Chapter 14: Consequences of Biochemical Dogma 1969-1975[1]

HANDLER'S RISE TO POWER WAS shaped by his early belief that life could be entirely explained by biochemistry, and he aimed to solidify science, especially biochemistry, as a societal cornerstone. Driven by a reductionist ideology, he disregarded the methods of system-level biology and denied the importance of electromagnetic biophenomena, even when such perspectives could have illuminated fundamental biomedical questions. His formative belief that life was a biochemical machine led him to aggressively redirect federal research funding exclusively toward molecular biochemistry, blocking research on integrative or emergent biophenomena, whose understanding required recognition of a role for electromagnetic energy. After becoming the head of the National Academy of Sciences, nation's most prestigious scientific institution, Handler used the platform to achieve his ideological goals — centralized control of national science policy and recognition of science as a pillar of society. He appointed loyalists to Academy committees that produced one-voice reports, and used his influence over federal spending for biomedical research to crush scientific perspectives he opposed.

While heading the Academy, , Handler functioned as the chairman of the board of directors of the National Science Foundation, the nation's only agency specifically tasked to fund basic scientific research. He also served as one of only a few scientific advisors to the President, and frequently testified before congressional committees that set the budgets for biomedical research. Except when incapacitated by a flair-up of one of his medical problems, Handler worked diligently to establish science as an independent institution within government that functioned like the Academy but with an annual budget required by law. In pursuing his ambition, Handler displayed an authoritarian leadership style, showing his central belief that biochemistry was the only legitimate biomedical science.

Handler strengthened the Academy's business arm to facilitate an increased number of advice-providing contracts with government clients. The net income, discretionary funds controlled solely by Handler, allowed him to create the bureaucratic machinery he needed to produce advisory reports regarding issues he decided should be addressed — novel behavior for a head of the Academy. Handler annually appointed of an average of ten volunteer experts to each of about five hundred advice-providing Academy committees, some formed pursuant to contracts and other appointed at his own volition. In his committee management scheme, Handler said the Academy was a private institution whose "advice is rendered by the institution rather than by a committee." The device of institutional authorship, which he called "aegis," allowed him to create a novel tripartite form of scientific writing consisting of the institution, which was legally responsible for the advice provided, the Academy staff, which did the actual wordsmithing of the reports, and the committee members, whom he said were "responsible" for the scientific reliability of the report.

Handler argued he had the right to require strict secrecy for committee deliberations, edit all committee reports, and "comment upon a report while transmitting it."

[1] This is a preprint of a manuscript that will undergo proof-reading and copy-editing prior to publication.

The upshot of Handler's management scheme was always a report of an Academy committee that strictly conformed to his opinion in all instances where he had one.

There was, however, no one who could be held to account for perceived errors of commission or omission, absence of expertise or relevant experience , or for bias, which was a frequently leveled charge.

Motivated by his scientistic ideology, Handler aimed to solidify science, especially biochemistry, as a societal cornerstone. Earlier in his career, through key positions he held at the National Institutes of Health and the National Science Foundation, Handler propounded and implemented funding policies that systematically favored biochemical approaches to biomedical research, and sidelined other perspectives, especially integrative and system-level research. Having done to biomedical research in the United States what Lysenko did to agriculture research in the Soviet Union, Handler concentrated on securing a sufficient level of reliable annual federal appropriations for basic research, which never appeared in quantities that satisfied Handler. But his desire to shape national science policy tightly around his beliefs became jeopardized by increasingly negative public attitudes about science.
Fundamental changes occurring in American society, particularly regarding health and environmental risks linked to technology, increasingly, interfered with Handler's plans and ideas. Handler's rigid, pro-science rhetoric met substantial backlash; the role of science in society was increasingly undermined as technology's unintended consequences sparked public and political disillusionment.

Handler's initial reaction to the sustained national attention gained by the problems of health risks and environmental degradation was to castigate scientists who pointed to the problems, which he dismissed as nothing more than emotional reactions. He preached that more technology and biochemical research would yield knowledge that solved any actual biomedical problems. But his untrue assertion created confusion and delayed rational discourse regarding experimental approaches that had a realistic chance of resolving the problems. As they continued to multiply, the prestige of science, scientists, and the Academy declined in the eyes of the public and the Congress. It was as if Handler was like Hans Christian Andersen's *Emperor*, who believed he was wearing magnificent clothes when he was actually parading around naked.

Handler believed science was based on objective reasoning and proven methodology, and should have a primary role in governance because of its intrinsic value as the engine for the intellectual, economic, and cultural progress of society. He regarded science as the "intellectual structure of our time" and believed the government had a moral responsibility to fund the efforts of scientists at an appropriate level. Because he viewed scientists as morally and intellectually superior, Handler did not value the diverse and equal-standing viewpoints that characterize democratic governance. Handler sought to impress on the public and policymakers the necessity of supporting basic research so that science could continue to serve as the parent of technological and societal development. Essentially consumed by scientism and reductionist orthodoxy, Handler presented himself as the Pope of science, a posture that precipitated a cultural clash with President Nixon.

Handler viewed his scientistic ideology as the rational basis for national decision-making, and surrounded himself with physicists and engineers, evoking the Cold War narrative of scientific triumph that commenced with the atomic bomb and Sputnik. His overconfidence and uninvited advice to the Nixon Administration alienated the pragmatic and politically minded President, who repeatedly rejected Handler's calls for more biochemical research; instead, the Nixon sought managerial, business-centered approaches to science and health risk. Handler's policies clashed with President Nixon's pragmatic approach, which regarded science as a tool for producing technological benefits as distinguished from producing knowledge for its own sake.

In his role as a presidential science advisor, Handler advanced policies opposing those of the Nixon Administration; as head of the Academy he undercut presidential decisions and programs. Handler's use of the Academy and his White House position to consolidate scientism was viewed by Nixon as insubordination. He considered Handler's influence as a political problem, and their increasingly contentious relationship culminated in Nixon's dismantling of the White House science advisory office, which included Handler, and assigned the science advisory function to lower level executive agencies. Nixon's decision underscored his rejection of a permanent role for science in
government that Handler envisioned.

In response to Nixon's actions, Handler appointed an Academy committee —which mirrored his ideology — that issued a report recommending a law to create an independent science office in the White House that had its own budget and did not answer to the President. The report, which enshrined scientific principles as a superior guiding force in government policy, was ignored by Nixon and received nil support outside the biochemical culture. Handler's ideas were seen as undermining the principles of democratic governance, which prioritize political decision-making over the expert advice of unelected scientists. In a second desperate attempt to establish to reinstate science as a privileged voice in policymaking, insulated from democratic checks and balances, Handler lobbied the Ford administration, and similarly failed. Ford saw Handler as failing to recognize the necessity of integrating science advice with advice from other fields, acting primarily in the clientele interests of science and scientists rather than the public, and emphasizing science and technology as ends in themselves rather than as means for achieving national objectives.

Handler's overreach in trying to influence science policy and increase funding for basic research progressively led to his marginalization. The demotion of the science advisory functions signified the repudiation of Handler's vision of a privileged leadership role for scientists in government. The rejection of the recommendation in the Academy report affirmed the principle that, in a democracy, political decision-making must take precedence over the opinions of scientific elites. Handler's dream of institutionalizing science as a permanent, independent establishment in American governance was thwarted, marking a clear boundary between the roles of science and politics in the United States. Handler's efforts were increasingly viewed as authoritarian, elitist, and ethically compromised, and he failed because government chose pluralistic inputs and policies driven by societal needs, not academic ideology.

HANDLER RESENTED WHAT HE saw as unwarranted concern about health risks from exposure to anthropogenic chemicals in air, water, and food, which he attributed to

inflammatory media stories stoked by maverick scientists who aroused unfounded fears. He claimed the only conclusive evidence of health effects stemmed from the misuse of chemicals, and rejected the possibility that harm could reasonably be suspected on the basis of animals studies, epidemiological reports, contributory models of disease, or other experimental methods that did not confine biomedical knowledge to what could be learned from studying molecules in a beaker. The idea that biomedical knowledge that was less than certain could be sufficient to warrant government efforts to protect the public, or at least warn of the possibility of danger, was foreign to his training, contrary to his norm of scientific authority, and a threat to his view of progress.

Handler's ideology predisposed him toward a laissez faire attitude regarding determinations of the safety of exposure to industrially-produced chemicals, and food additives were no exception. His approach to the regulation of food additives privileged biochemical mechanisms of acute toxicity while ignoring chronic disease pathways, and it blinded regulators to the impact of additives on chronic disease, the very phenomena most relevant to public health. In a stepwise fashion over a period of several years, Handler recast his definition of safety from a biomedical issue resolvable by biochemical research to an economic issue expressed in the language of cost minimization rather than risk mitigation. By so treating safety as an aesthetic judgement, Handler replaced scientific practices — collecting data, testing hypotheses, using transparent analytical methods — with a performative display of knowledge by the committees he appointed that looks authoritative but was only a show. The consequence was a regulatory façade that protected industrial interests, deferred innovation, and concealed harm. Handler stagnated federal policy regarding the safety of additives by excluding any scientific approach that could not be expressed in the language of molecular biochemistry.

Handler's policies regarding food additives clashed with the responsibilities and duties of the regulatory agency, but were not ignored because the Congress required the agency to consult the Academy for advice, and the committees he appointed invariably mirrored his opinions. Handler championed what he called relative safety, by which he meant relative to the cost to industry if it were required to conform to a specific safety level. He opposed the stronger public health policy specified in federal law, and instructed the Academy committees providing advice regarding food-additive safety to endorse his standard. Handler challenged the congressional requirement that the regulatory agency represent the public, meaning all of the people all of the time; he contended the agency had a duty to balance the public's concern about health with the economic interests of the chemical industry. Several Academy committees advised the agency to shift the burden of proof to the agency, thereby permitting the use of an additive unless the agency proved conclusively it was harmful. Handler unsuccessfully opposed a new law requiring the agency to make retrospective determinations of the safety of numerous food additives that had historically been added to processed food without prior testing for possible health risks.

