

# SCIENCE

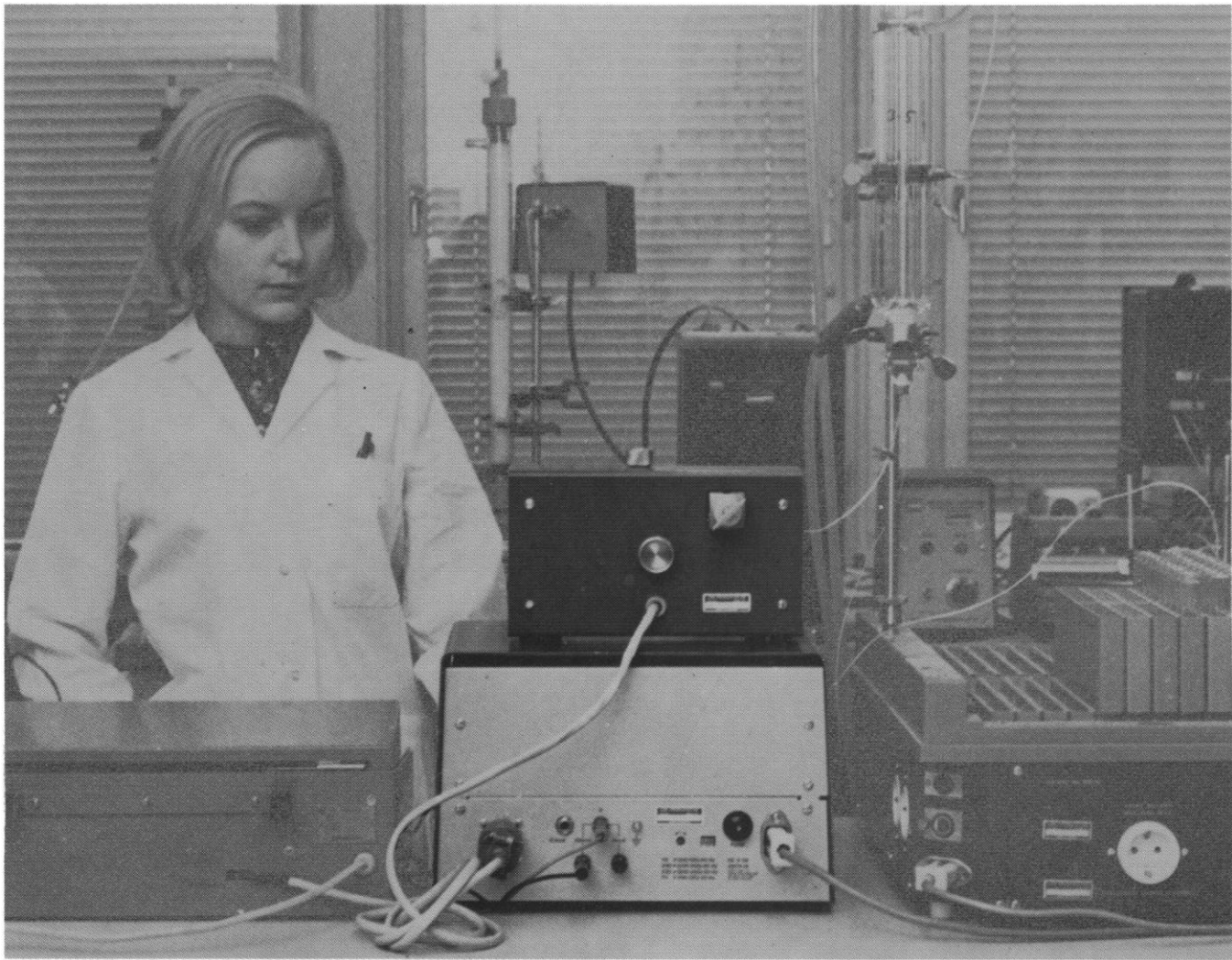
25 June 1971

Vol. 172, No. 3990

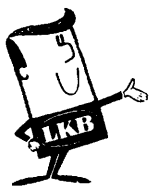
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Index Issue



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Satyrine butterfly (*Euptychia west-woodi*) ovipositing on its food plant (*Selaginella horizontalis*) at Barro Colorado Island, Panama Canal Zone. See page 1341. [L. E. Gilbert, Stanford University]

