Chapter 19: Authority Without Accountability 1979-1980[1]

In the fall of 1979, *The Invisible Threat: The Stifled Story of Electric Waves,* an in-depth investigative article that confronted an issue largely absent from common biomedical discourse — the biomedical consequences of high frequency (microwaves) and low frequency (Sanguine antenna and powerlines) electromagnetic energy in the human environment — appeared in a national review magazine. The article was not polemical but rather reconstructive — assembling clinical observations, experimental findings, institutional decisions, and administrative behavior into a single narrative that asked whether the health impact of a class of environmental exposures intrinsic to contemporary life had been misunderstood, or deliberately ignored. At its foundation, the article challenged a dominant paradigm that had become deeply entrenched in postwar American science. According to that paradigm, the electromagnetic energy (EE) was biomedically relevant only insofar as it produced heat. Below a threshold that raised tissue temperature, EE was presumed to be inert.

Safety, therefore, could be calculated mathematically, based on the laws of physics, rather than observed; models could substitute for living organisms; and absence of gross acute injury could be equated with absence of health risks. This assumption — rarely mentioned or defended explicitly—functioned as an axiomatic truth, shaping military standards, industrial practices, regulatory thresholds, and the boundaries of legitimate scientific inquiry.

The article opened not with theory, but with lived experience: individuals residing near military installations or electronic infrastructure who developed neurological, ophthalmologic, and psychiatric disturbances for which no conventional explanation sufficed. These cases were not offered as proof, but as signals — anomalies that demanded explanation rather than dismissal. The narrative emphasized that such individuals found little institutional recourse, not because evidence was lacking, but because the scientific framework governing electromagnetic safety rendered their experiences unintelligible. Effects that were systemic, delayed, or regulatory-based did not fit a paradigm organized around acute injury and thermal damage of tissue.

From there, the article traced the historical origins of the prevailing standards. Central to this history was the work of a physicist, Herman Schwan, whose influence over military and regulatory thinking about EE proved decisive. His approach — heavily supported by the military — rested on a series of simplifying assumptions: that the human body could be modeled as a homogeneous sphere; that electromagnetic exposure could be reduced to the amount of energy absorbed and that the biomedical response could be inferred from thermal calculations. Using these assumptions, Schwan computed safe exposure limits for microwaves despite the complete absence of direct biological and biomedical testing at the levels he deemed safe, and which he soon generalized across contexts and frequencies. The article treated Schwan's work not as fraudulent, but as profoundly irrelevant. The calculations were mathematically and conceptually simple but bore no relationship to living organisms. A spherical model of a dead, single-tissue human could not capture neural signaling, endocrine regulation, developmental processes, or stress physiology. The model excluded precisely those

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

features that define life. Yet it became the foundation of military and then national policy, in part because it aligned with institutional needs and ideological preferences.

It was at this juncture that Robert Becker entered the article narrative. He appeared not as an outsider, but as a strongly credentialed insider — a physician-scientist whose career had been built on the study of bioelectric phenomena in bone growth, healing, and regeneration. According to the article, his research had repeatedly demonstrated that living tissues were highly sensitive to electrical and electromagnetic conditions; endogenous electrical currents guided growth and repair, and subtle alterations in electrical environments could produce profound biological and biomedical effects. For Becker, electromagnetic energy was not an incidental feature of life, but a primary regulatory factor. When the Navy convened an ad hoc committee to evaluate the biomedical and ecological effects of low-frequency EE in connection with the Sanguine antenna[2] project, it judged as logical the inclusion of Becker. The project itself — an immense grid of buried wires designed to communicate with submerged submarines — operated at frequencies comparable to those of commercial powerlines. Although the signal strength from the antenna was about a million times weaker than that of powerlines, its scale and novelty raised questions that could not be addressed by thermal models alone.

The committee's conclusions, as described in the article, were measured but unequivocal. After reviewing animal studies, human data, and physiological research, the committee warned that exposure to low-frequency EE could alter blood chemistry, disrupt central nervous system function, affect biorhythms, and induce stress responses. It called for urgent continuation of the Navy's studies, explicitly noting the relevance of these findings to the broader population exposed daily to powerline EE.

These recommendations were unanimous, but ignored. The Navy suppressed the report, conducted none of the recommended additional research, and rebranded the project as Seafarer to deflect attention.

The article suggested this was the moment, not any later public controversy, that marked the point of direct conflict between Becker and the reductionist establishment. Becker did not retreat. Instead, he acted as a physician-scientist accountable to the public. When utilities proposed the construction of ultra-high-voltage powerlines in upstate New York, Becker warned state regulators that the EE exposures involved would dwarf those contemplated in the Sanguine-Seafarer project.

Becker —with me at his side as he had directed — presented experimental evidence in court showing that low-frequency EE could induce anesthesia-like states, alter organ chemistry, disrupt cardiac rhythms, impair animal growth across generations, and produce stress responses consistent with established physiological theory. These findings were characterized in the article not as speculative but rather as empirical reproducible observations grounded in whole-organism biology.

The response was said in the article to be swift and revealing.

Becker was subjected to a prolonged court case where his pro bono testimony was opposed by a team of three utilities' consultants headed by Schwan — who was hired to present and defend the thermal standards he had created as evidence of safety of the proposed powerlines. The same calculations were once again substituted as experimental evidence and offered as a

[2] See Chapter 9 and Chapter 17

rebuttal to animal and human data. Studying the reaction of living systems to EE was treated as too expensive and inconvenient for assessing human health risks to powerline EE.