Handler's prioritization of economic gains over public health raised serious ethical issues. Despite the mounting experimental evidence from animal studies suggesting health risks of specific additives, he valued the economic benefits over the potential dangers, a position that compromised the Academy's responsibility to protect public welfare. His arbitrary dismissal of the implications of scientific evidence from animal studies demonstrated a disregard of pertinent ethical issues and considerations of social justice. Handler prioritized economic

interests and ignored the consequences of his policies on vulnerable populations who might be disproportionately affected by food additives

When the government declined Handler's solicitation that it fund biochemical research on the effects of food additives, he commenced advocating for what he called the next best policy for determining safe exposure levels. He proposed a two-step method for agency decision-making, based on a distinction between authority and responsibility, respectively embodied by biochemists who had and professional judgement and agency officials who had a legal obligation to promulgate safety levels. Reliance on the subjective judgement of biochemists was a Hobson's choice for Handler, but because of his failure to persuade the government that a huge biochemical research program was the proper scientific course of action, he conjured the two-step method as the optimal pro-industry alternative. The method called for a sequestered biochemists appointed by the Handler to identify safe levels subjectively, and for regulatory officials to posit their judgement in the absence of any communications with the biochemists — a necessity, according to Handler, to avoid their politization. The agency ignored Handler's proposal but only after the Congress inadvertently strengthened Handler's influence by requiring the regulatory agency to contract with the Academy for advice regarding methods of decision-making, which allowed an its committee to advance his policy.

Undaunted, in the context of another contract, Handler appointed a committee that strategically substituted a scripted ritual of expert judgment for biomedical evidence, and economized the judgement of biochemists by adopting risk-benefit analysis to subjectively quantify what could not be known. He bypassed the need for biomedical data by relying on a fourfold risk classification scheme — safe, probably safe, probably unsafe, unsafe — which masked biomedical uncertainty in rhetorical certainty. The real function of the framework was to disenfranchise alternative methods for decerning scientific truth, especially those rooted in complexity science, epidemiology, and nonlinear physiology. Handler's version of risk-benefit analysis was a political sedative, designed to project calm and competence while evading difficult questions.

The Academy committees minimized the health risks associated with food additives by emphasizing the benefits they provided while deprecating health concerns and emphasizing the absence of conclusive evidence of harm. Handler's schtick was to champion relaxed regulations and criticize scientific findings that questioned the safety of additives, and his Academy committees reflected his
perspective. They dutifully dismissed, as irrelevant, animal studies that linked additives to adverse health effects, and promoted reliance on subjective safety guidelines based on economic considerations and the historical record of additives which was devoid of public complaints of harm. By favoring the economic interests of food manufacturers over concerns about potential health impacts, and ignoring the results of animal studies, Handler compromised the public's right to safety and skewed the regulatory advice provided by Academy committees in favor of corporate interests.

Handler interpreted the historical record of the thousands of food additives used prior to the law requiring premarket testing for safety as evidence they were safe
because no obvious health problems were reported, and he argued that any problems they might have caused were outweighed by their benefits. He framed the notion of safety as a

subjective concept and steered the Academy committees he appointed toward industry-friendly conclusions by rigging their composition, as could readily be determined from the appointees' public statements and publications. The lack of meaningful conflict-of-interest regulations and the imposition of Handler's ideology on the advice provided by Academy committees fueled skepticism about the objectivity of the Academy and its ability to impartially assess the safety of food additives. Handler's dereliction of biomedical science and the duty he owed the public as the nation's most prominent biomedical expert became obvious in each case of individual food additives, but none more flagrantly than cyclamates, a sweetener manufactured by a drug company he served as a board member.

Despite clear evidence from animal studies that cyclamates caused cancer, based on flawed logic and subjective opinions, Academy committees appointed by Handler ruled that cyclamate was safe for human consumption. They asserted the validity of Handler's dogma that there existed a level of exposure to every chemical below which no harm would occur, including cancer, and offered it to the regulatory agency as if it were learned advice. The committees similarly supported Handler's opinion that the law prohibiting cancer-causing additives was unscientific. However, an independent committee of national cancer experts publicly debunked the Academy committees reports, demonstrating how Handler's ideological commitment to biochemical reductionism had produced conclusions that were not merely flawed but anti-scientific. Even though the cancer committee said it was impossible to set a safe threshold for chemicals that caused cancer, Handler continued to argue the cancer committee was wrong and could be proven so by biochemical research. Handler's credibility collapsed, not only in the eyes of policymakers but among scientists themselves — especially in fields that embraced systems biology or public health.

The cyclamate affair exposed Handler not just as a failed science-policy maven, but as an impediment to the scientific enterprise itself.

Handler created a series of committees to advise application of his dogma to the synthetic hormone DES used in livestock feed, red dye2, and the flavor enhancer glutamate. Despite overwhelming evidence that DES caused cancer in both humans and animals, Handler and his committee supported its use and dismissed concerns raised by cancer experts. He unabashedly demonstrated his preference for protecting the interests of the meat and agricultural industries over safeguarding public health, and said he would continue to do so until biochemical evidence to the contrary was produced. Red dye 2 was another additive Handler defended despite evidence of harm from animal studies and objections from some Academy members, who objected to his revision of an Academy report on the dye to reinforce his opinion that the dye must be safe because it never caused any immediately apparent harm. In defending glutamate, Handler and his committee continued his pattern of relying on economic and legal arguments, claiming that companies had a right to use additives that had previously been approved, and that any opposition to them was driven by ill-informed public fear rather than legitimate scientific concerns.

Handler sought to place the burden of proof regarding safety on the regulatory agency, which would effectively insulate the food industry from accountability. He framed adverse effects of food additives as requiring molecular proof of causation, which excluded probabilistic models where the effect was only probable rather than certain, and eliminated consideration of

multicausal models where the additive was a contributing but not sole cause of the effect. Handler opposed recognizing that chronic disease could arise from long-term, low-level exposures to additives. His rejection of probable and contributory causality echoed his earlier opposition to statistical evidence linking smoking and cancer.

Handler's denial of a role for contributing causes in chronic illness such as cancer, birth defects, degenerative diseases served his ideological needs but sacrificed scientific integrity. His blind spot was not a technical error; it was the deliberate result of a worldview that dismissed as unimportant any emergent, nonlinear, or probabilistic biomedical phenomenon as unscientific. Handler's insistence on causality via molecular mechanism meant that any biomedical approach to studying the side-effects caused by food additives too complex to dissect in reductionist terms simply ceased to exist in policy. Handler's policies thus had a disabling effect on biomedical innovation by impeding the development of new conceptual frameworks and attempting to turn the regulatory agency into an instrument of ideological enforcement rather than public-health protection. He sought to operationalize these policies through a decision-making framework that separated risk assessment from risk management, shielding scientists from political accountability while still steering policy.

Handler's application of reductionist biochemistry to the real-world problem of food-additive safety failed not merely in outcome but in principle. His approach proved inadequate for assessing and managing the risks of food additives because it was an area that demanded multilevel, emergent, and systems-based understanding. Instead of adjusting course, Handler doubled down, embracing an engineering concept of health risk that reduced complex, long-term biological realities into crude cost-benefit equations. Rather than safeguarding public health or advancing biomedical knowledge, Handler's ideological rigidity created a toxic intellectual environment in which dissenting scientific perspectives were suppressed, methodological pluralism was rejected, and federal science policy became entangled in corporate-aligned pseudoscience masquerading as objectivity.

A draconian continuation of Handler's ideology was his belief the safety of anthropogenic chemicals was an objective scientific issue — food additives were no exception. He deeply resented the political reality that non-scientists were in charge of the process of determining safe exposure levels and treated science as mere tool rather than the highest expression of mankind's intellect. Handler extended his perceived objective ideal of science to scientists as a group, elevating them to the status of a uniquely superior class of human beings. His distorted imagination blinded him to the reality that scientific advice could be bought, like any other commodity, or influenced by prejudice and self-interest. No biochemist employed by a chemical company expressed opinions counter to those of company management and remained so employed. Oppositely, as Handler himself evidenced, biochemists who sang the song of their employer routinely fared well — he consistently advocated in favor of the safety of cyclamates and he remained a well reimbursed director of a cyclamate manufacturer for many years.

Handler believed in the existence of objective knowledge and that it was discoverable only by science. Knowledge of how to solve societal problems was an example, but complaints of health risks caused by exposure to man-made contaminants in the environment continued to vex him. Handler's ideology told him there was no such thing as a health risk, so asking

scientists for a solution to the problem was futile, like the plea in the Scottish poem for God's protection from the mysterious and frightening noises caused by things that go bump in the night.

Handler considered the problem — which he viewed as a manifestation of irrational fear —a threat to the authority of science because it seemed to the public that science had no answer. He feared public respect for scientists, which was crucial for sustained federal funding of basic research, would be diminished if the complaints were not placated. The issue he chose for his fight to overcome them was the safety of the thousands of chemicals added to foods for non-nutritive purposes, whose health consequences where unknown and unstudied.

Handler formulated a policy to vitiate the problem of health risks, which he believed had no scientific solution. The foundation of his policy was risk-benefit analysis based on statistical evaluation of actuarial data, the method the nuclear industry originated for determining safe levels of exposure to radioactive chemicals.

The method appealed to Handler because of the absence of an explicit role for biochemical research coupled with the appearance of mathematical certainty. He was particularly enthusiastic after learning from Chauncy Starr that the method proved with numerical certainty that the health risk from nuclear power was less than the risk of being hit by a meteor.

The objective of Handler's version risk-benefit analysis was to manipulate data for the purpose of justifying the dollar value of the weakest possible safety level and the highest possible dollar value of the benefit factor that didn't evoke laughter. Handler's policy sought to capitalize on the simplistic logic of risk-benefit analysis — that an excess of the dollar value of benefit over the dollar value of risk indicated the chemical would be safe, and the greater the excess the more certain was the interpretation. "A decision about safe exposure levels," he said, "would be illogical unless one knew the costs in dollars and the marginal return in decrements of health risks." He believed the quantitative determination of risk and benefit could shift public attention from the illusion of health risks to the mathematical certainty of safety.

When Handler adopted risk-benefit analysis for determining safe exposure levels he assumed that safety could be equated to statistically determined risks and the putative health risks could be objectively characterized purely in monetary terms. He also supposed that risk-benefit analysis was an objective alternative to shortcomings he perceived in the government's regulatory framework regarding exposure to chemicals, which he denigrated as based on "undefined words like risk and safety." In effect, Handler transmuted the multifaceted biological concept of health risk into a capriciously-determined mathematical probability that was summarily quantified in dollars. His strategy obscured but did not erase the subjectivity inherent in judgments formed using risk-benefit analysis. But when Handler added "professional judgement" as another way of determining the numerical values of risk and benefit, the subjectivity of his policy for decision-making became starkly obvious.