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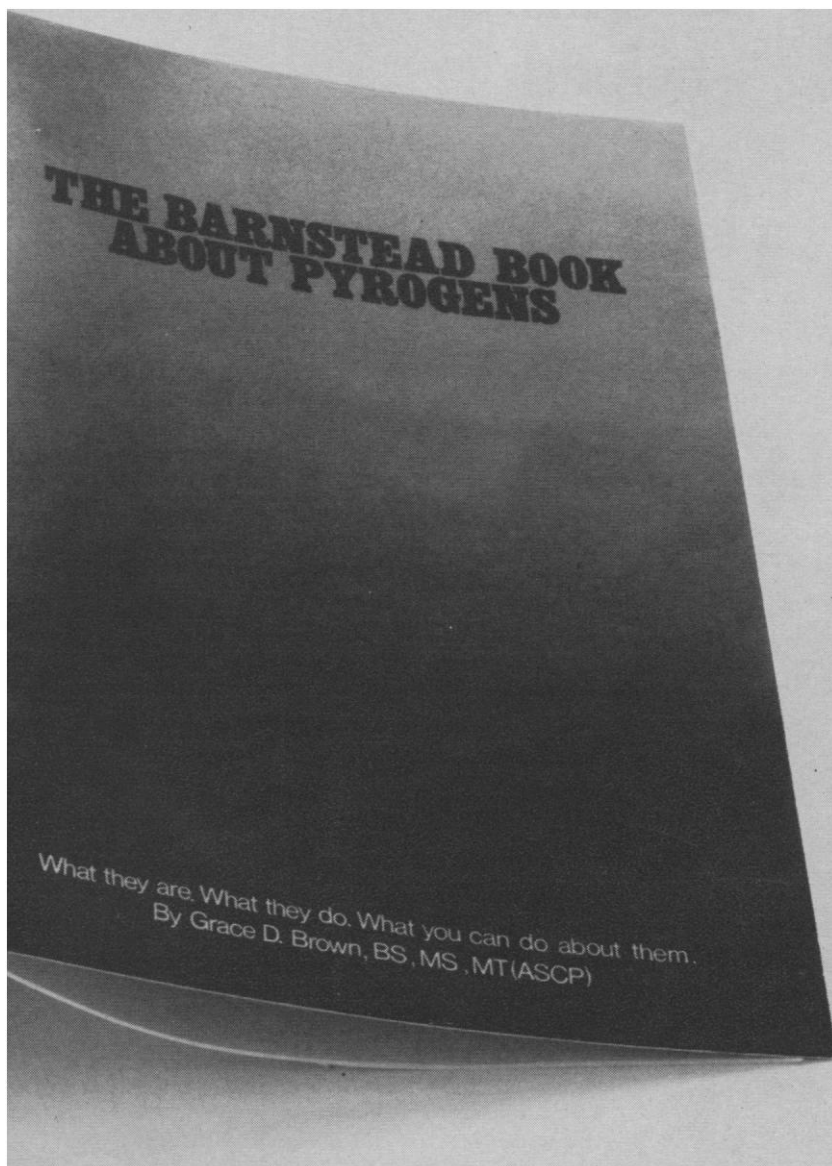
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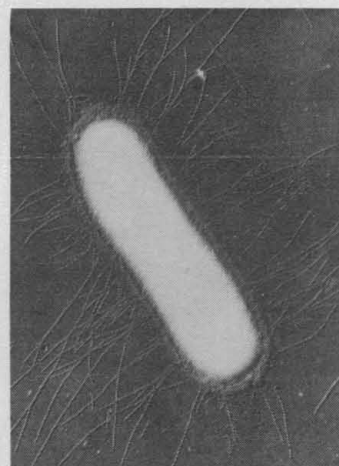


