBSTITUTION LAWS

A. History and Current Status

U.S. antisubstitution laws were enacted in the early fifties. They were advanced as a response to the drug "counterfeiting" problem, the dispensing by pharmacists of drugs similar in size, color, and packaging to popular brand name products but of unknown quality or origin. Antisubstitution laws were adopted by all fifty states and generally prohibited any form of substitution for the brand denoted on the physician's prescription. At the time of passage, they had the support of the pharmacists' and pharmaceutical manufacturers' major trade associations.[19]

The impetus for repeal of these laws was development of government cost-containment programs for drugs under state Medicaid plans and growth of the consumer movement in the sixties. In 1970 the American Pharmaceutical Association, a trade association, supported the repeal of antisubstitution laws. A few states, including Florida and California, repealed their laws between 1972 and 1975. The number of states passing substitution laws has accelerated rapidly since 1976.

By the end of 1978, forty states and the District of Columbia had enacted drug substitution laws. Table I provides a list of the major provisions of these laws. As demonstrated in the Table, there is considerable variation in substitution laws from state to state.

All states allow physicians to prevent substitution. In several states, there are two-line prescription forms: one line stating substitution is permitted and the other stating that the prescription must be dispensed as written. In the two-line prescription states, excepting New Jersey, the physician consents to substitution by signing the line permitting substitution. States which do not

19. The history and growth of antisubstitution laws is discussed in more detail in Bureau of Consumer Protection, *supra* note 4, at 141–54.

TABLE I

MAJOR PROVISIONS OF STATE DRUG SUBSTITUTION LAWS

State	Year Enacted	Formulary Limitations*	Two-Line Rx Form Required†	How Substitution Can Be Prevented‡	Pharmacy Substitution Mandatory	Cost Savings Pass-On Required	M.D. Exemption from Liability
ALASKA	1976	None	Yes	C	No	Yes	No
ARIZONA	1978	Positive	Yes	A	No	Yes	No
ARKANSAS	1975	Negative	No	B	No	Yes	No
CALIFORNIA	1975	Negative	No	B	No	Yes	Yes
COLORADO	1976	None	No	B	No	Yes	No
CONNECTICUT	1976	None	No	B	No	Yes	No
DELAWARE	1976	Negative	Yes	A	No	Yes	No
D.C.	1976	Positive	No	B	No	No	Yes
FLORIDA	1976	Negative	No	B	Yes	Yes	Yes
GEORGIA	1977	None	Yes	A	No	No	No
IDAHO	1978	None	Yes	A	No	Yes	No
ILLINOIS	1977	Positive	Yes	A	No	No	Yes
IOWA	1976	Negative	No	B	No	Yes	No
KANSAS	1978	None	No	B	No	No	No
KENTUCKY	1972	Positive	No	B	Yes	No	Yes
MAINE	1975	None	No	B	No	No	No
MARYLAND	1977	Negative	No	B	No	Yes	No
MASSACHUSETTS	1976	Positive	Yes	A	Yes	No	No
MICHIGAN	1974	None	No	B	No	Yes	No
MINNESOTA	1974	None	No	B'	No	Yes	No
MISSOURI	1978	Negative	Yes	A	No	No	No
MONTANA	1977	None	No	B	No	Yes	Yes
NEBRASKA	1977	Negative	No	B	No	Yes	Yes
NEW HAMPSHIRE	1973	Positive	No	E	No	No	No
NEW JERSEY	1977	Negative	Yes	B	Yes	Yes	No
NEW MEXICO	1976	Fed. MAC List	Yes	B	No	Yes	No
NEW YORK	1977	Positive	Yes	A	Yes	No	No

OHIO	1977	Community Pharmacy NDA-ANDA	No	B	No	Yes	Yes
OKLAHOMA	1961	None	No	D	No	No	No
OREGON	1975	None	No	B	No	No	No
PENNSYLVANIA	1976	Positive	Yes	A	Yes	No	Yes
RHODE ISLAND	1976	Positive	Yes	A	Yes	No	Yes
SOUTH CAROLINA	1978	None	Yes	A	No	No	No
SOUTH DAKOTA	1978	None	Yes	A	No	No	No
TENNESSEE	1977	Positive	Yes	A	No	Yes	No
UTAH	1977	Negative[2]	No	B	No	Yes	Yes
VERMONT	1978	Positive	No	B	No	No	No
VIRGINIA	1977	Positive	Yes	A	No	Yes	No
WASHINGTON	1977	Negative[2]	Yes	A	No	Yes	Yes
WEST VIRGINIA	1978	Negative	Yes	A	No	Yes	No
WISCONSIN	1976	Positive	No	B	No	Yes	No

[1] In cases where the actual manufacturer of the product to be substituted is the same as the manufacturer of the prescribed name brand, physician may not prevent substitution.

[2] Board of Pharmacy is empowered but not required to adopt negative formulary.

• A drug formulary, or listing, may be either positive (listing all substitutable drugs) or negative (listing all nonsubstitutable drugs).

† States having a "yes" in this column require two signature lines on all prescriptions. A signature on one line expressly permits substitution, while a signature on the other would prevent it.

‡ Legend: A — Physician must give prior approval by signing the appropriate line in the prescription for substitution to occur.
B — Pharmacist is authorized to substitute unless M.D. indicates express disapproval, such as by indicating "DAW."
C — In Alaska, physician must indicate permission to substitute. No permission implies DAW.
D — In Oklahoma, authority to substitute is with the prescriber or purchaser.
E — In New Hampshire, physician must write "or its generic equivalent drug listed in N.H. drug formulary" to permit substitution.

SOURCE: H. Grabowski, *The Effects of Substitution Laws on Innovation*, DRUG THERAPY 91, 94-5 (1978). *See also* Bureau of Consumer Protection, *supra* note 4, at 177-84.

have two-line prescription forms allow physicians to prevent substitution by writing DAW (dispense as written) or a similar notation on the prescription form. In these states, the pharmacist is authorized to substitute if the physician does not take positive action to stop substitution. This type of arrangement has been called physician veto as opposed to physician consent for substitution required in two-line prescription forms.

Nine states (Florida, Kentucky, Massachusetts, New York, New Jersey, Rhode Island, Vermont, West Virginia and Pennsylvania) have provisions that make substitution mandatory. These states *require* pharmacists to substitute lower-cost drugs that they have in stock *except* where the physician has stipulated otherwise on the prescription. These mandatory laws are of recent origin and some question exists as to their effectiveness and enforceability. This is a question for future research.

Substitution is regulated by drug formularies (listings) in a majority of the states. A positive formulary provides an approved list of drugs for which substitution is permitted, while a negative formulary denotes drugs for which substitution is prohibited.

Other provisions have been included in the substitution laws in various states. Most states, for instance, require that some or all of the cost savings in dispensing generics be passed on to the consumers, but this provision is not well-defined in many cases. A number of states require that patients approve substitution and Alaska requires that the physician be notified if substitution occurs. Finally, several states specifically exempt physicians from liability in the event of an injury arising from substitution.

One important development is that many states are amending their laws to facilitate or even mandate greater substitution. Four states (Florida, Massachusetts, Kentucky and Rhode Island) have amended their laws to require substitution (unless the physician has designated otherwise on the prescription). New Jersey, New York, and Pennsylvania recently passed their first substitution laws and included mandatory substitution provisions. Thus, there is a trend toward substitution laws which increases the likelihood of substitution by providing for substitution or mandating substitution.

The expected level of substitution in any state will depend on the constraints and incentives regarding substitution. This issue is considered in the next two Sections.

B. Evidence on the Effects of Repealing Antisubstitution Laws

Since most substitution laws have been in effect for only a few years, there is not a great deal of empirical evidence available on the effects of such laws. The full market responses to them in most cases have yet to take place. However, studies of the initial experience in particular states have begun to emerge.

An extensive empirical analysis in Michigan of the first year under substitution laws was performed by a research group at Wayne State University, headed by Theodore Goldberg.[20] A major finding of this study was that substitution in Michigan occurred for only 1.5 percent of the multiple-source prescriptions. This was true despite the fact that physicians prohibited substitution (by designating DAW) on only approximately 6 percent of these prescriptions. In a follow-up study, Goldberg and his associates found that when substitution did occur, the average consumer saving was approximately 20 percent of the price of the drug prescribed by the physician.[21]

Professor Joseph Fink studied Delaware's substitution law and obtained very different findings. In Delaware, a two-line prescription state, physicians signed the DAW line prohibiting substitutions 62 percent of the time.[22] At the same time, pharmacists in Fink's sample substituted 56 percent of the time when authorized to do so by physicians and the product was supplied by more than one firm.[23]

Recently an FTC contracted staff report published findings of a survey of over 700 pharmacists in seven states (Arkansas, California, Delaware, Minnesota, Oregon, Pennsylvania, and Wisconsin).[24] This survey found a wide variance across states in the behavior of both physicians and pharmacists consistent with the findings of the Michigan and Delaware studies discussed above.

A striking finding of the FTC survey is the large difference in the behavior of physicians in states where the preprinted two-line substitution format is used compared to states where physicians must write DAW or a similar phrase. The FTC study notes:

> The study confirmed findings reported elsewhere that physicians rarely (only 1.4% to 5.1% of the time) find it necessary to prohibit substitution by handwriting such indications as "Medically Necessary" or "Dispense as Written." When physicians have to sign one of two instructions preprinted on the prescription form, however, they sign on the "Dispense as Written" line nearly half (31% to 51%) the time.[25]

An *American Druggist*[26] survey of pharmacists in seventeen states found similar results: physicians in states utilizing the two-line prescription format

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20. Goldberg, et. al., *Impact of Drug Substitution Legislation: A Report of the First Year's Experience*, 17 J. AMER. PHARM. ASSOC. (n.s.) 216 (1977).
21. Goldberg, et. al., Evaluation of Economic Effects of Drug Product Selection Legislation 9–10 (October 1977) (unpublished paper presented to the American Public Health Association Meetings, study supported by grant number R01 HS 02132 from the National Center for Health Services Research, HRA, Department of HEW).
22. Fink & Myers, *Effectiveness of Drug Product Selection Legislation in Delaware*, CONTEMP. PHARMACY PRAC. 4 (1978), *quoted in* Bureau of Consumer Protection, *supra* note 4, at 187.
23. *Id.* at 7, *quoted in* Bureau of Consumer Protection, *supra* note 4, at 188.
24. Bureau of Consumer Protection, *supra* note 4, at 188–95.
25. *Id.* at 190.
26. AM. DRUGGIST 13 (October 1978).

barred substitution 58.5 percent compared to 8.04 percent for physicians in states without this format.

The FTC survey also found a high variance in the extent of substitution by pharmacists in these states. The median percentage of substitution by pharmacists (where substitution is authorized by physicians and multiple suppliers of a product are available) ranged from 5.2 percent in Arkansas to 45.5 percent in Wisconsin.[27] With only seven observations in this sample, it is not clear what legal provisions are primarily responsible for this variance in pharmacists' behavior. We are collecting data on a larger cross section of states in order to test some hypotheses in this regard.

In any case, this FTC study suggests that substitution has reached significant levels in some states. In addition, it would be plausible to expect the amount of substitution to increase in future periods. In the short run the degree of substitution will be restrained by concerns of physicians, pharmacists, and patients. These concerns include: quality differences among products, low economic incentives, possible risks to pharmacists, and unreliable information about relative drug prices available to consumers. The long run situation should change with respect to most, if not all, of these concerns.

C. Factors Tending to Increase Drug Substitution Over Future Periods

1. *The FTC Model Law*

As noted above, many state legislatures appear predisposed to changing laws to facilitate or increase the level of substitution. In this regard, the FTC has recently proposed a model substitution law that includes provisions designed to encourage substitution. The FTC model law would: (a) allow pharmacists to substitute unless the physician writes DAW on the prescription; (b) only permit substitution in accordance with an FDA developed formulary; (c) require that the substitute product be lower priced than the prescribed brand name product, but not requiring all savings to be passed on to the consumer; (d) have an optional feature limiting pharmacists' liability from substitution; and (e) require that the consumer be informed of the substitution.[28]

Available evidence suggests that adoption of the first provision would help remove the significant level of physician restraints on substitution that exist in many states (i.e., two-line prescription states). Furthermore, the above FTC provisions on drug formularies, partial savings passed on to consumers, and limited liability for pharmacists are designed to increase pharmacists' incentives to substitute compared to the present provisions in many state laws.

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27. Bureau of Consumer Protection, *supra* note 4, at 332.
28. *Id.* at 9–12.

2. *FDA Activity on Drug Equivalence*

Another factor that has operated to reduce substitution is uncertainty among pharmacists and patients regarding the technical quality and safety of lower-cost substitute products. This uncertainty has been accentuated recently by considerable publicity about possible bioequivalence problems in drug products.[29] The FDA has been heavily involved in investigation of bioequivalence problems in light of HEW's emerging Maximum Allowable Cost (MAC) program.[30] The FDA has published in the Federal Register a list of over 100 drugs that have potential bioequivalence problems.[31]

The FDA's basic substitution position, however, is that except for relatively few drugs actively under investigation for bioequivalence, any multiple source drug with an approved NDA or an abbreviated NDA is equivalent therapeutically and safe to substitute. Recently, the FDA endorsed the New York formulary for containing only therapeutically equivalent products with no bioequivalence or other quality problems. In this regard, FDA Commissioner Kennedy has stated:[32]

> . . . FDA concurrence in the New York list reflects the Agency's view that there is no consistent difference in quality between drug products sold by large and small firms or between drugs sold under a brand name or "generic" name. We have a single standard for drugs in this country.
> [. . .] States that permit substitution and want some assurance of therapeutic equivalence can use this New York State publication with knowledge that [the] FDA has approved all the products on the list and the manufacturers listed have FDA approval to make them.

Furthermore, the fact that the FDA has given formal endorsement to the drugs in the New York formulary, and implicitly to identical drugs appearing on other states' formularies, should minimize the actual and perceived risks of legal liability for pharmacists. In particular, if a pharmacist were to substitute a chemically equivalent product approved by the FDA that is on the state formulary and this substitution subsequently led to patient harm, it is difficult to see how juries could place liability on the pharmacist instead of the manufacturer or another party.

Finally, the FDA is working to resolve the issues of bioequivalence for drugs on the Federal Register list. Accordingly, the number of drugs in this category is likely to decline in the future.

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29. Two drug products containing identical amounts of the identical *active* drug ingredients in identical dosage forms are "chemically equivalent." "Bioavailability" measures how fast and how much of the drug gets into the body, appears in the blood, or is excreted in the urine. Hence, two chemically equivalent products of approximately equal bioavailability are said to be bioequivalent.

30. *See* Bureau of Consumer Protection, *supra* note 4, at 134-40, for a description of the MAC program.

31. 40 Fed. Reg. 26164–69 (1975).

32. HEW News, Press Release No. P78–4 (January 23, 1978).

3. *Economic Incentives for Pharmacists to Substitute*

Another reason the literature offers for the low substitution rate is the lack of economic incentives for pharmacists to substitute.[33] It is sometimes argued that pharmacists obtain larger profit margins on higher priced brand name products and that incentives for price competition are dampened by the information imperfections that exist with respect to retail drugs.

Although these conditions may have prevailed in many segments of the retail drug market historically, recent structural changes are making this market more competitive. In particular, the legal barriers to price advertising which operated to increase information imperfection have been largely removed.[34] Many discount drugstore chains are promoting drug products on the basis of lower prices. The repeal of antisubstitution laws offers these chains a significant opportunity to expand market shares through promoting and dispensing low-cost generic substitutes.

The trade literature recently reported cases where the chain drugstores (e.g., Walgreens, Giant Rexall, and Peoples) have begun large-scale promotional campaigns stressing the price advantages of generic drugs to consumers.[35] The advertisements of these chains emphasize that they dispense only quality generic products meeting high manufacturing standards. The Giant Rexall chain in Washington has advertised that they have a quality control laboratory staffed by a Ph.D. in pharmacy and two chemists.

In summary, there are strong economic incentives for the discount drugstore chains to promote generic substitutes. As consumers become aware of the potential savings involved in buying such products, it is reasonable to hypothesize that an increased amount of substitution will voluntarily occur in the marketplace.

D. Implications for the Sensitivity Analysis

In this Section we have reviewed the current situation of drug substitution and its actual and potential effects on sales revenues. It is clear from this analysis that substitution laws are in an evolutionary state and their long term impact on drug revenues is uncertain. Nevertheless, significant levels of substitution have been obtained in many states, and there are plausible reasons to expect the degree of substitution to rise. Therefore, it is conceivable that drugs now in the R&D phase will encounter higher rates of substitution when their patents expire than is the case for drugs off patent today. Accordingly, we will utilize a broad range of values for this parameter in the sensitivity analysis which follows.

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33. *See* Bureau of Consumer Protection, *supra* note 4, at 93.

34. *See* Va. State Bd. of Pharmacy v. Va. Citizens Consumers Council, 425 U.S. 748 (1976).

35. Millman, *Battle Lines Harden in Fight Over Generics*, ADVERTISING AGE, February 13, 1978, at 76; Curran, *Multi-Source Drugs: An Acceleration in the Use of Lower Costing Substitutes?*, Reynolds Securities Information Report 9–13 (May 1977).

IV

SUBSTITUTION LAWS AND THE DECISION TO INVEST IN RESEARCH AND DEVELOPMENT

This Section examines the decision to invest in R&D and provides a sensitivity analysis of the effect of repealing antisubstitution laws on the expected profits of R&D.

A. Sensitivity Analysis

In accordance with our previous discussion, the rate of return on R&D is derived by equation 1. in Section II, or

$$1. \quad \sum_{t=1}^{m} C_{t-1}(1+r)^t = \sum_{j=0}^{p} \frac{R_{t+j}}{(1+r)^j} + \sum_{j=p+1}^{n} \frac{R_{t+j}}{(1+r)^j}$$

In an analysis of pharmaceutical returns on R&D, David Schwartzman obtained data on the sales revenues for NCE introductions from 1966 to 1972.[36] He combined this with corresponding data on lagged industry R&D expenditures to discover and develop new drug entities. He then used these data to compute representative time profiles for the costs (C) and net income values (R) in equation 1. above.

As the starting point to our sensitivity analysis, we will utilize the Schwartzman data on R&D costs and revenues (in his earlier rate of return analysis.) We will investigate how sensitive Schwartzman's estimated returns are to the structural changes occurring in drug substitution.

As a benchmark for our analysis, we employ Schwartzman's data profiles with the assumption that the typical NCE product life is twenty years and the gross (after-tax) profit margin is 20 percent. The assumptions underlying this case are Schwartzman's upper bound estimates on profit margin and product life.[37] However, these upper bound estimates yield a relatively modest rate of return of 7.5 percent on R&D. Schwartzman projected lower median values for these parameters on the basis of historical experience in the pharmaceutical industry.[38] However, we think his upper bound estimates on product lifetimes and profit margins are likely to be representative of what NCE introductions can reasonably expect to achieve given that significantly fewer drugs are being introduced now.[39] We are collecting data for a refined analysis of the returns to recent NCE introductions.

However, the purpose of this analysis is not to predict the effect of substitution on the return to R&D with exact precision, but to gauge the sensitivity

36. D. Schwartzman, *supra* note 2, at 139.
37. *Id.* at 144.
38. *Id.*
39. *See* H. Grabowski, *supra* note 2, at 39–42 for a discussion on this point as well as other criticisms of Schwartzman's analysis.

of this return to alternative assumptions concerning the extent of substitution and the longevity of patents. Schwartzman's estimates on R&D costs and revenues are adequate for this purpose.

Table II shows the values of annual costs and net incomes which yield the 7.5 percent return. The key assumptions underlying these values are listed as notes in the Table. In Table II, Schwartzman assumes that the stream of net income is constant over the product life except for an introductory growth period (years 11 and 12) and the final years of sales decline (years 29 and 30). He implicitly assumes that the introduction of competing products after patent expiration does not reduce the net income stream. In other words, given a patent life of 17 years from the date of marketing, in year 27 see Table) net income has the same value as in year 26. For this analysis, we will reduce net income in the year the patent expires and succeeding years to reflect the impact of substitution on the net income stream of the new drug.

TABLE II

ESTIMATED STREAM OF COST OF R&D AND NET INCOME FOR AN AVERAGE NEW DRUG YIELDING A 7.5 PERCENT RETURN
(MILLIONS OF DOLLARS)

Year	R&D Cost	Year	Net Income	Year	Net Income
1	−1.22	11	.64	21	1.91
2	−1.22	12	1.27	22	1.91
3	−1.22	13	1.91	23	1.91
4	−1.22	14	1.91	24	1.91
5	−1.22	15	1.91	25	1.91
6	−1.22	16	1.91	26	1.91
7	−1.22	17	1.91	27	1.91
8	−1.22	18	1.91	28	1.91
9	−1.22	19	1.91	29	1.27
10	−1.22	20	1.91	30	.64

Notes: (1) The R&D period is ten years. Costs are in 1972 dollars and reflect the average costs for all new chemical entities introduced in the 1966-72 periods.

(2) Sales revenues are estimated by the average 1972 sales of new chemical entities introduced in the 1962-68 period. Foreign sales are assumed to be 47 percent of U.S. sales.

(3) A 20 percent after-tax profit margin, including R&D expenditures is assumed. Subtracting 2.6 percentage points from this figure to cover working capital and investment in plant for the project yields 17.4 percent which, when applied to sales, produces the net income figures above.

(4) Commercial life of 20 years is assumed. Sales increase to the peak value in the third year and are assumed to be one-third of the peak in the year of introduction and two-thirds of the peak in the next year. A similar decline is assumed at the end of commercial life.

SOURCE: D. Schwartzman, The Expected Return From Pharmaceutical Research 25-34 (American Enterprise Institute for Public Policy Research, 1975).

To perform this sensitivity analysis, we must specify representative values for: (a) the effective patent life of an NCE; and (b) the expected percentage reduction in the net income stream due to substitution after patents expire.

As discussed above, the legal patent life is seventeen years, but this does not measure effective patent life in the pharmaceutical industry. Patent life usually begins while the drug is in the developmental and regulatory approval stage. By the time the drug is cleared for marketing the remaining patent protection period is much less than seventeen years.

Table III shows the effective patent life for annual NCE introductions from 1966 through 1977. These data show that the effective patent life has generally been ten to thirteen years for this period. It has been gradually declining in this period. In the last year of the survey (1977) it was 8.9 years. On the basis of these data we estimate rates of returns in our sensitivity analysis for three alternative patent lives: 10 years, 12 years and 17 years.

While we are unable to estimate precisely what impact substitution laws will have on the net income stream; on the basis of our discussion in the last Section it would be reasonable to consider a broad range for this parameter. In Table IV we report the rates of return for three alternative percentage reductions of net income: −10, −30 and −50 percent. It should be noted that this parameter denotes the overall change in after-tax profits due to substitution

TABLE III

AVERAGE EFFECTIVE PATENT LIFE FOR NEW CHEMICAL ENTITIES INTRODUCED INTO THE UNITED STATES FROM 1966–1977

Year	Average Effective Patent Life (years)
1966	13.8
1967	14.1
1968	13.1
1969	11.9
1970	13.0
1971	13.0
1972	13.0
1973	12.0
1974	12.4
1975	10.5
1976	11.4
1977	8.9

Note: Effective patent life refers to the length of time from the date of FDA approval until the date of patent expiration.

SOURCE: University of Rochester, Center for the Study of Drug Development, Department of Pharmacology and Toxicology (unpublished report, 1979).

through losses in market shares or through price reductions by the innovating firm resulting from increased competition from generic substitutes.

As expected, the calculated rates of returns in Table IV are lower for shorter patent lives while the percentage reduction due to substitution is greater. Under the most unfavorable conditions for R&D activity considered here—a 10-year patent life and a 50 percent reduction in net income—the rate of return is reduced to 5.6 percent, or by about 25 percent from the 7.5 percent benchmark. On the other hand, when a 30 percent net income reduction and a 12-year patent life are assumed, the return rate is 6.7 percent, or roughly a 10 percent reduction due to substitution. These estimated effects are not negligible and, other things constant, may be expected to make some R&D projects no longer attractive to pharmaceutical manufacturers.

The results in Table IV underscore the fact that the effects of substitution on R&D returns are highly sensitive to the length of patent protection. If the patent life for drugs actually equalled the legal life of seventeen years, the effects of increased substitution on R&D returns would be quite modest. For example, with a seventeen year life, a 50 percent reduction in net income from substitution causes R&D returns to decrease from 7.5 to 7.1 percent in the present example. On the other hand, as patent lives decrease, the effects of drug substitution are magnified.

TABLE IV

INTERNAL RATES OF RETURN FOR ALTERNATIVE ASSUMPTIONS ABOUT THE IMPACT OF SUBSTITUTION AND THE EFFECTIVE PATENT LIFE

Percentage Reduction in Net Income upon Patent Expiration	Effective Patent Life		
	10 Years	12 Years	17 Years
-10	7.1	7.2	7.4
	(-5.3)	(-4.0)	(-1.3)
-30	6.4	6.7	7.2
	(-14.7)	(-10.7)	(-4.0)
-50	5.6	6.1	7.1
	(-25.3)	(-18.7)	(-5.3)

Notes: The standard against which the above rates should be compared is a 7.5 percent return. This is the rate of return for the data given in Table II.

(2) It is assumed that at the end of the patent life substitution will result in the alternative reductions in income given above for the remaining years of the 20-year commercial life.

(3) The percentage reductions were applied to total net income even though foreign income should not be affected by substitution. Hence, the implied domestic percentages are somewhat larger than those above.

(4) The numbers in parentheses are the percentage reductions for each rate of return from the standard 7.5 percent return.

The results in Table IV are preliminary in character. The analysis is based on aggregative data sources and contains the simplifying assumptions discussed above. We plan to refine and expand the analytical framework and data for investigating this question in future work. Nevertheless, results suggest that the effects of substitution laws on innovation incentives are consequential in nature and are highly sensitive to the longevity of patent lives over the ranges considered (i.e., 10 to 17 years).

B. Further Remarks on the Research and Development Investment Decision

The substitution of generic for brand name products already off patent and supplied by multiple sources (about one half of all present prescriptions) shifts cash flow from research intensive firms to nonresearch intensive ones. This reduces the supply of internal funds available to the former firms to undertake R&D investment. While most economists would agree that the rate of return expected for new drugs is the key variable in determining R&D investments, several studies have found internal funds to be a significant determinant of pharmaceutical R&D expenditure.[40] This finding is explained by a number of factors, including the high level of uncertainty that surrounds the development of new pharmaceuticals.

In any event, further research on the relation of pharmaceutical industry R&D expenditures to expected returns and other factors appears warranted. Most of the research on this question was performed on data from the fifties and sixties. Given the major structural changes in this industry since then, there is a clear need to examine this question using recent data and refined statistical techniques. This is another issue that we hope to address in future research.

V

SUMMARY AND IMPLICATIONS FOR PUBLIC POLICY

Our sensitivity analysis suggests that substitution may have nonnegligible effects on the level of R&D investment. The reduced incentive to invest in R&D due to substitution is magnified because the effective patent life in pharmaceuticals has been curtailed by five to seven years as a result of the long development and regulatory approval times for new drugs. This analysis makes it clear that the disincentive effects could be offset almost completely by an increase in the effective patent life to a rate of seventeen years. In essence, the substitution laws could serve to make the patent life a more effective policy instrument because entry by generic substitutes will become more

40. *See* Grabowski, *The Determinants of Industrial Research and Development: A Study of the Chemical, Drug and Petroleum Industries*, 76 J. POLIT. ECON. 292 (1968). *See also* Kamien & Schwartz, *Market Structure and Innovation: A Survey*. 13 J. ECON. LIT. 1, 24–6 (1975).

important upon patent expiration. The relevant policy issue then is whether the current effective life of 10-12 years is too long or too short. Some government agencies and officials feel it is too short. Proposed legislative bills have posed that patent life for drugs begin at the point of FDA approval, restoring patent protection to the full 17 years.[41] An Advisory Committee to the President's Domestic Policy Review on Industrial Innovation has recommended this policy change for all products subject to premarket regulatory approval[42] and former HEW Secretary Califano proposed that Congress consider this policy measure.[43]

In the Appendix we present a theoretical model based on Nordhaus' theory of the optimum patent life,[44] which sets forth explicitly what the social benefits and costs of changing patent life are. The benefits of a shorter life are identified as the standard monopoly welfare triangle which becomes available upon patent expiration. Another benefit is the saving in R&D resources. The costs of a shorter life are the foregone benefits of the reduced innovation level. Our results here do not provide sufficient information to pass judgment on this issue. We have established that there is likely to be some reduction in R&D investment and, consequently, in the innovation level. On the other hand, it is unlikely that the full information required to calculate the optimum life will be forthcoming. Meanwhile, decisions on the appropriate patent life must be made. While admittedly a "second best" argument, one point to be considered is whether there is any valid reason that the patent life of pharmaceuticals should be five to seven years less than in most American industries. As discussed above, this is a result of the long development and regulatory approval times that have evolved in the past fifteen years rather than the conscious choice of policymakers.

Selection of a specific patent life implies difficult tradeoffs and would be made under considerable uncertainty. The seventeen year patent life in the United States may or may not be viewed as a reasonable policy for balancing the types of errors this policy choice entails (i.e., too little innovation or too much market power). Nevertheless, there would appear to be little basis for a policy of shorter patent lives for ethical drugs. Given the high risks as well as the potential for significant positive externalities connected with the discovery and development of new drug therapies, one might justify longer patent life for drugs compared with other products. In any case, given the current trend

41. Such a provision was contained, for example, in H.R. 12371 introduced into the Ninety-Fifth Congress by Representative Symms. *See* Hearings on H.R. 11611 (and all other similar and identical bills) before the Subcommittee on Health and the Environment of the Committee on Interstate and Foreign Commerce, House of Representatives, 95th Cong., 2d Sess. 2146 (1978) (statement of Hon. Steven D. Symms, a representative in Congress from the State of Idaho).

42. Advisory Subcommittee on Patent and Information Policy, Department of Commerce Advisory Committee on Industrial Innovation, Draft Report Proposal VIII (December 20, 1978).

43. Address by Joseph A. Califano, Jr., Secretary of Health, Education, and Welfare, Public Citizen Forum (October 5, 1977), *quoted in* Bureau of Consumer Protection, *supra* note 4, at 232.

