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July 2, 1979

Howard Bremer, Esq.
SUPA
Wisconsin Alumni Research
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614 No. Walnut Street
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Dear Howard:

Enclosed is a copy of an article from the May issue of Science by Peter F. Drucker entitled "SCIENCE AND INDUSTRY, CHALLENGES OF ANTAGONISTIC INTERDEPENDENCE". This was sent to me by a Professor who is retired from the University of Missouri and is also an inventor.

I read some of Peter Drucker's books when I attended the Executive Program at the University of Chicago. I also have read several of his books and articles since then. He has demonstrated a great deal of insight into these problems and has an exceptional ability to put his thoughts into writing that is understandable.

Both you and I have been around long enough to appreciate some of the observations that Mr. Drucker has made. I believe that many of these observations bear on the attitudes both pro and con, expressed in the Dole/Bayh bill. Perhaps this information could be included in the next News Letter of SUPA or at least reference made to it.

Some of this animosity between industry and science was expressed in my recent phone conversation with Mr. Roadman of the Illinois Manufacturer's Association. His initial reaction was a little leery of any meeting that involved an interchange between university professors and members of his association. I agree that a certain amount of doubt and suspicion exists on both sides. However, that doesn't help anyone, and I believe that the people in our position need to act as an interface and moderate some of these attitudes.

Good luck on your testimony. If I can be of assistance, please feel free to call on me as always.

