chanical design science but have not yet been enabled to fund major research programs. Major long-term academic research has proved to be cost-effective and productive of new technology, and it is now essential for rapid development. At this time, no centers for light machinery research are known to exist in the United States.

It is apparent that in the light machinery field, foreign manufacture has outstripped U.S. technological development. This continuing weakness of our machinery and manufactures is clearly evident from the trade balance which reached a peak of $20 billion in 1975, went down to $5 billion in 1977, reached parity in the middle of 1978 (*11*), and may continue its downward slide. Correcting this condition should be a national concern. Parity is not a sufficient goal. Accepting parity would imply an eventual reduction of our standard of living. The overwhelming burden of oil imports suggests that no major deficit category in manufactures should be tolerated. A national policy to establish a cohesive program for light machinery research (or intelligent machines) is not only desirable but necessary.

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NEWS AND COMMENT

Ever So Cautiously, the FDA Moves Toward a Ban on Nitrites

The hazard to animals and man of eating excessive amounts of nitrates and nitrates has been known for more than three-quarters of a century, ever since N. S. Mayo reported in 1895 on the deaths of cattle in Kansas that had eaten nitrate-laden cornstalks. It was confirmed by scientists much later that nitrates, when consumed by man or animals, break down in saliva and in the digestive tract into nitrites, which many subsequently combine with amines present in foods or other sources to form nitrosamines. Nitrosamines have caused cancer in laboratory animals.

Now it appears that the federal government is about to ban the second of the substances in this hazardous chain—nitrites—as an additive in everyday foods because of a study that demonstrates that it, too, may cause cancer in laboratory animals. Both the Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) have recommended such a ban, although they have proposed to implement it over an as-yet unspecified period of time. The ban is being held up, however, through an unprecedented decision by Secretary of Health, Education and Welfare (HEW) Joseph Califano to submit the regulatory proposal to the Justice Department for final review. FDA and USDA officials were incensed by Califano's decision, because it has delayed formal announcement of the plan and opened it up to sniping by congressional and other critics before the rationale had been laid out before the public. Because the Justice Department review is still pending, a final decision on whether or not the nitrites will be banned remains up in the air.

Initially, nitrites were added to meat, poultry, and fish by food processors because the substance reacts with bacteria to impart an appealing pink or red color. Subsequently, it was found that nitrites retard the growth of botulinum spores, which are ubiquitous in food and nature and which can cause botulism in humans, a food poisoning that is fatal in between one-third and one-quarter of all cases. The addition of nitrites to meats, fish, and poultry accounting for 7 percent of the entire U.S. food supply is generally thought to have reduced the risk of botulism poisoning to almost zero. Concern in the past over the additive has stemmed from the fact that nitrates, the precursors of nitrites, are also ubiquitous in nature—in air, water, and many edible plants. And nitrites are the direct link to nitrosamines.

These circumstances have all of the makings of a classic dilemma for federal regulators, who for some time have been asked by public interest groups to minimize the existent but unquantified hazard of adding nitrates to food. Within the last year, FDA and USDA have both moved to ensure the absence of nitrosamines from poultry and bacon, targeting in typical fashion the most certain hazard in the nitrate trio. (Nitrosamines are not added to food, but there is evidence that added nitrites may be converted to nitrosamines even before the food is eaten.)

These actions left the public interest groups—principally the Environmental Defense Fund and Ralph Nader's Public Citizen Litigation Group—determined to seek greater concessions, and the industry—represented in Washington primarily by the American Meat Institute—just as determined to prevent further nitrite restrictions.

Now, whatever delicate equilibrium that existed between these opposing forces has been forever upset. In late spring of this year, Paul Newberne, a toxicologist at the Massachusetts Institute of Technology, completed an FDA-sponsored study that furnishes, for the first time, solid evidence that nitrites are themselves carcinogens. The study, which cost $500,000, involved 1954

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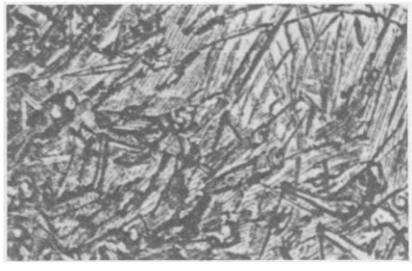
Sprague-Dawley rats and took 3 years to complete. In contrast to earlier studies with nitrites, amines were not added to the animal feeds, and the type of cancers that subsequently developed appear to rule out the possibility that the nitrites were converted to nitrosamines.

