other; granted that this has not been achieved universally nor without some friction. The University of Ottawa contributes her share to all levels of government, including the ministerial level, and, we believe, holds especial importance for the future of Confederation.

EDWARD O. DODSON
Department of Biology,
University of Ottawa, Ontario, Canada

Parnassus Revisited

After self-administration of a drug, in the presence of a group of friends, a young English scientist reported:

... a thrilling, extending from the chest to the extremities was almost immediately produced. I felt a sense of tangible extension, highly pleasurable, in every limb; my visible impressions were dazzling, and apparently magnified; I heard distinctly every sound in the room, and was perfectly aware of my situation. By degrees, as the pleasurable sensations increased, I lost all connection with external things; trains of vivid visible images rapidly passed through my mind, and were connected with words in such a manner as to produce perceptions perfectly novel. I existed in a world of newly-connected and newly-modified ideas; I theorised, I imagined that I made discoveries. When I was awakened from this semi-delirious trance... indignation and pride were the first feelings produced by the sight of the persons about me. My emotions were enthusiastic and sublime, and for a minute I walked around the room, perfectly regardless of what was said to me. As I recovered my former state of mind, I felt an inclination to communicate the discoveries I had made during the experiment... with the most intense belief and prophetic manner, I exclaimed... "Nothing exists but thought! the universe is composed of impressions, ideas, pleasures, and pains."

"Wild enjoyment" persisted for more than 2 hours. Marihuana? LSD? Mescaline? No, the drug was nitrous oxide; the scientist was Humphry Davy; the time was 1799 (f). Southey and Coleridge are said to have been inspired more to laughter than to poetry at ensuing laughing-gas parties. These anticipated the "ether frolics" of the past century and the "pot parties" and "LDS-trips" of today.

The fact that simple N2O can elicit subjective responses resembling those caused by complex molecules, like LSD and mescaline, should give added perspective on the action of hallucinogenic drugs. Researchers hampered by the
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20 JANUARY 1967
Save Enough Redwoods!

"Save-the-Redwoods" does not imply simply a need to preserve a species as interpreted by Fahnestock (Letters, 2 Dec.). The Save-the-Redwoods league was founded with the idea of purchasing and setting aside (by means of contributions from individual donors and matching funds from the state of California) remnants of the once extensive virgin redwood forest for the enjoyment of future generations. A single statistic does not tell the whole story: 50,000 acres (20,250 hectares) of virgin redwoods in existing state parks may appear to be a lot of acreage, but it is a pitifully small fraction (about 3 percent) of the existing coastal redwood stand in California and it is insufficient to absorb in reasonable fashion the hordes of people who visit the groves in increasing numbers each year. A visit to a redwood forest is, after all, meant to be a unique and vital experience, not the museum experience which Fahnestock advocates by preserving isolated groves.

The redwood is remarkably viable, it is true. However, its vaunted ability to survive storm, fire, and flood has not yet met its full measure in the locust-like depredations of man. Unfortunately, California's existing Forest Practices Act still lacks the teeth required to make operators comply with a minimum of good logging practices. The tendency today to log on ever steeper slopes with heavy tractors and machinery can only lead to a decrease in slope stability and accelerated erosion and runoff.

It cannot be stated categorically that current "shrouds around LSD" (Letters, 18 Nov.) may wish to reconsider nitrous oxide for provoking sensory perturbations. Nitrous oxide is not likely to compete with LSD or mescaline as an illegal chariot to Parnassus, because of its inconvenient form (compressed gas in cylinders), variability of action, and unpleasant side effects at times.

ARTHUR CHERKIN
Psychobiology Research Laboratory, Veterans Administration Hospital, Sepulveda, California 91343

Reference
a grove will flourish and regenerate independ ently of its surroundings, as suggested by Fahnestock. Steep intervening ridges may be of little avail against weather modifications which are induced by regional deforestation.