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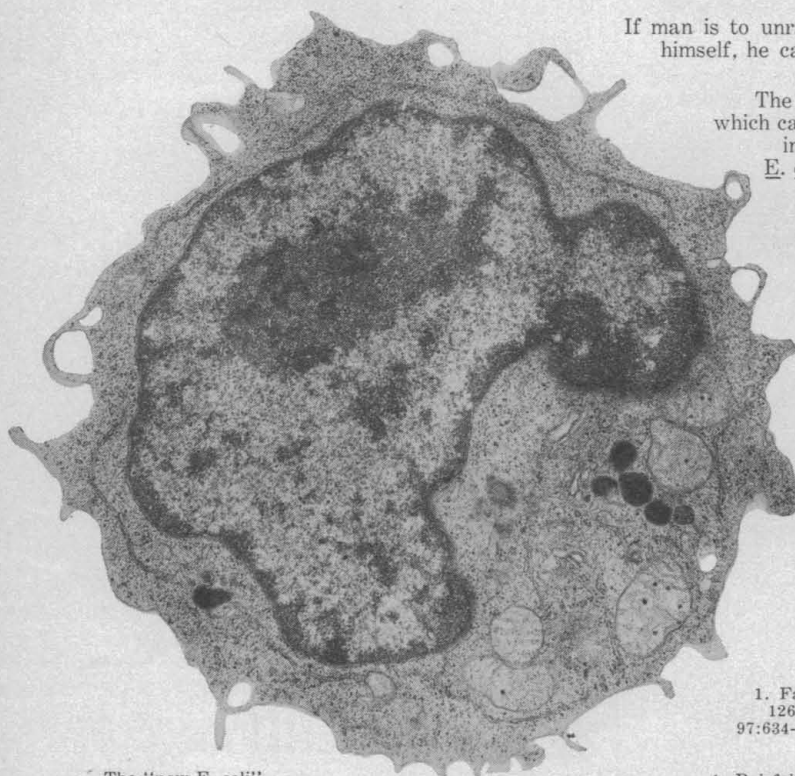
This  
helped  
answer  
a lot of questions.



The "old" *E. coli*

Courtesy of Dr. C. Brinton

## The "new *E. coli*" will help answer the new ones.



The "new" *E. coli*

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1. Fahey JL, Feingold I; Rabson AS, Manaker RA; Science 152:1259-1261, 1966 / Tanigaki N, Yagi Y, Moore GE, Pressman D; J Immun 97:634-649, 1966 / Glade PR, Chessin LN; Clin Invest 47:2391-2401, 1968
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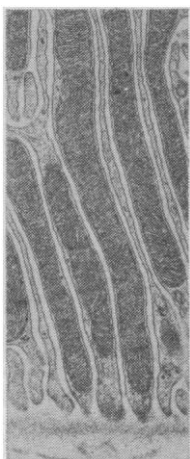
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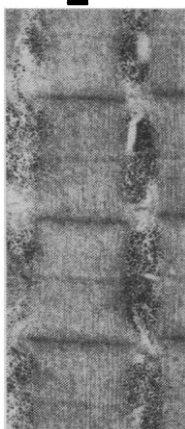
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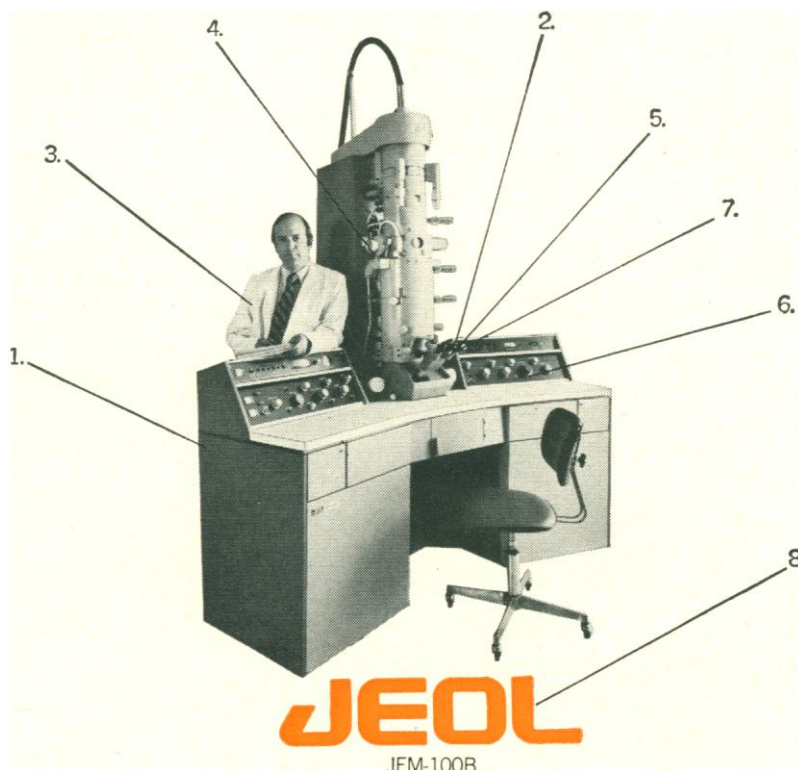
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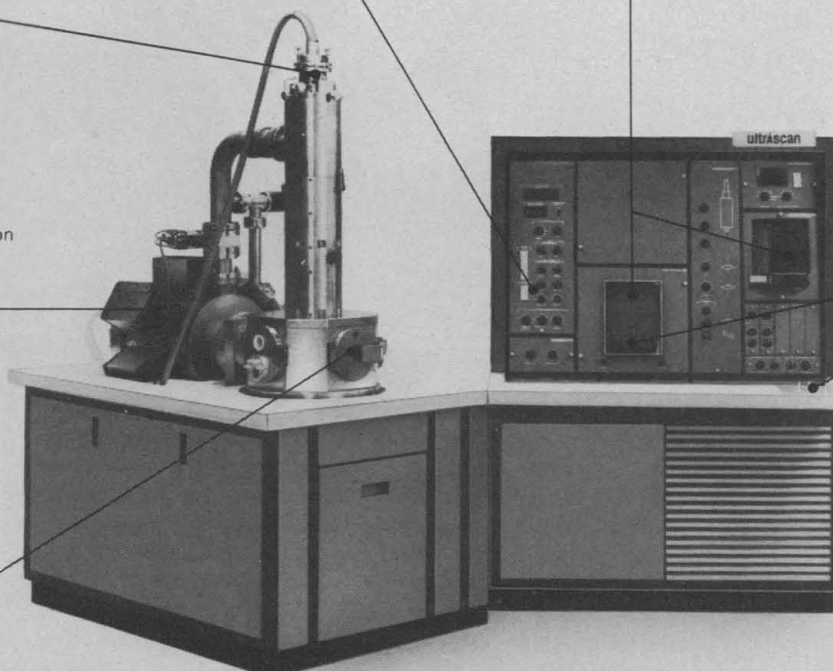
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agricultural crops is negligible. We are currently studying rural groups 12 miles north of Aligarh which illustrate these principles. These groups maintain outstandingly good productivity with very little cost or damage to villagers. Under proper rural management, rhesus monkeys provide a source of income and cultural interest for local people, and at the same time a valuable biological resource is fostered. We hope the ideas of Bermant and Chandrasekhar find wide distribution and favorable consideration.