44. W. Nordhaus, INVENTION, GROWTH AND WELFARE, at 76–86 (1969).

of policy developments in the ethical drug industry further attention by academicians and policymakers to the tradeoffs involved here would seem highly desirable.

APPENDIX

In this Appendix we present a simple theoretical model designed to represent the benefits and costs of passing substitution laws. The model is basically a reinterpretation of Nordhaus' theory of optimal patent life.[1]

A major problem arises in applying the Nordhaus model to innovation in the drug industry. His model dealt with cost reducing innovations while innovation in the pharmaceutical industry takes the form of new products. If cost reduction innovation takes place, the demand function for the product is unchanged and consumer surplus can be used to evaluate social benefits. New drugs usually replace older, less effective drugs, provide treatment for previously untreatable diseases, or provide effective treatment with fewer contraindications. These forms of innovation imply shifts in traditional demand functions.

Wu suggests that Lancasterian demand functions can be used to model some new drug innovation classes.[2] Lancaster's theory assumes that satisfaction is derived from the product characteristics rather than from the products themselves.[3] For example, pain relief would be a characteristic and a new drug can be viewed as providing pain therapy units more efficiently than an old drug. In what follows we shall postulate the

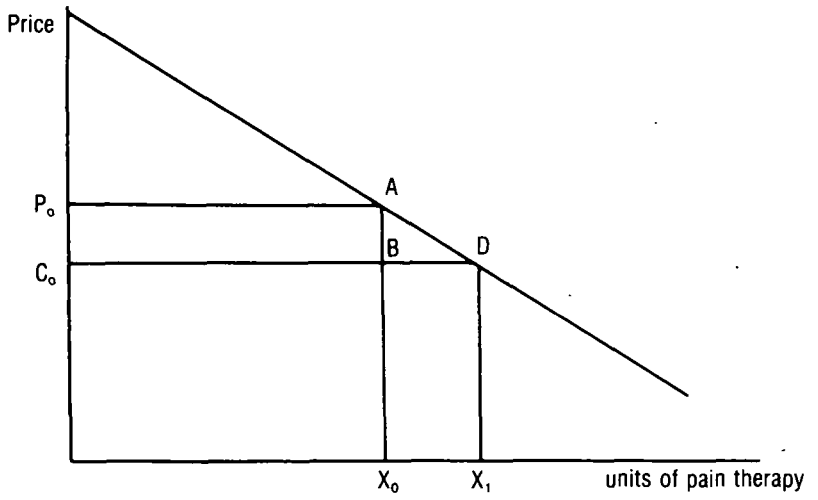


Figure 1

1. Nordhaus, *The Optimum Life of a Patent: Reply*, 62 AMER. ECON. REV. 428–31 (1972).
2. S. Wu, Measures for Social Rates of Return from Pharmaceutical Innovations 7 (1978) (unpublished report on file with the authors of this article).
3. K. LANCASTER, CONSUMER DEMAND: A NEW APPROACH (1971).

existence of Lancasterian demand functions. Although we recognize the sometimes strained applicability of this approach to new drug innovation, it does serve to illustrate the benefits and costs of passing substitution laws and the important role of patent life.

We begin with a situation in which substitution is not allowed. Pharmacists must supply the consumer with the brand name drug prescribed by the doctor.

1. Let the demand for pain therapy units be as shown in Figure 1. For simplicity we shall consider only one characteristic here (i.e., pain relief).
2. Prior to innovation, the competitive price-quantity equilibrium is P_0, X_0.
3. The innovator chooses its profit-maximizing level of R&D inputs which results in a new drug that is more efficient in providing pain relief. This greater efficiency is reflected in its lower unit cost, C_0. The cost saving P_0C_0 is referred to by Nordhaus as the size of the innovation.
4. The size of the innovation, P_0C_0, depends positively on the level of R&D inputs. This is Nordhaus' invention possibility function.
5. The innovating firm is assumed to appropriate all the cost saving benefits of the new drug, P_0 ABC_0. (More realistically, the initial price of the new drug would be set below P_0 thereby passing on some of the benefits to consumers.)

Hence, the profit-maximizing level of R&D investment prior to passing substitution laws can be represented mathematically as yielding a net present value of:

$$(1) \qquad B_0 = \int_0^\infty [P_0ABC_0]\, e^{-rt}\, dt - R_0$$

where: (a) P_0ABC_0 is the flow of net revenues to the innovator;
(b) r is the appropriate discount rate;
(c) R_0 is the dollar value of R&D investment compounded to time t = 0.

A key assumption is that the innovator appropriates P_0ABC_0 indefinitely over the future. The rationale is that entry after patent expiration is taken to be completely ineffective because of brand loyalties built up over the patent period, and the existence of antisubstitution laws. While this is admittedly unrealistic, it greatly simplifies the analysis and there is some empirical support for strong brand loyalty barriers.

If the firm's discount rate equals society's discount rate, and if R_0 is equal to total social R&D investment, then B_0 also represents the present value of society's net benefits. We now show the benefits and costs to society resulting from enactment of substitution laws.

In terms of our simple model, passing substitution laws can be conceived of as a reduction in the period of appropriability by the innovator from the infinite life above to some finite period T, the patent life. We assume that upon patent expiration, substitution will bring about (as a result of entry by generic drug suppliers) a drop in price from P_0 to C_0. This permits consumers to share in the benefits by transferring the cost savings P_0ABC_0 to them plus enabling them to obtain the welfare triangle ABD, as a result of the expansion in output.

While the above benefits characterization is correct in the short run for existing drugs, the appropriate comparison requires a long run view. The reduction in expected profits to innovating firms should result in a reduced level of R&D investment and a consequent reduction in the typical size of innovation.

In Figure 2 we show the long run comparison between the amount of innovation before and after the passage of substitution laws.

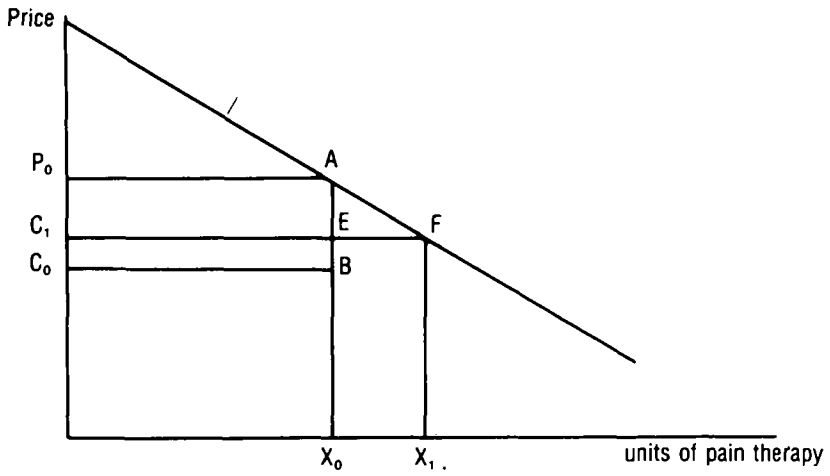


Figure 2

As before the present value of net social benefits before repeal is:

$$(2) \qquad B_0 = \int_0^\infty [P_0ABC_0]\, e^{-rt}\, dt - R_0.$$

After repeal, the size of innovation is reduced to P_0C_1. Upon patent expiration in period T, price falls to C_1 and output expands to X_1. We can write the present value of net social benefits as:

$$(3) \qquad B_1 = \int_0^\infty [P_0AEC_1]e^{-rt}\, dt + \int_T^\infty [AFE]e^{-rt}\, dt - R_1.$$

The change in net benefits is simply the difference between B_1 and B_0. This can be written as:

$$\Delta B = -\int_0^\infty [C_1EBC_0]e^{-rt}\, dt + \int_T^\infty [AFE]e^{-rt}\, dt + (R_0 - R_1)$$

or,

$$(4) \qquad \Delta B = -\frac{C_1EBC_0}{r} + \frac{[AFE]e^{-rt}}{r} + (R_0 - R_1).$$

The three above terms represent the costs and benefits of passing substitution laws. In particular, the first term is negative and represents the reduced innovation. The two positive terms represent the benefits: one is the gain of the welfare triangle which becomes available only upon patent expiration in period T and the other is the saving in R&D resources.

Of course, the model sketched above is abstract and is based upon strong assumptions. Nordhaus has discussed these assumptions and the effect of relaxing them elsewhere. We shall not repeat his discussion here.[4] However, there are several points peculiar to the application of the model here that warrant brief comments.

One interpretation of the comparison above is that the new substitution laws make the patent life an effective policy instrument. If the patent life can be viewed as becoming a policy variable as a result of the passage of substitution laws, then the model suggests that policymakers should not consider the benefits and costs of substitution laws independently of the patent life. In short, if the existing T is such that passage of substitution laws makes ΔB negative, policymakers can always offset this by an appropriate choice for a new T. In fact, Nordhaus' model determines the optimum T which maximizes the net present value of benefits. Only by chance would one expect the optimum T to equal the existing life which is now on the order of ten-to-twelve years in this industry.

We have not distinguished between consumers and producers in evaluating social benefits. While this is justifiable given our concern with economic efficiency, it is also true that the primary political impetus for passing substitution laws derives from the large transfer expected from producers to consumers.

Finally, we have ignored the issue of possible quality differences between the innovator's new product and the generic drugs that are introduced upon patent life expiration. It is a controversial point as to whether the generic drugs are perfect substitutes for the pioneer drug, as we have implicitly assumed here.

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4. Nordhaus, *supra* note 1, at 428.

Appendix A2

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INNOVATION AND INVENTION

Consumer Protection Regulation in Ethical Drugs

By HENRY G. GRABOWSKI AND JOHN M. VERNON*

A number of studies by economists have emphasized that government regulation often produces undesirable or unintended side effects. In this paper, we examine some effects of this nature on the structure of innovation in the pharmaceutical industry.

In the first section of the paper, we review recent changes in the regulatory environment in ethical drugs and show that they have been a major factor leading to higher costs and risks in pharmaceutical innovation. In the second section, we show that significant shifts have also occurred in the structure of innovation in this industry. Namely, innovation has become more concentrated in large multinational drug firms. These firms are apparently in a better financial position to deal with the higher costs and risks of innovation and also can shift resources on a worldwide basis to offset some of the adverse impacts of regulations in this country. Some evidence concerning these international transfers is presented in last part of the paper.

I. The Effects of Regulation in Ethical Drugs on the Costs and Risks of Innovation

In 1938, with the passage of the Food, Drug and Cosmetic Act, Congress authorized the Food and Drug Administration *(FDA)* to perform a premarket safety review of all new drug compounds. Despite these new regulatory controls, innovation in ethical drugs flourished over the next two decades. Several notable therapeutic advances were achieved in antibiotics, psychotropic medicines and other fields. Furthermore, drug industry *R & D* expenditures increased dramatically along with the annual volume of new chemical entities (*NCEs*) introduced commercially. While the premarket safety reviews of the *FDA* obviously resulted in time lags for all drugs and deterred some new drugs from the marketplace, regulatory review times were still quite short (7 months on average) and the annual volume of *NCE* introductions was at record levels (over 50 per year) at the end of the decade of the 1950's. (See Grabowski, 1976, Ch. II.)

In the early 1960's, following the thalidomide tragedy, *FDA* regulation of ethical drugs became much more stringent in character. A major factor in this regard was the passage by Congress in 1962 of the Kefauver-Harris Amendments to the Food, Drug and Cosmetic Act. This new law required firms to demonstrate the efficacy as well as safety of all new drugs to the *FDA* and also imposed regulatory controls on the clinical research process and on drug advertising and labeling.

One would expect the more stringent regulatory environment that evolved after 1962 to have some adverse effects on costs, risks and development times of new drug innovation. In fact, a number of studies have indicated that significant shifts took place in the economics of new product innovation in ethical drugs in the post-amendment period. In particular, studies by V. A. Mund, L. H. Sarett and others indicate that development costs and times increased severalfold after 1962. By the early 1970's, Sarett estimated that the introduction of an *NCE* required more than ten million dollars in development costs and a gestation period of 8 to 10 years in length. In addition, data developed by

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W. Wardell and L. Lasagna indicate a high attrition rate on new drug candidates in the postamendment period. This is reflected in the fact that less than ten percent of the drugs entering clinical testing on humans after 1962 have become commercially available drugs. These adverse developments on the input side have been accompanied by a sizeable decline in the annual rate of *NCE* introductions in the postamendment period. (See Table 1.)

While there is little argument that innovational activity in ethical drugs has been characterized by significant adverse structural trends, there has been considerable debate about the role of regulation in explaining this situation. Previous studies by Martin Baily and Sam Peltzman indicate that the 1962 Amendments had a strong negative effect on the rate of drug innovation. However, their analyses have been criticized by the *FDA* and others for not adequately discriminating between the impacts of regulation and other factors (see the discussion in Grabowski, 1976). An alternative hypothesis advanced in the literature is that a "depletion of research opportunities" has occurred in ethical drugs as a result of the rapid rate of innovation in the earlier postwar period; and that this has produced the adverse trends attributed to regulation.

In a recently completed study, we have attempted to disentangle the effects of regulation from nonregulatory factors like research depletion, through a comparative international study of the United States and the United Kingdom (Grabowski, Vernon and L. Thomas, 1976). International comparative analyses would seem to offer one of the most promising methodological approaches for analyzing this question. This is because a depletion in basic research opportunities influences innovational activities in all countries in a common way, whereas regulatory procedures have differed considerably across countries. This type of analysis therefore offers one of the closest things available to a natural experiment for distinguishing between these two hypotheses. Of course one must also recognize the multinational character of the firms in this industry in structuring this type of comparative international analysis.

Our comparison of the United States and *U.K.* focuses on the number of *NCE*s discovered and developed in each country, per dollar of *R & D* investment, in both the pre- and postamendment period. We found both countries experienced significant increases in the total *R & D* investment expenditures necessary to produce an *NCE* in the postamendment period. However the increase was relatively greater in the United States, where regulatory controls were much more extensive. On the basis of a production function analysis using these data, we estimated that increased regulation, by itself, roughly doubled the cost of producing and introducing an *NCE* in the United States in the postamendment period.

In summary, our analysis (along with several other studies) points to increased regulation as an important factor underlying the higher costs and risks of drug innovation in the United States.

II. Structural Changes in Drug Innovation

In this section we examine various supply side shifts and structural changes that have occurred as an apparent consequence of the much higher costs and risks of drug innovation in the United States (see also Grabowski and Vernon).

A. Innovation and Firm Size

The first issue we consider is whether innovation has become more concentrated in fewer and larger firms. Some data on this question are presented in Table 1. The first two rows show the total number of *NCE*s and the number of firms having at least one *NCE* over three successive five-year periods, 1957 to 1961, 1962 to 1966, and 1967 to 1971. These data clearly show that the number of independent sources of new drug introduction has declined significantly over time, along with the rate of total introductions.

The third row of Table 1 gives the dollar value of "innovational output" in each period. This is the total number of *NCE*s introduced in each period, weighted by their sales during the first three years after introduction. This measure of innovation, like the simple count of *NCE*s, also shows a significant downward movement over time. Table 1 next presents 4-firm and 8-firm concentration ratios of innovational output. These data indicate that the leading

innovative firms have been accounting for increasing percentages of total innovation in successive periods, and reinforce the point that the number of independent sources of innovation is declining.

The final question considered in Table 1 is whether innovation has become more concentrated in the largest drug firms. The last two rows show the share of innovational output and the share of total drug sales accounted for by the four largest drug firms (ranked by ethical drug sales) for each of these 5-year periods. Thus, in the preamendment period, 1957–61, and in the first postamendment period, 1965–66, the largest four firms accounted for a roughly equal amount of innovational output and sales. In the final period, however, the four largest firms accounted for 48.7 percent of innovational output, which was much greater than their share of sales (26.1 percent).

TABLE 1—CONCENTRATION OF INNOVATIONAL OUTPUT IN THE U.S. ETHICAL DRUG INDUSTRY

	Periods		
	1957–61	1962–66	1967–71
(1) Total Number of New Chemical Entities (*NCE*'s)	233	93	76
(2) Number of Firms Having an *NCE*	51	34	23
(3) Total Innovational Output[a] (millions $)	$1,220.3	$738.6	$726.8
(4) Concentration Ratios of Innovational Output:			
4-firm	46.2	54.6	61.0
8-firm	71.2	78.9	81.5
(5) Four Largest Firms' Share of Innovational Output	24.0	25.0	48.7
(6) Four Largest Firms' Share of Total Sales	26.5	24.0	26.1

Sources: List of new chemical entities obtained from Paul de Haen *Annual New Product Parade*, various issues; all data on ethical drug sales from intercontinental Medical Statistics.

[a]Innovational output is measured as new chemical entity sales during the first three full years after product introduction

These findings were also consistent with a polynomial regression analysis of innovational output on sales for 51 drug firms for the three periods. In the first two periods, a linear relationship between innovational output and sales offered the best statistical fit whereas in the third period a cubic relation offered the best fit, with innovational output increasing at an increasing rate over the upper range of size. Two regressions from our analysis are given below. Equation (1) is the linear regression for the preamendment period and equation (2) is the cubic regression for the most recent period.

1957–61:

$$(1)\quad Y = 359.35 + .74\,S,\ R^2/F = .51/50.52 \qquad (.07)\quad (7.11)$$

1967–71:

$$(2)\quad Y = -11467 + .94\,S - .88 \times 10^{-5}S^2 + .25 \times 10^{-10}S^3,\ R^2/F = .64/20.7 \qquad (1.67)\quad (3.17)\quad (3.19)\quad (3.81)$$

where: Y = innovational output ($000); S = total ethical drug sales in middle year of period ($000); and t-statistics are in parentheses

It is interesting to note that the cubic regression equation in the 1967–71 period contributed .19 incrementally to R^2 compared with a linear regression and .11 compared with a quadratic regression.

The hypothesis that the largest firms in an industry will be the dominant sources of innovation dates back to Joseph Schumpeter's pioneering analysis. However, most empirical studies (including those for the drug industry) have not provided much support for the Schumpeterian hypothesis. Nevertheless, the results reported here are quite consistent with the trends in pharmaceutical innovation discussed in the first section. Given the much higher costs and risks of drug innovation in the postamendment period, it is plausible that the structure of innovation would shift in the direction of the

Schumpeterian hypothesis.

B. Innovation and the Multinational Activities of Pharmaceutical Firms

The most innovative firms in the ethical drug industry are not only relatively large in terms of domestic sales, but also tend to have a strong multinational character. For example, the eight leading innovative firms in the 1967–71 subperiod (which accounted for over 80 percent of innovative output in that period) have a strong multinational orientation. Each of these firms had manufacturing plants in at least eight foreign countries, and seven of them has foreign sales in excess of 100 million dollars in 1970. While past studies of the Schumpeterian hypothesis have not considered this aspect of firm structure, it would appear to be highly relevant in the current context.

Multinational firms have some significant advantages in their ability to respond to the more stringent regulatory conditions that have evolved in this country. First, they can introduce new drug products into foreign markets (where regulatory conditions are less stringent) prior to (or in lieu of) introduction in the United States. This allows them to gain knowledge and realize sales revenues while a new drug compound remains under regulatory review and development in this country. While a firm with no foreign operations could in principle do the same thing through licensing, significant information and transaction costs exist in this situation to reduce the gains from a licensing arrangement.

In addition, multinational firms also can perform *R & D* activities in foreign countries in order to reduce time delays and the overall costs of developing new products. Some important institutional barriers do exist to this strategy however. Historically, the *FDA* has been unwilling to accept data from foreign clinical trials or patient experiences. Because of this, *U.S.* firms have incentives to perform their *R & D* in this country, even if they choose to introduce their new drugs first and in greater numbers abroad. Nevertheless, it should be borne in mind that only a small fraction of compounds entering clinical testing in the United States ever become commercial products (as noted above, Wardell and Lasagna indicate this fraction is now less than 10 percent). Multinational firms therefore have the option of screening new drugs abroad and performing duplicate *U.S.* trials on the relatively small fraction of drugs for which New Drug Applications are submitted to the *FDA*. They also can perform different phases of development alternatively here and abroad in order to reduce regulatory lags and bottlenecks.

Some descriptive statistics serve to illustrate the extensive shifts that have occurred in the behavior of multinational firms with respect to foreign introductions and clinical testing over the postamendment period. In Table 2, data on all *U.S.* discovered drugs introduced in the United Kingdom over the period 1960–1974 have been assembled in order to consider whether *U.S.* discoveries are now being introduced there before here. A *U.S.* discovered drug is defined as one originating in a *U.S.* laboratory.

Table 2 shows that in the early 1960's, the vast majority of *U.S.* discovered *NCE*s introductions in the *U.K.* become available there only after here. However, a rather dramatic shift in this situation has occurred over time. By the final subperiod, 1972–74, approximately two-thirds of the United States discovered *NCE* introductions in the *U.K.* were either introduced later, or have yet to become available, in the United States. Preliminary analysis of data on France and Germany suggest similar patterns.

The shift in firm behavior depicted in Table 2 would seem to be strongly tied to regulatory differences in these countries. We might also point out that the *U.S.* firms share of *U.K.* total ethical drug and new product sales declined in the post-1962 period (Grabowski and Vernon), thus amplifying the incentives operating on firms to modify their traditional practices of introducing new products abroad only after *U.S.* introduction.

It would seem important to note that the behavior of pharmaceutical firms in recent years represents a significant departure from the pre-

TABLE 2—INTRODUCTION OF U.S. DISCOVERED DRUGS IN THE UNITED KINGDOM, 1960–74

Period	Number of *NCE* Introductions in *U.K.* of *U.S.* Origin[a]	Number (Percent) of these *U.S.* Discovered *NCEs*:			
		In *U.S.* Before	In *U.S.* Same Year	In *U.S.* Later	Not In *U.S.*
1960–62	57	38	13	5	1
		(66.6)	(22.8)	(8.7)	(1.8)
1963–65	33	16	5	10	2
		(48.4)	(15.1)	(30.3)	(6.1)
1966–68	24	10	4	8	2
		(41.6)	(16.7)	(33.3)	(8.3)
1969–71	21	9	4	3	5
		(42.8)	(19.0)	(14.2)	(23.8)
1972–74	28	8	2	6	12
		(28.5)	(7.2)	(21.4)	(42.9)

Sources: Information on *NCE* introductions in the United Kingdom and the origin of each *NCE* introduction were obtained from data compiled by Paul de Haen, Inc., and the National Economic Development Office of Great Britain. In cases of conflict between these two sources on the country of origin, the drug was not included in the above sample of U.S. discovered introductions.

[a]Drugs of *U.S.* origin defined as an *NCE* discovered in *U.S.* research laboratory.

dictions of the product life cycle trade theory proposed by Raymond Vernon and others. Not only are these new drug innovations being introduced first in foreign countries with much smaller markets than the United States, but they must also be produced in their initial stages of product life in foreign plants as well. This is because *U.S.* regulatory law prohibits drugs not yet cleared by *U.S.* authorities from being exported to foreign countries. Indeed, this provision of the law would appear to provide substantial incentives for direct foreign investment by *U.S.* firms.

Data recently developed by Lasagna and Wardell also suggest some significant shifts have taken place in the location of clinical testing by *U.S.* firms. They have recently completed a study of the new drug compounds clinically tested by 15 large *U.S.* ethical drug firms over the period 1960 to 1974. (These firms accounted for 80 percent of *R & D* expenditures in the United States.) Their results suggest an increasing tendency for *U.S.* firms to perform clinical testing of new drug compounds first in foreign locations. Specifically, they found that in 1974 these firms clinically tested approximately one-half of all their new drug compounds first abroad, whereas before 1966, they performed virtually all their clinical testing first in the United States. Although industry *R & D* expenditure data indicate that the percentage of total *R & D* outlays expended in foreign countries by *U.S.* firms is still small (15.4 percent in 1974), foreign outlays are growing much more rapidly than domestic expenditures and this percentage has doubled in the space of a few years (Grabowski, Ch. III).

In summary, the data analyzed in this section indicate that *U.S.* based multinational firms are increasingly testing and marketing new chemical entities abroad before the United States. As discussed above, the option to engage in such foreign activities offers multinational firms significant advantages in dealing with the more stringent regulatory situation that has evolved in this country. It is therefore perhaps not surprising that large multinational firms now account for such a dominant share of innovation in the *U.S.* ethical drug industry.

III. Summary and Conclusions

Our results indicate that *FDA* regulation of ethical drugs has had some significant adverse effects on the structure of pharmaceutical inno-

vation. In effect, the higher costs and risks of drug innovation in the more stringent post-1962 regulatory environment have operated as a barrier to competition through new product introduction. Consequently, the supply of new drugs has not only declined, but it has also become more concentrated over time in the larger multinational firms better able to deal with this more stringent environment. Given the rapid spread of health and safety regulation controls throughout all sectors of the economy, further attention to the adverse effects of regulation on industry competitive structure would seem highly desirable. They constitute a potentially important source of long-run indirect costs to society that must be weighed against the benefits of these new regulatory controls.

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Appendix A3

The Determinants of Research and Development Expenditures in the Pharmaceutical Industry

Henry G. Grabowski
and
John Vernon

The pharmaceutical industry has been among the most innovative industries in the United States economy over the post–World War II period. A number of studies, however, have pointed to declining innovational outputs and lower research and development (R&D) productivity in this industry over the past several years.[1] Our main objective in this paper is to analyze the reaction of the major pharmaceutical firms to these developments in terms of their allocations for research and development activities. In particular, we wish to examine empirically how firm research intensities have been responding to factors such as the expected returns from R&D and the availability of funds to undertake R&D. To investigate this question, we utilize a model similar in structure to that previously estimated by Grabowski for the pharmaceutical industry over the earlier period 1959 to 1962.[2]

The section of the paper that immediately follows discusses the hypotheses to be tested as well as the general specification of the model. The second section presents the empirical estimates. The final section discusses the main conclusions and implications of the analysis.

Model Specification

The R&D Decision Process in Pharmaceuticals. From the standpoint of the pharmaceutical firm, R&D for new drug products constitute a long-term investment decision process. As a first step in modeling this process, we briefly review the investment theory of the firm and then discuss its general applicability to R&D decisions in the drug industry.

[1] See, for example, the discussion of these adverse trends and the hypotheses concerning their causes in Henry G. Grabowski, John M. Vernon, and Lacy G. Thomas, "Estimating the Effects of Regulation on Innovation: An International Comparative Analysis of the Pharmaceutical Industry," *Journal of Law and Economics*, vol. 21 (April 1978), pp. 133–40; and also in Henry G. Grabowski, *Drug Regulation and Innovation* (Washington, D.C.: American Enterprise Institute, 1976), chaps. 2 and 3.

[2] Henry G. Grabowski, "The Determinants of Industrial Research and Development: A Study of the Chemical, Drug, and Petroleum Industries," *Journal of Political Economy*, vol. 76 (March/April 1968), pp. 292–306.

R&D PROCESS: ECONOMIC FACTORS

To determine the optimal level of R&D investment using the economist's rate-of-return analysis, the firm must first estimate the expected time streams of costs and revenues for each of its potential R&D projects. This information can then be used to construct a marginal-return-on-investment schedule (*mrr*) by arranging projects in order of decreasing rates of return (appropriately adjusted for risk). The intersection of *mrr* and the cost-of-capital curve (*mcc*), which reflects the opportunity cost of alternative investments for the firm and its shareholders, determines the optimal level of R&D investment, R^*.

In algebraic terms, the optimal level of R&D investment, R^*, is given by solving the equation

$$mrr(R, X) = mcc(Z) \tag{1}$$

where R = investment expenditures in R&D; X = vector of variables influencing the rate of return from new drug R&D; and Z = vector of variables influencing the opportunity cost of investing in new drug R&D.

Equation (1) yields a determinant function for R^* of the general form

$$R^* = f(X, Z) \tag{2}$$

so that changes in the optimal level of R&D occur as a result of shifts in either the marginal return on investment (the X factors) or the cost-of-capital schedules (the Z factors).

We feel these basic factors influence the level of pharmaceutical R&D expenditures as in the case of other investment decisions, but one should also keep in mind some special characteristics of the R&D process in this industry. As industry managers frequently point out, the discovery and development of a new chemical entity (NCE) are characterized by great uncertainty and normally take several years to pass through all the different phases of research, clinical testing, and regulatory reviews.[3]

Basic research must first be undertaken before specific NCEs can even be identified. After a new product candidate is synthesized, it is

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[3] The quantitative characteristics of the R&D process in drugs (e.g., attrition rates, residence times, and costs in different stages) have been examined in a recent National Science Foundation research study at the University of Rochester under the direction of Professor William Wardell and Louis Lasagna. See, for example, Ronald W. Hansen, "The Pharmaceutical Development Process: Estimates of Development Costs and Times and the Effects of Proposed Regulatory Changes," in Robert I. Chien, ed., *Issues in Pharmaceutical Economics* (Lexington, Mass.: Lexington Books, 1979), pp. 151–82; and W. Wardell, M. Hassar, S. Anavekar, and L. Lasagna, "The Rate of Development of New Drugs in the United States, 1963 through 1975," *Clinical Pharmacology and Therapeutics*, vol. 24 (August 1978), pp. 133–45.

then screened on animals to obtain some idea of its properties in man. Typically, hundreds of drugs are screened for every one clinically tested in man. Those drugs that are taken into clinical testing come under the regulation of the Food and Drug Administration (FDA) and must pass through a number of development stages designed to illuminate their therapeutic and toxic effects in man. Wardell's recent analysis of the clinical investigation process in drugs indicates a high attrition rate here as well. Only about one drug in eight passes through all the stages to the point of filing a new drug application (NDA) with the FDA.[4]

Given this situation, industry managers indicate that it is only after the initial clinical tests are completed that sufficient information becomes available on a drug's therapeutic and toxic effects to allow them to perform a formal rate-of-return analysis. A firm also has considerable economic incentive to do so at this point because the R&D costs for a project begin to escalate rapidly in the more advanced stages of development.[5] It is also true, however, that there are many more projects at the discovery and early clinical stages. In the aggregate, these constitute a major share (more than half) of the industry's total R&D investment expenditures.[6]

Given the difficulties of estimating returns for discovery research projects and in early clinical development trials, how do firms allocate resources to these projects and determine their total R&D budgets? Interviews with industry managers indicate that, in the short run, drug firms accord considerable attention to rule-of-thumb relationships.[7] In particular, they tend to focus on the R&D-to-sales ratio as a device for budgetary control and the allocation of resources to R&D. This is a short-run management device for dealing with the high levels of uncertainty associated with drug R&D, and it also provides some underlying stability in the growth (or contraction) of scientific personnel and other R&D inputs.

