Health, Education, and Welfare failed to uphold Morris on most of the allegations. In a murky report issued on 20 May 1976, the examiner found that Morris's superiors exercised poor judgment in some instances, but in no case did the examiner conclude that Morris had been harassed.

The hearing on the proposal to fire Morris produced mixed results. The examiner in that case agreed with many (though not all) of management's charges that Morris had been insubordinate and scientifically inefficient. But he found the transgressions too trivial to warrant dismissal. Instead, he recommended that Morris be suspended for 5 days without pay. But Food and Drug Commissioner Alexander M. Schmidt, basing his decision solely on those charges which had been upheld by the hearing examiner, fired Morris effective 16 July (*Science*, 30 July 1976). The appeals process which begins shortly will consider whether that punishment fits Morris's crimes.

Thus the feud seems destined to continue—underlining the tremendous waste involved when deeply committed individuals work at cross purposes. Morris is energetic and dedicated in pursuit of what he perceives to be the public good. He often uses his personal funds to finance trips or scientific work that he believes crucial to gain understanding of vaccine safety. He seems to have the respect and affection of his staff. Yet he does not converse easily with many of his scientific peers and he is at perpetual war with his superiors. Many scientists close to the situation put most of the blame for the friction on Morris. But one hearing examiner concluded that both Morris and the Bureau administrators "have contributed to the atmosphere of noncommunicativeness." Wherever the fault lies, an observer can't help feeling that enormous energies have been expended on essentially pointless hostilities by scientists who supposedly seek the same goal—safe and effective vaccines.—PHILIP M. BOFFEY

Legion Fever: Postmortem on an Investigation That Failed

It has been nearly 4 months now since Legionnaires' disease took the lives of 29 men and women who were directly or indirectly associated with the Pennsylvania State convention of the American Legion that was held in Philadelphia last 21–24 July. The disease, which begins with flu-like symptoms, made another 151 persons sick, all within a matter of days after the convention.

Initial confidence that the cause of the malady would be expeditiously revealed as batteries of laboratory tests were completed has long since faded. Now, the best guess is that no one will ever know what caused Legion fever, although studies are still going on. As this story goes to press, a congressional hearing on what, if anything, was wrong with the investigation of the outbreak is getting under way in Philadelphia under the chairmanship of Representative John M. Murphy (D–N.Y.), who heads the House subcommittee on consumer protection and finance. In a widely leaked "confidential investigative report" dated 27 October, Murphy declared, "It was totally unacceptable that in a country of 220 million people, supposedly with the most advanced technology in the world, we find ourselves in a position of not knowing what happened in Philadelphia and, even worse, not being in a position to prevent it from happening again."

It is hard to cope when science fails. One expects an answer, and, when it does not come, one naturally tries to affix blame. It is more intellectually satisfying than accepting science's failure. And so the time has come for a postmortem on the search for the cause of Legionnaires' disease, but it is by no means certain that it will be possible to pinpoint the cause of failure any more than it has been possible to pinpoint the cause of the disease. Lately, a lot of criticism has been leveled against the federal, state, and local authorities who conducted the search, with the brunt of the allegations directed at the Center for Disease Control (CDC) in Atlanta whose officials became the de facto leaders of the investigation when state health officers invited their help on Monday, 2 August—day one of the investigation.

Critics, who count many toxicologists among their number, are quick to point out what should have been done, their principal complaint being that no one seriously considered toxic poisoning until the virologists and microbiologists ran into trouble in their pursuit of viruses, bacteria, and fungi. But the principal investigators reply that, given certain practical realities in the situation they faced in Pennsylvania, if they had it to do over again, they would do things pretty much the same way.

As is now well known, when the investigators did turn their attention to toxins, they discovered that tissue samples from the dead or ill were inadequate in both quanity and quality for their needs. And Congressman Murphy, who calls the entire investigation a "fiasco," concludes that "it appears to be the consensus of opinion that the failure to save, take and keep free from contamination the tissues of the victims of this epidemic is clearly the reason that ultimate resolution of the cause of Legionnaires' Disease may never be found." Actually, it is not all that clear. If the epidemic was caused by an organic chemical, it is possible that it would have been cleared from the victims' bodies before tissues could be collected. But the matter of "thinking toxins" in this chemically polluted world that the whole episode has raised is an extremely important one.

