[1]Chapter 9: Toxic Pope 1970-1971

PHILIP HANDLER HELD MANY positions of political power in the American scientific culture during the ascending phase of his career, and at each turn he faced limitations that constrained his efforts to implement his ideology. He hoped to finally achieve success after rising to what at the time was the zenith of political power in American science, the presidency of the National Academy of Sciences. At the inception of his career, his progress was blocked by lack of money for pointillist biochemical experiments, — what he regarded as the only method for producing reliable knowledge about living things. Handler overcame the problem with the help of friends who had influence at the federal agency that funded biochemical research. The grant money he received permitted him to produce and publish biochemical information and, because half of his grant awards went directly to the university for overhead costs, to insinuate himself into a position of importance at his university. But he suffered behavioral and medical problems while working in the laboratory, which forced him to retire from research. He redirected his efforts to advance biochemistry from performing experiments to advocating national policies regarding research and education in biochemistry.

Handler parlayed his managerial skills and silver tongue to reach leadership positions in the organization of biochemical research societies and in the federal agency that that provided university biochemists with money for research. He was dissatisfied with his lack of influence on political decisions in Washington D.C.
regarding national science policies. His frequent expressions of disappointment reached the ears of federal policymakers and led to an invitation from President Kennedy to accept a position as a leader in the government's major science agency.
Soon thereafter, Handler was appointed by President Johnson as a presidential science advisor and as chief research scientist for a Presidential task force on cancer and brain disease. Handler's potential to influence national science policy increased as a consequence of the appointments, but so did his feeling of resentment and disappointment. His service to the government was entirely unsalaried. He saw others, whom he regarded as less skilled and accomplished than he, making far more money than he earned as a university professor. Even worse, the gist of the advice Handler provided — the need to spend more money for basic research in pursuit of pure knowledge and to elevate the societal status of science — was consistently ignored by the Administrations he served. He achieved no objectives that advanced his ideology beyond his early success of establishing biochemistry as the only appropriate science for biomedical research supported by federal funds.

When Handler became the head of Academy, achieving his objectives seemed more realistic. The position was well-salaried, included an apartment and chauffeured limousine, and afforded him the right to speak with the aegis and authority of the nation's thousand most successful research scientists. His position afforded him control of the Business Arm, which generated the money he needed to advance his policies, as well as a staff of wordsmiths skilled in writing the science reports it produced. However, Handler was riding on the back of a tiger. He faced monumental difficulties and problems, opposition from every direction, and

[11] * This is a preprint of a manuscript that will undergo copyediting and review before publication in final form.

continued to suffer from his chronic medical problems, which came to include periodic bouts of depression.
Handler had very few friends but was surrounded by sycophants, agency officials, congressmen, and industrialists who sought to curry favor for their pet projects.
Nevertheless, essentially alone, he embarked on a mission to elevate science, especially biochemistry, to the highest strata of society, on par with government and law, but above religion and the press.

In one of the earliest speeches of his presidency, speaking with chilling bluntness to an audience of British biochemists, Handler revealed his somber view of the status of science in the U.S. and, as the head of the Academy, how he intended to improve it. He said science was "at the very height of success." But just when the stage was set for biochemists to learn about the "nature of life," and "the technology bred of science had catalyzed stupendous economic growth, a "violent reaction" against scientific was occurring "Science has been criticized for unwisely producing nuclear, chemical and biochemical weapons, and for contaminating the air, earth, water and food," he said and added "the mounting hysteria that exaggerates the magnitude of the threat of varying forms of pollution" wasn't "a passing phase" but rather "a profound movement." "The success of biochemistry," Handler said, "contributed to this movement" by proving that humans were simply another form of life, not "a special creature fashioned in the image of God"

Handler accused the government of "decelerating the pace of science" by refusing to support fundamental biochemical research. He criticized politicians for mostly funding "only applied research," by which he meant research that had a foreseeable societal benefit, and that as a consequence, "We are now in danger of losing much or our scientific establishment." The government's "foolish decision to ban the use of cyclamates" was another example of injurious science policy, he said.
Handler admonished the public for complaining that biochemical research had not produced any cures for cancer or other major disease despite the expenditure of "tens of billions of dollars of tax money." He said the effort to find a cure was doomed to fail because of the government's refusal to fund "free-roaming fundamental research" despite his advice that such research was a condition precedent to finding cures of diseases. Handler warned that the danger of failing to find cures would continue as long as spending for applied research "drives out" spending for basic research, and that his "principal occupation as president of the Academy is to avert that disaster."

Prior to becoming head of the Academy, in his capacity as the leader of the National Science Foundation, Handler met face-to-face with President Nixon and offered recommendations regarding the budget for research. Handler told the press that Nixon promised to support research, which Handler understood to mean increased funds would be provided to allow the Foundation "to plan for the future so as to utilize our national resources in as optimal a fashion." Handler said, "Mr. Nixon will place a heavy bet on science as the leverage with which this nation can improve the quality of life for all Americans." Privately, however, Handler expressed doubt about Nixon's intentions. Handler had a visceral distain for the attitude of politicians toward science, especially Republican politicians like President Nixon, believing they knew far too little about science, were too short-sighted to recognize its inherent

beauty, could not appreciate the value of science as the parent of technology. Consequently, in Handler's eyes, politicians were ideologically predisposed to underfund scientific research and education. Utilization of the prestige of the Academy to overcome the shortcomings of politicians, was high on Handler's agenda, and he believed he had taken the first step by convincing President Nixon that underfunding science would hurt the American people. However, soon after Handler's meeting with Nixon, the Administration announced that the Foundation's research budget would be reduced, not increased.

In the spring of 1969, President Nixon offered the position of chief executive officer of the Foundation to an eminent chemist whom Handler had recommended. But Nixon withdrew his offer after learning that the chemist had publicly opposed Administration policies regarding scientific and non-scientific matters. Nixon's withdrawal of the offer angered Handler because it was inconsistent with the practice of the previous two decades of keeping the choice of the Foundation's chief officer out of politics, and he mobilized key scientific groups to demand that Nixon reverse his decision. Although Nixon had a clear legal right to restrict his agency appointments to individuals who agreed with his policies, Handler argued that exercising the right against a leader of the Foundation was improper because the job involved science, not politics, and consequently the political views of the appointee were irrelevant.

The rejection of the chemist was the first disruption in the harmonious post-war alliance that existed between science and the government. In return for reticence on political questions by the leaders of the scientific establishment, scientists received federal funds and a large measure of influence in determining what research would be done, and how the funds would be distributed. Nixon's withdrawal of the appointment shook the confidence of Handler and other scientists that the alliance would continue.

Further, Handler saw the timing of the threat to the alliance as especially inopportune because a breach was then occurring in what had been a solid wall of public and congressional respect for science, and the threat had the potential to further widened the breach.

Handler orchestrated a national campaign of prominent scientists —the Foundation's board, which he chaired, the President's committee of science advisors, of which he was a member, and the National Academy of Science, of which he was the president-elect — in defense of the political independence of the Foundation which, at the time, was a strong symbol to the scientific culture of its alliance with government.

The result of the loud cry Handler raised led to a meeting of Handler and other prominent scientists with President Nixon at the White House, the results of which appeared to be a humiliating defeat for Nixon and a great victory for Handler. He announced that he and the other scientists thought Nixon said all the right things and said them well. Nixon affirmed that all appointed posts at the Foundation were nonpolitical and should be filled solely on the basis of scientific and administrative competence, and he withdrew his rejection of the chemist. Handler expressed happiness about the change in Nixon's attitude and observed, "The President wanted the scientific community to know that he regretted the situation and wanted to make amends." Handler said he was pleased by Nixon's about-face and observed that the episode marked the first time the nonpolitical nature of the Foundation's leaders had been tested and affirmed. However, Handler won only a Pyrrhic victory. As subsequent events soon showed, Nixon had no intention of allowing the alliance between the scientific culture and government to continue as it has in the past, and no intention of recognizing a special

exception for scientists at the Foundation, or any other government agency, whereby agency officers could publicly express views antagonistic to the policies of his Administration.

HANDLER CONCEPTUALIZED SCIENCE as a social structure paralleling that of the government but differing in the sense that science was based on objective facts whereas government was based on values. He saw himself as an expert on science policy — the rules and procedures governing human activities that occurred in the areas where science and government overlapped. His goals were to secure recognition of a high societal status for science, instantiate in the public mind the idea that the National Academy of Science was the greatest materialization of what science was, and to manage the Academy's programs, policies, and public positions to facilitate establishing a structural role for science in society.

Handler believed a biochemical revolution had occurred and he labored under a grand illusion that all of mankind's most important problems were ultimately solvable by biochemical research that was organized and administered by scientists, with minimal governmental interference. "Our understanding of living things is now so comprehensive," he said, "we should soon be able to apply that information to human affairs, in order to improve the condition of man." The problems he believed solvable by biochemical research were overpopulation, food scarcity, cancer and heart disease, side-effect and pollution, environmental degradation, the mistakes in human evolution that resulted in genetic diseases and, abnormal human behavior. According to Handler, governmental action that had the intensity and focus of the project that sent a man to the moon was imperative, and it was clear to him that America was rich enough to fund the requisite basic research.

Overpopulation was the greatest threat to society, according to Handler; he linked it to hunger, pollution, crime, over-large and dirty cities, and the seething unrest that leads to international conflict and war. Research in human reproductive physiology could lead to a new contraceptive technology that, he said, would be "cheap and safe, and which, when it failed, would result in failure to conceive, rather than the present situation in which failure results in conception." Next in importance was the problem of feeding the world. "If we don't provide more food," he said, "we face world-wide famine." He envisioned increased food production due to biochemical modifications of genes in plants and animals, and clones of the best food animals so "we can make any number of animals that is desired."

Handler extended his biochemical outlook to medicine and longevity. He said, "We all know that the major killers and incapacitating disorders are still with us — heart disease, cancer, rheumatoid ailments. We've managed to contain infectious diseases only. I'm sure that with time we'll have much-improved therapeutic techniques for many of the remaining diseases. I have reason to believe that in the near future, we'll learn, if not how to prevent cancer, how to cure early cancer."

He believed aging was caused by the death of cells, and that if the process were understood at the biochemical level, "conceivably we could do something about it."
He said, "I would like to see life like Shangri-la, where you stay physically young until you're 100, and then you die." Handler favored government funding of biochemical research to discover a technology that could correct the mistakes of evolution which resulted in many

genetic diseases. He maintained that research could show how to remove bad genes from DNA in the egg or sperm of prospective parents and replace it with good genes.

The world Handler envisioned included freedom from dread diseases, increased food production, an extended life span, mankind's control of evolution, and genetic surgery to treat genetic diseases. The biochemical nirvana he believed possible also included biochemical control of human values and behavior. He asserted, "The degree of understanding of man as a social creature is not adequate, as is evident in our domestic and international problems," and that" our lack of social understanding limits us badly. In Handler's eyes, social scientists were inherently unable to solve the problems because they did not rely on the scientific method, and therefore could not produce reliable knowledge; "compared with biochemistry, the social sciences are primitive," he said. Handler believed biochemists could find brain biochemicals that determined the values which led to specific behaviors — a causal link demanded by the doctrine of biochemistry — and that drugs could be developed to alter the behavior. He wanted the government to fund biochemists to determine the biochemical determinants of human behavior that he assumed must exist. He claimed that a blend of technological capabilities that resulted from biochemical research coupled with findings of social scientists would usher in a new era for mankind. "In the reasonably near future," Handler said, "we shall begin to make progress in understanding the biochemical bases for our behavior. Then, In all likelihood, this will generate the capacity to design chemical or physical processes to alter behavior in defined ways."

Handler was a hard ideologue who displayed a cornucopia of insensitivities to the feeling and beliefs of others. His descriptions of the biochemical basis of behavior were loaded with the implication that free will was a meaningless concept because it had no biochemical basis — the same outlook that previously led him to deny the reality of health risks and the nonscientific nature of the concept of life. Handler had nil regard for the beliefs of those who regarded as morally repugnant the seeking of biochemical knowledge of human values and drugs that could alter them. But from his perspective, seeking any kind of knowledge was a human imperative, and telling a scientist what research could not be done was like telling an artist what not to paint.

He saw a human being as a chemical machine whose brain contained chemicals that made the values which the machine translated into behaviors. Handler presumption that biochemists had a right to be supported by taxpayers and to spend their grant money as they saw fit, subject only to the oversight of establishment biochemists, further exemplified the extent to which he was blind to the offensive aspects of his ideology. He believed biochemists were on the cusp of great discoveries, and that the government had an obligation to fund their efforts to seek knowledge of their choice and in a manner, they thought best. "It seems to me," he said, "that we are rapidly closing in on crucial scientific discoveries. We should proceed with research into everything because all knowledge is laden with possibilities. Neither the political-power structure, the level of maturity of social organization, nor the historical ego of society should be allowed to restrict research. The curiosity and intellectual appetite of scientists can no more tolerate censorship in the laboratory than in speech." He added, "Attempting to frame constraints delimiting which segments of the endless frontiers of science may be explored is as repugnant as censorship of literature and is as potentially damaging, and most assuredly would imperil the national future."

Handler demonstrated preternatural skilled at obtaining research grants from the government to support his salary and research laboratory. He was the personification of Dr Grant Swinger, head of the Center for the Absorption of Federal Funds, a fictional character invented by a science journalist who was Handler's bête noire.

Handler obtained tens of millions of dollars for his salary and research laboratory over two decades, which was only a small part of the government money he raised to further acceptance of his ideological perspective regarding national science policy. He facilitated government grants from the National Institutes of Science and the National Science Foundation for research by his friends and favorite scientists, and by biochemists whom he didn't know personally but who promised to conduct their research according to the laboratory methods, models, and objectives he approved. One of his objectives after becoming head of the Academy was to institutionalize what he had accomplished. He sought creation of a high level of stable funding for scientific activities, particularly biochemical research and education, an achievement that would establish a prominent place for science in society.

Handler often used platitudes to describe the beauty and importance of science, its logical structure, and the reliability of the knowledge it produced, but without any apparent benefit. After he became the head of the Academy, the thrust of his stories shifted to the practical results science could produce. New technology would be spawned, he said, which could cure disease, support the military, enhance national prestige, supply unlimited electricity using breeder reactors, create limitless consumer products, and feed the country without limits. An additional, related aspect of the new messaging was that new science graduates, who helped produce technology while performing basic research at the universities, would strengthen the nation's reserve of experts; Handler said they could assist the government in carrying out risk-benefit safety analyses regarding potential hazards of technology.

Handler wanted to abandon the traditional passive posture of the National Academy of Sciences regarding provision of advice to the government and transform it into a politically active institution. Traditionally, the Academy spoke only when requested by the government, but Handler announced that in the future there would be an increasing number of occasions where the Academy would take the initiative.

Handler said the Academy wouldn't "sit around and wait to be asked how the knowledge of scientists is relevant to the major problems of society." He said he wanted the nation to hear his opinions about the importance of reliance on science for the nation to meet "the brute problems in front of us." Among his earliest actions after becoming the head of the Academy was implementation of changes in the Academy's organizational structure and procedural rules to facilitate implementation of his ambitions.

Handler provided insight into his plans during an interview where he described his perception of the problems of society and their solutions. He said "the sad consequences" of ignorance about science, misuse of technology, and unplanned growth were plain to see, and he proposed reliance on central planning to choose the kind of society the people desired and how they want to manage the technology needed to create it. "Surely it must be time to begin to plan what a human world should be," he said, "to know how large the population of the U.S.

should be to assure that we have all the kinds of people we need, yet not too many." He predicted his approach would eventually become politically realistic, and he promised to seek a broad mandate for the Academy to take the lead in bringing it about by identifying the nation's science priorities.

He said he expected money to be available for domestic priorities after the Vietnam war ended, and anticipated the need to compete fiercely for funding of his science priorities. He said the problems encompassed by the environment and pollution could "soak up vast sums from the federal coffer," and that his job as head of the Academy would be to persuasively compete against such programs. To buttress his case, Handler intended to move beyond his stock array of platitudes about the importance of science and hit upon more effective language. "Hopefully, by finding relatively recent illustrations of the operational truth of those platitudes, I can convey a sense of conviction," he said, "not as a way to put something over on the American people, but because I truly do believe that science is the leverage our civilization has invented to give shape to its own future."

Handler promised that the Academy would describe "the kind of community human beings can thrive in, and what a proper human society should be." He said he directed the Academy's Policy Committee to devise rules for technological assessment, a task he regarded as a harbinger of the Academy's campaign to provide leadership regarding the problems of the times. The Committee's effort, he claimed, would exemplify the Academy's a proactive and assertive posture, and its report would introduce and regularize his business-friendly ideas about how to assess the safety of side-effects and pollution caused by technology. Handler claimed that, as the head of the Academy, he had the right and responsibility to function as a voice of wisdom and reason in such matters, and ask rhetorically if not him, then who?

In a speech to a university audience, Handler spoke about a panorama of issues. Degradation of the environment was a genuine phenomenon, he said, but was frequently exaggerated by the press and scientists who portrayed the problems "as a series of unchallenged horror stories." Handler claimed environmental degradation caused by humans was not a new phenomenon and supported the claim by reciting a tenth-century verse that lamented damage mankind did to nature. He conceded that air pollution from automobiles was unpleasant and potentially dangerous, but maintained it was controllable by new technology and "trivial in impact compared to highways accidents caused by intoxicated youth." He returned to his oft-versed complaint about the government's management of DDT. "Bumper stickers decry DDT across the land" he said, "but no American is known to have been injured by DDT." Handler expressed bewilderment at the contrast between the interest college students had in the environment and their apathy toward "nuclear weapons, attainment of an enduring and just peace, and the desperate state of our rural poor."