Very truly yours,

Ray E. Snyder

Ray E. Snyder

RES/ao
enclosure

scopic coverage), an accurate slope measurement cannot be obtained. A method using shadows may prove useful.
12. D. L. Anderson *et al.*, *J. Geophys. Res.* **82**, 4524 (1977).
13. T. A. Mutch *et al.*, *Science* **194**, 1277 (1976).
14. T. A. Mutch *et al.*, *ibid.*, p. 87.
15. H. H. Kieffer, *ibid.*, p. 1344.
16. J. A. Ryan, personal communication; S. L. Hess *et al.*, *J. Geophys. Res.*, in press; J. A. Ryan and R. M. Henry, *ibid.*, in press.; J. E. Tillman *et al.*, *ibid.*, in press.
17. H. H. Kieffer writes (personal communication) that according to his calculations (*15*) "[on] a surface with the physical properties estimated for the VL-2 site, e.g., thermal inertia (units of 10^{-3} cal cm^{-2} sec$^{-1/2}$ K^{-1}) $I = 8$, and albedo $A = 0.225$, CO_2 frosts might form at night during the middle of winter but would not last through the day. Even for the soil alone (exclusive of rocks) with a thermal inertia of approximately 6.2, ground frost would not last through the day. Those calculations assumed a frost albedo of 0.65 whenever any frost at all was present. To have CO_2 last throughout the day, at least one of the following is required. [i] The effective frost albedo must be close to one. This is particularly a problem for thin frosts, where even a material with very high single scattering albedo will scatter a considerable fraction of the radiation into the underlying soil. [ii] The surface material must have a thermal inertia considerably less than expected. Preliminary calculations indicate that $I = 2$ or less is required for frost to last until mid-day. [iii] The insolation at VL-2 must be considerably lessened by the polar hood without a compensating increase in the infrared opacity of the atmosphere."
18. The minimum temperatures (151 to 157 K) and maximum pressures (~ 10 mbar) at the VL-2 site are thermodynamically consistent with the conversion of $H_2O(s)$ to a CO_2-clathrate. However, any CO_2-clathrate that formed would have reconverted to $H_2O(s)$ on about the same time scale as the expected disappearance of $CO_2(s)$, since the sublimation rate of CO_2-clathrate is similar to that of $CO_2(s)$ (S. L. Miller, personal communication).
19. The vapor pressure of $H_2O(s)$ is strongly dependent on temperature. However, over the temperature ranges measured at the VL-2 site, values vary from 2×10^{-7} mbar at 155 K to 2.2×10^{-6} mbar at 165 K. This converts into 5.5×10^{-3} and 5.9×10^{-2} precipitable micrometers of $H_2O(s)$—an undetectable thickness.
20. An additional source of H_2O that must be considered is water bound in soil materials beneath the surface at the site. The temperature gradient that results when the surface temperature drops below the subsurface temperature should favor an upward transport of water vapor. Water bound in soil materials or present as subsurface ice might tend to diffuse toward the surface. However, at the low temperatures measured at the site the diffusion rate would be extremely small. Whether it would be negligible is not easily determined. One must consider such complications as the presence of the duricrust at both sites, which may act as a barrier to the upward migration of water vapor. However, the dust transport mechanism seems clearly supported by the data and we believe that a subsurface source of H_2O is not required.
21. S. L. Hess, *J. Atmos. Sci.* **27**, 1117 (1970).
22. ———, *Icarus* **28**, 269 (1976).
23. Any equivalent dust accumulation on the body of either spacecraft is indistinguishable from material spilled during the numerous sampler deliveries to the lander's chemical and biological experiments.
24. J. A. Ryan, personal communication.
25. J. E. Tillman, personal communication.
26. H. H. Kieffer, personal communication.
27. At the altitude of 400 km the angular resolution of the orbiter cameras is ~ 8 m per pixel. Two factors, however, significantly reduce the image quality. First, the sun angle was high when the images were acquired, and no shadow information was obtained. Second, the exposures were shortened to minimize blur due to spacecraft motion. Consequently, the images have very few discernible brightness levels, which are as important as angular resolution in identifying surface features. Nevertheless, they are a significant improvement over previous images.
28. E. C. Morris, K. L. Jones, J. P. Berger, *Icarus* **34**, 548 (1978).
29. M. H. Carr *et al.*, *Science* **193**, 766 (1976).
30. E. A. Guinness and R. E. Arvidson, *Eos* **59**, 313 (1978) (abstract).
31. C. Sagan, *J. Geophys. Res.* **78**, 4155 (1973).
32. C. Sagan *et al.*, *Icarus* **17**, 346 (1972); *J. Geophys. Res.* **78**, 4163 (1973).
33. J. Veverka, P. Thomas, R. Greeley, *J. Geophys. Res.* **82**, 4167 (1977).
34. The accumulation of a layer of bright dust where an equivalent accumulation did not already exist implies that the processes of deposition and removal alternate on a time scale measured in Mars years. Recently acquired repro images show a brightening of trenches, as well as what appears to be bright dust on the surface, at the VL-1 site. Although the quantity of bright dust is less than at the VL-2 site, it provides us with equivalent evidence that both sites experience this type of dust accumulation and removal on a regular basis. Having detected the dust at both sites, we anticipated documenting its removal (possibly as part of the "wave of darkening"), but this has not occurred.
35. We thank the Viking Orbiter Imaging Team for supplying the photograph for Fig. 6. We thank L. Cooley, D. Stuhr, and B. Vensel for typing the manuscript. This work was supported by NASA contracts NAS1-11500 to the Bionetics Corporation, NAS1-13889 to Washington University, and NAS1-9000 to Martin Marietta Aerospace and by NASA Langley Research Center.

Science and Industry, Challenges of Antagonistic Interdependence

Peter F. Drucker

Summary. No one is responsible for the disenchantment of American science with its customers, government and industry, and of the customers with science. But the estrangement that has replaced the earlier relationship of mutual respect, while dangerous to both sides, is a mortal threat to American science.

Science and industry in the United States used to enjoy a relationship of mutual respect based on an unspoken conviction that they depended on one another. That relationship, while distant, was uniquely productive for both science and industry (*1*).

The first change in the traditional American relationship occurred after World War II. Research became fashionable in industry and government alike. These were the years when the stock market valued a company according to the amount of money it spent on research, and in which a lavish campuslike research center was considered proof of a management's competence. Similarly in those years—culminating in the space program of the 1960's—science and research increasingly came to be seen as the mark of the effective well-planned and properly progressive government program.

