

SCIENCE

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Volume 193, No. 4256

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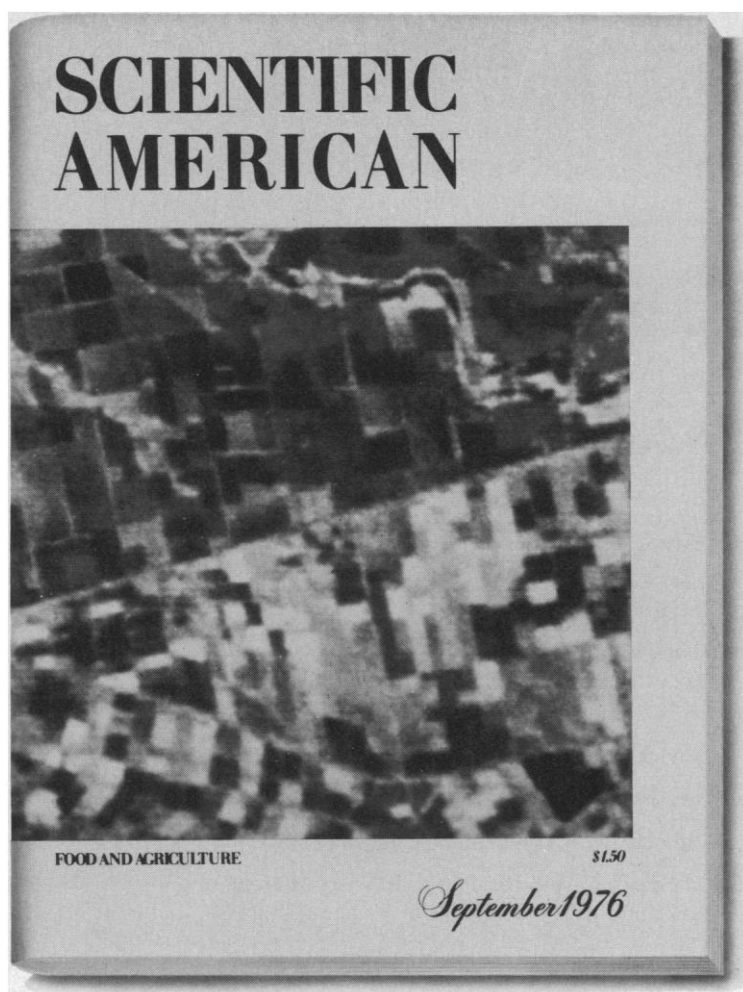
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**Three billion more
people will join us
at the dinner table
between now and
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**How in the world
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That question provides the occasion for the publication of the September issue of *SCIENTIFIC AMERICAN*, devoted in its entirety to *Food and Agriculture*. The answers come from a distinguished group of authors who are otherwise engaged in implementing their answers in the laboratory—and in the gardens, greenhouses, rice paddies, croplands and ranges of the world.

Pundits and publicists have put abroad a great deal of misleading information on this subject. There is wide acceptance of the proposition that the exploding populations of the poor ("underdeveloped") countries have overrun their agricultural resources. The "lifeboat ethic" instructs the people of rich ("developed") countries to be ready to repel boarding parties.

In fact, the peoples of the underdeveloped countries have outgrown not their resources but the subsistence-agriculture technology that has held them in misery from the dawn of history. The demonstrated agricultural technology of the industrially developed countries could multiply world agricultural output by more than a dozen times. It could support a well-fed population of 40 billion. This is a much larger number than that at which, it is now reckoned, the world population will stabilize some time in the next century.

What is required is the transfer of modern agricultural technology from the developed to the underdeveloped countries. That is the answer to the 2000 A.D. question. The fact that it is now technologically possible to banish hunger from human experience carries immense force against the political, economic and social obstacles that stand in the way.

For regular readers of *SCIENTIFIC AMERICAN*, this September single-topic issue supplies the latest installment in a continuing story. Starting in 1950, with "The Food Problem" by Lord Boyd-Orr, this magazine has reported step-by-step the revolution in agricultural technology that helped to double world food output in the years since.

Our readers have kept abreast of all the other developments in science that have made this period the most momentous in intellectual history. Consider what has occurred: the unlocking of the genetic code; the discovery of continental drift; the proof of uncertainty in logic; the recognition of the role of toolmaking in our biological evolution; the sudden arrival of solid-state electronics, the microcomputer, the laser; the elucidation of the nerve circuitry that organizes perception; the penetration of the structure of the fundamental particles.

To our readers all this has been reported by the scientists who did the work. (More than 60 Nobel prize-winners have written for *SCIENTIFIC AMERICAN*, nearly all of them in advance of their recognition by Stockholm.) The collaboration of our editors in the preparation of text and illustration makes this work accessible to a growing worldwide readership.