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### Intourist: A Pleasant Experience

Romer's letter (23 Apr., p. 326), complaining about his experiences with Intourist in the U.S.S.R. should be considered in relation to general conditions in that country and to the conditions encountered by any tourist not speaking the native language. I spent May and June 1970 in the U.S.S.R. on the exchange program of the U.S.S.R. and U.S. national academies of science. After traveling once to Norosibirsk on my own, I was thereafter most pleased to have the help of Intourist. Thanks to this organization, the foreign tourist benefits from a special waiting room at airports with uncrowded meal facilities, on domestic airlines he can board the plane (one class, with no reservations) before the Russian travelers and thus can select the preferred seats and stay with his friends, and finally, he does not have to stand in line for either reservations or baggage registration. Thanks to the representative of Intourist in the Moscow hotel of the U.S.S.R. Academy of Sciences where I was staying, I was provided, on short notice, with tickets for the opera or the ballet at the Bolshoi Theater, for concerts, and so forth. These events could not be attended without the help of Intourist because of the great demand for tickets.

Considering the still-limited tourist accommodations in the U.S.S.R. and the existing bureaucratic procedures, I found that Intourist was most helpful in relieving the foreign tourist of the numerous difficulties found when traveling alone. Is Romer aware of the vexations of the non-English speaking foreign tourist who, on arrival in the United States, attempts to book a flight

or a hotel room, or reserve a seat at the Metropolitan Opera? It is even difficult for him to call home, since the New York operators handling the international lines to Europe do not speak or understand the foreign language involved.

ROGER W. JEANLOZ  
Massachusetts General Hospital,  
Boston, Massachusetts 02114

I have twice visited the U.S.S.R., once as a tourist in 1958, and again as a representative of the U.S. government to the 9th International Conference of Wildlife Biologists in 1969. For that conference Intourist arranged five tours and handled groups of 30 to 75 biologists flawlessly.

I personally took two tours, one near Moscow, another to eastern Siberia with a group. In 20 years of traveling around the world, I have never seen groups better handled. For example, after we visited Lake Baikal, Intourist informed us that the next day we would be flown to Brask to tour its massive hydroelectrical development. We, being biologists, objected and indicated that we would much prefer to spend time in primitive woodland habitats (the taiga). After some discussion, Intourist agreed, flew us to Brask, bussed us to the taiga, turned us loose there for half a day, fed us, and then gave us a quick tour of the hydroelectrical development. We were all flown back to Irkutsk, and the tour returned to Moscow while my wife and I took the Trans-Siberian railroad to the east coast. Accidentally, one of our bags was returned to Moscow with the tour group. Four days later at Khabarovsk our bag had been located, shipped across the U.S.S.R. by air, and returned to us.