He asked the audience to demand scientists stop frightening the American people and admonished the government to begin a biochemical research program to acquire data sufficient to evaluate the health-risks versus benefits in all areas where the environmental and health consequences of man's commercial activities were unknown. "We need to know far more about pesticide usage, food additives, drugs, industrial practices, hazards from electromagnetic energy, and the alleged problem of global warming if we are to make sound judgments and establish public policy," he said.

Handler criticized the government for seemingly not understanding overpopulation was largely responsible for environmental degradation, and he judged the government's response to the issue as "pitiful, much like prescribing aspirin for a brain tumor." He characterized concern about the environment as racist, a white upper-middle-class issue, because it "offered little trouble to laborers who equate smoking industrial chimneys with jobs, or to Blacks and Chicanos who have much more compelling concerns."

Speaking to an assembly mostly of medical professionals, Handler elaborated on another aspect of his grand illusion — what he perceived to be distortions in the nation's medical system. He said the public and congressmen demanded production of physicians who were uneducated in medical research. And even worse, they wanted what little research was tolerated be directly addressed to the problems of disease rather than to exploring the nature of life — "they could not be more wrong," Handler protested. He contended medical care, in most instances, was merely the use of palliative technologies to treat symptoms; because the biochemical knowledge needed for prevention or cures was lacking. Consequently, Handler said, the major diseases went unexplained and uncured. He repeated himself to emphasize the point; the major diseases engender large human and financial cost and frustrate the health-care system not because of a shortage of physicians or hospital facilities, but primarily because of a lack of effective medical technology due to the absence of biochemical research.

In contrast, Handler emphasized, promising avenues of research were being pursued by biochemists who shared "an atmosphere of confidence" that scientific breakthroughs were imminent. He said cures of the major diseases of mankind was "not a hopeless dream" but an expectation because biochemists had objective knowledge about the world and a method to generate knowledge without limit; therefore, they had the ability to fulfill the dream. But he warned that if the nation refuses to fund biochemical research, by the turn of the century, "vasty more hospitals, sanitariums, and physicians will be needed, and the people will endure vastly more suffering."

Handler generalized his point to include not only health problems, but all human problems. He said, "Just as biology is presently too immature to cope with our vast environmental and medical problems, the social sciences are too immature to cope with our most pressing national and international social problems." The common cause of all the problems, Handler declared, was a lack of objective knowledge — fertile ground for science because it was mankind's only objective source of knowledge. Handler concluded basic research that uncovered the biochemical basis of human physiology and behavior was, ultimately, the only possible path to fulfillment the dream of curing disease and solving the nation's social problems. If the dream fails, he said, it will be because of the inability of laymen to recognize the power of science.

FREDERICK SEITZ, HANDLER'S PREDECESSOR, was confronted by complaints from engineers that the Academy viewed scientists as above suspicion regarding competence, integrity, and honesty, but did not hold engineers in similar regard simply because they were based in industry rather than universities. He responded by granting engineers permission to form a National Academy of Engineering as an adjunct to the National Academy of Sciences, with the

ability to select its own members, governing council, and bylaws, and to enter into contracts to provide advice to the government.

However, the Business Arm — which was controlled by the corporate Academy — was given authority over all of the engineering Academy's financial matters. The engineers were not sovereign tenants of the Academy building and squabbled frequently with their landlord over matters involving money and business freedom. The restriction on their finances greatly aggravated the engineers, and for several years the morganatic union of the two organizations was persistently contentious, although both parties remained discreet regarding public disclosure of what caused the disharmony.

The relationship worsened after Handler became president of the corporate Academy. He believed Seitz had made a grievous mistake, because engineers weren't scientists. Engineers chose new members not only on the basis of publications — the sole criterion for the membership in the sciences Academy — but also for accomplishments in pioneering and developing fields of technology, as demonstrated by rising to the top of corporate management. Handler complained bitterly that achievements in business management rather than scientific was sufficient for entry into the Academy. But as the nation's problems progressively shifted from the domain of science to that of engineering, Handler found it difficult to maintain an air of superiority and economic hegemony over the engineers, and undoing Seitz's actions became impossible.

The engineers capitalized on the burgeoning societal importance of technology to elevate their national importance by developing management policies for how technology should be regulated and controlled, and they contracted with a congressional committee to provide detailed recommendations. The sciences Academy followed suit and, based on Handler's ideology, recommended increased basic research in biochemistry as the basis for controlling technology. The engineering Academy, in contrast, using novel, verbally dense sophistry rivaling that of Protagoras, characterized the problem of technology assessment as a business problem best approached by the newly management method commonly called risk-benefit analysis.

The engineers said the method could be used to manage not only pollution and side-effects but any societal question including the war in Vietnam, building an airport next to a nature preserve, deciding whether to build a supersonic commercial airplane, designing a process to store nuclear waste, or choosing between nuclear or fossil-fuel plants for generating electricity.

Handler opposed growth of the engineering Academy, refused to negotiate its demand for more economic freedom, and even declined to talk to its president. He believed the goals of the scientists and engineers in the corporate Academy were incompatible — scientists were university professors who sought to produce permanent knowledge that expanded the edifice of science, whereas engineers were mainly corporate vice-presidents or other industry employees whose professional goal was to advance the interest of their companies. Handler saw the engineers like Jesus saw the moneychangers in the temple and did all he could to limit growth of the engineering Academy. However, he also saw the engineers could help him advance his agenda. They had a method for solving the problem of side-effects and pollution which consistently yielded what he and they considered was the right answer — that when weighed against the benefits, the side-effects were acceptable and the pollution was not too serious. Handler's biochemical approach to the problem, in contrast, had absolutely no chance

of winning the day, which even he began to recognize. He saw strategic merit in using the engineers' risk-benefit verbal formula to fend off scientists who alleged health risks where Handler was certain there were none.

Both Academies were in the business of seeking to enlighten the government with sage advice, but Handler seriously doubted the validity and reliability of advice from the engineering Academy. Advice from engineers was always constrained by considerations of cost and time, which Handler regarded as an improper limitation on the elaboration of true knowledge that sapped the validity of the advice. Additionally, most of engineers in the Academy were full-time businessmen, agency employees, or military officials, which indicated to Handler that their advice could be based on more than just scientific merit because it often concerned matters of vital interest to their employers. From the viewpoint of the engineers, the sciences Academy consisted mainly of campus-based academics who were remote from the economic realities that figured large in many environmental and urban problems. The difference in perspectives between the Academies generated mutual antagonism and chronic disagreements. But the corporate Academy had a thousand times more money in the bank than the engineers, which translated into power and authority for Handler, who prevailed in virtually every dispute.

The corporate academy lacked the expertise to provide policy advice to the government concerning the health of the public because very few Academy members were physicians, and even they were admitted as experts in biochemical research, not in clinical medicine or medical policy. In the mid-1960s, a group of physicians, some Academy members, proposed creation of a National Academy of Medicine as part of the corporate Academy. They envisioned an organization whose members represented excellence in all branches of medicine who were chosen for their experience and capabilities rather than their biochemical research. The group anticipated that the medical Institute would advise the government on strategy for medical research and for delivery of medical care to the public through federal programs. Their seminal idea was that the medicine Academy would speak for all of the academic professions involved in providing health care, and provide advice regarding all of its aspects, a need then unmet by the existing medical associations, which primarily represented private practioners.

For several years, scant progress occurred toward establishing the medical Academy; the physicians' group remained only a small socially-minded appendage of the large science-minded Academy. The prospects for forming a medical Academy dimmed even more when Handler became head of the corporate Academy. High on his list of priorities was maintaining the Academy's reputation for providing, objective scientific advice and he saw creation of a medical Academy as antithetical to his objective. He told the board of directors of the corporate Academy, "I am afraid it would be thought of in the world at large as a guild of some sort" which he characterized as a mark of disgrace.

During meetings with Handler, the physicians argued that a medical Academy would help organize America's haphazard system of health care. But Handler continued to view the proposed medical Academy as competition rather than as a complementary institution for providing disinterested advice. He said he believed a medical Academy would initiate views on public policy rather than limit itself to responding to requests for advice, as was traditional for the corporate Academy, and that offering health-related advice would make the medical Academy a lobbying organization. He also expressed concern about what he called a

fundamental incongruity between the members of both organizations. He said the members of the science Academy were distinguished scientists who predicated their advice on scientific facts, whereas the members of the medicine Academy would mostly be clinicians or other health professionals who relied primarily on practical experience and addressed problems that had no scientific solution. In the same vein, Handler told the physicians their intention to have a mixed membership of various types of clinicians and social scientists would make the corporate Academy a home for non-scientists, thereby weakening public trust in its advice.

During heated discussions, the physicians maintained that the social aspects of medicine were important issues for the Academy to address, and that a medical Academy consisting of a broad cross-section of the medical and health-care profession was the ideal vehicle for that task. Handler, however, remained adamant in his belief the corporate Academy was a place where basic-science merit alone, measured by publications and membership in prestigious professional societies, could secure membership, and that all social problems, including but not limited to health care, were too imprecise to be defined in a scientifically meaningful way.

Handler privately confided his determination to remain steadfast against allowing creation of a medical Academy. Doing so, be believed, would be making the same huge mistake his predecessor made when he allowed creation of the engineering Academy as part of the corporate Academy. Handler feared that not standing firm would result in a flood of requests by social scientists and many other groups to create separate academies, ultimately resulting in dilution of the Academy's prestige. He expressed concern the federal government would turn to a medical Academy for advice, leaving the science Academy "with only minor advisory functions" in matters related to health.

Consequently, he said, "Its role in our national life will have been very markedly diluted and its prestige very significantly eroded." The differences in outlook between Handler and the physicians resulted in personal confrontations between him and the physicians, who were aware that Handler was restructuring the corporate Academy and believed he stalled their negotiations until he completed the changes.

Handler was reorganizing the Business Arm to make it useful for his ideological purposes, a project — which included obviating the possibility of multiple additional Academies — I will describe soon, He was stressed to resolve a litany of problems prior to returning to negotiations with the physicians. I will briefly mention his three main problems. The publicly inapparent reality was that the members of the sciences Academy, mostly semi-retired male physicists and chemists detached from the complex problems of society, were not qualified to serve on ad hoc committees of the Business Arm. Younger, still-active non-member experts were badly needed. The problem was how could the Academy members be competent to validate the advice of younger scientists and award their aegis if they themselves were incompetent? There was also a serious problem of conflict-of-interest on the part of the younger scientists, who were frequently bonded economically to the organization that had a stake in the solution to the problem under adjudication by their committee. Further, Handler was wrestling with the problem of secrecy. He believed the key to the success of the Academy's advice-providing service to the government was wholly dependent on absolute secrecy regarding the deliberations of Business-Arm committees, which was a highly controversial policy. Handler delayed his negotiations with the physicians until he was satisfied he had the best reorganizational plan he could reasonably expect.

The restructured Business Arm afforded Handler the authority he sought to emasculate the engineering and medical Academies, and to ensure that no other professional group could ever successfully demand a presence in the corporate Academy. After completing the process, Handler resumed meeting with the physicians and told them he “warmly” approved their general objectives and had decided to take steps in the direction they advocated, but only if they agreed to abandon the title of National Academy of Medicine and accept his chose, the “Institute of Medicine,” as well as other conditions, rules, policies, and limitations. The long delay in their negations with Handler wearied and finally demoralized the physicians, and they had no real choice except to accept whatever Handler offered them. He obliged the medical Institute to obtain his approval before undertaking studies, and to submit to him all final reports for review prior to sending them to the clients. Unlike the science Academy, members of the medical Institute would be expected to commit a significant portion of time to work on health problems and would have fixed terms of membership and age limitations. Also, contrary to the right Handler incorporated into his reorganization of the sciences Academy, the medical Institute would not have the right to propagandize for their own views or to offer evaluations regarding proposed health-related legislation that Handler regarded as inherently political. Handler retained final authority over the Institute in all basic areas including the right to review all publications and the right to add or delete names of those nominated for membership.

The physicians, who were without the resources or will to further contest with Handler, accepted his terms, and he then created the medical Institute and tasked it to "to address the larger problems of medicine and health care. The new Institute had two dozen members but could have no staff until it generated an income sufficient to support a staff. The board of the medical Institute drafted a charter and bylaws which Handler ultimately approved, and at the end of 1970 the Instituted began soliciting business from the government for providing advice about public health and medicine.

Handler insured that the medical Institute could never infringe on his prerogatives of the sciences Academy in dealings with the government and would likely never become familiar to average citizens or produce reports that could directly affect public opinions.

The Institute was born subject to rules ensuring its subservience to Handler, and he was soon called upon it to serve him. President Nixon proposed a plan to create a National Cancar Authority, which Handler violently opposed. He wrote strong letters to prominent congressmen opposing the plan, lamenting that it “was against the national interest,” and he pressured the head of the medical Institute to similarly oppose the plan and write letters to congressmen. Handler believed his actions had made an impression on Nixon as evidenced by his appointment of Handler to an industry-oriented task force charged by Nixon to make recommendations concerning the government's policy for assessing the impact of technology on society. The task force recommended reliance on risk-benefit analysis, the method for assessing the safety of technology that was universally favored by industry stakeholders. Additionally, the task force deferred to Handler and recommended the government increase funding for biochemical research so that any health-related dangers posed by technology could be evaluated scientifically.

President Nixon was sympathetic to the recommended reliance on risk-benefit analysis for evaluating the acceptability of health risks, but he not only rejected the proposed funding

increase for biochemical research he also continued the trend of reducing funding levels for biochemical research at universities. And in what Handler regarded as a further affront, Nixon directed the National Science Foundation, which was headed by Handler, to provide financial support for a nascent group of economic planners that was forming an international Institute devoted to development of the risk-benefit analysis as a systematic approach for addressing all of the societal problems caused by technology, including but not limited to health risks and pollution. Handler had scant interest in the project because the planners envisioned a business-management methodology unrelated to biochemistry. Additionally, Handler strongly resented a president's directive that the Foundation provide funds from its budget to support the U.S.'s participation in the project. Handler's anger increased when he learned the funds were not part of a new appropriations but rather came from those previously allocated for basic research, which Handler had chronically complained were already far too low. In what was the last insult Handler thought he could tolerate, Nixon appointed him, in his capacity as head of the National Academy of Sciences, to be the official U.S. representative to the new international Institute. The appointment required Handler to attend meetings in five European cities, which consumed the time and energy he had intended to devote to the mobilization of the Academy in pursuit of his agenda.

At a press conference late in 1970, ostensibly held to describe an Academy report intended to persuade the government to spend much more money on biochemical research, Handler made the excessively flamboyant demand that the government provide a bolus of several hundred million dollars as reparations for past failures to provide adequate funding, with annual increases of fifteen percent thereafter, and he commenced a direct attack on President Nixon. Handler presented graphs that showed spending for biochemical research hadn't changed for many years, asserted much more should have been spent because "we can afford it" and "the dividends are beyond calculation," and roundly criticized the President's overall science policies. Handler upbraided Nixon for allowing the American system of science "to drift toward decay" and to reach a point where it was "squealing with pain" as result of insufficient financial support. Handler said science was not a high priority for Nixon, but "not for a lack of my input," and expressed pessimism regarding the Administration's future spending policy. Handler pointed to the high rate at which students were earning PhDs in biochemistry, and said, "We need to take advantage of this," because only by means of the fruits of biochemical research can America cope with the problems posed by a growing population and pollution." Handler claimed the structural reason for inadequate funding of basic science was that the research budget "lies within the controllable expenditures of the federal government "and is therefore subjected to political considerations, which Handler regarded as a bad arrangement for producing good science. Handler asserted Nixon should support passage of a law that guaranteed adequate funding for research by specifying expenditure levels, like the law that specified Social Security payments. Handler noted that Nixon was reducing funding for the educational grants that produced more biochemists, a step that Handler strongly opposed, transparently because new biochemists added to his constituency and increased the political pressure to provide more research funds. In a profound understatement regarding his science-funding policy in comparison with that of the President, Handler said, "I think there's a profound difference between us."

In the annual report of the National Science Foundation, Handler repeated his criticism of Nixon for short-changing research, thereby threatening the country with scientific mediocrity. As he did regularly, Handler had assumed the money he thought should have been spent on research, but wasn't, had been spent on projects that had a far lesser beneficial effect on society.

The retort to Handler's scolding of President Nixon came from his Administration's science officials, who denied Handler's accusation that Nixon was shortchanging science and accused him of always crying wolf and "using his podium to cry woe, gloom, and doom." Nixon and his science advisors regarded Handler's frequent lamentations as so removed from both scientific and political reality they could not be taken seriously. The dispute cemented Handler's intention to weaponize the Academy as an independent voice which spoke as an institution to criticize government science policy, a mission he planned to support financially from the earnings the Academy received from advising the government about science policy. For more than a year, Handler lectured nationally, speaking for himself, the broad culture of science, and the Academy, as if their respective interests were identical. During his campaign, Handler completed his project of reforming the structural organization of the Academy to maximize the impact of his voice.

HANDLER APPEARED AT A UNIQUE time in the history of the relation of science to society. Science had grown rapidly after the Second World War and reached great heights of political popularity and economic importance, and he possessed the ambition and temperament to exploit the opportunities presented to him, the latest of which was control of the paradoxical National Academy of Sciences. The Academy was tasked by its charter to advise the government about science and technology, when asked, and authorized to allow its members to elect new life-time members. Nothing in the charter defined it as an honorary society but, over time, successive generations elected the most famous physicists or chemists of the day, and membership became viewed by the members and the public as a great honor. Before the Second World War, the members had no duties or responsibilities except to elect new members. After the War, the Academy's Business Arm, which had been created many years earlier but remained essentially moribund, slowly began generating profits under Handler's two immediate predecessors by providing advice to government agencies regarding technical issues.