Here, the article exposed not merely a scientific disagreement, but a clash of systems for distinguishing justified belief from opinion. Becker's work rested on the premise that living systems were integrated, adaptive, and electrically mediated: as a consequence, environmental signals could matter precisely because they could interact with the body's natural electromagnetic regulatory processes, and disrupt them. The reductionist counter-position advanced by Schwan insisted that if effects could not be derived deductively from simplified physical models, they were not real. In his view, biology and biomedicine were inexact sciences, subordinate to physics, and observation without a sanctioned physical mechanism was suspect. The article's treatment of the National Academy of Sciences committee that reviewed the Sanguine-Seafarer project — to which Handler appointed Schwan and his co-consultants from the powerline case—sharpened the contrast between the systems. The committee — chaired by a biochemist, J Woodland Hastings but dominated by Schwan and his co-consultants — gave the antenna project what Hastings said was "a clean bill of health." But it did so only by stretching the credibility of Handler and the Academy beyond their limits. Prior testimony by the powerline consultants was mischaracterized by the committee, which also ignored judicial and experimental findings favorable to Becker. Schwan and his co-consultants had testified that powerline EE would be completely safe almost a year before Handler appointed them to the Hastings committee to judge the safety of the Navy's antenna, whose EE was almost a million times less. Even small children could see what their verdict regarding the safety of the antenna would be. It could not truthfully be said that the Sanguine-Seafarer committee Handler appointed was unbiased or competent.

Although Handler was not named in the article, his ideological presence was unmistakable. The Academy's posture reflected a worldview he had long championed: safety could be inferred from reductionist principles; molecular certainty was the gold standard of knowledge; challenges to reductionism grounded in systems biology or physiology represented, at best, confusion and, at worst, subversion. Handler's reliance on Schwan's conclusions — despite his own lack of training in electromagnetism—was not accidental.

Those conclusions rationalized Handler's deep belief that low-level exposures, whether chemical or energetic, were inherently benign.

The article concluded by widening the frame. It argued that the suppression of electromagnetic research was not an isolated failure, but part of a broader pattern in which institutional science avoided unpleasant questions that threatened military, industrial, or ideological commitments. Models replaced bodies, peer-review became gatekeeping, and dissent was reframed as incompetence. The article suggested that the danger lay not only in electromagnetic energy itself, but in a scientific culture that mistook mathematical elegance for biomedical truth. The article captured Becker at the moment when his work on EE — rooted in decades of experimental biology — collided head-on with an entrenched reductionist order. It recorded the early stages of a conflict that would soon turn personal, vindictive, and destructive. And it documented with unusual clarity how biochemical reductionism, organized around abstraction and control, responded when confronted with evidence of complexity, vulnerability, and systemic risk. The story it told was not merely about electromagnetic energy.

It was about what kinds of knowledge were permitted to count, and what happens to scientists who insist on listening to living systems when institutions prefer to listen to ideology and equations.

The article functioned as an institutional indictment of the biomedical worldview Handler had spent his career co-inventing, advancing, defending, and enforcing, which infuriated him. It directly implicated the National Academy of Sciences as an active agent in the suppression of biomedically grounded evidence concerning electromagnetic energy, portraying the Academy not as a neutral arbiter but as an enforcer of a reductionist orthodoxy. It exposed how authoritative safety standards were derived from abstract physical models rather than living organisms, how whole-organism experimental findings were marginalized, and how Academy committees — staffed by individuals with clear conflicts of interest — were used to confer legitimacy on conclusions that aligned with military and industrial priorities.
Most provocatively, the article elevated Robert Becker as a credible, ethically motivated scientist whose systems-level, bioelectric research directly contradicted the Academy's preferred framework, and it identified the Sanguine-Seafarer episode as a case in which Becker's experimentally grounded warnings were suppressed rather than refuted.

In doing so, the article transformed reductionism from a methodological preference into a causal explanation for scientific failure, implicitly assigning moral responsibility to those who wielded institutional authority and used it to exclude inconvenient forms of knowledge. For Handler, whose presidency of the Academy rested on the premise that molecular reductionism guaranteed objectivity, safety, and epistemic control, the article did not merely challenge particular conclusions, it threatened the legitimacy of the entire system of biomedical research he represented.
The article's investigative posture, refusal of deference, and insistence that scientific authority be judged by evidentiary integrity rather than institutional prestige made the piece intolerable to Handler, whose power depended on precisely the opposite assumptions.

In the months following publication of the article, the conflict it exposed moved rapidly from the realm of scientific dispute into one of personal retaliation and institutional coercion. Viewing the article as an existential threat to the authority and reputation of the Academy, Handler responded not by engaging its evidentiary claims but by attempting to extinguish the article. He personally called and threatened the career of the article's author, and told the magazine's editor he was prepared to pursue litigation to protect the Academy's standing if the article were not retracted. Handler also asked Hastings, Schwan, and his two co-consultants to lodge formal complaints with the editor alleging libelous criticism of the Academy. Hastings and Schwan declined, but the co-consultants agreed to sign such letters drafted for them by Handler's staff. However, Handler's attempts to coerce retraction of the of the article failed.

Convinced that Robert Becker was the animating force behind the article, Handler acted vindictively toward him. During this period, Lionel Jaffe, without any apparent independent rationale related to regeneration research, issued a Purdue University press release accusing Becker of "plain ordinary fraud," an intervention that bore all the hallmarks of external orchestration rather than spontaneous concern for the institution of biomedical science. In parallel, Handler successfully persuaded Marguerite Hays, newly installed as head of the VA's

research service, that Becker's renewal application failed to meet NIH standards — criteria the VA had reluctantly adopted under threat from the Academy to issue a report recommending that the VA no longer exist as an autonomous institution[3]. The upshot of Handler's intervention in the VA's grant-funding decision was Hays' formal termination of Becker's research support once his existing grant expired. Hays provided Becker only one adverse review, which had been heavily redacted as if to remove vulgar or libelous language; the language she allowed Becker to read unmistakingly echoed that of Lionel Jaffe. Hays made her decision to terminate Becker's career, at age 56, despite his having just received the Nicolas Andry Lifetime Achievement Award —the highest honor presented for achievement in orthopedic research — and having successfully organized and conducted the First International meeting on Mechanisms of Growth Control, which took place only weeks before she informed Becker of her decision. After Handler's efforts had successfully secured the date Becker's career would end, he turned to other objectives.

Handler sought the destruction of Becker's legacy regarding the role of electromagnetic energy (EE) in emergent biomedical phenomena — especially health risks from man-made EE — and vindication not merely of the Sanguine-Seafarer committee's conclusion but of the conceptual architecture that made it inevitable. At the time, there existed a genuine and unsettled social-policy question: whether chronic exposure to anthropogenic EE posed long-term threats to human health. Animal studies, occupational observations, and physiological research had demonstrated that EE was biologically active in the sense of altering measurable features of living systems. The question was not whether EE could cause acute injury but rather whether prolonged exposure might create a chronic threat to health — a health risk. Ever since Handler, working with Herman Schwan, advised the government that the microwave beam aimed at the American Embassy in Moscow was not a health threat to the Embassy personnel, Handler routinely addressed the question of exposure to electromagnetic energy not with scientific evidence but through a rigid reductionist framework[4].