The regulatory implications of the finding are significant and difficult. Until now, the FDA and USDA have been faced with a trade-off between the certainty that nitrites prevent botulism and

Briefing

Year of the Grasshopper Keeps EPA on the Hop

When grasshoppers began appearing in unusually large numbers in the high plains states late in the spring the reaction of some farmers and ranchers was to call their congressmen. They were not asking for federal disaster relief, but rather were seeking help in pressuring federal officials to relax the rules on certain pesticides outlawed under regulations administered by the Environmental Protection Agency. Farmers were seriously alarmed because the assault by the hoppers was the worst in years, probably since the early 1950's, which, of course, was long before strict controls on pesticides were applied. And the response of state and federal officials was vigorous; it is, after all, an election year.



In the fields, the first phase of the battle against the hoppers seems to be over, with mature crops better able to withstand the attack. But growers are now beginning to sow the next crop of winter wheat and they are concerned that the seedlings which appear a month or so later will be vulnerable to the grasshoppers, especially to a voracious second generation which some of the insects are expected to produce.

Hundreds of thousands of acres of crop- and rangeland have been affected by the hoppers in Colorado, Kansas, Nebraska, and Oklahoma, and in adjacent states including Texas. Damage has varied greatly from state to state and locality to locality. Assessments of the toll are now being conducted, but no solid estimates are available. Overall, however, despite heavy damage in some areas, the grasshopper invasion is not expected to make a serious impact on predicted bumper harvests of wheat and corn and other crops.

Such conclusions are not much consolation to farmers in areas where losses are heavy. As one sympathetic federal official put it, "A farmer doesn't read those projections. When a guy looks up and the hoppers are eating the paint off his outbuildings and his corn is going down, what he does is call his senator."

When the grasshoppers struck, high plains farmers wanted to use pesticides that they remembered as working for them in the past, mainly aldrin, dieldrin, and heptachlor—especially heptachlor. These, however, had been "canceled" by EPA. They are chlorinated hydrocarbon pesticides and are highly persistent. Heptachlor was banned from use after being found to cause cancer in laboratory animals. Farmers valued heptachlor because they felt it gave effective, long-term protection to crops, and fairly heavy pressure was exerted on state governors to permit its use. Most state agriculture officials, however, advised against it, arguing that residues of the pesticide would be likely to show up on crops or in the meat or milk of animals and cause them to be confiscated. Requests for permission for emergency use of heptachlor were turned down.

The EPA has sought to meet the Westerners halfway, essentially by permitting broadened use of pesticides which were available for use on some crops in some situations. In late July, EPA announced that states could exercise authority to allow farmers to use the pesticides diemthoate, carbofuran, chloropyrifos, and orthene on all major crops attacked by grasshoppers. The EPA had approved each of these pesticides for use against grasshoppers on one or two crops but not on the wide variety of crops attacked by the hoppers. This was the core of EPA's effort to collaborate with the states on a broad strategy against the insects.

Extension entomologists in the region say that one problem in dealing with the emergency this summer was that the hiatus in serious grasshopper problems in the region had caused uncertainty about what pesticides would work on them and under what conditions. There was particular concern that some of the approved materials would not be effective on heavy infestations. Some fast field testing apparently produced needed answers.

USDA

Many farmers still are far from satisfied with the restrictions on insect controls, but the compromise program seems to have worked well enough to have brought a lull in the chorus of complaints directed at Washington and the state capitals.