Progressively, the agencies confronted issues inextricably intertwined with social, environmental, behavioral, and public-health matters that were not resolvable by experts in physics or chemistry, a development that promised to degrade the usefulness of the Academy because its members were almost all semi-retired old white male physical scientists. Frederick Seitz, Handler's immediate predecessor made two pivotal managerial decisions aimed at solving the problem. He appointed non-member experts from universities and industry to ad hoc technical committees he created each time the Academy signed a contract with a federal agency to provide advice. His appointees were more diverse and actively engaged in scientific affairs compared with the members of the Academy, which afforded the appointees first-hard experience in area of their committees' concern. They were motivated to serve as volunteers because the prestige of association with the Academy was a professional milestone, an objective that, unfortunately, made the appointees susceptible to the influence of the Academy personnel who managed the committee process.

Seitz's advice-providing service was almost totally dependent on the services of the non-member appointees, which created a paradox in the sense that the service had a contradictory quality — the advice was provided by experts, but it was managed by Academy bureaucrats and validated by the prestige of the members of the Academy, who themselves were incompetent to serve as appointees. Seitz's second important managerial decision was intended to resolve the paradox —use of the trope of aegis.
His Business Arm painted the appointees with the fame and respect then associated in the public mind with great scientists and implicitly asserted that the members of the Academy deserved inclusion in that company. Seitz's decisions, taken together, transformed the advice of ten-person, specially chosen groups of volunteers on ad hoc committees into unanimous advice of the greatest scientists of the time.

Handler embraced and further developed Seitz's legerdemain; "If this Academy is to contribute to solution of the nation's problems, it requires easy access to those who are knowledgeable and have a kind of expertise that most members of the Academy lack," he said. He greatly increased the use of Seitz's innovative decisions, reaching an annual average of about four hundred reports a year. The advice of Business-Arm committees was structurally independent of the elected members of the Academy and was validated by the mythical infallibility of science itself. Handler justified his actions on the basis of "a kind of inner voice that guides me regarding the rectitude of my decisions."

Handler faced organizational difficulties after the engineers forced entry into the Academy and suffered from a similar problem with physicians which he inherited.
He cursed both groups, like Kierkegaard did to God, swore that non-scientific groups would never again enter the edifice of science, and successfully foreclosed the possibility that the attempts he anticipated by a diaspora of behavioral, social, and health disciplines to form separate sub-academies would succeed. But that was only as small part of the changes he made in the warp and woof of the Academy. He appointed every member or every ad hoc committee, paying particular attention to committees that adjudicated issues of special importance to him. His ideology became the disembodied conscience of the Business Arm; each ad hoc committee's advice to a government agency was normalized by his permanent staff on the bases of his personal opinions, and he reserved the right to modify or eliminate any language in any committee final report. Handler became the chief executive of what was, by far, the biggest consulting firm in the world, which he governed mostly by top-down ideology and attitudes, rather than rules.

Handler's staff and his activities related to his agenda were supported financially by funds provided by government contracts for advice. The federal agencies benefited by contractually securing the right to pose the question to be addressed, which they could shape with the intent of obtaining advice that supported agency decisions. Handler normally received a formal letter of request from an agency seeking the Academy's advice, but only after his staff have done the preliminary legwork, sometimes even drafting the agency letter. Handler acknowledged that he was creating what he called a "buddy system" between staff members working with "counterparts" in client agencies, but he rejected criticism of his management system and claimed it was a common practice throughout science, especially in the universities.

The Academy essentially had no income except for the vigorish from its advisory contracts with the government. One of the reasons Seitz accepted the engineers as a sub-Academy was a philanthropic grant they had secured which enabled construction of the main auditorium in the building that housed the Academy. Handler had a willing market because government agencies increasingly saw a need for apparently authoritative, independent advice on issues with substantial scientific aspects, particularly those related to side-effects and environmental degradation. Ad hoc committees undertook an astonishing variety of studies to provide advice in both areas

They advised the federal drug agency on matters of drug efficacy, the atomic energy agency on electromagnetic radiation standards, the food industry on food nutrition, the health department on air quality standards and on evidence on the health effects of fluorides, lead, and asbestos, the housing department on racial mixing in housing, the environmental agency on the efficacy of technology in reducing air pollution, the defense department on the environmental effects of herbicides used in Vietnam, the transportation department on the weather and climate modification that would result from the operation of a proposed supersonic transport aircraft, and a state agency about the environmental effect of expanding an airport. The conclusions of most ad hoc committees' final reports were exactly what could have been deduced from an examination of Handler's background and ideology, and the backgrounds of his appointees to the committees. Complaints of bias and conflict-in-interest in Academy reports became commonplace.

An ad hoc committee's final report regarding the atomic energy agency's plans to store radioactive wastes in salt mines was a good example of Academy committee bias. Handler had a long history of association with the agency; early in his career it had awarded him grants and hired him as a consultant, a relationship that continued for many years.The agency was invited by the Academy to seek its advice regarding the agency's waste disposal plan and it accepted, expecting to receive a strong endorsement and thereby bolster its political position when responding to congressional oversight inquires. Handler appointed members to the ad hoc committees whom he knew or should have known would strongly favor the agency's position, and the committee's final report strongly supported the agency's plans, as he surely intended. Congressional reaction, however, was the opposite of what the agency sought and what Handler expected. The Academy's apparent bias and favoritism created a furor among congressmen, who complained the committee was rigged, and Handler was forced to appoint additional members who were not economically bonded to the agency.

Handler operated the Business Arm with the objective of advancing his ideas while credibly addressing the technical and policy issues raised in the agency contracts, particularly the issues that involved the impact of technology on public health and the environment. He imposed stringent procedural conditions on the ad hoc committees; all deliberations took place in secret and permanently remain secret, all decisions were expressed using one voice, which created the appearance of unanimity. Dissents were prohibited. The actual wordsmithing of the final report was done by the Academy staff.

Handler did not require a bright line between scientific judgments and policy judgements, thus allowing the objective character of scientific judgements to bleed over onto the value-laden

policy judgements; the commingling the judgements obscured the impact of the appointees' values on the advice in the final report. He refused to require that the final reports carry a statement that the study reflected the views of the appointees and nothing more, which was the plain truth. Instead, he worked diligently to encourage the fiction that each report was the voice of the scientific culture, and that there were no objections to its conclusions. Critics complained about the lack of candor, openness, and credibility but Handler was undeterred — the agencies needed the Academy's support and Handler needed their money, and he couldn't expect continuing business if he failed to consistently meet the market demands. In almost every instance, the conclusion of an ad hoc committee appointed by Handler was highly predictable based on analyses of his ideology and the publicly available background of his appointees.

Handler almost never notified the members of the Academy of his plans and intentions. They learned of ad hoc committee decisions only after notice a decision had been reached was announced in newspapers. Some reports were held in secret and not published. Copies of published reports were available for purchase by the members or the public. He altered the procedures for election of the Academy's board of directors so that he controlled the nominating committee, which controlled who was presented to the membership as a candidate — the same process, although then unofficial, his predecessor had used to ensure Handler was the only candidate on the ballet for Academy president. The board had no meaningful control over the Business Arm or involvement in its activities — it was Handler's exclusive domain in his capacity as its chairman. The chief responsibility of the board was to legally declare that each report of the Business Arm or the Policy Committee was produced under the aegis of the corporate Academy.

Handler inculcated the supremacy of the physical sciences, especially biochemistry, into the management of the Academy. Engineering, which produced only commercial technology as opposed to true knowledge, was pegged at a distinctly lower level of influence and access to Academy financial resources. The engineering Academy complained constantly about Handler's attitude toward them — that he treated them like they were businessmen who deserved to be restricted to the wings of the edifice of science. The social sciences, which produced neither true knowledge nor technology, were even lower in Handler's esteem and fared even worse — as if they were lepers who had no right to even enter the edifice. Handler distained social scientists because they didn't produce what he considered to be objective knowledge, and in return they were equally disdainful of him. They considered his reductive model of human behavior — that it was in the domain of biochemistry because behavior was based on values created by biochemicals in the brain — as childishly simplistic.

Handler instituted what he regarded as quality-control procedures to assure the government and the public that the reports produced by the Academy were entirely valid, reliable, authoritative, objective and unbiased. But mostly, the reality was otherwise. Handler appointed each expert on each ad hoc committee only after considering the recommendations of the client. The appointees were not investigated regarding possible conflicts-of-interest related to the subject matter of their committees. The final report of each committee was first reviewed by a policy committee Handler appointed, and then by a review committee composed of Academy members answerable directly to Handler, like the Council of Cardinals serving a Pope.

Handler sought contracts for the entire range of problems that involved science, from the routine to those of genuine national importance. The torrent of advice from his Business-Arm committees created numerous managerial problems, and Handler more or less lost his North Star. Handler continues to claim that all Academy decisions resulted from objective knowledge and rational analysis, but expediency and Academy self-interest, often seemed to be more credible explanations for Academy decisions.

Handler's welcoming policy for agency business enticed the agencies to seek the Academy's approval for planned actions, made money for the Academy, and generated publicized reports that helped insinuate the institution into the national process of making science policy. He rotely continued his journey toward achieving a science nirvana which he should have recognized couldn't exist— politics, human nature, and its embrace of values being what they were. But his mind was too polarized by his ideological embrace of biochemistry to permit insight into his times or human nature.

The advice his Business Arm furnished came to be based mostly on considerations of expediency and Handler's values — impactful reliance of scientific knowledge was often a distant third in priority.

The Academy's involvement in a controversy concerning electromagnetic radiation standards was an early revelation of his lost beacon of inspiration, as well as a sad reminder of his ethical shortcomings regarding policy decisions in matters of social justice —whether the public or industry should bear the burden of uncertainty regarding health risks. Handler contracted to create an ad hoc committee for assessing the biological effects of electromagnetic radiation on humans, but his committee appointees had serious conflicts-of-interest; many were closely associated with the sponsoring atomic energy agency and related commercial interests that favored limited health-related restrictions on radiation-producing technology. Handler offered full-throated support for the agency position, favoring economic development over protection of public health because the latter option wasn't justified by conclusive scientific evidence. President Nixon intervened, however, and opposed the contract on the grounds it would place decision-making power in the hands of the Academy, a private institution. The resulting controversy jeopardized Handler's reputation, diminished the Academy's status as a trustworthy source of advice, and led to an historically significant polarization regarding views of the relation of science and society that divided the national political parties.

Democrats tended to look on the Academy as the only source of independent scientific advice. Republicans, however, grew skeptical about trusting advice from professional scientists concerning societal problems that involved technical matters, which in their eyes were primarily political and economic issues. Republicans also challenged the notion of determinative scientific advice to solve societal problems, regardless of whether the advice came from the Handler's mouth, ad hoc committees of the Business Arm, or scientists employed by federal agencies. The Congress, which was controlled by Democrats, began passing laws that required federal agencies to seek advice from the Academy— a development that produced a schizophrenic reaction in Handler. Legally mandated Academy involvement in science-related tasks would likely generate both positive publicity and profits for the Academy, but its right to refuse a request would be vitiated, effectively making the Academy a tool of the

government. Further, Handler's managerial techniques were threatened by mandated Academy advice. As a private organization, the Academy could operate in complete secrecy, without public records of proceedings. A decision-making function thrust upon it by law, however, would subject the Academy to public scrutiny, and likely deter volunteer experts from serving on ad hoc committees.

Other controversies also developed, including those that involved Academy contracts to study the effects on humans and the environment of defoliant spraying in Vietnam, the feasibility of proposed deadlines for the required use of auto-emissions control technology to reduce air pollution, and potential ecological effects of the extension of an airport runway into a bay. While Handler tinkered with the managerial details of these contracts, other technological problems appeared that also had enormous economic implications and complicated potential answers. He confronted each problem by relying principally on his ideology to identify his favored solution, like a gardener whacking mole as they appeared.

The historical mission of the Academy had been to concentrate exclusively on providing advice about technical issues when asked. But the reports of its ad hoc committees, which were coated with the prestige of the Academy, sometimes influenced government policy. In one instance, the recommendations of an ad hoc committee on air pollution became the basis for state air pollution standard-setting; in another case, the new federal agency for protecting the environment set electromagnetic radiation protection standards on the basis of recommendations of an Academy committee. Additionally, Academy reports were sometimes used by federal agencies to support a regulatory decision. Removal of DDT from the market was a poignant example for Handler. The result infuriated him because he thought it relied on the authority of the Academy to validate a misguided policy. But the experience showed Handler the power he held in his hands and cemented his resolve to explicitly extend the Academy's influence into the realm of policymaking.

The Academy was a private organization and therefore could not legally make public policy, a limitation Handler acknowledged when he said described the Academy as "a private, co-optative society with two functions, one honorific and one advisory."

But during the years he prepared his evangelical book on the merit and authority of biochemistry in biology, he decided that, if the opportunity presented itself, he would use the bully pulpit of the Academy to proselytize, as an institution, in favor of particular policies that benefited what he alternately described as "pure science" or "basic research" and most especially meant biochemistry. When Handler became head of the Academy, he soon arrogated to himself sufficient authority to add another function to the society, recommending science policy. The Academy commence speaking as an institution in favor of policies that supported basic research, claiming it was the sole source of the knowledge needed to solve many of the nation's problems, particularly those involving public health, the environment and population control.

Most Academy members believed the Academy's mission was limited to advising the government in matters directly related to the physical sciences and to furthering the development of science, and did not include developing recommendations for national science policy. But they had no influence on Handler's zeal to implement his ideology.

He had the authority and chutzpah to unilaterally force the Academy into the policy-making arena without consulting the members, and he did so.

Handler's staff in the Business Arm developed skill at defining the parameters of public policy, laying out alternatives, and describing their technological consequences while assiduously avoiding the unlawful overreach of appearing to make final choices in the reports of its ad hoc committees. The staff insinuated Handler's principles in rules for wordsmithing the reports, for example, using "therefore" to indicate the committee had not made a value judgment. Publicly, Handler expressed a laissez-faire attitude about the policy-making process; he said, "The edges of the boundary zone between advising and policy making are indeed fuzzy," and continued, "We can only try to make certain that our recommendations are soundly based in technical detail, and then if we must use them as a point of departure to discuss larger social questions, so be it."

Handler held out the Academy as the only organization with the credibility to defuse public concerns, what he called "emotional problems," and clarify alternative answers to the complex societal questions that derived from technological change.

He said "the nation's value system must change and become more rational when forming science policy," and asserted the Academy deserved respect for implementing process because it was the most prestigious body of scientists in the world. Handler believed the Academy spoke with the voice of reason regarding policy issues that engendered a high level of public interest such as side-effects, pollution, environmental degradation, safe foods and drugs, and the cure of cancer.

The policy issue of enduring personal interest to Handler was the size and stability of the research budget for biochemistry. Publicly, He approached the issue via the notion of value, realizing that society spent the most on what it most cared about the most, and recommended the government establish a policy of valuing science by law, with a fixed budget of appropriate size that was independent of extraneous factors like inflation or war. The law he sought law would declare the nation's policy regarding the goal of science included not only the promotion technology, development of the economy, and strengthening the national defense, but also "simply to illuminate man and his universe" by means of basic research." Handler asserted basic research was a necessary goal of national science policy because the knowledge it discovers will produce the most important gains for society that can occur. During many dozens of appearances before congressional budget committees, both before and especially after he became the head of the Academy, Handler made fervent pleas laced with extravagant rhetoric and poetic imagery aimed at achieving codification of the policy into law, which he believed would greatly benefit biochemical research. But his philippic was ignored by every Administration and Congress of his time, including those during the early years of his leadership of the Academy. Despite his extreme efforts, funding of science was decided the same way as all other funding decisions — via the political process. Budgets were determined by the Congress after considering the science-related goals of each federal agency, and Executive Department made the final decisions about how budgeted funds would be allocated. Handler reacted angrily to the government's rebuff of his policy objectives, derogating its decision as "a policy of no policy."

Handler created a voice that aggressively spoke for the Academy and described what federal science policy ought to be. His efforts engendered constant stress from political

controversy and criticism that adversely affected his health, which was already burdened with a range of chronic illnesses and periodic bouts of depression, conditions worsened by his a near pathological dislike of physicians and penchant for self-medication, but he soldiered on. In numerous speeches, Handler expounded on his science policies for overpopulation, the intellectual freedom of scientists to pursue their visions of knowledge, and formally prioritizing government spending on pure research, especially that which involved public health and clinical medicine.

IN 1970, HANDLER EMBARKED on a long whistle-stop tour of America, delivering an unprecedented series of speeches to diverse audiences during which he laid bare every aspect of hie ideology in a desperate effort to rally the nation to his cause.

In the spring, Handler was the keynote speaker at the largest meeting of biochemists ever held in the U.S. The mood was somber, what Handler called "heavy with foreboding," because the government was reducing the number of grants awarded to biochemists, and its practice of paying students to learn biochemistry was
being sharply curtailed. Handler intoned, "There is a deep sense of concern regarding federal support of science, apprehension that not only do things not go well, but that they may worsen. I share that concern and wish to enlist your cooperation in efforts to alter the apparent course of future history." He said the decrease in funding for biochemical research and education was a result of the growing disenchantment among the American people with the consequences of technology, which they mistakenly thought was science.

Handler described the public's view of science as something Kafkaesque — no matter how diligent and dedicated biochemists were, no matter how hard they worked to generate knowledge, the public blamed science for the destruction of the environment and the harmful impacts on public health, which were actually caused by the misuse of technology. He said there was a "continued failure of most Americans to appreciate the difference between science and technology," and a perception science was responsible for evil.

Handler blamed the problem on a cult of alarmist biochemists. He said, "The most painful aspect of our current circumstance is the fact that, in considerable measure, we have generated it ourselves. The growing wave of public concern for the quality of the environment has been generated, in large measure, by biochemists who exaggerate the deterioration of the environment and who, seemingly, seek to have national policy made by reiteration of horror stories when what is required is quantitative scientific evaluation of the real, and as yet unknown, dimensions of these problems. Through their efforts, in the minds of others, science is thought to have contributed to the deterioration of the quality of life because science is equated with technology, and both are judged to be immoral." He offered an explanation for the environmental degradation that prompted the exaggerating biochemists to tell horror stories. Handler said, "It clear is that we are transitioning from a society where judgments about public health and the environment were made to favor investors and business interests, thereby promoting a strong market economy." However, nowadays, Handler claimed, industry was beginning to learn to make its major decisions by weighing hazard against benefit, which he explained was the proper manner in which the major decisions ought to be made regarding the jeopardy to health and the environment caused by technology.