Last August people started out thinking swine flu. The idea, if not the virus, was in the air. And the disease that the victims had looked very much like a severe flu complicated by viral pneumonia. Furthermore, during the first few days it was not clear whether the disease was contagious. Pennsylvania State health commissioner Leonard Bachman told the press he even imagined having to impose quarantines or seize temporary control of hospitals.

Pennsylvania State, city of Philadelphia, and CDC health officers reviewed what had happened and answered questions on their performance recently at a meeting that the local chapter of the American Lung Association sponsored in what its president described as an effort to improve the association's image. It was held in the pink- and gold-domed cameo room atop the Bellevue Stratford on 15 November, just 3 days before the hotel, which had been headquarters for the convention, closed its doors, the 30th fatality of Legionnaires' disease.

It was during the week of 26 July that

Legionnaires first became ill and two died. But it was not until Friday, 30 July, that anyone had even a clue that something was awry. Dr. Ernest Campbell of Bloomsburg had three patients with similar symptoms—chest pains, high fever, and lung congestion—and that afternoon he called the state health department to arrange for laboratory tests, only to be told not to send anything until Monday. On Saturday, Robert G. Sharrar, chief of communicable disease control for Philadelphia, recalls getting calls at home about a patient with what appeared to be viral pneumonia and one with what looked like mycoplasmic pneumonia. But, he says, for a city the size of Philadelphia, that did not appear so odd. And so it was not until Monday morning, 2 August, that health officials first realized that they had an epidemic on their hands. By then, they had learned that eight convention-goers had died and many more were ill.

Once people realized there was a problem, they acted quickly. State and Philadelphia health departments set up hot lines, and CDC dispatched three members of its epidemiological investigation service (EIS) when the state asked for help. (The CDC has no direct authority in local health matters and becomes involved only by "invitation" when its investigative or diagnostic services are needed.) The next day, more EIS officers were sent to Pennsylvania—20 in all. But, by then, although no one knew it, the epidemic was subsiding and many of those who died of Legion fever had already been buried. As H. Bruce Dull of CDC commented, "The epidemiologist rides to glory [or defeat] on the crest of a downward curve."

Specimens from recently deceased or hospitalized Legionnaires were rushed to state labs and flown to CDC. And the hunt for the swine flu virus was on. According to virologist Jay E. Satz of the state health department, for purposes of virological and microbiological analyses, the samples they received were fine—properly taken, in adequate quantity, and fresh. If the disease was caused by a microbe, they would find it.

Meanwhile, in Washington members of Congress who had been struggling with the unwieldy swine flu program and the refusal of vaccine makers to produce without insurance were frantically calling hearings. The House held one on Tuesday, 3 August. The Senate scheduled one for 5 August, and staffers were confident that by then they would know not only whether Legion fever was really swine flu but, if not, what it was. The first round of laboratory tests would be complete and the expectation that there would be an answer was great indeed.

It was only at the end of the week, when the disease turned out not to be swine flu, and not one of more than 50 viruses, bacteria, and fungi tested for, that the possibility of a toxin obviously gained prominence. But the time to start looking had passed with respect to many candidate agents.

The question that is now being asked is whether the investigators are culpable for what they did not do. The possibility of a toxic cause was certainly considered at the outset, but its probability was judged to be low and the emphasis was placed on microbes first. Had the investigators been right, if Legion fever had been caused by a virus, for instance, they would have been instant heroes. Being wrong has made them look like villains.