During the years after the war, the ability of America to convert science into industrial application was considered the outstanding strength of both American science and American industry. Treatise after treatise pointed out that the British, for instance, were America's equals in science. But the British failed to convert their own scientific achievements—in electronics, in polymer chemistry, in the computer, in radar, or in aviation—into technology, products, and economic advancement, whereas America did.

Equally, especially during the Truman and the Kennedy years, the willingness, indeed eagerness, of the American politician and government executive to apply science—"hard" as well as "soft"—to both the study of social and political problems and to the design of social and political programs was seen both inside this country and outside as a distinct and great American achievement. The innovating ability of American society was

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widely explained throughout the world, including the Communist countries, as the result of the sensitivity of the American scientist to political and social needs and opportunities, and to the values and dynamics of the political process.

In quantitative terms, the relationship seems to be as close as ever—and perhaps even closer in computer sciences, solid-state and nuclear physics, the earth sciences, and biochemistry. It might be argued that nothing has really changed despite all the talk of irrelevance of science or of the wickedness of "American Imperialism" by the vocal critics on the New Left, despite Vietnam, despite inflation, and so on. One might indeed assert that the highly publicized and highly visible developments and media events—the headline- and demonstration-makers—are little more than whitecaps on the surface of the ocean.

Yet there has been a major change, not in the measurable realities of the relationship between science and the decision-makers in industry and government, but in the moods, the values, and the meaning of the relationship. There is today distrust, disenchantment, mutual dislike even, and, worse, lack of interest in each other on both sides. American scientists today, in large number, tend to suspect the traditional relationship as being tainted or impure. Industry still professes to honor the relationship and to respect research. But industry's actions no longer fully live up to industry's professions. As to government, there is now a strong tendency to judge science by what is politically expedient or politically fashionable; that is, to attempt to subordinate science, whether pure or applied, to value-judgments that are the reverse of, and largely incompatible with, any criteria one could possibly call scientific.

In both industry and government, there is even increasing doubt whether science and research do indeed lead to results. It is often argued that this reflects lengthening lead times resulting from the increasing complexity and specialization of today's advanced scientific research. But there is no evidence that the lead times have lengthened; the time span between new theoretical knowledge and the first application is the same 30 to 40 years that it has been all along (for example, between Maxwell's theory and Westinghouse, between x-ray diffraction and Carruthers' development of nylon and polymerization, or between quantum mechanics and semiconductors). What is changing are not facts but faith. On both sides the mood is becoming one of alienation and perhaps even of recrimination. It is a dangerous mood, above all for American science and American scientists. Both sides stand to lose, but science stands to lose far more.

Ways of Industry

The mind-set and values of industry—but equally of the government decision-maker concerned with effective policy—are in danger of becoming hostile to the needs, the values, the goals, and the perception of science. One reason for this is the increasing pressure, especially in an inflationary period, to produce results fast. An inflationary period, by definition, is one that erodes and destroys both industrial and political capital. In an inflationary period the existing value of future results is subject to the exceedingly high discount rate of inflation which, in effect, means that no results more than a year or two ahead have any present value whatever, whether value is defined in economic or in political terms. It is, therefore, not a period in which either industry or the policy-maker can take risks.

Thus both industry and the governmental policy-maker in an inflationary period concentrate on small, but sure and immediate, payoffs; that is, on what can be calculated with high probability. The application of true scientific knowledge is by definition a big gamble in which payoffs are far in the future and thus exceedingly uncertain although very great in the event of success. In an inflationary period, the industrialist or the policy-maker is almost forced into the small but quick payoff of a lot of small and, by themselves, unimportant projects that require very little science altogether and can only be damaged if exposed to too much science.