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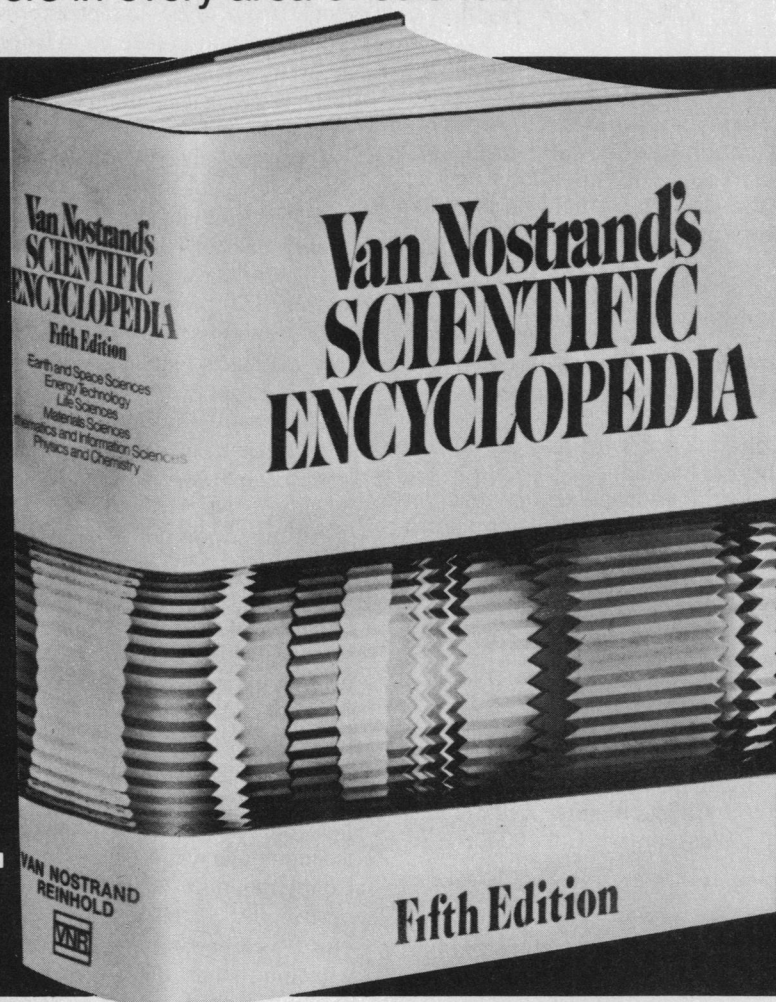
COVER

Two low-ranking older females charge an adult male Hanuman langur to rescue an infant he has seized from its mother and severely wounded. After retrieving the infant, the older of the two defenders, "Sol," continued to harass the infanticidal male. The infant's mother (not shown) did not participate in the rescue. See page 913. [Sarah Blaffer Hrdy, Harvard University, Cambridge, Massachusetts]

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gin, unusual virulence, and unprecedented epidemiology. If scientists do not conclude from this juxtaposition that it would be good to face up to ignorance in areas in which we have no experience, instead of engaging in facile speculation, I hope the public will.

I am not claiming that the mystery disease is a result of genetic manipulation, since obviously no one knows its cause. But I wish to point out that to pretend to know more than we do about causes and prevention of disease can only discredit science and scientists. (At this writing, infectious and toxic agents have in turn been ruled out as causes of "Legionnaire's Disease" and today's newspaper talks about Fort Detrick and possible unknown varieties of infectious agents.)

A further point: if a recombinant (and perhaps short-lived) coliform organism ever were to produce an outbreak of an epidemic, it might well be nearly impossible to identify or to culture as the cause in the presence of all the other, normal strains of *Escherichia coli* that grow in us.

Davis suggests that medical history shows such risks must be taken and implies that the high child mortality rate of a century ago was reduced through medical intervention. This is not true. Almost nine-tenths of the decline in the combined death rate from scarlet fever, whooping cough, diphtheria, and measles in children under age 15 occurred before the introduction of specific therapies or vaccinations; and similarly with tuberculosis, cholera, typhoid, and most other infectious diseases. The most probable reasons for these reductions were improvements in nutrition and public health measures—better housing, clean water, and so forth. The specific medical measures of the last three to four decades only clipped the tail off the asymptotic curve. This is not to underrate the importance of every life saved. Furthermore, those risks were taken to cure known diseases, not to create new ones.