Handler told the audience that any jeopardy to health or the environment potentially

associated with technological development was a business issue properly resolvable by what he called “hazard-benefit analysis.” A hazard, according to him, was a biochemical concept that could be quantified based on biochemical data from toxicological studies. A benefit, in contrast, was a managerial concept quantified in dollars saved if a proposed regulation were not enacted. To spare his audience the mathematical details of how hazard-benefit analysis was actually carried out, Handler asked them to use their imagination. They were to visualize a process wherein biochemical information provided by biochemists was transmuted by managerial experts into a number that measured the amount of hazard, and skilled accountants determined the benefits expressed in dollars saved by industry; the winner was the side with the larger number. Handler’s attempt to elaborate a financially secure position for biochemical research was warmly received by the audience. He responded by urging them to become politically active in the defense of their jobs, and to speak out against the bad biochemists, who were the root cause of the problem. He said, “Your voice has not been heard, while the shrill voices playing to the top galleries are registering both in the public consciousness and in the budget process.“

Handler listed several specific cases wherein he thought biochemists had failed to act in their own interest and support his efforts. “What has been your influence on public altitudes regarding banning cyclamates, or DDT, or lead in gasoline” he asked.
“There was no hazard versus benefit analysis in these issues,” he said, “but unlike me, you didn’t object.” He said the lies told by some biochemists to the government about the environmental dangers posed by these chemicals “returned to haunt us.”

Handler conceded that, despite his best efforts and the enormous potential of biochemistry for human betterment, he had been unable to persuade the Congress to support basic research for its own sake The simple fact was, he said, that the ignorance of laymen about science blocked his success, and the time was right for a change in strategy. Handler said it was no longer possible to gain financial support for biochemical research by promising cures for major diseases, or by arguing that the historic record gives good cause to believe that biochemistry will continue to be successful as it has been, or that if biochemistry isn’t supported there is no hope of finding cures. At the risk of sounding crass, he said, the time was right to suggest that “we should use protection of the environment as an excuse for large expenditures for fundamental research.” He continued, “Inevitably, that must seem to be a defense of our own personal incomes” because the strategy “can quite accurately be described as personally self-serving, regardless of the honesty or objectivity of our intentions”. Nevertheless, Handler asserted, his new strategy was the only recourse open to defend the economic basis of biochemical research. He urged the biochemists in the audience to become actively involved when he is subjected to attacks by the scientific press after he begins implementing the new strategy.

Handler criticized the audience for their past failure to complain loudly when national and international science journals criticized his behavior for defending the interests of biochemistry and biochemists. Handler took umbrage at such reporting but was even more upset because biochemists had not spoken publicly in his defense, notwithstanding that he was protecting their interests, and he provided examples.
“For some years science magazines,” he said, “have contained news stories written by a small group of nonscientists as rather personalized editorials, and which occasionally recount

scandal, large or small, seemingly without compunction and seemingly almost enjoying the embarrassment or discomfiture of some element of the house of science."
Handler asserted "There have been few protests," and that it was counterproductive to their interests of biochemists for them to remain passive. A criticism that particularly aggravated Handler appeared in a British magazine. Handler was not mentioned by name, but the criticism transparently referred to him; "American research leaders might profitably interrupt their marathon last rites for science in the United States and examine the policy statement that outlines how their British counterparts plan to live with the common problem of a shortfall between money and scientific ambitions."
Handler asked his audience rhetorically, "Does that attitude represent you?" He continued. "The magazine was read by the staffs of congressional budget committees. The sentence may well outweigh our efforts to arouse concern for the dire consequences of current funding policies to the scientific endeavor, yet you remain silent."

During his speech there was a point that Handler lapsed into what seemed to be a reverie in which spoke incoherently, a behavior that gave credence to the rumors that he had periodic bouts of mental instability. He began by saying his concept of how the nation should determine how much money it should spend to support basic research in any particular year was to budget fifteen percent of its gross national product. Control of the amount of money so determined, he said, should be given to the National Science Foundation, which would decide exactly who received financial support. He then changed his focus and explained he had reviewed the process by which corporations determined their research budgets and learned they spent what they could afford. He said the Congress ought to follow that example, and that it was in the best interests of those in the audience to recommend to the Congress that "we should be provided as much money as we know how to spend prudently in the conduct of science." His reverie ended with a plaintive plea: "Lacking any better reason to justify basic research, we should reiterate our articles of faith; that inquiry is among man's noblest pursuits, that the very doing of science itself is a purpose of our society, and that, assuredly, scientific information gathered today is at least as likely to be used for the betterment of man tomorrow as it was yesterday."

Handler then snapped back to reality and urged the audience to lobby for the interests of biochemistry, like any other interest group. "The immediate problem," he said, "is to persuade your neighbors and your congressman personally of the validity of our articles of faith, to sharpen these by bringing to public attention the potential for public good of currently exciting areas of research, as well as to make clear the consequences of continuing attrition of support for the biomedical research endeavor to the success of that endeavor, to your university, and to your research." He urged the biochemists to immediately write letters to their congressmen and senators as well as to the congressmen and senators who held the keys to federal appropriations for biochemical research. His advice was detailed and specific and projected his sense of urgency: "If you or your institution is in difficulty, please make that clear. If you know how to quantitate the case, so much the better, because nothing else you could do would be quite as effective. Enlist the cooperation of your colleagues, your friends in business, your university president, your patients. Do not wring your hands or complain to each other — get out your pens and write! And send copies to the White House and your local newspaper. Remember, what is at stake is not your research, your institution or science for its own sake;

what is at stake is the national future."

Handler's insatiable ambition to establish biochemistry as the science that could ultimately provide the answers to all of society's problems, led him to express sentiments that were the opposite of those he voiced earlier in his career. He said, "The present separation of government support for the humanities, social sciences, and natural sciences institutionalizes an artificial division that is harmful to the national interest." Previously he said that social science was "voodoo science" and the humanities were based on values and were useless in matters where knowledge was needed. Nevertheless, he recommended creation of a federal agency for research — "particularly for the biomedical research endeavor" —at the cabinet level, with a Secretary and a broad charter. "Importantly," he said, "the proposed agency would be large enough to justify a set of new congressional committees which could take genuine interest in its success, and whose chairmen could politically identify with that success." Handler emphasized that science itself would be the mission of the agency, and the level of funding of science would be determined in the light of its mission rather than in competition with research at the mission-oriented federal agencies. He said the new agency would "bring together the scientific and humanistic enterprises so that scientific discovery in the future will take place within the context of humanistic thought about how best to use the discoveries that are being made in science." Handler had come to believe that "the humanities and the arts were coequal with science in our national culture," and therefore he considered it appropriate that the programs in the humanities and arts should be folded into the new agency. He said the humanities, arts, and sciences collectively determined the intellectual quality of the nation and were crucial to national viability. "If you agree that the new agency is needed," Handler asked the audience, "why not tell those who represent you in Congress, in your own language and advancing your own arguments?"

Handler concluded his lecture with a staccato crescendo of science-related canards that were effusively pompous even by his standards: "Let it be clear that the song of hope for a better world is still written in the rational language of science."
"Despite the frenetic concern for environmental pollution, there is no question in my mind that man can live with his technology. "Science is still the instrument with which can make man's dreams come true."

In a lecture to biochemists who specialized in developing agricultural technology, Handler expounded on his policy views regarding mankind's problems, and the critical role of biochemical research. He expressed a dubious belief mankind would survive the nuclear crises, but great optimism that, if it did, mankind's dream of a healthy, prosperous, and peaceful society was possible because biochemical research had the potential to permit refashioning mankind and the world. The main problems, he predicted, would be overpopulation and environmental degradation.
The world's population was increasing rapidly and, he said, "the planet could not conceivably tolerate the continuing insult of the expectable magnitude." He detailed the tragic ills of human existence he thought derived from the unbridled growth of human populations: "Hunger, pollution, crime, despoliation of the natural beauty of the planet, extermination of countless species of plants and animals, overlarge, dirty, overcrowded cities with their paradoxical loneliness, continual erosion of limited natural resources, and the seething unrest which

engenders the political instability which leads to international conflict and wars" He said, "If humanity is ever to realize its potential, if life in that future world is to be worth living, population growth must be checked." According to Handler, that could be accomplished by "weighing risk against benefit" to determine "the quality of life necessary to achieve the greater good for the greater number," he used several semantic versions of the formula but provided no examples of their implementation.

Handler acknowledged that the nation had problems with air, water, and land pollution but warned against regulatory overreaction. "It is imperative," he said, "that we recognize that we know little and badly require scientific understanding of the nature and magnitude of our actual environmental difficulties." He reiterated his charge that unnamed biochemists and others acted irresponsibly and caused a wave of public concern by exaggerating the deterioration of the environment and overenthusiastically demanding economically unrealistic steps be taken to address the problems. Using grandiloquent language, Handler described the evil consequences caused by the vocal unnamed, "Science was thought by many to have contributed, along with technology, to the deterioration of the quality of life and both are judged to be immoral." The unnamed persons "turned much of the public, the Congress, the Administration and an increasing fraction of the nation's youth against science. "He predicted that the nation "would pay a dreadful price for their public behavior because they departed from established fact to indulge themselves in hyperbole." He told the audience that public concern regarding health risks and environmental degradation were ephemeral matters that "will surely pass as public concern and interest turn elsewhere, as the public and its political representatives begin to take environmental deterioration as much for granted as they now do the presence of an arsenal of nuclear weapons." He said he preferred to look forward and "build the glorious world that only science-based technology can make possible."

Handler asserted that a deliberately delayed policy of pollution abatement was optimal. "Smog is unpleasant", he agreed, "but it has not seriously harmed man or animals, and technology is being developed to rectify its degradation of air quality." He said the consequences of increased atmospheric carbon dioxide were uncertain and, "on balance, might even be beneficial."-Handler conceded that water pollution had "woefully injured" some lakes and streams, making them "sewers for a mélange of all of the chemical outpourings," but said the good news was that the damage was mostly reversible.

Handler advanced a series of bizarre science policies. He told the audience that public-health standards for water, air, foods and population policy "cannot be left to the capricious judgments of individual national governments" He said, there was an urgent need for an international organization to establish worldwide standards after completion of "a very substantial research and development effort," but conceded "The nature of this organization and its policing power, I leave to those more politically sophisticated than I." However, he had no reticence describing the portfolio of the putative agency; "This agency must be as temperate and conservative as it is determined, must understand that the terms "pure air," "pure water," and "pure food" are essentially without meaning, as is the word "safe" when applied to drugs or food additives." According to Handler, the agency should produce a numerical definition of the acceptable level of each chemical, as determined by a trade-off between its hazards and benefits. Handler mocked the idea that any chemical could actually be a health risk unless it was biochemically proven to be toxic at common environmental levels. In the absence of that

evidence, he asserted, chemicals in the environment were “a very small threat to life,” citing as examples, carbon monoxide, lead, sulfite, and nitrogen oxides in automobile emissions.” Handler claimed that “extremists are seeking to ban automobiles” to protect against the health risks of the emissions, and that the government was considering “zero tolerance for all food additives and for all drugs with respect to untoward consequences to the consumer,” and rhetorically asked, “What are the trade-offs, and where is the supporting toxicological data to support the positions.”

Handler pleaded for what amounted to useless biochemical research, because no possible results of the policy he advocated could be linked to establishing safety levels of chemical pollution. He said food additives should be “without hazard” and that an “extremely large effort” was needed to obtain pertinent biochemical data,” notwithstanding that there were no methods to relate basic biochemical data to safe exposure levels. In effect, Handler urged a policy of pointillism research like that he practiced in the early 1950s, when he worked in the laboratory — it kept biochemists occupied but led to an aporia. Nevertheless, he maintained that until the impossible task was completed, the best course for the government was to “behave rationally rather than run scared as it did with respect to cyclamates and DDT.”

Handler’s comments became less fluent and deepened toward irritability or frustration, even over small matters, as if he were depressed and could no longer tolerate the world he experienced. He expressed exasperation with the public’s failure to understand what chemical research had done and could do in the future. He said chemistry gave the nation synthetic fibers and modern agriculture, “which is nothing short of miraculous,” and lamented, “There are few more glorious tales in the annals of mankind, few activities by which so many have benefited, and yet there is minimal public appreciation of this endeavor.” Handler told the audience that the public was similarly ignorant about medical research, where “incomprehension is the norm.” He lamented the practices of publicizing only breakthroughs and demanding that medical schools produce only “ordinary practicing doctors at the expense of research activity,” and rejected both practices because “They could not be more wrong.” He said what was commonly called medical care was “only the use of manpower and facilities to operate inadequate half-way technologies,” and predicted that “When research is funded to provide a basis for truly definitive prevention or therapy, control of disease will be enormously simpler and cheaper.” He supported the promise with a fictional account of the historical connections between biochemical research and medical advances — that every medical cure was the consequence of biochemical research, and that for diseases where there were no cures, the reason was the lack of biochemical research. Handler evinced no understanding and accepted no blame for the existence of untamed diseases — that they were so because they were unamenable to cure by means of Handlerian reductionism, which was the only research method he had trained the federal biochemical advisory panels to permit. Oppositely, he said biochemical research could permit mankind to remake itself, and if it didn’t happen the fault would lie with laymen who were “too immature” to cope with the nation’s problems. He said laymen were permanently ignorant about science and mistaken in their imagined abuses of public health and the environment.

Handler concluded his speech with and a contingent prediction of man’s future and a paean to biochemistry. Despite laymen’s’ attitude toward science, he said it was the only instrument mankind had to make its dreams come true, and if they go unrealized “the cause

will not be science but rather man's nature." He cited an ancient poem he said captured his belief that only biochemistry, not God or nature, could fulfill the dream of a happy and healthy life: "It is not the shrines of the gods nor the powers of the air that send the dreams which mock the mind with flitting shadows; man makes his own dreams,"

Several months later, at a meeting of biochemists, while in a pontifical mood, Handler lectured on the problems of science, scientists, and society, sparing no one's sensibilities.

"Many problems weigh on my mind. Overridingly incumbent on me is the need to explain to the nation the need for each citizen to seek at least a modicum of education in science. Science is the most powerful tool the mind of man has yet conceived to serve humanity, and the pursuit of science is both the leading edge of our culture and the only rational basis for a better way of life tomorrow. I intend to say so repeatedly in my ongoing campaign to popularize the understanding of science so that the imaginary threats can be distinguished from those that are real.

"Degradation of the environment is real, but its scope, intensity, frequency, and impact have been dreadfully exaggerated by scientists and the press. Pollution and assertions of so-called health risks and side-effect are always presented as a series of unvetted horror stories rather than as a collection of verifiable scientific data. Actually, the present-day situation is improving. The pollution levels of our lakes and rivers are decreasing. Air pollution and smog are unpleasant but controllable by technology and should be seen in perspective. The problem is trivial compared to the frequency of highways accidents caused by young drunken drivers, the apathy of college students toward nuclear weapons, attainment of an enduring and just peace, and the desperate state of our rural poor.

"Scientists must stop frightening the American people and instead demand the very large biochemical research program necessary to acquire the data that would permit quantitative evaluation of the risks versus the benefits in all those areas where the environmental and health consequences of man's commercial activities are still not clear and obvious. We need to know far more about pesticide usage, food additives, drugs, industrial practices, hazards from electromagnetic energy, and the alleged problem of global warming if we are to make sound judgments and establish public policy.

"No one in authority in the government seems to understand that environmental degradation is a result of overpopulation. Consequently, our response to the situation as a society is pitiful, much like prescribing aspirin for a brain tumor.

"Environmental problems are only problems for the higher class of society. Environmental quality is a white upper-middle-class problem, entirely solvable in the early future if we are but willing to pay the costs. Such matters offer little trouble to laborers who equate smoking industrial chimneys with jobs, or to Blacks and Chicanos who have much more compelling concerns.

"The public and congressmen demand that we produce ordinary practicing doctors in greater numbers even though medical students are uneducated about research. What passes today as medical care is nothing more than use of inadequate technologies. Biochemical research, which can provide a scientific a basis for truly definitive disease prevention or therapy, is vastly underfunded even though it could provide an enormously simpler, vastly more effective, and significantly cheaper method to control disease, compared with the present

procedures. Elimination of diseases and discovery of cures is not a hopeless dream but a rational projection into the future. If the nation refuses to fund basic research, by the turn of the century, it will need vasty more hospitals, sanitariums, and physicians, and the people will endure vastly more suffering.

"It is the responsibility of scientists to make it abundantly clear that, for beneficial changes to occur, an understanding of the world in the language of science is absolutely necessary. Scientists have objective knowledge about the world, and a method to generate whatever new knowledge is desired, without limit. They are capable of fulfilling of the American dream. By means of the scientific method they can refashion our world. If the dream is unrealized, it will be because the makers of science policy in the government too immature."

A week after he addressed the biochemists, Handler lectured a university audience on the obligations of scientists to promote science. "From my point of view, the crumbling of the scientific enterprise, the slowdown of the economy and the disappearing blind faith in the utility of science by a public have combined to generate a rising sense of apprehension in the scientific community. The community's anguish peaked after funds for research and education in the Foundation's budget became scarce, and the mission-oriented federal agencies began insisting that their research support be spent exclusively to seek practical results.