Nevertheless, it is also clear from examining data on the pharmaceutical industry that firm R&D-to-sales ratios or research intensities

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[4] Wardell et al., "Rate of Development," p. 133.

[5] Hansen, "Pharmaceutical Development Process," p. 165.

[6] David Schwartzman, for example, estimates that discovery research by itself accounts for approximately half of the industry's R&D expenditures. See David Schwartzman, *Innovation in the Pharmaceutical Industry* (Baltimore: Johns Hopkins University Press, 1976), p. 70.

[7] The decision-making process in this regard was examined by Grabowski in his doctoral dissertation, "The Determinants and Effects of Industrial Research and Development Expenditures" (Princeton University, 1967), and more recently in a doctoral dissertation by Erol Caglarcan, "Economics of Innovation in the Pharmaceutical Industry" (George Washington University, 1977).

do change over time and that there is also a considerable variance in these ratios across firms at any point in time.[8] It seems reasonable to hypothesize that firms will attempt to adjust their research intensity over time in accordance with the factors specified in the investment model given above; that is to say, we would expect that firm research intensity would change in accordance with management perceptions of the prospective returns to R&D relative to the cost and availability of investment funds (namely, the X and Z factors in equations (1) and (2) above).

In this paper, we plan to develop and estimate a model of the determinants of firm research intensity in the pharmaceutical industry using this general methodological framework. Our analysis of firm research intensity builds directly on an earlier empirical study on this subject by Grabowski for the 1959–1962 period.[9] The current study will investigate the determinants of research intensity for a sample of ten major pharmaceutical firms over the more recent period 1962 to 1975.

An investigation of the determinants of drug firm research intensity for the post-1962 period would seem desirable on a number of counts. First, there have been a number of important structural changes affecting the pharmaceutical R&D process since 1962, including the Kefauver-Harris amendments to the Food and Drug Act. Second, there are some new data sources that can be employed to formulate some of the determinant variables in a form conceptually superior to what was previously possible. Finally, there are a number of important policy developments now taking place in the pharmaceutical industry, such as the passage of state substitution laws, which could influence significantly the incentives for R&D over the immediate future. To gain insights into the likely quantitative effects of these developments, however, R&D determinant equations estimated on current rather than historical data are necessary. Because there have been no published studies to our knowledge on R&D determinants specific to the pharmaceutical industry for the post-1962 period, we undertake such an empirical study here.[10]

Data Sample Characteristics. Data on firm R&D expenditures were obtained from the Standard and Poor Compustat Tape. Two major

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[8] Data supporting this point are discussed in the next section and are also presented in the data appendix at the end of this paper.

[9] Grabowski, "Determinants of Research and Development," passim.

[10] Ben Branch has published a study of the determinants of R&D for drugs and other industries, using patents as a proxy for R&D inputs, that also focuses on the earlier time period, 1950 to 1965. See Ben Branch, "Research and Development Activity and Profitability: A Distributed Lag Analysis," *Journal of Political Economy*, vol. 82 (September/October 1974), pp. 999–1011.

considerations in selecting the sample of firms to include in the study were the availability of R&D expenditures for the complete 1962–1975 period and the degree of specialization of the firm in ethical drugs. Only firms with 40 percent or more of their total sales accounted for by ethical drug sales were included. (In addition, we included this percentage as an explanatory or control variable in the regressions.) These two conditions resulted in a sample of ten major pharmaceutical firms for the period 1962–1975.

Further details on this sample are presented in the data appendix. At this point, however, we should note that there is a wide variance in the research intensity for these ten sample firms. In the initial year of the sample, for example, R&D expenditures as a percentage of sales vary from a low of 3.8 percent to a high of 11.6 percent. Another interesting fact is that the R&D-to-sales ratio exhibited a decided downward trend over time between 1962 and 1975 for most of the firms in our sample.[11]

It is instructive in this regard to examine the time pattern of R&D expenditures and research intensities obtained by aggregating the individual firm data over the group of firms in our sample. These aggregate figures are shown in figure 1. R&D expenditures for this group of ten firms, measured in constant dollar terms, grew at a rapid rate over the 1960s but increased at relatively low rates during the 1970s.[12] In contrast to this pattern for absolute dollar outlays, however, the aggregate R&D-to-sales ratios for this group of firms peaked in the 1961 to 1963 period and exhibited a general decline over the remainder of this sample period. Hence, in contrast to the studies of R&D determinants previously done for the period of the 1950s and early 1960s, we are investigating here a period of generally declining rather than rising firm research intensities. It will be interesting to see how this affects the empirical estimates.

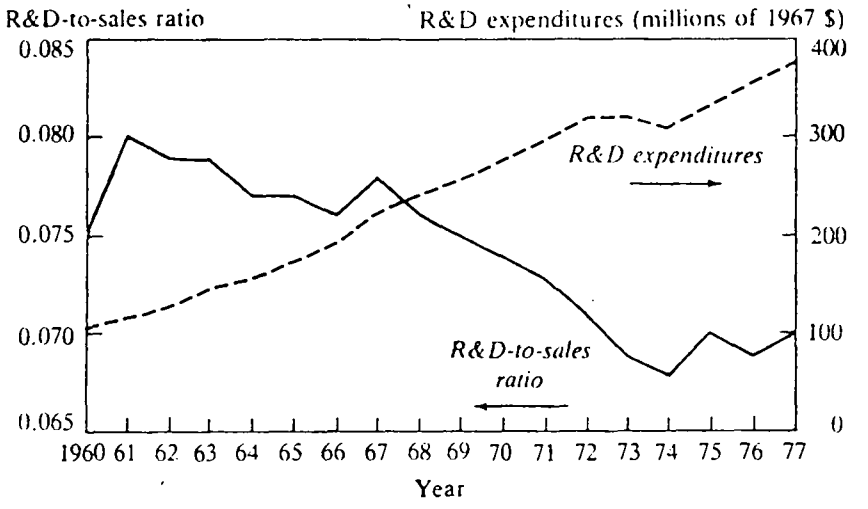
Explanatory Variables and Model Hypotheses. *Past R&D success.* A key question is how firms form expectations on the returns from R&D, given the high degree of uncertainty that characterizes the large share of projects in the discovery and early clinical development stages. A basic assumption made in Grabowski's earlier study was that firm expectations

[11] This was true for seven of the ten firms in the present sample. Furthermore, the three firms with a positive trend in R&D-to-sales ratios were the three with the lowest R&D-to-sales ratios in the beginning year, and their R&D-to-sales ratios remained significantly below the sample mean throughout the full period.

[12] Absolute R&D expenditures were transformed to constant 1967 dollars using the wholesale price index as the deflator. It is generally acknowledged that R&D costs have risen at a faster rate than this price index. Hence, the very low positive rates of growth for R&D expenditures over recent years observed in figure 1 could actually be negative if a better deflator of R&D expenditures were available to transform these data.

FIGURE 1

TIME TREND IN R&D VARIABLES FOR AGGREGATE SAMPLE



are significantly influenced by past successes or failures from R&D. Under this hypothesis, expectations change over time as a result of the firm's cumulative track record from R&D. Significant differences in attitudes and expectations concerning R&D can be expected to arise across firms from this adaptive type of process.

In Grabowski's earlier study, a variable indexing a firm's past "research productivity" was constructed to test this hypothesis. This variable was formulated as a moving average of the patents received by a firm relative to its R&D employees over a prior period of several years. Although this variable was highly significant, there are a number of obvious conceptual problems associated with using patents as one's basic index of R&D outputs.[13]

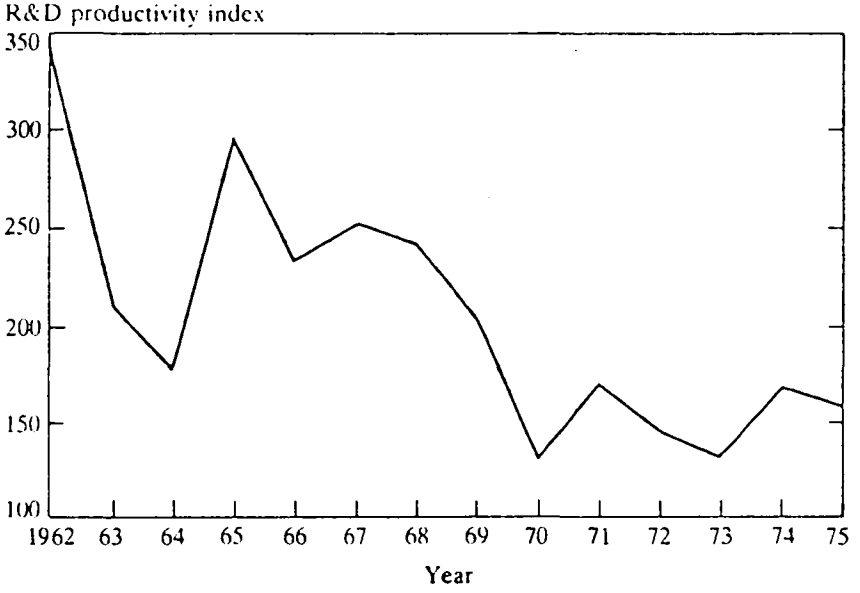
In the current study, an R&D productivity variable is constructed that has new product sales rather than patents as the basic measure of R&D output. In particular, the R&D productivity variable is formulated as a moving average of a firm's introductory sales of NCEs over a prior five-year period divided by its R&D expenditures over this period. This is a much better proxy variable for a firm's past return from R&D. It therefore should provide a better test of the expectational hypothesis above.

In addition, it will be especially interesting to see how this past

[13] These are discussed by Grabowski in "Determinants of Research and Development," pp. 294–95.

FIGURE 2

TIME TREND IN R&D PRODUCTIVITY INDEX FOR AGGREGATE SAMPLE



success variable performs in the period under analysis, given the fact that a number of recent research studies point to sharply declining private rates of return to drug R&D activity in the post-1962 period. Martin Bailey, for example, found (pretax) rates of return to R&D in the pre-1962 period of approximately 30 percent while projecting rates of return in the post-1962 period to have declined to less than half this level.[14] David Schwartzman, in an extensive study of this question, estimated an (after-tax) return to drug R&D for the 1966–1972 period to be in the range of 3.3 to 7.5 percent, also down significantly from his pre-1962 estimated (after-tax) return of 11.4 percent.[15]

In figure 2, we have plotted the trend over time in our past R&D success variable that was obtained by summing the values on new product sales and R&D expenditures over all ten firms in our sample. Although there is considerable year-to-year fluctuation in this aggregate index, the long-term trend over the 1962 to 1975 period is clearly downward. The value in the terminal year is roughly half what it was in the

[14] Martin N. Bailey, "Research and Development Costs and Returns: The U.S. Pharmaceutical Industry," *Journal of Political Economy*, vol. 80 (January/February 1972), p. 83.

[15] David Schwartzman, *The Expected Return from Pharmaceutical Research* (Washington, D.C.: American Enterprise Institute, 1975).

initial year. The behavior of this aggregate variable over time therefore appears consistent with results from the formal rate-of-return studies cited above.

From a disaggregative perspective, of course, some of the firms in our sample experienced significant new product successes during this period while others did not, and this should be reflected in their R&D behavior if the hypothesis above is correct.

Diversification. A second determinant variable of research intensity included in Grabowski's early study was an index of firm diversification. This variable was included to test Richard Nelson's hypothesis that firm diversification will positively influence profit expectations from R&D.[16] The basic idea is that a more diversified firm will be better able to exploit serendipitous research findings than one with a narrow base of operations. Hence, it will have the incentive to undertake more R&D, especially basic or discovery research activity.

In Grabowski's earlier study, the measure of firm diversification used was the number of separate five-digit standard industrial classification (SIC) pharmaceutical products produced by the firm. This variable was statistically significant in his study. At the same time, however, diversification measures have exhibited a mixed performance in other studies of R&D expenditures and outputs. Some studies have found a positive effect for diversification, but others have found insignificant or even negative relationships.[17]

In the current study, we include firm diversification as a determinant variable of research intensity. Instead of counting the number of five-digit classes to construct this variable, however, firm data on market share by therapeutic product classes were assembled to construct a Herfindahl-type measure of diversification. This is a conceptually superior measure of this structural characteristic and should provide a better test of the effect of diversification on firm research intensity.[18]

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[16] Richard Nelson, "The Simple Economics of Basic Scientific Research," *Journal of Political Economy*, vol. 67 (June 1959), pp. 297–306.

[17] The results of these studies are summarized in M. J. Kamien and N. L. Schwartz, "Market Structure and Innovation: A Survey," *Journal of Economic Literature*, vol. 13 (March 1975), pp. 26–27. In addition, an alternative measure of diversification based on the number of separate therapeutic categories in which a firm performs R&D has also been employed in past analysis. See Erol Caglarcan, Richard E. Faust, and Jerome E. Schnee, "Resource Allocation in Pharmaceutical Research and Development," in Samuel A. Mitchell and Emery A. Link, eds., *Impact of Public Policy on Drug Innovation and Pricing* (Washington, D.C.: American University, 1976), pp. 331–48.

[18] The Herfindahl Index, which is formally defined in the next section and illustrated in the data appendix, is generally considered a more discriminating measure of diversification because it takes account not only of the number of different product classes in which a firm produces but also of its level of production in each class.

Cash flow. In addition to expected returns, the cost and availability of investment funds are another basic set of factors influencing long-term R&D investment decisions (that is, the Z factors in equation 2). In Grabowski's earlier study, a highly significant relation was found between a firm's research intensity and its cash flow margin (measured as the ratio of lagged profits plus depreciation to sales). The basic rationale for including such a cash flow variable is the hypothesis that firms impute a lower cost of capital to internal funds, because of the lower transactions costs and risks compared with those from external sources.

The general relation between firm investment expenditures and cash flow availability has received considerable attention in the empirical literature on investment determinants. A number of studies have found results consistent with the hypothesis above, whereas others have disputed its validity.[19]

In the case of the relation of R&D investment in the pharmaceutical industry to cash flow availability, however, there are some particular factors that should be kept in mind. First, the industry invests relatively large sums in the search for new drug products and in the promotion of new products after they enter the marketplace. At the same time, the industry is not very capital-intensive in terms of fixed capital assets (that is, investment in plant and equipment). Hence, a large share of a firm's investment is in so-called intangible capital,[20] which generally involves above average riskiness.

This latter point is supported by recent research studies that indicate that the distribution of returns to drug R&D is highly skewed.[21] In particular, it is not uncommon for major firms to go several years without any commercially successful NCEs while, at the same time, a few new drugs have earned spectacular returns. Furthermore, the capital value of an established drug product can erode very quickly in pharmaceuti-

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[19] Perhaps the most supportive empirical study of the general hypothesis underlying this relation is given in a paper by W. Baumol, P. Heim, B. Malkiel, and R. Quandt, "Earnings Retention, New Capital, and the Growth of the Firm," *Review of Economics and Statistics*, vol. 52 (November 1970), pp. 345–55. They find much lower average returns for investments financed by retained earnings compared with debt or new equity. For a review of studies specifically focused on the effects of cash flow on R&D investment, see the review in Kamien and Schwartz, "Market Structure and Innovation," pp. 24–26.

[20] This result emerges in studies by Kenneth W. Clarkson, *Intangible Capital and Rates of Return* (Washington, D.C.: American Enterprise Institute, 1977), and Henry G. Grabowski and Dennis C. Mueller, "Industrial Research and Development, Intangible Capital Stocks, and Firm Profit Rates," *Bell Journal of Economics*, vol. 9 (Autumn 1978), pp. 328–43.

[21] This finding, for example, is emphasized by Schwartzman in *The Expected Return*, pp. 137–39, and also in the paper by John Virts and Fred Weston, "Expectations and the Allocation of Research and Development Resources," herein.

cals, if a competitor comes out with a product clearly superior in the eyes of physicians.

Given these circumstances, it is not implausible that firm managers in the drug industry would have a strong desire for secure financial underpinnings to their investments in R&D and that a positive link between R&D outlays and cash flow availability would occur. This hypothesis is also consistent with the very low debt-to-equity ratios traditionally observed for this industry.[22]

In the current study, we therefore include cash flow availability as another determinant variable of drug R&D investment. Because the dependent variable in our analysis is research intensity, the cash flow variable is also deflated by firm sales.[23] Hence, we are testing the hypothesis that a firm's research intensity is positively related to its (lagged) cash flow margin. The trend over time in this cash flow margin variable for our aggregate ten-firm sample is shown in figure 3.

Basic Model Specification. The basic model that is to be estimated in our regression analysis for the 1962 to 1975 period is therefore the linear functional form of the following equation:

$$RDS_{it} = f(NR_{it}, DVR_i, CFM_{it}, PC_{it}) \tag{3}$$

where the variables are defined as follows:

RDS_{it} = research and development expenditures divided by sales for the ith firm in year t

NR_{it} = index of past R&D success for ith firm in year t—in particular, it equals sales of firm's new product introductions, during first three years of product's commercial life, for all its introductions in years $t = 0, -1, \ldots, 4$, divided by R&D expenditures in year $t - 2$

DVR_i = a Herfindahl-type index of ith firm's diversification that equals $1 - \Sigma S_j^2$ where S_j = fraction of firm's ethical drugs sales in jth class, calculated at a midpoint year of the sample

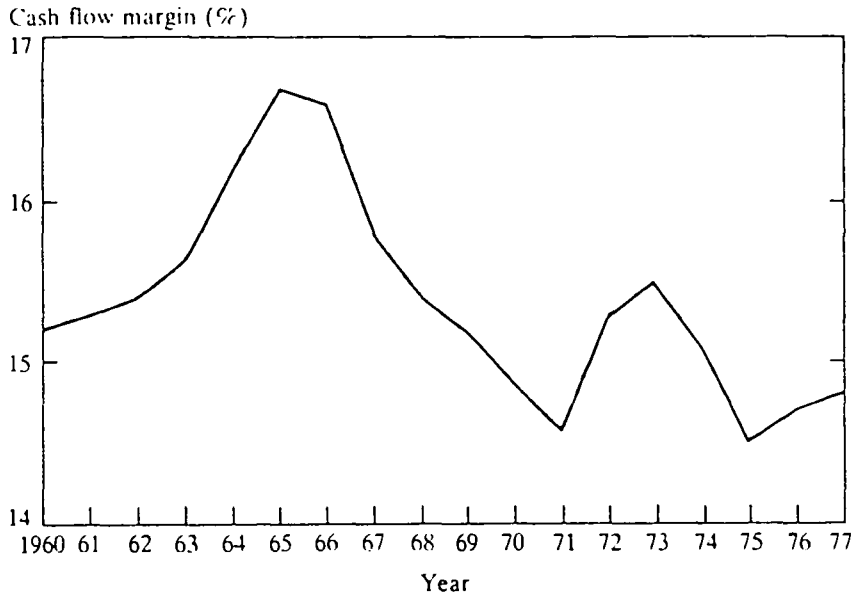
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[22] Stewart Myers argues that firms that tend to invest in assets that take a relatively long term to realize returns and are not easily salable (i.e., R&D as opposed to plant and equipment) are less likely to finance with debt instruments. See Stewart Myers, "Determinants of Corporate Borrowing," *Journal of Financial Economics*, vol. 5 (November 1977), pp. 147–75.

[23] By expressing these variables as intensity measures or size-deflated ratio variables, one also avoids the econometric problem of heteroscedasticity that is generally present in cross-sectional models estimated on absolute values.

FIGURE 3

TIME TREND IN CASH FLOW MARGIN FOR AGGREGATE SAMPLE



CFM_{it} = cash flow margin for ith firm in year t—in particular, it equals lagged profits after taxes plus depreciation divided by sales

PC_{it} = percentage of ith firm's total sales accounted for by ethical drug sales during year t

This is essentially the same structural model previously estimated by Grabowski for the 1959 to 1962 period. In the present analysis, however, we have constructed the past R&D success as well as the diversification variables in a conceptually superior form. The percentage of firm's sales accounted for by pharmaceuticals has also been included as a control variable to take account of the fact that firms have secondary, but nonsignificant, operations in other industries that will affect their overall research intensity.[24]

Several variants of this basic equation will also be estimated and discussed in the next section on empirical results.

[24] Because the pharmaceutical industry is among the most research-intensive sectors, diversification to other product areas generally implies lower overall firm research intensity. Hence, a positive coefficient is expected for the *PC* control variable in this regression equation.

Empirical Results

In table 1, we present the linear regression coefficient estimates for the model specified in equation (3). The coefficients are estimated on the pooled sample for the ten pharmaceutical firms taken over the entire fourteen-year period 1962–1975 and also for the two seven-year subintervals, 1962–1968 and 1969–1975.

As in the earlier study, both the cash flow and the R&D productivity variables are positive and statistically significant at normal confidence intervals. The diversification variable takes on the expected positive sign. It is statistically significant, however, only at the 10 percent level for the fourteen-year period and insignificant in the subinterval equations. Finally, the variable indicating the percentage of firm sales volume accounted for by pharmaceuticals, which has been added to present specification as an additional control factor, also has the expected positive coefficient and is statistically significant in all cases.

The present set of estimates is very similar in character to the previously published results. Thus, the model appears to be quite robust.

TABLE 1

LINEAR REGRESSIONS EXPLAINING R&D/SALES RATIOS FOR TEN PHARMACEUTICAL FIRMS

Equation Number	*Intercept*	*CFM*	*NR*	*DVR*	*PC*	R^2/F	*Period*
(1–1)	−.051	.268	.019	.045	.063	.49/32.6	1962–1975
	(−1.86)	(6.07)	(3.80)	(1.73)	(5.11)		
(1–2)	−.005	.224	.015		.064	.48/41.9	1962–1975
	(−.73)	(6.16)	(3.36)		(5.18)		
(1–3)	−.057	.282	.016	.035	.084	.53/18.9	1962–1968
	(−1.36)	(4.38)	(2.49)	(.88)	(5.01)		
(1–4)	−.021	.249	.013		.085	.53/25.1	1962–1968
	(−1.81)	(4.76)	(2.45)		(5.10)		
(1–5)	−.033	.255	.029	.042	.041	.44/13.1	1969–1975
	(−.85)	(3.81)	(1.96)	(1.09)	(2.18)		
(1–6)	.007	.209	.030		.043	.43/17.1	1969–1975
	(.72)	(4.01)	(2.01)		(2.30)		

NOTE: *t*-statistics are given in parentheses; *CFM* (cash flow margin) = profits after taxes plus depreciation divided by sales, all lagged two years; *NR* = sum of *NPS* (*t*) for $t = 0, -1, -2, -3, -4$, divided by R&D expenditures in $t-2$, where *NPS*(*t*) = sales of new chemical entities introduced in year t in $t+1$, $t+2$, and $t+3$; *DVR* = index of diversification, which equals $1 - \Sigma s_i^2$, where s_i = share of prescriptions in ith class; *PC* = percentage of total firm sales accounted for by pharmaceutical sales.

Source: See appendix.

Moreover, its robustness over the current fourteen-year sample period is illustrated by the high degree of stability in the coefficients when estimated over the two seven-year subintervals. Using the standard F-test devised by Chow, we were unable to reject the hypothesis that the estimated coefficients were identical over the two periods (with $F = 1.10$).[25]

Because the formulation of the R&D productivity variable as a five-year moving average of a firm's prior NCE introductions is quite arbitrary, we experimented with several variants of this variable. First, we tried constructing this variable as a moving average using shorter time intervals (three and four years) but found that the five-year period performed somewhat better from a statistical standpoint. Second, we estimated this variable using an Almon polynomial distributed lag approach. This relaxes the constraint of a uniform lag structure implicit in our moving average formulation. The pooled samples used in the present analysis do not provide the best basis for discriminating between alternative lag structures because of the short time intervals involved here. The general pattern emerging from the Almon lags estimates, however, indicated a declining lag structure as one moves backward in time. This is a plausible lag structure for this variable. Nevertheless, the five-year moving average formulation, which uses up fewer degrees of freedom, performs about as well from the standpoint of explanatory power. It therefore appears to be a reasonable formulation of this variable in the present situation.

We also investigated some alternative lag formulations for the cash flow margin variable. In particular, we estimated equation (3) with the cash flow margin separately lagged zero, one, and two periods and also with all of these lagged terms put simultaneously in one equation. We found all three lag specifications had similar coefficients when entered separately, but the two-period lag performed marginally better in terms of statistical significance. The two-period lag also dominated statistically when all three lag terms were entered simultaneously; so this particular lag term was selected for our summary results in table 1.[26]

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[25] We should also observe that because the data involve a pooling of cross sections, the usual Durbin-Watson coefficient cannot be used to test autocorrelation. Theoretically, an estimate of the autocorrelation parameter for the error terms of each of the ten firms might be appropriate, yielding ten parameters to be used in transforming the data. A visual examination of the residuals, however, indicated that serial correlation did not appear to be a problem in the present situation. This contention was given further support by estimating regressions using observations for the years 1962, 1969, and 1975 only for each firm. The coefficients were quite close to those in table 1.

[26] There is such a high degree of correlation between these lag terms in our pooled cross-sectional sample that attempts to estimate more complex lag structures were not feasible. Nevertheless, it is interesting to note that when we entered these lag terms simultaneously, the sum of the regression coefficients was approximately equal to the value observed when the lag terms were estimated separately.

It is interesting to point out that the coefficient estimates for the cash flow margin variable in table 1, and also for the alternative lag term formulations, are quite close to the 0.24 coefficient estimate on this variable in Grabowski's early study. These estimates imply that a $1 million increase (decrease) in cash flow will lead approximately to a quarter-million increase (decrease) in R&D expenditures. Moreover, estimates on the magnitude of this coefficient have remained stable for an extensive period in which a number of important structural changes have occurred in the industry.

We should emphasize at this point that the effects on R&D investment of the past R&D success and cash flow variables are interrelated. In particular, past R&D success influences not only a firm's expected future returns to R&D but also its level of cash flow availability to undertake R&D. We investigated this point by estimating distributed lag relations between the cash flow margin and past R&D productivity measures. We found a statistically significant relation between these variables that was characterized by relatively long mean lags—namely, seven to nine years. Hence, there is a long-term interactive relation between these variables and R&D. Specifically, if a firm's research productivity remains low for a number of years, its cash flow will also eventually be significantly affected, and there will be further negative impacts on its R&D investment.[27]

The diversification variable was not statistically significant in the present analysis, in contrast with the earlier study. One problem with this variable in the current case is that all ten firms turned out to be very diversified across ethical drug classes. Hence, there is not much sample variation to investigate this hypothesis.[28] As discussed above, this variable has also performed in a mixed fashion in several related studies by other investigators.

In addition to the linear regression specification given in table 1, we also estimated a logarithmic specification of this model. This specification was confronted by a basic problem not applicable to the linear case—namely, the presence of some zero observations in the R&D productivity variables. We circumvented this problem by the standard

[27] The observed coefficient on the cash flow variable can also be expected to be altered, over the long run, by the firm's expected return to R&D. Whereas we have estimated the parameter using a linear specification over the relatively short period under study, a firm's investment allocations from its cash flow should change in accordance with its long-run perceptions of relative returns from different investment activities. Thus, if a firm were to become convinced over time that the expected returns from R&D were generally going to remain below those of other investment activities, one would also expect to see the share of cash flow devoted to R&D diminish.

[28] This point can be seen from the data presented in the appendix. The sample mean for the diversification variable is 0.84, and its coefficient of variation is only .08. Eight of the ten firms are concentrated in the narrow interval from 0.83 to 0.91.

(but ad hoc) procedure of assigning arbitrary low values to these zero observations. Two firms had so many zero values that they were omitted from the analysis. Nevertheless, the resulting estimates were generally supportive of the linear equation specification, in the sense that both the cash flow and the past R&D success variables were statistically significant.

In sum, the empirical results presented here generally confirm the investment model presented in the first part of the paper. They are also broadly consistent with Grabowski's empirical findings for the earlier 1959 to 1962 period.

Conclusions and Implications

As noted at the outset, drug innovation has been characterized by a number of adverse trends over the last two decades, including higher research costs and development times and fewer new product introductions. Several researchers have formally investigated the private rate of return to pharmaceutical R&D over this period, and they have generally found low average returns on R&D. Nonetheless, these rate-of-return studies also give rise to a somewhat paradoxical question: Why have drug firms continued to maintain such high levels of investment in R&D if the expected returns are as low as these studies seem to indicate?

The analysis of R&D determinants undertaken here provides some insights into this question. Our regression results indicate that firms do react to lower realized returns on R&D in the expected manner, but the adjustment process is a very gradual one with relatively long lags. This is perhaps not surprising, given the fact that new product innovation has historically been a central and quite profitable mode of competition for the industry dating back to the pre–World War II era. Moreover, the high degree of uncertainty and serendipity that characterizes discovery research and early clinical development trials in pharmaceuticals is also consistent with a cautious response to lower realized returns on past R&D efforts. Future returns may be very different from current or past returns, especially for individual firms. Although the major drug firms have not generally responded to lower returns by decreasing the *absolute* size of their R&D personnel and other inputs, the research intensities of these firms have been gradually declining over the past two decades, and there have been increased investment and diversification in nonpharmaceutical areas.

Our regression results also indicate that the general availability of internal funds, or cash flow, is another important factor that influenced R&D behavior over this period. We found a statistically significant, stable positive relation between firm research intensities and their lagged

cash flow margins. Moreover, these margins were relatively high over much of the period under study as a result of the record number of products introduced in the 1950s. These products remained under patent protection and generated high cash flows for the innovating firm well into the 1960s, and even 1970s, in many cases.[29]

We can therefore infer from our analysis that the relatively high levels of internal cash flow over much of the post-1962 period operated to moderate the observed decline in firm research intensities. Whether this will be the case in the future, however, is not at all obvious. Industry cash flow margins are now well below the peak of earlier years. Furthermore, there are a number of institutional and structural changes taking place in the industry that are likely to have negative effects on both the expected returns to R&D and the cash flow margins of the research-intensive firms in the future. These changes, which we have analyzed elsewhere, include much shorter effective patent lives on current new product introductions,[30] as well as the likelihood of increased competition from generic products in the postpatent period as a result of the new state substitution laws and the maximum-allowable-cost program on government purchases of drugs.[31]

Should policy makers be concerned about declining research intensity in the pharmaceutical industry and the prospect that such trends may accelerate if the private returns on R&D remain low? The answer to this question depends on whether current levels of private R&D expenditures are too high or too low from the perspective of overall *social* benefits and costs. The positive analysis of R&D behavior undertaken here does not directly address this question.