A curse—yes, if the meeting organizers have not communicated their wishes effectively; a tremendous boon if matters have been properly arranged.

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### Nutrients in Lake Erie

Hubschman suggests (12 Feb., p. 536) that massive harvesting of unspecified organisms from Lake Erie could remove sufficient nutrients to improve the polluted condition of the lake. Quantitative considerations indicate, however, that the amount of common nutrient element removed under such a program



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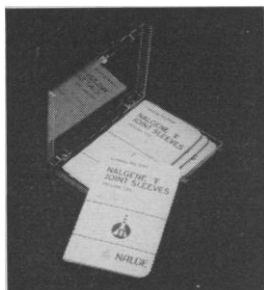
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would be small compared to inputs and very small compared to amounts already accumulated in sediments or solution.

For example, input of phosphorus into Lake Erie is estimated to be  $2.3 \times 10^{10}$  g/year, with 24 percent from runoff and 76 percent from municipal and industrial wastes (1). Loss to Lake Ontario is a small fraction of this amount. Photosynthetic production approximates  $1.7 \times 10^{12}$  g of carbon per year (1) and this productivity (66 g of carbon per square meter per year) compares well with Ryther's estimate of 100 g of carbon per square meter per year for productive coastal areas (2). An average mass ratio of C:N:P = 40:7:1 applies to phytoplankton (3). Thus, primary production could sequester as much as  $4.3 \times 10^{10}$  g of phosphorus per year or an amount about double input.

It seems unlikely that more than a few percent of this quantity could be harvested on a sustained basis. Harvesting of phytoplankton is clearly impractical, and harvesting of animal species would involve trophic levels near 2 at best. Commercial fishing now removes only about  $1.4 \times 10^8$  g of phosphorus per year or about 0.6 percent of input. This corresponds to an average trophic level of about 3, if the calculation is based on carbon and the current catch of  $4.5 \times 10^9$  g (dry weight) per year is assumed to represent the maximum sustainable yield (1). The harvest of lake organisms might depress biological productivity, however, by removing the growth-limiting nutrient, provided the nutrient accumulates only slowly in the lake and is neither nitrogen nor phosphorus. We are unaware of data which clearly determine the growth-limiting nutrient for Lake Erie.

It would seem more efficient in terms of energy and technology to intercept nutrient elements from cities and industries before they become part of the lake system.