DONALD H. GRAY
Department of Civil Engineering,
University of Michigan,
Ann Arbor 48104

Rare Birds Identified

It was kind of Science to include Ripley’s letter, “Save the Endangered Birds,” (11 Nov.) It was most unfortunate, however, that a Mallard duck was chosen to illustrate the point of his letter. The Mallard is one of the most abundant waterfowl in the world, and the fact that its numbers decline somewhat during one breeding season does not mean that it is about to become extinct. This is not the type of bird for which the International Council for Bird Preservation is seeking aid, and if anyone seriously thought we were worrying about saving the Mallard, we would become a laughing stock. One biologist asked me, “What will you try to protect next, the Starling?”

The sort of birds with which the I.C.B.P. is concerned are the California Condor, of which about 50 remain in southern California; the Horned Guan (Oreophasis derbianus), very rare and local in cloud forests in southern Mexico and Guatemala; the Atitlán Grebe (Podilymbus gigas), of which a small population lives on Lake Atitlán, Guatemala; the Hawaiian Crested Honeycreeper (Palmeria dolet), very rare and restricted to Maui Island, Hawaii; the Japanese Crane, of which less than 200 remain in Japan plus a small population in Manchuria; the South Island Saddleback (Creationis carunculatus), restricted to a few tiny islets off South Island, New Zealand; the Cahow or Bermuda Petrel, breeding in very small numbers in Bermuda; the Spanish Imperial Eagle, reduced to about 100 in Spain with perhaps a few pairs in North Africa; and the Imperial Parrot (Amazona imperialis), confined to the high mountain forest of Dominica, West Indies.

G. STUART KEITH
Department of Ornithology,
American Museum of Natural History,
Central Park West at 79th Street,
New York 10024
There are at least 16 UV monitors already available (and one of them is even ours). Whatever possessed us to develop number 17?

Unbounded optimism. That, and the rather firm conviction that it was now time for a first-rate, fully quantitative flow analyzer for monitoring UV absorption at either 254 or 280 μm.

This new analyzer, the Uvicord II, is now available as a particularly useful tool for continuous measurement of the UV absorption of electrophoretic or chromatographic effluents containing fractions which absorb at 254 or 280 μm. And it is especially suited for cold room use because: (1) the light source compartment is insulated and has its own built-in heating coil, and (2) the control unit and/or recorder can be physically separated from the detector unit, thanks to a very long cable. (One of several advantages of a separate recorder.)

The primary source of the 254 μm in the Uvicord II is a stable, long-lived, low-pressure mercury lamp. But then getting the desired 280 μm was quite another matter and proved to be somewhat of a strain on the aforementioned unbounded optimism. The eventual elegant exclusive solution: the 254 μm from the mercury lamp is used to excite a transparent rod which has been specially activated to fluoresce strongly. This rod then emits UV in a relatively narrow peak with a maximum at 280 μm. Unwanted radiation is eliminated by using black glass and selective interference filters. This latter interference filter was also developed by us and provides unique assurance of getting the essentially monochromatic light needed for quantitative measurements.

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Then we should probably also tell you that this instrument has a well-designed detector unit, that the very small measuring cells have good flow properties and are easy to get to, and that the circuitry is simple, straightforward and dependable. All true. Or, that the Uvicord II is compatible with our entire line of chromatographic devices, fraction collectors, and recorders. The Uvicord II takes its place comfortably in our complete systems (whose individual units are all LKB-designed and built), or, alternatively, can perform as a versatile UV analyzer when coupled to other equipment. Incidentally, the Uvicord II follows the Uvicord I but doesn’t necessarily displace it. You might keep the Uvicord I in mind if your need is solely for 254 μm; it’s still very viable.

So now there are at least 17 UV monitors, and two of them are ours.) For complete specifications on the Uvicord II, ask for bulletin 8300511.
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One of the latter, George Reedy, head of a small research and development firm in Washington, was Johnson's first and perhaps most harried press secretary. A long-time friend and associate of the President, Reedy possibly will give the commission an informal line of communication to Johnson. Four members of Congress, including the chief sponsors of the marine act, Senator Warren G. Magnuson (D-Wash.) and Representative Alton Lennox (D-N.C.) will sit on the commission as advisory members.

