the NAS review, and because it occasionally reaches a different conclusion, the agency has no intention of releasing the NAS study wholesale. Instead, it is proposing that once it does publish findings on a specific product, those findings must then be included in advertising immediately—before the company issues a rebuttal and before any final regulatory action is taken. That post-publication process can take months to years. Meanwhile, physicians would be alerted to the questions raised about a product and, presumably, might stop prescribing it.

According to Bruce Brennan, chief counsel for the Pharmaceutical Manufacturers Association, the PMA's specific line of legal attack has yet to be drawn. There are, however, a couple of broad approaches. It may challenge FDA's basic legal right to require such specific, negative disclosures. And it is likely to contest the scientific validity of the judgments rendered by NAS scientists, claiming that they do not represent a full range of medical opinion. By and large, members of the NAS review panels were drawn from academic medicine. Admittedly, they were not always unanimous in their views and, to the distress of drug companies, tended to place little weight on testimonials from industry sources. □

LINEAR ACCELERATOR

Saving space with superconductors

AEC

Two miles of superconducting waveguide could raise SLAC to 100 GeV.

The only practical way to construct high-energy electron accelerators is to build them in straight lines. Electrons revolving in the magnetic fields of circular accelerators lose energy by giving off so-called synchrotron radiation. At energies in the tens of billions of electron-volts, they lose energy almost as fast as they gain it from the machine, and very large amounts of energy have to be supplied by the machine to get a very small increase in the net energy of the electrons.

To achieve the present maximum energy of the Stanford Linear Accelerator, 20 billion electron-volts (GeV), required an accelerator two miles long. To achieve an energy of 100 GeV, a conventional electron accelerator would have to be tens of miles long.

The alternative is to change technology to get more energy per running foot of accelerator. Using superconductors instead of ordinary conductors in the waveguides that accelerate the particles is a possibility that now begins to look favorable, and physicists at the Stanford Linear Accelerator Center under the leadership of Dr. Perry Wilson are working on a plan to rebuild their accelerator with superconductors, jumping its energy to 100 GeV without increasing its length.

Heat from electrical resistance is the main problem in conventional technology. The electrons are accelerated by radio waves that run in metal waveguides. The amount of energy that can be delivered per linear foot is limited by the danger of melting the waveguides.

Superconductors will pass electric currents without resistance. With superconducting waveguides the heating problem virtually disappears.

The advantages are threefold: More energy per foot of flight can be delivered to the electrons; more of the total energy delivered to the machine will get to the electrons, and more of the time the machine is on can be used for actual acceleration rather than for cooling. Under the plan the machine will spend six percent of its time on actual acceleration, 100 times the current percentage.

Superconductors function only at temperatures very near absolute zero. The SLAC physicists envision refrigerating the whole two-mile length to 1.85 degrees K. with liquid helium.

Formidable technical difficulties are involved in designing waveguides and refrigeration systems. Work on these problems has been under way for several years at the Stanford University High Energy Physics Laboratory under the direction of Dr. William Fairbank (SN: 6/22/68, p. 599).

The time that a superconducting accelerator the size of SLAC can be built is not yet, says Dr. Wilson, but "to make big improvements you have to start 10 years in advance." One of the major efforts in the work is finding a good waveguide material. Niobium looks most promising now but its electrical qualities deteriorate on exposure to air. Either a very good vacuum system or a protective coating will have to be developed to use it, says Dr. Wilson.

To bypass some of the problems, the SLAC physicists are constructing what they call Project Leapfrog, a 52.5-centimeter section built to the specifications of the larger project. This should be ready for test early in 1971. If it works, the next step is a prototype between 20 and 40 feet long. So far the project is being funded out of SLAC's operating budget, but the prototype would cost about $1 million and probably require a separate appropriation.

According to Dr. Raymond Fricken of the Atomic Energy Commission's high-energy physics division, the SLAC conversion is one of several things the AEC would like to do in the 1970's. Its cost is estimated at between $70 million and $80 million, which Congress would have to be persuaded to authorize. □

MYCOPLASMA

Vaccine for a pneumonia

When Dr. Norman Somerson got out of graduate school in the 1950's, he couldn't find a job in the field in which he had taken his degree. Almost nobody was interested in mycoplasma. Only three laboratories in the world were at work on these cells, almost as small as viruses and lacking the rigid cell wall that encloses most bacteria. Some workers thought these smallest of free-living forms were an early growth state of well-known bacteria.

But when, a decade later, a species of *Mycoplasmatales* was identified as a major producer of human pneumonia, Dr. Somerson quickly got research funds to pursue the pathogens at Ohio State University School of Medicine.

Last week Drs. Somerson and Dennis Pollack were proud producers of an experimental vaccine against *Mycoplasma pneumoniae* that has evoked a high response of neutralizing antibodies in humans and is easy to purify. Clinical trial began Sept. 10 at Baylor University

School of Medicine, Houston, where Dr. Robert Couch is vaccinating young adult volunteers. Blood samples are tested at New York-Cornell Medical Center for the presence of antibodies. Last week Cornell's Dr. Norman Senterfit telephoned Ohio: The vaccine is producing substantial amounts of protective growth-inhibiting antibody in a remarkably high percentage of persons who had none.

