C. G. Aulisio in 1967 . . . but no action was taken to correct the deficiency then or since." Aulisio was told he could not seek collaborative help within or outside the DBS to evaluate the problem, the Morris-Turner indictment states.

The Benenson committee agrees that the test in question would not detect all the viruses concerned and admits that one lot of measles vaccine was passed by the DBS on the basis of this inadequate test. This, says the committee, was an "improper deviation from the published requirements."

Discouragement by the DBS management of important scientific work. The principal and most serious charge of the Morris-Turner indictment is that the DBS has deliberately discouraged research by DBS scientists which would adversely affect vaccines. This charge is documented by reference to three individual scientists—Eddy, Morris, and Aulisio. The indictment suggests that other scientists have left the DBS because they lost support after taking positions that were not in favor with the DBS leadership.

Aulisio is the DBS scientist who Morris and Turner say was ordered to abandon his study of virus-like particles in duck eggs. Morris was relieved of his duties as influenza control officer in 1966, 2 days after he had informed DBS director Murray of the results of a field trial indicating that influenza vaccine was inefficacious. From then on, Morris's support was progressively whittled away by his supervisors, one of whom even ordered the destruction of some 5000 mice being held on long-term influenza and scrapie virus studies. A Civil Service grievance committee upheld Morris's claim that he had been harassed by the DBS management but made no finding on Morris's imputation of the DBS's motive in so treating him. (The DBS management claimed Morris's support had been removed because of his failure to communicate with his supervisors.)

The third instance, that of Bernice Eddy, is perhaps the most anomalous of the three. The harassment of Eddy at the time of the SV40 affair by her supervisor Smadel went to such lengths that a colleague, Lawrence Kilham, now at the Dartmouth Medical School in Hanover, New Hampshire, protested to the office of the Surgeon General. In a letter of 13 June 1961, Kilham wrote: "[Eddy's] work is more outstanding than that of any scientist in the DBS today and yet the proposition is to take away many facilities and trained personnel which she needs and at the crucial point when her main research is reaching fruition. . . . Many scientists at the NIH are extremely dissatisfied with the conditions that prevail. A true intellectual atmosphere is practically nonexistent."

The record of Eddy's treatment by the DBS management provides one of the stronger items of evidence in support of the Morris-Turner thesis. In 1954 Eddy, as polio control officer, found live virus in supposedly killed polio vaccine; in 1955 she was relieved of her duties as polio control officer. In 1960 Eddy, as influenza control officer, remarked on the inaccuracy of the CCA test for assessing influenza vaccine and was removed from the control duties on the vaccine, with which she had worked for the past 16 years. After her discoveries concerning the SV40 virus, her staff and animal space were reduced and she was demoted from head of a section to head of a unit. Eddy's supervisor during this time was Smadel, who died in 1963, but many of the memoranda of the period pass through or emanate from the present director of the DBS.

The Benenson committee, in effect, sidesteps this charge by saying that the personnel problems of the DBS fall within the purview of another group, the Schriver committee, which was appointed by Marston to examine the administrative affairs of the DBS. Nevertheless, the Benenson report assents to the important point that "such interpersonal difficulties must interfere with the effectiveness of the overall program."

The significance of the Benenson committee report was that it at least showed the existence of another side to some of the questions raised by Morris and Turner. But the committee seems to have believed that the weight of its collective authority would in part substitute for facts in denouncing the conclusions of the Morris-Turner indictment. Geoffrey Edsall, of the Massachusetts Department of Public Health, a member of the DBS board of scientific counselors, wrote to Senator Ribicoff on 26 January this year: "I am deeply concerned that you are willing to place your faith in three relatively unknown scientists and a young lawyer, and yet to apply the term 'whitewash' to the considered judgment and evaluation of the eleven able and distinguished scientists—professors, a Dean and a Nobel Prize winner—who conducted the formal review of the Morris-Turner charges."