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[3] See Chapter 18

[4] Handler did not first conjure the notion of reductionism to deal with the health risk problem posed by the Sanguine-Seafarer antenna. He first encountered reductionism during his brief study of physics as a biochemistry student, and learned it was an experimental method for analyzing complex phenomena by examining their parts. Awed by the success of physics, Handler imagined the then infant field of biochemistry could ape the success of physics by relying on reductionism to learn the laws that explained life and functions of living organisms. He imagined the day would come when biochemists could pour chemicals into a beaker and thereby create life. But Handler never learned that the laws of physics actually predicted reductionism could never be the sole method for explaining the existence or behavior of living organisms because they are open systems in the sense that they continually exchange matter with their surrounding — unlike inanimate matter, which is a closed system and does not do so.

This meant biological and biomedical phenomena could never be understood by relying solely on biochemical reductionism — various forms of energy, especially electromagnetic energy, are the sine qua non of life itself and its behaviors. Handler's historical error resulted in his belief that all biology was fully explicable in terms of molecular parts , and that explanations invoking electromagnetic energy, system-level organization, or emergent physiological properties were illegitimate, as were experiments designed to determine causes rather than seek to identify biochemical mechanisms. During his years in authority, Handler was significantly responsible for establishing as federal science policy — implemented by the National Institutes of Health and the National Science Foundation — his doctrine that all biomedical phenomena could and should be reduced to a defined molecular mechanism, and that merely explaining biophenomena on a causal basis was epistemically suspect and unworthy

Reductionism, as Handler deployed it, was not only a methodological preference, but also an epistemological rule: scientific knowledge of biolgy was legitimate only insofar as it could explain observations at the molecular or biochemical level. Causal explanations of biophenomena that existed at the level of organismal regulation, systemic adaptation, or probabilistic disease patterns were regarded as provisional at best, suspect at worst, and generally went unfunded as a matter of federal science policy. In the context of public-health issues, Handler's version of reductionism was the methodological and ideological position that biomedical phenomena were fully explicable in terms of lower-level processes — specifically biochemical and molecular interactions — and that explanations invoking higher-order organization, system-level regulation, or emergent properties were either unnecessary or illegitimate. He treated reductionism as an institutional doctrine enforced through peer review, funding criteria, and advisory authority. Under this doctrine, biological effects that cannot be directly derived from molecular mechanisms were dismissed in advance, regardless of empirical evidence at the organismal or physiological level.

Within the framework of reductionism, Handler drew a sharp distinction between *hazard* and *health risk.* In the context of human health, a hazard was generally regarded as an agent capable of producing acute, short-term injury under defined exposure conditions— thermal burns from electromagnetic energy and arsenic poisoning as examples. Hazards unfolded rapidly, produced immediate effects, and typically could be studied at the molecular or cellular level. They were conceptually compatible with reductionism because their mechanisms were localized and directly observable. A health risk, by contrast, was emergent and probabilistic. It arose from prolonged or repeated exposure to a biologically active factor, was manifested over time as increased probability of adverse health outcome, and was mediated by chronic perturbation of regulatory systems — endocrine, neural, immune — the effects of which accumulated and eventually became evident, as determined in epidemiological studies. For example, such studies led to the discovery that smoking caused lung cancer. A health risk cannot be demonstrated in a moment; it must be inferred from organism-level responses, population patterns, and time-dependent evidence. Handler treated the *hazard* category as genuine because it could be studied reductionistically; reasoning the same way, he denied the existence of the *health risk* category because it could not be so studied. Deceptively, he developed a career-long style of intentionally obfuscating the difference between *hazard* and *health risk* when speaking to the lay public or expressing general conclusions in Academy reports, its Sanguine-Seafarer committee, for example.

In advisory settings and public statements, Handler repeatedly demanded molecular proof as a precondition for acknowledging a danger to health caused by an anthropogenic factor, whether chemical or energy, and whether in food or the environment — electromagnetic energy was no exception. Chronic exposure to EE from powerlines, electrical devices, radio and television antennas, military installations, and technological infrastructure,

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of federal support. Reductionism thus became not a method, but a gatekeeping rule for proposed experiments that would be funded. When the rule was applied to biomedical studies of electromagnetic energy, it welcomed applications based on searches for molecular proof, such as those proposed by Lionel Jaffe, but shunned those based on studies of emergent biophenomena, such as those of Robert Becker.

posed potential long-term threats to human health. This was not a speculative anxiety. Many university scientists had published evidence suggesting there was a danger. Animal experiments, occupational observations, and physiological studies showed that electromagnetic energy was biologically active in the sense that it was capable of altering measurable aspects of organismal physiology, including stress responses, endocrine function, growth patterns, and neural signaling.

The health question raised by exposure to EE was not whether man-made electromagnetic energy in the environment could create a physiologically significant amount of heat in human tissues — it can't. The non-trivial understanding of the health question was whether EE could perturb living systems in subtler regulatory ways over time. Because no defined biochemical pathway linked non-thermal EE to a discrete molecular lesion, Handler regarded EE health risks as fictitious.

Handler had frequently applied the same reasoning in response to assertions health risks were caused by cigarette smoke, food additives, pesticides, or automobile emissions — claiming they were safe. For both EE and chemicals, Handler reasoned the absence of biochemical evidence was evidence of safety which, in turn, evidenced the non-existence of health risks. But Handler's reasoning rested on two related logical failures. First, he treated the absence of molecular evidence of harm as proof that no health risk existed — a classic fallacy in scientific reasoning that confused the limits of detection with proof of non-existence. Second, his argument was circular. Health risks were emergent and probabilistic biophenomena that did not initially appear as molecular lesions, yet Handler required molecular evidence as a condition for acknowledging their existence, thereby imposing a standard the phenomenon could not satisfy. The result was a logically closed argument: the phenomenon was defined so that it could not be detected, and the resulting failure of detection was then cited as proof that it did not exist. For a scientist occupying one of the most influential advisory positions in American science, such reasoning was not a minor analytical lapse but a profound distortion of scientific inference. The inconsistency becomes unmistakable when placed beside Handler's own observation that life itself cannot be fully captured by any molecular definition — an observation that did not lead him to deny life's existence. In the case of health risk, however, he did.

