an unpalatable truth that no less a person than President Nixon gave the impending closure of the Princeton-Pennsylvania Accelerator (SN: 3/21, p. 298) as an example of his fiscal prudence....

"There is nothing in the Administration that could pass for a policy toward science and technology," continued NATURE. ". . . The truth is that, on several important questions which lie at the roots of the conduct of science in the United States, the Federal Government has not had the time or the inclination or the wit to make up its mind."

The journal then turned to Dr. DuBridge, "a card-carrying hot-gospeler for basic research when he went to the White House 18 months ago (who) now comports himself as just another pragmatist." It went on to rebuke the OST for its alleged failure to defend academic science against the impact of the Mansfield Amendment, curtailing defense support of basic research (SN: 5/23, p. 501).

"A part of the trouble is that the present holder of the office, Dr. DuBridge, is not the kind of fellow who is able to create the illusion of being a means by which the scientific community can make its voice heard in high places. He is too shy, even gauche. . . ."

This was too much for even the gentle spirit of Dr. DuBridge. After expressing his amusement to the Daddario subcommittee about Dr. Dupree's charge that the OST had dropped from the Government's organization charts, Dr. DuBridge last week, in an unusual move for OST, called a press briefing. Ostensibly to explain OST's diverse activities, the session was later acknowledged to be an attempt to counter what was termed the badly informed recent criticism of the Administration's attitudes on science.

"The President has . . . indicated an intense interest in science," contended OST Deputy Director Hubert Heffner. "Of all the controllable areas in the budget, science was the most favorably treated. I think it is valuable to try to inject some reality into the situation."

Dr. DuBridge placed some of the blame on Congress. He repeated his earlier-expressed opposition to the Mansfield Amendment, which he said was directly responsible for $8 million or $9 million of the $28 million in Defense Department cuts of funds for university research.

"The Mansfield Amendment was one reason that the President proposed substantial increases in NSF funds for 1971," says Dr. DuBridge. "There may be a few months of uncertainty, but I think, I hope, that most of the real high quality research will be picked up by NSF." □

ATOMIC ENERGY

Light on heavy water

Canada's fledgling nuclear power industry—two plants in operation and three under construction—is already outgrowing its britches. Today, it finds itself with a shortage of heavy water (deuterium oxide) needed for nuclear plant operations. This short-term shortage could be a setback to the Canadian nuclear power program.

Canada's situation is a special one. Most nuclear power plant reactors operate on enriched uranium—which has a higher proportion of fissionable U-235 atoms in comparison to nonfissionable U-238. This makes it possible to use easily available graphite or light water as the moderator to slow down neutrons to the point where they can cause U-235 to split. Canada, because of its abundant uranium—40 percent of the world's reserves—and modest needs does not use enriched uranium. If it did, it would either have to build a costly enrichment plant or depend on the United States.

But in order to use natural uranium, Canada also has to use heavy water as the moderator since graphite is not efficient enough and light water would not work.

In 1971-72, Canada will need 2,000 tons of heavy water. At present, it has about 1,000 tons, which it bought from the United States Atomic Energy Commission. To come up with the remainder—the present shortage should end by 1973, when other heavy-water plants now under construction are completed—Canada is counting on three types of sources: two domestic and one foreign.

Some 400 tons of the deficit can be made up for by Canadian General Electric's plant at Point Tupper, Nova Scotia. It is expected to go into operation this summer and hit full production by early 1971.

That would still leave about 600 tons to go, which Canada is hoping to get from foreign imports, with Sweden accounting for half.

As a last resort, Canada could scavenge the water from various prototype plants and put it into a commercial plant. However such a move would interrupt the country's nuclear power development.