Tax Effects and Investments

More important perhaps—or at least more insidiously deleterious over a longer period of time—is taxation. The tax system adopted by the United States in the last 20 years or so penalizes basic research and the adaptation of basic research to technology. Worse, through the combined working of corporation income tax and capital gains tax, the system greatly favors short-term, immediate gains and makes long-term investments in an uncertain future unattractive and unrewarding.

Equally inimical to investment in research and innovation is the increasing burden of regulation. It is not primarily that regulation adds cost, but that it creates uncertainty. Whether in respect to the environment, to safety, or to new drugs, regulation makes investment in research irrational, not only increasing the odds against research producing usable results but also making research into a crooked game.

Tax laws and regulations also push industry away from technology focus and toward financial conglomeration. Under the tax laws of the United States—laws which in this form do not exist in many countries—the proceeds of liquidating yesterday are considered profit and are taxed as such both to the company and to the investor. Hence, businesses, instead of liquidating the obsolete, have to find new investments in new businesses for whatever cash is being released by the shrinkage of an old technology, an old product line, or an old market. And this, in effect, imposes conglomeration on them. This policy makes it increasingly difficult to shift resources from low and diminishing areas of productivity to areas of high and increasing productivity and this impedes innovation. It also shifts businesses from a technological to a financial focus. It makes management increasingly a matter of finding the right financial investment.

The Antitrust Bias

This constant pressure of the tax laws, which results in a swerve from the scientific and technological toward the financial and from the long term toward the short term, is then aggravated by the antitrust laws, which probably are responsible more than any single factor for turning American industry away from building on a technological, science-oriented base and toward the financially based conglomerate.

In the world economy, even businesses that are very large on the national scene are becoming marginal, if not too small. The "big business" of 1938 or even 1958 is a small, if not a marginal, business in the 1979 world economy. Yet our antitrust laws frown on the scaling-up of businesses except through the formation of conglomerates, which, however, lack the fundamental core of technological unity. This conglomerate is focused on financial rather than on technological results. Hence, investment in long-range research and in the application of scientific knowledge to economic production becomes difficult in the conglomerate. People who are good at building and running conglomerates are financially oriented people. Yesterday's business, with its unified technology, organized around a process, such as making glass, was basically technologically oriented and therefore looked to science for its future. The conglomerate, which comprises everything from tin cans and electronics to fast-food restaurants and dress shops, from airlines to banks and toys, is, of necessity, financially oriented. Research becomes a cost center rather than a producer of tomorrow's wealth.

Similar forces operate in government in respect to the interest and the investment in science. Even the most shortsighted businessman still has to focus on both the short term and long term. But a governmental budget is always myopic. It knows no time span other than the fiscal year. It has to justify allocation of resources on the basis of short-term and mostly political expediencies. This was one reason why some older and wiser heads in American science warned against dependence on government 25 years ago. Their fears proved well founded. As soon as science ceases to be an article of the faith and popular, and becomes *one* application of governmental funds rather than *the* application of governmental funds, the pressures of the budget process make science a low-priority choice for politician and bureaucrat alike.

There is also disenchantment with the results. Whether science oversold itself or whether industry and government expected miracles, is beside the point; the results that business and government anticipated when they rushed into lavish expenditures on scientific research have rarely been attained. Surely, the relation between scientific work and results, whether in terms of goods, services, or such benefits as better schools or better health care, is far more difficult and complex than either scientist or policy-maker thought.

As a result of these pressures and developments, industry and government are drifting toward what might be called a scholasticism of the budget in which the budget is a closed system, with its own absolute logic.

Both the business executive and the governmental executive proclaim their faith in research, but neither can practice it today. The mind-set of executives, whether in business or in government, and their values thus inexorably shift from what Thorstein Veblen, about 60 years ago, called "the instinct of workmanship" to what he called "the spirit of business"—the right term today would be "the spirit of the budget." It is a shift from a concern with the creation of wealth-producing resources toward immediate payoffs. It is a shift in cost-effectiveness from emphasis on "effectiveness" to emphasis on cost. And this trend is perhaps a good deal more pronounced in government today than it is in business.