Handler misleadingly claimed professional judgement was objective when exercised by the Academy committees he appointed because their members were elite scientists. The advice of a committee that relied on professional judgement to estimate numerical values for risk and benefit was always provided in a report that

spoke in one voice and provided advice to the regulatory agency in an unconflicted package — a homogenization of the opinions, biases, and conflicts-of-interests of its members. Handler's intent was that the subjective opinion of each of the members of an Academy committee, when

converted to one voice, became transformed into value-free objective advice, thereby averaging away the individual biases, conflict-of-interest and professional shortcomings. The objectivity of science, he asserted, allowed a committee scientists, acting in unison, to make valid determinations of what benefits people wanted, what risks they were willing to accept to gain them, and how to quantify both factors in dollars. Pursuant to his policy plan, agency officials would then directly make deductive decisions regarding safety regulations based on the Academy report, confident that their decisions were correct because they were coherent with scientific reasoning and judgement. In a scientistic trance, Handler said a committee's professional judgement was "sufficiently compelling as to logically determine the agency's decision" — like Santa Claus leaving gifts for children. Handler rendered inconspicuous the subjective nature of "professional judgement" by adopting a rule for Academy committees that prevented holding committee members individually accountable for their advice. He believed science was non-adversarial and produced objective answers, in contrast to politics which he said was adversarial and produced only subjective answers. Because cross-examination was an adversarial process, Handler said that to avoid the taint of politics, a policy rule was needed to protect scientists on Academy committees from answering any questions about their opinions, even questions posed by the client regulatory officials. His rule prohibited all members of Academy committees whose report contained advice about political matters, such as safety levels, health risks, or economic impacts, from explaining or defending the basis of their individual judgements or contributions to the report. Handler enforced the rule, even though it facilitated the resolution of public issues by unelected individuals who answered to no one except him.

Handler undertook a multifaceted approach to persuade the government and the public of the merits of risk-benefit analysis for determining safety levels. His arguments blended appeals to authority, emotional manipulation, and the portrayal of risk-benefit analysis as a scientifically validated method endorsed by unbiased experts.

It was, he said, "the cornerstone of an optimal decision-making policy for establishing safe exposure levels to man-made chemicals." His arguments centered on the supposed efficiency of the policy, which he framed as a cost-effective strategy that would "eliminate the need for animal studies" and streamline decision-making processes." Handler's focus on efficiency and his praise for the results of industry's method of contrived calculations —such as his claim that "calculated values of health risks due to food additives were invariably nil" — were warmly welcomed by the food industry. His exaggerated praise and misleading characterization of the decision-making underpinnings of risk-benefit analysis ignored its quintessential subjectivity and neglected the reality of the scientific uncertainty surrounding the health consequences of chemical exposures. Similarly ignored were the pure inventions of metrics assigned to dollar values of human lives and mathematical probabilities to health risks, both of which were confected out of whole cloth.

Emotional appeals also played a significant role in Handler's strategy to promote support for reliance on risk-benefit analysis for determining safety levels.
He warned that in the absence of risk-benefit analysis, the regulatory agency would continue to make decisions based on "perceptions, values, and judgments" rather than objective science, a scenario he characterized as detrimental to public welfare. This framing of alternatives created a

false dichotomy between risk-benefit analysis and reliance on animal studies, and portrayed the former as the only rational method for decision-making regarding safety levels. His misleading rhetoric veered into hyperbole, such as his assertion that "professional judgments" were inherently equivalent to "dollar considerations."

Unsurprisingly, the food industry was pleased with Handler's dismissal of decision-making based on animal studies and his prioritizing of industry interests over considerations of public health. The response to Handler's policy was quite different among stakeholders who valued reliance on precautionary principles; Handler alienated them and increased their negative perceptions of science. Although his efforts to popularize decision-making based on risk-benefit analysis pleased industry, it displeased the public and was received coldly by federal regulatory agencies.

However, up to the end Nixon era and the emergence of the issue of air pollution from automobile emissions, the agencies were required by the Congress to continue contracting with the Academy regarding a spectrum of health and environmental issues. The agencies thus remained forced clients of the Academy, affording Handler multiple opportunities to advance his policies.

Under Handler's rule, the Academy advised extension of risk-benefit analysis beyond assessing safety of new technologies such as nuclear power to determination of safety levels for exposure to anthropogenic environmental chemicals. He promised that the method, using either statistical formulas or professional judgement, would quantitate the risks and facilitate regulatory decisions. At Handler's direction, the Academy entered into a series of contracts concerning food additives in which risk-benefit analysis was the basis of the advice provided by the committees he appointed.

During pre-deliberation briefing sessions conducted by Handler's staff, the committee members learned that Academy policy regarding determination of safety levels was based on economic considerations, actuarial data, and professional judgement, and that the conclusional advice was shaped by balancing risk against benefits. Handler inculcated in each member of a food-additive committee a responsibility to adhere to the Academy's policies for providing advice regarding safety issues. The members were told that the efficiency, clarity, and precision of risk-benefit analysis was unmatched by alternative approaches such as animal studies, and that it separated scientific facts from political considerations, thereby showing science could operate independently of societal values.

The version of risk-benefit analysis Handler touted was fraudulent because it relied on arbitrary calculations and subjective judgements for determination of the degree of risk and the amount of benefits. In the decision-making process, It derogated science by reducing health risks to an economic factor, and it ignored non-monetary values such as ethical and social concerns. The ethical consequences, particularly the disregard of precautionary principles and the prioritization of economic considerations over human well-being in regulatory decisions, were ideologically invisible to Handler.

He was also blind to the blatant contradiction he preached; on one hand he said Academy reports were objective but on the other he said risk-benefit analysis —the foundational reasoning in the reports —was quintessentially-subjective.

Handler welcomed a contract with the military for a study to evaluate the effects of its herbicide spraying program in Vietnam and to assess whether the spraying was. a legal use of chemicals in warfare. The contract aligned with his strategic goal of maintaining the Academy's relevance and with practical considerations because the military was the main client of the Academy throughout its history. Handler also welcomed the opportunity to influence public policy regarding the safety of pesticides, a cause he championed throughout his career. His appointees to the Academy herbicide committee responsible for conducting the study had pro-military biases or no relevant expertise in herbicide-related health or environmental studies, or both limitations, and were schooled by Handler's staff regarding the policies they were expected to follow. Handler main aim was to vindicate the decade-long spraying program, at least to the extent of blunting congressional pressure to classify airborne spraying of herbicides as a violation of international protocols forbidding chemical warfare.

The absence of relevant unbiased knowledge and experience among the members of the committee required Handler to hire numerous consultants, whose efforts, because of exceedingly poor study design, were shaped by limited access to Vietnam, ongoing military conflicts, and reliance on military-provided data. The working reports of the consultants and the resulting draft reports of the herbicide committee were subjected to continual review by a high-level Academy committee chaired by the Academy Vice-President— the only committee in the Academy that Handler did not control. Fierce unprecedented internal strife ensued between Handler and the review committee concerning the working reports and their integration into draft reports of the herbicide committee. After almost a year of in-fighting, spurred by the review committee's rejection of Handler's demand that members of the review committee be replaced, a truce was declared that satisfied neither side but allowed preparation of the timely report required by its contract.

The herbicide committee's report aggravated Handler because it reflected the perspective of the review committee. Historically, Handler exercised a droit du seigneur over Academy reports, wielding editorial power like a feudal lord. He expected servility from his committee appointees in return for the prestige of serving on an Academy committee, and invariably received it. However, the herbicide committee was a precedential exception, because of the determined influence of the institutional review committee. The rebellion of the review committee denied Handler the right to exercise the final word over the report of the herbicide committee.

Handler's distress increased after Academy insiders leaked the report to the press, bypassing the military's privilege to release Academy studies it funded and shade their characterization in press releases. The internal strife and the leak, together, exacerbated the symptoms of Handler's chronic medical conditions and, to the surprise of some, he considered not running for re-election as the head of the Academy.

The leak resulted in news articles that highlighted significant environmental damage and probable medical side-effects of the herbicides among the heavily-sprayed Montagnard tribes, which included sickness and death. The tone of the press stories was directly counter to what Handler had led the military to expect. He condemned the press coverage and criticized the leakers for undermining the integrity of the Academy, accusing them of propagating a false narrative, which took chutzpah considering he had attempted to do exactly that — portray the report as a neutral objective scientific inquiry.

The herbicide committee's report criticized the evidence suggesting the spraying caused medical harm as anecdotal and likely influenced by enemy propaganda. The report supported the military's position only to the point of emphasizing the lack of conclusive evidence linking herbicide exposure to adverse health effects, which was hardly surprising because the study design preempted that possibility, and downplayed the possibility of adverse effects over the long term from a toxic herbicide contaminant detected in soil, crops, and animals, although conceding they were possible. The report had the distinct flavor of a compromise between the draft reports of the Academy's review committee and those of herbicide committee's consultants, which it was. Handler provided a personal analysis of the committee report, essentially a rebuttal, , in which he complained about the committee's attitude and some of its findings, as if they had not followed his script. He stressed the strategic benefits of the spraying program and dismissed as unjustified the committee's seeming implication that the herbicides might have had health impacts. Handler rationalized the environmental destruction as a military necessity and framed the lack of conclusive health evidence as validation of herbicide safety. His analysis reflected his ideological bias toward the safety of pesticides and his intent to safeguard the Academy's long-term and mutually beneficial ties with the military. He showed allegiance to the military and supported it position that the herbicide program was not a form of chemical warfare, but evinced no concern for health implications or science itself

Handler's autocratic management of the herbicide study alienated academicians, undermined the credibility of the herbicide committee, and triggered serious conflict within the Academy. He prioritized political expediency over scientific integrity in an attempt to control the study and the tone of the committee report.

Handler's intention to bolster the military's narrative subverted the Academy's ostensible mission of providing unbiased advice, exposing fundamental internal dysfunction in the Academy. The herbicide study revealed ideological and structural flaws in the Academy's decision-making structure, leaving a legacy of controversy over whether a nineteenth charter creating a scientific advisory body was obsolete in the twentieth century.

Handler's design, management, and evaluation of the herbicide study stemmed from his dogma that reductionist biochemistry was the solution to all real-world problems. But his approach proved inadequate— in both principle and outcome — for assessing the herbicide use in Vietnam because the problem demanded multilevel, emergent, and systems-based understanding rather than molecular analysis and anthropological evidence. Instead of adjusting his course to produce worthwhile information, Handler doubled down, embracing chemical and engineering concepts of health and environmental risk that reduced complex, long-term biomedical, biological, and political realities into crudely simplistic issues. Rather than advancing knowledge, Handler's ideological rigidity created a toxic intellectual milieu in which policies and prejudices became entangled and masqueraded as objectivity.