The Sanguine-Seafarer committee operationalized this architecture. It concluded there was "no evidence of a hazard," a statement that was accurate only within the narrow terms Handler had imposed. The committee answered a question Handler had deliberately redefined so as to exclude the one that mattered. Once *hazard* displaced *health risk* as the governing category and the committee was structured to reflect that displacement, the outcome became predictable — the committee's conclusion did not arise from impartial evaluation but from deliberate construction. A manuscript Handler sent to the magazine, demanding publication, did not revisit these actions, it sought to defend them.

Handler's continuing success in establishing his ideology as federal science policy largely stemmed from the absence of a platform for a national debate regarding his stratagem — the appropriate establishment forums were under his control or at least his influence. Thus there was no need for him to openly defend his opinion that chronic exposure to man-made EE was naturally safe. But after all major figures involved with the Academy's Sanguine-Seafarer

committee were interviewed for the magazine article — except Handler himself, who declined —his stratagem was publicly questioned for the first time in the article. Its treatment of the Academy and Handler himself sent him into an epic rage. He had presided over many contentious issues, and his practice was to remain behind the scenes, never disclosing his role in the Academy's process for producing advice, always preferring instead to work through intermediaries, like the Pythia who spoke for Apollo at Delphi. When the magazine article appeared, Handler's staff urged him to continue projecting an image of aloofness, but he ignored them. Having failed to coerce withdrawal of the article, Handler dramatically injected himself directly into the controversy in a way he had not done while fathering about a thousand Academy committees during his more than ten years as the head of the Academy.

In January 1980, he sent an incendiary letter to the magazine's editor, complaining that the article was replete with what he called willful and venal distortions, misrepresentations, inaccuracies, and slanderous descriptions of Hastings and Schwan. He said the article insulted the National Academy of Sciences and that, considering its benefit to the nation, the Academy deserved to be held above such treatment. Included with the letter was a manuscript — unprecedented in tone and tenor for him or any Academy head — which Handler demanded be published in the magazine as a rebuttal. He said the manuscript provided "actual scientific knowledge" regarding the effects of electromagnetic energy from the antenna and from powerlines, and he threatened to sue the magazine to rectify "the grievous injustice done to the Academy" if it were not published. That manuscript — sent after Handler had secured termination of Becker's research funding, ending his career — was the culminating document in Handler's campaign of revenge against Becker. It was also the first time Handler came down from his bully pulpit and explained why he believed man-made EE posed no health risks. He co-authored the manuscript**,** *Scientific Evidence and Public Decision Making,* with two Academy bureaucrats, a business manager and an editor. It was a polemical paper which criticized *The Stifled Story,* and Handler demanded its publication in the magazine. Ironically, it was the same magazine that, in the early 1960s, had solicited and published articles by Becker and Handler concerning "The Research Frontier," in which they answered a question posed by the magazine, "Where Is Science Taking Us?"

The heart of Handler's pique was the magazine article's analysis of four of his appointees to the Academy's Sanguine-Seafarer committee — E. Woodland Hastings, a biochemist and Handler's personal friend, who was chairman of the committee, Herman Schwan, a biophysicist and its central figure whom Handler admired, and Schwan's two co-consultants in the powerline court case, a botanist and a veterinarian. Hastings was criticized in the article for providing the Navy with what he called a "clean bill of health," and for "lying" about the research Becker and I had done. Hastings was quoted saying he had welcomed Schwan to his panel because testifying for a power company "is not a basis for removing anyone from eligibility," and for calling Becker and me "quacks" who had not done any research relevant to EE health risks. Schwan was mocked in the article for asserting calculations could determine what was or was not a dangerous assault on health. Handler took umbrage at the article's mocking treatment of Schwan and its favorable treatment of Becker's research, which was regarded as honest and relevant. Handler resented its negative depictions of the Hastings committee and Schwan's theoretical approach to human safety. He similarly disliked the respect shown in the article for

Hans Selye, the discoverer of biomedical stress who, when interviewed, offered support for Becker's research showing EE was a stressor.

Handler's paper began with the jargon he used many times in speeches and testimonies in congressional hearings — descriptions of the magnificence of science, its importance to humanity, and the stalwart role the Academy played in protecting the sanctity and independence of science. Then, relying on his Sanguine-Seafarer committee and the utilities-controlled publications they cited, Handler denounced the gold-standard studies on animals that reported biological effects of man-made EE — a literature consisting of several hundred publications — as hopelessly conflicted and larded with conspicuous defects. Handler described the physics of electromagnetic energy, expressed profound regard for Hastings and Schwan, and attacked Becker personally. Handler said the author of the article was ignorant of "the physics of electromagnetic energy" and failed to recognize Schwan was "perhaps the leading authority in the United States, if not the world on the biomedical effects of EE." He expressed resentment at the assertion metal balls and calculations cannot determine human safety, calling it "chutzpah!," and he parroted the criticisms of Becker's EE studies that Schwan made in the powerline hearing. Handler characterized Becker's results as "paradoxical," "artifacts," and "not statistically significant." "Perhaps the growth of some mice was indeed stunted," Handler wrote, "but it must have been a very small fraction of the total." Handler falsely asserted that Becker's EE studies of the stress response in animals described in the magazine article were contradicted by results produced by utilities-sponsored research, ignoring that the discoverer of the stress-response syndrome favored Becker and dismissed the utilities research Handler relied on.

When rebuking Becker and his publications, Handler used exactly the same words Schwan and his two co-consultants used when they opposed Becker during their testimony in favor of the utilities. The gist of what the said was that the electromagnetic energy surrounding powerlines operating at 765,000 volts —which extended more than 500 feet on either side of the centerline and was present continuously — would be completely safe in the sense that living in the energy would not produce any physiological changes that could cause or serve as co-causes of disease. Handler used their language to express in the paper his ideological belief the EE from the Sanguine-Seafarer antenna would be completely safe. Some of the opinions Handler expressed in his paper, labeled here as *Handler Answer*, were[5]:

Question What are the biomedical effects of man-made electromagnetic energy, if any.