For most, if not all, of the commission members* oceanography is not a new interest. For example, John H. Perry, besides being a Florida publisher, is a manufacturer of small submarines. James Crutchfield, University of Washington economist, is a co-author of a sharply critical analysis of the National Academy of Sciences' 1964 report "Economic Benefits from Oceanographic Research."

Some of oceanography's "old hands" — leading scientific and technical people who in the past have figured prominently in public discussion of marine science and technology — appear skeptical about the commission's chances of making a large and significant contribution to the shaping of the government oceanographic establishment. It seems, in fact, impossible to avoid the conclusion that the commission runs a risk of being not much more than a minor advisory appendage to the marine council. The council, or at least its chairman and staff, had a major part in screening prospective commission members. Moreover, it will be through the council that the commission's report is transmitted to the President. The council, served by a professional staff of 13, began its work in August and now has a half-year head start on the commission. Catching up may not be easy inasmuch as the commission, with a professional staff of only three, expects to meet just two days a month during the 18-month period allowed it by law for its work. The commission will share quarters with the council and will work with it intimately.

Among the old hands there is concern that the highest level of expertise in ocean science and engineering is not adequately represented on the commission, even though its chairman is a physi- cist and academic administrator of distinction and its other members are people of achievement. From this viewpoint, the commission study would promise greater results if, through a better selection of members, it were linked more closely to previous study efforts, such as that completed last year by the President's Science Advisory Committee's oceanography panel (Science, 22 July 1966). The PSAC panel, chaired by Gordon J. F. MacDonald, U.C.L.A. physicist now on leave to serve as vice president for research at the Institute for Defense Analyses, recommended the establishment of a new environmental science agency which would administer most of the government's nonmilitary activities in oceanography.

The Stratton commission will seek the advice of scientists, such as MacDonald, who have pondered the question of the government's responsibilities and opportunities in marine science and engineering, and of leading oceanographers at universities and at institutions such as Scripps and Woods Hole. "It may take them 18 months just to educate themselves," one of oceanography's elder statesmen observes, however, "I think they're going to have an awkward hard time."

Within the administration the commission is extolled as a new group free of bias and precommitments. Indeed, the omission of the old hands is conspicuous enough for some to surmise that it is deliberate. But the chief considerations underlying the makeup of the new body appear to have been a desire for geographic balance and, especially, the necessity of meeting Congress's requirement that academic, industrial, and governmental (both state and federal) circles all be represented. It was felt, moreover, that the academicians appointed should be drawn not just from science and engineering but also from other relevant disciplines, such as law and economics.

However the commission performs, the President is likely to need some competent advice, other than that which Humphrey's council will provide, on the question of the most appropriate governmental structure for oceanography. The new agency envisaged by the PSAC panel would represent mainly a pulling together of the Commerce Department's Environmental Science Services Administration (ESSA) and the Interior Department's Geological Survey, Bureau of Commercial Fisheries, and Bureau of Mines. Proposals of this kind (for which the President's as yet not fully disclosed plan to merge the Commerce and Labor departments possibly will have important implications) automatically stir bureaucratic rivalries. No doubt the President would find it helpful to have the views of a qualified panel made up largely of nonbureaucrats.

Some 18 months hence one perhaps will learn whether the Stratton commission has risen to the challenge or has simply confirmed the cynical view that the true role of government advisory bodies is to support whatever views are arrived at by those responsible for their appointment.

—LUTHER J. CARTER

Announcements

The four schools that comprise Joint Oceanographic Institutions Deep Earth Sampling (JOIDES) invite planning advice for a deep drilling program scheduled to start early in 1968. The project is designed to obtain samples of earth sediment and shallow core at depths ranging to 20,000 feet in the Atlantic and Pacific. Data and materials produced will be available to scientists, providing that their studies are published promptly. The project will be conducted under an 18-month contract from the National Science Foundation to the Scripps Institution of Oceanography, operator for JOIDES; the other sponsoring institutions are the Institute of Marine Science, University of Miami; Lamont Geological Observatory, Columbia University; and Woods Hole Oceanographic Institution. Additional information is available from the executive secretary of JOIDES, J. H. Stanbrough, Jr., of Woods Hole.