Handler's pro-military bias was a factor that influenced the composition and management of the herbicide committee's report. The members he appointed favored the military's perspective, setting a high bar for recognizing any link between herbicide exposure and adverse health outcomes. His personal analysis of the committee's report reflected a bias that prioritized military interests over independent scientific inquiry.

The committee report itself was another factor. Under his hegemony, it downplayed the health risks for both Vietnamese civilians and U.S. personnel exposed to the chemicals.

The testimony of witnesses who observed illness and birth defects due to the herbicides was hotly contested by internecine Academy committees, some of which backed Handler and others that opposed him, ultimately resulting in a muddle in herbicide committee's report. By treating potential health consequences as secondary to the military's concern for vindication of its program, Handler shaped a narrative that minimized the urgency of understanding the biomedical impact of mass spraying of civilians.

At several levels, Handler exploited his authority to steer the committee's advice toward benefiting the interests of the military. He restricted the scope of the study, thus ensuring it would lead to conclusions that downplayed health risks and avoided documenting actual harm. He interpreted the permanent environmental destruction caused by the spraying as a good because, he speculated, it helped protect American troops by denying camouflage to the enemy — hypocritically, the use of emotion to elicit sympathy for a preferred scientific position, a tactic Handler railed against through his career when he imagined it had been used against his position. He attempted to bend the Academy's internal review structure to emphasize the absence of observable harm, vindicate the use of herbicides, and deny congressional claims the spraying program violated international protocols against chemical warfare. This approach helped Handler mold the Academy committee's advice in favor of military use of herbicides —a desired outcome shaped by political pressures rather than scientific standards. Handler's manipulation of the Academy and his internecine warfare within its bureaucracy seriously eroding its integrity. By allowing military funding and interests to shape the study's conclusions, Handler compromised the Academy's role as an unbiased scientific body.

HANDLER'S REDUCTIONISTIC APPROACH TO BIOMEDICAL problems raised by food additives or herbicides provided no solutions, but his ideological methodology proved even more useless as a guide to evaluating the wisdom of building numerous plutonium breeder reactors, the proposed heart of a developing nuclear power industry. In its general aspect, Handler's ideology — that scientific reasoning was the solution to all human problems because it was mankind's only process for producing true knowledge — spawned a series of contradictory policy pronouncements concerning the safety of plutonium exposure whose only common factor was the absence of supporting evidence or rational analysis. The collective consequences of Handler's dogmatic pronouncements not only failed to resolve the safety issue but also seriously wounded his reputation and that of the Academy.

Initially, Handler recommended national reliance on breeder reactors for production of electrical energy, asserting they would produce cheap energy without causing any health risks. He said the extent of radioactive pollution that might occur would be acceptable, and therefore opposing construction of the breeders was "knowingly hypocritical." He forcefully proclaimed that civilization would collapse if the breeders were not built. Several years later, however, with no gradual shift, preliminary statements, or clear events signaling that he was about to change his position, Handler reversed himself and warned that breeder reactors would jeopardized the future of humanity and should be avoided at all costs. But soon after delivering the speech that dramatically warned against the peril of relying on nuclear power plants fueled by plutonium produced in breeder reactors , the head of the government agency that was developing breeder technology made Handler an offer he couldn't refuse. Seeking political help, not wisdom, the agency head secretly offered Handler a multimillion dollar contract if he personally

endorsed breeders and appointed an Academy committee whose report would support the agency's view.

Handler, seeking money and a prominent role in national policy, not knowledge, agreed to both conditions. He publicly proclaimed that reliance on breeders to produce electricity was the only possible choice if Americans wanted to avoid facing higher costs for food, housing, and transportation, and he created a rigged committee, as promised. His appointees were all pro-breeder, thus guaranteeing that the committee's report would support the interests of the energy agency. Handler's breeder reactor flip-flop-flip contributed to a developing resistance to his authority within the bureaucratic machinery of the corporate Academy. In contrast, the members of the honorary Academy, didn't care much about what Handler said or did as long as he didn't interfere with their right to elect new members.

Handler's influence over national policy matters involving nuclear energy waned after his behavior was exposed during congressional testimony and he was seen as susceptible to corruption by the energy agency and industry interests. His erratic behavior stemmed from a toxic mixture of his ideology, desire for money to support his discretionary Academy committees, and political pressure exerted by the Academy's clients. That behavior, the latest example in a series of quizzical actions and decisions, coupled with his history of unexplained absences and secretive behavior regarding his chronic medical problems, added to intra-Academy speculation about his physical and mental health. His changing opinion about breeders also diminished the Congress' propensity to seek Academy advice, particularly as regards energy policy; seemingly, the legislators realized they were receiving political not scientific advice.

Handler's practice of urging policies that favored political expedience and the economic interests of the Academy over health-related issues evidenced corrupt leadership of the Academy and its unreliability as an unbiased advisor, at least in the eyes of key congressional leaders. For the first time, they seriously questioned whether there was such a thing as objective advice from an honorary society that ran a consulting business. The immediate consequence of Handler's behavior was the cessation of congressional demands that regulatory agencies seek Academy advice on energy policy. It became apparent that seeking advice from a self-perpetuating institution of scientists and engineers regarding the safety and economics of nuclear power was foolish, because they were political questions answerable only on the basis of values, not scientific questions answerable on the basis of biochemistry or the laws of physics. Nevertheless, industry and the military continued to regard Handler and the Academy as politically useful for implementing what was called their "consulting the gods" strategy.

HANDLER EXERCISED ECCLESIASTICAL-LIKE AUTHORITY over all committees and employees of the National Academy of Sciences. Whenever he spoke or acted, he did so as the Academy incarnate, exercising its aegis, offering advice, and striving to advance the interests of science. *Arrowsmith* was his bible, the source of his inspiration and the foundation of the authoritarian ideology of science he sought to instantiate in society.

He raised the funds needed to pursue his objective from contracts for the Academy to advise regulatory agencies, departments, and congressional committees. The biggest and most controversial contracts Handler negotiated involved regulation of air pollution caused by automobile emissions — the major environmental issue of the 1970s. The Academy's servant-

master relationship with government was strong and mutually beneficial during the early post-War period, but progressively became tendentious during Handler's reign as head of the Academy, and reached its denouement in the context of his management of the emissions problem.

In areas where technical complexities and public interests intersected, the Congress, under the assumption Academy reports were balanced and unbiassed,
routinely required regulatory agencies to contract with the Academy for policy advice and factual determinations. Handler accepted many such contracts not only because he needed the profits to advance his agenda, but also because the contracts leveraged perception of the Academy as a judicial institution.He attempted to use the contracts to advance a scientistic outlook in the sense that science could provide solutions to major societal problems, thus emphasizing the value of science itself as contrasted with the results it produced. Handler's ideology, however, was internally inconsistent and self-defeating. It led him to foster a culture within the Academy that on one hand emphasized the importance of scientific rigor in environmental policymaking, but on the other hand promoted policymaking regarding safety that was based on economic factors. The two-arm approach was a common thread in his opinions in diverse areas including food additives, pesticides, breeder reactors, offshore drilling, radioactive waste disposal, and pollution of water and air, and reached its zenith in the context of automobile emissions. Despite criticism from many directions, operational challenges in managing the Academy bureaucracy, and total dependency on governmental funding, Handler continued his forlorn efforts to advance an ethos of scientism.

Handler had a dim view of automobile emission regulations because they were not based on conclusive biochemical studies, and inculcated his opinion in the Academy emissions committee he appointed to carry out contracts to provide advice to the regulatory agency. Handler sought to strengthen public and congressional perception of the Academy's prestige and expertise, and their acceptance of the Academy as the appropriate spokesman for issues related to public health and pollution. He believed technology had become a source of concern and anxiety because
the public didn't understand the realities of technology and its proper role in society.
Using the language of doubt concerning health risks to mask his ideological agenda, Handler advocated restraint in regulating automobile emissions, and increased research to provide a robust foundation of biochemical knowledge upon which regulatory decisions could be based. He boasted that such knowledge could be discovered before the end of the century If adequate financial support were provided.
In the meantime, while protective regulations were held in abeyance in the vainglorious hope biochemists would be successful, Handler preached tolerance of whatever public harm might result from suspending enforcement of emissions standards as the lesser evil compared with limiting the industry and raising its costs.

Handler was ideologically predisposed in favor of the automobile industry's view that emission standards should not be enforced because of the absence of conclusive evidence that emissions were harmful. His believed toxicity was the sole biological mechanism of harm caused by exposure to environmental anthropogenic chemicals, and automobile emissions were no exception. Handler used the Academy's bureaucracy as an instrument to minimize the biomedical significance of chronic exposure to air pollutants and obfuscate development of

meaningful remedial policies. He approached the question of safety from the point of view that an air pollutant was either hazardous or not hazardous as determined by whether it produced acute adverse reactions mediated by established the biochemical pathways; and if not hazardous, the pollutant was completely safe and unable to constitute a health risk irrespective of the circumstances. Handler refused to recognize the possibility that chronic exposure to pollutants could cause disease via pathways unknown to biochemists; he argued sophistically that the absence of a known mechanism of a harm was evidence that it was not caused by exposure to pollutants. Handler's reductive views of harm and denial of health risks mothered a bias in favor of protecting industry from what he saw as overzealous and premature regulation of air pollution, and a misplacing of the burden of proof. He supported the automobile industry's view that it had no responsibility to prove exposure of the public to exhaust gases was safe but rather that it was the government's responsibility to show exposure was unsafe.

Handler believed that since conclusive evidence of harm from exposure to exhaust gases was nonexistent, decision-making regarding safety could not be based on scientific grounds. He rejected any version of a precautionary principle based on gold-standard animal studies, which would place the burden of proof of safety on the automobile industry, and advocated resolving the issue on economic grounds. His public policy position, however, was a gemisch of heterogeneous, or unrefined concepts. Handler argued that health conditions associated with exposure to exhaust gases should be measured in dollars, and ignored if the dollar level were lower than that of the economic benefits, but then contradicted himself when he conceded that the two factors were incommensurable. He believed the only health risks of automobiles were not caused by the automobile industry but rather by drivers who were responsible for deaths and injuries that resulted from traffic accidents.