Handler Answer Obtaining a reliable, definitive answer to that question turns out to be rather difficult, but we can readily provide some gross answers. While there are plentiful data, much of them are contradictory, and some are simply experimentally invalid. Efforts to search for biological effects of electromagnetic energy have been persistent, catholic, and imaginative. The examination has included searches for possible effects on the growth and development of

[5] Handler's irrelevant comments, verbal flourishes, redundant language were removed, otherwise the *answers* were the opinions he expressed in his paper, *Scientific Evidence and Public Decision Making.* They were first offered in 1977 by Schwan and two co-consultants in testimony on behalf of the utilities. The corresponding *Questions* were those posed by the utilities' lawyers to the consultants during their testimony.

plants and animals, for changes in physiological or molecular aspects of cellular metabolism, for genetic and chromosomal changes, and for any effects on the behavior of animals or people. The general conclusion extractable from the sum of these efforts is that if a hazard does exist it has not been demonstrated.

Question Are you saying that you just don't know if there are hazards?

Handler Answer In the absence of any proof and in the absence of any theory that predicts such effects, we are left with the unprovable negative: that there does not exist any danger from electromagnetic energy at the level at which people are customarily exposed. And we are left also with a burden to improve the experimental methods necessary to appraise further those small effects that have been seen to ascertain whether they signal real hazards.

Question What small effects are you referring to?

Handler Answer Many result have been inconsistent, with superficially similar experiments seemingly finding opposite results. For example, one report claimed a significantly increased human reaction time upon exposure to electromagnetic energy of 3 Hz as compared to exposure to 10 Hz, whereas another report claimed that there was an increased reaction time at 12Hz as compared to 2Hz. These results can't both be correct, and probably neither is.

Question Can you describe other instances that in your opinion are examples of inconsistencies?

Handler Answer Two studies assessed the effect of 60-Hz energy on the growth rate of chickens; one found no effect and the second a decreased growth rate. Such inconsistencies have been obtained repeatedly in the history of science, particularly when, as in this case, the effects sought are small.

Question In addition to inconsistencies, are there other scientific flaws in the experiments that Becker and Marino relied on when they testified in this case?

Handler Answer In some experiments, incomplete technical information was provided, in others there was a drawing of conclusions not supported by what purportedly was measured. To illustrate, Soviet investigators reported a number of complaints — listlessness, excitability, headache, drowsiness, and fatigue attributable to exposure to electromagnetic energy. However, a nine-year study of linemen conducted by American power companies found no physical, mental, or emotional effects attributable to exposure to powerlines energy. Similarly, a study in France of people working and living in proximity to powerlines found no increase either in the frequency of visits to physicians or use of medications. Studies in Canada, Germany, Sweden, and Japan have failed to show significant effects on electrical workers from the electromagnetic energy in which they intimately work.

Question Is it your opinion that the absence of evidence is evidence of absence?

Handler Answer In many cases, studies have failed to show significant effects. A reasonable conclusion is that there weren't any.

Question What should the ordinary person think under these circumstances?

Handler Answer The layman should be wary and recognize that conclusions from seemingly positive experiments are tentative at best, and perhaps invalid. American utilities scientists have noted that the Russians found similar results in different working environments, which is suspicious.

Question Do the problems you described also occur in animal studies?

Handler Answer Similar puzzles crop up in experiments with rats and mice. In an experiment conducted by the utilities, for example, there was no effect on either the growth or development of mice that were exposed to very high levels of electromagnetic energy. In contrast to this benign result, Becker and Marino asserted statistically significant decreased water consumption, food intake, and weight gain as well as increased adrenal and pituitary weights and decreased blood steroid levels in rats exposed to lower energy. These results are inconsistent.

Question Why are they inconsistent?

Handler Answer Similar animal experiments should find the same results.

Question Have experiments looked for changes in the chemical composition of the blood, such as serum triglycerides?

Handler Answer In a Navy study by Deitrich Beischer in which volunteers were confined to a small room and exposed to electromagnetic energy, he reported higher tri-glyceride levels compared with controls. But this is slippery ground for public decision because another experiment in which humans were exposed found no differences in other blood constituents. In a related series of experiments conducted on personnel involved in the Navy's Project Sanguine facility at Clam Lake, Wisconsin, supposedly elevated serum triglyceride levels were found in these personnel; but the control subjects lived in Illinois. The best explanation for all these results is that there were no real effects due to exposure to electromagnetic energy.

Question Has the research of Becker and Marino been generally accepted by the scientific community?

Handler Answer Their research and opinions have been rejected as valueless by the rules by which science guards against shoddy work. Their results seem provocative, but they are not believable because they are not real.

In *Scientific Evidence,* Handler made false statements, advanced claims that were simplistic to the point of parody, and deprecated literature reports about biomedical effects of electromagnetic energy, using technical arguments that didn't belong in the mouth of a

biochemist. He plagiarized much of the language in his paper from the testimony which Herman Schwan and his co-consultants provided for the utilities — they were paid witnesses expected to opine as they did, but the leader of the National Academy of Sciences was not expected to pilfer their words and offer them as scientific truth. When Handler lifted the testimony of the utilities' witnesses, he constructively adopted their bias and immorality — relying on rigged utilities studies that manufactured doubt regarding the validity of EE-induced biological effects reported by independent investigators. Handler's paper contained so much fantasy and fustian its conclusion could be rhetorically supported even without invoking testimonies of biassed scientists.

Handler's professed objective when responding to the magazine article was to defend the prestige of the National Academy of Sciences. His unprofessed objective was to protect ongoing implementation of the policy that anthropogenic EE should be considered safe until conclusively proved otherwise by biochemical evidence. His criterion, however, was immoral, because it substituted humans for animals as experimental subjects. Moreover, it was thrice impossible; scientifically, financially and — after obfuscation of the difference between *hazard* and *health risk* ceased — politically. Handler believed he had a right to perpetuate and enforce the policy he created, and sent his paper to the magazine to defend this putative right. In the end, the magazine did not publish Handler's paper and he didn't sue[6]. The ideologically-based policy edifice Handler built in the area of health risks due to man-made electromagnetic energy continued to operate effectively in promoting a public-health fiction — that chronic exposure to electromagnetic energy was completely safe — as if it were a scientific fact.