Estrangement

Let us now look at what has happened to change the mood, the mind-set, the values of American science. Those changes, or at least their underlying causes, go back to an earlier period during which the relation between science and its nonscientific patrons and customers both in industry and in government seemed to be closest, most harmonious, and most productive.

American science first began to feel uncomfortable in the traditional relationship of mutually advantageous coexistence. Or perhaps science was uncomfortable all along, but did not see any alternative until after World War II, when government emerged as its rich and more generous patron. Whereas industry had at best spent hundreds of thousands and hired a dozen scientists, the government spent billions and seemed to have an insatiable appetite for well-paid science professionals in an ever increasing number of government agencies.

Even more appealing: Government increasingly offered scientists, including a great many junior ones still at the beginning of their scientific careers, the best of both worlds—to live in academia on a Washington income. No wonder that grantsmanship rapidly became the most prized and the most accomplished of the liberal arts. And where industry, whenever it offered support, had the insulting habit of expecting results, government, or so it seemed, was willing to support the scientist for science's sake. Indeed anyone who in the palmy days of the early 1960's raised such nasty questions as the accountability of grants-receiving scientists for performance and results, risked being branded an anti-intellectual. And anyone who then doubted that government support would continue to grow, let alone whether government's intentions were truly honorable, was likely to be dismissed as an old fogy.

As a consequence, science became accustomed to large sums of public money, in return for which it then had to accept political rather than economic yardsticks for success and performance, the main yardstick being whether a program for the support of this or that major scientific enterprise could be sold to the governmental policy-makers; and—a logical consequence—whether this or that search for knowledge fitted the political ideologies and popular fads of this or that clique or faction. Thus American science, quite understandably, came to consider the question of economic application and economic benefits to be irrelevant and irksome, if not somewhat demeaning. Few raised the question whether political favor and acclaim might not be equally irrelevant and perhaps even more demeaning as yardsticks of scientific achievement.

But I would consider even more crucial in the estrangement from industry on the part of science the fact that, for the last quarter-century, work in graduate school has come to focus on the production of Ph.D.'s, certified for teaching in institutions of higher learning. Prior to World War II, science teaching in the university focused on undergraduates, on students who were unlikely to make science their career. In graduate school the focus was largely on the preparation of research scientists for outside laboratories, that is, in industry and, to a lesser extent, in government. The best graduates were the ones who then got the good jobs in industry; other jobs for graduate scientists were exceedingly scarce.

The "educational explosion" of the mid-1950's, of necessity, meant a shift in focus to basic theory, which is what an undergraduate teacher teaches. It meant, of necessity, a loss of close contact with industry. For one's brightest graduates no longer went into industry—and it is largely through his graduates that the university scientist stays in contact with the world outside of science. Indeed the distinguished scientist's best students did not even go into undergraduate teaching, but stayed on in graduate teaching and graduate research. The educational explosion made the scholar into an industrialist who produced graduates. Graduate school became a growth industry, and the university largely became a closed system, preparing people for its own continuation and perpetuation.

This also changed the meaning of research. Research now became something for which one gets entitlement to a specific type of job, to promotion, or to tenure. It became a ticket of admission. Whenever a piece of work becomes a ticket of admission, it becomes increasingly formalized. It increasingly focuses on satisfying requirements rather than on producing results.

Again, 15 years ago only an "old fogy" would have dared to suggest that graduate school enrollment and, especially, enrollment in graduate programs preparing for teaching in graduate school would not and could not expand indefinitely. Long after the "baby bust" of 1960–1961 had occurred—indeed long after it had clearly become irreversible—graduate schools, and especially those in science, continued to intensify their efforts to produce larger numbers of graduates trained and mentally prepared for rapid careers in the academic "growth industry," of the ever expanding university. When the university stopped expanding, these graduates then understandably felt let down. They did not blame the university which had led them on and had overpromised. They did not accept the facts of baby boom and baby bust. They tended to blame the outside world, namely, industry and government.