Professors and deans, however, do not hold a monopoly on truth and the Morris-Turner indictment would seem at the least to substantiate that serious personnel problems have afflicted DBS scientists over a long period and that there was a lack of evident aggressiveness on the part of the DBS management in resolving scientific issues such as the testing of influenza potency. (Management of research in the DBS will be considered in a future article.) Whether or not the DBS management has deliberately discouraged research relevant to vaccine control is a harder issue to assess. But Morris and Turner at the least have done no harm to the public interest in asking that this and other issues at the DBS be looked into.

—NICHOLAS WADE

Office of Technology Assessment: Congress Smiles, Scientists Wince

In what can only be regarded as a minor miracle of legislative revival from the dead, the House of Representatives on 8 February approved former Congressman Emilio Q. Daddario's 1967 plan for an Office of Technology Assessment (OTA) for Congress.

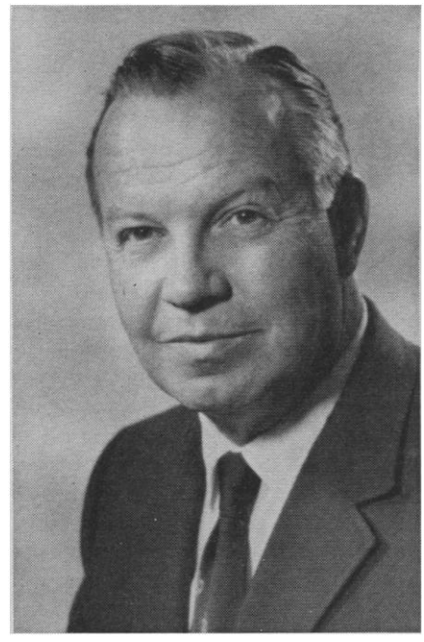
The sudden introduction of the measure, the swift, hour-long debate, and the substantial (256 to 118) vote in favor of the bill was a revelation that technology assessment has been in recent years not dead but only sleeping. The legislative Lazarus is scheduled for immediate (2 March) hearings in the Senate, and floor debate and vote is likely to occur soon thereafter. But many high priests of science, with a bow to their old pal Daddario, are highly skeptical of the measure.

In the current bill the OTA would produce "technology assessment" studies of such live-wire issues as the SST and the antiballistic missile, petroleum reserves, or electric cars. The OTA would consist of a small core staff who some estimate will number 20 and others say could be 100. There would be a director (allegedly some people are already politicking for the post), and a board of directors who now would be congressmen, but who were originally to include four presidential appointees. Budget for the first 2 years would be $5 million; other congressmen say it would rise soon thereafter to $10 million per year. Studies would be made only at congressmen's requests and would be performed outside—but it is unclear which groups would get the contracts to make the objective and impartial studies that the congressmen are dewily anticipating.

But the primary doubt about the measure comes from scientists and some congressional staffers who are veterans of technical and political scuffle and know, firsthand, the scope of the problems involved. Some simply don't believe that "technology assessment," as such, is a meaningful term. If the term is interpreted too narrowly, an office of technology assessment could warp the free, creative development of American science and technology. "I hope you give technology assessment a black eye," reacted one scientist in industry when asked for his opinion of the concept.

The technology assessment idea is largely the brainchild of Daddario (who stages a comeback this week as a star witness before the Senate subcommittee). Daddario, during his tenure as chairman of the House subcommittee on science, research, and development of the Committtee on Science and Astronautics, began discussion of technology assessment in 1965. A bill was introduced in 1967, but, according to staffers, it was intended only for "discussion purposes." The committee asked subsequently for four separate studies on technology assessment to back it up (see *Science*, 14 November 1969). A seminar was held in 1967, for "a lot of blue sky types."

However, blue sky types are not the sort of people who get legislation through Congress. In fact, the legislative progress of technology assessment under Daddario proceeded at a speed only comparable to that of the advance of the Ice Age. Not until 4 years after the idea was introduced, in 1969, did the Daddario effort produce a serious bill proposing technology assessment machinery for government. The following year, 1970, Daddario resigned his congressional seat to run for governor of Connecticut (he did not win the election).