We might close, however, by noting that it is generally presumed in the theoretical literature that social rates of return will usually be

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[29] This general point is illustrated by examining the trend on the aggregate cash flow margin for the ten firms in our sample that is plotted in figure 3. This variable was still increasing for several years into the 1960s while the level of sales per R&D input had peaked and was trending sharply downward (as reflected in the behavior of the research productivity variable in figure 2).

[30] The University of Rochester's Center for the Study of Drug Development has undertaken an analysis of average effective patent life for new introductions over recent years. They found that average patent life for an NCE introduced in 1966 was 13.8 years, but by 1977 the average patent life for an NCE had declined to 8.9 years (Martin Eisman, University of Rochester, private correspondence, 1978). The short effective patent lives on new drug products reflect the long development and regulatory approval times and the fact that a patent is normally granted several years before a typical NCE is approved for marketing.

[31] In a recently published paper, we perform a sensitivity analysis that examines the joint effect of shorter patent lives and increased substitution on the incentives for R&D: "Substitution Laws and Innovation in the Pharmaceutical Industry," *Law and Contemporary Problems*, vol. 43 (Winter-Spring 1979), pp. 43–66.

TABLE 2

DATA VALUES FOR ALL VARIABLES, 1970

Firm	*R&D/SALES*	*CFM*	*NR*	*DVR*	*PC*
Abbott	0.058	0.115	0.4	0.88	0.72
Eli Lilly	0.103	0.174	154.8	0.89	0.71
Merck	0.092	0.197	52.2	0.83	0.90
Pfizer	0.035	0.120	411.6	0.84	0.48
Robins	0.044	0.135	6.5	0.86	0.70
Schering-Plough	0.054	0.150	192.7	0.88	0.63
SmithKline	0.090	0.171	15.3	0.91	0.62
Syntex	0.119	0.301	186.1	0.63	0.74
Upjohn	0.105	0.135	205.6	0.86	0.86
Carter-Wallace	0.063	0.102	0.0	0.86	0.42

Definition of variables and sources:

- R&D/*SALES* = research and development expenditures divided by sales; obtained from Standard and Poor's Compustat Annual Data Tape.
- *CFM* (cash flow margin) = profits after taxes plus depreciation divided by sales, all lagged two years; obtained from the Compustat Tape.
- *NR* = sum of $NPS(t)$ for $t = 0, -1, -2, -3, -4$, divided by R&D expenditures in $t - 2$; where $NPS(t)$ = sales of new chemical entities introduced in year t in $t + 1$, $t + 2$, and $t + 3$. Units are normalized for descriptive purposes (see figure 2). List of new chemical entities each year obtained from Paul de Haen, *Nonproprietary Name Index*, and special reports by de Haen. All data on sales of new chemical entities obtained from Intercontinental Medical Statistics.
- *DVR* = index of diversification, which equals $1 - \Sigma s_i^2$ where s_i = share of prescriptions in ith class. This index was constructed using data from a marketing research firm, Lea Associates. In a special report for the year 1968, an analysis of pharmaceutical manufacturers was prepared in which each firm's total prescriptions were distributed among twenty-two classes (for example, infective and parasitic diseases, neoplasms, allergic disorders). Hence, *DVR* values for 1968 were assumed to hold for the entire period.
- *PC* = percentage of total firm sales accounted for by pharmaceutical sales. The value of *PC* for 1970 was obtained from NEDO Chemicals, *E.D.C. Focus on Pharmaceuticals*, September 1972. Values of *PC* for 1975 were obtained from *Scrip*, January 8, 1977. Hence, the 1970 *PC* values were applied to all prior years, and succeeding years were found by linearly interpolating between 1970 and 1975 values.

greater than private rates of return on R&D activity for a number of well-known reasons.[32] Furthermore, Mansfield et al. recently investigated this question empirically for a sample of seventeen (nonpharmaceutical) innovations and found the social rate of return on average

[32] A classic article in this regard is Kenneth Arrow's paper, in the National Bureau of Economic Research conference volume, "Economic Welfare and the Allocation of Resources to Invention," in R. Nelson, ed., *The Rate and Direction of Inventive Activity* (Princeton: Princeton University Press, 1962).

to be roughly double the private rate.[33] The case study analysis by Weisbrod and Geweke[34] to be presented later in this volume also indicates relatively high social returns to R&D. Although considerable research remains to be done in this area, these initial results suggest that policy makers should at least examine the basic factors underlying the declining levels of drug firm research intensities and innovations and should also consider possible policy options for dealing with this situation.

Data Appendix

The data used in this study were obtained from various sources, as will be described. Table 2 contains values for the variables for the year 1970 to provide the reader with an understanding of the relative magnitudes. The ten firms selected were all firms for which complete data were available for the 1962–1975 period. Generally, the unavailability of data on R&D expenditures was the primary reason that most other firms failed to be included.

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[33] Edwin Mansfield, J. Rapoport, A. Romeo, S. Wagner, and G. Beardsley, "Social and Private Rates of Return from Industrial Innovation," *Quarterly Journal of Economics*, vol. 91 (May 1977), pp. 221–40.

[34] John F. Geweke and Burton A. Weisbrod, "Some Economic Consequences of Technological Advance in Medical Care: The Case of a New Drug," herein.

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Appendix A4

A Sensitivity Analysis of Expected Profitability of Pharmaceutical R & D

Preliminary Draft

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Duke University
April 1981

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The pharamaceutical industry has been one of the most innovative industries in the U.S. over the past thirty years. However, the rate of new drug introductions in the past decade has been significantly lower than it was in the earlier post World War II period. As a result, the reasons for and social significance of this decline have been the subject of considerable attention by both policymakers and academicians.

The decline in new drug introductions has been accompanied by strong upward trends in costs, time, and risks associated with discovering and developing new drugs. As one would expect, studies of the rate of return to drug innovation have found relatively low returns (Schwartzman (1975) and Weston and Virts (1981)). It is also the case that U.S. firms are increasing their R & D expenditures in foreign countries at a faster rate than in the U.S. In fact, in real terms, U.S. R & D expenditures may be declining. One important explanation for these trends has been the increased regulatory controls of the Food and Drug Administration (FDA) which resulted from the 1962 Kefauver-Harris amendments to the Food, Drug and Cosmetic Act (Grabowski, Vernon, and Thomas (1978)). These amendments required a new drug's efficacy, as well as safety, to be demonstrated on the basis of well controlled scientific tests prior to marketing approval by the FDA.

An indirect effect of regulation has been a reduction in the effective patent life for a new drug. The reason is that the average time to develop a new chemical entity (NCE) and gain regulatory approval far exceeds the time necessary to obtain a patent. While the length of patent protection has been of secondary import historically in the drug industry, this situation appears to be changing with the repeal of antisubstitution laws (Grabowski and Vernon (1979)). That is, the antisubstitution laws made it possible for innovating firms, through strong brand loyalties, to maintain dominant market positions for their products even after patent expiration. Now, in many states, lower cost generic products that become available upon patent expiration can be substituted by pharmacists even though the physician prescribes the original brand name products.

The period of patent protection now averages only ten years or so as compared to the legal life of seventeen years. For this reason, legislative

proposals have been made to restore part or all of the patent life lost during the chemical testing and FDA review period. The objective, of course, is to stimulate innovation by increasing the expected return to pharmaceutical R & D.

Given the current interest in patent policy and its impact on the expected return to pharmaceutical R & D, we have performed a preliminary sensitivity analysis which sheds some light on the relationship between product life and profitability. Of course, the results are inadequate to support any particular product life as being the "socially optimal" patent life. Rather, the work here is intended as a first step in understanding the quantitative effects of various product lives on profitability as well as other related issues.

Based upon a number of important assumptions, we show, for example, that at a 10 percent real interest rate the average 1970-1976 new drug required 19 years to break even. At an 8 percent interest rate, 12 years would permit the firm to break even. "Breaking even" means to cover all R & D discovery and development costs in addition to production and marketing costs.

While the above paragraph refers to the average investment in drug innovation, we also show that the variance in payoffs is great and highly skewed. For example, of the 37 NCE's discovered and introduced in the U.S. in the 1970-1976 period, only 13 were able to at least cover their costs (over a 20 year life). This is true despite the fact that the average payoff to the 37 NCE's was slightly in excess of the average cost.

An interesting finding for R & D strategic decisions is the variation of profitability across therapeutic classes. Although the small numbers of NCE's in certain classes makes it dangerous to generalize, it appears that for the 1970-1976 period the anti-infective category was clearly the most profitable. The cardiovascular and anti-inflammatory drugs were apparently next in order of profitability, while the remaining classes failed, on average, to break even.

Another interesting result is the impact of reducing FDA approval time on profitability. Suppose there is no change in the amount of clinical

testing performed; however, suppose the time taken by the FDA to approve a submitted New Drug Application (NDA) is reduced from the usual 24 months to 6 months. What is the impact of this shorter approval time on profitability? We show, for one set of assumptions, that the average drug's product life necessary to break even is reduced by about five years -- from 19 years to 14 years. In other words, reducing NDA approval time by 18 months is equivalent in present value terms to adding on five years to the drug's life.

In the next section we shall review the data and assumptions used in the analysis. The concluding section consists largely of a set of figures which show our principal results.

Data and Assumptions

The primary data used in the analysis are U.S. sales and promotion expenses for NCE's introduced into the U.S. market between 1970 and 1976, and R & D costs by therapeutic class estimated by Professor Ronald W. Hansen (Hansen (1979) and Hansen (1980)). The sales and promotion data are IMS data.

Two additional important types of data were not available -- the cost of producing the NCE's after FDA approval and the net revenues resulting from sales in foreign countries. In both cases we have relied on estimates made by Celia Thomas as part of her Ph.D. dissertation at Duke University. For example, her best estimate for production costs as a fraction of sales is .30. However, because of the uncertainty about this estimate, we have also examined the effect of estimates of .20 and .40. A similar approach was taken with respect to Thomas' estimate of 1.75 as the ratio of worldwide net revenues to U.S. net revenues. That is, estimates of 1.5 and 2.0 were also used in a sensitivity analysis.

As noted above, the R & D cost estimates are based on a study by Hansen. Hansen (1979) obtained survey data from 14 pharmaceutical firms on the R & D costs for a sample of NCE's first tested in man from 1963 to 1975. The average discovery cost was $19.6 million and the average development cost was $14.1 million, for a total of $33.7 million. The $33.7 million

represents the capitalized value (at 10 percent interest and in 1967 dollars) at the date of marketing approval.

At our request, Hansen (1980) estimated the costs per NCE on a therapeutic class basis. These are the cost estimates used in this analysis, and as will be shown, reveal a rather large variation across classes. We should also note that Hansen's estimates include the costs of NCE's that enter clinical testing but are not carried to the point of NDA approval. Hence, the estimates should be interpreted as the average expected cost of discovering and developing a marketable NCE.

Of course, real R & D costs have probably been increasing over time. However, by restricting the analysis here to NCE's marketed between 1970 and 1976, we can assume that Hansen's estimates match our NCE's reasonably well without the need for further adjustments. We also note that our primary analysis pertains to 37 NCE's that were both discovered and introduced in the U.S. Some 23 additional NCE's were discovered in foreign countries and introduced in the U.S. during this period. However, only limited use was made of these 23 NCE's because Hansen's R & D cost figures clearly do not apply to foreign discoveries.

As observed above, Hansen's estimates are expressed as capitalized values at the date of marketing. For example, the capitalized expected cost of discovering and developing a cardiovascular drug at the date of marketing is $30.6 million in 1967 dollars. Because he worked with constant dollars, Hansen used real interest rates; in the example above, the interest rate is 10%. The natural measure for comparison with Hansen's cost estimate is the present value of the net revenue stream resulting from the NCE. To be consistent, of course, the net revenue stream must be deflated to 1967 dollars and discounted to the date of marketing at the same real interest rate. The ratio of present value of net revenue to capitalized R & D cost is termed the profitability index (PI) in the finance literature, and it will be the measure of expected returns used here. Clearly, a PI = 1 implies a project that just breaks even.

The formula for the PI for a particular drug is:

$$PI = \frac{1}{RD} \sum_{t=1}^{L} (S_t - P_t - mS_t) f e^{-r(t-1)}$$

where: S_t = deflated sales revenue in year t

P_t = deflated promotion expenses in year t

m = production cost as fraction of sales

f = ratio of worldwide net revenues to U.S. net revenues

r = real interest rate

L = product life

RD = capitalized value of R & D costs by therapeutic class

Table 1 below provides some general information about the data:

TABLE 1

Therapeutic Class	Hansen's R & D Cost (10%, 1967 dollars)	# of US NCE's	# foreign
A. Cardiovascular	30.6	4	1
B. Neurologic, Analgesic	36.3	6	2
C. Psycho-pharmacology	70.0	3	4
D. Metabolic, Antifertility	65.3	5	4
E. Anti-infective	19.1	12	6
F. Anti-inflammatory	68.3	4	1
G. Gastro-intestinal, Respiratory, Surgery	28.5	3	5
	Total	37	23

Actual sales and promotion data were available for ten years for NCE's introduced in 1970, for nine years for 1971 NCE's, . . ., and for only four years for 1976 NCE's.* Hence, projections into the future were necessary and were made in two steps. In step one, sales and promotion expenses were projected out to the tenth year after introduction for all NCE's based

*The numbers of NCE's by year of introduction are as follows: 1970(4), 1971(7), 1972(3), 1973(3), 1974(7), 1975(7), and 1976(6).

on the average growth rate experience for a sample of 55 NCE's with introduction dates extending back into the mid-1960's. No projection was necessary for 1970 NCE's while 1976 NCE's required a six-year extrapolation. In step two, sales and promotion expenses were projected beyond the tenth year by assuming that nominal dollar increases would be exactly offset by inflation. In other words, real dollar sales and promotion were held constant at their tenth year values.

Results of the Analysis

The figures appended at the end of this section are intended to be largely self-explanatory. The basic relationship is that between the PI and the Product Life. For the analysis here we have simply set the net revenue stream equal to zero at the end of the assumed Product Life. More reasonable assumptions about the time pattern of net revenues will be incorporated in later work. For example, we might assume that upon patent expiration there may be an immediate impact of generic competition, but that market share diminishes gradually.

Figure 1 shows the PI versus Product Life relationship for four alternative real interest rates (cost of capital). As stated the PI variable is a weighted average PI for the 37 NCE's, where the weights applied are the R & D costs. The fraction of production cost to sales is held at .30 and the ratio of world net revenues to U.S. net revenues is taken to be 1.75. If we assume that the appropriate real cost of capital (inclusive of a risk premium) is 10 percent, then the product life necessary to break even on average is 19 years. An 8 percent cost of capital reduces the break even life to 12 years.

Since the assumptions about production costs and foreign sales are uncertain, Figure 1 was prepared to reflect this uncertainty. Given the subjective probability distributions shown in Figure 2, a band of one standard deviation in width about the weighted average PI is presented. The one standard deviation band brackets the break even life between approximately 14 and 30 years.

More specifically, we assume that there is a 50 percent chance that the

ratio of production cost to sales is .3, and a 25 percent chance each that the ratio is .2 or .4. Similarly, we assume that the ratio of world net revenues to U.S. net revenues is 1.75 with a .5 probability, and either 1.5 or 2.0 with probabilities of .25 each. These probability distributions give rise to a probability distribution of the weighted average PI, and the one standard deviation band for this distribution is shown by the dashed lines in Figure 2.

Figure 3A focuses on a different type of uncertainty. It shows a frequency distribution of the PI's of the 37 NCE's. Clearly, the distribution is highly skewed -- with only 13 of the 37 projects breaking even or better. The letters are codes for the innovating firms and indicate that firm "A" had three "winners," while the remaining ten were spread over ten different firms. Figure 3B is the same figure except that the letters are codes for the therapeutic classes of the 13 NCE's that break even or better.

Of course, the 24 NCE's that have PI's of less than unity fail to break even only in the sense of not covering fully allocated discovery and development costs, including a share of the costs of drugs that never make it to the point of NDA submission. This is the nature of Hansen's R & D cost estimates. If we consider only the development costs of a single NCE (neglecting discovery costs and attrition costs), the capitalized R & D costs decline substantially. For comparison with the values in Table 1, they range between $1 million and $2.3 million. As one would expect, substituting these lower R & D figures into the PI calculations lead to a larger number of "break even" NCE's. In particular, the number of NCE's that fail to cover their own development costs is only seven. Hence, in only 7 of 37 cases were firms worse off by carrying through the projects to marketing.

Figures 4A and 4B indicate that PI's by therapeutic class. Figure 4A shows the weighted average PI's while Figure 4B shows the median PI's. One striking result is that the anti-infective class average PI is far above unity while the converse is true for the median PI. This is easily explained

by reference to Figure 3B which shows that one anti-infective NCE had a PI of about 22, far above that of any other NCE in the sample. The median PI is, of course, unaffected by this "outlier" while the average is strongly affected.

Figure 5 is a comparison of the 37 U.S. discoveries versus the 23 foreign discoveries. The incorrect assumption that the foreign NCE's had the same R & D costs as the U.S. discoveries is made for purposes of the comparison. Perhaps the main message is simply that the average sales of U.S. discoveries exceeds that of foreign ones.

The final figure, Figure 6, shows the effect of reductions in NDA approval times. As discussed earlier, reducing NDA approval time by 18 months is equivalent in present value terms to adding on five years to the drug's life. That is, the break even life with no change in approval time is 19 years, but with an 18 month reduction the life is reduced to 14 years.

Figure 1 WEIGHTED AVERAGE P.I. VS. LIFE FOR VARIOUS Interest Rates
(weights are R+D Costs)

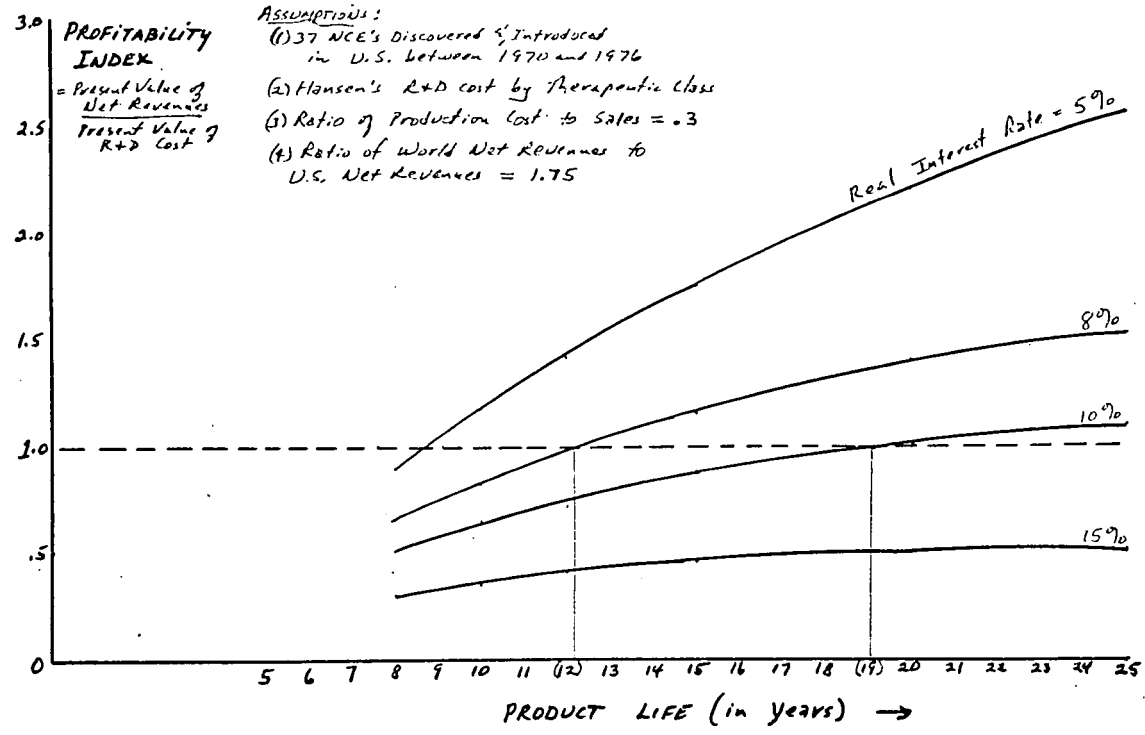


Figure 2. WEIGHTED AVERAGE P.I. Vs. LIFE WITH UNCERTAINTY BANDS
(UNCERTAINTY DUE TO ESTIMATES OF M, F)

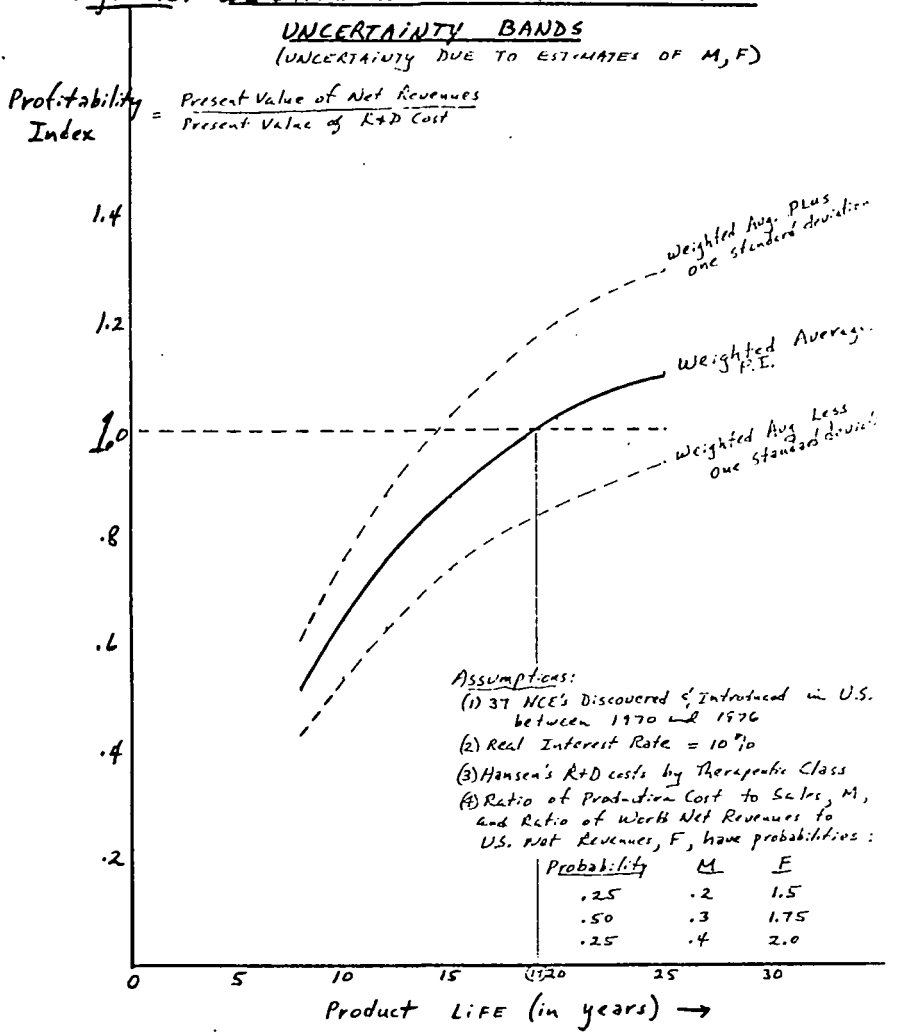
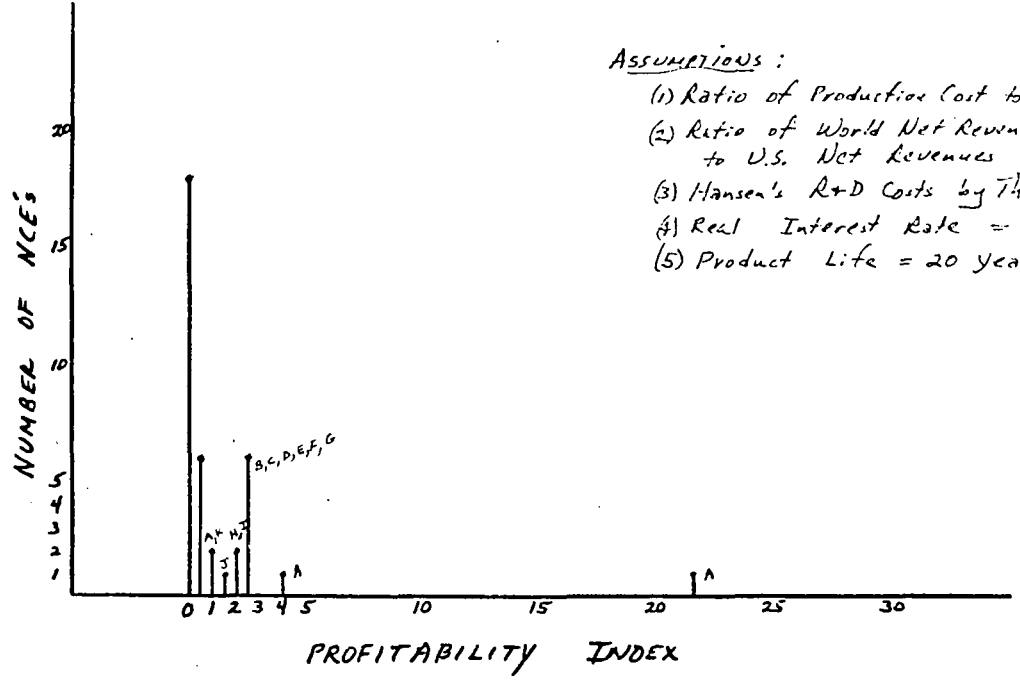


FIGURE 3A DISTRIBUTION OF P.I.'s OF 37 NCE's 1970 - 1976

(LETTERS INDICATE FIRMS INTRODUCING THE 13 NCE's WITH P.I.'s ≥ 1)

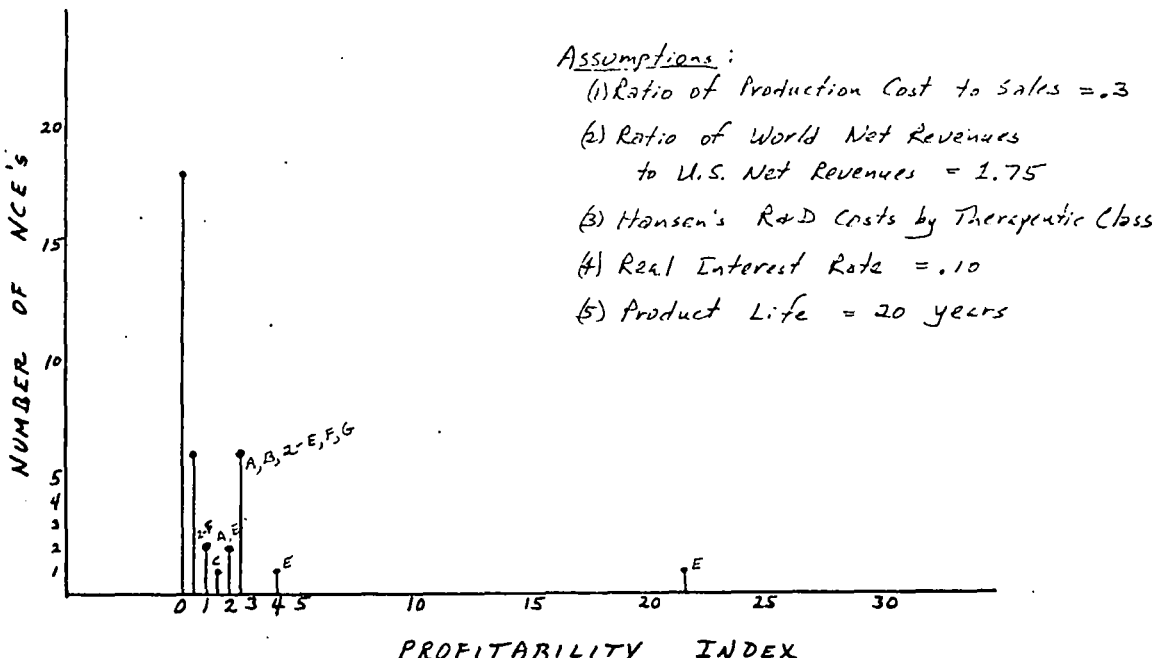


Assumptions:

(1) Ratio of Production Cost to Sales = .3
(2) Ratio of World Net Revenues to U.S. Net Revenues = 1.75
(3) Hansen's R+D Costs by Therapeutic Class
(4) Real Interest Rate = .10
(5) Product Life = 20 years

FIGURE 3B DISTRIBUTION OF PI's OF 37 NCE's 1970-1976

(LETTERS INDICATE THERAPEUTIC CLASSES OF 13 NCE's WITH P.I.'s ≥ 1. FOR IDENTITY OF CLASS, SEE Table 1)



Assumptions:

(1) Ratio of Production Cost to Sales = .3

(2) Ratio of World Net Revenues to U.S. Net Revenues = 1.75

(3) Hansen's R&D Costs by Therapeutic Class

(4) Real Interest Rate = .10

(5) Product Life = 20 years

FIGURE 9A WEIGHTED AVG. P.I's Vs. LIFE FOR 7 THERAPEUTIC CLASSES 1970-1976

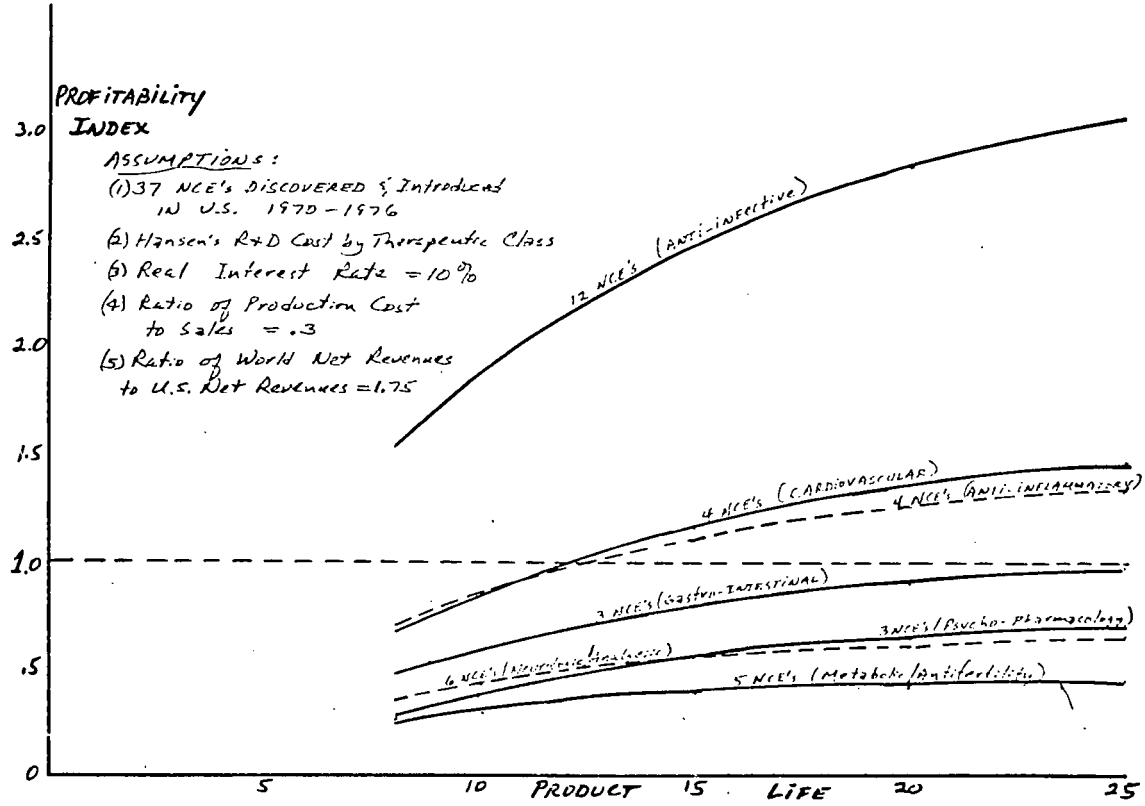


FIGURE 4B MEDIAN P.I. OF CLASS vs. LIFE FOR 7 THERAPEUTIC CLASSES 1970 - 1976

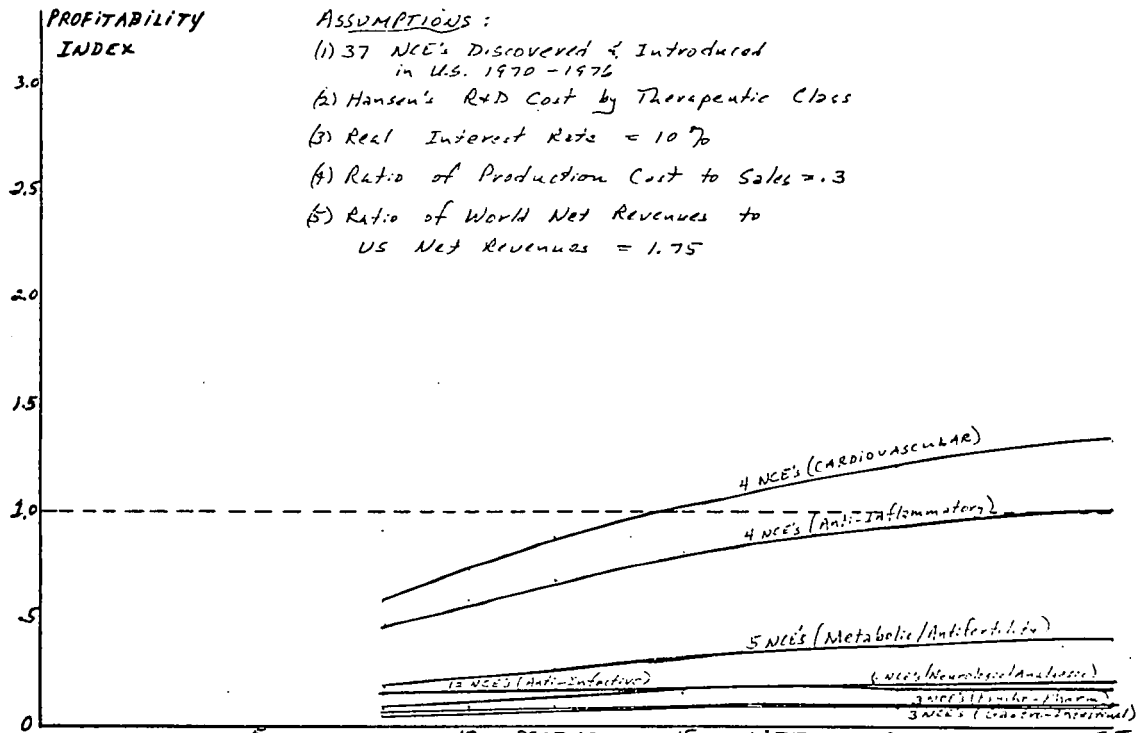


FIGURE 5 WEIGHTED AVERAGE P.I. VS. LIFE FOR U.S. DISCOVERIES AND FOREIGN DISCOVERIES

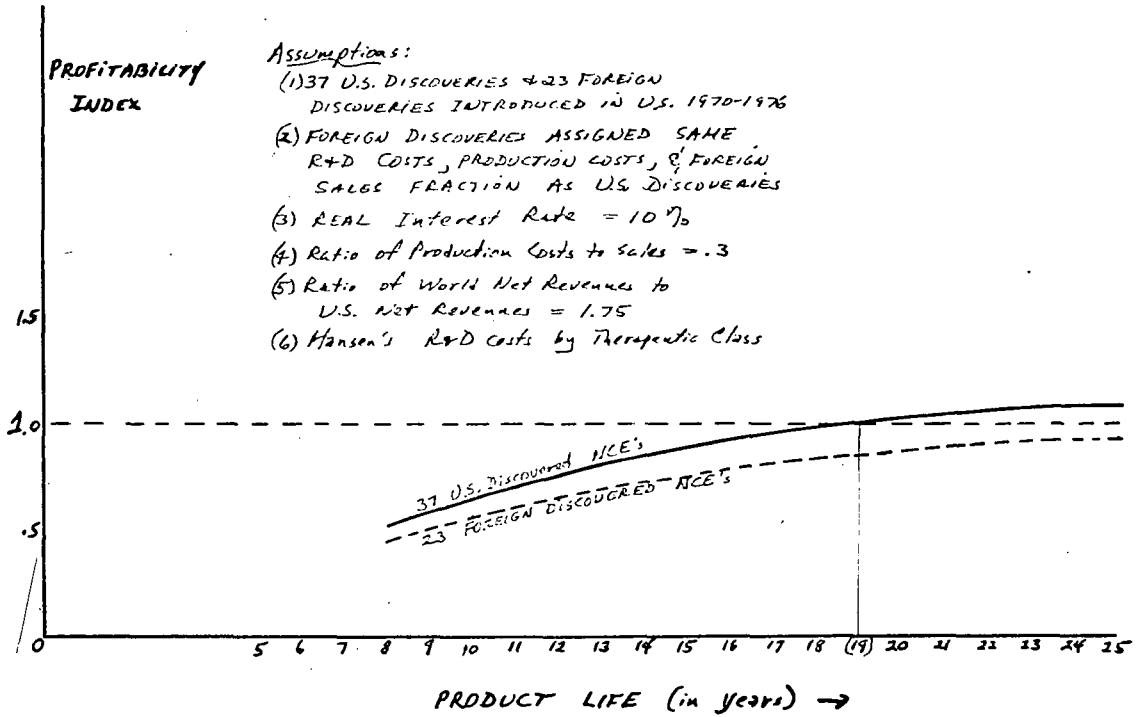
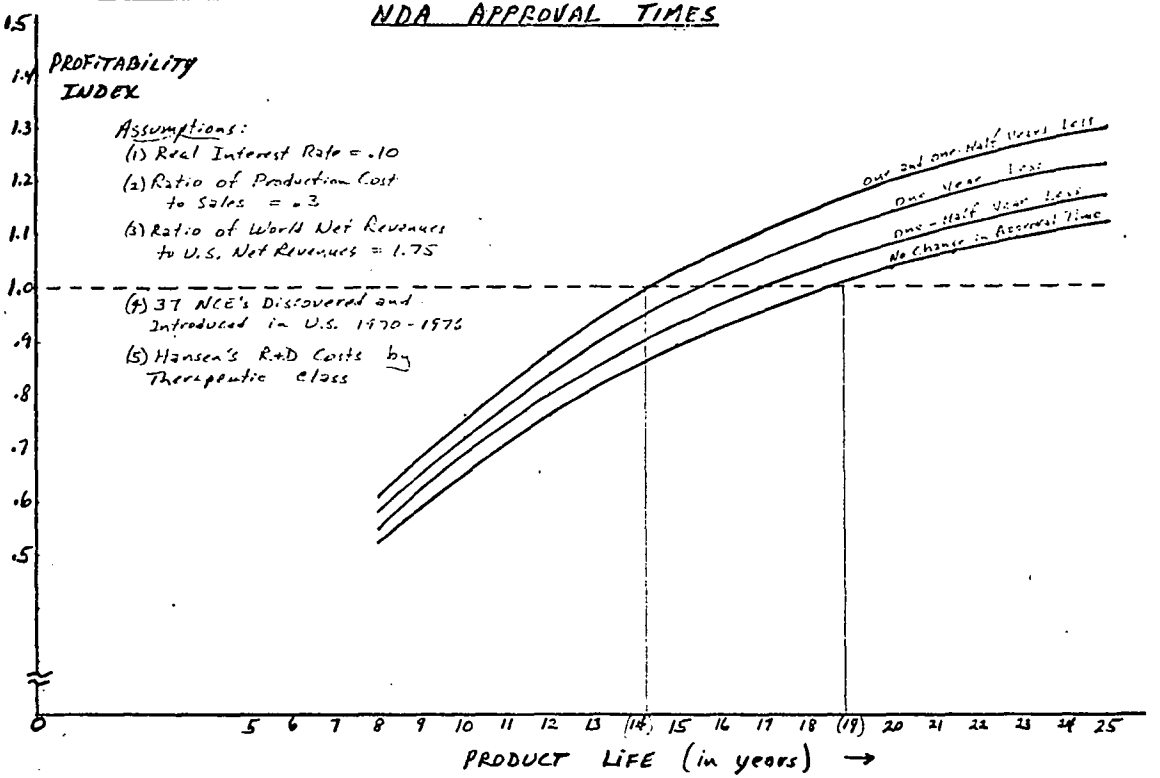


FIGURE 6 WEIGHTED AVERAGE P.I. VS. LIFE FOR ALTERNATIVE NDA APPROVAL TIMES



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Genentech, Inc.

STATEMENT OF

THOMAS D. KILEY

VICE PRESIDENT AND GENERAL COUNSEL

Mr. Chairman, my name is Tom Kiley. I am the chief legal officer of Genentech, Inc., a small California company founded just five years ago in the belief, not then widely shared, that genetic engineering technology could quickly be made to produce practical benefits in the pharmaceutical and other fields. Today, three products of our researches are already undergoing the human clinical testing that is required before marketing approval can be obtained: human insulin, human growth hormone and interferon, all made by genetically engineered microorganisms.

Although just a tiny company, Genentech thought enough of the importance of patents to its future to appear before the Supreme Court in its recent consideration of the question whether patents would be available for the new microorganisms our technology produces.[1] We appeared then in the role of amicus curiae, or "friend of the Court". We appear today as a "friend of the Congress" to again emphasize the importance of patents and of a strengthened patent incentive to the small, high technology company. When, under the umbrella of patent protection, a small company can compete on the strength of its innovative capability with larger, older and more entrenched concerns, the patent system operates to best purpose, as an essentially procompetitive mechanism.

I am no greybeard of the drug industry, nor any expert in it. For sixteen years, my experience has had to do with patents, first as an examiner of patents, then in a multi-national corporation, then for ten years in the patent trial courts, and more recently in the small company context of Genentech. Nothing in my experience has been more instructive with regard to the vital role patents play in our free enterprise system than the opportunity I have had to look at the world from the vantage point of the small, start-up company. Although surrounded by trees that cast great shade, we at Genentech are seeking our own place in the sun, and we expect that the availability of meaningful patent protection will help us do it.

We strongly endorse S.255, the Patent Term Restoration Act of 1981, as should every small company whose competitive edge lies in its innovative capabilities and whose activities must undergo regulatory review before the onset of commercialization.

My thesis is straightforward. Innovation is important. It arises most frequently in the small, entrepreneurial company context.[2] Patent term restoration will make patent protection more meaningful. More meaningful patent protection will permit small companies to flourish, and grow, where otherwise they might not. Conditions that encourage the growth of start-up companies also encourage investment in them, and therefore investment in innovation. The formation of small, innovative companies that can grow up under the shelter of patent protection only enhances competition, by increasing the number of market entrants and by the downward pressure the new products of innovation exert on the prices of older products.

The genius of the patent term restoration legislation before this Committee immediately follows from these precepts, and from the commonsense notion that what government gives with the right hand, it ought not to take away with the left.

Venture Capital and the High Technology Start-up Company

It is not surprising that most innovation arises at the level of the individual entrepreneur and in the small company context. One who would start any new enterprise needs a good idea because, at the outset, that is the only asset he has. The idea should be a new one, otherwise the start-up company will be unable to differentiate itself from established companies in the marketplace. But the new company whose principal asset is a good idea is also the company least likely to secure access to conventional financing. Most bankers don't lend on dreams. The availability of risk capital is accordingly an essential ingredient in formation of the new, innovation-intensive concern. The circumstances of Genentech's own formation are illustrative, and underline the importance of both venture capital as a source for science funding, and patent rights as an inducement for investment.

Genentech was formed in 1976. In that same year, one Nobel laureate unequivocally characterized predictions that human peptide hormones could be made in bacteria, using synthetic genes, as belonging "more in the field of science fiction than science".[3] That same year, scientists at the City of Hope National Medical Center in Duarte, California were rebuffed when they sought federal funding for just such a project. The project lacked scientific merit, they were told, and could not in any event be completed within the three years for which

funding had been sought. Genentech, with venture capital funding, made the money available in exchange for patent rights if the project succeeded. The privately funded project was completed not in three years, but rather in nine months. And in testimony before a committee of the Congress, another Nobel laureate hailed the Genentech-funded achievement as "astonishing".[4] In similar testimony, the president of the National Academy of Sciences called it a "scientific triumph of the first order".[5] The promise of patent protection induced private risk capital investment that established the credibility of the new technology, leading to all that has followed.

The Relationship of Patents to Capital Access

The availability of meaningful proprietary protection is a significant, if not indispensable, criterion for selection of new venture investments.[6] Investors are risk-takers, but absent the availability of meaningful protection for the product of innovation, the risk of investment in innovation is too great to bear. What farmer will invest in seed if the law permits others to take his crops? A new company is a fragile thing, and patents are part of its survival kit. And patents which provide the full term of protection intended by earlier Congresses become an important inducement to risk investment in research. This is particularly so where the products of that research can be sold, and the risk reward realized, only after long years of regulatory review.

Patent Term Restoration and the Small Company

We have spent millions of dollars on research and development at Genentech, and the level of those expenditures

is increasing as the company grows.[7] We have been in existence for more than five years but, owing to the recognized and understandable necessity of obtaining regulatory approvals, we have yet to sell an ounce of product to end-users. The promise of patent protection lets us raise capital to sustain the company in these dry years. By licensing a portion of that technology to others, we can also earn the revenue needed for operations on an expanded front until our first products can be sold directly. The available levels of both types of funding are, naturally, influenced by perceptions of the ultimate worth of our proprietary position. To the extent the patent reward is made more meaningful, as by restoring the full term envisioned by earlier Congresses, the opportunities for start-up companies like Genentech to continue to fund life-giving research will be enhanced.

Patents and Competition

We believe that patent term restoration will enhance competition, not diminish it.

Every opponent of patenting chooses the pejorative term "monopoly" as the cornerstone of his argument. The argument from "monopoly" overlooks a fundamental precept of the patent system. Rather than taking away from the public something it earlier enjoyed, patents produce to the public understanding, and ultimately to its own enjoyment, something the public might otherwise never have had, or had only after long years. The only "monopoly" the patentee gets is a monopoly over his own creation, and then for only a limited term. Those who endure the risk of innovation ought to receive in full measure the reward for success.

S.255 will not extend the patent for any product for which regulatory approval has been given in the past, and therefore will not influence its price in the future. And we believe enactment will lead to lower prices for the products of the future by increasing competition in two ways.

1. Competition between products. When the courts look at a monopolization charge, they first define the relevant market. They look not at monopolization of any single product, but instead at the whole constellation of different products that compete with one another because they exhibit what the judges call cross-elasticity of demand. In this philosophy, cellophane competes with wax paper, plastic wrap with both, and aluminum foil with all three. The new products of innovation, when they are better, exert downward pressure on the prices of the different but cross-elastic products that predate them. Legislation that enhances the climate for new product innovation enhances the climate for this most meaningful form of competition.

2. Competition between companies. Competition is also a function of the number of companies operating within a given field. The fewer the entrants, the less occasion there is for competition. And yet many studies have shown that since 1962 the number of firms engaged in the manufacture and distribution of pharmaceutical products has markedly declined. Some have predicted that the tendency toward market concentration will continue as a result, among other things, of the costs imposed by the regulatory environment and the inability of small companies to maintain the research and development efforts required to provide new patents.[8] But the new revolution in

biotechnology offers ground for optimism. Genentech was only the first of the dozens of new firms that have formed around this technology, all seeking a formula for survival and growth in research and in the development of a proprietary position. Restoring the full term of patents can help these new market entrants to sustain themselves. Capital is more easily raised when research and regulatory costs can be recouped from marketing revenues over the full term of an issued patent. Where the remaining patent term has not been foreshortened by regulatory delays, economics will more often justify the small company's defense of its patent (and its market) in expensive litigation brought to "break the patent", oftentimes by breaking the patent owner. And to the extent the full measure of patent protection is made available through restoration of term, start-up companies can get greater value from licenses they grant to meet interim cash needs. In every respect, the restoration of the full term of patent protection can be expected to enhance competition.

Patent Term Restoration: An Ideal Adjustment of Regulatory Mechanisms

The genius of the legislation before this Committee lies in its simplicity, flexibility and automatic adaptation to a host of different circumstances. The useful life of a patent is restored in every different case only as the period of regulatory review in that case requires. The more a new product departs from past practice, the longer will be its review period, the longer will be its patent term restoration, and the more will the patent reward be assured for those who take the greatest risk in departing from the tried and true.

But we do not believe passage of the legislation before this Committee will in any way encourage regulatory delay. The greatest incentive will remain for eliminating delays in new drug approvals: the need to get safe and effective drugs to people who are sick.

I should add that in the case of each of the new products of our research now undergoing clinical testing, our experience with the Food and Drug Administration has been encouraging. We have found that Agency both professional in its attention to its important mission and receptive to the potential of our new technology. FDA's attitude to the present time has been both forthcoming and cooperative. It is quite possible that regulatory clearance will come before any basic patent issues to Genentech.[9] Our concern is accordingly not one of focus on products now in testing, but rather on the future conditions under which our young company and others like it will seek their full maturity.

The Need for Patent Term Restoration Relating to Processes

S.255 makes no provision for restoring the term of patents on new processes for making old substances. Although a limited number of new substances have already been produced by gene splicing techniques, by far the greatest efforts to date have been expended in creating practical means for the industrial production of substances that are old in the sense that they are already made in the body. Until Genentech devised a process for biosynthetic production of human insulin that substance, though old and of known composition, had never been available in quantities suitable for the treatment of diabetics.[10] Until Genentech devised a method for the

biosynthetic production of human interferon that substance, though old in nature, was available for the treatment of cancer patients only in low purity, minute quantities and at a price that effectively put it beyond reach of the people who might need it. Until Genentech devised a method for the biosynthetic production of human growth hormone, that substance, though old and of known composition, was unavailable to the great majority of children suffering from dwarfism because of critical limitations in raw material sources.[11] One can anticipate that a great number of additional materials, until now unavailable or in short supply, will become available through the development of other such methods, if the full patent incentive for such developmental work can be restored.

The present position of the Food and Drug Administration is that an old substance, even one hitherto approved for treatment when gotten from conventional sources, will be treated as a "new drug" when made by genetically engineered microorganisms.[12] If the product that FDA regards as a "new drug" is in fact old and hence cannot be encompassed within the scope of the patent, as required by Section 155(a)(1) of S.255, then the Act will not be available to restore patent term lost through the "new drug" regulatory review period that FDA will impose.

The genetic engineering example is only one of many that might be imagined. Frequently, occasion will arise for protracted regulatory review before an invention of great value can be commercially practiced, even where the invention relates not to a new thing, or a new method of using a thing, but rather to the first practical method of making that thing. Innovation in the science of making "old" things in better and

more economic ways should be encouraged to the same extent the bill in its present form would encourage the making of new things. Most particularly should this be done when regulatory agencies bid fair to treat products that are "old" in the patent sense as "new products" for purpose of regulatory review.

We believe S.255 should be amended to provide for the restoration of patent term where "old" products are subjected to regulatory review because manufactured by a new and patentable process. We believe that this can be accomplished by a minor clarifying amendment and will be pleased to provide any assistance to the Committee and its staff in developing such an amendment.

Mr. Chairman, this concludes our statement. We appreciate the opportunity to present testimony to you today on this important issue and will be pleased to respond to any questions you may have.

FOOTNOTES

1. Diamond v. Chakrabarty, 447 U.S. 303.

2. Jewkes, Sawyers and Stillerman, The Sources of Invention, St. Martins Press (1958).

3. "The Position of Applied Research in Nonindustrial Laboratories," an address by Sir Ernst Chain, May 1976, in Biotechnological Applications of Proteins and Enzymes, Zvi Bohak and Nathan Sharon, eds., Academic Press, N.Y. (1977), at 15. Sir Chain holds the Nobel Prize for Physiology and Medicine.

4. Hearings on Regulation of Recombinant DNA Research before the House Subcommittee on Science, Technology and Space, 95th Congress 1st Sess. 55 (1977). (Testimony of Paul Berg). In 1980 Dr. Berg was awarded the Nobel Prize for Chemistry.

5. Testimony of Phillip Handler, id at 27.

6. Address by Thomas J. Perkins, President, National Venture Capital Association, before the San Francisco Bay Area Council Outlook Conference, January 13, 1981. The Supreme Court's confirmation of patents on genetically engineered microorganisms preceded the October 14, 1980 public offering of Genentech stock by several months. The October 14, 1980 banner of the San Francisco Examiner declared "Genentech Jolts Wall Street", a reaction that suggests the investing public agrees with Mr. Perkins.

7. Five years ago Genentech had one employee. Today it employs 230 and is seeking more.

8. F.H. McKim, "Will Your Company Survive the Economics of the '80s?" in Pharmaceutical Executive 1, 50-55 (April 1981).

9. Examination of related patent applications was suspended pending resolution of the threshold question addressed by the Supreme Court in Chakrabarty, supra n. 1.

10. Previously, only animal insulin was available to diabetics.

11. Until recently, human growth hormone could be extracted only from human remains.

12. "The statutory definition of new drug (21 USC §321(p)) is 'any drug . . . the composition of which is such that such drug is not generally recognized, among experts qualified by scientific training and experience . . . as safe and effective.' Until drugs made by recombinant DNA techniques become 'recognized [by] experts . . . as safe and effective' they will be treated as new drugs." Statement of Henry Miller, M.D., M.S., Medical Officer, Bureau of Drugs, Food and Drug Administration before the Industrial Practices Subcommittee of the Federal Interagency Advisory Committee on Recombinant DNA Research. Minutes of 4th Meeting, December 16, 1980, pp. 3-4.

STATEMENT OF SENATOR ALAN K. SIMPSON

ON PATENT RESTORATION ACT

Mr. Chairman: I am a cosponsor of this legislation, and I do want to briefly set forth my reasons for doing so. First, I am deeply concerned that the United States is losing its technological competitive advantage in world and domestic markets. The loss of this "edge" is acutely felt by many American industries, including automobiles, chemicals, and photographic equipment. In the near future business will also be facing increased foreign competition in areas that were heretofore considered exclusively American domains: pharmaceuticals, industrial chemicals, and highly sophisticated micro-miniature electronic equipment and computers. Any competitive advantage that we currently possess must be maintained; that which we have lost must be regained. The economic health of this nation depends upon it. The rebuilding of our industrial capability requires that this be done.

If inflation is ever to be brought under control, if the keystone of President Reagan's economic recovery program is to be made a reality, with inflation to be reduced to pre 1970 levels, then it is essential that new products and services that will be available at the lowest possible cost in both domestic and foreign markets be made readily available to consumers.

If these goals are to be achieved, then American industry must be encouraged to invest the billions of dollars in capital that are needed to conduct the basic research and development efforts that underlies the creation of all new products. Industry and potential investors must know that, if these vast expenditures are made, that a fair return on that capital investment will be realized. Bondholders must be assured that their massive loans will be secure, and that their risk capital will not be further jeopardized by forces beyond the control of the corporations in which they invest. To whatever extent existing policies of the federal government contribute to this climate of uncertainty, it is essential that those causes of uncertainty be removed.

The pending patent restoration legislation, of which I am a cosponsor, is one significant step in that direction. As the patent

laws currently stand, if the patent holder is required to obtain approval from one or more government agencies prior to being allowed to market its new product, the term of the patent is not suspended pending the receipt of that agency's final approval -- the patent runs on while the agency reviews. It is entirely possible that half, or more than half, of a patent's non-renewable life will run out while a regulatory agency is contemplating whether to issue its approval.

This problem is especially acute in the pharmaceutical industry, where the Food and Drug Administration has been known to require 5 to 7 years of testing and retesting, in order to satisfy itself that a new drug is safe for human use prior to allowing it onto the market. It is entirely possible that a 5 to 7 year loss of sales may well have represented the entire profit that the manufacturer might have made on that drug, since the first 10 to 12 years of sales and profits might well be needed merely to recoup research and development costs, and to repay bondholders their principal and interest.

I see no rational reason for allowing a patent term to run while the inventor is barred by other federal statutes and agencies from bringing his product to market. To me, it would seem to be only elemental fairness to suspend the running of the 17 year patent until such time as the product may finally be sold in the United States. To contend, as may some opponents of this legislation, that some sales (and thus profits) could be realized by marketing the product outside of the United States is to only shift an unfair competitive burden onto the backs of American firms. How will an American company be able to successfully compete with rival foreign products in foreign markets when their product will be attacked as "unsafe" since it has not been "approved by the U.S. Government for sale in the United States"? The principle market for many of the products that this legislation will assist will undoubtedly be within the United States. Foreign markets will be important, but they are of secondary importance. The capital for research and development, and the profits that investors are legitimately entitled to expect must be generated within this Country.

For these reasons, I urge that this patent restoration legislation, long overdue and badly needed, be enacted as swiftly as possible.

###

STATEMENT BY SENATOR EAST IN SUPPORT OF S. 255, THE "PATENT TERM RESTORATION ACT OF 1981

MR. EAST. I am pleased to be a co-sponsor of S.255, the Patent Term Restoration Act of 1981. It is a long-overdue reform that has broad support.

Under the authority of Article I, Section 8 of the U.S. Constitution to "promote the Progress of Science and useful Arts," Congress enacted laws to encourage the research and development of new products by providing the holders of all patents with 17 years of protection for their discoveries. However, some products, such as drugs and chemicals, require a lengthy approval process by the federal government to demonstrate safety and effectiveness before they can be marketed. Thus, patented products undergoing a review and approval process by a government agency are being kept out of the commercial market and are being denied part of their congressionally guaranteed 17 years of patented life protection.

As an example, it now takes, on average, seven to ten years to develop and test a pharmaceutical product. Thus, it is not unusual for a drug product to lose up to one-half of its patent life before it is approved for marketing by the Food and Drug Administration. Similarly, the Environmental Protection Agency has estimated that the patent life for chemical products has been reduced to about 12 years.

To correct this inequity, the Patent Term Restoration Act simply would restore the patent life that has been consumed during a particular product's review and approval process. Specifically, the bill directs that a "regulatory review" period be calculated for each product that under-

goes federal pre-clearance procedures and that an equal amount of time be restored to that product's patent, with a maximum restoration period of seven years.

Passage of the bill would restore fundamental fairness by fulfilling the intent of Congress that all inventions be accorded equal and adequate protection. The bill would also help stimulate investment in the research and development of products such as drugs and chemicals that require lengthy governmental approval. Increasing such incentives will help stimulate the flow of new and improved products to the public. In the health area, for example, the bill will encourage the development of better medicines which often obviate the need for more costly forms of therapy, such as surgery or hospitalization.

The bill that I am supporting would in no way affect our strong commitment to the public that only safe products are placed on the market. Yet it will alleviate the inadvertent effect that pre-market testing and regulatory review requirements have had on the patent system to the detriment of innovation.

One of the greatest challenges we face in the 97th Congress is to find ways to revitalize the American economy. Restoration of the incentive to innovate and create should be one of our principal objectives in this revitalization effort. S. 255 is a simple, equitable, and cost-effective means to achieve this goal and should be a priority item on our legislative agenda. It is therefore my hope that the Committee on the Judiciary and the full Senate will promptly approve this bill.

APPENDIX--A

Question submitted by Senator Grassley for each witness at the Judiciary Committee hearing on patent term restoration:

S. 255 provides a regulatory review period to be calculated for each product and then an equal amount of time is to be added to the life of that product's patent. In your opinion, when should their regulatory review period begin and when should it end?

PHARMACEUTICAL MANUFACTURERS Association

LEWIS A. ENGMAN
PRESIDENT

1155 FIFTEENTH STREET, N.W.
WASHINGTON, D.C. 20005
AREA CODE 202-463-2020

May 12, 1981

The Honorable Charles McC. Mathias, Jr.
United States Senator
Committee on the Judiciary
United States Senate
Washington, D. C. 20510

Dear Senator Mathias:

Thank you for your recent letter regarding the April 30th hearings you chaired on patent term restoration. I appreciate your giving PMA the opportunity to testify and graciously rearranging the witness schedule to permit me to fulfill a prior commitment. I too look forward to continuing to work under your leadership on this issue.