The coming crunch on the winter wheat, however, is not the only crisis pending. A worried watch is being kept on one species of "migratory" grasshoppers reported to be thick on the ground in southwest Kansas. Adult grasshoppers all have wings, but most types tend to spread slowly and rather haphazardly. One species, *Melanoplus sanguinipes*, however, has a tendency to swarm and can move en masse 50 miles a day or

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the uncertainty that they cause cancer. The Newberne findings reduce but do not eliminate uncertainty on the latter point. The rats fed nitrite in their diets had 4.6 percent more lymphomas, or tumors of lymph tissues, than those in the control group, and 3.6 percent more precancerous lesions. Two previous studies, in 1958 and 1963, had not shown that nitrites induce cancer in test animals, but the FDA considers both to be technically deficient by today's standards.

Briefing

more, cutting a swath of devastation as it goes.

Then there is the matter of next year. Adult hoppers are laying eggs now and, although there are a lot of variables, experienced observers expect that the "hatch" next year will be a big one. The theory is that the cycle of dry weather of the past few years on the plains set up the grasshopper population explosion and that 1979 could well be another tough year for farmers and the EPA.

Some Insights from Inside in NSB Report on Research

The National Science Board's tenth annual report is titled *Basic Research in the Mission Agencies*, and, since it is based on information solicited from federal agencies with major research programs, it has a bit of an *Apologia pro Vita Sua* flavor. It essentially provides the insiders' view of what the agencies are doing and where they think their research programs are going. Not startlingly, a solid consensus is reached that basic research is useful. However, interpretations by the NSB, which is the policy-making body for the National Science Foundation, and some mild self-criticism from the agencies themselves convey a sense of the issues facing federal science. And the problems turn out, at least in part, to be caused by fancy new government regulations and plain old red tape.

Much of the report is devoted to descriptions of existing programs and information on trends in research policy and financing. The report, for example, documents the decline in federal support of basic research in dollar terms adjusted for inflation. It notes that in the years between 1968 and 1976 obligations for basic research grew by 4.3 percent annually in current dollars; this translated into an average 1.8 percent yearly decline in constant dollars over the period. Basic research has made something of a comeback in the budget since 1975, but that recovery has been threatened this year as Congress, reportedly reacting to California's Proposition 13, has aimed the economy ax at basic research in the Carter budget.

Federal funding has been the major factor in basic research increasing much more rapidly in universities than in industry. In the 25 years after 1953, basic research in universities increased 25-fold, while in industry the increase was 5-fold. Federal support of basic research in universities totaled about $1.3 billion in 1977, while the figure for industry was $201 million in current dollars, or about 7.3 percent of total federal obligations for basic research.

Limitations on basic research funding per se pain federal research officials, but the ways of their congressional paymasters add to their discomfort. According to the "overview" section of the report, "The chief agency concerns have to do with (1) sharp yearly fluctuations in budget authority and (2) legislative expansion of agency responsibilities without commensurate increases in funding. The latter unintentionally can lead to reductions in basic research funding to meet operational or other requirements." Examples of agencies called on to do substantially more without allowances being made at budget time are the National Bureau of Standards, United States Geological Survey, and the National Oceanic and Atmospheric Administration.

Increasing hindrances to the government's doing its scientific business are seen as being created by legislation and regulation. The Mansfield Amendment, which restricts mission agencies to supporting only that basic research which is directly relevant to their missions, is cited as causing some agencies "to deemphasize basic research." The sponsors as well as performers of federal research find themselves enmeshed in requirements of laws intended to protect the public's health, safety, and civil rights and the environment. And new congressional emphasis on accountability imposes record-keeping and research-justification tasks that greatly complicate life for the feds. These complaints are hardly unfamiliar to the clients of the science agencies. What is different is the perspective of the report and the tone, which is the aggrieved one of a man bitten by his own watchdog.

For the Eleemosynary Elite and Others, a New Magazine

A brand new entry among specialized periodicals is *Grants Magazine*, which is aimed at an audience of grantors and aspiring grantees. Subtitled "The Journal of Sponsored Research and Other Programs," the new quarterly is intended to range across private philanthropy and public patronage and run the disciplinary gamut from the sciences through the arts and humanities.