RUTH HUBBARD

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Computers: Reassuring, but Dispensable

Paul Chernoff's insightful letter on understanding mathematical proofs (23 July, p. 276) includes a remark that is perhaps misleading. He states that Shanks spent years calculating pi to 707 decimal places and implies that it was only after the advent of computers that the last 200

digits were found to be wrong. But it did not take computers to inspire verification. As early as 1854 Shanks' approximation was verified to 500 decimal places. In 1945 it was found to be in error past 527 places. D. F. Ferguson, of the Royal Naval College and the University of Manchester, extended the result to 808 places, cowardly resorting to the mechanical calculator to obtain the last 300 or so. In 1949, George W. Reitwiesner and his colleagues verified the work, extending the approximation to 2035 figures on the Electronic Numerical Integrator and Calculator (ENIAC) at the Aberdeen Proving Ground. The computer was convenient and reassuring, but hardly indispensable to uncover the error.

D. J. MONTGOMERY

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and Materials Science, College of
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Open Debate

I can only assume that Frank J. Munger (Letters, 30 July, p. 358) had no opportunity to express his "concern for freedom of information" while National Science Foundation (NSF) officials physically barred a member of our staff from attending a meeting of the former advisory committee for research, of which he was a member, since the meeting was held behind closed doors, in violation of the Federal Advisory Committee Act.

I must also assume that he was unaware of the nearly unanimous criticism of the committee's operation, as reflected in letters from past committee members, which the committee reluctantly agreed to supply but which were not included in their report.

Munger also calls for "open debate" on issues such as "fewer but larger grants," which Nicholas Wade correctly reported in his article (News and Comment, 28 May, p. 872) was among the suggestions offered by NSF officials as a potential way of cutting administrative costs.

Unfortunately, such open debate in the scientific community would require access to information on plans and problems, which NSF has been so unwilling to provide in the past. Thanks, in part, to such discussion of the issues, NSF has, in recent weeks, come closer to being the open-door, nonsecret organization that it should be.

ARTHUR KRANISH

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Preventive Medicine

To most medical students, "preventive medicine" is a bore. To them it is a repetition of the obvious and, for the most part, an area over which they have little or no control. Smoking, suicide, automobile accidents, polluted water and air, the public's ill-chosen diet, and physical unfitness are a few examples. But when they become physicians, they soon realize they will be blamed for not practicing preventive medicine.

They are told that medical practice is not cost-effective, with no hint of what this means in terms of a patient's health or life. If it costs, say, \$75,000 a year for a germ-free room in which a child lacking immunoglobulin must live, is it worth it? You tell me whose child it is. With the advent of government-subsidized medicine through Medicare, how does the doctor, the patient, or the third-party payer decide what is a necessary medical procedure? Should doctors not practice "defensive medicine," which in the old days—that is, before 1960—was the art of covering all contingencies?

The public assumes that the some \$118 billion expenditure for health brings better health, and for the most part they are right. If minor ailments go unattended, all too often a major illness follows, and the chance of a cure is lost. Not only that, the physical discomfort of patients is often immeasurably increased. Few itches are ever reflected in the mortality tables but for the patient it seems they ought to be. Hypertension causes no symptoms in its initial stages and therefore treatment often seems superfluous to the patient, but to ignore it is to invite long-term trouble. Is this cost-effectiveness? How could we have so quickly forgotten the conquest of most bacterial infections, along with a viral disease such as polio? Is that part of medical practice not beyond cost?

The chief problems of preventive medicine are two: (i) to prove beyond doubt that such modalities as exercise, low-fat diets, and a 55-mile-an-hour speed limit are cost-effective, and (ii) to persuade a pleasure-loving, affluent, and undisciplined society to accept the necessary warnings. It is not for want of trying that various government agencies and private organizations, such as the American Heart Association and American Cancer Society, have had so little success in terms of the mortality tables.

Thus, man-made environmental hazards are the greatest threat to human life. People perversely seem to prefer to teach their children violence on the television screen, and thereby add to suicide and crime, than to give up the questionable pleasure of a nightly fare of murder and implausible detectives. Ann Somers* stated that in 1973, 18,032 Americans between 15 and 24 years of age died in auto accidents, 5,182 were murdered, and 4,098 committed suicide—15 percent more deaths by violence than in 1960 and 1961. The culture of violence is now a major threat and is seriously contributed to by television's daily fare of "entertainment."

In the days when we had a surgeon general, who usually was neither a surgeon nor a real general, even though his authority was great, a stamp of disapproval was required on every cigarette package and advertisement warning the smoker that smoking was a dangerous business, but this has had little effect on the billions of cigarettes consumed by the American public.

It is time that politicians and public alike realize that preventive medicine is seldom an issue that doctors can influence except through giving advice, usually neither wanted or accepted. The mortality statistics are not a measure of the good that physicians do. If you do not know this, you have never been seriously ill. I have never determined what wisdom and compassion and the giving of hope were worth. Come to think of it, they are not for sale. —IRVINE H. PAGE, *Research Division, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, Ohio 44106*

*A. Somers, *N. Engl. J. Med.* **294**, 811 (1976).



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