Handler routinely functioned as a two-armed policy maven, giving advice in all areas of science or technology, irrespective of his actual knowledge, and then offering conflicting advice. On one hand, he emphasized the importance of science for developing new technologies to address the problems facing society, especially side-effects and environmental degradation, which he blamed on an insufficiently regulated technology. He said society had two choices; either seriously reduce the American standard of living or develop new technology. On the other hand, he objected to regulating new technology because of the economic burdens it places on industry, and he did so with the same intensity that characterized his opposition to regulating the existing technology. On one hand, Handler argued that the automobile industry was not responsible for the problems of air pollution because the industry was simply trying to elevate the economy using existing technology. He blamed the pollution on the government because it refused to adequately support the basic research that would lead to technology that eliminated pollution, which he baselessly assumed was possible. On the other hand, Handler opposed government development of automotive technology because building automobiles was in industry's domain, and governmental involvement would violate the principles of capitalism. On one hand, citing drugs, food additives, and automobiles as examples, Handler said basic knowledge was needed to scientifically evaluate the safety levels so that intelligent decisions could be made regarding their use. On the other hand, he said safety was a political decision based on balancing values — by which he meant money — not a scientific question based on facts. Handler testified that cost-benefit analysis, an actuarial economic-based methodology, was the skill most in need of cultivation to control the balancing process.

He said the analysis should consist of determining the dollar values of the health risk of a technology and its benefit; if the benefit value exceeded that of health risks, the technology was safe.

Handler routinely sought to advance his policies and beliefs regarding the health and economic consequences of air pollution by making false and misleading arguments, and employing rhetorical tropes to bend the meaning or significance of words. Sometimes his story included both false arguments and misleading tropes, as exemplified by his common argument that the absence of conclusive evidence a particular pollutant in automobile emissions adversely affected health was proof the pollutant had no effect on health. The truth was far different. The absence of proof of a biomedical effect is never evidence of the absence of the effect — it is axiomatic in science that a negative result proves nothing. Further, to say the that biomedical evidence was not "conclusive" is a misleading rhetorical trope because almost nothing in biomedicine is conclusive — employed as did Handler, the word was vacuous.

Privately, Handler complained that the language in the Clean Air Act requiring protection of the public health with an ample margin for safety made the hair he had remaining stand on end. Publicly, he attacked the law as financially wasteful by fabricating assertions that an unidentified "we" would have to pay X dollars, where X was a number he sucked from his thumb and changed depending on the audience. The argument was particularly misleading when applied to individuals chronically exposed to automobile emissions who developed lung disease, but Handler repeated it often, like a politician delivering a stump speech.

Handler's air-pollution committees worked for two years to provide an analysis of the technological feasibility of meeting automobile emissions control standards set by the Clean Air Act — the most complex advisory task ever undertaken by the Academy. The nature of the contractual task afforded Handler had less control than normal over the advice the Academy could provide. Typically, the Academy committees he appointed provided advice concerning specific scientific issues on which he had personal opinions. Now he found himself with dealing with an inter-related complex of engineering, political, and economic problems, all of which were beyond his ken: the durability of catalyst-dependent control systems; the need for a network of inspection and maintenance stations; the development of dual-catalyst systems; the ability to manufacture sufficient vehicles meeting specific standards by a time certain; the development of new engine designs by foreign manufacturers; the economic implications of emissions control, including costs associated with purchase, maintenance, and operation; the effectiveness of emissions control standards in improving air quality. Handler could not realistically comprehend or judge the issues, but was forced by the circumstances to act otherwise.

There were no scientific measurements or experiments capable of conclusively determining the public health consequences of automobile emissions. Regulatory decisions of the type the Congress envisioned as necessary to protect the public against the health risks of air pollution could be based only on values, not science as imagined by Handler. But the Congress, in its naivety about science in the first half of the 1970s, did not appreciate the reality that decision-making about safety levels was intrinsically subjective. This reality, however, came into sharp focus during the protracted controversy concerning motor-vehicle emissions that involved the automobile and petroleum industries, the government, and the Academy.

When Handler testified before the Senate committee that sought the Academy's guidance regarding the technological feasibility of emission standards, he voiced frustration with the limited scope of the Clean Air Act, which the committee wrote, and the consequent narrowness of the Academy's contractual task. He said the critical issue was not technological feasibility but whether the standards chosen were scientifically justified — Handler's not-to-subtle way of chiding the committee and the Congress for failing to base the standards of solid biochemical evidence. He said the Senate's limited purview led to industry reliance on the catalytic converter, which was faulty technology, and predicted the converters would lead to unscientific decisions by the regulatory agency. Handler told the committee that preventing the Academy from considering the engineering and biochemical justification of the standards was a serious error, and suggested that the Academy be asked to design a long-term strategy to address the problem of air pollution that took into consideration the plethora of unconsidered problematical factors. Among the unconsidered factors, Handler listed sulfur oxides, carcinogens, and allergens, which he said weren't even measured in the environment much less studied to determine their health impact, and he listed many other factors the Senate committee had failed to consider.

Handler criticized the automobile industry's choice of catalytic converters as the technology for meeting the legal standards because there likely were superior pollution-control technologies that would cost less and not increase fuel consumption, and he predicted the converters would breakdown in public use. As an alternative to depending on the industry to develop cost-effective technology, which he said they clearly had not done, Handler suggested a federal program of research grants to elite universities to foster development of alternative technologies. He said federal funding should also support studies in areas like health-related effects and how pollutants move in the atmosphere. Handler spoke in favor of weak emissions standards, if any, unless and until research yielded conclusive scientific evidence indicating otherwise, reasoning that overregulation imposed unreasonable economic burdens on the industry. Presently, he said, excluding the minor inconvenience of smog, the only known health impact of automobiles were automobile accidents, and that the requirement in the Clean Air Act requiring emission standards to include ample margins of safety was based on politics rather than science.

In a striking shift of personal policy, Handler recommended regulating air pollution within an economic rather than scientific framework, pending the future development of conclusive scientific evidence. Under questioning, he conceded that the absence of conclusive scientific knowledge required policymakers to rely on a pragmatic approach, and as a means of doing so, he proposed that the government no longer seek to minimize health risks but rather to minimize costs. He said that quantifying health risks and overall benefits in dollars would lead to rational decision-making regarding safe emission levels, at least over the short run. Handler told the committee that such an approach could be implemented using cost-benefit analysis — a method of manipulating actuarial data, originally developed by the nuclear industry to rationalize industry-friendly safety levels without the need to do any biological research — could be relied upon because, he falsely testified, it was scientific and objective. Handler said cost-benefit analysis would provide short-term answers to the pressing problems while also allowing sufficient time for biochemical research, which would yield all necessary data to provide a true scientific basis for emission standards.

Actuarial manipulation was arbitrary and subjective but it putatively provided the tool Handler needed to quantify health effects in terms of dollars — which he had come to regard as a condition precedent to rational decision-making for safe emission levels.

During his testimony before the Senate committee in mid-1973, Handler complained the Academy was not authorized to investigate the totality of the consequences and ramifications automobile exhaust gases had on human health, nor to evaluate the automobile industry's claim there was no valid evidence proving emissions had adverse consequences on human health. The committee accepted his offer to explore numerous scientific and non-scientific factors he said played a role in determining the effects air pollution can have on human health and authorized the study. Handler was given complete authority to plan the study provided that he answer the question whether the emission standards in the Clean Air Act were justified — a term he was allowed to define. But he was punching far above his weight — exactly as he had done when he joined his college boxing team at the age of fifteen, resulting in permanent neurological problems. Handler knew nothing about how to design the elaborate study he envisioned. His ineptitude became evident when he presented the Senate committee with a list of nine objectives he promised he would achieve within a year, but which were arrant nonsense that on their face were unachievable. Handler promised the Senate committee The Academy would provide all the scientific information the committee needed to make the political judgement whether the emission standards struck a reasonable balance between their public health benefits and the costs entailed by their implementation. Like Don Quixote who promised his squire the governorship of a non-existent island, Handler promised the Senate committee information that existed only in his imagination.

The principal reason the committee was so easily bamboozled by Handler was its complete ignorance of a profound, fundamental, and irreversible transformation in the. scientific endeavor that had occurred, for which he bore a major responsibility. As a consequence of Handler's decade-long toxic leadership of American science, it had bifurcated, resulting in two distinct branches that differed in their objectives,

The original branch was university science; it consisted primarily of scientists employed by universities who taught and did research, seeking basic knowledge for the benefit of all mankind. After World War II, some scientists at elite universities became partially employed by the government via grants for performing research of particular interest to the funding agency. In that financial environment for scientists, in the early 1950s, Handler began a national campaign extoling the honesty, objectivity, and distinctive knowledge-generating capabilities of scientists, and offering those characteristics as the basis of his annually increasing request for grant funds so that more knowledge could be created. During his campaign, *Silent Spring* and epidemiological evidence of a link between smoking and cancer appeared and irreversibly changed American science.

Employment-based bifurcation of scientists began when tobacco companies commenced spending prodigiously to produce putative scientific evidence that arguably supported the safety of smoking, which was as easy for a scientist to do as lying. With Handler's active support, the nations' business and industry leaders, who traditionally hired lawyers to protect and advance their interests, began hiring scientists — either as employees or via contracts with for-profit research companies — to provide help for the same purpose. Thus emerged a mature, organized enterprise, the industry branch of science. Industry scientists did research and

interpreted the results as directed by their employers, advanced their interests by exploiting the limitations, inherent uncertainties, and flexibility of the scientific method, and served their employers as expert witnesses. Industry scientists sought knowledge for the benefit of their employers, who generally did not make it available to mankind except in the limited instances in which it was first protected by patent law.

The moral and legal duty of scientists employed by industry to serve and protect the interests of the employer distinguished the industry scientist from the university scientist. Typically, the work of industry scientists who specialized in health effects and environmental degradation starkly opposed that of the university scientists, and confrontations routinely occurred between the two groups in the press, administrative hearings, and court cases. Industry science quickly became the dominant branch because industry spent whatever was necessary to support their interests whereas the government —principally the National Institutes of Science, the National Science Foundation, and the Department of Defense — strictly curtailed their funding for projects that touched or concerned the areas of health effects and environmental degradation, because it contributed to political controversies. Prior to becoming the head of the Academy, Handler was intimately involved in blocking government funding in these areas.

