

state & society

Corporate Associates meeting stresses industrial physics

For the first time, the annual meeting of the Corporate Associates of the American Institute of Physics took place at an industrial research laboratory, that of the General Motors Corporation in Warren, Michigan. So it was especially appropriate that the theme of the meeting, held 8-9 October, was "Physics in Industry." The meeting brought together Corporate Associates representatives, physics-department chairmen, government officials and society officers. In addition to talks on today's industrial research, applications of physics, and frontier areas of physics, the 150 participants were given a tour of the General Motors Research Laboratories and participated in informal discussion groups.

N. Bruce Hannay (Bell Laboratories) discussed innovation in industry. He noted many signs of declining industrial R&D, observing that 85% of industry-funded R&D is in just seven industries: electrical equipment, chemicals and allied products, electrical machinery (including computers), motor vehicles, aircraft and missiles, petroleum, and instruments. Only 29 companies, each spending \$100 million or more on R&D in 1975, accounted for almost half the industrial total.

Basic research in industry amounts to about \$600 million, he said, which represents a decline of over 30% in real spending over the last ten years. Furthermore,



Coffee break at the American Institute of Physics Corporate Associates meeting, which was held at the General Motors Research Laboratories in Warren, Michigan, 8-9 October.

the last few years have seen a significant reduction of basic research in a number of companies.

Hannay's central concern is whether the capacity for fundamental innovation,

which in the past has produced the transistor, synthetic fibers, the digital computer, and so on, is being adequately sustained. Much of today's innovation is,

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Bureaucracy stifles US research community, NSB says

Basic research is in trouble—such appears to be the consensus of several hundred scientific and administrative leaders of the US research community, according to statements solicited by the National Science Board. The problems and potential solutions brought up by these researchers range from the immediate and practical to the long-range and esoteric, but most respondents to the NSB survey agree that present policies, institutional structures and objectives endanger the future of American research. In particular, many perceive excessive, all-pervasive supervision and regulation of the research enterprise as a grave threat.

The NSB obtained the personal, subjective impressions of more than 600

leaders of the American research effort in order to produce *Science at the Bicentennial: A Report from the Research Community*. This latest report complements the earlier Science-Board survey *Science Indicators 1974*, a predominantly statistical examination of the state of US research in science and technology (see *PHYSICS TODAY*, May 1976, page 93). Both reports indicate concern about the course of basic research, but the opinion survey reveals a degree of anxiety—especially over the public's attitude toward science and scientists—not indicated in the objective study.

Causes for concern. The NSB asked top administrators, research heads and department chairmen in the nation's leading

research universities, governmental and independent laboratories and industries to name the most important problems affecting US research. The Board further requested that comments deal with "circumstances in the institutional, managerial or policy environment" influencing "the productivity of working scientists and engineers," rather than financial complaints. The allocation of funds in a tight economy, however, remains a matter of concern. The dwindling of resources spent on basic research in industry, for example, is cited by a number of industrial research leaders. "Research and development is a highly visible overhead expenditure," according to Thomas R. Miller (Vice-President,



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Union Carbide Corp), "and is usually high on the list for reductions when profits are too low, as they are for capital-formation purposes. Generally, basic research is cut back the most." Some industrial-research leaders suggest preferential tax treatment for R&D and mechanisms to ensure the continuity of basic-research funding as needed countermeasures.

But some, like George L. Pake (Vice-President, Xerox Corp), believe that "basic science is what universities do best." The academic research leaders, too, worry over a possible waning of basic-research efforts. H. S. Gutowsky (Director, School of Chemical Sciences, University of Illinois) warns that "the amount of basic research being accomplished will be reduced in proportion to falling graduate enrollments unless other components of the enterprise are increased concurrently," and Charles E. Hathaway (Head, Department of Physics, Kansas State University at Manhattan) says an "aging static faculty" may prove the most detrimental problem in the long range. Daniel D. Perlmuter (Chairman, Department of Chemical and Biochemical Engineering, University of Pennsylvania) suggests that graduate-student support should not be tied to faculty members' research grants: "Students ought to be supported because of a commitment to science and engineering education, not dependent on the fund-raising skill of a particular adviser."

Another reason given for the perceived decline in basic science's fortunes is the quality of the researchers. For example, Hans Mark (Director, Ames Research Center, NASA) sees a drift of the most promising workers away from basic fields. The major issue is not money, according to Mark, but rather it is the need "once again to convince our very best young people to pursue careers in basic scientific research."

Red tape. Surely the most universally recognized problem among those consulted was the superabundance of rules, regulations and sundry requirements—most of them governmental in origin—that seek to guide and channel research but may end up stifling it. Perhaps the most vehement was Harold Agnew (Director, Los Alamos Scientific Laboratory): "Bureaucracy will eradicate creative endeavor and innovation in the long run. Bureaucracy eventually loses sight of what the real objective was and becomes only concerned in its own management and control functions. Unless this trend toward centralization is somehow reversed I predict the US will rapidly lose its lead in science and technology."

Industrial research leaders told the NSB that multiplying regulatory actions could make basic, long-term research efforts too costly for all but the largest companies. Though part of the decline in industrial support for such research, according to Lee A. Iacocca (President, Ford Motor Co), is due to a depressed economy, "another serious cause is the need for industry to commit a substantial and increasing proportion of its research resources in response to regulatory demands and goals established by the Congress and a number of Federal agencies."

At the universities, excessive supervision may be proving counterproductive, in the view of some academic research leaders. Dale R. Corson (President, Cornell University) has misgivings about a governmental trend toward the targeting of sponsored research on "short-range, high-payoff objectives." Such specifically targeted research, he says, is not well suited to university research. Allan M. Cormack (Chairman, Physics Department, Tufts University) laments the

erosion of the "traditional view" of the university's function; assorted legislators and bureaucrats, he says, have "demanded that we explicitly demonstrate in our work innovations, relevance, concern for interdisciplinary matters and so on" with the result that "we have lost much of what is most valuable in solving any problem—time to think."

Public confidence. Respondents from all sectors of the US research enterprise express doubts about society's attitude toward scientific and technological advances. Robert G. Sachs (Director, Argonne National Laboratory) refers to "an unfortunate erosion of the intellectual climate in this country..." of which a negative attitude toward basic research is just one aspect. Decreasing public confidence in research scientists, a distrust of technological advancements and misunderstanding of the role and function of basic research are among the problems cited by research heads. Some feel the need of a national education program to put science and its practitioners in a more favorable light with the public.

How far scientists may actually have fallen in public esteem is not easily determined, beyond these subjective impressions. The NSB report includes a brief recapitulation of what public surveys have revealed about national confidence in science and technology. In summary, the data appear to indicate that there has been a drop in general regard for public institutions since the middle 1960's, and that scientists have shared in the drop. But compared to other professionals, they have held their own or even gained. Thus some of the concern shown by the research leaders would appear from the report to be unwarranted. But if there is cause for worry, perhaps researchers themselves are a factor; David Langmuir (TRW Systems Group, Santa Monica, Calif.) says there has been a shift of motivations for researchers in the past half-century, away from "love and fame," toward wealth and power. This, he thinks, "has been more obvious to people outside the ranks of scientists than to those within."

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instead, incremental, and some of it amounts to little more than product differentiation. Industrial research with the potential for fundamental innovation has been declining, he feels.

He catalogued some of the forces affecting innovation: Most important are financial factors, which include the increased cost of launching new ventures and the very high rate of return required