Representative John W. Davis

Daddario's successor to the subcommittee chair is John W. Davis (D–Ga.), a veteran Southern Democrat. Daddario is the intellectual father of the Office of Technology Assessment, but Davis appears to be the man who will probably get credit for OTA's actual creation. Finally, late last year, the measure was presented to the House Rules Committee (which was tied up with other pressing congressional proposals), but it declined to clear the bill for floor debate and a vote. However, in late January, the rules committee took up the bill and quickly approved it. The floor debate and passage of the bill followed a little more than a week later.

Why the sudden breakthrough, 7 years after the idea first came up? None of those connected with the bill claim to know the answer, but two possible causes are often cited. The first is that the new subcommittee chairman, Davis, is politically close to his fellow Southern Democrat William M. Colmer (D–Miss.), who is one of the kingpins of the House and chairman of the key House Rules Committee.

A second explanation is that congressional frustrations in obtaining technical information have mounted rapidly since the Nixon Administration took office and became embroiled in bitter dogfights with Congress over the ABM and the SST. Historically, Congress has had virtually no technical expertise among its members or staff. It has had only the General Accounting Office (GAO) and the Library of Congress's Congressional Research Service (CRS) for conducting its own studies. In the past, Capitol Hill has had to rely on the executive agencies for technical information. Furthermore, under the Nixon Administration, the executive agencies are less cooperative in handing out data in answer to congressional requests. This trend is creating pressure within the Congress to set up a technical information service of its own. Hence the sudden popularity of technology assessment.

Whatever their motives, the members of the House who debated the technology assessment bill were generally rapturous. Richard T. Hanna (D–Calif.) said that the current congressional work load is "so great it would give the Jolly Green Giant a double hernia" and inquired, "Who is in charge?" As politicians will, he answered his own question, saying that the "avalanche" of "so-called progress" created by technology is, "whether we like it or not, who is in charge." John F. Seiberling (D–Ohio) said that without an OTA to aid it, Congress would be threatened by an erosion of its Constitutional authority. Alphonzo Bell (R–Calif.) said that the OTA would have had "an invaluable role" in the ABM and SST debates, and called OTA's assignment a "comprehensive intelligence gathering and early warning system for the Congress." But, reassured Jack Brooks (D–Tex.), Congress is not setting up a batch of scientists to run its business for it. "I am convinced . . . the experts should be on tap, not on top," he said. Finally, mixing his sciences and his metaphors, John B. Anderson (R–Ill.) declared that the future OTA will "crystalize a concept that has long been percolating in this body."

Enthusiasm notwithstanding, the technology assessment bill seems to present problems. First, the well-meaning lawmakers hold widely varying views of what OTA will do. The language of the bill suggests a sort of scientific DEW line, but many representatives simply see it as another research office.

One camp views OTA's functions as being very grand. OTA will be a "technology-predictive tool," said Thomas M. Pelly (R–Wash.). It will examine, he

Lawmakers Lack a Crystal Ball

Many scientists have doubts as to what, exactly, technology assessment is. But Congress, in recent weeks, has become suddenly enamoured of the idea of setting up an Office for Technology Assessment, to research all kinds of technology-related problems. The preamble to the bill, (H.R. 10243) passed by the House of Representatives on 8 February and now before the Senate, explains why.

"Emergent national problems, physical, biological, and social, are of such a nature and are developing at such an unprecedented rate as to constitute a major threat to the security and general welfare of the United States . . .

"The growth in scale and extent of technological application is a crucial element in such problems and either is or can be a pivotal influence with respect both to their cause and to their solution.

"The present mechanisms of the Congress do not provide the legislative branch with adequate independent and timely information concerning the potential application or impact of such technology, particularly in those instances where the Federal Government may be called on to consider support, management, or regulation of technological applications.

"It is therefore imperative that the Congress equip itself with new and effective means for securing competent, unbiased information concerning the effects, physical, economic, social and political, of the applications of technology, and that such information be utilized whenever appropriate as one element in the legislative assessment of matters pending before the Congress."—D.S.

said, "the effects of the choice of a particular technology at a time when the application of that technology lies in the future, or is still hypothetical." [In fact, the merits of the technology assessment office and its governing board began sounding so fantastic that H. R. Gross (R–Iowa) got fed up and snapped, "Perhaps this Board could give us some advice before we get into another war. . . ."]