"The most important response a scientist can make is to speak out publicly with the honesty and integrity that, presumably, characterizes his research. The burden upon each scientist is to publish statements containing facts and figures that document his opinions, not to engage in hortatory declamation. It is essential for everyone engaged in research to find opportunities to make known to our fellow citizens our sense of the value of science in the world of tomorrow. If you believe science remains the most powerful tool the mind of man has yet conceived to alleviate the condition of his fellows — please say so. If you believe that the pursuit of science is not merely the expensive hobby of scientists but both the leading edge of our culture and the only rational basis for a better way of life tomorrow — please say so. If you believe that the tremendous productivity of science-based technology is, despite what our youth proclaim, what provides future opportunities and solutions — please say so.

"But as you sell science, remember that your audience stoutly believes all research must be done for a purpose — intellectual develop alone is an insufficient basis on which to try to secure a sound future for science. The point you should emphasize is that seeking intellectual development leads to unexpected, unpredictable bounties, whereas goal-oriented directed research offers little except achieving a goal. If we seek support for scientific research on that ground alone, the outlook is hopeless. Congress has long demanded that scientists list their priorities for research funding. The time has probably come to accommodate their wishes.

"I propose that one priority should be to eliminate incompetent and nonessential research, which could be accomplished by eliminating federally-supported research at most of the several hundred universities where it now take place, and concentrating funding research at a few elite universities."

Several months later Handler gave the keynote speech at the annual meeting of the world's largest science organization. At the time, he was suffering from undisclosed, professionally untreated physical and mental-health difficulties. Like a Pope of Science, he

spoke about his religion of Scientism, seemingly depressed but clearly undaunted, as if he had just begun to fight for his beliefs.

"I would like to share with you my concerns for the future of science. Within the context of a deepening national despair over the specter of nuclear war, the war in Vietnam, racial inequality, environmental degradation, the hazards of technology, and civil unrest, the nation is searching for new values, a clear sense of direction, and a national purpose. This sense of a headlong rush into an uncertain future has generated a national desire for leadership, stability, and assurance that the problems of the day are understood by someone and are manageable. A biochemist would be pretending to be more knowledgeable than he truly is if he addressed himself to these problems from the perspective of science, but such an effort is necessary because they must be addressed, and science is the only source of knowledge that can yield the answers.

"Both political parties have promised an education for all citizens to the extent that they are educable, independent of their financial means, maintenance of our international scientific leadership, a vigorous national biomedical research program, and increasing utilization of the nation's scientists to help secure the national defense and promote the welfare of society. But the politicians have not lived up to their promises. The government has retreated from these great goals and the gulf widens yearly between the available resources and scientific opportunity on the one hand, and national needs on the other. For science students, federal stipends to pay for tuition and living expenses are disappearing, replaced by loans, a change that imperils the scientific enterprise. The morale of their teachers, scientists on university faculties, may soon be broken, and in the meantime, they are troubled, distracted, and less creative. A level of apprehension has been generated which goes far beyond the reality of current fiscal problems, much like a run on a bank in the great depression.

"One reason the government failed to honor its promises and commitments to support university-based biochemical research is the behavior of some of its faculty members. They are unconcerned with the mores of their students while proclaiming expertise with respect to public health, environmental degradation, foreign policy, urban problems, and the economy. They are appalled by violence in the ghetto but not by that of some students on campus. They oppose environmental pollution but remain quiet about drug abuse on campus. These professors form an entrenched adversarial culture in the universities. Their dogmatic nihilistic doctrine of barbaric hostility to routine industrial practices, accompanied by a will to believe the worst about industry, joined with a compulsion to distort and fabricate events, have combined to diminish the common will to support a university system. The entrenchment of an adversary culture and the increasing number of these neo-Luddite know-nothings weakens the ability of the university administrations to exercise authority over their campus activities and creates an extremely hostile reaction among ordinary tax-paying citizens.

Their ire is then directed not at the neo-Luddites but at science itself, and their influence spread into national politics. Proposals to strengthen universities were made by me, private philanthropies, and the Foundation, but the scientific communities remained silent. Neither Congress nor the White House detected any significant support and these proposals vanished into the limbo where reports go when the time is not right. Change can come about only if there are sufficiently vocal and numerous constituencies.

"Some accuse science, through the technology it produced, of having engendered our environmental problems, degraded the quality of life, and as serving as the willing servant of industry. Nevertheless, the fact remains that there is no tool but technology that can further improve the human condition, and serve human purposes, the evidence of which surrounds us. Modern machines have replaced animals and humans in the performance of many tasks. The tin can, frozen foods, refrigeration which liberated women from the thralldom of the kitchen are examples. The advances in medicine which permit us to live out our lives free of pain or serious illness, and abolition of malaria and typhus by DDT are further examples. While recognizing the dangers ahead, I believe that, with judicious use of applied science, dangers and hazards associated with technology can be averted and humanity freed as never before.

"Appallingly exaggerated statements have been made by some scientists with respect to the immediate seriousness of environmental problems. Our most acute environmental problems can be managed even now by appropriate regulatory measures which require utilization of technology either already available or readily devised. I consider our air pollution concerns to be rather temporary and, at least in a historic sense, readily solved. Water pollution is decidedly more complex and solid waste disposal is still without a real solution; but both can be markedly alleviated even now if we are but willing to pay the costs. Intense emotion is elicited in people by water and air pollution, but strangely, not by the possibility of nuclear war or the plight of the rural poor or millions who suffer from malnutrition. How remarkable that is. The nation is determination to avoid health hazards from automotive exhaust, which is unpleasant but not harmful, while remaining apathetic to the hundreds of thousands of Americans who are killed or maimed annually in accidents for which alcohol is often responsible.

"Huge large-scale measures are needed to abate side-effects and pollution. But if we are to undertake the effort, we must first systematically acquire data, point by point, and then synthesize it in a manner that will allow experts to evaluate the health hazards and the societal benefits and to weight them against one another. We need to know much more than is known about the health threats of pesticides, food additives, drugs, diverse industrial practices, electromagnetic radiation, electromagnetic atmospheric phenomena, and the alleged fragility of animals and plants in the environment if we are to make sound judgments and establish rational public policy. The hysteria of those who demand that we possess this information prior to the marketing of products or introducing new technology into the environment is unacceptable.

"The American people cannot be expected to look with favor on spending the huge sums required to support science students and scientific research because they don't understand what science is or how it functions. The science press which, ironically, is usually hostile to scientists, only exacerbates the problem by providing a platform for the neo-Luddites. The only strategy open to scientists is to become active lobbyists for their cause. You must learn how to advocate for science and find opportunities to make our case. The public should be made to understand that time is needed for the results of basic research to yield useful information, and that targeted programs like the so-called war on cancer are futile until basic research about life is carried out. Targeted research projects are possible in physics, like putting a man on the moon, but not in biology because it is far more complex than physics. Non-targeted scientific research is essential to our security, public health, general welfare,

economic vigor, and the conservation of our environment

"Lobbying on behalf of science will invite charges of self-service and conflict of interest. But we know that it is the national interest we serve, not ourselves. Should we succeed, we will compel President Nixon not to dishonor his campaign promise to fertilize science."

Stewart Udall, a congressman and then a cabinet minister in the Kennedy and Johnson Administrations responsible for the environment, heard Handler's speech and delivered a critique unprecedented in the history of American science policy. Udall accused the science establishment, particularly the National Academy of Sciences, of failing to exert moral and political leadership on issues involving the impact of technology on mankind and singled out Handler for special attention. Udall declared Handler and his two immediate predecessors as president of at the Academy, should have alerted the nation years ago to the developing problem of environmental degradation. Not only did they fail to do so, he said, Handler attacked those few scientists who did alert the nation, branding them as extremists.

Udall said establishment scientists seemed primarily interested in science rather than society; he accused theme of asserting that science merited public support unburdened by either the need to account to the public or the responsibility to seek foreseeable benefits for the nation. He agreed science had generally returned good value in terms of scientific results, but noted that "as we all know today, science, lacking any foresighted ethical or social vision, can be a menace to man as well as a beneficence." He said, in effect, the advice the Academy provides is couched strictly in terms of physics, chemistry, and engineering without humanistic language, and that like "political eunuchs," the Academy avoids consideration of the ethical, moral, or justiciable consequences of their judgements. The gist of Udall's comment about the shortcomings of the Academy system was a foundational criticism — that the Academy wore social blinders to detach itself "from prime national issues involving the relationship between science and society, "especially the environmental crisis." He characterized the Academy as a too-often puppet of government agencies, a political position that left little room for the Academy to function as an independent critical voice.

With rare exceptions, Udall said, scientists, both individually and institutionally, had wrongfully ignored the negative impacts of science on society by abhorring involvement in social issues. "To be sure," he added, "a handful of scientists must be accorded a high place of honor for alerting the public to the menaces of nuclear weapons, population growth, environmental degradation, and the inadequacies of American education. But in many instances, these scientists have been lone voices in the wilderness." Udall said he thought the most encouraging developments of the last two years were that some scientists had spoken publicly "with power and vigor on environmental issues and the errors of misguided technology, and that they have won a growing national audience for their views." He said the nation needed scientists who dared to stretch their minds and relate their expertise to the whole human enterprise — men and women who were "not afraid of integrating their ideas into a larger context that embraces man, nature and technology."

Udall criticized Handler for his efforts to repress dissenting scientists. "A few weeks ago," he said, "Handler saw fit to warn that 'the nations of the world may yet pay a dreadful price for the public behavior of environmental scientists who depart from the established fact to indulge themselves in hyperbole'." Udall continued with a series of questions concerning the

morality of Handler's actions. "Is it wrong for scientists who have deep-seated fears about the future to express them." "When human survival — or at the least the quality of human existence on the planet—is at stake, are their warnings unscientific and alarmist, as Handler has said?" "Should concerned scientists allow themselves to be cowed by outmoded concepts of professional discipline when their insights can help society resolve issues of the highest order?" More often than not, Udall said, concerned scientists were looked upon with disdain by Handler and other establishment officials for venturing beyond their technical fields of expertise, which was exactly what Handler and the others do routinely but forbid others from doing. Udall said the lack of support by the Academy for scientists who spoke up about environmental matters was the most glaring example of the misbehavior of the National Academy of Sciences, and a good reason why some segments of youth are disillusioned with science in the 1970s.

A new-breed of scientist-statesmen was needed, according to Udall, who have opinions on the national purpose and are unafraid to speak for reform. "I would rather see scientists err on the side of activism and occasional hyperbole than see industry and government officials act irresponsibility," he said. Udall concluded the Academy's overspecialized technical approach to environmental problems puts the nation in peril and recommended a government committee be formed to intensively investigate how the Academy operates.

When Udall and Handler were interviewed about their speeches, Udall reemphasized that the Academy was biased in favor of government agencies and that Handler was wrongfully intimidating scientists who did not espouse his ideology. He said what was needed was an organization concerned about the future and the environment, which was able to act as a counterforce to the Academy by expressing judgements, arrived at in an open unbiassed process, concerning how to use science to solve the nation's problems. Presently there is none, he said, and individual scientists were afraid to speak out because of repression from the Academy the Institutes, and the Foundation, which together, directly or indirectly, control most federal grants for university-based research. Handler expressed deep indignation at Udall's speech and subsequent comments, as if it were a sin to criticize him or the Academy, and called Udall's charges "ill considered, unfounded, unnecessary, gratuitous, and unwise." Handler said the nation's environmental problems were Udall's fault, not the Academy's, because Udall didn't follow the Academy's advice when he was a government official. Handler said Udall "didn't lift a finger" to implement recommendations the Academy made in several reports, especially "a remarkable report on waste management" that Udall lacked "the wit to implement."

Early in 1971, in the midst of his period of frenetic speech-making, Handler's health worsened, and he decided to enter a hospital for tests and treatment. He maintained complete secrecy regarding the condition of his health, and to facilitate secrecy he decided to forgo hospitalization the Washington D.C. where he lived, and chose a hospital in Durham, a trip he explained was necessitated by the process of selling the home he had built there. The results of the hospitalization and its impact on his health were similarly undisclosed, but by the end of the year his speech-making activities decreased precipitously.

THE MOST IMPORTANT BIOLOGICAL discovery that occurred during Handler's career was the vulnerability of human health and the environment to unintended consequences of industrial activity and technology. By the time he assumed control of the Academy, the nation had awakened to the problem, and the urgent mission of the government was to regulate industry so that neither the citizenry nor the environment would be poisoned. Historically, the environment was treated as if were infinite and immutable and benign; any safety-related measures were designed solely to prevent hazards — acute dangers that had obvious consequences, like fire or poisoning or electrocution. While Handler was preoccupied trying to elevate science to the level of a fourth estate, prodigious technological changes occurred which necessitated adoption of wise management policies that went beyond guarding against hazards and sought to protect against the risks of technology-related health impairment and environmental degradation. Development of the requisite policies required scientific characterization of the risks, and then adoption of laws and regulations that justly balanced the economic and social interests of the stakeholders. Handler saw the complex reality — a Gordian knot of the issues, concerns, and values that motivate human beings — in simplistic terms, as a problem in biology. His misperception led him to advocate an egregiously bad policy of biochemical-based solutions to problems that existed at the level of human values.

Handler said the government was not the authoritative source of the solutions and that it was "cynical sophistry" to suggest the federal agency created by the Congress to protect the environment "should determine the scientific steps." The proper authorities to render such judgments, according to Handler, were the National Science Foundation, of which he was the chairman, and National Academy of Sciences, which he headed.

The societal problems Handler recognized initially were overpopulation and "poisoning of the human genetic pool" by the heritable genetic defects. When problems involving chemical pollution of air and water and food, electromagnetic energy pollution in human living space, and the side-effects of commercial products developed, Handler responded minimally because he regarded them as scientifically insignificant. His attention level increased, however, after the problems progressively became perceived by laymen and the government as serious threats of danger to public health and the environment. The government responded to public concern by rapidly expanding the use of gold-standard studies to evaluate the potential health risks. Although it was a generally accepted scientific method, Handler regarded gold-standard studies as the antithesis of science because they were not based on biochemical hypotheses — in his eyes, the only valid basis for studying biology. He successfully blocked financial support for gold-standard studies by the Institutes, but they were performed in the laboratories of federal agencies.

Numerous environmental agents produced as a consequence of technological developments were found capable of producing biological effects in animals, commonly used as subjects rather than humans in gold-standard studies. The implication of the results that the agents could be health risks irritated Handler because he rejected the validity of the experimental method that produced them.

Even more disturbing to him, however, was the emergent message that reductive biochemistry of the type he championed were not be the solution to the national controversy about health

risks from side-effects and pollution — government studies were providing a cognitive basis for prediction of safety, whereas there were no relevant biochemical studies.

Handler began characterizing the controversy as only part of the larger problem of technology assessment, the solution of which he said was properly the business of the Academy because it was the nation's pre-eminent source of advice about science. His concentrated focus on biochemistry for the sake of biochemistry and promise it was the ultimate solution for any problem in biology slipped away. Maintaining regard of the Academy as a prestigious and trustworthy institution became the center of his ambition. He wanted to preserve, protect, and propagate its perception as the personification of science and the only source or unbiassed authoritative scientific knowledge and policy. Handler no longer had the luxury of time and opportunity to plan still another attempt to achieve his dream of limitless funding to pursue a biochemical nirvana. But he did have absolute control of the then most prestigious and profitable corporation in the world of science policy, so there was still much that he could do to advance his ideology.

Benign neglect was the attitude Handler developed regarding health-related consequences of environmental chemicals when he was confronted early in his career with the dangers of smoking. The attitude subsequently colored his reaction to subsequent threats posed by residual pesticides, food additives, and electromagnetic energy emitted from radioactive pollution. Research that could provide biological information concerning the nature and extent of health risks was scanty, and its paucity grew steadily more controversial. Handler exacerbated the problem by successfully blocking funding of relevant research by the Institutes and the Foundation. The resulting situation strongly resonated with the interests of industry. It was much easier and less expensive for industry to design, build, and test a machine, food additive, or plastic product for its primary function and then immediately market the item sans any considerations of health risks. With Handler's support, industry developed a defensive strategy based on professed disbelief, doubt, evidentiary-unsupported denial of health risks, and assertions that pre-market evaluations were expensive and unnecessary.

Handler told the Congress that knowledge of how the environment reacted to various forms of large-scale pollution was unknown, and consequently, until appropriate research was done for each pollutant, predicting what regulatory strategy would be successful was impossible. "Until we gather the necessary environmental understanding," he advised, "the best course of action was to maintain the status quo."

Over the long term, Handler said, the problem the nation faces is that "we don't know how much or what kind of research is needed, and acting precipitously in the absence of sufficient scientific understanding, for example, banning DDT, could do more harm than good." He testified that a more reasonable policy would be to determine the number of biochemists or other scientists available to do research in universities or private institutes, and then to use their talents to assure "vigorous effort on each major frontier of science," by which he meant give them research grants and allow them to follow their own lights. Adhering to that the approach, he said, was the wisest possible course society could follow because a scientific approach to the nation's environmental problems could then be distilled from the accumulated knowledge.

Referring to a suggestion that the government should quickly that steps to protect health, Handler responded, “One can only undertake drastic measures when the time is right.” “Historically,” he continued, “slaves have been freed when they became a burden rather than an asset, long after public opinion found human slavery repugnant, laws protecting women and children at work were passed only when the economy could afford it, and we did not become kind to horses until we no longer required living
horsepower” — his typical hyperbolic language that oversimplifies reality and drives social scientists into apoplexy. He said the public was unlikely to bear the costs of protecting public health and arresting pollution until technologies that were certain to be effective were discovered. He claimed that engineers were “not yet competent in that art, and precipitate action based on insufficient scientific understanding could do more harm than good.”

Handler’s sense of social justice, which was muted after he arrived at Duke, disappeared sometime during his rise in power — a victim of his ideology. He rejected the idea that the burden of responsibility for health risks from untried technologies or industrial practices should be on its sponsors and profiters, choosing instead to place it on the public. Placing the burden on industry, he said, was vindictive and confiscatory of the rights of business, and “not a necessary ingredient of a fair market. Handler proposed a policy for resolving allegations of jeopardy to public health from chemicals.
The government should fund research by university biochemists aimed at finding conclusive evidence regarding biochemical mechanisms of toxicological hazards, he said, and contract with the Academy for ad hoc committees to extract meaning from the data and determine the dose level at which the chemical became hazardous — his time-worn plan of unstructured pointillist research conducted over an infinite time horizon.