I believe I responded directly to Senator Grassley during the hearings regarding the question enclosed in your letter, but I am taking the liberty of attaching a similar response.

Best wishes,

Sincerely,

Lew Engman

Lewis A. Engman

Attachment

PMA supports the regulatory review period specified in the bill. With respect to drugs, the regulatory review period generally would begin with the filing of the Investigational New Drug (IND) application with the Food and Drug Administration. This is appropriate since the IND filing marks the beginning of basic clinical testing in humans. The type, design, and extent of this human testing is determined basically by the FDA, not the manufacturer. Moreover such testing is effectively monitored by the FDA from the time the chemical compound is first introduced into human subjects. The regulatory review period for drugs would end with the approval by the Food and Drug Administration of the new drug for marketing (NDA approval).

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

11 MAY 1981

Honorable Charles McC. Mathias, Jr.
United States Senate
Washington, D.C. 20515

Dear Senator Mathias:

Thank you for your kind letter of May 1, 1981, in which you also enclosed a question posed by Senator Grassley at the recent Judiciary Committee hearing on S. 255, the Patent Restoration Act of 1981. Specifically, the Senator asked for the opinions of all witnesses regarding the length of the regulatory review period upon which an extension of the patent term should be based. In general, we support the approach adopted by S. 255, which defines the regulatory review period upon which the patent term is restored as that period commencing on the date on which the patentee initiates certain actions pursuant to a federal statute or regulation and ending on the date on which such review is completed.

Certain witnesses at the hearing suggested that the compensable period equal the amount of time spent in testing and analysis plus the amount of time spent in actual agency review, rather than the period which runs from the initiation of any testing to the end of the review period. We are concerned that efforts to achieve too precise and too exact a term measurement would have undesirable effects. Patentees would be burdened with additional record keeping and unnecessary paper work. The Patent and Trademark Office might be forced to institute an investigatory system for the purpose of determining precisely how long an extension should be granted. Disagreements on exactly what time interval should or should not be ccunted toward the restoration period could only result in additional administrative burdens without any real benefit to the public. Further, efforts to achieve too precise a term for extension could also lead to uncertainties as to whether a particular time period should have been taken into consideration, thereby detracting from the otherwise commendable purpose of the bill.

Some witnesses at the hearing voiced their concern with respect to the possibility that companies might attempt to extend the patent period in an unwarranted fashion simply by conducting short term tests as soon as the product was patented, and then delaying any attempt to market such product. In our opinion, patentees have strong incentives not to delay the obtaining of market approval of their product, as there is always the possibility of a competitor's introducing a similar or superior product. Market delay by the patentee may result in serious competitive problems to him, especially if another used the patentee's delay to establish a market for his own product. Although we do not foresee any intentional delay by patentees as a result of patent term restoration under the bill, any abuse of this nature could well be taken into consideration in a judicial proceeding dealing either with the adjustment of the patent term or with damages in an infringement action.

I hope this responds fully to the question Senator Grassley posed at the hearing. I appreciate the opportunity to have appeared as a witness before you, and should you have any further questions, please do not hesitate to call on me.

Sincerely,

Rene D. Tegtmeyer
Acting Commissioner of Patents
and Trademarks

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
THE ADMINISTRATOR

JUN 0 4 1981

Honorable Charles McC. Mathias, Jr.
United States Senate
Committee on the Judiciary
Washington, D.C. 20510

Dear Senator Mathias:

I want to thank you once again for the opportunity to appear before you on patent term restoration. I received your kind letter and am gratified that the hearing proved to be so valuable.

Enclosed is my response to the additional question submitted by Senator Grassley. I hope this aids your efforts.

Thank you again for your interest in our views on this bill. If I can be of further assistance, please contact me.

Sincerely yours,

Edwin H. Clark II
Acting Assistant Administrator
for Pesticides and Toxic
Substances

Enclosure

In my statement before the Committee, I outlined a number of specific suggestions concerning the determination of factors relating to patent term extension. As relates to the calculation of the regulatory review period, our concern is that companies might attempt to extend the patent period for no good reason by doing a simple short-term test as soon as the product is patented, and then delaying any attempt to market it. To avoid such non-beneficial trade constraints, we would suggest that the compensable period equal the amount of time spent in testing and analysis plus the amount of time spent in the actual Agency review period, rather than a period which runs from the initiation of any testing to the end of the review period. Under our proposal any dormant time between testing and analysis and the actual agency review would not be compensable. We recognize that this comment does not directly affect our programs, and only in unusual cases would the suggested change have any health or environmental impacts. We also recognize that the concern this comment addresses would be less critical if the compensation period commenced only upon initiation of significant testing. I recognize that this approach may involve significant record-keeping problems for manufacturers, the Patent and Trademark Office, and the regulatory agency responsible for pre-market clearance and may also give rise to uncertainties as to what is a "dormant" period. These concerns and others must be addressed in the bill. However, we believe that such a modification could further the beneficial purposes of the bill.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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TELEPHONE (617)253-6366

May 12, 1981

The Honorable Charles McC. Mathias, Jr.
United States Senator
United States Senate
Committee on the Judiciary
Washington, D.C. 20510

Dear Senator Mathias:

Thank you for the opportunity of testifying before the Committee relative to the Patent Term Restoration Act. I would answer Senator Grassley's comment as follows. In my opinion, the regulatory review period should begin at such point in time as the regulatory agency first acquires jurisdiction over the process and should end at such time as in the opinion of the agency the government's review has ceased. Although my expertise does not lie in the area of regulatory review procedures, I am of the opinion that in the case of drugs the review procedure should begin at the time when the applicant applies for the IND and should end after the new drug application has

been approved. Likewise, in the case of chemicals, I would suggest that the regulatory review procedure begin at the initiation of the environmental test required by the agency and should end with the grant of agency approval. As to other applications, it would seem fair to me that the review procedure should begin upon application for approval to the agency and should end when such approval is granted.

Once again, thank you for your courtesy. I enjoyed appearing before the Committee.

Very truly yours,

Arthur A. Smith, Jr.
General Counsel, O.S.P.

AAS:LB

THE JOHNS HOPKINS UNIVERSITY - BALTIMORE, MARYLAND 21218

OFFICE OF PATENT MANAGEMENT (301) 338-8137

May 6, 1981

The Honorable Charles McC. Mathias, Jr.
The United States Senate
Dirksen Senate Office Building
Washington, D.C. 20510

Re: Patent Term Restoration Act

Dear Senator Mathias:

Thank you for your letter of May 1, 1981 in connection with the above. It was my pleasure to testify on the Patent Term Restoration Act at the recent Judiciary Committee hearing.

Concerning Senator Grassley's question as to when, in my opinion, the regulatory review period should begin and end, let me comment as follows.

In the case of new drugs, it would seem reasonable for the regulatory review period to start when an application for an Investigatory New Drug (IND) is filed with the Food and Drug Administration and to end when a New Drug Application (NDA) is approved. Similarly, the regulatory review period for medical devices would commence at the time of filing for regulatory approval with the Food and Drug Administration and terminate with the grant of approval.

With regard to chemicals, I feel that the regulatory review period should begin at the start of a six month environmental test required for agency approval. The review period would end on the date approval was granted.

Let me take this opportunity to express my appreciation on behalf of Johns Hopkins for your continuing efforts in bringing

about needed changes in the patent laws. I would be pleased to continue working with you on these issues.

With all good wishes,

Sincerely yours,

Edwin T. Yates

Edwin T. Yates, Ph.D.
Patent Management Officer

ETY/sc

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION
THE MADISON BUILDING
1155 Fifteenth Street, N.W., Washington, D. C. 20005
202 • 296-1585 Cable: NAGRCHEM

May 12, 1981

The Honorable Charles McC. Mathias
United States Senate
Washington, D. C. 20510

Dear Senator Mathias:

Thank you for the opportunity to comment further on the question raised by Senator Grassley regarding the triggering device for patent restoration under S. 255. As you know, the bill contains three triggers. By far, the most appropriate one -- considering that the purpose of the bill is to restore the period of patent life during which market introduction has been delayed due to regulatory requirements -- is the initiation of the first long-term toxicological test required by regulations. That test must be of a major health or environmental nature, lasting at least six months.

In fact, the other two triggers -- the submission of an EUP or submission of all data to EPA for the initiation of the review period -- are not as appropriate in that they do not sufficiently restore lost patent life.

While I think that S. 255 is a reasonable approach to patent restoration, it is imperative in the National Agricultural Chemicals Association's view that the long-term toxicological test trigger remain in the bill. In fact, as I testified, a case could be made for treating regulated products in exactly the same way as non-regulated products, which would call for a seventeen-year patent life from the first authorization for commercial use.

In summary, I would repeat again that the present bill is a reasonable and appropriate approach and is supported enthusiastically by the National Agricultural Chemicals Association.

Yours truly,

N L Reding

Nicholas L. Reding, Chairman
NACA Board of Directors

cc: The Hon. Charles E. Grassley

American Chemical Society

DEPARTMENT OF
PUBLIC AFFAIRS

Robert G. Smerko, *Director*

1155 SIXTEENTH STREET, N.W.
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Phone (202) 872-4474

May 14, 1981
565-81

The Honorable Charles McC. Mathias, Jr.
Committee on the Judiciary
United States Senate
Washington, D.C. 20510

Dear Senator Mathias:

As requested in your letter of May 1, 1981, enclosed is the Society's comment in response to Senator Grassley's question on the timeframe for a "regulatory review period."

We appreciate the time that was given to us to address a very important issue to the scientific community. If we can be of further assistance, please do not hesitate to call upon us.

Sincerely yours,

Robert G. Smerko

Enclosure

cc: Dr. W. E. Buting
Dr. W. Marcy
Dr. A. C. Zettlemoyer

Since the various products that would be covered under S.255 are so diverse, it would be extremely difficult for the Society to generalize at what point the regulatory review period should begin. Different parameters would need to be established depending upon the category of the product involved, i.e., drugs, new chemicals, pesticides. The ACS does believe that the starting point should be a time readily determinable, verifiable and not subject to abuse.

The end point of the review period should be whenever the government agency involved grants approval for marketing or when by failure of the agency to take action within a prescribed time frame, the product becomes legally marketable.

President
Harold O. Buzzell

health industry manufacturers association **hima**

1030 15th street, nw • washington, dc 20005 • (202) 452-824

May 12, 1981

Honorable Charles McC. Mathias, Jr.
United States Senate
Washington, D.C. 20510

Dear Senator:

Thank you for your May 1 letter to Dr. Thomas Duerden, who represented the Health Industry Manufacturers Association (HIMA) at the Committee's recent hearing on patent term restoration. On behalf of Dr. Duerden and HIMA, I am providing a written response to Senator Grassley's question about calculation of the regulatory review period for purposes of patent term restoration.

We believe the regulatory review period should be calculated in the manner prescribed by the new section 155 (c) (4) that your bill, S. 255, would add to title 35 of the United States Code. This would provide reasonable patent term restoration to medical device manufacturers for periods attributable to the premarket approval process.

We appreciated the opportunity to testify at the hearing and look forward to continuing to work with you on this issue.

Sincerely,

Harold O. Buzzell

CC: Senator Grassley
Dr. Thomas Duerden

ZENITH LABORATORIES, INC. PHARMACEUTICALS

140 LeGRAND AVENUE
NORTHVALE, NEW JERSEY 07647
TELEPHONE: 201-767-1700
TELEX 135-405

OFFICE OF THE PRESIDENT

May 11, 1981

Senator Charles E. Grassley
Rayburn House Office Building
Washington, D. C. 20510

RE: Patent Restoration Bill of 1981
(S.255)

Dear Senator Grassley:

During the Patent Restoration Hearing you asked that all parties comment on using the IND filing date for starting the extension clock. From my testimony, copy attached, and the points brought out in the discussion with the Committee, you can see this is one of the critical points of concern.

Prior to joining Zenith Laboratories, I spent thirty years in a major multinational pharmaceutical company, therefore, I have an advantage of being able to view the issue from both perspectives.

The Exhibit included in my testimony points out for

four products how patent life of drugs can and will be extended prior to seventeen years. This serialization and timing of products, processes, and use patents can restrict competition. This aspect must be taken into consideration in developing a restoration bill. Senate Bill S.255 does not cover extensions for process patents but innovators can obtain coverage of new and more efficient processes which when parlayed with the proposed patent extension bill could almost provide indefinite coverage.

One of the consequences of process patents is that chemical manufacturers in the United States are precluded from producting the basic active materials used in new drugs until after all the patents have expired. As a result, the generic manufacturer, large and small, tend to be dependent on outside raw material sources for these new drugs which adversely effects the United States balance of payment.

The Bill as drafted does provide for product use extension which would provide the innovator greatly extended product life as product applications tend to develop after the product is introduced into the market for an initial FDA approved application. Under the Bill, innovators could obtain extensions on the basis of each new product application.

Our concerns of using the FDA filing date to start the extension clock can probably be best illustrated by a theoretical, but yet possible, application. Let's assume your company patents a second generation product for the same indication for which the original successful product had seven years remaining patent life. At the time you filed your patent on the second generation product your filed an IND. Having filed the IND the extension clock begins to run. The incentive to expedite the development of the product does not exist. The objective would be to gain FDA NDA approval of the second generation product just before the other products patent coverage expires. By retarding the development process you would take more years of patent protection for the second generation product.

We do believe innovators deserve sufficient time to recover their research and development investments and generate adequate profit to encourage further research. However, to do this requires the Restoration Bill give in depth consideration to the concerns we have identified, if consumer and government interest in lower cost drugs is to be satisfied.

I was somewhat surprised to receive a call on Friday asking me to submit this letter immediately since I understood that the record of the Hearing was to remain open until May 14. On that basis, I have solicited comments from other members of the Generic Pharmaceutical Industry Association and suggested that they submit their position directly to your Committee by May 14th. It is clear that this proposal needs a great deal of revision and refinement before it is right for Committee action and I would hope that the Committee would not rush it through in a manner that would prevent the careful work necessary to make it a reasonable piece of legislation that we could support.

I have responded in greater depth than what you asked, but hope it provides greater insight and help as the Committee evaluates the Bill. If there is any other way in which we can assist the Committee, we would welcome the opportunity.

Very truly yours,

ZENITH LABORATORIES, INC.

K. N. Larsen

Kenneth N. Larsen
President

QUESTION SUBMITTED BY SENATOR GRASSLEY

RESPONSE BY PUBLIC CITIZEN HEALTH RESEARCH GROUP

Question: S. 255 provides a regulatory review period to be calculated for each product and then an equal amount of time is to be added to the life of that product's patent. In your opinion, when should their regulatory review period begin and when should it end?

Response: The regulatory review period actually starts when a New Drug Application (NDA) is submitted to the Food and Drug Administration (FDA) and ends with its approval or disapproval. The animal and human testing (IND) period should not be included as part of the regulatory review process.

However--and this is a very important point--in many cases, the data submitted by the company seeking approval do not meet the requirements of the law. The NDA is then returned to the drug company or the FDA asks the company for more or better data. This time consumed by the companies should be subtracted from the regulatory review period.

The manufacturing and control review is frequently the major factor contributing to the total time utilized in the NDA approval process. The March 10, 1980 issue of the Food, Drug & Cosmetic Report (The Pink Sheet) described an example of the type of delays which can be encountered. Approval was sought for a "large volume parenteral" rated by the FDA as offering "little or no therapeutic gain." The medical and pharmacological reviews for the application were completed in six months, but the product was tied up for over three years because of recurring questions on the manufacturing and controls data and the capability of the firm to manufacture the product in accordance with good manufacturing practices.

Another factor causing delay is the tendency for the drug companies to claim more than their data can support. Negotiations concerning claims for indications and disclosure of possible adverse reactions can be protracted.

Many of these delays are not within FDA's power to control, and it is our view, that such delays should be subtracted from the time required for the regulatory review process.

Under no circumstances should the animal and clinical testing period be counted as part of the regulatory review process. These activities are under the control of the industry, which can prolong or abbreviate the process, although certain legal requirements must be fulfilled.

Our patent laws require that a patent can be issued for a product or process based on newness and usefulness. (35 U.S.C. § 101) The usefulness of a drug can only be determined after animal and clinical studies have shown it to be useful, that is, safe and effective for its claimed uses.

We, therefore, urge that all the data resulting from these studies be included in the patent, and should be considered during the approval process. The Patent Office has for many years been profligate in granting patents on drugs for which usefulness has never been demonstrated and where newness has been questionable. The result has been a large percentage--perhaps 70%--of patents having been found invalid when litigated.

Question submitted by Senator Grassley for each witness at the Judiciary Committee hearing on patent term restoration:

S. 255 provides a regulatory review period to be calculated for each product and then an equal amount of time is to be added to the life of that product's patent. In your opinion, when should their regulatory review period begin and when should it end?

In industries like pharmaceuticals where the clinical development process is subject to direct regulatory controls, I would begin the regulatory review period when the clinical process begins. Hence, the relevant regulatory review period would for pharmaceutical products begin at the time of IND filing and would end at the time of NDA approval.

This method of calculating the patent restoration period might be considered as excessively generous to the innovating firm in that some portion of the time now spent in clinical trials and for NDA approval would necessarily be incurred even if there were no premarket approval of new drugs. This is a valid point. On the other hand, from the standpoint of economic incentives, adding equal amounts of time on to the end of the patent period on a one for one basis will not fully compensate for the upfront time and resources used up in the regulatory process. This fact basically reflects the time value of money. In our sensitivity analysis on this issue, we found that a one and one-half year increase in the time necessary to get a new drug approved increases the time necessary for an innovating firm to recoup its R and D investment by a full five years. This point is discussed further in my written testimony and attached appendix A4.

A patent restoration period for new drugs equal to the total patent time lost during the IND and NDA approval phases is easy to administer. It also strikes a good balance between the opposing arguments for a shorter or longer period discussed above. Hence, I would recommend computing the patent restoration period in this manner.

Henry G. Grabowski

CHEMICAL MANUFACTURERS ASSOCIATION

May 12, 1981

ROBERT A. ROLAND
President

The Honorable Charles E. Grassley
United States Senate
Washington, D.C. 20501

Dear Senator Grassley:

At the Committee hearings on the "Patent Term Restoration Act of 1981" (S.255) you asked for comments on the "triggering" of the "Regulatory Review Period" as set forth in the bill. At this time we would like to address your questions as a supplement to our letter of April 29, 1981 to Senator Mathias and the Committee on the Judiciary in support of S.255.

These comments are submitted on behalf of the Chemical Manufacturers Association, a non-profit trade association of 196 United States and Canadian member companies who account for 90 percent of the total production capacity for basic industrial chemicals in this country.

We would like to point out that the proponents of the bill are first of all not taking issue with the government regulatory process as such, and recognize that there must be some reasonable regulation of the release for marketing of some chemicals such as pharmaceuticals and pesticides and other toxic substances. Any responsible manufacturer will undertake to supply products to the market that are made safe for the consumer and society, and to assure this they will engage in significant testing of a certain amount of the patent life that is lost to the patent owner while he conducts all the necessary testing to assure that no harm will come to the user of his products.

However, the restoration of the patent life will be of little value if the process by which it is extended will be subject to challenge due to vague and difficult to determine events. Accordingly, it is believed the proponents of the bill would rather forego some of the potential restoration time in exchange for a clear and objectively determined event that will commence running of the "Regulatory Review Period". This is evidenced by the fact that as the bill is presently drafted the patentee will have undertaken, in most all cases, considerable testing and investment of time and money before the running of the "Regulatory Review Period" is triggered.

If other less definite means are employed to trigger the running of this period, most of the proponents fear that when a patentee would want to enforce his patent during the restored period, an alleged infringer would be permitted to raise as a defense that the patent owner was not entitled to the restored period he was awarded. In other words, reasonable men could differ as to when the "Regulatory Review Period" commenced.

We therefore urge that changes in the triggering methods be resisted. Unless the triggering method can be objectively determined, the benefits of the patent restoration will be tremendously diminished because of the added burden of proof that will be heaped upon the patent owner when he tries to enforce the patent during the restored period. A shortened "Regulatory Review Period" would be preferred over a bill that would have a built-in uncertainty in its administration.

Sincerely,

Robert A. Roland
President

APPENDIX--B



National Association
of Manufacturers

Resources and Technology Department
Energy
Environmental Affairs
Natural Resources
Science & Technology

April 7, 1981

The Honorable Strom Thurmond
Chairman
Committee on Judiciary
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The National Association of Manufacturers notes with great interest the recent introduction of S.255, The Patent Term Restoration Act of 1981 by Senator Charles McC. Mathias, Jr.

The patent system provides important incentives for innovation. The patent right to exclude others for a limited time is now widely recognized as fostering, and often essential to, the large investments of time, talent and money required for research to find new products and uses for the many additional steps of innovation needed to bring a product to market.

In recent years, proper concern for the environment and health has resulted in federal legislation requiring pre-market testing and regulatory review of many products sold to the public. Increasingly stringent regulations and increased sophistication of testing procedures have made this process more complex and time-consuming.

This federal regulatory process now often consumes part of the 17-year period of protection offered by a patent on a particular product or its use. During the pre-market regulatory period no commercialization is permissible even though the patent time-clock may be "ticking". In such cases the federal review policy erodes the federal policy of encouraging innovation through patents.

The National Association of Manufacturers supports legislation which would restore the normal patent life by extending the patent term to compensate for time lost in testing and regulatory review.

Specifically the NAM supports passage of S.255 which applies this principle across-the-board to all products and uses of whatever nature that are subject to federal pre-market testing and regulatory review limits the term extension to a maximum of seven years and applies the extended patent only to the specific product approved by the regulatory review and not to the entire range of products which might be included in the original patent.

We would appreciate if our views could become part of the record of the hearings on S.255, to be chaired by Senator Mathias, on April 30, 1981.

Sincerely,

A. L. Bolton, Jr.

Archer L. Bolton, Jr.
Chairman, Committee on Innovation,
Technology and Science Policy
(Chairman--Bolton-Emerson, Inc.)

RAY E. SNYDER
PATENT LICENSING CONSULTANT
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TELEPHONE
312.263-1841

April 8, 1981

The Honorable Charles McC. Mathias, Jr.
United States Senate
Committee on the Judiciary
Washington, DC 20510

Dear Senator Mathias:

In keeping with your expressed interest in patent legislation and reform, and supplementing my earlier correspondence with you, I wish to offer the following: Enclosed is a report of the Patent Law Association of Chicago legislation committee action on S255 "Patent Term Restoration Act of 1981". The Board of Managers has not yet acted on this report, but it is offered for whatever useful information it does contain.

Your proposed bill was scrutinized in some detail as you may note from the summary of comments. One comment made was that it would be better if the regulatory agencies would clean up their act and move more promptly on the work before them. I pointed out that the regulatory agencies could care less if someone has a patent or not, or is losing valuable time because of bureaucratic delays. I feel that the universities that have worked closely with some of these regulatory agencies can more readily appreciate the merits of your proposed bill.

Overall, the committee was in favor of your bill and I believe they did make some worthwhile comments as to how it might be improved.

We sincerely appreciate the efforts of your office in trying to improve the patent system.

If I can be of further assistance in this matter, please feel free to call on me.

Very truly yours,

Ray E. Snyder

Ray E. Snyder

RES/at
Enclosure

cc: William Dominick
Clark A. McCartney
Howard Bremer

Date: April 1, 1981

TO: Arthur A. Olson
President, PLAC

FROM: William E. Dominick
Chairman, Leg. Comm.

Report of PLAC Legislation Committee Action on S.255
"Patent Term Restoration Act of 1981"

I.

1. S.255-Mathias(H.R.1937-Kastenmeier)providesthat,where a product or method requires federal approval before commercial sale, the term of the patent or those claims covering the product or method shall be extended by an amount of time equal to the "regulatory review period" required to obtain approval for such product or method, provided the product or method has been submitted to regulatory review prior to its commercial marketing and provided the patent has not expired prior to notice being given to the PTO Commissioner as required.

The length of the "regulatory review period" is said to extend from the date of initiation of the first major health or environmental test (i.e. a test which takes at least 6 months to conduct) to the date the product or method is approved or licensed for commercial marketing.

The products or methods which would be covered by the bill includes any machine, manufacturer, compositional matter or any specific method of use thereof for which U.S. Letters Patent can be granted, such as any new drug, antibiotic drug, new animal drug, device, food additive or color additive subject to FDA regulation; any human or veterinary biological product subject to Federal regulation; any pesticide subject to Federal regulation and any chemical substance or mixture subject to Federal regulation.

2. The purpose of the bill is to avoid reducing the economic value of a patent due to the inability of the owner to sell the product or use the method covered by a patent until government approval is granted and thus reducing the effective term of a patent to less than the usual 17 years.

II

1. The PLAC Legislation Committee by a small majority (8 to 7) favored in principle a bill such as S.255 with

most members indicating the bill should contain one or more provisions which would prevent abuses. Among the provisions suggested for inclusion in Bill S.255 were:

(A) Since the "regulatory review period" is not required to commence before the patent issues and could be delayed a number of years after the patent has issued, the bill should include provisions that:

(a) The "regulatory review period" should commence not later than the date the patent issues;

(b) The "regulatory review period" must be conducted with due diligence on the part of the patentee or licensee; and

(c) If the "regulatory review period" is initiated after the issue date of the patent, the time between the start of the "regulatory review period" and the issue date of the patent should be subtracted from the restoration period.

(d) The "regulatory review period" should be limited to that part of the period the Federal agency requires to process a complete application through final approval for commercial marketing which extends beyond the issue date of the patent covering the product or method.

1. The latter provision would remove the period during which test data are being gathered and would limit the term extension to only the time required for the Government Agency to process the application which takes place after the issue date of the patent.

(B) Provisions should be included in S.255 for making the procedure within the Patent Office an interparty proceedings, as by publishing for opposition, and making the Commissioner's decision appealable.

4. The portion of the bill set forth on page 8, lines 15-23 was criticized as being unclear. For example, does the proviso apply to all products or only those in paragraph "D". Either the punctuation or the paragraphing is incorrect. Clarification is required.

5. Those objecting to the Bill S.255 expressed apprehension that patentees in other art groups would find reason

for special legislation to extend the term of their patents so there would be a significant group of patents whose expiration date could not be predicted or determined with certainty.

CONCLUSION

With Bill S.255 modified to contain provisions of the foregoing type which would prevent abuses under the bill, the Committee voted as follows:

9 - For

5 - Against.

Respectfully submitted,

Wm. E. Dominick

J I Case
A Tenneco Company

700 State Street
Racine, Wisconsin 53404

TENNECO

Lawrence H. Hodges
Vice President
Technical Affairs

1981 April 23

The Honorable Strom Thurmond, Chairman
Committee on Judiciary
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

The J I Case Compoany notes with great interest the recent introduction of S.255, The Patent Term Restoration Act of 1981 by Senator Charles McC. Mathias, Jr.

The patent system provides important incentives for innovation. The patent right to exclude others for a limited time is now widely recognized as fostering, and often essential to, the large investments of time, talent and money required for research to find new products and uses for the many additional steps of innovation needed to bring a product to market.

In recent years, proper concern for the environment and health has resulted in federal legislation requiring pre-market testing and regulatory review of many products sold to the public. Increasingly stringent regulations and increased sophistication of testing procedures have made this process more complex and time-consuming.

This federal regulatory process now often consumes part of the 17-year period of protection offered by a patent on a particular product or its use. During the pre-market regulatory period no commercialization is permissible even though the patent time-clock may be "ticking." In such cases the federal review policy erodes the federal policy of encouraging innovation through patents

The J I Case Company supports legislation which would restore the normal patent life by extending the patent term to compensate for time lost in testing and regulatory review. Specifically, the J I Case Company supports passage of S.255 which applies this principle across-the-board to all products and uses of whatever nature that are subject to federal pre-market testing and regulatory review limits the term extension to a maximum of seven years and applies the extended patent only to the specific product approved by the regulatory review and not to the entire range of products which might be included in the original patent.

We would appreciate having our views become part of the record of the hearings on S. 255, to be chaired by Senator Mathias, on April 30, 1981.

Yours very truly,

Lawrence H. Hodges

AMERICAN PATENT LAW ASSOCIATION
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April 24, 1981

Senator Charles McC. Mathias
Chairman
Subcommittee on Criminal Law
Committee on the Judiciary
United States Senate
Washington, D.C.

Re: S.255, The Patent Term Restoration Act

Dear Mr. Chairman:

The American Patent Law Association (APLA) is a national society of more than 4,400 lawyers engaged in the practice of patent, trademark, copyright, licensing and related fields of law relating to commercial and intellectual property rights. APLA membership includes lawyers in private, corporate and government practice; lawyers associated with universities, small business and large business; and lawyers active both in the domestic and international transfer of technology areas.

We commend you, Mr. Chairman, for sponsoring S.255 and promptly scheduling public hearings on this legislation which will improve the effectiveness of the American patent system. The APLA membership is aware of your active interest in this bill, as well as other intellectual property matters such as improving the performance of the Patent and Trademark Office and monitoring the Law of the Sea Treaty negotiations, all of which are particularly critical to our country at this time. We are grateful and appreciative of that interest.

The APLA supports the enactment of the Patent Term Restoration Act because we believe it will serve the public interest. Our belief is not based on an analysis of the economics of the industries most directly affected, nor an analysis of the impact of the Federal regulatory process on those industries or American industry in general. Rather, we believe history teaches that an effective patent system, premised on a commercially viable 17-year patent grant, has been of immense direct benefit to our country since the patent laws were enacted by the First Congress in 1790.

In 1790 America was an agricultural country, almost totally dependent on Europe for machines and manufactures of all types. We have developed into the most successfully industrialized nation in the world. The American people now enjoy a standard of living not equalled elsewhere. However, our preeminence in productivity, innovation and technology is now in grave jeopardy. Competition in world markets in high technology products and goods produced by advanced technological methods and processes is growing stiffer for American business each year. Our declining

ability to compete is a contributing factor to our current substantial trade deficit. The trade deficit is a root cause of inflation, weakness of the dollar abroad, and the decline of American industries sensitive to domestic competition from foreign imports.

