Rising debate on science policy

Until a few years ago virtually the only science policy recommended to the President was an annual increase in spending in response to the demands of the Federal agencies that needed science to support their missions. That was a headier era that, in retrospect, seems already to have taken on the character of a golden age of United States science. The money rolled in (or out) to the tune of 15 to 20 percent more each year, a large and sophisticated research and science education enterprise was put into gear, and among scientists it was a case of rising expectations seemingly unable to outpace rising gratification.

Now that times are troubled, for science as well as for the rest of society, the cry is out for a new science policy, a set of guidelines that will regularize the flow of support for science and insure that it continues to serve some articulated national purpose. It is the observation of Presidential Science Adviser Lee A. DuBridge that, from many scientists, the plea for a more formal science policy is really just a plea for more money.

Nevertheless dissatisfaction is widespread. "The nation has clearly arrived at a point where the Government-science relationship, which has been in a period of stability since World War II, is now faced with radical alteration," says Rep. Emilio Q. Daddario (D–Conn.). His Subcommittee on Science, Research and Development is conducting hearings to consider "whether a structured national science policy is desirable in the future, and if so, what the elements of that policy should be."

The hearings—billed as the first ever by a Congressional committee specifically on the need for a national science policy—have already generated some sparks. More are sure to follow before conclusion of the sessions on Aug. 19.

Most of the issues being faced have been around for some time, but many leaders believe that the economic strains and diverse currents for change in society now make them urgent. What should be the proper balance between basic and applied research? If the shift away from traditional military research continues, how should the Government determine adequate support of science? To what extent can the National Science Foundation shoulder the burdens of basic research dropped by other agencies as well as responsibility for more social science and multi-disciplinary research given it in recent legislation (SN: 2/7, p. 144)? How far should the Government support research jointly with higher education? Should there be a redefinition of the mission of American universities, especially in regard to science? Should there be a new organization in the executive branch for the administration of Federal science activities? Is there a corresponding need in Congress for new organizational forms?

To Dr. DuBridge, as to all of his predecessors, the dangers of a too-rigid and formalized science policy seem too important to be overlooked. "It would have been most unfortunate," he told Daddario's subcommittee, "if, for example, in 1946 we had adopted a policy that all federally supported R&D should be carried out in Federal laboratories."

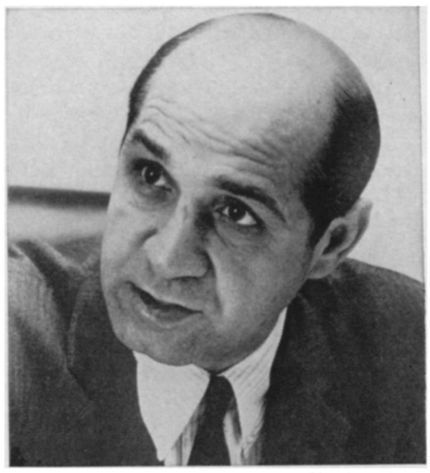
Dr. DuBridge is doing more than defending the merits of a flexible system; his Office of Science and Technology has embarked on a study of the need for a national science policy —at least to take the hills and valleys out of support for university research, without at the same time isolating science from the missions it supports— and expects to report to President Nixon by fall.

He is defending as well the science-related policies of the Administration, which are very much in the minds of the scientist-participants in the debate over the need for a more formal and consistent national science policy.

At the same Congressional forum where Dr. DuBridge catalogued the merits of the present system of Federal support for science, for example, Dr. A. Hunter Dupree, a Brown University science historian, described a science policy as a necessary defense of science against what he views as the negative, antiscience attitude of the Administration.

"What few of the people who built this structure contemplated," said Dr. Dupree, "was a serious change of attitude on the part of those who man the institutional Presidency itself. If the White House does not support the Government-science partnership, the whole formal mechanism is useless." He went on to catalogue "the unpleasant details of the present disarray of the system of science support," such as the departure of the director of the National Institute of Mental Health and the breaking up of research teams at mental health care centers (SN: 6/13, p. 572).

"At the level of central scientific organization," he charged, "the whole structure in the White House and Executive Office of the President has dropped right off the organization charts, and major reorganizations of science agencies emerge from commissions which have not called for public discussion or given public critics an opportunity to be heard. The emphasis on applications in the White House structure has left extremely unclear where science fits in. . . ."



Charles Palm

Daddario: Radical policy alteration.

OST

DuBridge: Nixon is not anti-science.

"Science has apparently dropped out of the high councils of the Nixon Administration," he claimed, adding that a new science policy is a present necessity which cannot be postponed to better times.

The controversy peaked a few days later, when the July 11 British journal NATURE appeared, carrying four pages of scathing attack on the deficiencies of the United States science policy, and on Dr. DuBridge and the OST.

"The past six months have been a vivid demonstration of how muddled are the ways of Washington in administering an amount of money so large that many other governments must consider it extraordinary wealth.

"It is plain," the journal declared, "that many vigorous fields of research are being damaged by the way in which policy is made—or, rather, unmade—in Washington. . . . It remains

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.

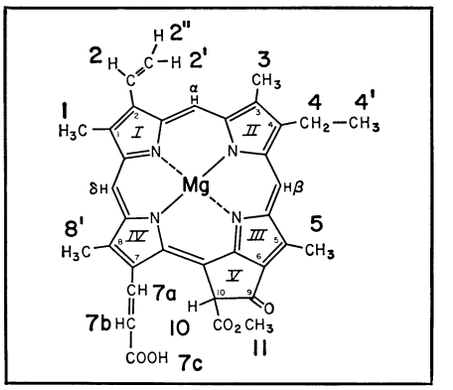
It is not certain that these remedies will work. For one thing, the Point Tupper plant could develop starting-up problems, as has happened with the 400-ton-a-year plant at Glace Bay, Nova Scotia. That plant is supposed to go on line in 1972, but it will take several months to reach full capacity.

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