Congressman Murphy, fed by criticisms his staff unearthed in an inquiry into the toxin theory, lambastes the CDC and others for concentrating on swine flu in the face of "warnings from highly qualified professionals" that the symptoms were not compatible with swine flu but were like those of toxic poisoning. "This," he says, "the medical sleuths chose to ignore." Murphy goes on to level criticisms of the failure to look instantly for outside advice, particularly among the faculty of Pennsylvania's many medical schools. (One toxicologist interviewed by Murphy's aide suggested, for instance, that there might have been a statewide faculty meeting of sorts at which any interested scientists could speak.) "Some governmental experts, who are highly regarded among themselves, are not nearly so well regarded by others who by reputation and assignment to reputable medical facilities are the possessors of impeccable credentials," Murphy snipes in his report which is not entirely reliable.

Impeccable credentials are one thing; solutions to the problem are another. It does seem that, in the matter of seeking outside advice, CDC failed when it comes to public relations. CDC director David Sencer, who was unavailable for comment to *Science*, is said to be jealous of his turf and not prone to turn too quickly to outsiders for advice. *Science* has documented several instances in which toxicologists tried but were unable to get through to CDC or state officials to offer their advice. Understandably, they were put off by being put off. And, it is safe to say that CDC's capability in toxicology is not nearly as great as it might be, so these volunteer toxicologists felt doubly unhappy at being left out.

But it is not apparent that this situation involving poor communications at the opening of the investigation materially hampered progress. David Fraser, who directed the CDC effort, points out that on the evening of day one, Sencer held a meeting with 20 CDC scientists, going around the room asking for speculation on possible causes. Furthermore, once the first harried days had passed, CDC did begin thinking about outside expertise. In August, CDC convened a panel of epidemiologists; in September, pathologists; in October, "senior infectious disease" people who were asked to review everything and second-guess the agency's handling.

Investigation Not Flawless

This is not to say that the legion fever investigation was flawless. Quite the contrary. Three distinct health agencies were involved, each with its own sense of importance, and although CDC lead the effort, it certainly had no authority to tell state and city officials what to do. There was a certain amount of squabbling, there was concern about who would look best with the press (the governor of Pennsylvania himself stepped in to make the announcement that it was not swine flu, for instance), there were conflicting instructions, and instructions that never percolated down through the hierarchies to persons working in the field. There were errors.

But there was also an enormous amount of work that went reasonably well. The patients and their families were interviewed and questionnaires were sent to convention-goers to establish patterns of activity that might be relevant. What did you eat? Where did you stay? Which hotels did you enter? Did you drink any water? Did you smoke any of the cigarettes that were being handed out free? Dozens of questions like these were being analyzed by one group of epidemiologists while environmental toxicologists were examining the air conditioning system, collecting samples of drapery and carpet material and checking hotel records for evidence that welding or similar work had gone on during the convention.

In addition, epidemiologists checked local hospitals for pneumonia cases and discovered what they called "Broad Street pneumonia," a disease that is similar to but not exactly like Legion fever, that was identified in 39 individuals who had nothing to do with the convention and never entered the Bellevue Stratford, but were in the neighborhood, on Broad Street.

In the end, as CDC's Fraser reported at the Lung Association's meeting, they could draw only a few conclusions. There may be a correlation between get-

ting Legionnaires' disease and the amount of time spent in the Bellevue's lobby, or drinking water in that hotel. But it's just a correlation and none of the evidence fits all of the cases, or even most. The disease was more likely to strike those who are older and who have some preexisting heart or lung condition, but that is no surprise.

The possibility that Legionnaires' disease was no accident has been raised and everyone concedes that it could have been sabotage. Murphy, at the Congressional hearing, expects testimony to the effect that if it were deliberate, a protein extract of castor beans called ricin, that was studied by the military, would be a candidate. But no one has any evidence that it was sabotage, and no one can prove that it was not.

It is logical to ask what one would do if a situation like this developed again. What would happen next time? CDC has said that it would like more money to beef up its capabilities in toxicology, but there is apparently no strong feeling that substantial changes in procedure are in order. But surely there will be suggestions and, for a while at least, pressure from the outside for plans to preclude another such epidemic from slipping away unapprehended.