When Handler contracted to provide the Senate committee with what he said would be the honest, objective, and responsive information needed to make the requisite political judgements, he deceived the committee into believing all scientists were open, honest, and objective, obfuscating the distinction between the two types of scientists. As a consequence of this bifurcation, even if such information existed, it could not be recognized by laymen, who did not understand the language and logic of science. What the public saw was internecine verbal warfare between university and industry scientists based on their opposing data and conclusions, the consequence of which was a reduction in the public's traditionally high respect for scientists and the scientific endeavor. Handler, whose ultimate goal was to elevate science to the level of a fourth branch of government, corrupted science during his decade-long toxic leadership at the national level, and facilitated its descent. His contract with the Senate committee was just another descending step in the process.

The conclusion of the Academy's multi-volume report simply berated the obvious— there was no conclusive evidence that supported the automobile emission standards nor the industry's view that they were too strict. The report said that even though the available evidence was about as unless as one could imagine, it was sufficient to support the intuitive view that air pollution adversely affected human health, and thus that there was "no substantial basis" to weaken the emission standards. Despite what was considered an absence of essential research, the Academy committees said it seemed clear the available evidence showing automobile emissions caused human disease was sufficient to justify the emission standards, and that there was no scientific basis for changing them. The clarity perceived by the committees was derived from subjective economic analysis of the cost-benefit relationship wherein the benefits of the emission standards, expressed in dollars, were said to be greater than the predicted cost of implementing the standards, indicating they were "cost-effective." The committees said their best estimates were that air pollution caused by automobile emissions could have caused somewhere between four-hundred and four-hundred-thousand deaths, as well as a completely unknown amount of non-fatal disease.

During Handler's testimony in defense of the report, the arrogant demeanor he displayed a year earlier was gone, and he appeared cowed and dispirited. The report he produced was a ponderous tome of technical mumbo jumbo fit for no use accept kindling — the government's two million dollars bough nothing more worthwhile.

Its gist was that the automobile industry and the government were responsible for the null result — the industry had consistently acted in bad faith and the government had failed to support the requisite research. Handler had promised the Senate committee that the Academy would provide all the scientific information the committee needed to make the political judgement whether the emission standards struck a reasonable balance between their public health benefits and the costs entailed by their implementation. However, the mammoth Academy study yielded no new information or insight. The pre-existing scientific information supported the Senate committee's judgement concerning the appropriateness of the emission standards. Handler's only addition to the record was criticism of the industry and the government. Handler's vaunted nine objectives, which he promised would be achieved by the Academy committees, were confirmed as fantasy, like something one might experience under the influence of opium.

The Academy report generated little attention in the lay or science press; where reviewed, the report was mostly interpreted as supporting the regulatory agency in its attempts to establish vehicle emissions standards that reduced key pollutants in automobile exhaust gases. Industry offered no official reaction initially, although it was displeased the Academy didn't recommend relaxation of the emission standards. In mid 1975, however, the Association that represented the automobile industry sent a highly critical examination of the report to the Senate committee which wrote and exercised oversight over implementation of the Clean Air Act. The tone and tenor of the Association's report were unprecedented in the Academy's history; the report grievously injured Handler's reputation because he had conceived of and personally managed the project, and the reputation of Academy itself, under whose aegis the report was issued.

The Association leveled two serious charges against the Academy report and Handler's supporting testimony,—that they were unscientific and reflected ignorance of economic realities. The Association claimed the Academy committees were unqualified to opine on the problem of determining emission standards, and that they were ignorant of national developments such as the energy crisis. The Association's critique listed numerous inconsistencies in the body of the report, its summary statements, and in Handler's supporting congressional testimony; it accused the report of misleading the reader by obscuring the reality there was no scientific evidence to support the emission standards. Handler and the Academy committees were accused of showing a lack of understanding of important issues and an intention to mislead the reader by fabricating unjustified estimates of the monetary value of disease and the costs of meeting the emission standards. The Association agreed with Handler and the committees regarding the need for the research, but their reasons for doing so were quite different. The Association argued that research was necessary before sufficient information was available to scientifically establish emission standards — a scenario that would significantly, or even permanently, delay implementation of emission standards, and concomitantly benefit the members of the Association financially.

Handler supported the report's call for research because it would entail a more or less permanent program of funding biochemical research.

The unpreceded criticism leveled against Handler and the Academy committees by the politically powerful automobile industry stunned Handler, who had to personally shoulder the opprobrium because he controlled every element of the Academy effort — its rationale, solicitation, design, appointment of committee members, and the tone and tenor of the final report. Handler's situation worsened when other stakeholder industries unleashed their scientists — the kind, ironically, Handler had helped create — to deliver sciency arguments like those made by Academy committees he appointed, but that reached opposite conclusions. In testimony at congressional hearings, industry scientists claimed the Academy Conference report was nothing more than a collection of personal opinions regarding irrelevant questions, and that it ignored economic realities. The industry critiques were couched in assertive quasi-pompous technical language, previously the exclusive domain of the Academy, indicating that its halcyon days of unchallenged authority were over, and that it faced strong comments and criticisms which required a response.

Handler's bizarre response was to hold a one-day conference in which his staff and several dozen of his Academy-committee appointees were asked to assess the torrent of situation, identify key issues concerning automobile emission standards, and summarize them in a report. Handler asked the group to create defensible regulatory policies regarding emission standards, and to identify their technological feasibilities and consequences, all while paying attention to the balance of costs and benefits to society in achieving the desired air quality. He told the hapless group of employees and volunteers he wanted the Conference's report to be about twenty pages rather than a thousand pages like the Academy report, so that the advice it provided could understood my laymen and would be reported in the press.

The Conference report, written in less than a month and immediately released by Handler, consisted of several dozen brief conclusory notes dealing with automobile emission controls and management of air pollution, written in Handler's style of posturing a health-risk issue as an example of the complexity of acquiring and using scientific information in political decision-making. The report said using catalytic converters to meet the emission standards was feasible for hydrocarbons and carbon monoxide and probably feasible for nitrogen oxides, but problematic for nitrogen oxides because the industry had slowed down its development of converters. The Conference attendees concluded there was no evidence to justify relaxing the emission standards, and that it was important to examine the health effects of non-regulated pollutants. They also concluded fuel economy could be improved by modifying the converters, and recommended that emission standards be developed for trucks, motorcycles, evaporation of gasoline, and for stationary sources of air pollution such as electric power-generating plants.

Industry's response to the Conference report commenced with a scathing analysis from Texaco that delineated many flagrant shortcomings, as determined by oil-industry scientists. The Academy was accused of failing to produce a report based on intense study, careful documentation, and cogent, relevant, objective, and scholarly analysis, a failing that was inconsistent with the general presumption the Academy was the ultimate scientific authority in the U.S. The report was condemned as shoddy work that resulted from only a few hours of discussion by a committee that included no one with experience manufacturing automobiles or what fuels them. Handler was notified that Texaco believed the committee he appointed was

incapable of carrying out the task he assigned it and incompetent to opine on the matters it discussed. The company regarded the behavior as shameful, and irreconcilable with the conduct of a supposed authority on scientific and technological matters; it supported position by providing Handler a detailed critique written, by the company's scientists, that consisted of three dozen critical comments, each linked to one of the eight conclusions in the Academy Conference report.

The Texaco scientists said that although attainment of the statutory hydrocarbon and carbon monoxide standards was technically feasible, the conclusion in the Conference report that the standards were worthwhile was indefensible, considering the available evidence. The scientists argued that emission control standards should be viewed not as entities in themselves, but as they interrelate with air quality, energy requirements, and the national economy. According to the scientists, the report's predictions of the effects of the standards on fuel consumption conflicted with the predictions of all American automobile manufacturers. Furthermore, the Academy calculations of the costs entailed by the standards were invalid because they were based on faulty data and false assumptions. In view of the limitations and shortcomings in the report, the company scientists said there was no rational basis for arbitrarily concluding emission standards for hydrocarbons and carbon monoxide are worthwhile.

The company scientists also accused the Academy of evading the basic questions of what nitrogen oxides standards were necessary and how they can be justified; the scientists argued that the present standard was indefensible regardless of whether or not its attainment was feasible. They said the Conference report's claim that achieving the statutory emission standard for nitrogen oxides is probably feasible with catalyst technology was speculative and misleading because it implied the catalyst technology needed to achieve this goal on a mass production basis was imminent, which was untrue. Also untrue, according to the company scientists, was the Academy's assumption that the automobile industry had a practical method of testing each car as it comes off the assembly line to ensure that manufacturing variability didn't result in cars that failed to meet the standard; no such method existed.
Considering these and other factors, the scientists asserted, the credibility of the Academy's statement on feasibility was untrue.

The company scientists interpreted the report as evidence the Academy favored overly restrictive emission controls at the expense of conserving gasoline — a choice they believed was antagonistic to the country's best interests. Additionally, they said, the failure of the Academy report to even question the use of catalyst technology was similarly harmful to the economy. The scientists contended that since none of issues surrounding use of catalytic converters were addressed in the report, it was irresponsible to support the emission standards, because converters were unproven, expensive, and wasteful.

Texaco's scientists viewed the Academy report's estimation of the cost of removing sulfur from fuel as seriously wrong because it ignored the costs and consequences of the removal process, and because the possibility that improved technology or less severe emission standards might obviate the need for low-sulfur fuels. In either case, a tremendous waste of capital, manpower, and construction would have needlessly occurred. Further, they pointed out essentially all American petroleum producers and refiners predicted many small refiners would

be forced out of business, which would be antagonistic to achieving the national goal of energy independence.

Texaco's critique concluded the Academy Conference report erred by considering only health effects when it supported the establishment of emission standards while ignoring other important factors such as the time it takes to develop the remedial technology and the effects of the standards on the nation's economy. The report also erred when it assumed that controlling harmful emissions within tolerable levels was more important than ensuring that such control should be cost-effective and only imposed upon society when there was a commensurate and needed benefit.

Many national and international automobile manufacturing companies and associations, as well as companies in related industries, notified Handler and the Senate committee that they opposed the conclusions reached in the Academy Conference report. Scientists and economists representing these companies also attacked Handler and the Academy on the basis that their policies and advice regarding emission control were unscientific and economically devastating. An official at Ford Motor Company told Handler and the Senate that, in his company's view, the conclusions and recommendations of the Academy report were completely contrary to the engineering and scientific data provided in in sworn testimony, and that Academy's conclusions contradicted many of the earlier findings of the Academy as reported in its earlier report. The official concluded that the Conference report was nothing more than the personal opinion of the small group Handler assembled, and that his attempt to use the conclusions of a one-day study, unsupported by evidence, to influence national policy was unworthy of the Academy.

The automobile industry Association expressed similar thoughts. It told Handler and the Senate committee that although the stated purpose of the Conference was to consider new and additional information, there was none in the report, and that although the facts were not new the conclusions in the Conference report were.

