

At present the medical research expenditures of research-oriented drug companies average about 11 percent of sales, compared with an average of 2 percent for all types of industry in the United States.

The total PMA member firm expenditures for research and development this year will exceed \$460 million. For the 10 years 1958-67, these firms expended nearly \$3 billion of their own funds in such activity.

A report entitled "Ethical Pharmaceutical Industry Operations and Research and Development Trends—1960-66"¹ based upon PMA annual surveys of member firms, contains considerably more detail than I have briefly outlined in my statement. A copy of this report is attached for inclusion in the record.

It should be noted that the research-oriented firms in the pharmaceutical industry employ the highest ratio of scientists of all industries. A study done a few years ago by the National Science Foundation showed 156 scientists per 1,000 employees in the drug industry, compared with the next highest of 48 in the chemical industry, 32 in the petroleum industry, and an average of eight for all manufacturing industries. The large number of research scientists in pharmaceutical laboratories attests to the complex problems of biomedicine and fundamental drug research in contrast to the more applied and technical nature of research in other industries.

Drug research progress is complex and slow. The unfinished work hopefully leading to understanding of the biochemistry of health and disease and in new drug development is vast and needs to be pursued more intensively by all sectors of the research establishments in academic and private institutions and in Government and industry.

Mr. GORDON. You say 2 percent of all industry. Does that include manufacturing only, or does that include agriculture and mining? What does it actually include?

Dr. SCHEELE. It is all manufacturing industries.

Mr. GORDON. Only manufacturing, you say?

Dr. SCHEELE. Yes, sir.

Mr. GORDON. All right.

Dr. SCHEELE. These elements of our research force are not separate. They have and need to continue to work together closely for maximum achievement. For example, it was academic-industrial collaboration that brought about the discovery of cortisone and then made it available as a major drug of value in the treatment of arthritis. Later industrial research and good molecular modification led to the finding of other uses and the development of other steroids with new uses, such as treatment of skin problems. In more recent times, still other molecular changes have led to progestational steroids and such steroids, combined with estrogens, provide a useful treatment of women's menstrual disorders. More recently, used together or sequentially, they have become important in spacing pregnancy—family planning. Although great strides have been made with the now classical 20-day regimes, it is certain that, in the not too distant future, altogether new concepts of hormonal modification may be expected, which will control fertility in either sex with specificity and relative lack of side effects. These developments will only be made possible by continuation of the reproductive physiology studies of the past 20 years. The current compounds are playing a role in attacking one of the world's

¹ See p. 2293, *infra*.