STUART M. ROSENBLUM  
THOMAS C. HOLLOCHER

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Brandeis University,  
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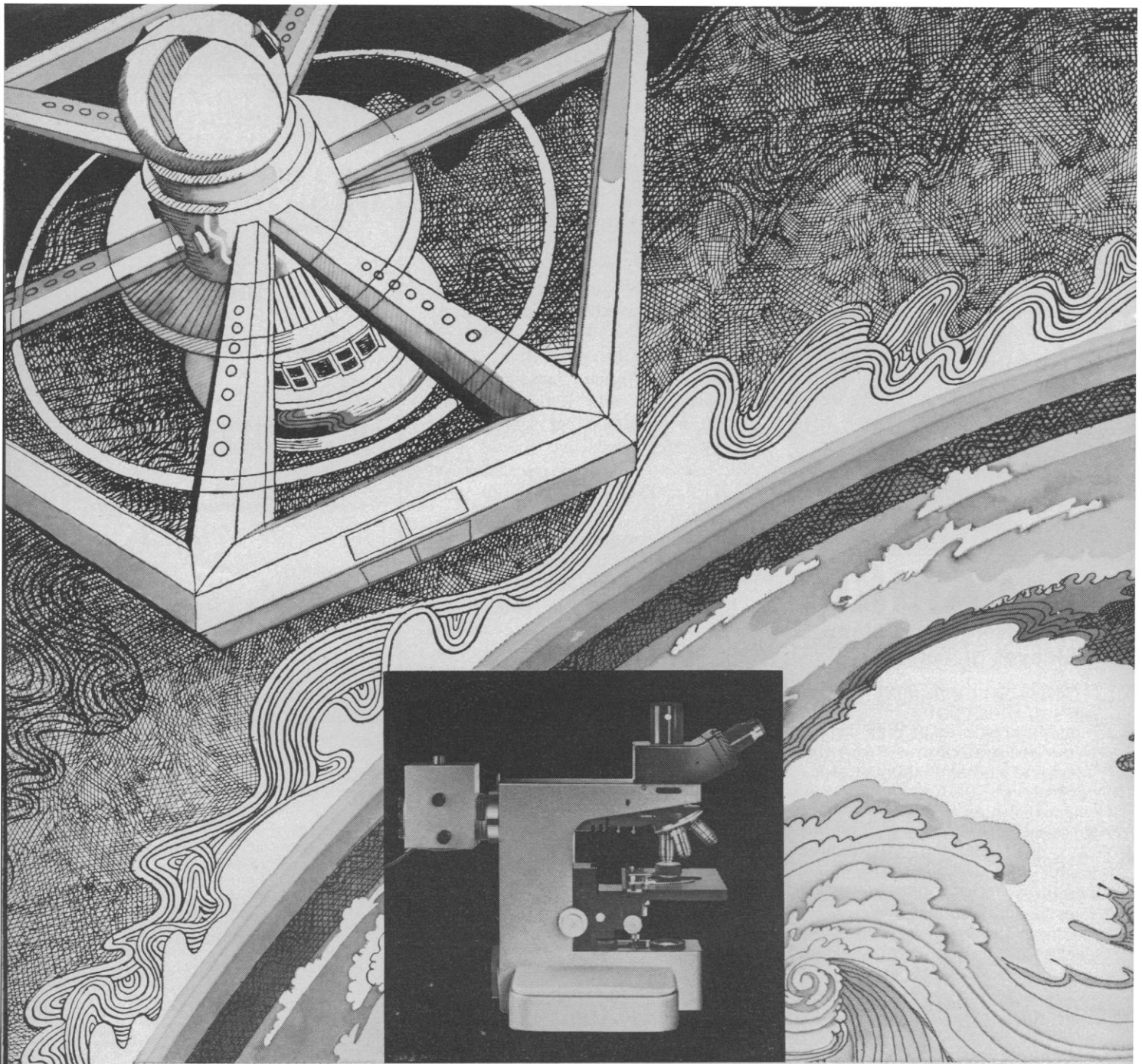
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## The Survival of Nations and Civilization

Is a vigorous pronatalist policy necessary for national survival in a competitive world? Over the centuries many men have thought so. In the 19th century Parson Weems (who created the legend of George Washington and the cherry tree) wrote:

My friends, 'tis population, 'tis population *alone*, that can save our bacon. List, then ye Bachelors and ye Maidens fair, if truly ye do love your dear:

O list with rapture to the decree,  
Which thus in Genesis you may see:  
Marry, and raise up soldiers, might and main,  
Then laugh ye may, at England, France, and Spain.

If national survival depends on winning a breeding race, what is the prognosis for America? As of 1970 the United States' population was 205 million out of a world total of 3632 million. That makes us just 5.6 percent of the world's population. One person out of 18 is an American. We are decidedly in the minority.

Everyday we are a smaller minority. We are increasing at only 1 percent per year; the rest of the world increases twice as fast. By the year 2000 one person in 24 will be an American; in 100 years, only one in 46. The projected figures assume that present trends will continue. They may not; but is there any better basis for a national policy?

What should we do? In the past, we might have used these facts to justify imperialism, conquest, and the extermination of other peoples. No more. We are not saints, but we are beyond the point of adopting an explicit national policy of this sort.

Should we, then, take Parson Weems's advice seriously and try to outbreed everybody else? Merely keeping up with the rest of the world would require American women to double the number of their children. Can a government of men persuade women that it is their patriotic duty to emulate the rabbits? Or force them?

If we renounce conquest and overbreeding, our survival in a competitive world depends on what kind of world it is: One World, or a world of national territories. If the world is one great commons, in which all food is shared equally, then we are lost. Those who breed faster will replace the rest. Sharing the food from national territories is operationally equivalent to sharing territories: in both cases a commons is established, and tragedy is the ultimate result. In the absence of breeding controls, a policy of "one mouth, one meal" ultimately produces one totally miserable world.