Experimental challenge will be the next step. Volunteers will have to be found who will accept both intramuscular vaccination with killed (formalin-inactivated) *M. pneumoniae* and subsequent injection with live disease-producers. If the vaccine protects humans against the pathogen as effectively as it has already protected experimental animals, it will be moved along to large-scale testing.

Although a half-dozen bacteria and a much larger number of viruses produce pneumonia, *M. pneumoniae* is the chief cause of the disease in older children and young adults. Young people pick it up when they are brought together in colleges and camps; as many as half the freshman classes of some universities have been hospitalized with this disease. Although antibiotics will knock out the infection, preventive measures are clearly needed.

Many trys at anti-mycoplasma vaccine have failed to elicit antibody response in more than half of experimental subjects. Dr. Somerson says the antigenic capacity of his experimental vaccine is the result of passage through only seven cultures (sometimes organisms are attentuated for vaccines by passage through as many as 100 cell cultures or other growth media in the effort to retain antigenicity—capacity to provoke antibodies—while destroying ability to produce disease).

The vaccine is produced from a strain never exposed to horse serum, a once-common culture nutrient now known to be one cause of the serious sensitivity reactions that have been a basis for occasional lawsuits against vaccine manufacturers.

The minute mycoplasma cluster thickly on the surface of larger tissue cells; the tightness with which they cling to the cells lining the lung is part of their ferocity as disease producers. This property is exploited, Dr. Somerson says, in producing the vaccine. Grown on broad glass surfaces in a nutrient broth, *M. pneumoniae* cling so tightly that they are easy to wash free of contaminants from the broth.

Pilot-test lots are being produced by Huntington Research Center, Baltimore, a division of Becton Dickinson & Co., under a contract with the National Institute of Allergy and Infectious Diseases.

OCEAN DUMPING

One small step

Lane—ESS

"Is this nerve gas perch or mercury perch?"

The oceans have sometimes been viewed as man's last resort. An ever-growing population with a higher and higher per capita consumption of goods (at least in the developed countries) may finally have to turn to the oceans for most of its food, minerals and other staples of life, say some.

This view sometimes optimistically assumes that the oceans will be a perpetual bonanza. But it fails to perceive that the amosphere, land and oceans are really a continuum and that whatever destructive things man does to his air and land are inevitably reflected also in the oceans. Persistent pesticides used on North Dakota farms eventually find their way via the Missouri and Mississippi Rivers to the Gulf of Mexico. Mercury from chlorine alkali plants eventually is carried by rivers to both oceans. The oceans, in fact, are a kind of ultimate sink, and most air pollutants, too, eventually get into the oceans.

President Nixon's announcement that he will recommend legislation to the next Congress to control ocean dumping of various classes of materials (SN: 10/10, p. 302) is encouraging in that it will be a major step toward eliminating a particular source of ocean pollution. But it would be folly to believe that such a step will in one fell swoop take care of the ocean pollution problem.

Mr. Nixon's proposals were based on a report by the President's Council on Environmental Quality. The report itself, in a chapter on the general effects of ocean pollution, makes few distinctions between the sources of the pollution, and its warnings could be taken to apply in a far broader area than just ocean dumping: "Knowledge of ocean pollution is rudimentary, and generally it has not been possible to separate the effects of ocean dumping from the broader issue of ocean pollution," says the report. ". . . There is reason for significant concern. . . . If no action is taken . . . the long-term damage to the marine environment will be great."

Many kinds of damage are already known, and in some areas the mechanisms by which pollution is disseminated into marine ecosystems are understood at least in a broad sense. Floating pollutants, such as oil slicks, are transported great distances by current and wind; suspended particles, likewise, are rapidly disseminated, with the 500 square miles of the polluted New York Bight being exchanged and flushed about once a week, the polluted waters distributed to the Atlantic at large. Biological mechanisms are also broadly understood, with many pollutants—including pesticides and heavy metals—being concentrated by a factor of 1,000 as they move up the food chain from phytoplankton to large predators.

Some of the effects of these pollutants on marine life are generally understood, too. Copper concentrations lower than those found in the New York Bight, for example, killed soft clams in 10 to 12 days and polychaete worms in 4 days; these concentrations reduced photosynthesis in kelp 70 percent in 9 days. Chlorinated pesticides, besides inhibiting reproduction in large predators, as has long been known, also reduce the size and strength of mollusc shells and reduce the growth rates of various fish. There is now no doubt that they also inhibit oxygen production by phytoplankton (SN: 10/10, p. 296). Marine levels of pesticides continue to rise each year, according to the report.

If the recommendations of the report are followed, the new Environmental Protection Agency would have broad authority to prevent ocean dumping, a rapidly growing practice. In addition, and perhaps ultimately as significant, marine ecological and physical and chemical oceanographic research projects would be financed well enough to remedy the "serious information deficiencies" in these areas. In addition, marine research preserves would be established to allow baseline studies—so that man can learn how marine ecosystems work in their natural state.

Such research is already proving that man has already gone much too far in contamination of the oceans. Stopping ocean dumping is one step toward a reversal of this dangerous course. But the oceans will not be safe for life until the land and the air are also reclaimed. □