The Association was particularly critical of Handler's career-long penchant to lace putative objective conclusions with subjective words such as should, ought to, and can be met. The industry scientists employed by the Association claimed the Conference report directly contradicted the findings of the previous Academy report on air pollution, made false claims regarding the results of their marginal-costs and marginal-benefits analyses, and made unsupported speculative assertions that the emission standards could be achieved while improving fuel economy. The Association rejected accusations that the automobile industry slackened its efforts to develop catalytic converters as baseless and contrary to reality. In turn, it accused the Academy of hypocrisy regarding its description of the industry's technology for controlling nitrogen oxides, its failure to consider questions regarding the relationship of pollutant effects on human health and cost benefits, and for basing the Conference report on mere unsupported opinion.

HANDLER HAD A BIOCHEMICAL CONCEPTION of biomedical science, which he framed within a reductionist and elitist ideology that sanctioned exclusive reliance on biochemical methods and hypotheses as the basis for understanding biomedical phenomena. This ideological commitment fostered in Handler a deep and unyielding resistance to alternative scientific approaches to the study of biophenomena—an inflexibility that ultimately contributed to his professional decline and left a lasting, detrimental impact on the broader scientific enterprise. When Handler

entered the national stage of science policy in the early 1960s, serving as a leader of the National Science Foundation, biochemical research had achieved notable advances in the area of genetics and metabolism, and the enterprise enjoyed widespread public respect.
However, by the time Handler concluded his first term as president of the National Academy of Sciences in the mid-1970s, progress in biomedical research had markedly stagnated, the emblem of which was the persistent failure to find the cause of cancer.
Despite decades of work and the investment of billions of dollars, cancer research produced nil substantive breakthroughs — only unsubstantiated claims of progress, often advanced by Handler and others who stood to benefit from continued funding of laboratory research. Cancer was the most visible and damning exemplar of the conceptual bankruptcy that characterized biochemical reductionism, which was the dominant paradigm of biomedical science at the time.
The paradigm suffered from a fundamental limitation — its exclusive reliance on biochemical methods, which proved inadequate for explaining the complex biomedical phenomena associated with cancer.
The reduction of living systems to genes, proteins, and molecular pathways failed to lead to yield a coherent account of cancer's origins or behavior.

While the 1970s witnessed technical advances in the molecular experimentation that was the basis of biochemistry, these innovations did not translate into meaningful understanding of why cancer arose in specific tissues, how systemic or environmental conditions contributed to its emergence, or what underlying mechanisms governed its development. Instead, biochemists operating within their reductionist framework, generated a growing body of molecular data without effecting a conceptual synthesis.
The appearance of progress masked the deepening crisis occasioned by the absence of useful scientific knowledge. Years of effort and enormous expenditures produced a cascade of so-called breakthroughs that ultimately proved not to be so, a series of conflicting statistical associations, and an ever-expanding catalog of molecular details.
These developments occurred without any corresponding advance in the biomedical understanding of what caused cancer. Consequently, the biochemical research could not provide a rational basis for preventing cancer.

Handler sustained the illusion of progress by publicly promoting optimistic narratives calculated to secure political support for the prevailing research agenda.
But although the biochemical establishment flourished, the cancer problem increased.

Handler responded by changing his interest from seeking to explain why cancer occurred to how it could be cured — it was as if as if he had made a Faustian to accept cancer in return for federal largesse to support basic biochemical research and industry support of applied research to find drugs and technology that cured cancer. By not seeking to understand the causes of cancer — which likely would be found to be anthropogenic factors — politically and economically undesirable information would remain undiscovered and biochemists could continue their laboratory search for molecular knowledge, undisturbed by political considerations. Handler's response was the same as the one he made in the early 1960s when he worked to obscure the link between tobacco and lung cancer.

By the mid-1970s, an increasing number of observers recognized that a purely biochemical framework—divorced from ecological, systemic, and emergent perspectives—was

fundamentally incapable of explaining the cause of cancer. The cancer impasse thus symbolized the failure of Handler's scientific vision: his fixation on molecular precision at the expense of conceptual clarity resulted in the misallocation of resources, the propagation of false hope, and the institutionalization of a research program that advanced the interests of its practitioners more than the understanding of disease. By exercising his influence over government funding of biomedical research, Handler suppressed efforts to generate knowledge that were not explicitly based on molecular hypotheses, the only language used in science he knew and accepted. Handler opposed research models that could explain the consequences of gene-environment interactions, the occurrence of long-latency diseases like cancer, or the adverse health effects of cumulative exposure to anthropogenic agents. His opposition severely restricted the breadth of inquiry and inhibited progress in protecting public health and improving clinical medicine. Lines of investigation were shut down or never pursued, so the knowledge base of biomedical science — as distinguished from the development of technology and drugs — stopped expanding. By declaring certain questions as unscientific or settled, ridiculing alternatives, or labeling dissent as fringe, Handler narrowed the acceptable national research agenda. Scientists self-censored, shifted fields, or left research rather than risk confrontation with the biochemical review committees of the National Institutes of Health, leaving fewer scientists to do research not designed to develop profitable drugs. In essence, Handler helped make finding a profitable cure of cancer more desirable than the humanitarian success of discovering the cause of cancer.

Handler touted his ideology in speeches and encoded it in Academy policy recommendations delivered in reports of committees he appointed. His beliefs were presented as their advice, and included in recommendations for regulatory frameworks that privileged the subjective opinions of biochemists over empirical data obtained from animal studies. Handler regarded graduate training in biochemistry and experience working in a laboratory as sufficient to enable biochemists to intuit numerical values of safe levels of exposure to environmental anthropogenic agents, despite an absence of empirical data. Based on nothing resembling science, Handler asserted the validity of rhetorical safety guidelines, exemplified by his naked assertion that "five years of use without issue" was sufficient for regarding as safe, thousands of chemicals that were added to foods without pre-market testing.

Among other deceptions Handler passed on to regulatory agencies via reports of his Academy committees, was obfuscatory rhetoric such as "no conclusive evidence of harm" — clever-sounding but misleading reasoning rather than fair scientific assessment. Handler deployed the phrase to endorse the strict evidentiary standard of beyond reasonable doubt, instead of the preponderance-of-evidence standard which was typically used in regulatory decisions. Were his endorsement accepted, the bar for enacting preventative health regulations would be set impossibly high, because research deals in probabilities not courtroom-level certainties. Under Handler's implied framework, unless regulators could prove with near certainty that a substance or activity caused harm, no precautionary measures could be taken, effectively stalling or blocking preventive action. Handle's standard was nothing more than artful misdirection.

Handler's ideological fault lines branched out in several directions. He rejected the need for public-health regulation unless biochemical mechanisms of scientifically proven adverse health consequences were demonstrated. He was opposed to considering of pluralistic values during regulatory decision-making and publicly condemned dissenting scientists from the bully

pulpit of the Academy. Handler use his authority as its head to block admission of duly elected scientists as revenge for disagreeing with his biomedical policies. His manipulative practices — rigged committees, ideological purges, and untrue conflict-of-interest denials — undermined his credibility, which decreased continually throughout his service as the head of the Academy. Handler's fervid ambition and monocratic personality made him the opposite of the ideal leader to arrest the worsening cultural climate of distrust of science then overtaking American society.

Handler preached a gospel of scientism and biochemical reductionism that promised scientific solutions to all biomedical problems, but delivered a toxic legacy which seriously inhibited the development of biomedical science.He spent his career constructing bureaucratic edifices to implement what he preached — government agencies that supported only the research he approved, and the Academy, a deceitful private consulting business that possessed scientific wisdom only in the sense that a dictionary possessed the works of Shakespeare. The knowledge possessed by the Academy ad hoc committees Handler cobbled together was superficial, containing science only as isolated data points and reports. The committees were intended to be obedient to his policies, not to exercise independent judgement, synthesize data or exhibit vision. Handler traded on the aura of wisdom while offering no genuine unbiased insight. The wisdom Handler claimed the Academy offered as an institution was purely nominal: it possessed the raw materials of knowledge but none of the creative or ethical qualities that make those materials meaningful.

Philip Handler's tenure as a central figure in American science policy marked a critical turning point in the relationship between science, public health, and industry.
His leadership had many consequences on reshaping the nature and purpose of biomedical research during his time. Handler's rigid adherence to biochemical reductionism led to a narrowing of legitimate scientific inquiry. Research into the environmental causes of chronic disease—particularly those involving chemical and electromagnetic pollution—was actively sidelined, a distortion that limited progress in understanding long-term public health risks.

Through his leadership of Academy committees, Handler redefined public-health policymaking as an insular, technocratic activity.
His committees, staffed by loyal appointees, rendered decisions with minimal public accountability, replacing democratic deliberation with privately influenced authority.
Handler used ad hoc committees to launder predetermined conclusions through the appearance of scientific consensus. By instructing volunteers on the positions they were to endorse, he transformed the Academy's reports into instruments of his personal agenda, undermining their scientific credibility.

Handler's distrust of academic dissenters—whom he labeled "mavericks"—led him to promote a counter-scientific establishment aligned with industrial objectives.
Industry science emerged as a mechanism to suppress challenges to dominant narratives and displace independent academic scrutiny. Handler facilitated the rise of a commercial research industry that specialized in generating favorable findings for its sponsors. These firms, often commissioned by chemical, manufacturing, or military interests, advanced the appearance of legitimacy while producing strategically biased results. The ideal of science as a pursuit of knowledge for the public good was steadily replaced by a market-oriented model in which outcomes were tailored to client needs.

This transition marked a decisive rupture from the post-WWII vision of science as a civic enterprise.

Under Handler's autocratic leadership, the National Academy of Sciences suffered a dramatic loss of prestige. Once revered as a bastion of objective expertise, the Academy became increasingly viewed as a partisan tool for elite interests, weakening its influence and symbolic authority. Handler's policies contributed to a stagnation of basic biomedical research. The elevation of technology over inquiry, and reductionism over complexity, left fundamental questions about life processes and disease mechanisms unanswered. The field languished in a state of intellectual inertia.

The most consequential intellectual casualty of Handler's reign was the neglect of systems biology and emergent biophenomena. His framework left little room for integrative or holistic models of health, life, and disease—scientific approaches essential to addressing chronic illness in the modern era.

Conclusion

The consequences of Philip Handler's tenure reverberated far beyond his immediate sphere of influence.

His leadership reshaped science into a hierarchical, ideologically driven, and commercially aligned enterprise.