In the meantime, according to Handler, the most desirable public-health policy was to rely on epidemiological studies to identify catastrophes in the human population, in the same manner the dangers of thalidomide and smoking were identified. Handler ignored his critics who said relying on human catastrophes for scientific evidence of injury was a species of involuntary human experimentation and continued to urge the government to adopt the approach until biochemical studies of suspected chemicals were completed. According to Handler, any governmental regulatory action prior to definitive results from biochemical studies and an analysis of their meaning by the Academy was a policy of desperation and an unwarranted interference in technological progress.

At a conference on the side-effects and pollution of technology he organized at the Academy, Handler blamed the problems on overpopulation, which he claimed was the greatest and most pervasive threat to the future of the human race. In a claim enlarged beyond truth or reasonableness, variants of which he used frequently, Handler said, “Hunger, pollution, crime, despoliation of the natural beauty of the planet, irreversible extermination of countless species of plants and animals, overlarge, dirty, overcrowded cities with their paradoxical loneliness, threatened exhaustion of our limited natural resources, and the social unrest which leads to internal upheaval and international conflict — all these and more, derive from the unbridled growth of human population.” According to him, modern technology was being used as a scapegoat for the declining quality of the environment whereas technology contributed to the problem only when it was “utilized carelessly and in massive proportions.” His favorite policies for

solving the nation's environmental problems by reducing demand for technology were to reduce the population by means of legalizing abortion, and to fund basic research in gene modification and the biochemistry of reproduction with the aim of reducing the national birthrate "to the bare replacement rate." Unless these steps were taken, Handler warned, the comforts, conveniences, and culture of contemporary American civilization would be denied to posterity. He acknowledged that his proposal called for a dramatic break from the teaching of the Roman Catholic Church on birth control and abortion, but said the teaching was only "the unchallenged precepts of St. Augustine," and that "the times have changed, new practices are needed."

Handler changed the mission of the Academy. It had been created in the nineteenth century as a private corporation to provide free technical advice to the government, when asked, but was largely moribund throughout its history. The Academy's only significant activity occurred after Handler's immediate predecessor created a modern business operation within the Academy which allowed it to be quickly compensated by the government for expenses incurred when providing advice.

Handler expanded the Academy's mission to include the voluntary provision of advice concerning science policy that came from his mouth or from ad hoc committees in the Business Arm. He thus changed the Academy from a provider of requested technical advice regarding narrow questions from specific agencies to an institutional provider of unsolicited policy advice regarding diverse topics, advice that usually meshed with Handler's ideology. Although the Academy couldn't enforce the policies it extolled, its perceived institutional prestige pressured government agencies to do so or explain why they declined to follow the advice of the nation's best scientists. Handler thus effectively transformed the Academy from a non-democratic into an anti-democratic institution where, in appearance, national science policy was planned by the self-elected members of the Academy but actually was planned by Handler.

The Academy's change in direction afforded Handler unprecedented freedom to pontificate regarding any matter that touched or concerned his ideology, and he had a lot to say, the platform from which to say it, and the money to underwrite his project.

He was the head of the Academy's Business Arm, which generated the money. Handler had the authority to appoint the politically sophisticated men who served on the Academy's influential Policy Committee. The officers of the corporate Academy depended on Handler's approval for their board membership and answered directly to him. He appointed every member of every committee in every division of the corporate Academy, and he exercised tight-fisted control over all major activities of the National Academy of Engineering and the Institute of Medicine. He also had the authority to paint the scientific prestige of the membership of the corporate Academy —its aegis — on any report issued by any committee he appointed, any statement he issued, or on anything he said when spoke ex cathedra, like a Pope of the Academy.

Arguably, Handler was the most politically powerful and opinionated man in the culture of science in the last century. The policy advice he offered the nation had little intrinsic merit or measurable impact, but it came from a position of authority and thus usually attracted notice.

Handler's ideology led him to characterize societal problems caused by conflicting human values as amenable to scientific solutions, and his misperception of reality had toxic consequences on science. They included his policy recommendations regarding risk-benefit analysis, his vendetta against scientists who disagreed with him, his Faustian bargain regarding the link between pollution and disease, and his unethical conflict-in-interest between his roles as a drug-company director and Academy head. Handler's extreme policies and actions had a nil possibility of helping to resolve society's ills but a high probability of exacerbating them.

The policy Handler touted for identifying health risks created by technology exemplified his damaging impact on science. He described a rhetorical framework seemingly responsive to public concern about an increasing public-health threat due to side-effects and pollution. Handler departed from the normal practice of utilizing biological experimentation to identify health risks and adopted a non-mathematical version of a computational technique developed by engineers called "risk-benefit analysis." He retained the phrase as the name for his bastardization, using it frequently in speeches and interviews, but only as a oratorical formula unconnected to science —unreferenced to experimentation, reliance on computations, or scientific reasoning. In effect, Handler transformed "health risk" from a biological concept to a cliché.

He further clouded the public's ability to understand his discourse by resorting to sematic obfuscation — using "risk" in his speeches when he actually meant "hazard," an established toxicological concept amenable to biochemical research. Handler relied on the semantical and syntactical devices to leverage public concern regarding health risks due to technology into an argument for increased funding for biochemical research. He said the health risks of environmental pollution were greatly exaggerated but that he thought the public was open-minded enough to be educated by proper scientific authorities regarding the pertinent facts, especially the fact that there was no looming acute danger to health. He conceded there was evidence of environmental deterioration, citing excess phosphate in the rivers and lead and mercury in food as examples, but emphasized his belief the pollutants "were not an urgent threat to man."

Handler advocated governmental program to assess these and other environmental hazards by means of laboratory studies designed to elucidate biochemical processes.

Only then, he claimed, could realistic public policies regarding their management be developed without endangering the economy.

Handler cautioned that any steps by the government to protect public health might generate new problems. In managing the environment, he said, "The world has to be viewed through realistic glasses" and "we must learn to make judgments by weighing risks versus benefits." By "risks" Handler meant costs related to health impact and by "benefits" he meant the totality of what was good; he intended that both elements would be assessed subjectively in qualitative terms by scientific experts, particularly his appointees to Business-Arm ad hoc committees. When conducting the weighing process, Handler said, the experts would consider all political and economic matters and make the best possible decisions. Handler declared the result of the process would be identification of what he labelled "acceptable risks."

Handler conceded that risk-benefit analysis was non-scientific because it was based on subjective elements that were subjectively compared. He maintained, however, his method

was a rational response to the problem of coping with society's irrational concern about potential hazards arising from side-effects and pollution.
Further, according to Handler, the method provided an important task for biochemists because their expert advice about biology was needed to interpret the available data.
In the end, he said, either society accepts some pollution whose health consequences are unknown and unstudied, or the present standard of living will become unsustainable.

Handler directed the Academy's Business Arm to implement his risk-benefit ideology when furnishing advice to government agencies. His staff organized the ideology into a recipe consisting of specific ingredients that insured successive ad hoc Business-Arm committees followed common reasoning principles. The recipe included a hazard assessment to determine whether a particular agent caused a particular health effect. If more than one effect was alleged, the rules called for aborting the inquiry based on a biochemical shibboleth to the effect that each chemical could cause only one disease. The extent of likely human exposure was estimated to gauge the degree of human exposure and the likelihood that the health effect might occur.
Handler's ideological requirement that all real biological effects were linear was incorporated into the recipe by a requirement that a linear dose-response relationship be observed between the level of exposure of experimental animals to the chemical agent under study and the biochemical changes it produced. In the absence of such an observation, the inference required was that there was no real biological effect despite appearances to the contrary.

Risks were never denied; instead, they were characterized using a staff-produced verbal formula that emphasized their unlikelihood, which the committee appointees adopted in a single unanimous voice in their final report. The expected benefits to society could be described qualitatively or in terms of dollars that would be realized by a stakeholder. The terms "risk" and "hazard" were comingled so as satisfy Handler's belief that only the latter was real while simultaneously appearing to protect against what the public called health risks.

According to Handler, the government lacked the knowledge needed to set standards for regulating the quality of the environment. He said there were serious gaps in knowledge regarding the biochemical mechanisms by which agents in the environment produced harmful consequences, and he urged the government to remedy the problem by authorizing a coordinated research efforts in the laboratory and in the field so that the data needed to establish truly appropriate regulations could be obtained. "We need time to acquire an understanding upon which to base such regulations," he said, and in the interim "little if any regulatory action was needed."
Handler maintained that the need for biochemical knowledge was particularly acute in the areas of pesticides and air pollution, where the government's policies were excessive and scientifically unjustified. "Only a handful of bird species are endangered by DDT," he said, "and the available alternatives are even worse. To do without available pesticides, the price to man would be too high." Handler said the public was panicking unnecessarily about the problem of air pollution because "no heavily populated area in the U.S has acutely bad air, and the automobile exhaust emission problem can be managed within a few years, probably." "Technologies will surely be developed to manage the problems," he said, and will lead to "a better tomorrow."

Handler had a toxic effect on the culture of science. Earlier in his career, using his influence at the retail level of governmental support for scientific research, he was largely successful in his attempts to limit funding by the National Sciences Foundation and the National Science Foundation for biological research to experiments whose designs he deemed acceptable. After moving from his positions of authority at the federal granting agencies to the politically more powerful position of head of the Academy, he adversely affecting the culture at the personal level, attacking individual scientists whose thinking, speaking, or research results displeased him. Handler did not directly express his distain in focused dialog with his antagonists but rather spoke in a unilateral voice, spoke like the leader of a religion chastising wayward members of his flock. He accused his antagonists of displaying a reckless tendency to incite emotions in favor of what he called “impossible instant solutions to pollution,” and of exaggerating its health dangers and disregarding the consequences of their actions. He said pollution problems were not immediately hazards, and that the emotional overreaction stoked by scientists was the only acute danger.

Ad hominem attacks against scientists were a hallmark of Handler’s speeches and interviews throughout the early 1970s. He frequently assailed unnamed scientists publicly for what he regarded as going to excess in arousing the public about environmental issues, especially those involving the energy industry. He criticized scientists for publicizing the environmental dangers in drilling for oil in the oceans, and he attacked opponents of the use of lead in gasoline, claiming its removal would complicate the chemical processing of oil into gasoline, thereby increasing its cost.

Handler opposed environmental restrictions on the coal and electric-power industries, the effect of which he believed would seriously curtail the nation's ability to produce energy. He called scientists who disagreed with him “extreme environmentalists” and accused them of “intentionally trying to cause a shortage in the nation’s energy supply in order to provoke a crippling energy crisis.” He professed a belief the U.S. had more than enough time to allow a deliberate biochemical-based approach to the health-risk problem caused by pollution and that in the meantime, “The nation won't choke soon on its own wastes.”

Handler’s blocked Academy membership of nationally prominent scientists whose opinions displeased him. A salient example was his rejection of an integrative biologist whose candidacy was endorsed by vote of Academy members for his scientific achievement. He had speculated that the earth’s oxygen supply might be threatened by continued high use of fossil fuels — in the view of many of his contemporaries, a somber warning of a possible phenomenon that merited analysis. Handler was incensed at the publicity generated by the idea, seemingly because it had no nexus with reductive biochemical research and that he feared the idea threatened continued use of fossil fuels. In a secret Academy meeting, Handler rejected the vote of the membership, claiming the biologist had not proved his hypothesis and therefore had improperly aroused the public. Handler’s public explanation was, “It behooves a scientist to be even more sure of his facts when speaking before the public than before a scientific body”

Handler believed science alone could solve the problems of society, irrespective of human considerations like values, politics, beliefs and emotions. An advertising slogan in the 1930s, "Better things for better living through chemistry,” and the enthusiasm of a college

chemistry teacher birthed his ideology and ultimately led to a litany of extreme behaviors, especially after he became head of the Academy. Handler embraced the better-things aspect of chemistry and passively accepted the unintended consequences — the side-effects of chemicals in the internal and external human environments — as a Faustian bargain in which some people suffered so that others could enjoy the benefits of chemistry. He routinely providing the government with pro-industry policy advice regarding health and safety issues chemicals., the gist of which was that whatever harm to public health or the environment chemicals might produce, the harm was outweighed by the good the chemicals provided.

The biological damage caused by of the annually increasing number of chemicals introduced into the human environment was essentially unknown, but surely not trivial. Regulations and laws obviated most of the obvious hazards — those that instantly caused harm. However, the possibility of nonobvious hazards — conditions not readily recognizable as hazards but capable of causing serious harm to some people after a period of exposure — was almost always ignored by industry. Handler was the most active and influential advocate of his generation of doing so as a matter of public policy. His policy of ignoring health and environmental risks significantly helped legitimize the industrial practice of marketing chemicals in the absence of adequate pre-market scrutiny for safety. But his increasing inconsistent and even contradictory arguments in favor of the policy led to speculation in the science press regarding whether they evidenced expedient behavior or mental instability.

There was a serious unmet need to assess the health risks of environmental chemicals regarding their propensity to cause cancer, genetic damage and stress that could result in disease. However, according to Handler, the task of assessing health risks should not be attempted because the concept itself was too vague and, at most, the resulting knowledge would benefit only a few but would result in the loss of economic benefits to many. His level of proselytization was unprecedented for an American science-policy maven. During the early 1970s, he delivered more than two dozen major speeches, testified before the Congress almost a dozen time, and his activities were reported thousand times in the popular press. In each instance, Handler preached his ideology from the pulpit of the Academy while projecting the false impression that its members agreed with him.

In the beginning of his career at Duke University, Handler made financial arrangements with the National Institutes of Health to pay his salary to do research that he hired other to do. After he became the head of the Academy, he further evinced a dubious moral sense that had more serious implications: both he and committees he appointed were accused of unethical behavior by various sources including high-level government officials. An early instance involved the artificial sweetener cyclamate, which was added to many processed foods.

The food industry routinely added artificial chemicals to processed foods for various business, manufacturing, or cosmetic purposes, but without meaningful testing for safety. The chemicals were generally regarded as safe by the chemical industry and their opinions were accepted by the government at face value, a policy Handler strongly supported. Customers who consumed the food were almost always unaware they were also consuming non-nutritional man-made chemicals that were not tested prior to marketing as carefully as were prescription drugs. The food companies satisfied themselves that their probable benefits outweighed any known hazards, but the companies did not consider the possibility of unknown hazards — called health risks by most people but not Handler, who regarded the term as scientifically

meaningless. One limitation on the industry was a federal law that prohibited use of a food additive if “found to induce cancer in man or animal.” Based on the law, the government banned use of cyclamate in food because it caused bladder cancer in rats, and because cyclamate was proven biochemically to cause genetic alterations, a necessary step in cancer formation. Handler was on the board of directors of a company that made cyclamate and sold baby food that contained it. Speaking as the head of the Academy as well as a director of the company engaged in the commercialization of cyclamate, Handler said the evidence from the rat and biochemical studies relied upon by the government was insufficient to rationalize the ban when weighed against the financial benefit to his company and what he asserted was a medical benefit to the consumer— a hypothetical reduction in obesity.

The foundation of Handler’s position were beliefs that, in science, everything was uncertain until it was certain, the health risks of environmental chemicals were uncertain, and that the public should bear the burden of any uncertainty regarding safety until hazards were proven biochemically. Consequently, Handler argued, the ban was a mistake because there was no conclusive evidence cyclamate caused cancer in humans. Notwithstanding Handler’s advice, the general attitude in the country was that taking the risk of leaving cyclamate in foods was folly because it was quite dispensable, and the ban remained in force despite his opposition. A common presumption was that an additive should not harm as many as one person per million of its innocent users, and the estimate for cyclamate was far above that level. Handler gainsaid the use of numerical criteria for harm because they were human judgments based on dose-effect gold-standard studies, not biochemical facts. He especially objected to the suggestion that the estimated number of users per million expected to be harmed should be listed of the product label; he said the information would frighten the public and have an adverse economic impact.

Handler was criticized by his contemporaries for the dubious moral sense he evinced. The highest-ranking physician in the government charged him with “at least a possible conflict of interest" because he was a director of a drug company that made cyclamates. Handler “holds an extraordinarily important public trust,“ the physician said, because the Congress and high-level executive agencies ask the Academy for advice, and therefore he should reconsider the advisability of continuing his relationship with Squib.” The physician also questioned the propriety of the Academy’s relationship with drug companies; he said the Academy advised the government on matters related to drug policy, but that more than half of the members of its committee on drug policy had economic ties to the pharmaceutical industry. He said physicians had a code of ethics that declared serving on a board of directors of a pharmaceutical company while practicing medicine was unethical, and that those serving on Academy committees should be bound by a similar code. But Handler denied he had a real or apparent conflict-of-interest and refused to give up his seat on the board of directors. Handler also dismissed the proposal of a code of ethics for scientists serving on Academy committees as awkward and unnecessary.

As Handler progressively moved the Academy into dealing with complex societal issues, his integrity and that of the Academy came under attack more frequently on the grounds of conflict-in-interest and bias. The cyclamate issue, like those involving tobacco, thalidomide, DDT, tetraethyl lead, nuclear waste, and carcinogens in food, directly challenged the historical idea of scientists — both in general and those on the ad hoc committees Handler appointed in the Academy’s Business Arm in particular — as purely objective and no more likely to make

biased judgements than clergyman were to engage in pederasty. Handler conceded the Academy had no established procedures to protect against bias and conflict-of interest because, he said, “we never have had an incident which would have precipitated the need for such procedures.” He did not explain why the public should be confident that his judgments and those of the committees he appoints concerning health risks were unaffected by personal financial interest or opinions of right and wrong. Instead, he defended his position by asserting he was more ethical than his predecessors, claiming “I resigned from the boards of directors of three companies. I was the first Academy president to behave in this manner.”