The innovation process brings new products to the marketplace. The first step of industrial innovation is research and from research flow new and improved solutions to problems. If these inventions meet our legal tests they can be protected by patents. Once protected, the incentive to develop and commercialize inventions is created. The innovation process requires the outlay of capital and manpower resources and will only be undertaken if a profit is expected. But research in the private sector is and has been declining. Twenty years ago 80% of all patents granted by the Federal government were to American inventors and 20% to foreign inventors. Today, foreign inventors are awarded 40% of all patents granted. Clearly, fewer and fewer Americans are laboring at the cutting edge of technology, while such labor is increasingly effective elsewhere in the world.

In recent years, a number of beneficial new laws have been enacted to protect the health and safety of the citizenry and the integrity of the environment. The enforcement of these laws delays or even prohibits new products from being sold or industrial processes from being employed if possibly prejudicial to the public good. In many cases these laws delay the sale or use of a patented invention. In effect, the 17-year patent term granted to the inventor for the exclusive use of his invention is thusly shortened. This raises a question of equity. The inventor has disclosed his creation to the public so that it can be used by others to build on and to advance the progress of the useful arts. In return, the Government has granted and then interfered with the full patent term. The Patent Term Restoration Act will bring the equities back in balance.

However, merely providing relief to certain inventors is not the compelling reason why this bill should be enacted into law. The Patent Term Restoration Act inevitably will stimulate the innovation process. In some cases, renewed activity will be industry-wide. In some cases, a single small business will be assisted. In all cases, the incentive to engage in research will be strengthened. All constructive legislative solutions to reverse declining industrial productivity and innovation are preeminently in the public interest.

You will undoubtedly hear criticism of this bill from those who fundamentally do not believe in the wisdom of the patent system. They view the patent grant as a monopoly which is anti-competitive and which unjustly enriches inventors. However, we submit that these views are short sighted, narrow in focus, and not well founded. Without question some inventions return profit to inventors and those who provide the financial resources to support research and bring inventions through the full innovative process to commercialization. The great inventions of Edison, Whitney, Bell, Goodyear, Eastman and many others were patented. Upon those patents, and the 17 years of exclusive use they gave, personal and corporate profits were realized. But also upon those patents entire industries were created. Upon patented lesser inventions, existing corporations can more successfully compete and small businesses can be successfully carried on. The return from successful

patents allows more research and further advances to take place. The General Electric Company began but did not end with the incandescent light bulb. Profits, the profit motive and inventions protected by patents were the ingredients of a vigorous American economy in the past and will continue to be a dominant economic force in the future.

The Patent Term Restoration Act solves the recent and inadvertent problem caused by the operation of certain Federal laws and regulations conflicting with the purpose of the patent laws. We strongly urge that it be enacted.

Sincerely,

George W. Whitney
President

Arthur A. Olson, Jr., President
77 West Washington Street, Room 2000
Chicago, Illinois 60602

The Patent Law Association of Chicago

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April 27, 1981

The Honorable Charles Mathias, Jr.
United States Senate
Committee on the Judiciary
Washington, D.C. 20510

Dear Senator Mathias:

Re: Senate Bill S-255 - Patent Term Restoration Act of 1981

As President of the Patent Law Association of Chicago, I am writing to you concerning the above bill which is presently before your sub-committee. Our Association is the oldest patent law association in the country and has approximately 750 members. The Patent Legislation Sub-committee of our Association and the Board of Managers have carefully considered Bill S-255 and approve and endorse same with the following comments:

1. A significant portion of the term of a patent covering a product or method, which requires approval of a Federal regulatory agency, can be lost due to delays in obtaining the required agency approval for the commercial exploitation in interstate commerce of such patented product or method and, as a result, the economic value of such a patent can be significantly diminished.

2. A proper means of avoiding such an inequitable reduction in the economic value of a patent

would be to restore the term of such a patent for the period during which the Federal regulatory agency takes to issue the required approval; provided, that the patentee acts with due diligence in complying with the requirements and requests of said agency relative to such approval.

3. Restoration of the term of such a patent would increase the incentive to file a patent application without delay and thereby make inventions available to the public at an earlier date.

4. It is suggested under the proposed bill that an applicant for approval by FDA might be able to cause the proceedings before such agency to become unnecessarily extended and thereby achieve a longer period of exclusivity. This possible condition, we believe, could be effectively prevented by providing that the "regulatory review" where possible, should be commenced prior to the issuance of the patent.

Our Association believes that the economic rewards obtained by getting the patented product and method into commercial sale as soon as possible will, in any event, militate against the aforementioned problem.

Respectfully submitted,

THE PATENT LAW ASSOCIATION OF CHICAGO

By: Arthur A. Olson, Jr.
Arthur A. Olson, Jr.
President

STATEMENT OF

FRANK B. PUGSLEY, CHAIRMAN

SECTION OF PATENT, TRADEMARK AND COPYRIGHT LAW

AMERICAN BAR ASSOCIATION

I am Frank B. Pugsley, Chairman of the Section of Patent, Trademark and Copyright Law of the American Bar Association. My testimony today on S. 255, the "Patent Term Restoration Act of 1981", is being presented solely on behalf of the Section of Patent, Trademark and Copyright Law and does not represent the position of the American Bar Association itself. To date, the Section's views on this specific bill have not been submitted to -- and therefore have neither been approved nor disapproved by -- the House of Delegates or Board of Governors of the ABA.

For several years now, both the Congress and the Section of Patent, Trademark and Copyright Law have been concerned about the decreasing term of effective patent life for products that may

not lawfully be sold within the United States until after they have undergone pre-marketing federal agency review. The types of products most directly affected are (i) chemical substances and pesticides which are subject to review by the Environmental Protection Agency under either the Toxic Substances Control Act or the Federal Insecticide, Fungicide, and Rodenticide Act, and (ii) human and veterinary drugs and biological products, medical devices and food and color additives which are subject to review by the Food and Drug Administration under, inter alia, the Federal Food, Drug and Cosmetic Act.

Of necessity, the regulatory review process for these products requires substantial safety and/or efficacy testing. Advances in scientific instrumentation and testing techniques over the past two decades coupled with increased regulatory requirements have resulted in the substantial dilution for these products of the 17-year patent grant contemplated by Congress. New pesticides now have, on average, 12 years of patent life remaining when marketing commences and newly approved drugs, on average, have but 9.5 years of patent term.

This dimunition of patent term because of EPA and FDA requirements was hardly contemplated by the Congress in 1836 when the first patent statute was codified -- we then had neither an EPA nor an FDA. Nor was the impact on patent term considered when Congress enacted the statutes administered by these federal agencies.

During the 95th Congress, several measures were introduced to remedy the impropriety of depriving the innovator -- through no fault of his own -- of the ability to profit from the commercial exploitation of an invention through the full 17-year life of the patent. Among the bills introduced in the 95th Congress were H.R. 8891, introduced by Congressman Rogers; H.R. 11447, introduced by Congressman Symms; and S. 2040, introduced jointly by Senators Javits and Williams.

At its 1978 Annual Meeting, the Section of Patent, Trademark and Copyright Law passed a resolution favoring in principle -- but without endorsing any specific legislation -- the granting of

an extended patent term where marketing has been delayed by governmental agency requirements. The resolution approved at the 1978 Annual Meeting provided as follows:

> RESOLVED, that the Section of Patent, Trademark and Copyright law favors in principle granting to a patent owner an extended patent term when the ability to commercially exploit a patented invention has been delayed, during the term and through no fault of the patent owner, by governmental authorities, statutes or regulations.

I should note that the Section's decision at that time not to support specific legislation was based upon the coupling in S. 2040, for example, of patent term restoration with compulsory licensing at some time during the term of the patent. It has been the longstanding position of the Section of Patent, Trademark and Copyright Law to oppose the principle of compulsory licensing as being contrary to the basic purpose of the patent system.

During the 96th Congress, patent restoration legislation was again introduced in the Senate. S. 2892 was introduced late in the second session and time did not allow for full consideration of this measure. Nonetheless, at the 1980 Annual Meeting of the Section of Patent, Trademark and Copyright Law, the following resolution was adopted which specifically supported passage of S. 2892 or similar legislation:

> RESOLVED, that the Section of Patent, Trademark and Copyright Law favors in principle granting to a patent owner an extended patent term when the ability to exploit commercially a patented invention has been delayed, during the term and through no fault of the patent owner, by governmental authorities, statutes or regulations; and specifically the Section of Patent, Trademark and Copyright Law favors enactment of S. 2892 (Bayh) 96th Congress, entitled The Patent Term Restoration Act of 1980, or similar legislation.

That resolution of support by the Section of Patent, Trademark and Copyright Law clearly encompasses S. 255 and its companion bill in the House of Representatives, H.R. 1937. The House bill, we should note, was originally introduced by Congressman Robert Kastenmeier (D-Wis) and Harold Sawyer (R-Mich) and now has 4 additional co-sponsors.

Over the years, studies of the American patent system generally have concluded that it has performed well its

Constitutional mandate "to promote the progress of science . . . by securing for limited times to . . . inventors the exclusive right to their . . . discoveries." U.S. Const. art. I, § 8, cl. 8.

Indeed, the Subcommittee on Patent and Information Policy of the federal Advisory Committee on Industrial Innovation suggested in its September 1979 final report that the patent system's "significant contribution to the economic development of our country . . . is so well accepted . . . that we tend to take it for granted." However, the Subcommittee's report also noted a decline in innovation in the United States and recommended a number of legislative initiatives to address the problem, including several in the patent area.

Recent evidence strongly suggests that the patent system's failure to compensate for the federal pre-marketing review requirements imposed on certain products and devices has discouraged America's innovative talents. As Senator Mathias noted in his January 27, 1981 remarks introducing S. 255, the average number of new drugs introduced annually in the United States has declined by approximately two-thirds over the past 20 years.

It is our understanding, moreover, that the annual growth rate for pharmaceutical R & D in the U.S. was about 11% from 1973 to 1979. At the same time, the corresponding growth rates for competitors from the United Kingdom, West Germany and Japan were approximately twice that number. As a result, between 1963 and 1975 U.S. patents for new drugs obtained by foreign-based companies increased from 34% to 46%. American pharmaceutical companies' share of the international market declined from 34% in 1955 to 13% in 1975 and at least one study also predicts that by 1985, U.S. companies' share of our own domestic pharmaceutical market will decline by 12%.

This decline in our technological preeminence, as regrettable as it may be, is quite understandable when we realize it currently takes 7 to 10 years and some $70 million of capital (as opposed to the 2 years and $6 million it required in 1962) to

bring a new medicine from the laboratory to the marketplace. Instead of increased patent incentives to compensate for such increased risks and costs, during the same period the effective patent life of a new drug has decreased to an average of 9.5 years. Moreover, as EPA's own studies have concluded, the commercial patent life for new pesticides has been reduced to an average of just 12 years because of pre-marketing federal agency procedures.

It is not our purpose today to lay blame for these conditions at the feet of governmental regulators. Instead, we submit that the patent system itself must be adjusted to provide adequate flexibility to accommodate national health and safety concerns, while continuing to serve its fundamental purpose of encouraging domestic research and development efforts through the incentive of 17-year commercial exclusivity.

The Chairman of this Committee, Senator Thurmond, and Senator Mathias each remarked on January 27, 1981 that S. 255 leaves fully intact the federal government's ability to assure the safety of new products. At the same time, this bill manages to provide a simple but effective remedy for many American innovators -- both small and large businesses alike -- who have seen their patent protections severely diluted by the pre-marketing federal agency review process.

We commend the sponsors of S. 255 and H.R. 1937 for their well-reasoned and balanced approach to this issue. Specifically, we consider it wholly appropriate to limit the patent restoration provisions to products or devices which successfully pass the agency review process. We also consider the addition of Section 155(c)(4)(D), which was not part of S. 2892, to be an important improvement. Under this provision, all products subject to federal pre-marketing review or notification requirements will receive the same equitable treatment as those categories of products and devices expressly identified in the legislation.

Moreover, the Section of Patent, Trademark and Copyright Law supports the limited application of this legislation only to the specific purpose or use involved in the regulatory

approval and not to the entire range of products that might result from the original patent grant. The Section also concurs in the use of a maximum 7-year patent extension period since this should provide adequate time for pre-marketing testing without encouraging a patentee to engage in dilatory behavior.

The Patent Term Restoration Act of 1981 is also commendable for its use of objectively identifiable criteria to define the applicable "regulatory review period". Pursuant to proposed Section 155(c)(4), the review period automatically terminates either on the date the agency involved in the review process formally grants marketing approval to the patent-holder or upon expiration of the statutorily-defined period for agency action.

Likewise, the procedures for exercising the right to a patent term restoration are extremely workable. All the patent-holder need do is to give notice to the Office of Patent and Trademarks that the product has successfully completed regulatory review. Upon timely filing of this notice by the patent-holder within 90 days of completion of the review process, the Commissioner of Patents will publish this information in the Official Gazette and, thereafter, will issue a certificate extending the patent life and will record the certificate in the official file of the patent.

In summation, we think the record is quite clear that domestic research and development efforts and, in turn, the American public at-large, have been adversely impacted by the problem which S. 255 seeks to redress. Our country simply can no longer tolerate the continued growth in the importation of foreign manufactured goods, nor must we suffer the consequences of this drain on our economy when we have at hand a means of encouraging domestic R & D. Indeed, the federal Advisory Committee on Industrial Innovation has endorsed legislation in the nature of S. 255.

The enactment late last year of Public Law 96-517 -- in particular, its patent reexamination provisions -- should substantially improve the quality and reliability of U.S. patents

and reduce the amount and scope of patent litigation. On behalf of the Section of Patent, Trademark and Copyright Law of the American Bar Association, I urge the Congress to take the next step by passing S. 255 and restoring to the life of a patent the amount of time required for government testing of a new product.

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FRANCIS J. McKAY
ASSOCIATE DIRECTOR

April 29, 1981

Hon. Charles McC. Mathias, Jr.
Criminal Law Subcommittee
162 Russell Senate Building
Washington, D.C. 20510

Dear Senator Mathias:

In behalf of the Institute for Cancer Research of Philadelphia, Pennsylvania I wish to express wholehearted support for S.225, on which a hearing before the Senate Judiciary Committee is scheduled for April 30, 1981.

Although the Institute for Cancer Research is primarily a research oriented institution, its researchers have made useful inventions relating to diagnosis and treatment of disease, which have proven to be of great value to mankind. The Institute owns patents on some of these inventions.

In view of the almost certain increased difficulties in obtaining federal funding for basic research, the Institute will be looking to the patent system as a means to assure funding of its programs. As a practical matter, however, the Institute cannot benefit monetarily from its patents unless it licenses them to commercial manufacturers of pharmaceutical and health care products, since it has no marketing or manufacturing capability of its own. Under the present system, the Institute's licensing efforts are impeded in no small measure by federal regulation of the pharmaceutical and health care fields which operates as a disincentive for commercial manufacturers to accept a license. While the loss to the Institute in unrealized revenues is a matter of concern, it pales in comparison to the deprivation suffered by the public, which receives no benefit from inventions which do not reach the market place.

If the full incentives of the patent system are to be maintained, both for the public and for patent owners, the period of time that is lost in complying with government regulatory procedures should be restored to the term of the patent. In my view, the legislation which you are sponsoring is very timely.

I applaud your commitment to improving the United States patent system, and hope for speedy passage of S.255.

You may include the views expressed in this letter in the printed hearing record.

Very truly yours,

F. J. McKay

Francis J. McKay
Associate Director

FJM:emk



CHEMICAL MANUFACTURERS ASSOCIATION

ROBERT A. ROLAND
President

April 29, 1981

The Honorable Charles McC. Mathias, Jr.
Committee on the Judiciary
United States Senate
Washington, D.C. 20510

Dear Senator Mathias:

The Committee on the Judiciary is now examining proposed legislation, S.255, that would restore to the term of the patent grant the period of time that regulatory approval procedures delay commercial marketing of a patented product or patented use of a product.

This letter is being submitted on behalf of the Chemical Manufacturers Association (formerly the Manufacturing Chemists Association). CMA is a non-profit trade association whose 186 United States member companies account for more than 90% of the total production capacity for basic industrial chemicals in this country. CMA members conduct extensive research and development on new and existing chemicals for application to new and ever-expanding uses in pharmaceuticals, pesticides, fertilizers, plastics, building materials, and many other applications in the industrial as well as consumer segments of our economy. Accordingly, CMA members are directly and substantially affected by regulatory clearance procedures before new products can be commercially distributed.

Economic progress is encouraged by an investor's expectation of a 17-year term of patent exclusivity, a term during which he can hope to get a reasonable return for bringing an innovation forward for the use of society. In the chemical field, unlike many other fields of innovation, the Government properly subjects new chemicals or significant new uses of existing chemicals to an assessment for unreasonable risk of injury to health or environment.

For example, many chemicals manufactured by our members are formulated into products subject to premarket regulatory

clearance under provisions of the Food, Drug, and Cosmetic Act and the Federal Insecticide, Fungicide, and Rodenticide Act. Furthermore, basic industrial chemicals are also subject to an initial regulatory clearance hurdle under provisions of the Toxic Substances Control Act of 1976 (TSCA), 15 U.S.C. 2601 et seq. While many of the rules implementing TSCA have not been in effect for a sufficient period of time to permit precise impact analysis, it is not premature for our expression of concern over the potential for delays, in regulatory approval caused by TSCA, encroaching on the normal patent term. This is especially so in the event that the EPA finds that a product presents an unreasonable risk of injury to health or the environment, orders major additional testing, and delays the manufacture, processing, or distribution of the product. Thus, the term of the patent covering the product or its use may begin to expire before the inventor is able to obtain an economic benefit from his innovation.

This concern for the potential marketing delays due to TSCA comes from historical analysis of what has happened to the effective patent life in other industries. For instance, in 1962, it took about two years and $4 million to bring a new pharmaceutical product from discovery to marketing; now it takes eight years and $70 million. This means for the average new drug, the patent term is almost half over before the inventor can begin to market it. An EPA study in 1977 estimated there may be only twelve or so years left on a patent by the time a pesticide manufacturer has established through long term testing that a pesticide is safe enough to be registered for commercial marketing, with costs per new product increasing from about $7 million in 1974 to $20 million or more currently.

We are concerned that as TSCA matures there will be a similar evolution of ever increasing time and costs to comply with agency clearances. The body of knowledge on chemicals is clearly growing and as a result more testing is required to satisfy the agency's concern that all that is known is explained.

By restoring the patent term, chemical innovators are given the same incentive for research and development and commensurate rewards for progress as are available in other areas of science and useful arts.

We believe S.255 to be a fair and equitable bill and it is designed to be administered objectively with a minimum of

costs, and we hope that the Committee will give it favorable consideration.

Sincerely,

Robert A. Roland
President

cc: The Honorable Max Baucus
The Honorable Joseph R. Biden
The Honorable Robert C. Byrd
The Honorable Dennis DeConcini
The Honorable Jeremiah Denton
The Honorable Robert Dole
The Honorable John P. East
The Honorable Charles E. Grassley
The Honorable Orrin G. Hatch
The Honorable Howell Heflin
The Honorable Edward M. Kennedy
The Honorable Paul Laxalt
The Honorable Patrick J. Leahy
The Honorable Howard M. Metzenbaum
The Honorable Alan K. Simpson
The Honorable Arlen Specter
The Honorable Strom Thurmond

STATEMENT

OF THE

NATIONAL RETIRED TEACHERS ASSOCIATION

AND THE

AMERICAN ASSOCIATION OF RETIRED PERSONS

Mr. Chairman:

I am Cyril Brickfield, Executive Director of the National Retired Teachers Association and the American Association of Retired Persons. Our Associations, representing 12.5 million older Americans, have a strong interest in encouraging innovative research and development, especially in the pharmaceutical industry. We, therefore, appreciate this opportunity to present our views on S. 255, the "Patent Term Restoration Act of 1981" introduced by Senator Mathias and co-sponsored by Senators Thurmond, DeConcini, Byrd and Percy.

Background

Older Americans have a keen interest in patent term restoration as it would affect the prescription drug industry. Our Associations believe that everyone--including pharmaceutical manufacturers--is entitled to, and should receive, fair and equal treatment under the patent laws. For this reason, we can support the provision of S. 255 that would restore the term of a patent grant for the period of time that nonpatent regulatory requirements prevent the marketing of a patented product but in no event for more than seven years. We believe that such protection is essential to the encouragement of innovation and the introduction of major new drug therapies. The elderly have a direct interest in expanded and more meaningful research and development activity. However, other factors and considerations that fall outside the scope of S. 255 as drafted cause us considerable concern.

Those over the age of 65, while today representing only 11.3% of the population, account for over 25% of all expenditures for prescription drug products. On a per capita basis, they spent $133 in CY 1978 on drugs and drug sundries, nearly double the $68 spent by all age groups. More significant perhaps, prescription drugs represent approximately 36% of total out-of-pocket health care expenses for this group. And in meeting the ever-mounting burden of drug costs, the elderly find that they must pay for 84% of total expenses from their own financial resources, with only 7.9% being financed by private insurance and 8.4% by the public sector (e.g., Medicare, Medicaid). This situation is compounded by other ominous trends; namely, the increasing incidence of chronic debilitating conditions among the elderly, the relatively greater utilization of multiple prescription drugs, and an increased tendency among physicians to over-prescribe prescription drugs or to do so with less than adequate knowledge of their patients' current consumption patterns and experiences. It is also germane to the present discussion to note that some 70-75% of drug misuse among the elderly is due to under-utilization, most often because they cannot afford the medicine that has been prescribed.

Clearly, older Americans, often subsisting on relatively fixed incomes, have much at stake in the current debate over patent restoration. In a larger sense, our Associations are also very much interested in working toward drug regulatory reform so as to devise a means to achieve the essential purposes of regulation in a way that is affirmative and supportive of innovation yet does not deny the most dependent and needy segments of our society access to prescription drug products because the price is too high. Within this context it would be fallacious to characterize patent restoration as embodied in S. 255 as a "cure-all". There is a pressing need for changes

in the attitudes and value systems of both the Food and Drug Administration (FDA) regulators and the drug industry.

Our Associations strongly support increased emphasis upon drug research, development and innovation, because it is all too evident that the absence of certain drug therapies is effecting a cost. The real question for us, however, arises as to the level, direction and nature of drug innovation. We are concerned about the effect patent restoration would have on competition in the drug industry, particularly price competition, and whether the benefits of patent term restoration are commensurate with the costs such legislation would necessarily entail. The impact of reduced competition and patent restoration on aged persons dependent upon prescription drugs can not be discounted. We, therefore, believe that the Congress would be well advised to examine very closely whether extended patent protection would, in fact, likely lead to significantly more research, development and innovation. The importance of patent restoration and its long-term impact on drug prices behooves the Congress to examine a multitude of causal factors--some exogenous in nature--which have led to a slowdown in innovative research and development in the drug industry. We would hope that patent (term) restoration, if enacted, would lead to new <u>real</u> R & D spending by the industry as well as more new major breakthroughs and new chemical entities that can be profitably marketed. We can be sure that additional years of patent protection will result in very real income transfers from elderly consumers to large brand-name manufacturers. The elderly should not be asked to accept the worth of these substantial transfers on faith alone or for that matter the assertion that "competition" from new products generates downward pressure on the price and market share of old products.

We do not deny that the drug industry is entitled to profits

from their investment of high-risk capital in drug R&D, nor deny the cost effectiveness of many types of drug therapy when compared to higher cost alternatives (e.g., acute care hospitalization, nursing home care). Should S. 255 be enacted, we sincerely hope that the new age or renaissance in research productivity and actual innovation, which the industry proclaims, is fully realized in the near term.

The FDA Drug Approval Process

For the most part, the FDA has developed an excellent new drug review process. However, this regulatory process does need to be reformed. While there should be no lowering of the statutory standards of safety and efficacy, there is clearly a need to assess those factors needlessly delaying new drug approval and to subsequently remedy the situation.

A great deal of debate continues as to the existence of a "drug lag" in this country. Without becoming sidetracked on this issue, we would state the obvious--that lengthy approval times can add substantially to the cost of developing a drug. However, to the extent that a "drug lag" does exist, our Associations would equate it with greater consumer protection and a substantially improved and more thorough drug approval process.

The gains from the FDA approval process are primarily reflected in today's quality drug development process. Yet the clinical phases of the new drug approval process now average 5 years, and the NDA , or New Drug Application phase, at least 2 years, with an additional 1-3 years of pre-clinical (IND) investigation, for a total of 8-10 years. The development and approval of minor chemical variants or innovative dosage forms take, on the average, only about half this time. In a major report issued in May of 1980, the General Accounting Office (GAO) cited several factors affecting drug approval time. It was

the opinion of the GAO, which we share, that both the FDA and the drug industry contribute to the time it takes to approve new drugs--often needlessly. This happens due to a number of factors, including: imprecise FDA guidelines which are subject to varying interpretations; scientific and professional disagreements between the industry and FDA; slow or inadequate FDA feedback to the industry on deficiencies in applications; incomplete new drug applications and industry's slow rate of resolving deficiencies; communication problems and an adversary relationship; and limited time spent by FDA reviewers actually examining drug applications, along with an uneven workload. Such deficiencies have resulted in 76% of all NDA's having to be resubmitted for additional data one or more times by the sponsor (with 85% being approved after the second or third review cycle).

The drug industry has asserted that there has been a rapid and progressive decline in the introduction of new molecular entities. While we do not deny a long term downward trend that needs to be addressed, data from the FDA indicates that, despite some up and down movement, over half of all new molecular entities introduced in the U.S. in the past decade are considered by the FDA to have provided "significant medical gain". Furthermore, any comparison of the risks of delay in the introduction of new drugs presents serious difficulties. The assumption that reduction in the risk of adverse effects from drugs must be accompanied by an increase in the time taken for their introduction is not necessarily valid. Labels for regulatory systems, such as "fast" and "strict", should be used cautiously. To the extent such system comparisons are possible, however, we would note that of the four new chemical entities introduced in the United Kingdom since 1964, which were subsequently withdrawn due to unacceptable toxicity, three (ibunefac, practolol, and alclofenac) were never introduced

in the U. S. Largely on the basis of preliminary toxicology data, the FDA postponed a decision about the drug practolol, for example. This wait-and-see attitude turned out to be well advised since, during the FDA review process, the suspected tumorigenic quality of the drug was confirmed with the discovery of severe adverse reactions in Britain.

Another factor that may be impinging upon truly innovative drug R&D, and the decline in productivity of R&D investment, is what seems to be a change of strategy by the industry. There has been a sharp drop in the portion of total R&D funds expended on basic research. From 1968-1978, this spending fell from 15.4% of total R&D outlays to 11.4% and became narrowly targeted toward more economically significant diseases (e.g., cardiovascular drugs). This tendency of companies to concentrate research efforts in a relatively small number of fields which appear promising from a commercial point of view has, quite naturally, led to crowding in some areas of research and neglect of others. The outcome has been a plethora of closely related "me-too" drug products. Instead of limiting their efforts in introducing new drugs that are qualitatively and quantitatively superior to those already available, many drug companies expend considerable effort in copying or modifying successful therapeutic principles, with the result being the introduction of numerous analogous drugs--quite commonly accompanied by exaggerated claims of efficacy. Examples would range from closely related penicillin and cephalosporin derivatives to diuretics, topical corticosteroids and minor tranquilizers. We would contend that some measure of self-restriction on the part of research-based pharmaceutical companies in this regard would contribute significantly to improving the credibility of their arguments for patent restoration. We would also add that, for the most part, we agree with the many experts in this field who have claimed

that it has become increasingly more difficult to discover drugs of major therapeutic importance.

Former FDA Commissioner Kennedy repeatedly referred to the relationship between the FDA and medicine as "creative tension". Perhaps this is an ideal description of the relationship that could be developed between the drug industry and the FDA. Such tension should be acceptable as long as it is not only negative but also has positive side effects that are visible in the quality of the drug approval process. We strongly believe that there is little to be gained at this point in time from imposing additional restraints upon industrial drug research and development. At the same time, the industry should accept the statutory requirements that serve the purpose of substantiating the efficacy and safety of a drug within reasonable time limits. Industry protests as to unnecessary regulatory practices and redundancy should be fully substantiated with convincing data.

Comments on S.255 - The Patent Term Restoration Act of 1981

With respect to S.255, we have a number of specific comments to make. First, we would note that patent restoration is not likely to accelerate the IND (pre-clinical) and NDA (clinical) approval process. The industry has to bear some of the responsibility for the lengthy delays in drug testing and the submission of data to FDA. To quote from the Heritage Foundation report, Mandate for Leadership, "care must be taken in any restructuring of the patent laws to avoid creating disincentives to sponsors' proceeding as rapidly as possible with their research programs." We hope this concern will be addressed by the Committee either in the context of S.255 or in other patent restoration legislation, especially since the FDA is now in the process of making major revisions in its IND and NDA guidelines in order to improve and expedite the drug approval process.

Second, because of its limited scope, S.255 would have little impact on research and development efforts aimed at "orphan drugs" or drugs with limited marketing potential. Our organizations continue to support "flexible patents" for such drugs for which the clock should start ticking at the time they are approved and not when they are first patented as a molecule. Patents for orphan drugs could thus be extended two to three times the standard 17 year period. Realistically, however, we would concede that such extended patent protection may produce only marginal improvement in such new drug discovery if projected sales are well below a threshold the company has established for marketing purposes. This seems to us one area where the Federal government needs to involve itself more intensively in new drug research and development given the somewhat logical reluctance of the industry to devote its resources to meet these special needs.

Another issue of major importance that ought to be addressed but that falls outside the scope of S.255 as drafted is what we refer to as the "de facto" patent protection afforded brand name manufacturers by brand name loyalty and entrenched prescribing patterns. Indeed, with no limitations being placed on the exclusivity of brand names and the drug industry's continuing persistence in litigation aimed at competitors who utilize similar product size, shape and color, trademark protection may be more important to the brand name manufacturer than patent protection in extending monopoly pricing and market shares. Data from recent studies clearly indicate that neither generic nor brand name manufacturers have met with much success in capturing significant market shares from original brand name manufacturers. A 1978 study of 12 major drugs (including Librium and Darvon) revealed that not one of these original products had less than 92.4% of their market five to eight years after patent expiration and that the average share in 1978 was 96.1% of the

drug store market.*/ Other examples of this experience would include Orinase - which still retains 97% of its market (tolbutamide) - and Persantine (dipyridamole) - which maintains 99% of its market 1½ years after patent expiration. Pioneer producers do not necessarily maintain market share by reducing prices (upon patent expiration). Prices generally continue to increase over time as even large, research - based drug companies have a difficult time entering these markets in a meaningful fashion. It is a very gradual and protracted process, more often than not, whereby a major drug product coming off patent loses its grip on its market.