The legacy of his actions includes diminished institutional trust, delayed public health protections, and a scientific culture that privileged conformity over creativity.

Restoring scientific integrity requires a critical reckoning with this legacy and a recommitment to the values of independent inquiry, interdisciplinary exploration, and public accountability.

The Academy committees Handler appointed were chronically biased in favor of his ideologically-driven policies; the historical records of his appointees almost invariably indicated how their committees would decide the issues and what advice they would provide.-The foreseeability of the advice in the reports indicated that the Academy's theoretical role as a nonpartisan judge was intellectually and ethically diminished, measured against the expected performance of a historically prestigious institution that was fading from the limelight. Congress and regulatory agencies responded by creating their own sources of advice regarding matters of science policy, and became progressively less dependent on advice from Handler or ad hoc pro bono committee members whose main job was working for a university or industry, and who agreed to pose as the authors of reports written by Handler's staff.-When particularly serious national policy questions arouse, numerous think tanks were available for providing advice that match any shade of political thinking from the far left to the far right.-Handler, however inadvertently, proved the Academy's consulting business was obsolete — that there was no such thing as nonpartisan competent advice from the Business Arm of a self-propagating honorary institution, at least when that Arm appointed volunteer committees that answered only to an autocratic leader who had instructed them to recommend implementation of his policies to the maximum extent possible

Throughout the first half of the 1970s, Handler conceived a string of deceitful and unethical policies regarding health risks of anthropogenic agents. Some of the policies were unveiled in speeches at the Academy, others were represented as advice in Academy reports to the government. The context of the safety problems Handler addressed included involuntary human experimentation, food additives, pesticides, breeder reactors and automobile emissions. The solutions demanded multilevel, systems-based understanding of emergent biophenomena, and ethical experimental designs when humans or animals were used as subjects to obtain pertinent scientific data. But Handler sanctioned only the limited perspective of molecular analysis and linear models of biophenomena, and an ideology that regarded the advancement of science as the highest ethical consideration.

With an intensity difficult to understand, Handler regarded public concern about the health risks of man-made chemicals and electromagnetic energy as no more than emotional and unscientific reactions to modernity. Nevertheless, the concerns were real and hung like an incubus over his effort to grow societal respect for science.

Handler's attitude concerning health risks and his desire to defuse public concern prompted him to develop a policy of reliance on involuntary human experimentation, based on statistical analysis of actuarial data, which he expected would show there were no health risks, thus relieving public pressure on science to solve what he considered to be nonexistent problems. Handler was entirely oblivious to the immoral and unethical nature of his policy. When used retrospectively, statistical analysis of actuarial data proved that people who chose to smoke were more likely to develop cancer than non-smokers. Handler, in marked contrast to the historical use of actuarial data, sought to use the statistical method prospectively on people who did not knowingly chose to be exposed chemicals, to test his hypothesis there were no health risks. In effect, Handler proposed using humans the way scientists use animals to test theories. He ceased promoting his policy of conducting prospective analysis of actuarial data because, for practical reasons, it was impossible to implement, not because he recognized it was immoral and unethical

Handler supported the marketing of all additives the food industry chose to employ, including a chemical that caused cancer in animal experiments which was manufactured and added to food by the company he served as a director. He based his decisions regarding safety on subjective rules that he formulated or were set by the food industry. The only exception to the subjective rules Handler countenanced was the theoretical case where an additive was conclusively proven harmful based on evidence from molecular experiments.

Handler favored essentially unrestricted use of pesticides in both war and peace. With an intensity difficult to understand, Handler regarded public concern about the health risks of pesticides as no more than emotional and unscientific reactions to modernity. He adopted this position soon after *Silent Spring* was published and gave rise to the idea that exposure to chemicals could have adverse health consequences, an issue that was the black beast of Hander's career. He waged a passionate prolonged defense of the safety of DDT; in doing so, he rejected strong scientific evidence that falsified his belief it was safe.

Handler's ideology framed every decision he made during the Academy's Vietnam herbicide inquiry. Although he professed a belief that molecular analysis alone could resolve complex health and ecological questions, he limited the study's scope to anthropological interviews and analysis of data provided by the military. He appointed a pliable Academy study

committee, imposed near-impossible proof standards for recognizing biomedical effects of herbicides, and rewrote dissenting sections of the committee's report to more closely conform to his views —actions that exposed a pattern of deceitful, agenda-driven manipulation. By subordinating objective assessment to the military's priority of obtaining support for its herbicide practices , Handler warped the Academy's review process, suppressed eyewitness accounts of biomedical consequences, and issued conclusions that minimized risks to both Vietnamese civilians and U.S. troops. His misuse of authority blurred the line between independent science and advocacy and eroded the National Academy of Sciences' credibility as an impartial guardian of scientific integrity.

Handler's unwavering faith in biochemical reductionism and his belief that only laboratory science yielded true knowledge, led him to opine in areas far beyond his expertise which included experimental methodology such as human experimentation, substantive topics like food additives and pesticides, and policy issues including breeder reactors and automobile emissions. His ideological approach to the biomedical problems raised by exposure to food additives and pesticides provided no solutions, and was equally useless in evaluating the wisdom of building numerous breeder reactors as the heart of a national nuclear power industry. In its general aspect, Handler's ideology led to a circus of opinions. His public statements on building breeder reactors swung wildly, unmoored from evidence and guided by expediency and financial considerations rather than scientific integrity. After first championing breeders as vital and harmless, Handler abruptly reversed course, declaring them existentially dangerous. Yet when the federal agency developing breeder technology secretly offered a lucrative consulting contract, Handler pivoted again — endorsing the reactors and appointing an Academy committee he engineered to bless the agency's position. Handler's abrupt policy change showed his willingness to trade ideology for income.

Handler's double reversal and rigged Academy committee lowered the Congress' confidence in the Academy's advice and perception of its prestige. Recognizing that the Academy's advice reflected political expedience and institutional self-interest rather than dispassionate analysis, lawmakers curtailed requests for Academy advice on energy policy. And questions were raised in the press regarding whether an honorary science society operating a lucrative consulting arm could ever claim objective authority.

The unraveling of Handler's career — and the Academy's standing with it — began with he secured a high-stakes contract to assess the scientific and technological feasibility of federally mandated automobile emission standards. Handler saw an opportunity to elevate the Academy's authority and his own and, with his characteristic overconfidence, assured the Senate that the Academy would deliver clear definitive scientific guidance to support national policy regarding the standards. While lobbying for the contract, Handler made nine outlandishly extravagant promises regarding specific information he would provide that was needed to regulate automobile emissions on a scientific basis. But what he promised was impossible because he lacked the requisite means, data, and expertise; that void, together with his ideological rigidity and arrogant confidence, ensured his sale of blue sky to the Senate would have damaging consequences for his career and for the Academy.

Handler believed only conclusive biochemical evidence could justify regulatory action, dismissing as irrelevant the broader environmental and epidemiological data that had raised public alarm. This conviction, rooted in his reductionist view of harm as something

biochemically quantifiable, and his industry-sympathetic narrative that framed the absence of definitive proof of harm as proof of safety, misled him to anticipate that the Academy's automobile emissions committee report would be greeted warmly by industry. But the multi-million-dollar effort Handler managed yielded a report that contained only disputable subjective advice and baseless conclusions. Handler's committee found no evidence that the legally mandated emission levels were either scientific or unscientific — they were simply policy judgements made by politicians based on what scientific evidence existed. Although Handler and his committee were pro-industry, they could not reach the conclusion it most desired — that the legally mandated emission levels were unscientific and should be rescinded.

The Academy report elicited an avalanche of criticism unlike anything the Academy had ever endured. Automobile and related industries, supported by their scientists and economists, accused the Academy of producing speculative nonsense, contradictory conclusions, failing to grasp economic realities, and ignoring engineering and economic constraints. Another report, issued by a committee Handler quickly cobbled together in an effort to rebut the firestorm of industry opposition, was ridiculed even more intensely. Industry scientists, who were trained in the very playbook Handler had written and helped institutionalize, used his own tactics against him — offering assertive, technical-sounding rebuttals that matched and outpaced the Academy's formerly unchallenged voice. Handler's once unassailable control over the narrative collapsed, and he became a diminished figure, enmeshed in broken promises and institutional disrepute.

In an attempt to cement his ideas about the importance of what he saw as science, Handler ensured his own eclipse and took down the Academy down with him.
Long regarded as the nation's premier scientific advisory body, the Academy became an object of skepticism. The automobile emissions episode did not conclude with the clear, definitive scientific guidance to support national policy Handler had promised. It ended with silence — the Academy's reports quietly shelved, its influence weakened, its leader undone. Handler, once the architect of a grand vision for science in public life, had become a spent man, and the Academy, under his watch, lost not only its prestige, but its purpose.

Handler proposed a series of false and misleading policy solutions to the problem of determining safe exposure levels to anthropogenic agents. His first proposal was the elimination of regulatory reliance on gold-standard animal studies in favor of basic biochemical research, which he predicted would provide the necessary information. Despite the support of Academy advisory committees, rendered in reports to the regulatory agency, Handler's molecular-based approach proved useless for objectively determining safety levels of food additives — the initial health-risk issue Handler managed during his first term as the head of the Academy. Handler adjusted tactically to the setback, and his committees commenced advising the agency that biochemists could determine safety levels for exposure to man-made chemicals by relying on their professional judgement, which he declared was equally objective as laboratory data. When failure ensued again, inspired by Ayn Rand's model of institutional cruelness, Handler proposed implementation of a regulatory principle that man-made environmental agents should be assumed harmless until conclusively proved otherwise. Academy committees attempted to sell Handler's undistilled sophism to the agency , but without success because, in the context of their reports, "conclusive" meant "conclusive

enough," which was a subjective value judgement by unelected biochemists — a policy basis that had already been rejected. After receiving his third strike three, Handler refrained for a while from proposing solutions to the problem of determining safety levels. When he began again, impressed by the success achieved by the statistical ruminations of nuclear engineers, and with the warm support of industry, Handler advocated translocating the safety issue out of the domain of science and into the economic domain. Academy committees had a fair amount of success in persuading regulators to rely on cost-benefit analysis as the decisional-basis for setting environmental exposure limits, although the committees didn't succeed in completely persuading regulators to overthrow the risk-benefit paradigm. A main consequence of Handler's policy gamesmanship regarding safety levels was a public perception that science —both branches — was an enterprise for providing employment for scientists, either directly by universities or indirectly by industry and the military, who used it as a tool in the service of their interests.