The publisher is Plenum, a New York commercial publisher of scientific and technical books and journals. Plenum seems to have got the idea for *Grants* from a book of the same name they had published and by whose sales they had been pleasantly impressed. As editor of *Grants* they recruited the author of the book, Virginia T. White, who had other credentials to commend her. As a grants-person, White has had experience in both public and private sectors and both cultures. Before assuming the editorship she was director of sponsored programs at the City University of New York, and earlier worked at the Smithsonian's Woodrow Wilson Center, Salk Institute, and Oak Ridge National Laboratory.

White says that *Grants* will combine comment on policy and trends in the field—the first issue includes articles by Senator Edward Kennedy and Adam Yarmolinsky—with how-to-do-it help. A regular "grants clinic" section will feature model applications illustrating how it's done.

Volume 1, Number 1, came out in July, which was a little confusing since it was dated March 1978, but Plenum, after a leisurely start, plans to catch up with the calendar. Subscriptions for the quarterly are $45 a year ($20 for those who pledge it is for personal use). A good question is whether subscribers can charge *Grants* off to their research grants.

—John Walsh

According to the FDA and a top nitrosamine researcher, no nitrosamine has been found to induce lymphomas exclusively. It was noted in Newberne's study, however, that the diet of nitrites generally suppressed the animal's immune systems, offering the possibility that nitrite acted as a cancer promoter in the Sprague-Dawley rats, which are considered to have a high incidence of spontaneous lymphomas. Nevertheless, the FDA concluded "after reviewing the results of the MIT study, [that] nitrite induces cancer when ingested by rats and that it therefore poses a significant cancer risk to man." The matter of *how* significant is uncertain because it depends on unsettled assumptions of the precise daily intake of nitrite from cured meats and other foods, as well as a scaling factor used to extend Newberne's animal findings to humans. Still, the FDA places the lifetime risk of lymphatic cancer from average consumption of cured meats at between 0.6 and 2.7 per 10,000 persons.

This, one might assume in a decision to ban the additive, would be balanced against the lifetime risk of contracting fatal botulism from eating meats, fish and poultry *without* nitrite. If the risk of cancer is uncertain, however, the risk of botulism is unknown; currently, only 10 to 20 cases occur annually and there is no way to predict how many would occur if nitrite were banned.

To some degree, the regulatory dilemma is already resolved because Congress in 1958 decided to preclude the FDA from balancing the risk of cancer from a food additive against the risk of another hazard from removal of an additive, by passing the Delaney clause of the Food, Drug and Cosmetic Act. (The clause prevents the use in foods of additives shown to cause cancer in animals or man). The issue is muddled, however, because the law exempts from Delaney all food additive uses that were sanctioned by the government prior to 1958, The use of nitrites in meats is apparently exempted because of an informal approval by USDA in 1925. Poultry, fish, imported cheese, and pet food are not exempted because nitrite was not approved for use in them prior to 1958, according to USDA and FDA claims; a poultry processor is contesting the issue in court. The use of nitrite in these foods is automatically prohibited.

Because of its possible impact on the public, the Newberne study was tightly held within the FDA during the period in which the results were reviewed. On the basis of the findings, USDA and FDA decided to propose a complete phase-out of nitrite, with an immediate ban on the addition of nitrite to smoked tuna fish and canned pet foods, where it is used solely to impart color. Cured poultry and fish would be covered by the Delaney clause, and the presence of nitrites in meats would be ruled "injurious to health" and banned as an adulterant instead of an additive; all three uses would be phased out over an undetermined period of time. "At some point, we would have no more nitrite added to foods," a top FDA official told *Science*. "Our interpretation of the law tells us that it's our discretion as to when that point is reached."

The last time FDA proposed to prohibit the use of a food additive based on the Delaney clause was 1977, and the additive was saccharin. Congressional investigators, industry lobbyists, and outraged dieters battered the agency, and its power to pull saccharin off the market was emasculated by Congress pending completion of a study by the National Academy of Sciences on the risks of saccharin use and on food safety, including the validity of animal tests as cancer predictors.