In a less than perfect world, the allocation of rights based on territory must be defended if a ruinous breeding race is to be avoided. It is unlikely that civilization and dignity can survive everywhere; but better in a few places than in none. Fortunate minorities must act as the trustees of a civilization that is threatened by uninformed good intentions.—GARRETT HARDIN, *University of California, Santa Barbara*



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1964-1965, and to the tail end of a mini-epidemic of thalidomide embryopathy in 1962. This is because, in advance of these events, specific rubrics for limb reduction deformities and cataract or eye malformations had been included in the coding.

A. Gittelsohn (Johns Hopkins) discussed the possible use of computerized hospital records for monitoring malformations. Discharge abstracts are already extensively computerized in many hospitals (and in one entire state) for the purpose of characterizing medical care. The greatest limitation to efficient use of these data for surveillance is lack of patient identifier such as social security number (or name) with the abstract provided. Sensitivity to confidentiality currently precludes this. It is thus difficult to match abstracted hospital summaries for the same anonymous individual for whom little identifying data is available. However, the more demographic variables that are specified the greater the likelihood of linking any two records. In one small state with about 10,000 annual births, use of just sex, birth date, residence, and birth weight provides a high degree of accuracy of matches. Inclusion of information derivable from hospital records increased the ascertainment of malformations 250 percent over that from just birth certificates alone. A main advantage of record linkage is its low cost compared to other methods of monitoring.

In Metropolitan Atlanta hospitals are visited systematically, and defects noted in the charts or otherwise reported by nurses or physicians are recorded. There have been three temporal clusters of defects since 1967, but investigation has not revealed any suggestive environmental causes (J. W. Flynt, Center for Disease Control, Atlanta).

The higher incidence of mental retardation in children with minor birth defects such as low-set ears or wide-set eyes strongly implies that mental deficiency in such affected individuals had its onset in prenatal life (D. W. Smith). The possibility of using gross minor defects in newborns as indirect markers of environmental insult is enhanced by the fact that there is a relatively high frequency (10 to 15 percent) of defects in the newborn population. Significant trends could thus be detected more easily than with the use of less frequent markers (E. B. Hook, Birth Defects Institute). The outstanding question with this approach is the

unknown sensitivity of such defects to environmental insult.

In discussion of some problems in the biochemical approach to monitoring mutations, it was pointed out that although it is relatively easy to automate screening for deficiencies of protein associated with disease states, it is a much more formidable task to automate monitoring of qualitative protein changes (I. H. Scheinberg, Albert Einstein College of Medicine). It was suggested that zone electrophoresis of cord blood is one of the more promising methods of detecting fresh mutations in the human population. However, the current electrophoretic techniques may detect only 10 percent of allele variability, the rate of (electrophoretically) detectable mutations for a protein coded by 1000 nucleotides may be  $5 \times 10^{-6}$  per protein per generation, and the error rate for typing and other procedures is likely to be at a minimum 1 per 1000 or at least 100 times greater than the mutation rate. Furthermore, the rate of nonpaternity in the United States is vastly higher than the frequency of a new mutant at any particular locus. These apparent problems could be overcome by limiting the investigation of the possibility of new mutation to individuals with variants with a collective gene frequency of less than .0005. In this event, an estimated 400,000 blood samples must be screened for 30 proteins to obtain enough variants to detect 60 mutants (the number required statistically to document a change of about one-third above the background rate). Automation of electrophoretic techniques is probably the only possible approach to a task of this magnitude (L. Weitkamp, University of Rochester).

The high correlation of chromosome breakage with mutation in lower organisms as well as the increased rate of breakage in irradiated individuals suggests that these markers may be general signs of mutagenic environmental insult (A. Bloom, University of Michigan, and M. Cohen, State University of New York, Buffalo). However, the significance of breakage in vitro after addition of drugs to cells in culture is harder to assess and may be indirectly influenced by a host of unknown culture conditions. The main drawback to large-scale monitoring of chromosomal breakage in human populations is the tedious task of examining metaphase plates and scoring breaks. Cohen was optimistic about the