These developments may account for what, to the outside viewer, seems to be the most fundamental shift of all. This is the shift toward a definition of knowledge as "whatever has no utility and is unlikely to be applied." This is not a form of Marxism, let alone social responsibility. It is incompatible with any philosophy of society or economy. And it is far more elitist, and in the worst possible way, then the so-called elitism of the traditional scholar. It is a view of science as existing primarily for the sake of academia.

The American scientist, by and large, still invokes Francis Bacon as his patron saint. But to an outside observer, and especially an outside observer located in the employing institutions other than the university itself—that is, in government or industry—it sometimes seems that American science is rapidly shifting to its own neo-scholasticism, its own closed system. Like any scholasticism, it suspects experience, despite its emphasis on experiments. It tends to reject utility, application, technology, and any kind of payoff altogether. To the outside observer it looks as if the mind-set and the values of American science are becoming incompatible with, or at least alien to, application, utility, and results.

The Dangers

The drift of science and industry from mutual respect and advantageous interdependence to the antagonism and alienation which characterize the last 10 or 15 years, is dangerous first to American industry. The great danger is that what I have called the "spirit of the budget" will paralyze the ability to innovate and to change.

We know very little about the actual relation between scientific knowledge and technology, but we do know that science creates both vision and performance-capacity. It would be a very poor trade-off to exchange the increased analytical capacity of the policy-maker in government and business for lack of vision, lack of will to innovate, and paralysis of the capacity to change. We face a period in which ability to change will be crucial—with the impacts of 20th-century science on our vision, as well as on our technology and our way of life, just beginning to be significant.

The danger of the drift into antagonism and alienation is, however, even greater for science than it is for industry. It is possible, and even fairly easy, to buy the application of science. By its very nature, science is public. Technology, the application of science, is usually available in prepackaged and applicable form and for a reasonable fee. This has been proved by such totally different countries as the Soviet Union and Japan. In both, investment in science has been kept low—in the Soviet Union it has essentially been focused on a few selected areas considered of prime importance for defense; and in Japan it has been reserved for areas that were considered intellectually prestigious. In both countries, the technological fruits of science were readily available by purchase from the outside world.

It is not true, in other words, that a modern developed country needs a science base. It can purchase it or import it. If American science loses the support of industry and of government policy-maker because it spurns both in the name of scientific "purity," it may find that for long years to come the country can get along without it. Ultimately there may be a very high price to pay—but this may well be far into the future.

In purely opportunistic terms, American science can therefore ill afford to be estranged from industry. Clearly the expectation that government would turn out to be a more reliable, let alone a less demanding, patron than industry can no longer be maintained. Government may turn out to be a far less dependable and a far more restrictive patron than the economic sector would ever be. Certainly, government is likely to impose political values on science, far more than pluralistic and atomized industry would ever do, whether this is in respect to biomedical research with its politically popular fads and crash programs, in respect to the demand that scientific research be focused on projects rather than on knowledge, or in the demand that what is science is what elects politicians or what pleases an intellectual mob.

Equally, it is no longer able to anchor American science in the graduate training of Ph.D.'s for college or university teaching. Colleges and universities will for long years to come be amply staffed, especially in traditional scientific disciplines. At the same time, government employment for scientifically trained people has reached a plateau, and may indeed go down rather than up—both because the pipelines are full and because spending cuts are likely to fall on areas of long-term promise—that is, on areas that employ scientists in large numbers—rather than on areas of immediate performance.

For the next 25 years or so, American science will therefore have to look to industry to find employment for its graduates. It will again, as it was 40 or 50 years ago, become the rule to expect one's ablest graduates to find employment and livelihood in industry. The alternative is a sharp curtailment of the academic establishment in science, and especially of graduate work in science, and almost certainly a drop in standards and quality.