At the opposite end of the spectrum John J. Rhodes (R–Ariz.) termed OTA simply "a clearinghouse" and "a purveyor of knowledge which has been gathered by other governmental or nongovernmental bodies." Many of the representatives compared OTA with GAO, but Representative Gross declared, "there is no similarity whatever with the General Accounting Office. . . ."

Technology assessment, like motherhood, is hard to oppose. But there seems to be a plethora of views on what, exactly, it is. Many of the ingenuous lawmakers said that they were looking forward to the "objective" and "impartial" studies that OTA would produce on such complex matters as the SST. But the Davis committee's most recent report, which even attempts some sample technology assessment studies, says impartiality is impossible.

Conducted by the CRS, which has a reputation for milk-toast responses to the issues of the day, the report concludes: "A technology assessment institution . . . cannot exclude all bias. . . . Bias lurks in the basic assumptions, explicit or implicit, in every study. It is found in the omissions and neglected challenges. Selection of factual evidence to present, since no study can accept all evidence, is subject to bias. Sometimes even the order in which the elements of the analysis are presented reveals bias. The author of a technology assessment must not claim, therefore, that his is the last word on the subject. . . ."

There are vast differences, too, on what a technology assessment study should include. The language of the bill calls on OTA to list the "physical, economic, social, and political" effects of a technology. Yet in this February's *Scientific American*, two Cornell scientists, Raymond Bowers and Jeffrey Frey, have published a technology assessment of future microwave devices, in which they specifically disclaim any ability to predict the social impact of widespread use of them.

Many scientists simply believe that these impacts cannot be foreseen, hence to predict such effects is at best a relativistic exercise. Harvey Brooks, Dean of Engineering Sciences and Applied Physics at Harvard, says, "The assessments will be probabilistic. Assessments will identify the issues to be resolved, the pros and cons and alternatives. But if the Congress expects the office to come up with a go or no-go answer, it is totally naive. If they tried to do that, they'd get clobbered. . . . But I think such an office could do a great deal to illuminate the issues." Brooks says he believes an OTA could have helped Congress on the SST dispute.

But a prominent government scientist, who asked not to be identified, takes a more negative view. He does not think that an OTA would have altered the ABM debate very much. "In private industry, the president of a company can make his own evaluation of which product the company should build. . . . But in government, issues become focused only after millions of dollars have been spent.

"The Congress doesn't have the option of buying various products off the shelf. On issues like the SST—we literally made a decision to go or not to go. There is no room for comparison and alternatives.

"An office of technology assessment will come up with a long list of things we don't know. For politicians opposed to a given project, it will supply grounds for not going ahead. One effect of such an office will be to take more time on big projects."

An even more drastic fear in the scientific community is that technology assessment—in the most rigid sense, that of predicting and then directing technology—could warp the creativity of American R & D. William O. Baker, who is vice president, research and patents, of Bell Laboratories said in an interview that he feared crude arbitration of technical development by Congress. "Technology assessment can subvert the principles at the very heart of free choice in democracy," he said. "There is no basic or natural concordance between the capability to do science and technology and the public purpose. The efforts of making technology assessments may well destroy the long-range values of the technology itself. When you attempt to prejudge certain alternatives, you thereby bias possible later and realistic choices of action.

"Technological development flourishes

only with a more delicate balance."

The sudden emergence of a real, live technology assessment bill has sparked many emotions—from the fatigue of legislators tired of wheedling facts from executive agencies to the fears of some scientists that Congress may now embark on a clumsy, destructive attempt to manage national R & D.

The fact is that no one—neither scientists nor lawmakers—has a clear idea of what sort of creature the OTA will be or what it will and will not do. But Congress seems prepared to rush ahead anyway. —DEBORAH SHAPLEY

Carlsberg Laboratory: Ferment over Future of Copenhagen Lab

The Copenhagen breweries, which are the fount of one of Denmark's premium exports, have also been the source of support for a research laboratory of international standing. For a year or more, however, misgivings have been mounting among Carlsberg Laboratory alumni in the United States and elsewhere that changes in the laboratory's status threaten its essential character.