* Members are Julius A. Stratton (chairman), chairman, Northrop Corporation, president of Northwestern University, Chicago; Robert H. Baldwin, Undersecretary of the Navy; Frank C. Diluzio, Assistant Secretary of Commerce for water pollution control; and Robert M. White, administrator of the Environmental Science Services Administration. Four members of Congress will serve as advisory mem- bers: Senators Warren G. Magnuson of Washington and Norris Cotton of New Hampshire; and Representatives Alton Lennox of North Carolina and Charles A. Mothet of Ohio.
pletely brittle ceramics fracture in a manner similar to glass, a reduction in flaw size and density is necessary. Improvements in semibrittle ceramics may be obtained by increased ductility or strength. Solid solution and precipitation hardening have been attempted, but grain size refinement and elimination of porosity appear to be the best avenues of approach. Finally, improvement in the ductile fracture resistance at high temperatures implies an improved creep resistance. At present, he said, it appears that high density polycrystalline ceramics containing a second phase may provide the most satisfactory properties.

In an analysis of the brittle-to-ductile transition in polycrystalline metals, T. L. Johnston (Ford) placed major emphasis on factors related to the plastic resistance associated with grain boundaries and the effects of plastic anisotropy. Utilizing a generalized form of the Griffith criterion, he said it can be readily shown that several individual factors may be made reasonably quantitative and that the nature of plastic response can be predicted. Specifically, it can be shown that a critical factor relates to the length of a plastic shear zone which is constrained by an elastically loaded matrix. As this length increases, the Griffith inequality is satisfied and brittle failure occurs; however, the use of decreased grain sizes or the refinement of dislocation or twin distribution can further tend to "homogenize" the plastic flow and to decrease the magnitude of the shear zone. Of considerable importance in the consideration of plastic resistance is the availability of favorably oriented slip systems in an unshocked crystallography. This factor takes a semiquantitative form in the expression of the Von Mises criterion, which states that plastic deformation of a polycrystal will proceed with relative ease if each grain possesses five independent slip systems. In the case of hexagonal-close-packed lattices, for example, if slip is confined to basal slip, each grain will have an average of two systems, so that the grain boundaries will serve as effective barriers for plastic flow and brittle fracturing may result. He demonstrated that if the product of applied tensile stress, grain size, and plastic shear resistance reaches a value proportional to modulus and surface energy, brittle fracture will result. Similarly, the appropriate variation (in the temperature) with any of these "intrinsic" variables will provide a situation where the material is ductile as would be the case where high temperature promotes the ease of cross slip and an attendant decrease in grain boundary resistance.

N. S. Stoloff (Rensselaer Polytechnic Institute) reviewed the effects of solutes on the fracture behavior of metals, discussing the influence of various alloy additions on the different factors entering the expression of the fracture criterion. He said that a detailed study on such a problem is complicated from the outset, since it may be difficult to isolate individual parameter changes because a given alloying element can produce multiple (and sometimes competing) effects. However, since there has been considerable research in this field, several general conclusions can be drawn. It is clear that the Cottrell-Petch theory of fracture, including modifications to take into account slip character, provides an adequate qualitative picture of alloying effects, but it is not yet possible to unambiguously predict the influence of a given solute on the transition temperature of a base metal.

In his discussion of tensile failure, C. J. McMahon (University of Pennsylvania)
nia) emphasized the role of microstructure and the mechanisms of crack initiation and propagation. For brittle fracture, he demonstrated that the probabilities of both initiation \( P_i \) and propagation \( P_p \) must contribute to the total fracture probability, and that these factors may affect properties to widely differing degrees. For example, in iron-containing carbides, cleavage micro-cracks can be nucleated readily at low stress by carbide cracks, but fracture will not occur (except at very low temperatures) until \( P_p \) has been raised by work hardening. Here \( P_p \) controls fracture. In the case of polycrystalline and single crystal chromium below the ductility transition temperature, it has been demonstrated that fracture is very definitely initiation-controlled and that large ductility can be achieved by rendering potential crack sources inoperative.