By the time Handler submitted his manuscript to the magazine, the substantive outcome of his conflict with Becker had already been decided. Becker's research support had been terminated; his laboratory dismantled; his career placed on a fixed timetable for retirement at 56 years of age. The VA's decision to cease supporting regeneration research, which Handler instigated, marked a turning point. With Becker's research laboratory and that of other VA researchers dismantled, progress became agonal. The field he had begun to cultivate — one rich with implications for healing and the electrical nature of life itself — was left untended. Handler's success in halting Becker's work was total, and it was final. Becker's heart regeneration work was shelved.

His spinal cord studies never progressed to the mammalian stage. His efforts to identify electrical conditions for bone and tissue regeneration were terminated. The data remained, but the experiments were done.

The glimmer of a new approach to biomedical research was silenced not by evidence, but by authority. When Handler prevented Becker from receiving any VA or non-VA research funding, he ensured that a vision of biomedical research rooted in measurable phenomena and a rigorous challenge to dogma would be pushed to the margins. No serious alternative explanation was offered for the biophenomena Becker described, and no molecular mechanism was put forward by Handler or his main ally, Lionel Jaffe, to account for the regenerative-type

[6] I strongly urged the editor to publish Handler's paper together with my point-by-point rebuttal, which I furnished him and copied Handler, believing that an open debate with him was the best possible thing that could occur, given his position of great power. Unfortunately, Handler withdrew his paper and never published it anywhere, but I made it and my rebuttal generally available.

electrical signals or their polarity reversals that heralded the blastema formation in lower vertebrates which facilitated occurrence of regeneration.

Handler's paper did not function as a scientific reply, in any ordinary sense, to either Becker's research or its depiction in the magazine article. Instead, it served as justification for actions taken and as a public assertion of his authority to orchestrate them. It was not the content of Handler's arguments — which largely recycled the language and positions previously advanced by industry-aligned witnesses — that was striking, but the confidence with which they were presented. Handler wrote not as a participant in an unsettled scientific debate, but as an arbiter announcing closure.

That confidence did not arise from new evidence or superior analysis. It arose from institutional position. The National Academy of Sciences under Handler's presidency did not merely advise government agencies; it shaped the boundaries of admissible knowledge. Committee membership, review criteria, and the framing of uncertainty were all subject to control mechanisms that favored biochemical reductionism and excluded systems-level biological evidence. The Sanguine/Seafarer review process, the pre-emptive announcement of conclusions, and the treatment of dissenting witnesses were not anomalies. They were expressions of a governing ideology operationalized through procedure.

Seen in that light, Handler's paper appears not as an isolated overreaction to an inconvenient article, but as the visible surface of a deeper pattern: the use of institutional authority to convert methodological preference into enforceable orthodoxy, and to punish those who persisted in advancing incompatible forms of knowledge. The events surrounding Becker were not aberrational — they were diagnostic. To understand why the suppression of evidence, the termination of Becker's research, and the assertion of doctrinal closure emerged as predictable consequences of the system itself — rather than as exceptional responses to particular events — it is necessary at this point to step back from the chronological narrative and examine the structure of power that governed scientific legitimacy under Handler's leadership.

The conflict between Handler and Becker was not a dispute between competing scientific equals. It was an exercise of authority by Philip Handler, acting from the presidency of the National Academy of Sciences, to define the boundaries of legitimate biomedical knowledge and to enforce those boundaries when they were challenged. The issue at stake was not merely how biology should be interpreted, but who possessed the institutional power to decide which interpretations would be permitted to exist within federally sanctioned science. Handler's position at the Academy conferred a unique form of epistemic authority. From that office, he was able to influence committee appointments, shape peer-review norms, and establish methodological criteria that functioned as gatekeeping devices. These mechanisms, in connection with the Sanguine-Seafarer review process, allowed Handler to convert biochemical reductionism from a theoretical preference into an operational doctrine.

Research that conformed to this doctrine was advanced; research that did not was excluded, regardless of evidentiary merit.

Handler's reductionism was not passive or abstract. It was actively enforced.

He treated molecular explanation not as one level of biological understanding among others, but as the exclusive language of legitimacy. Work that addressed biological regulation at the

organismal or systems level — particularly work involving electrical or electromagnetic processes — was dismissed in advance as unscientific because it did not conform to the biochemical framework he championed. In this way, Handler transformed reductionism into a criterion of admissibility rather than a hypothesis open to empirical challenge. The asymmetry of power between Handler and those whose work he opposed shaped every outcome.

Handler could define review standards, influence funding decisions, and legitimize conclusions through Academy imprimatur. Those subjected to these processes could not contest the rules by which they were judged. Peer review under these conditions did not function as a neutral evaluative process but as an enforcement mechanism, ensuring that only research compatible with Handler's worldview survived institutional scrutiny. This enforcement was not impersonal. Handler's conduct demonstrated that he construed challenges to his reductionist framework as challenges to his authority. When that authority was publicly questioned, Handler did not respond by engaging the underlying scientific issues. Instead, he sought to suppress the criticism itself, employing threats of litigation, mobilizing allies from committees he had appointed, and attempting to extinguish the credibility of those associated with the dissent.

The treatment of Robert Becker illustrated how Handler's authority operated in practice. Becker's research posed a direct contradiction to Handler's core assumptions by demonstrating that biomedical regulation depended on electrical and electromagnetic processes that could not be reduced solely to molecular chemistry.

Handler did not refute these findings experimentally. Rather, he used institutional channels — review criteria, advisory influence, and administrative pressure — to ensure that Becker's work was declared inadmissible. The subsequent termination of Becker's VA research support cannot be understood as an ordinary scientific judgment. It was the predictable outcome of a system in which Handler controlled the standards by which validity was defined.

