

## Breaking down the boundaries

Ecology has been called the "subversive science." This, of course, does not mean ecologists are revolutionaries or that they tend to be less loyal than other scientists. But it does imply a new kind of science; in ecology, the neat divisions and hierarchies that characterize such entities as university departments do not hold. Ecology deals with relationships as well as rankings, with synthesis as well as analysis, with totals as well as parts.

"Environmental Science: Challenge for the Seventies," a 50-page study issued by the National Science Board, the policy-making body of the National Science Foundation, takes an official step toward looking at the new (or newly rediscovered) realities. Although the report was produced largely by academicians, the conclusions sometimes are candid: "Within universities the interdepartmental nature of environmental science ensures an awkward relationship with discipline-oriented research. Neither the institution nor the individuals can tolerate excessive crossing of boundaries, and interdepartmental arrangements usually fail to incorporate the mix that is needed for study of environmental systems."

**The problems** within universities make up only one aspect of the difficulties facing the environmental sciences, says the report. Another is that the trained scientific manpower to utilize new techniques for systems analysis of total environments simply does not exist. For instance, of a total of 153,068 natural scientists in the nation, only 10,506 are in the environmental sciences (although another 12,516 are in applied and supporting specialties). And the number of Ph.D.'s per specialty in the environmental sciences is only about one-half what it is in the natural sciences as a whole. The shortage of environmental scientists is exacerbated by the fact they are spread too thin to form the "critical size" research groups that NSB believes are necessary for effectiveness.

The NSB proposes a "national program for advancing the science of environmental systems" distinct from, although not necessarily apart from, existing environmental quality agencies and their current programs. Although the new program would have Federal direction, universities (which now have two-thirds of the environmental scientists) and industry (which "possesses great capability in systems analysis and systems management") would play key roles "in new types of research organizations and . . . new approaches. . ."

The main thrust of the new program would be systems studies of environ-

ments, possibly along the lines of the International Biological Program's biome studies (SN: 4/10/71, p. 247) or the U.S. Geological Survey's EROS program (SN: 6/19/71, p. 413), with a view to constructing predictive models. The models could provide structures for assessment of proposed new technologies; they could also delineate existing problems that require the earliest action.

**Every study** by every agency involved in any way with research and development makes a plea for assured, continuing and high levels of funding, and the NSB study is no exception. Tire-some as these pleas may be, environmentalists insist this one cannot be ignored. For instance, scientists with Federal agencies know the gross levels of mercury in various environments, but—because they lack funds for instruments—they often cannot tell whether it occurs in relatively harmless forms or in highly toxic compounds. An environmental sciences program certainly deserves at least the same assurance of continuing support as the Federal highway program, the environmentalists insist.

The report has its flaws. Its writers acknowledge, for instance, that it largely ignores the possible input of the behavioral sciences to systems studies of environmental problems. This leaves a large gap—because environmental problems, ultimately, will be solved or not solved through man's decisions to do so or not. These decisions are based on forces that science has scarcely begun to examine.

And the report, although it acknowledges the deficiencies in university departmental systems, nonetheless largely accepts the traditional assumptions of academia, among them the one that people with Ph.D.'s will function better than anyone else even in interdisciplinary work. The environmental sciences may invalidate some of these assumptions one day soon. Flexibility and open-mindedness, whether or not accompanied by advanced degrees, may be the keys in this new ball game. □

### PROTESTS A-TEST

## Suit against Cannikin

A new environmental group, the Committee for Nuclear Responsibility, filed suit in U.S. District Court in Washington last week asking a halt of the Atomic Energy Commission's plan to explode a nuclear device underground on Amchitka Island in the Aleutians (SN: 5/22/71, p. 350). Because the test is of a device that would be used for antiballistic missiles, the outcome of the suit might set a new legal precedent—a Federal court has never ruled in a weapons-related case. □

## Separating mother and child

For humanitarian and ethical reasons, behaviorists are not able to perform many of their experiments on humans. They use animals instead, monkeys especially, and attempt to use the experimental results as models for understanding human behavior patterns. At Cambridge University, for example, Drs. R. A. Hinde and Yvette Spencer-Booth, who died in April, conducted experiments based on the supposition that a temporary or permanent disruption of a child's relationship with its mother may have far-reaching effects. Because it was not possible to conduct such experiments on human mothers and children, the researchers used 16 infant rhesus monkeys.

When the monkeys were between 21 and 32 weeks old they were separated from their mothers for a six-day period, two six-day periods or a thirteen-day period. These infants were monitored during the separation and again after they were returned to their mothers. The results, published in the July 9 SCIENCE, verify the researchers' original contention. As expected, they found that when the mother is removed for a few days, the infant calls a great deal at first and then shows a decrease in normal movement and play activity. More significant, tests given six months and even two years later strongly suggest, the doctors said, that these symptoms are persistent. Control monkeys who had undergone no separation did not display these symptoms.

**Dr. Harry F. Harlow**, a pioneer in primate research at the Primate Research Center at the University of Wisconsin in Madison (SN: 8/1/70, p. 100), calls the findings "more dramatic than those of previous studies, but they are reasonable." Dr. Harlow's similar studies were terminated after 90 days but he feels that in some instances the results of separation (strong protest and despair) may last two years or even longer.

If this is so, it may be important to the monkeys, but what does it mean to humans? Drs. Hinde and Spencer-Booth suggested that the effects on both monkeys and humans are similar and that the phenomena are comparable. If this is so, they concluded, "long-term effects may occur also in man." Dr. Harlow, however, is more cautious. "Man and monkey are undoubtedly closely related," he says, "but more testing is needed. The results of single small studies are encouraging and look very nice but we don't know at the present time their exact relationship to man. To base human treatment or therapy on the results of monkey experiments would be a gamble." □