The Philosophical Issue

Modern free society rests on three foundations: autonomous local government as opposed to the centralized bureaucracy of enlightened absolutism; the autonomy of science as independent value and self-directed intellectual inquiry; and pluralism in the economic sphere, in which autonomous self-governing institutions in the pursuit of their own mission promote economic well-being. The three are interdependent.

Of the three, industry has shown itself capable of survival even if free society is snuffed out. In the most totalitarian society, the economic unit—that is the management of industry—is still autonomous. Whenever a modern tyrant tried to subordinate the economic institutions to the all-powerful Party, he failed, and very soon. Stalin's successors learned this lesson and so today do the successors of Mao in China.

Science, by contrast, has proved to be fragile, easily subordinated to tyranny, subject to dogmatic thought control and easily swallowed up in the bureaucratic appartus of a totalitarian system. Science, in other words, has a greater stake in the survival of an autonomous and self-governing industry than industry has in the survival of an autonomous and self-governing science.

The deterioration in the science/industry relationship may be only a symptom of far more profound changes in world view way below the surface. But the change is in itself a dangerous, a disturbing, a painful symptom that deserves being treated.

Most needed perhaps is an attitude of responsibility on the part of science. It is no longer permissible for scientists to dismiss the difficult question of the results the laity might expect from scientific endeavor and research. To say, as scientists are wont to do, that scientific knowledge is its own result beyond appraisal or measurement, could be justified when science was a marginal activity. For this is an argument with which one justifies a small luxury, or a harmless self-indulgence. We may never be able to measure scientific results, let alone to plan them. But science may—and should—be able to tell us what to expect, what to anticipate, and how to judge. Science is unlikely to be measurable. But it might hold itself accountable.

Such a change in attitude may not cure anything. But it would enable science, industry, and government to function better and more productively. And the initiative clearly rests with science. We may never be able to work out the complex relationship between science, technology, and innovation—whether in the economy, in education, or in health care. But that the scientist has a stake in the relationship and in its productivity needs to be emphasized—and most by the scientist.

But industry and the decision-makers in government also need to change their attitudes and correct their vision. They know that slighting research and long-term work is dangerous and may even be suicidal. The means to convert this knowledge into action is systematic abandonment of the obsolete, the outworn, the no longer productive. In a few businesses this is understood. There every product, every technology, every process is considered as becoming obsolete, the only question being "how fast?" And then an attempt is made to assess the amount of the new, and especially of the new science and technology that is needed to fill the gap, accepting that of every three major innovative thrusts, one at the most is likely to live up to its promise. For most businesses, however, this is still something only talked about—if not something stoutly resisted as a threat. Most businesses—and practically all governments—seem to believe that yesterday should last forever.

The traditional relation between science and its customers in the economic and governmental system was based on mutual respect and understanding and a keen awareness of interdependence. American science must effect a return to these values however old-fashioned they now appear to be.

Note

1. I know of no comparative study of different models of integration of science and society. The few Marxist analysts, such as George Lukacs or Lancelot Hogben, wore nationalistic blinkers; Lukacs, for instance, assumed the German model to be universal.

AAAS–Newcomb Cleveland Prize

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The AAAS-Newcomb Cleveland Prize is awarded annually to the author of an outstanding paper published in *Science* from August through July. This competition year starts with the 4 August 1978 issue of *Science* and ends with that of 27 July 1979. The value of the prize is $5000; the winner also receives a bronze medal.

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Throughout the year, readers are invited to nominate papers appearing in the Reports or Articles sections. Nominations must be typed, and the following information provided: the title of the paper, issue in which it was published, author's name, and a brief statement of justification for nomination. Nominations should be submitted to AAAS-Newcomb Cleveland Prize, AAAS, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Final selection will rest with a panel of distinguished scientists appointed by the Board of Directors.

The award will be presented at a session of the annual meeting. In case of multiple authorship, the prize will be divided equally between or among the authors.