financed agencies. And it appears that in fact the drug firms do not engage extensively in truly basic research. But this does not necessarily imply that drug industry research activities give rise to no distortion in the spectrum of basic research efforts. It has been said that too little basic research in areas relating to health and therapy is done by non-industry organizations, at least partly because the ability of the industry to pay high salaries (in turn dependent upon the high profitability of drugs under present market conditions) diverts too large a portion of the very small pool of qualified investigators and technicians away from public employment in basic research and toward private employment in applied research and product development, testing, and application—all of which are lower-priority uses for their very scarce skills. The remedy would seem to lie not in increasing the amount of basic research done by private firms, but in taking steps to reduce their ability to drain off the best scientific personnel for work in less productive employments than they are capable of pursuing.

Applied Research.—The economic rationale of applied research is quite straightforward in any industry: to serve as one means of implementing a profitable marketing operation. The direction and emphasis of this research in the field of drug therapy is influenced by (1) the nature of the patent system: (2) the impact of the patent system on the organization of the industry; and (3) the effect of industry activities on research outside the industry. The mere existence of the patent privilege for drugs biases research toward patentable inventions and away from areas where no patents can be obtained. This discriminates against basic research and stimulates applied research. It also discriminates among different channels of applied research. From the medical point of view, research is unbalanced due to an unduly intense emphasis on chemotherapy, while the complementary fields of nutrition, public health, biochemistry, and preventive medicine are underemphasized. Antibiotics provide the most sharply focussed example. Concern has been widely expressed that antibiotic therapy may ultimately prove to be a blind alley due to overuse and the development of resistant strains of micro-organisms. It would seem wiser to spend less effort on activities which tend to make micro-organisms increasingly resistant to control, and more effort on attempts to make man naturally more resistant to micro-organisms.

Furthermore, by biasing efforts toward applied research, the patent system will reduce the scope of basic research findings which can be applied, and ultimately will depress the productivity of applied research. There has been much discussion in recent years of the "increasing cost" of drug research per new discovery. (This was true even before the FDA began to implement more stringent controls over new drugs.) But to speak of increasing costs is simply to refer indirectly to the decreasing productivity of efforts. Again, antibiotics offers a good case in point. Applied research here was productive for a good many years, in large measure because fundamental research in this field had already elucidated much of the mechanism of infection by micro-organisms. Bacteriology was already an established field of study. But the same is not true in the other major areas of drug research, such as tranquilizers and oral antidiabetic agents. Here there has been a less prolific output of various useful drugs and less enthusiasm among independent authorities regarding the extent to which the later drugs are advances over the earlier drugs, and perhaps even over related drugs which antedated the "miracle drug" era.

Another bias of some interest is related to the fact by protecting new products, either as such or through exclusive process privileges, the patent law biases applied research in the direction of concocting new products rather than fully investigating the properties of known compounds. As Prof. George Wright of the University of Toronto has contended, it seems to indicate rather overly one-sided emphasis that new drugs coming from drug houses are almost invariably novel concoctions and therefore patentable, while the reservoir of some two million already known compounds has only been pharmacologically investigated to a very modest degree.[11]

To the extent that patent reforms can reduce biases of this type, resources will be allocated more efficiently throughout the drug research sector of the

[11] Professor Wright advocates more screening of known compounds rather than an exclusive emphasis on the concocting of new ones, on the assumption that "much is yet unknown about the association between chemical structure and pharmacological action," observing that the screening approach originally brought the sulfa drugs into existence. Canadian Hearings, *op. cit.*, no. 8, p. 540.