Special concern appears to center on the laboratory's chemical section, which was headed successively by two remarkable men, S. P. R. Sørensen and Kaj Lindstrom-Lang, in the period spanning the first six decades of the 20th century. Particularly in the 1950's, when Lang was director, the Carlsberg Laboratory provided an important formative experience for a generation of distinguished researchers during a vital period for protein chemistry.

A clear prognosis for the Carlsberg Laboratory is hard to establish, since its future hinges on decisions in which the Danish government and academy of sciences, the Carlsberg Foundation (which has funded the lab), and the Carlsberg-Tuborg breweries must all participate. Furthermore, negotiations are being carried on so deep in the Danish establishment that there has been no real airing of the matter in the press and even researchers in the laboratory are uncertain of how things are going.

Most important of the known facts, however, is that control of the laboratory has been transferred from the foundation to the breweries. Under the terms of the transfer, the laboratory is to retain its character as a separate entity, but the transfer, combined with the lack of information about future plans, has raised apprehension among scientists that the lab will lose its autonomy and its identification with fundamental research.

The transfer follows the merger of the Carlsberg and Tuborg breweries. This merger changed the Carlsberg Foundation from owner of the Carlsberg brewery to majority stockholder in the combined operation. According to those involved in working out the new relationship between the laboratory and the breweries, it is not the merger that forced changes in the lab's operations but the costs of running the laboratory. These costs have risen rapidly in recent years and have exerted a financial strain on the foundation, which has other heavy commitments.

The issue is complicated by historical, legal, and personal factors, and this account is necessarily incomplete because it is based primarily on conversations with alumni of the laboratory who are now in the United States and on access to correspondence with individuals involved in the negotiations. It is clear, however, that the Carlsberg Laboratory occupies a special place in Danish science, and its fate is not likely to be settled simply by reference to a profit and loss statement.

The Carlsberg Laboratory was established nearly 100 years ago by J. C. Jacobsen, founder of the Carlsberg brewery. Jacobsen was a quintessential 19th-century figure, with scientific interests which he applied to brewing with spectacular success and philanthropic inclinations which he followed to the considerable benefit of Danish science and culture. Jacobsen created the Carlsberg Foundation in the 1870's and ultimately made it heir to his brewery. Foundation funds now go to the support of three departments—the laboratory; a program of grants in the physical sciences, mathematics, and the humanities; and a national museum in a Copenhagen palace that was restored through the foundation.

The Carlsberg Laboratory was created in 1875, when Jacobsen replaced a small lab serving the brewery with a separate laboratory that was to have two sections devoted to work on chemical and physiological problems broadly related to the brewing process. Jacobsen meant his brewery as a model for the industry and decreed that there would be no proprietary secrets, including the improved fermentation process that contributed much to Carlsberg's success. In the laboratory, the same rule was applied to results of experiments, and the Carlsberg Laboratory had its own journal almost from its earliest days.

Jacobsen's assumption seems to have been that the interests of brewing should be primary in the laboratory, but he specifically allowed scientists to work in a "second direction," thus recognizing the value of free research.

Starting with Johann Kjeldahl, who is remembered for his development of techniques of nitrogen analysis and who first headed the chemical section, Carlsberg scientists pushed the founder's concept to the limits. In 1901, Sørensen took over the chemical section; in the first decade of the century, he gained international notice for enzyme studies and achieved the first really accurate method for the determination of *p*H. He established the laboratory's traditional interest in protein chemistry, and during the 1930's an increasing flow of visiting scientists came to the Carlsberg lab to work with Sørensen and with Linderstrom-Lang. Lang, who was trained as a chemical engineer, came to the laboratory immediately after World War I as Sørensen's assistant. A versatile scientist with a special gift for conceiving and designing experiments, Lang's interests moved from colloidal chemistry to the structure of proteins. Then, in the 1930's he collaborated with Heinz Holder, who later became