Equally revealing is the contrast in personal conduct. Becker responded to opposition through continued experimentation, careful qualification of claims, and adherence to professional norms. There is no evidence that he sought retaliation or attempted to leverage institutional power against his critics. Handler's behavior, by contrast, exhibits a pattern of vindictiveness once his authority was challenged. The effort to destroy Becker's scientific standing followed immediately upon the failure to suppress the public critique of the Academy's role, indicating that punishment of dissent was not incidental but integral to the maintenance of control. Handler's magazine manuscript represents the culmination of this process. Written after Becker's research support had been effectively terminated, Handler's paper did not aim to resolve uncertainty or advance understanding. It asserted closure. Handler spoke not as a participant in an ongoing inquiry, but as the final arbiter of what constituted "actual scientific knowledge." The paper's tone, its reliance on authority rather than evidence, and its personal attacks all reflect a position secured by power rather than persuasion.

What this episode ultimately revealed was not merely Handler's commitment to reductionism, but his belief that he possessed the right to impose it as national science policy. Under his leadership, the Academy functioned less as a forum for critical evaluation than as an instrument for stabilizing ideological conclusions and excluding incompatible forms of knowledge. Reductionism, once institutionalized in this way, became a means of control. The consequences extended beyond any single career. By enforcing biochemical reductionism as orthodoxy, Handler narrowed the conceptual scope of biomedicine, foreclosed investigation of

organism-level regulatory phenomena, and contributed to a public-health framework incapable of recognizing chronic, emergent risks that could not be demonstrated in short-term molecular experiments. The suppression of dissenting science was not an unintended side effect of this system. It was one of its primary functions.

In the end, the distinction that mattered most was not between competing scientific theories, but between competing relationships to power. Handler exercised authority to constrain biology within boundaries he defined and defended. When those boundaries were crossed, he responded with retaliation rather than reconsideration. The Sanguine-Seafarer episode demonstrated how reductionism, when fused to institutional dominance, ceases to be a scientific method and becomes a mechanism for enforcing conformity.

In the aftermath of his unsuccessful attempt to compel publication of his rebuttal in the magazine, Philip Handler did not retreat from the controversy concerning Academy bias. Instead, he chose a different venue. In late 1980, he published an essay in an Academy volume, *Issues and Current Studies*, in which he directly addressed the mounting allegation that Academy committees were biased in composition, interpretation, and conclusion. His defense was unequivocal. Academy committees, he argued, were not biased at all; they merely appeared so to "those who do not understand how science works." Bias, in Handler's formulation, was not structural but perceptual — a failing of insufficiently trained outsiders to recognize the rigor of science. To illustrate this claim, Handler turned in detail to the episode of the Sanguine-Seafarer antenna.

The episode exemplified the institutional mechanism he created to marginalize dissenting evidence and achieve implementation of the policies he favored. Only after those outcomes were secured routinely did Handler offer his retrospective justification.

The essay was the first and only time Handler explained why he thought the Academy's conduct should be understood not as bias, but as scientific necessity. He used the Sanguine-Seafarer episode as the basis of his explanation not because it was the latest episode in the chronology of bias accusations but because it was, in his view, the most dispositive. The episode allowed him to defend himself and the Academy at the time its authority had been publicly questioned, and to do so retrospectively — after dissent had been neutralized, research terminated, and conclusions administratively secured.

The episode, which took place in the 1970s, reappeared in 1980 because it was only then that Handler felt the pressure to explain why the dubious honesty, objectivity, and scientific knowledge of the Sanguine-Seafarer committee should not trouble the reader.

What Handler offered in his description of the episode was neither discovery nor reconsideration, but what he repeatedly called *closure*. The function of his rehashing was ratification of his committee's decision to give the Navy's antenna a "clean bill of health." Handler did not ask whether the Sanguine-Seafarer review was properly constituted or whether relevant evidence was excluded; he asserted that the process itself guaranteed correctness. The legitimacy of the outcome was said to follow inexorably from the way science is done — by those qualified to do it. Handler began his attempt to secure approval of how the Academy managed the antenna safety issue by framing it as a routine Navy-requested procedural review.

The committees was “assembled with care,” meetings were “intense and open,” and hypotheses were “thoroughly examined,” thus invoking procedural completeness as a substitute for structural transparency. One representative passage suffices: the committee, Handler wrote, “made an intense and open effort to examine all relevant hypotheses and to review all relevant experiments.” His language emphasized how something was done, reassured the reader that steps were followed, and invoked thoroughness, openness, and deliberation. But it did not address who selected the participants, what prior commitments they brought, how evidence was weighted, whether dissenting views were structurally represented, or whether key testimony had been impeached.

Handler’s language was rhetorically powerful because it sounded responsible and neutral, but it was analytically insufficient because it ignored structural bias. He invoked procedural thoroughness as proof of epistemic legitimacy, while avoiding examination of the power structure that shaped the outcome — procedural reassurance presented as proof. Attention was directed away from committee composition, evidentiary asymmetry, and interpretive authority, and toward the reassuring cadence of procedure itself.

Handler then executed the decisive conceptual move on which the entire defense of the Academy’s management of the antenna’s safety issue depended.

The antenna, he wrote, was ”related to electromagnetic exposures from high-voltage powerlines.” On its face, the statement appeared contextual in the sense that, at first glance, in its most obvious reading without examining implications, it looked like harmless background framing that seemed to situate the antenna within a broader technical domain. The statement appeared explanatory rather than strategic, but in fact, it converted history into destiny. By equating the antenna with powerlines, Handler made dispositive the prior sworn testimony of Academy appointees who had already declared under oath that the far stronger EE levels of powerlines posed no health risk. In other words, to a casual reader, Handler’s linkage to powerlines seems like reasonable scientific continuity. But once the history was known —the powerline witnesses were impeached and then appointed to the Academy committee, the composition of which was engineered — the linkage looked determinative. So, what seemed like innocent contextualization had actually locked in the ultimate outcome —if powerline exposure were safe, antenna exposure must be safer still.