Joshua Lederberg, a Nobel-Prize winning biochemist, expressed concern in a letter to Handler about public perception of conflict-in-interest and bias in Academy committees. He said, “the Academy is coming closer and closer to controversial questions where not only social and political decisions, but important economic interests are at stake. The recent cyclamate flap is one very obvious example.”

Lederberg told Handler the Academy's integrity might be attacked on the grounds of conflict-of-interest, and that even innocent affiliations might appear to be not so, leading to great deal of hostility toward the Academy. He asked whether the Academy had formal procedures that required disclose of conflicts-of-interest by the experts Handler appointed to advisory committees. “If not,” he said, it would be “very hard not only to deny aggressive allegations of improper conduct, but even to be entirely sure that one's judgments have been totally disconnected from questions of financial interest or close personal affiliation.” He said he recognized that disclosing financial interests or other potential interests “may be a tiresome burden,” but that “the need for such disclosures must be recognized.” Lederberg also complained he was sometimes perturbed that Academy’s name was invoked, “and therefore indirectly my own personal reputation,” to support reports from Business-Arm committees “whose conclusions are not directly responsive to the judgments of the Academy's own membership.”

In his response, Handler said the Academy had no conflict-of-interest program regarding the behavior its members or those of the Business Arm’s ad hoc committees.

He said the credibility of Academy was assured by creating committees whose members were balanced with respect to discipline and employment sector —industry, government, and universities. “Surely as long as we behave in this fashion, we are not vulnerable, and it is the balanced nature of the committees which is our protection,” Handler said and added, “Nowhere do we ask for disclosures of personal financial involvement.” Handler told Lederberg, “I am unaware that we ever have had an incident which would have precipitated the need for such disclosure. “ “Indeed, the only instance of which I am aware relates to myself,” he said, and related that after he was elected president, “I resigned from the Boards of Directors of three corporations, thereby suffering a loss of income, Handler said, and that doing so was sufficient to demonstrate he had no conflicts-of interest regarding drug companies. However, he did not resign from Squib’s board but rather praised the company while serving as guest speaker at the dedication of almost ten acres of new biochemical laboratories built by the company. He said the laboratories were a “modern cathedral, built to acquire practical knowledge through research that would lead to profitable commercial drugs.”

A year after raising the conflict-of-interest issue with Handler, Lederberg expressed concern that the Academy had not develop formal procedures for disclosing financial interests or other potential conflicts-of-interests. He wrote, “It seems to me of utmost importance that no plausible imputation of self-interest be attached to Academy-connected activities,” and he outlined a procedure whereby conflicted interests by appointees to Business-Arm committees would “be openly stated.”

He suggested a committee’s final report should “simply indicate that committee member so-and-so has reported a potential source of conflict of interest having to do with organizations such-and-such. "When an organization was vitally affected by the conclusions of the report, Lederberg suggested that members of the committee connected to the organization should describe their relationship in more detail.

He urged that creation of “a regular and well-established procedure for reciting potential conflicts in a routine way,” and added,” Much hangs on this.”

Handler, however, rejected Lederberg’s proposal, saying his board of directors had privately disclosed their financial interests to the Academy, but that he and they “feel it unnecessary to ask that all of the 7,500 individuals who serve on Business-Arm committees do likewise.”

During the following months the conflict-of-interest issue continued to fester, forcing Handle to take at least minimal steps to combat concerns regarding the integrity of the Academy’s reports, which were exceeding four hundred reports annually. Using himself as an example of proper behavior when bias issues arise, Handler said he was a director at Squib and “To pretend that I don’t have a built-in sympathy for a drug house would be false because I know of the gambles and hurdles of bringing al drug onto the market,” he said. “Because of this,” he added, “I disqualify myself whenever pharmaceutical matters come up;” he urged his appointees to follow his example, but the steps he took were trivial compared with the extent of the problem.

About twenty percent of the members Handler appointed to a of a pesticides committee were officers in pesticide-related businesses, and a similar situation occurred on a committee he created to offer advice on pollution control standards for automobiles.

In the wake of continuing criticism of the Academy advice-furnishing process, Handler took another minor remedial step and served notice he would go no farther. He required each new committee appointee to file a statement titled “On Potential Sources of Bias” that summarized biases on issues that might come before the committee. Handler said the aim was to determine if appointees might benefit financially from a committee judgment, or if long-standing positions might compromise objective judgement. But he ordered the statements held in strict secrecy and disclosed to no one except other committee members who requested to see them.

Handler’s most toxic behavior probably involved his policy on abortion. He supported a national policy of destroying prenatal babies in whom prenatal tests revealed one the hundreds of genetic diseases discovered by biochemists. He argued that the high rate of population growth, taken with modern medical methods, permitted those with genetic defects to survive long enough to procreate, resulting in what he called “a serious threat of damage to the human gene pool.” Natural selection, which historically weeded out the unfit, was thwarted by modern medical care, Handler said, but abortion provided “a modus operandi for eliminating the unfit fetus,” thereby accomplishing the same result as natural selection.” Additionally, Handler said,

elective abortion would make the physician's task of treating disease easier by eliminating the unborn who had a higher risk of poor health. Much of society, he said, now feels that "the early fetus is a nonperson, an extension of the woman involved," and that the decision to abort it should be made by the physician whom, Handler said, should recognize that "The responsibility of medicine is not merely to the individual but to the human species, and the welfare of the individual now may be less important."

A tsunami of controversy developed regarding Handler's abortion policy, the first such intense reaction to a proposed science policy in the nation's history. He had intended to showcase the importance of biochemistry in the solution of the problems of society, but the opposite occurred. Opinions about abortion came from a spectrum of fields far broader than biochemistry and included many biological and non-biological subspecialties not even remotely represented by the Academy including law, philosophy, ethics, theology, social science, medicine, journalism, and politics. The resulting discourse regarding abortion fueled creation of numerous lay organizations that advocated for and against abortion, but always in a context that involved human beliefs and values, not science, as the proper decisional domain. The historical ideological error Handler committed when he classified abortion in the wrong cognitive domain directly led to an immediate diminution of the public's perception of the Academy's credibility and that of science itself — Handler's worst nightmare.

ONE OF THE MOST VIBRANT areas of biological — as opposed to biochemical — research then in progress involved the consequences of exposure to low levels of naturally present atmospheric electromagnetic energy on living organisms — from plankton to people. All life on earth evolved in the presence of the energy, and myriad scientific and anecdotal reports appeared supporting the hypothesis that dynamic changes in the energy level were transduced by living organisms, thereby providing information about the environment that was crucial for survival. Prominent among scientists investigating the biological effects of electromatic energy active during Handler's political ascendancy was Frank Brown (see Chapter 3), whom Handler knew personally from interactions at a marine laboratory in Massachusetts, which they both visited frequently. Unfortunately for Brown, his work angered reductive biochemists, especially J Woodland Hastings, who studied the rhythmic changes in physiological activity that occurred in plankton. Hastings sole research interest was identification of the biochemical nature of the enzymes in plankton that activated the genes which coded for the enzymes that produced the rhythmic changes. He was a preeminent Handlerian reductionist, fully subscribed to the orthodox bias of biochemistry that, with very narrow exceptions, living organisms were fully understandable based on chemical energy alone — he allowed no meaningful role for electromagnetic energy.

Hastings disbelieved environmental electromagnetic factors — other than light —had a role in rhythmic physiological changes that occur in living organisms.

Brown hypothesized the opposite was true and published the results of many experiments that supported his hypothesis. He was content for the biochemists to conduct their pointillist biochemical studies — which were guaranteed to be successful in the sense of identifying the responsible enzymes and their genes because biological activity is impossible without them. What he cared about was the process that controlled the biochemical activity, how it repeatedly waxed and waned for precisely fixed period that could be changed by moving

the animals from place to place. Simply for studying the question, Hastings considered Brown as an outcast from science, as if wearing a scarlet A. Hastings could not see that Brown's research proved the existence of a previously unrecognized animal sensory system for detecting low-level environmental electromagnetic energy — one of the seminal biological discoveries of the last half of the twentieth century. Like Handler, Hastings was deeply prejudiced against the idea biochemistry alone was insufficient to explain life, believing one day it would be created in a bottle by mixing biochemicals.

Handler routinely subverted the processes of scientific research by limiting funding support to the ideology he favored. When he controlled the National Science Foundation, he supported biochemical research on biological rhythms but blocked funding for Brown, an outcome that was predictable after Handler secured the appointment of Hastings to the advisory committee at the Foundation that had jurisdiction over proposed research on biological clocks. Handler also assisted Hastings in insolating Brown from interactions with other Investigators. He authorized the Business Arm to seek financial support from federal agencies for an international symposium on biological clocks, and appointed Hastings to the committee that invited the participating experts. Hastings invited all the well-known researchers except Brown, and Handler published the results of the symposium under the aegis of the Academy, which effectively marginalized Brown. Working through Hastings, Handler undermined and demeaned Brown. In the process, Handler blunted a serious evidence-based threat to his dicta that electromagnetic energy had no meaningful role in explaining how living systems functioned.

Handler's experience with the biological effects of electromagnetic energy involved only exceedingly high, inherently hazardous energy levels and occurred
in the context of his relationship with the Atomic Energy Commission. The Commission funded Handler's earliest research and hired him as consultant to train physicians on the use of radioactive atoms — those that spontaneously emitted electromagnetic energy — for diagnosing disease, and it sent him to Japan to study the health consequences of exposure to the electromagnetic energy released by atomic bombs.
Two decades later, the safety issues of medical radiochemicals, and that of nuclear reactors, then under development for generating electricity, were being considered by the government, and the Commission had vital interests to protect in both areas.
Handler was asked to appoint an Academy committee to evaluate the validity of the Commission's proposed safe-exposure levels for industry workers, radiologists, and the general public to the electromagnetic energy. Handler appointed only experts who were on record as favoring the Commission's proposed safety levels, which were significantly biased toward favoring industrial development. He said the experts who criticized the recommended safety levels were irresponsible for claiming they could ultimately result annually in thirty-two thousand extra cancer deaths and up to one and a half million extra deaths caused by genetic defects, and for asserting that the proposed safety levels were designed primarily to protect the interests of the Commission, the Defense Department, and the two companies that manufactured nuclear power generating equipment.

A senator from Alaska, wrote Handler and objected to the composition of the committee because it contained only experts who worked for the Commission or were

receiving research grants from it, and were on record as favoring the Commission's position. Since only experts on one side were appointed, he expressed the fear that nothing worthwhile could emerge from the committee. Handler replied but ignored the two considerations that most disturbed the senator: why only the experts who were on record as supporting the Commission were appointed while those who objected to its opposed it were not appointed; why only technical experts were appointed considering that the basic question involved questions of values. The senator wrote again, asking why Handler had appointed an engineer to chair the committee who had four current research contracts with the Commission and had publicly stated that the Commission's standards were reliable and scientifically justified. He said, "life-and-death matters" were involved in the committee's review, and that it should be conducted openly by those "with no nuclear-industry axe to grind."

Handler acknowledged that everyone on his committee had publicly defended the Commission's standards but claimed the inherent honesty of scientists was a defense against charges of apparent conflict-of-interest of committee members. He said, "there is no room in science for dishonesty, for shading of meaning, for distortion of truth," and that "There is no Commission science, there is only science itself." Handler said the senator's assertion that Committee members might abuse science because of their Commission affiliation was not only unconscionable but also inconceivable. Handler concluded: "No better committee could be assembled. If their motives are impugned, even as they commence work, for which they receive no compensation, they would be justified in resigning. And that would leave us without rational guidance, without a voice of measured, objective reason."

In his reply, the senator addressed Handler's tone of umbridge and said, "Financial and psychological conflicts of interest are so commonly acknowledged as part of human nature that we have rather tight codes for public servants generally and especially for senior officials. Surely scientists are human in this respect as in others."

In the eyes of the senator, it made no sense for Handler to ask a committee of experts who devoted their lives to promoting medical, military, and peaceful uses of atomic energy for an objective analysis of its safety because it was human nature for such experts to have either a psychological or monetary bias — or both.

Handle eventually wound up with another of his Pyrrhic victories. His committee remained substantially unchanged, and he continued to assert it was unbiased and exercised independent judgment. He refused to allow the public to observe its deliberations because, he said, the public had no role in a scientific inquiry, and its presence would only hinder the process. Reasoning similarly, he also blocked public involvement in the decision-making process; he had the power to do because he answered to no one and had the Academy's aegis in his lockbox.

In the end, the committee sided with the Commission on the safety rules. But the credibility of the Academy, and of Handler personally, took a beating. In the wake of the controversy, a historical change occurred in the relationship between science and society—-not prominent but existent and ready to grow. Specifically, even if Handler's appointees, who mirrored his ideology, had no bias, for two reasons, they would still have been unqualified to decide the allowable exposure levels to electromagnetic energy; the appointees lacked special expertise regarding human values, and they were not chosen by the public or its representatives to speak for society.

Handler's choices reflected blindness to the reality risk-benefit decisions were not scientific problems but rather political issues that had to be subjected to the struggles of the political process — the proper manner for determining what benefits the public wants and what risks is it willing to assume. Instead, Handler effectively designed the committee to tell the public: "You are going to have to assume these risks in order to have the benefits I say you want." In Handler's vision of a scientific nirvana, the public acquiesced to the naked opinion of scientific experts, as decided from behind closed doors and delivered in one voice, what risks were acceptable to society.

The committee's decision regarding the Commission's proposed safety rules was an outstanding example of decision-making in his nirvana, where complex societal problems involving science were properly resolved by scientists because they alone were capable of discerning objective knowledge. Handler rejected the principles that value judgements should be based on the entire range of societal knowledge —sociologists, lawyers, theologians, economists, psychiatrists, psychologists, political scientists, and other focused human endeavors — and that the judgements ought to be verbalized by a representative group accountable to the public. What emerged in the wake of the controversy regarding the safety rules for electromagnetic energy was the dawning realization that Handler and the Academy were irrelevant.

For almost a decade, the U.S. Navy worked to develop an antenna capable of communicating with submerged submarines even after ordinary radio transmissions became impossible because of atmospheric disturbances resulting from a nuclear attack. The final design called for an antenna, named Sanguine, that would operate at an electromagnetic frequency similar to powerlines and consist of a grid of buried wires that extended over about thirty-two percent of the land area of the state of Wisconsin. During the time the Navy conceptualized and finalized designing the antenna , *Silent Spring* was published, the environmental movement began, the first biological studies suggesting that man-made environmental electromagnetic energy could alter animal and human behavior were published, the National Environmental Policy Act became law, an extensive system of federal rules were developed to protect the public from health risks arising from many man-made environmental agents, and Philip Handler became head of the National Academy of Science.

The Navy held numerous local meetings throughout Wisconsin where its spokesmen informed the residents of the antenna's size and tried to convince them it was a technical achievement and a military necessity. The residents were told no adverse environmental effects would occur and that the antenna would be completely safe, just like the powerlines of all sorts and sizes that crisscrossed the nation. The spokesmen quoted the opinion of the Navy's main expert on the safety of electromagnetic energy, Herman Schwan, who said there was no mechanism known to physicists by which the antenna's electromagnetic energy could harm people or animals.

The successful unopposed usurpation of a biological problem by a physicist was a continuation the historical error that began two decades earlier. The Navy had interviewed Schwan in Germany after Second World War, sponsored him for U.S. citizenship, and employed him to continue his research on diathermy for the purpose of setting safety levels for radar and other electromagnetic transmissions. The Navy adopted safety rules that were based on

Schwan's opinion. However, the Navy could no longer rely solely on Schwan's opinion because a new federal law required evaluation of the environmental impact of the planned construction of the antenna, including scientific evidence of safety. In response, the Navy began funding gold-standard studies by university biologists and private companies of the effects of simulated Sanguine electromagnetic energy on animals.

Despite the Navy's efforts to assuage health concerns, its promises the antenna would be an economic boom, and its emphasize on the importance of Sanguine for national defense, the Sanguine project was vigorously opposed by the governor and most of the state's congressional delegation. After separate reports by two university engineers questioned whether the proposed antenna would function as intended, both Wisconsin senators assailed the project in Congress as a "a potential billion-dollar boondoggle." In response, the Navy contracted with Handler to form a committee in the Academy's Business Arm to assess whether the university engineers or the Navy's experts were correct about whether the antenna would actually function as intended. Handler appointed seven engineers to the committee, all of whom were economically bonded to the Navy, none more so than its chairman, whose research on Sanguine-type electromagnetic energy had been heavily funded by the Navy for many years, and whose opinions regarding whether the antenna would function properly were exceedingly clear.

During the committee's deliberations, a committee member who objected to the chairman's opinions resigned in protest and wrote a report that concluded the antenna would not work. The other committee members, however, decided that despite the opinions of its resigned member and the two university engineers, "the Sanguine system contemplated by the Navy would work substantially as they anticipate." As Handler obviously intended when he appointed the chairman to be the judge of his own work, the Navy got what it wanted — a report published under the "aegis" of the Academy which supported the Navy's position.

Soon after Handler released the committee report, the Navy published its environmental impact statement, and the potential environmental and health risks produced by the antenna's electromagnetic energy became serious issues in Wisconsin.
The environmental impact statement — published while the gold-standard studies designed to provide scientific evidence of safety were in progress — was a large rambling document written in technical jargon that ignored what was "possible," the condition that gives rise to health risks, and concluded that "there would be no probable environmental impact." The Navy did not consider public-health or environmental risks, the existence of which could reasonably be inferred from the initial results of its ongoing gold-standard studies, some of which had already been published in scientific journals.