The Patent Term Restoration Act (S.255) proposes to provide an extension of patent protection for a new drug sponsor equal to the marketing time "lost" in the "regulatory review period". It is our understanding that this additional protection could not exceed 7 years and would include drugs already in the pipeline but exclude those which have already received NDA approval for marketing. And, as we have already noted, the drug would retain patent protection from the time it is patented as a molecular entity throughout the FDA review process.

Our Associations cannot object to the goal of treating all patent holders equally in terms of patent protection. But we do not believe that the Congress should consider patent term restoration in isolation. While we support equitable treatment of industries such as pharmaceutical industry and the medical devices industry, we would suggest that patent restoration be limited for the vast number of me-too product re-constitutions that provide little if any new therapeutic value and which are often accompanied by higher prices. Also, the deregulation of early clinical research and reform of the FDA drug approval guidelines should be

*/ Presentation by Meir Statman, Rutgers University, at Conference on "Drugs and Health: Economic Issues and Policy Objectives", American Enterprise Institute (AEI), November 15-16, 1979.

allowed to precede any form of patent restoration. Companies receiving patent extensions should also be required to demonstrate to the Congress and Commissioner of Patents a "real" increase in total R&D spending in at least the relevant therapeutic category of the drug in question. So as not to delay competition once the extended patent period of a particular drug product has expired, we would also recommend that as a condition of patent restoration all safety and efficacy (or testing) data be made available to the public sometime during the period of restored patent protection, perhaps after three years. We would note in this regard that the NDA (new drug) approval process with its confidential documentation has to date actually provided better protection than patents for many new drugs. At this point, we would note with approval the recent announcement of HHS Secretary Schweiker that he has lifted the previously imposed "stay" on so called paper-NDA's. This action should greatly facilitate the competitive movement of both brand name and generic manufacturers into the marketing of certain well-established prescription drugs (approved after 1962) as they come off patent. Not requiring new entrants into these markets to repeat already published studies demonstrating the safety and efficacy of a particular drug helps save valuable scientific (research) resources, lowers drug prices through increased competition, and avoids ethically questionable repetition of clinical trials in human subjects.

We also think there is need for a specific provision, mandating the prominent use of a drug's generic name in labeling and advertising. Furthermore, we would hope that brand name manufacturers would drop their litigation aimed at generic manufacturers who produce products of a similar size, shape, and color (to off-patent pioneer drug products). These legal actions, in the absence of Congressional action,

have seriously hampered the development of competition. We would also suggest that this problem could be addressed through an effective consumer education effort on the part of the FDA and other interested parties and would urge such action.

Finally, our Associations recommend that alternative approaches to furthering drug research, development and innovation be explored with the aim being to find alternatives to prescription drug prices as a means of financing R&D. One approach we find particularly attractive, especially in light of its broader applications, is the amending of our tax laws to provide accelerated depreciation and capital investment in research facilities and equipment. The U.S. lags too far behind its foreign competitors in this area. If this nation is to remain competitive in pharmaceutical innovation investment in R&D must be effectively encouraged by our tax laws. In such a manner the financial burden of providing for increased and ostensibly more targeted drug R&D would be distributed more equitably throughout all segments of our society.

Summary

Older Americans have a direct and continuing interest in the researching and development of truly new and innovative drug products. At the same time this Committee should be fully aware of the direct financial burden older Americans are bearing as a result of their dependency on prescription drug products. With the vast majority of incurred expenses coming out-of-pocket, the elderly have much at stake in seeing that competitive forces in the drug industry are encouraged.

To repeat, our Associations are supportive of equitable treatment of all industries under the patent laws. We therefore, can support S.255's restoration of the patent grant

for the period of time - not to exceed seven years - that nonpatent regulatory requirements prevent the marketing of a potential product. We fully realize that the FDA new drug approval process is in need of reform and that this process is inflicting a very real cost on the industries subject to its review as well as consumers. In this regard we must also note that the elderly are already spending 44% more on out-of-pocket health expenses than the non-elderly and that per capita drug expenditures for this group are twice that of the non-elderly. In these times of sustained high rates of inflation which are particularly burdensome on older Americans we would hope that this Committee and the Congress would closely examine suggestions for improving or expanding the scope of (S.255) or developing additional but separate legislation.

The suggestions we have offered as to how S.255 could be expanded to make it more equitable and to lessen its impact on the elderly we believe deserve serious consideration. At the very least we would contend that legislative action should be delayed until the Office of Technology Assessment (OTA) completes its study of general approaches to restoring patent terms for prescription drugs, and more specifically, the impact of this on industrial innovation. We are told this will be available by mid-June. We would also counsel further caution and suggest that the major revisions in FDA's IND and NDA guidelines be implemented before patent restoration legislation is actually implemented. These revisions should also be available this year.

The pharmaceutical industry claims that lengthy new drug approval times have resulted in fewer new drugs and higher prices. For the most part this is probably true. As such, it points to the pressing need for Congressional action to effect necessary drug regulation reforms. However,

our Associations do not believe that Americans would benefit from undue haste in judging the acceptability of new chemical entities or from lowering statutory measure of safety and effectiveness.

Enactment of patent restoration will likely result in additional increases in the elderly's expenditures for prescription drugs. It is our sincere desire to see the industry utilize these income transfers in the development of new and innovative drug products and therapies. Our Associations sincerely urge the Congress to consider the suggestions and concerns we have raised before moving to restore patent protection.

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May 1, 1981

Honorable Charles McC. Mathias, Jr.
United States Senator
Criminal Law Subcommittee
162 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Mathias:

Your sponsorship of S. 255, which is drafted to restore to the life of patents the time lost during the government's pre-market testing and clearance process is most important and is heartily endorsed by me.

Ultimate passage of the legislation will provide a much needed incentive to spur industrial and pharmaceutical research by removing the penalty imposed on the life of patents resulting from the lengthy product clearance process. The United States is experiencing a drug lag, and S. 255 is a step in the right direction to help alleviate this serious problem.

Sincerely,

K. E. Leffren
Patents & Licensing

PPG INDUSTRIES, INC./ONE GATEWAY CENTER / PITTSBURGH, PENNSYLVANIA 15222 / AREA 412/434-2101

May 4, 1981

L. STANTON WILLIAMS, Chairman of the Board

The Honorable Charles McC. Mathias, Jr.
Chairman, Subcommittee on Criminal Law
Committee on the Judiciary
United States Senate
Washington, D.C. 20510

Dear Senator Mathias:

The purpose of this letter is to present a statement on behalf of PPG Industries, Inc., in support of S.255, the "Patent Term Restoration Act of 1981". S.255, if enacted, would restore to the term of patents a period up to seven years corresponding to the time during which governmental regulatory requirements prevent marketing of the product to which the patent is directed.

PPG Industries, Inc. urges enactment of this legislation as a means to encourage investment in the development and manufacture of new products in vitally important fields such as medicine, pharmaceuticals, herbicides and pesticides. PPG is a diversified manufacturer of glass, chemicals, coatings and fiber glass. Biochemicals, primarily herbicides and pesticides, is one area of our business.

It is important to note that, unlike process and machine inventions where other effective forms of proprietary rights (such as trade secrets) may be available to protect the innovator's investment in research, the formula for a biochemical or similar product, once sold, is usually available to anyone because modern analytical tools today make full analysis within ready grasp. Additionally, regulatory action by state and federal agencies often requires disclosure of the formula.

Therefore, it is in these fields that patents are especially important in order to permit recovery of the expenses incurred in finding and marketing new products. Because the effectiveness of materials for such applications is inherently unpredictable, many must be tested in order to find one which can be marketed. But the act of marketing that material informs others of its utility, as well as its composition, without those others having had to fund the research required to identify it. Under these circumstances, in deciding whether to engage in research in these fields (in our own case, biochemicals) the probability of effective patent protection and the period of time during which such protection will be available are critical factors in assessing whether the potential return justifies the investment and risk required.

The present and growing regulatory requirements for biochemical products, while justifiable based on consumer and environmental protection considerations, have the concomitant effect of drastically reducing the effective life of any patents obtained on those products, i.e. the patent term remaining after marketing of the product is permissable. The business assessment and decisions required to engage in the necessary research are thereby affected, and in a direction which clearly results in fewer attempts to develop new products. The loss to the public in not having more effective and safer products cannot be measured, but that there is a loss cannot be disputed.

The reduction of the effective term of a patent by regulatory requirements has another important effect. Even when development of a product is undertaken, calculation of the potential return from its successful marketing necessarily involves correlation of the time period during which the product can be expected to retain a reasonable market share with the price the product can command in the marketplace. One factor in judging the expected time period is the effective term of patent protection, after marketing begins, so that shortening that effective term (e.g. by delays due to regulatory action) means that the price to the consumer must be correspondingly higher in order to attain the return necessary to justify the product's development.

The patent system is indispensible to encourage innovation, and the reform embodied in S.255 can be a significant step in improving the incentives to industry in areas of significant public concern. PPG therefore advocates its favorable consideration by the Judiciary Committee, and its enactment by the Congress.

Sincerely,

L. Stanton Williams
Chairman of the Board

LSW/nkk

PRODUCT RESOURCES INTERNATIONAL, INC.
800 Third Avenue ☐ New York, N.Y. 10022
TEL: (212) 980-8980
TWX: 710-581-2516

May 11, 1981

Charles McC. Mathias, Jr.
United States Senator
United States Senate
Committee on the Judiciary
Washington, D. C. 20510

Dear Senator Mathias:

Thank you for your letter of April 22, 1981, inviting us to express an opinion, for the record, of your bill (S. 255) which proposes to restore to the life of patents the time that is lost during the government's premarket testing and clearance procedures.

We are deeply versed in the problems your bill is designed to overcome, and applaud its purpose. We urge your colleagues to approve it promptly.

Our own expertise is in the health-care area, where many a potentially valuable drug has been put to one side -- undeveloped -- because a company believes that so much of the patent time will be eaten up by premarket testing and other FDA-mandated clearance procedures, that the profit return during the balance of the patent period will be inadequate to produce a sound business value.

The result is: America loses out on a potentially valuable drug.

Once again, we wish you Godspeed with your bill.

Sincerely,

Eugene F. Whelan,
Chairman
EFW/gk

AIRCO, Inc.

55 CHESTNUT RIDGE ROAD, MONTVALE, NEW JERSEY 07645 - TELEPHONE 201-573-0511

ANGELO N. TARALLO
VICE PRESIDENT
CORPORATE AFFAIRS

May 12, 1981

Honorable Charles McC. Mathias
U. S. Senate
Washington, D. C. 20510

Dear Senator Mathias:

The Committee on the Judiciary is now reviewing proposed legislation S. 255, the Patent Term Restoration Act of 1981. This legislation would restore to the normal patent term of 17 years the period of time that non patent regulatory requirements and procedures prevent the marketing of a patented product.

Airco, Inc., headquartered in Montvale, New Jersey, is a producer of a diversified line of industrial and medical products. Last year our sales were in excess of one billion dollars and we employed more than 13,000 people. We are a research oriented company with on going programs to improve and further develop our product lines. In 1980 we employed over 500 people in research and related technical areas and spent in excess of $17,000,000 on research and development.

Airco, Inc. supports S. 255 with one major reservation. We believe that regulatory delay and the consequent shortening of effective patent life have been and will continue to be a disincentive to the expenditure of risk capital for the development of innovative and useful new products. The restoration of a normal 17 year patent life, as contemplated by proposed legislation S. 255, would eliminate this disincentive. Indeed, it would afford inventors of products faced with regulatory review the same incentives and rewards as inventors whose products do not face such review.

Airco has one major reservation regarding S. 255. In its present form the proposed legislation does not adequately deal with products covered by an unexpired patent on the effective date of the legislation, but which will have completed regulatory review by that date. These products will not be afforded any benefit under the proposed legislation, although their effective patent life may have been dramatically curtailed by premarket regulatory delay.

It has been widely reported that the effective patent life for drugs is presently in the range of seven to ten years, with approximately seven to ten years being consumed in testing and complying with premarket clearance procedures of the FDA. This contrasts with the experience of the drug industry in 1962 (prior to the impact of the 1962 amendments to the Food Drug and Cosmetic Act) when it took about two years to bring a new pharmaceutical product to market.

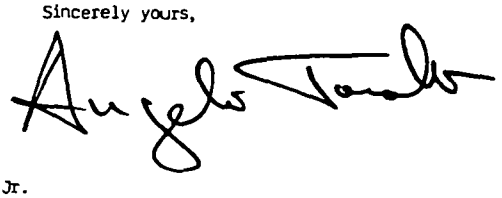
In 1969 Airco filed a notice of claimed investigational exemption (IND) for one of its products, an inhalation anesthetic agent, and received NDA approval late in 1979, thus losing ten years in the regulatory review process. Notwithstanding that extended delay (at the upper end of the range quoted above), Airco would receive no benefit from S. 255.

We believe that those products for which regulatory approval was granted prior to passage of S. 255 should not be precluded from the benefits of patent restoration. To do so would be inequitable and would penalize those companies, both large and small, who made investment decisions years ago in reliance upon a far shorter regulatory review period than actually took place.

It is Airco's basic position that all products for which patents have not expired on the effective date of the Patent Restoration Act be treated equally with respect to patent restoration regardless of when the regulatory review period ended. In the alternative, patented products for which regulatory review has been completed prior to the effective date of the Patent Restoration Act should be afforded a significant degree of patent restoration benefit. We urge that a minimum of three quarters of a year of patent extension be granted for each year consumed in the regulatory review process by those patented products for which the regulatory review period has been completed on the effective date of the law, with a maximum restoration period of seven years.

We would appreciate our views becoming part of the record of the hearings on S. 255.

Sincerely yours,



CC: Senate Judiciary Committee
Honorable Howard H. Baker, Jr.
Honorable Bill Bradley
Honorable Harrison A. William, Jr.

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aamc **association of american medical colleges**

JOHN A. D. COOPER, M.D., PH.D.
PRESIDENT

202: 828-0460

May 13, 1981

Honorable Charles McC. Mathias, Jr.
Criminal Law Subcommittee
Committee on the Judiciary
162 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Mathias:

On behalf of the Association of American Medical Colleges, I would like to endorse S.255, the "Patent Term Restoration Act of 1981."

Since its founding in 1876, the AAMC has steadily expanded its horizons so that today it represents the whole complex of individual organizations and institutions charged with the undergraduate and graduate education of physicians. It serves as the national voice for the 126 U.S. accredited medical schools and their students; for the more than 400 major teaching hospitals; and over 70 academic and professional societies whose members are engaged in an everyday basis with the activities---teaching, research and patient care that in the aggregate constitute medical education. The constituency of the Association is heavily engaged in biological and medical research and thus has more than a passing interest in the terms and conditions under which patents are issued.

The Association has long believed that it is of the utmost importance that research findings be transformed as rapidly as possible into practical applications for the betterment of the human condition; any failure to exploit a scientific discovery that could be useful in extending life, in preventing premature death or in decreasing morbidity from disease is a tragedy of significant proportions. Since the applied research and technical development necessary to convert a scientific discovery into a practical device are expensive, the

Association has also recognized the essentiality of patent protection, as an inducement to industry to make the large investments necessary to bring useful products to the market. Even when discovery accrued from public investment, the Association has opposed the populist idea that no private sector individual or organization should profit further from that discovery. Alternatively, this organization has argued that unless profits are permitted through patent protection, the discovery will lie fallow and a potential public boon will not be realized.

The Association recognizes the demands of the public that society be protected from ineffective and unsafe products; it also is aware that the regulations promulgated by agencies such as the Food and Drug Administration not only demand compliance with expensive requirements but also erode severely the period of time during which an approved product can be marketed under patent protection. The latter two factors conspire to significantly reduce the profitability associated with the development of new products and thereby diminish the motivation of industry to convert scientific discovery into practical and useful application. In many instances, industry attempts to maximize an often meagre return on investments by upward price adjustments, and thus increases costs to consumers. Thus, the present system, while responsive to public needs, works hardship on both producer and consumer.

The obvious disadvantage that will accrue from the adoption of S.255 is that the marketing of generic products will be delayed to the extent to which patent duration is extended. This implies that the price of products will remain higher longer than under present circumstances and thus contribute, at least as far as drugs and medical devices are concerned, to the elevation of health care costs.

On the whole, the Association is persuaded that without reasonable patent protection, the rate of medical progress, in terms of the introduction into the market of improved drugs and devices, will be significantly slowed by the reluctance of industry to risk large investments for uncertain returns. Thus, the provisions of S.255 serve an important public good. For this reason the Association offers its wholehearted endorsement of this bill.

Sincerely,

John A. D. Cooper

John A. D. Cooper, M.D., Ph.D.
President

NEW JERSEY

PATENT LAW ASSOCIATION

May 14, 1981

Senator Charles McC. Mathias
United States Senate
352 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Mathias:

The New Jersey Patent Law Association, through its Legislation Committee, has considered in detail the provisions of S.255. The Association now wishes to advise you that it wholeheartedly supports the purposes and provisions of the bill, and urges its passage.

New Jersey is home to a significant portion of the chemical and pharmaceutical manufacturing industry in the United States. Its concerned citizens, and particularly those who are members of the patent bar, have watched with great interest and appreciation the progress of efforts in the Congress, first with S.2892 in the 96th, and now with S.255 in the 97th, to redress the negative impact on innovation in our technological industries caused by the ever-increasing cost and delay of premarketing regulatory review.

The New Jersey Patent Law Association is composed of approximately 400 professionals who live or work in the New Jersey area and who are involved in patent, trademark, and other industrial property matters. Our membership includes both persons in corporate practice and private practitioners. They represent a large number of corporate clients in all of the various fields of technology.

As already indicated, the Legislation Committee of our Association has conducted an in-depth analysis of S.255, and has reported its recommendations to the Board of Managers. Accordingly, the Board of Managers, on behalf of the Association, recommends adoption of S.255.

During the deliberations of the Legislation Committee, two comments of importance were put forward:

(1) it was felt by some that the provision of Sec. 155 (c)(4)(D), which extends the coverage of the bill to "any other product or method of using a product that has been subjected to Federal premarketing regulatory review...:, unnecessarily broadens the bill to cover situations which may not require the redressing effects of the bill, while at the same time possibly including unknown problems with difficult-to-anticipate dimensions; and

(2) most agreed that the bill unfortunately fails to provide restoration of the term of patents on new processes for making old substances, that is, known substances that have either never been patented, or for which the patent has already expired, a very significant current example of which is the biosynthetic production of insulin, interferon, and other substances through the use of recombinant DNA techniques. Thus, the Legislation Committee recommends that the bill be amended to restore the patent term of any process for making an unpatented product.

We would appreciate your entering the above recommendation and comments in your record for the Judiciary Committee hearings on S.255 held on April 30, 1981.

We would be pleased to be of any further assistance in this matter which you deem appropriate.

Very truly yours,

Raymond M. Speer, Chairman
Legislation Committee

Richard T. Laughlin, President

/cm

cc: Charles F. Schroeder

THE INSTITUTE OF
ELECTRICAL AND
ELECTRONICS
ENGINEERS, INC.

May 14, 1981

1981 Vice President - Professional Activities
Richard J. Gowen
Vice President & Dean of Eng.
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The Honorable Charles McC. Mathias, Jr.
Criminal Law Subcommittee
162 Russell Senate Office Building
Washington, D.C. 20510

RE: S.255, The Patent Term Restoration Act of 1981

Dear Senator Mathias:

Founded in 1884, the Institute of Electrical and Electronics Engineers, Inc.(IEEE) is today the world's largest technical professional society with more than 206,000 members worldwide. Since 1972, through a mandate by IEEE's members, the Institute has concerned itself with social, political and economic problems of engineers. The United States Activities Board (USAB) was created to provide a mechanism through which the IEEE could provide its perspectives to the Executive and Legislative Branches of Government on professional and technical matters of concern to the U.S. members of IEEE.

The IEEE/USAB is troubled with the continued decline of productivity and innovation in the United States. In an effort to reverse this decline of innovation and productivity, we have tried to identify and eliminate barriers that may exist between sectors of our present "system". One of our areas of interest has been inequities that exist in our patent system. In this context we support your efforts and those of Senators Byrd, Thurmond, Percy and DeConcini aimed at relieving problems in the patent system. We agree that the existing regulations affecting the patent term on a product requiring regulatory review are a deterrent to innovation and productivity and should be modified; S.255 would help rectify this inequity by allowing an extension of up to seven (7) years in the patent term for those products subject to regulatory review. The IEEE/USAB therefore supports enactment of S.255 aimed at elimination of hinderances to productivity and innovation in the patent system.

On behalf of the IEEE United States Activities Board, I respectfully request that this letter of endorsement be included in the Senate Judiciary Committee printed hearing record for S.255, the Patent Term Restoration Act of 1981. Thank you for your contined efforts toward encouragment of innovation and productivity.

If we can be of assistance to you and your staff, please do not hesitate to contact Tom Suttle or Edith Carper in the IEEE Washington Office.

Sincerely,

Richard J. Gowen

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION
THE MADISON BUILDING
1155 Fifteenth Street, N.W., Washington, D. C. 20005
202 • 296-1585 Cable: NAGRCHEM

May 14, 1981

The Honorable Charles McC. Mathias
United States Senate
Washington, D. C. 20510

Dear Senator Mathias:

During the April 30, 1981, Senate Judiciary Committee hearing on S. 255, someone suggested that a patent holder is at liberty to indiscriminately establish the market price for his patented product.

On behalf of the National Agricultural Chemicals Association, I hasten to clarify the record insofar as pesticides are concerned.

Today's farmers are sophisticated, highly cost-conscious business-people. Many manage numerous cash crops on thousands of acres of farmland often valued in the millions. Many rely upon their own computers to reach cost-effective decisions. Like any other business-person, the farmer must realize a profit on his investment.

When it comes to pesticides, the farmer is looking for two things: (1) a product that will control his specific insect, weed or disease problem; and (2) one that will provide him with a return of $3 to $4 for every dollar invested. If a pesticide product falls short of either goal, he will choose competitive chemicals or non-chemical methods to control pests. Rarely, if ever, is a farmer limited to the choice of a single control option. Whether a particular pesticide happens to enjoy patent protection is not nearly so critical to the farmer as its cost in relation to competitive chemicals or less expensive non-chemical pest controls.

In short, pesticide manufacturers cannot price their products so high that the benefit to growers is ultimately erased by forced uncompetitive pricing of their food and fiber commodities in the marketplace.

The competitive pricing which occurs in the agricultural chemical industry is illustrated by Table 649 of Agricultural Statistics, 1980, published by the U. S. Department of Agriculture (copy attached) which shows that since 1967 the price of agricultural chemicals has increased only 50%, while the prices of other farm necessities such as seed and fertilizer, have increased 186% and 96%, respectively.

Yours truly,

N L Reding

Nicholas L. Reding, Chairman
NACA Board of Directors

Table 649.—Prices paid by farmers: Index numbers, by groups of commodities, United States, 1965–1979[1]
[1967 = 100]

Year	Family living indexes							Production indexes					
	Family living (all commodities)	Food	Clothing	Housing	Autos and auto supplies	Medical and health care[2]	Education, recreation, and other[2]	Production (all commodities)	Feed	Feeder livestock	Seed	Fertilizer	Agricultural chemicals
1965	96	96	92	97	97	89	96	96	97	90	100	103	98
1966	98	100	96	98	98	93	97	100	101	103	98	102	99
1967	100	100	100	100	100	100	100	100	100	100	100	100	100
1968	104	103	106	104	105	106	104	100	94	104	104	94	101
1969	109	108	112	107	109	113	109	104	96	117	106	87	100
1970	114	114	119	109	113	120	115	108	101	122	112	88	98
1971	118	116	124	113	120	128	120	113	105	125	124	91	100
1972	123	123	131	118	124	132	124	121	106	149	135	94	103
1973	133	143	143	127	130	137	127	146	160	192	167	102	105
1974	151	165	162	149	153	149	135	166	194	148	215	167	119
1975	166	178	174	168	172	167	147	182	187	134	245	217	160
1976	176	183	188	178	184	184	153	193	191	154	241	185	174
1977	[3] 181	(4)	(4)	(4)	(4)	(4)	(4)	200	186	158	261	181	157
1978	194	(4)	(4)	(4)	(4)	(4)	(4)	217	183	221	278	180	147
1979	215	(4)	(4)	(4)	(4)	(4)	(4)	248	204	298	286	196	150

Year	Production indexes—Continued							Prices paid (total commodities)	Interest	Taxes	Wage rates[5]	Production, interest, taxes, and wage rates	Commodities, interest, taxes, and wage rates
	Fuels and energy	Farm and motor supplies	Autos and trucks	Tractors and self-propelled machinery	Other machinery	Building and fencing	Farm services and cash rent[5]						
1965	98	99	93	92	93	97	.....	96	79	87	86	94	94
1966	98	99	96	96	96	99	.....	99	90	94	93	99	99
1967	100	100	100	100	100	100	.....	100	100	100	100	100	100
1968	101	102	107	104	104	106	.....	102	112	110	108	102	108
1969	102	104	112	111	110	113	.....	106	125	120	119	107	108
1970	104	108	120	116	116	118	.....	110	134	129	128	112	112
1971	107	111	131	122	122	121	113	115	142	136	134	117	118
1972	108	114	137	128	130	131	123	122	156	142	142	125	125
1973	116	120	145	137	139	147	136	142	134	145	155	149	144
1974	159	147	161	161	159	181	166	161	223	154	178	169	164
1975	177	168	191	196	197	206	199	177	262	166	192	186	180
1976	187	164	212	217	225	215	214	187	299	178	210	198	192
1977	202	165	234	238	246	229	232	196	339	196	226	208	202
1978	212	171	248	259	266	248	248	212	400	210	242	227	219
1979	276	189	278	289	293	272	265	241	501	226	265	251	250

[1] Index values for 1965 through 1975 were revised and published in May 1976 using 1971–73 weights. Indexes were reordered and several new indexes introduced. Revised monthly indexes for January 1965–April 1975 are available upon request.
[2] Based on Consumer Price Indexes of Bureau of Labor Statistics.
[3] Beginning 1977, based on Consumer Price Indexes of Bureau of Labor Statistics.
[4] Discontinued.
[5] New index; values for years prior to 1971 are not available.
[6] Simple average of seasonally adjusted quarterly indexes.

Economics, Statistics, and Cooperatives Service—Crop Reporting Board.

[Excerpt from AGRICULTURAL STATISTICS 1980, U. S. Department of Agriculture]

SOCIETY OF UNIVERSITY PATENT ADMINISTRATORS

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May 15, 1981

Senator Charles McC. Mathias, Jr.
Criminal Law Subcommittee
162 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Mathias

I am writing on behalf of the Society of University Patent Administrators (SUPA) to express support for your bill S.255, Patent Term Restoration Act.

SUPA is a national organization which is largely representative of universities having patent programs, and which are interested in licensing of inventions that are developed by faculty and staff. Its members are heavily involved in developing university-industry cooperative efforts. In fact, some industrial concerns also hold membership in the organization.

We appreciate the efforts to introduce S.255. The life of any patent is limited when time must be expended in having an invention cleared by regulatory agencies before it becomes marketable. This creates a problem for licensees, since it reduces the time potential for recovering costs of such clearances, and for experiencing a profit on their investment. The cost of obtaining clearances can also be prohibitive and, unless the life of the patent can be extended, industry may be reluctant to enter into licensing agreements.

If you need further information, please feel free to contact me.

Very truly yours

Clark A. McCartney

Clark A. McCartney
President

/fs

STATEMENT OF CHARLES A. HUGGETT,
GENERAL PATENT COUNSEL, MOBIL OIL CORPORATION
BEFORE THE SENATE JUDICIARY COMMITTEE ON
PATENT TERM RESTORATION ACT OF 1981 (S-255)

My name is Charles A. Huggett. As General Patent Counsel of Mobil Oil Corporation, responsible for intellectual property matters throughout the Mobil Corporation, I am pleased to present our views on S-255. The Patent Term Restoration Act of 1981, if passed, would restore the term of the patent grant for the period of time, not exceeding seven (7) years, that nonpatent regulatory requirements prevent the marketing of the patented product or a method for using a product. While we support the principle of restoring the seventeen year period of exclusivity to patent owners, we believe the legislation should not be limited only to product and method of use patents, but should also extend to patents covering a process for making a product. This change was suggested by Thomas D. Kiley, Jr., Esquire, Vice President and General Counsel of Genentech, Inc., on April 30, 1981, during the Senate Judiciary Committee Hearing on S-255.

During his testimony, Mr. Kiley pointed out that in genetic engineering industry (of which Genentech, Inc. is one of the most prominent members), process patent protection is often the only available route for obtaining patent protection for ongoing research, because both the products of the genetic engineering research and the methods of use thereof are widely known in the art. Similarly, in the area of synthetic fuels, patent protection is often limited to the processes for making a product because the product itself and the method of its use are conventional. At the same time, commercial implementation of patented processes is also subjected to nonpatent regulatory delays very similar to those experienced by owners of patents directed to products and to methods of use thereof.

For example, under Section 111 of the Clean Air Act, standards of performance have been proposed or promulgated for various new stationary sources. One may not construct such a new stationary source, such as a new synthetic fuels plant based on a patented process, unless the emission standards are met. These standards are generally applied as of the date of proposal, not promulgation. The delay caused by meeting these standards may be as long as two (2) to four (4) years. Many similar environmental and other nonpatent regulatory delays can postpone commercial implementation of patented processes for similar periods of time. Any one and/or any combination of such regulatory delays effectively decreases the life of the patent to less than the seventeen years envisioned by Congress.

In addition, we believe the bill should explicitly state that its provisions are directed to all patents, regardless of the technology involved, in spite of the exemplification of only four (4) specific technological areas in Section 155 (c)(1), viz., (A) drugs, devices, etc.; (B) biological products; (C) pesticides; and, (D) chemicals subject to regulation under Toxic Substances Control Act.

We would be pleased to answer any questions, and offer our assistance for any specific amendments to the bill which the Committee may desire.

Very truly yours,

Charles A. Huggett (SA)

Charles A. Huggett
General Patent Counsel

May 22, 1981