Telephone interviews with individuals who have been asked to testify at the hearing provided *Science* with an indication of what those suggestions will be. First and foremost, of course, is the idea that epidemiologists must in the future take toxins into account from the start. Another is that one should call immediately on the expertise of the FBI, the CIA, and the army's authorities on biological and chemical warfare. A representative of the Armed Forces Institute of Pathology will suggest that it routinely be considered as a source of expert advice on toxicology and data analysis. And Murphy himself is reported to be thinking about establishing some central authority, perhaps in the office of the secretary of Health, Education, and Welfare, to coordinate the activities of several relevant agencies and oversee the whole show.

"Thinking toxicology" certainly makes sense, not just in anticipation of some mysterious epidemic but also in terms of the broad relationship between environmental chemicals and health. But it is not immediately obvious that a massive legislative effort for bureaucratic reorganization is needed, because it is possible that even if this investigation had gone off without a single hitch, the mystery would remain. As Dull says quite aptly, "It is just so hard to accept the fact that in 1976 there are some things we don't know."

—BARBARA J. CULLITON

Amphetamines: Tighter Controls on the Horizon

The abuse of the central nervous system stimulants known as amphetamines has dropped since "speed" had its heyday in the 1960's. But amphetamine abuse is still a major problem in terms of physical damage and emotional dependency. And despite the fact that manufacture and distribution of the most dangerous varieties of the drug have been under strict federal controls since 1971, it still seems to be available to anyone who wants it.

That's what Senator Gaylord Nelson (D–Wis.), chairman of the monopoly subcommittee of the Senate Small Business Committee, heard in 5 days of hearings he conducted last month on the safety and efficacy of antiobesity drugs.

The major condition for which amphetamines and ampetamine-like drugs (amphetamine congeners) are legally prescribed is obesity. But the evidence is strong that for most of the 2.25 million Americans estimated regularly to take prescribed amphetamines—not to mention uncounted users who buy them on the street—the drugs are not primarily being used for legitimate medical purposes.

It has been 6 years since Congress passed the Controlled Substances Act, which enabled the government to put restrictions on the production and distribution of licit drugs that are subject to abuse. Amphetamines and their congeners are controlled under the law, which has sharply reduced prescriptions of the formulations thought to be most dangerous. But the act seems to have reached the limits of its effectiveness, because the level of amphetamine consumption, according to Food and Drug Administration (FDA) statistics, has remained constant over the past 3 years. Furthermore, consumption of amphetamine-like drugs has gone up and there are many experts who believe their potential for abuse is almost as great as it is for amphetamines.

This phenomenon, combined with accumulating evidence to the effect that diet pills are of marginal use in combating fat, has led Nelson to conclude that, according to an aide, "the time is ripe" for amphetamines to be wiped off the market altogether, and for stricter controls to be put on other sympathomimetic diet drugs. There remain two respectable applications for at least one amphetamine congener—Ritalin (methylphenidate)—which are narcolepsy and childhood hyperkinesis. Ritalin is not used as a diet drug but it and Preludin (whose only indication is for obesity) are said to be the most heavily abused drugs in the amphetamine family.

It has been 4 years since an FDA advisory panel concluded that amphetamine-type diet drugs were "clinically trivial." The preponderance of testimony from nongovernment witnesses at the hearings was to the effect that the drugs are neither safe nor efficacious. They curb appetite for a short time, but tolerance is quickly built, and if the pills are withdrawn the appetite returns in full force. Tentative evidence was also presented that these pills taken in the early weeks of pregnancy may cause fetal heart defects and other malformations.

Now, judging from what government witnesses said at the hearings, it appears that the FDA and the Drug Enforcement Administration (DEA) are getting ready to agree that the abuse potential of many of these drugs outweighs whatever short-term benefits they have in helping obese people change their eating habits.

As J. Richard Crout, director of the FDA's Bureau of Drugs, testified, in view of the failure of the Controlled Substances Act to minimize abuse, "the only meaningful next step which can be taken is to remove the indication for obesity from the labeling for amphetamines or to remove them from the market." Since obesity is the only indication for some, changing the label would be tantamount to outlawing them altogether.

It has been more than a dozen years since various groups, including members of Congress, have been attempting to