A strong negative reaction ensued. Wisconsin state and federal representatives asserted they were concerned not only with what was probable but also with what was possible. The impact statement was also criticized by the governor's review panel, which concluded that it contained "shallow investigations, factual errors, inadequate data, poor review of the scientific literature, scientifically meaningless statements, unscientific reasoning, and invalid conclusions." The panel's opinion further stoked public opposition to Sanguine and led to an order by the Secretary of Defense — who was from Wisconsin — that the Navy look elsewhere for a site for the antenna. The Navy then proposed to locate it in Texas, near President

Johnson's ranch, but that attempt was also blocked politically, forcing the Navy to choose a site in a state forest in Michigan.

Public-relations difficulties for the Navy quickly developed in Michigan, and the Navy again contracted with Handler to appoint another Business Arm committee, this time to address the rising public concern about the biological effects that could be caused by the electromagnetic energy produced by the Sanguine antenna. Handler negotiated what amounted to a rigged contractual purpose — determination of whether the results of the Navy's gold-standard studies, or any other published research results, had yielded "clear evidence of a harmful human effect;" "clear" was undefined and there were no human studies, so there was only one possible answer.

Handler further insured that the committee would reach the conclusion he desired, with no dissenters, by rigging it composition; his appointees were Herman Schwan, a veterinarian who worked closely with him, a career Navy officer, an Admiral, and a former Naval officer. The committee's final report, published under the aegis of the Academy, not only guaranteed the safety of the Sanguine antenna, it also emphasized the propriety of all Navy hygienic practices regarding exposure of service personnel to all sources of man-made electromagnetic energy. Handler frequently boasted he always chose committee members based on their objectivity and special expertise for providing scientific advice. But he knew or should have known of the zealotry and conflict-of-interest of his appointees to both Sanguine committees.

Handler's constitutive bias against the possibility that electromagnetic energy had any possible biological significance, together with his extreme reductive view of biology, engendered his long-standing affection for Schwan's apocrypha regarding the biological consequences of man-made environmental electromagnetic energy (see Chapters 2 ad 5). Handler conceptualized human and animal life strictly as the product of a DNA program. A consummate ideologue, Handler believed genes explained the uniqueness, order, stability, and reactions of individuals to the entire range of somatic and psychological stimuli. He explicitly denied what some of his contemporizes believed, that the immense heterogeneity of the individuals in every species could only be explained by the existence of regulatory systems that governed DNA biochemistry but were themselves not made of biochemicals but rather electromagnetic energy.

Although Handler's *Principles of Biochemistry* textbook applied to humans, his principles alone were inherently unable to account for myriad biological phenomena.

Electromagnetic energy was also required but Handler was adamant, and that was a hill he was prepared to die on.

In physics, a specialty Handler knew almost nothing about, the situation was diametrically opposite — its domain was vastly less complicated than that of life, and its laws could account for all observed behaviors of nonliving matter. The inanimate world was inherently deductive but the same could not be said of the living world.

Each nonliving object was assumed to be a copy of many identical objects — each sphere of copper, for example, was identical to all spheres of copper regarding how it reacted to heat, electromagnetic energy, mechanical forces, and chemical treatment.

Schwan took a step previously taken by only the most arrogant physicists in history —he claimed the laws of physics, as he interpreted them, not only applied to biology, they explained it. While employed by the Navy, Schwan modeled a human as a sphere of copper and

concluded that, according to physics, microwave-frequency electromagnetic energy was completely safe for constant exposure of Navy personnel. When called on by the Navy to evaluate the safety of powerline-frequency electromagnetic energy produced by Sanguine, Schwan used the same approach and reached the same conclusion of complete safety. Notwithstanding that biology deals with classes of heterogeneous living entities whereas physics deals with classes of homogeneous non-living objects, Handler embraced Schwan's conclusion about the health risks of Sanguine.

THROUGHOUT HIS CAREER, HANDLER proselytized about science, mostly biochemistry, using a verbose aggressive rhetorical style that among scientists, especially those who spoke primarily for public and congressional consumption. With a persistent certainty, he predicted that universal application of the scientific method would lead to progress in all of the matters that concerned humanity. According to Handler, social, political, and moral problems would be solved if approached in an enquiring and experimental spirit with a respect for deductive rules of thinking. However, the scientific utopia he promised didn't grow nearer but rather became impossibly remote. Despite an unremitting flow of cliches and fables about the power of science to bring about a better world, none of the policies he advocated led to identifiable progress or something good that was substantial or lasting. He said science was the vital center of cultural change, and that university students who studied science could gain understanding of the changes and insight into how they should be directed, but his assertions were only beliefs and opinions, not evidence-based, reasoned conclusions.

Handler offered condescending recognition that the humanities could contribute to understanding the breadth of contemporary problems and help in identifying solutions, but forcefully insisted that scientific knowledge was the primary weapon for solving the problems. He insisted that science, exclusively, was as the basis of a proper liberal education and the most powerful method invented by humanity for find truth about the world.

Handler's bluster did not lead toward progress in establishing a high position of respect in society for the importance of science. Contrarywise, he set society on a path in the opposite direction, a situation he recognized as it began to occur and tried to oppose, but with nil chance of success, like King Canute opposing the tide. Handler's quasi-religious attempt to promote scientism stemmed from his misplaced faith in basic research — the search for something fundamental — which he exalted far above practical knowledge. Science became his religion but basic research, its prayer, was unrequited by society.

Handler tried to popularize biochemists as a new type of national hero, and frequently pointed to research he had done almost two decades earlier. Despite his self-perception, he was not a doppelganger of Aerosmith's Gottlieb. He conceived of science as knowledge obtained in verifiable controlled experiments by researchers competent in physics and mathematics; "how can you expect to make progress if you do not know them," Gottlieb asked. Even if Handler had performed such experiments and developed such competencies, he was guilty of the egregious error Gottlieb made — a belief that living organisms were governed strictly by the chemical law of mass action.

During Handler's two decades in power, as respect and demand for technology soared, admiration, reverence, and acceptance of a need for science decreased precipitously.

The combination of inherently defective ideology and lack of technical knowledge and a large measure of hubris led Handler, over a period of two decades, to create a toxic culture in research in the United States. From the most politically influential positions in American science, he ignored, downplayed, and where necessary to achieve his objectives, opposed scientific initiatives that conflicted with his ideology, harassing and punishing those who disagreed with his policies. He believed biochemical research could burn through biological appearances to the actual truth of living systems. But lacking a background in physics and mathematics, he was constrained to understand biology only in terms of ruthlessly reductive version of biochemistry. His ideology was intrinsically insufficient to understand the complexity of living organisms because his principles of biochemistry were too narrow for that purpose. Some of Handler's contemporaries stood at the fountainhead of new paths for biology, approaches that emphasized the process of control of living organisms rather than mechanistic understanding of their nature as was Handler's exclusive focus. The new breed of scientists believed living organisms could be understood and manipulated without necessarily constructing fanciful mechanical models that could never be directly observed or proved. Handler, however, regarded their efforts as heresy against the true faith, and used his positions of power and influence to thwart their efforts. He succeeded in restricting governmental funding to pedestrian pointillist research that even he agreed was mostly valueless.

Scientists more modern than he sought to understand living systems by treating them as a black box from which all manner of behaviors could be coaxed by environmental factors. But they were systematically denied government research support as a direct consequence of Handler's actions. They would have relied on cause-effect studies to find answers to truly important questions like what causes cancer, what regulates growth and healing, how does memory work. But Handler regarded the questions s unscientific because they were unanswerable in strict biochemical terms

Handler's mirage was government funding of an army of biochemists who studied esoteric biochemical details in a search for hypnotical mechanisms in a process that scrupulously avoided consideration of causes. In some mysterious way at some indefinite point in the future, solutions to society's problems would emerge from the collective results of his army and be recognized immediately for what they were.

Handler was largely responsible for the financial isolation of many scientists, who were systematically rebuffed by advisory panels Handler bred to demand an exclusive focus on the search for biochemicals explanations of all biological phenomena. The threatened scientists who refused to retreat from performing societally beneficial biomedical research could follow two paths: seek a grant for promised biochemical research but, if awarded, use the funds for non-reductive experiments; seek a grant from a source other than the National Institutes of Health or the National Science Foundation. I survived by following both paths.

In the fall of 1971, at a European international symposium, Handler extolled his grandiloquent vision of biochemical research before a distinguished audience of scientists, physicians, sociologists, philosophers, and theologians. The published proceedings documented that, for the first time in his career, Handler met strident opposition to his policies about science from equally powerful voices in the scientific and intellectual communities, who revealed him as an Emperor with no clothes.

“There can be no more noble endeavor than the research enterprise,” Handler intoned, and “no better investment.” The biochemists responded with applause, but most of the audience sat on their hands. Increased biomedical research was crucially important, Handler continued, because "humanity is at a hinge of history." He indicated he meant recent advances in the biochemistry of genetics had created a novel and critically important situation which required immediate increases in funding for biochemical research “to prevent mankind from becoming a blind alley in evolution.”

Biochemists needed to learn how to remove defective genes, Handler explained, because clinical medicine was permitting those with genetic defects to survive long enough to reproduce, thereby thwarting the evolutionary principle of survival of the fittest. Handler was rebuffed by non-biochemists, who argued that the remaking of mankind was an impossible and inappropriate framework for biochemical research.

He was also confronted with suggestions that the most fruitful area of genetic research was not heritable defects but rather the genetic defects caused by man-made environmental chemicals in food and in polluted in air and water that resulted in death due to cancer or other diseases. Handler vigorously rejected the suggestions as too speculative.

The chief scientific adviser to the British government contradicted Handler, “I don't believe for one second that this is a hinge of history,” he said. Disagreement that stemmed from the stark difference between his pragmatism and Handler’s ideology continued throughout the symposium. Handler repeated his financial demands for increased biochemical research, but the science advisor expressed the opposite point of view — there should be less basic biochemical research, he said, with some of the present funds directed to meet more urgent needs. “I am one of those who believe that one should beam research funds at certain fields in relation to need," he said

Handler’s oblique response was that basic research was very expensive and wouldn’t exist if it weren’t funded by taxpayer; again, his position met favor only with the biochemists.

Strong disagreement developed regarding who should decide what research was done by biochemists. Handler maintained that biochemical advisory panels ought to be the judges, not the government, which he said always made political judgements based on perception of urgent needs. He reproached the government for doing because, he said, advances in basic biochemical knowledge occur by chance rather than design.

According to Handler, the intellectual curiosity of brilliant researchers is what leads to significant scientific advances; attempts by the government to direct their efforts, therefore, would be misplaced and unproductive. He advocated funding biochemists to perform the research they desired, even though conceding most would produce useless results and only one or two researchers would do Nobel-prize level research.

Several professors of theology argued that the desire for knowledge must be subjected to certain limitations because it was impossible for a researcher to have a proper grasp of the overall situation. The real problem, they argued, was to establish a set of ethical principles by which to judge biomedical progress; biochemists alone, they said, were unqualified to formulate the principles. The right to do so, they argued, belonged to a more diverse group of experts, scholars, and laymen. Handler’s responded that biochemists had a peer-review system, but others countered that sociologists and other humanists who studied the views of the public should have an important part in deciding which research was supported by government.

Handler was told that biochemists were elites concerned only with their own interests, and that they ignored the accurate predictions of sociologists that a public backlash against biochemists would occur for spending public money for their private purposes. The gist of the argument against relying exclusively on biochemical advisory panels was that the members of review panel should have a wider view of science than just their own specialty; the panels that chose what research was done should include people who had a sophisticated view about resources and societal needs. The British science advisor's comments were blunter; he attacked the reliability of Handler's peer-review system on the basis that it was tainted by the frequency with which personal influence determined what research was funded. Much to Handler's voiced displeasure, the science advisor also commented that biochemists had no political franchise; if they wished to be the people who determined the ends sought by research, he said they must enter directly into the political arena — the antithesis of Handler's conception of biochemistry as a great edifice of knowledge. Handler obliquely replied that biochemical research had opened many possibilities for physicians. The science advisor responded, "Whilst science opens enormous avenues for the future, at the same time it is closing other options," and added that biochemical research had "contributed little to medicine nor is likely to," and that perhaps it was time to "begin diverting funds to fields which represent clearly defined needs."

Handler was told that the days when scientists had no need to communicate with anyone but their peers were gone. He responded by placing the burden of communication on laymen, opining that they must try to learn the language of science, which he said was objective and valueless. But the humanists at the meeting continued to talk in their own value-laden language, which frustrated Handler. A theologian suggested that the failure of scientists to communicate with the public accounted for the public's deep-seated distrust of science, because the information void fostered fears that their values were under attack. Handler denied that scientists were manipulating the public but was met by the assertion that they felt they were being manipulated, which was even worse.

Handler was assailed in the symposium from all directions. It was the first time in his public career that he was challenged in an open forum and required to defend his opinions, and he fared poorly. His interactions with the other participants revealed the disharmony between his ideology and ordinary human values. Handler continued to see science as a truth-oriented discipline while, in reality, it had become a value-oriented discipline, like politics.

After Handler acquired control of the aegis of of the Academy, he manifested an ideology and personal shortcomings that ranged from unattractive to repulsive that cumulatively had toxic consequences on the institution of science and its role in society. He spoke in an authoritarian manner concerning the nation's science policies even though his electorate consisted of only a fraction of the members of a small undemocratic organization. He believed government had an obligation to educate more biochemists and financially support whatever research they chose to perform. He regarded scientists who disagreed with him or his policies as traitors to science and acted vengefully against them, criticizing them publicly under conditions that did not permit a defense or reply, and sometimes destroying their careers. He used his influence to inhibit development of lines of biomedical research that were not part of the research cannon he approved. He favored the economic welfare of industrial polluters over

the health concerns of the public and offered no real solutions to the problems of health risks or environmental degradation due to technological development. He had a persistent conflict-of-interest regarding drug companies, serving as a paid corporate office while advising the government on matters of drug policy. He was ideologically committed to creation of a society in which important national decisions were made by scientists based on their perception of facts rather than by elected representatives based on politically determined national values.

In the beginning of is public career, Handler was respected by prominent leaders in the Congress and the Executive Department, who saw him as an appropriate successor to the post-war physicists as the leader of American science. Newly emergent biomedicine had become the focus of public interest, eclipsing atomic physics, and Handler had already established biochemistry as the science of biomedicine. The chairmen of the House and Senate budget committees were enthralled by Handler's oratory and history as a professor of biochemistry. The committees routinely approved the budget requests Handler made on behalf of the Institutes and the Foundation for scientific education and research — sometimes even awarding more than he requested. Three successive Presidents appointed Handler one of their science advisors.

However, as Handler spoke on the national stage with increasing frequency, he alienated politicians and much of the public because his policies seemed invariably to champion the interests of science over societal values. His policy choices and the decrease in popularity of science combined to marginalize his role as a national science-policy maven. Congressmen less disposed to accept his ideas or approve his spending requests replaced retired budget committee chairmen whom Handler has impressed. Presidents Johnson and Nixon repeatedly emasculated Handler, not by directly confronting him regarding the policies he advocated but rather by treating him like a querulous child.

The government begin spending lavishly for technology development in matters of national defense, like the anti-ballistic missile system, and for enhancement of national prestige, like manned spaceflight to the moon. Funding for humanistic studies in political economy, sociology, science history, and political science also fared well.
However, Handler's requests for more money to support biochemical research were treated poorly — better than his efforts to secure funding for research in physics, but still far below what he regarded as essential.)

One of the major social occurrences in Handler's time was the government's decision to rely on gold-standard studies and other scientific methods as the basis of regulations for protecting the health of the public from untoward consequences of technological development. Handler resolutely opposed the government's efforts on ideological grounds, but with nil success. After ultimately recognizing his inability to directly thwart the government's policy, Handler initiated a more a circuitous plan to undercut it. He encouraged industry to lobby the government in opposition to reliance on gold-standard studies, and to sponsor a contrary form of non-biochemical science designed to contradict the results of government studies.

Handler's actions were a material factor in the birth of contrary science. For the first time in the history of science, scientists, some at private research-for-hire companies, others at universities, were paid to design and publish results of experiments to produce evidence that supported the interests of their clients, as opposed to the traditional purpose of experimentation, which was production of valid and reliable information. Contrary science

produced information that was neither valid or reliable, but that on its face supported industry ideas and arguments regarding product safety, and contradicted the implications that formed the basis of governmental safety regulations. After the invention of contrary science, the Handler's universal notion of science as a disinterested search for truth became extinct, like the dodo bird.

Newly created research companies began providing information for industry-oriented political agendas. Industry's attack against science rapidly brought about its politicization, which in Handler's ideology was the worst possible thing that could happen, but he was unable to blunt its occurrence. Even worse from Handler's perspective, President Nixon sent clear signals that science wasn't an independent objective institution with a separate existence, but rather a dependent subjective niche in politics, and that he would conduit the affairs of his administration accordingly.

A battle had developed between President Nixon's political and science advisors regarding whether the nation should build a supersonic transport airplane, with the former in favor and the latter opposed to developing the technology. When the political decision to proceed with the project was made, the science advisors — in principle, independent objective scientific experts — revealed their opinions to the Congress and strongly criticized the case put forward by the political advisors. Almost overnight, the science advisors were reviled within the Administration and terminated for disloyalty. The vignette revealed the political impossibility of science advisors to provide advice based solely of their scientific judgement and independent of the political aspects of the issue. The result was logically entailed by the development of contrary science — if scientific evidence could be manufactured to serve industrial interests, it could also be ignored to support political interests.

When Handler supported manufacturing scientific evidence, however unintentionally, he birthed the process that would inexorably lead to the destruction of his illusion of science as an edifice of certain knowledge. If equally educated science experts, employed or not employed by industry, can reach diametrically conclusions — the state of affairs birthed by Handler's encouragement of the development of contrary science — there cannot be an edifice nor an expert whose opinion about science can be taken at face value, which was exactly the principle Handler had championed throughout his career. Moreover, if industry could create its own science, the way was clear for any economic, religious, or political interest group to generate its own scientific expertise. Under Handler's leadership, science commenced dying slowly, like a patient with incurable cancer, and was replaced in public esteem by technology