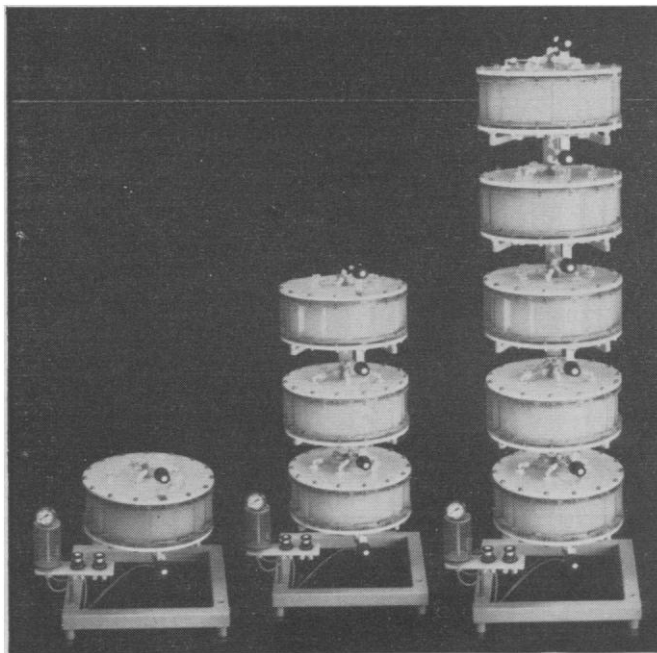
prospects for successful automation in view of the current status of several systems for either scoring from photographs of plates already picked out by human examiners, or else by automatic examination of slides without previous human selection of metaphase plates.

A histochemical method using 2-deoxyglucose-6-phosphate as a substrate for detecting variants of glucose-6-phosphate dehydrogenase in leukocytes was discussed as a possible means of monitoring somatic cell mutations. The wild-type enzyme lacks this property, but at least two known variants of the enzyme possess it. In peripheral blood of middle-aged people about one per 1000 cells strongly express the variant phenotype, in agreement with a hypothesized mutation rate of  $10^{-7}$  amino acid substitutions per cell generation and about  $10^4$  divisions of leukocyte stem cells during the middle-aged life-span. The heritable nature of the phenotype in white cells is yet to be established, however. This or similar approaches for detecting individual cell variants (if proven to be due to somatic mutation) will permit assessment of the mutational exposure of an individual through his lifetime, as well as fairly immediate evaluation of mutagenic effect of acute exposure to a suspect environmental factor (H. E. Sutton, University of Texas).

In closing remarks, Hirschhorn felt that too little attention had been devoted to the problem of the confidentiality of information acquired during monitoring. He cited misuse of Dutch genetic records by the Nazis during World War II as an example of the problems which record gathering for research purposes can entail. In reply, others commented that registries obtained from vital records use already collected data which have statutory protection and simply tabulate them in a different way. Collection of confidential information from any part of the population (as is currently mandated by law for censuses and income tax purposes, as well as for vital statistics) entails a certain personal risk which is accepted by society because of the presumed social benefits of use of this information.

Several participants briefly considered the problems of identifying the responsible environmental agent once an observed increase in malformation or mutation rate is observed. Some felt that appropriate epidemiological techniques were relatively well developed for such investigation. In addition,

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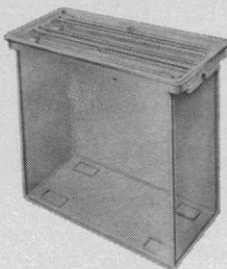
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tacit in many discussions was the assumption that accurate ascertainment of incidence rates and characterization of the populations at particular risk might permit identification of environmental factors already contributing to the background rates.

ERNEST B. HOOK

*Laboratory of Human Ecology,  
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New York State Department  
of Health, Albany 12208*

### Man and Environment:

#### A National Biological Congress

A series of national biological meetings of a new style has been inaugurated in which biologists talk not mainly to fellow-specialists but to those in other disciplines and to the public. The idea, conceived by William McElroy when he was president of the American Institute of Biological Sciences, is to bring biology to the public, somewhat as the AAAS meetings bring all of science to the public. Since the first of three projected meetings of this type, held in Detroit last November, was such a success, plans were immediately put in motion for the second, which is to be held 23–26 October in Miami Beach. The theme of the series is Man and Environment, and participating biologists are expected to present and discuss environmental biology and many related topics before an audience drawn from a variety of disciplines, or even laymen. Needless to say, this is not an easy assignment, and no doubt some of the meetings may become transmuted into technical discussions; but the goal is there, and everyone agrees that it is high time biologists met with those in other scientific fields and shared their plans and their secrets with them.

At a time when taxpayers are becoming skeptical about financial support of science, and indeed about support of education (as every university official knows), it is essential that the public be well and carefully informed as to what biologists are doing and planning. It is equally important, and even more stimulating, for those of us who are active in one area of biology to know at least something about what our colleagues are doing in other areas. To this end the program for the congress covers a wide sweep. It includes more applied biology than the regular AIBS meetings, since it reaches over into

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