S. Sternstein (Rensselaer Polytechnic Institute), in a discussion of fracture in polymeric materials, noted the differences between values of the surface energy calculated from “first principles” and those determined experimentally from an application of the Griffith criterion. The main conclusion from a series of experiments on controlled crack formation and propagation relates to the fact that the “crack size,” as normally considered in the Griffith relation, must be modified. Previous work had suggested that the excess values of surface energy (sometimes high by a factor of 100 to 1000) might be rationalized in terms of a thin layer of plastic deformation or reorientation near the fresh fracture surface. However, this assumption, he said, is inconsistent with what might normally be expected in an examination of the temperature-dependence of the surface energy. Sternstein and co-workers have, on the other hand, determined that the discrepancies observed can be rationalized in terms of a crack-tip size which is modified by a parameter dependent on the history of the crack. For example, they have shown that where cracks are introduced into polymers at different temperatures and then the polymers are fractured at the same temperature, the fracture characteristics are markedly different.

Superposed on this “static” behavior, it is important to consider the dynamic effects observed in the fracture of polymers, and the related fact that the size of the region around the crack tip will depend, in part, on the rate at which the crack tip grows. Thus, there is a cyclic problem: the size of the region at any instant will govern its growth at that instant, but the growth will in turn determine the ability to grow in the next instant of time, since the stress-concentration factor will be changing with time. He concluded that, in general, the rheological response of the material will be linked to the ability of the material to undergo a plastic deformation and that this link is achieved through a time-dependent stress-concentration factor.

Bernard Rosen (Southern Research Institute), continuing the discussion of failure in polymeric systems, spoke on homogeneous fatigue processes, in particular, the salient micro-failure habits of a class of polymeric bodies that are both fully amorphous and soft. These super-cooled liquids are taken as being composed of long and linearly-chained molecules, including unvulcanized rubbers, synthetic leathers, and soft organic glasses. Through a qualitative description of the effect of tensile forces on the reorientation of long chain molecules, he discussed models which may account for “work-hardening” and optical and mechanical anisotropies in
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An interesting consequence of this analysis is the observation that it can be easier to initiate a new crack than it is to propagate an already existing crack.

Turning to what is termed "homogeneous submicrocavitation," he pointed out that two types of analyses may be attempted: a consideration of a solid body complicated by liquid-like responses (the approach chosen by Sternstein), or a consideration of a liquid body complicated by solid-like responses (Rosen's choice). The model is developed through the introduction of a cavitation process (the existence of which has been supported through permeation experiments) which produces exceedingly small voids within the matrix. The subsequent failure may occur through either of two mechanisms: (i) a dense population of such cavities, or (ii) the presence of a few independent cracks. Whether one of these mechanisms dominates will depend strongly on the period of loading and the time required for relaxation. Rosen carried the argument, again in a qualitative sense, to the description of slipping of chain-like molecules and primary-bond scission of chains, thereby building a "molecular plane of reasoning" to obtain a self-consistent, though still qualitative, description of the flow and fracture of soft polymeric bodies.

In addition to the formal papers presented at the conference and the question-and-answer periods, two highly informative panel discussions, held in connection with the general considerations of fracture in a variety of different solids, provided a deeper insight into the limitations imposed when one attempts to translate one disciplinary approach to another field, while at the same time providing an atmosphere in which it was possible for the various backgrounds—metallurgy, ceramics, physics, chemistry—to supply "hints" to the solution of old problems.

The proceedings of this Fourth Symposium on Fundamental Phenomena in the Materials Sciences, including the papers presented, the question-and-answer periods, and the panel discussions, will be published by Plenum Publishing Corporation, 227 West 17 Street, New York 10011.

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