The maneuver was doubly hypocritical. First, the testimonies on which Handler relied, that of Herman Schwan and his two co-consultants in the powerline case, were successfully impeached during cross-examination. This was especially true of Schwan;[7] his credibility was so successfully challenged that, in frustration and anger, he suddenly rose from the witness stand and walked out of the courtroom. Handler and Hastings knew these facts but Handler ignored them in his essay. Second, the Sanguine-Seafarer committee was intentionally misbalanced by Handler. Three members arrived convinced the antenna was safe; none were appointed who believed otherwise or were willing to argue the contrary position and, with one exception, none of the other committee members had any experience in the area pertinent to the mission of the committee. This was not inadvertence. It was Handler’s design. His appeal to a parallel between powerlines and the Navy’s antenna thus rested on intentional misdirection layered atop a rigged advisory structure.

[7] The Electric Wilderness. Andrew A Marino and Joel Ray. San Francisco Press. 1986.

Handler's account of committee composition reinforced the pattern of deception. He emphasized the "high repute" of the members while conceding that the chair was "quite new to the problem." Handler portrayed the chair's unfamiliarity as a good thing because, according to Handler, unfamiliarity insulated against bias. He claimed that a chair without domain expertise presiding over a committee dominated by members with strong prior commitments, was desirable because it concentrated interpretive authority, rather than diffusing it. What was described as balance operated as control.

The rhetorical fulcrum of the committee report appeared in a single sentence: "if a hazard exists, it has not been shown." This phrase was not casual. No serious participant in the Sanguine-Seafarer controversy argued that exposure to the antenna's electromagnetic energy was a *hazard*. The contention — which Handler's committee ignored — was always that chronic exposure constituted a *health risk*. By substituting *hazard* for *health risk*, Handler furtively replaced the question under review with one everybody already knew the answer to even before the committee was formed. The absence of demonstrable acute injury was transformed into proof of safety. In this single phrase, Handler corrupted the entire Sanguine-Seafarer review process.

Handler refused to tolerate uncertainty in the context of scientific evidence — he resolved it in the direction consistent with his ideology. Reports suggesting physiological disturbance, stress responses, or organism-level effects were dismissed as inconsistent, methodologically flawed, or "paradoxical." Occupational cohort studies controlled by power companies — particularly those involving utility linemen — were elevated as dependable and decisive. Asymmetric treatment of experimental evidence produced by power-company and non-power-company scientists was Handler's norm — he favored the former and opposed the latter. Evidence suggesting biomedical effects was interrogated until it collapsed; evidence suggesting no effect do to EE exposure was aggregated until it appeared conclusive. Handler presented this as rigor, whereas it actually was fabrication and filtration, two crimes against science Handler could commit with impunity because they appeared in a volume published by the Academy Press

At this point, Handler's essay shifted from science to discipline. He devoted keen attention to the motives and competence of critics. Investigative journalism was dismissed as "scientifically illiterate" and "malicious." Television coverage was ridiculed rather than answered. Allegations of bias were reframed as personal attacks on integrity rather than structural critiques of committee design. Dissent was not engaged but rather was delegitimized. Handler's most extreme claim was that "the seeming bias lay with the observer," an assertion that fully exposed his thinking. Bias did not arise from committee composition, prior sworn testimony, or conflicts of interest — it arose from ignorance. Expertise, in Handler's formulation, was self-certifying. Accountability flowed inward; the Academy's processes were cast as immune to external evaluation precisely at the moment when their credibility had been most seriously challenged.

Handler closed the Sanguine episode by lamenting public cynicism and the erosion of trust in science. He casts himself as custodian of an embattled enterprise, wounded by a culture insufficiently deferential to authority. Read in isolation, the passage might appear reflective. Read in context, it was justificatory. The failure of trust was attributed not to institutional behavior, but to a public incapable of appreciating how science must be done

Handler's essay confirmed the trajectory of his career. The same ideology that governed his committee appointments, reframed *health risk* as *hazard*, shaped peer review, and terminated inconvenient research, reappeared in the essay in polished, retrospective form. What had previously been enforced through procedure was now articulated as principle. The decisions of Academy committees were no longer merely explicable, they were predictable. The Sanguine-Seafarer episode thus stood not as analysis but as doctrine — asserted after the fact, insulated from challenge, and offered as final.

Handler still possessed institutional power and influence but the underlying credibility that made that authority meaningful had been eroded. The doctrine of reductionism he promoted continued to regulate Academy committees and shape biomedical research despite growing controversy and a lack of meaningful oversight.

The possibility he would be held to account for his management of the Academy remained unlikely because he was only months away from the end of his term in office.

What occurred was not evaluation and reconsideration but rather an unsettled aftermath — the consequences that unfold when institutional power persists after credibility has begun to erode and control is maintained without attempting to correct misdeeds.

Handler believed elite scientific committees could settle contentious policy questions through authoritative expertise, but his attempt to elevate scientific authority into a stabilizing force above political conflict proved unsuccessful. With the exception of establishing the doctrine of Handlerian reductionism in federal agencies that funded biomedical research, his effort at exercising control over the government's science policies collapsed, for several reasons. Public trust eroded as controversies over environmental health, toxic chemicals, electromagnetic energy, and what biomedical science was, revealed conflicts of interest and committee bias. Congress and regulatory agencies ceased ceding authority to the Academy, leading to a precipitous decrease in the demand for Academy advisory reports, particularly in the most important areas. Scientific authority itself became contested, especially in biomedical research where experimental evidence regarding emergent biomedical phenomena challenged the established paradigm. And perhaps most significantly —largely in response to Handler's efforts to implement his ideology — biomedical science split into two species, university scientists and industry scientists, who differed in their views of what biomedical science was based on, the motives that prompted their work, and who employed them. Science in many different contexts became recognized for exactly what it was — an adversarial social process at two levels — scientist vs. scientist and scientists vs. non-scientists. That development alone would probably have been enough to explain why Handler's grand plan to raise science to the level of a fourth estate never materialized and that, instead, the scientific establishment became subjected to scrutiny, criticism, and political contestation. His plan had been to recast the National Academy of Sciences as an institution independent of executive or congressional control, with a budget fixed by law, answerable only to a committee of scientists appointed by other scientists. The plan failed because the authority of organized science proved neither politically sustainable for the reason that it was undemocratic, nor publicly acceptable given that the primary interests served were those of science rather than the public.