In the current circumstance, the agency has bent over backward to avoid giving rise to the same outcry. The only FDA announcement to date on the Newberne study has been a brief news release distributed on a Friday, 11 August, at 4:30 p.m., 3 months after Newberne sent his findings to Washington. Conspicuously absent from the release were any details about the methods of Newberne's investigation (that is, the dosage levels that featured so prominently in the saccharin press release and in the subsequent criticism).

Proposal Blocked by Califano

Originally, FDA and USDA officials had intended to hold a press conference announcing the phase-out on the following day, August 12—a Saturday, when the stock market was closed. In preparation, FDA general counsel Richard Cooper and other top FDA officials had written a 50-page document, replete with 83 citations, explaining the scientific and legal basis for the agencies' action in lay language. In early August, the document received the final stamp of approval from Donald Kennedy, the FDA Commissioner, and Carol Foreman, the USDA assistant secretary for nutrition. However, it encountered a roadblock in the upper echelons of the Department of Health, Education, and Welfare on the way to distribution at the Saturday press conference (FDA is a part of HEW). In a decision apparently reached afer consultation with Peter Libassi, the HEW general counsel, Eileen Shanahan, the agency's public relations chief, and its lobbyists on Capitol Hill, HEW Secretary Joseph Califano decided personally to ask the Justice Department to review the FDA-USDA proposal.

According to a half-dozen FDA and HEW officials contacted by *Science*, Califano's decision, which was acknowledged as extraordinary, stemmed from his desire to avoid repetition of the saccharin brouhaha. Several suggested that Califano wanted the additional security of Attorney General Griffin Bell's legal stamp of approval in the event of a consumer outcry, congressional disapproval, or an industry lawsuit. "He wants to avoid a messy scrap," one source suggested. "His department, and possibly the Administration's drug reform legislation now before Congress, could have to take the flack."

Top officials at FDA and USDA—whose attorneys had prepared the proposal—were said to be outraged by Califano's decision to seek a second legal opinion. Although Califano has apparently given no indication that he is opposed to the phase-out as proposed by the two agencies, FDA and USDA officials felt it was a mistake to seek a Justice Department review, not only because of the embarrassing precedent set but because the Justice Department is expected to provide a narrow view of the proposal's defensibility in court. "How can you base a health decision on that?" one source asked. In fact, when Justice Department officials rendered an initial, informal opinion about the proposal, they expressed skepticism about its legality—particularly about the ban of nitrites in meats, where the agencies have more discretion than under the Delaney clause provisions affecting cured poultry and fish. As a result, the 12 August press conference was canceled, and a more comprehensive Justice Department analysis was sought. Subsequently, both FDA and USDA leaked copies of their decision document to reporters.

The tentative, low-key nature of the document, as well as the fact that much of Washington is away on vacation during the last weeks of August, has minimized opposition thus far. However, two congressmen sympathetic to meat producers, Representatives James Martin (R–N.C.) and William Wampler (R–Va.) have introduced legislation to prevent any final FDA action on nitrites until 3 months after the National Academy of Sciences completes its study of food safety and cancer prediction. A spokesman for the American Meat Institute

called the study "not conclusive enough to call for a precipitous ban on nitrites," although he emphasized that he was not critical of the study itself.

What he and even the study's author, Newberne, have recommended is that it be replicated in another animal species prior to any regulatory action. Newberne has been quoted recently as saying that replication would ensure the carcinogenic effects are not unique to the Sprague-Dawley rats. Howard Roberts, the director of FDA's Bureau of Foods, told *Science* that "Newberne's remarks on our regulatory action are inappropriate. There is a remote possibility that the Sprague-Dawley strain is exquisitely sensitive to nitrite but no doubt that nitrite is a bad actor. My interpretation of the law is that it has to go. Although we would like to have tests in more than one species, Newberne's test was thorough and well done." William Lijinsky, an expert in nitrosamines at the Frederick (Md.) Cancer Research Center, echoed Roberts' appraisal of Newberne's test, although he said he had reservations about an absolute nitrite ban. "Newberne is very reputable, and if anything, rather conservative," Lijinsky said. "He used more animals and more prolonged treatment than anyone has before; moreover, the idea is to deliberately select a species that will be sensitive. While it is difficult to calculate the risk to humans, we know now that nitrites are not safe."