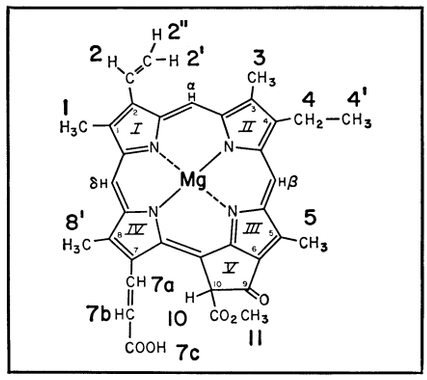
It is not certain that these remedies will work. For one thing, the Point Tupper plant could develop starting-up problems, as has happened with the 400-ton-a-year plant at Glace Bay, Nova Scotia. That plant is supposed to go on line in 1972, but it will take several months to reach full capacity.

Secondly, foreign sources are not reliable. There are other countries vying for heavy water, and Sweden could very well sell to one of them instead.

"The situation is very uncertain at the moment," says R. C. Hayden of Atomic Energy of Canada, Ltd. "There's a reasonably good chance of getting what's required, but it will be a few months before anyone knows." □

CHLOROPHYLL C

Subsurface photosynthesis



Argonne

Chlorophyll c_1: An underwater extra.

Chlorophyll is essential to photosynthesis, the process by which plants manufacture carbohydrates from water, carbon dioxide and the energy from sunlight. But there is more than one kind of chlorophyll. All plants that carry on photosynthesis, for instance, have chlorophyll *a*, a type of chlorophyll that utilizes most of the spectrum of visible sunlight. Most terrestrial plants, or plants that live on the surface of water, possess chlorophyll *a* alone. Some have chlorophyll *b*. Members of three classes of algae which live below the surface of fresh and saline water need something extra. Most of the red wavelengths of sunlight are filtered out after passage through six to eight feet of water, leaving blue, green and yellow wavelengths. Ordinary chlorophyll cannot use these wavelengths efficiently. Thus at some point in the evolutionary process the ancestors of these plants evolved a supplement.

A team of chemists at Argonne National Laboratory has succeeded in isolating and establishing the chemical structure of this adaptive substance, called chlorophyll *c*. The discovery fulfills a 30-year-old dream of Dr. Harold H. Strain, who worked on the problem in the 1940's, but was unable, because of the crude techniques of those days, to identify the chemical structure. Dr. Strain is part of the Argonne team. The discovery is important in itself. But it is also another step in understanding the highly complex total process of photosynthesis.

Subtle differences in the chemical structure of chlorophyll *c* enable this substance to be especially receptive to

the blue, green and yellow wavelengths. Thus the efficiency of the three classes of algae in the manufacture of carbohydrates is enhanced.

The three classes are brown algae, dinoflagellates and diatoms. "These are almost the only classes of phytoplankton that live in the high seas," says Dr. Strain. "And they are also very important in coastal areas and in freshwater."

The Argonne team began by isolating 15 to 20 milligrams of each of the two chemical substances that make up chlorophyll *c*—magnesium tetradehydro and hexadehydro pheoporphyrin a_5 monomethyl esters (chlorophyll c_1 and c_2); they used chromatographic absorption, a technique that relies on the varying speeds with which chemicals will move through a column of a special, finely divided, polyethylene compound to isolate the chemicals.

After crystallizing the chemicals, the researchers then studied their chemical composition and structure with infrared absorption, mass spectrometry and nuclear magnetic resonance. "We had to use the results of all three of them to deduce the molecular structure of these highly complex chemicals," says Dr. Strain.

The work required was tremendously painstaking, each technique providing small pieces of the total. Nuclear magnetic resonance, for example, is especially useful in determining the chemical relationships of hydrogen atoms and helped distinguish between the two chemicals. Infrared spectrometry provides clues as to the nature of chemical bonds and mass spectrometry gives further clues through the measurement of the ratio of masses to electrical charges.

The two chemicals are closely related, differing from each other by only two hydrogen atoms. Both substances were completely separated and purified by the Argonne chemists.

The three chlorophyll *c* algae are the primary producers of food in the high seas, and are part of the first step in the food chain in coastal and freshwater areas. In addition, they produce a significant amount of the oxygen needed for replenishment of bodies of water and the atmosphere and act as a sink for atmospheric carbon dioxide. "They have an extremely important role in maintaining the ecological balance," says Dr. Strain.