If nitrites are eventually banned, the impact on industry is uncertain. The American Meat Institute claims that the retail value of cured meats and poultry is $12.5 billion, but several alternatives to nitrite are available, including refrigeration, irradiation, freeze-drying, and possibly the additive potassium sorbate—all of which are in limited use now. Only one corporation, Du Pont, supplies sodium nitrite for use in U.S. foods, and company spokesmen have termed the impact minimal. On the opposite side, the impact the ban will have on human health is equally uncertain, although it may not be all that much. Researchers have estimated that less than 20 percent of all nitrite entering the stomach is derived from cured meats.

If the ban's effect on human cancer will be small, however, its impact on relations between the FDA and its parent, HEW, could be significant, depending on the outcome of the Justice Department review. The existence of the review is itself unsettling to FDA officials; if the result is a loosening of the FDA and USDA phase-out proposal, additional sparks can be expected to fly between the agencies.—R. JEFFREY SMITH

NSA Slaps Secrecy Order on Inventors' Communications Patent

At the request of the National Security Agency (NSA) the Commerce Department has placed a secrecy order on a group of private inventors in Seattle concerning their patent application for an advanced communications privacy device.

The inventors are fighting to have the order overturned so that they can market their device commercially. They regard their struggle as a test of whether the government will allow the burgeoning of cheap, secure communications technology to continue in the private sector or whether it will keep a veil of secrecy over the work—effectively reserving it exclusively for military and intelligence applications.

The case may result in a test of inventors' rights under the secrecy order laws, of whether the laws protect their right of due process, or place outside commercial inventors such as the Seattle group at an unfair disadvantage with defense contractors.

The government issues secrecy orders under some obscure laws passed in 1917, 1941, and 1952. Some have questioned whether these laws are even constitutional; they may be in for more public scrutiny and even a court test in the future.

The group's fight with the Commerce Department and the NSA appears to be unprecedented. Of the 200 to 300 secrecy orders Patent Office officials estimate are issued each year, the vast majority cover classified patent applications filed by government defense contractors. These are not contested, as far as Patent Office officials know. Officials could not recall the last formal challenge to a secrecy order, but one official told *Science* he thought that there had been such a challenge in 1962.

The technique involved in the patent is considerably beyond the voice scrambler technology now familiar in police and other communications. The technology that it embodies is related to spread spectrum communications. The inventors say they had hoped to sell the device for inclusion in citizens' band and maritime radios. But they declined to tell *Science* anything further about the device or the technology involved because of the secrecy order.

But the Seattle group's protests are the second challenge to the secrecy laws this year. Earlier, George I. DaVida, a university professor who filed for a patent on a new cryptographic scheme, was issued a secrecy order. DaVida protested and got the order rescinded, but officials at the National Science Foundation, which sponsors DaVida's research, explained that the order was lifted because the government had not intended to classify university research, and did not know that the work had been done at a university when the order was imposed (*Science*, 14 July, p. 141).

Whereas the DaVida case was a test of whether the government plans to classify university work on cryptography—a subject that is also spurring private sector interest in communications privacy—the Seattle case raises a different issue. This is whether the growing interest by private firms and private inventors in developing commercial communications privacy equipment will also run up against a roadblock of government classification.

"I feel my freedoms are being taken away" says Carl R. Nicolai, 35, one of the inventors. "But I also wonder if it is in the government's interest to suppress people's privacy."

Nicolai worked for different employers as a "job shopper" or what he calls a technical "Kelly girl" for several years while developing the device in his spare time. The other inventors, David Miller, 32, Carl R. Quale, 30, and William M. Raike, 35, who lives in Monterey, California, have been also employed in regular jobs while collaborating on the invention in their spare time. Together they estimate they have spent $33,000 of their

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