He believes the discovery, the culmination of five year's work at Argonne, will have important practical significance. For one thing, he says, pollutants, especially heavy metals and toxic organic compounds, harm aqueous ecosystems by interfering with photosynthesis. Knowledge of the structure of chlorophyll *c* will probably help in understanding these processes. □

NOAA IN COMMERCE

Getting ocean sciences together

In proposing creation of a National Oceanic and Atmospheric Agency in January 1969, the Commission on Marine Science, Engineering and Resources clearly stated the case for an independent organization.

". . . The size and scope of the program," its report said, "are such as to require that NOAA, at least initially, be an independent agency reporting directly to the President, rather than an agency of one of the existing departments. . . .

"The case for independent status is compelling. An independent agency can bring a freshness of outlook and freedom of action difficult to achieve within an existing department. Its greater public visibility would draw stronger interest and support. The head of an independent agency would be better able to organize the agency's activities to achieve the multiple purposes of a national ocean program. . . . Furthermore, no existing department now has sufficiently broad responsibilities to embrace the full scope of functions proposed for NOAA. . . ."

But when President Nixon announced on July 9 the creation of NOAA, the new agency was given not independent status, as proponents hoped, but instead a home within the Department of Commerce.

Nixon said it is one of his principles that in Governmental reorganizations, separate new agencies should not be formed unless absolutely essential. This was a circumstance he found to exist in the case of pollution-control activities, which concern every department of Government, but not in the ocean sciences. Placing NOAA in Commerce, he said, would cause the least dislocation. Commerce's Environmental Science Services Administration will represent about three-fourths of NOAA's initial activities.

Despite the less-than independent status, the supporters of a better-organized ocean effort tend on the whole to be cautiously approving of the proposal for a Commerce NOAA.

The major objective they had in mind has been fulfilled—a centralization of many of the Federal ocean activities to improve coordination and provide more political muscle. One commission member goes so far as to say privately that the plan goes much further than NOAA backers dared hope after the dark times earlier this year (SN: 3/14, p. 267), when Cabinet agency opposition and White House silence instilled fears that nothing might happen.

These difficulties tend to make supporters feel they were lucky to get any ocean-agency consolidation at all.

The head of the Marine Science Commission that proposed NOAA, Ford Foundation Chairman Julius A. Stratton, returned from a vacation trip this week and will not comment formally until he has had a chance to study the Administration proposal in detail. But his preliminary impression, he says, is generally favorable. He regards it as a major step toward a stronger and more cohesive ocean effort, although a critical matter will be how thoroughly the Commerce Department reorganizes itself internally to incorporate the new agency.

The vice chairman of the Stratton Commission, Dr. Richard E. Geyer, head of the oceanography department at Texas A&M University, terms the plan an effective compromise. "We would have preferred to see an independent NOAA," he says, "but on balance I am pleased with it. I am reasonably happy with the idea."

The board of directors of the National Oceanography Association, strong supporters of the NOAA concept, reaffirm their preference for an independent agency but term the Nixon proposal a workable compromise that merits support.

NOAA will consist of the Environmental Science Services Administration, already in the Department of Commerce; the Bureau of Commercial Fisheries, the marine sport fish activities of the Fish and Wildlife Service, and the Marine Minerals Technology Center of the Bureau of Mines, all from the Department of the Interior; the National Sea Grant Program, from the National Science Foundation; the Army Corps of Engineers' Great Lakes Survey and the Navy's National Oceanographic Data Center and National Oceanographic Instrumentation Center, and the National Data Buoy Development Project of the U.S. Coast Guard.

The main difference in composition from the original NOAA idea is that the Coast Guard itself stays in the Department of Transportation. NOAA will be established 60 days after Nixon's July 9 announcement unless Congress overrides the plan, which it is not expected to do.

The activities to be incorporated in NOAA will give it about a $270 million budget and 12,000 employes. It is not a superagency—even the Stratton Commission had no intent of funneling into NOAA the bulk of the strong marine programs of the Navy and the NSF, for example. But its creation is considered to be a solid step toward putting the organization of Federal marine affairs in order. □