SCIENCE

1 June 1973

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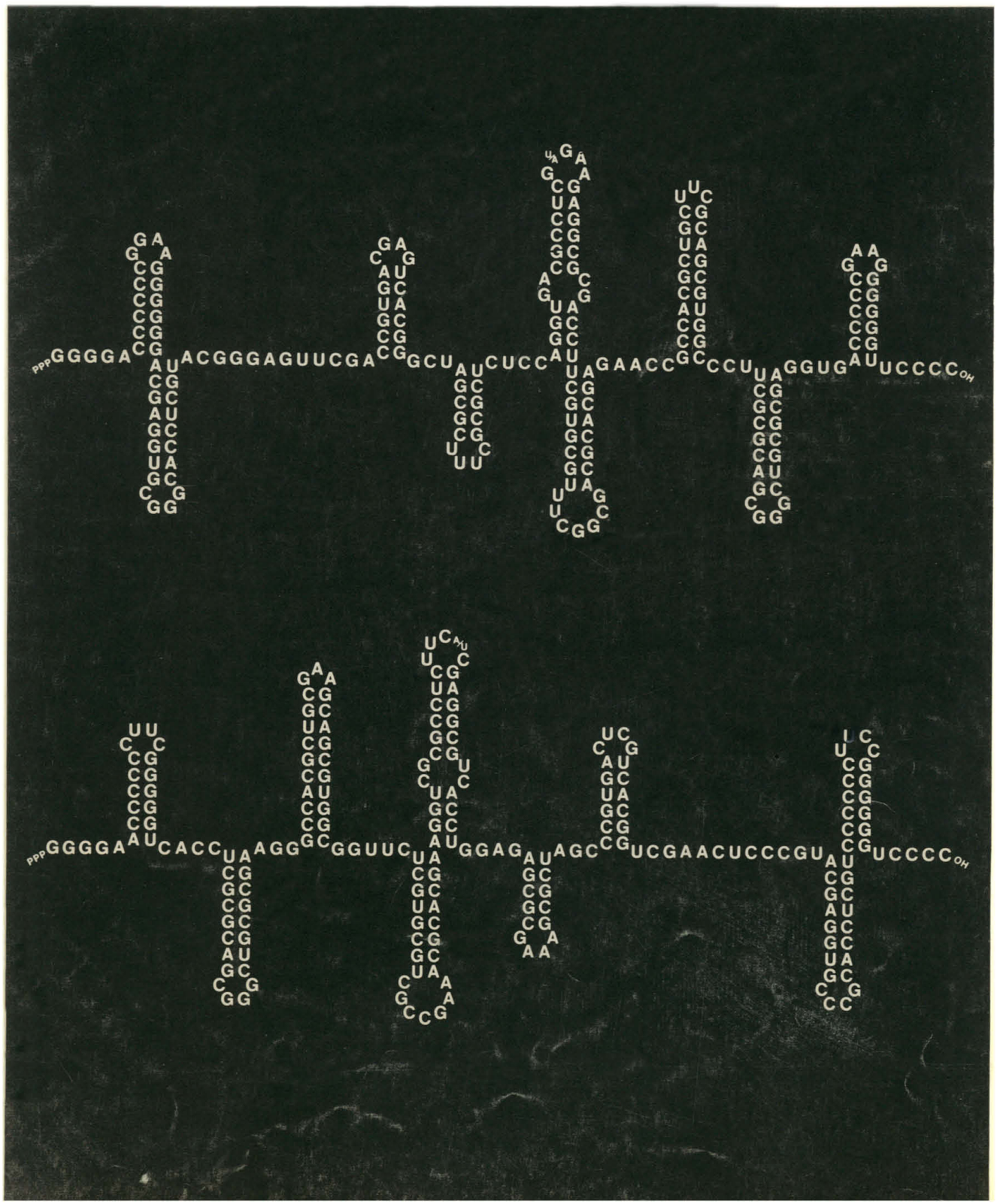
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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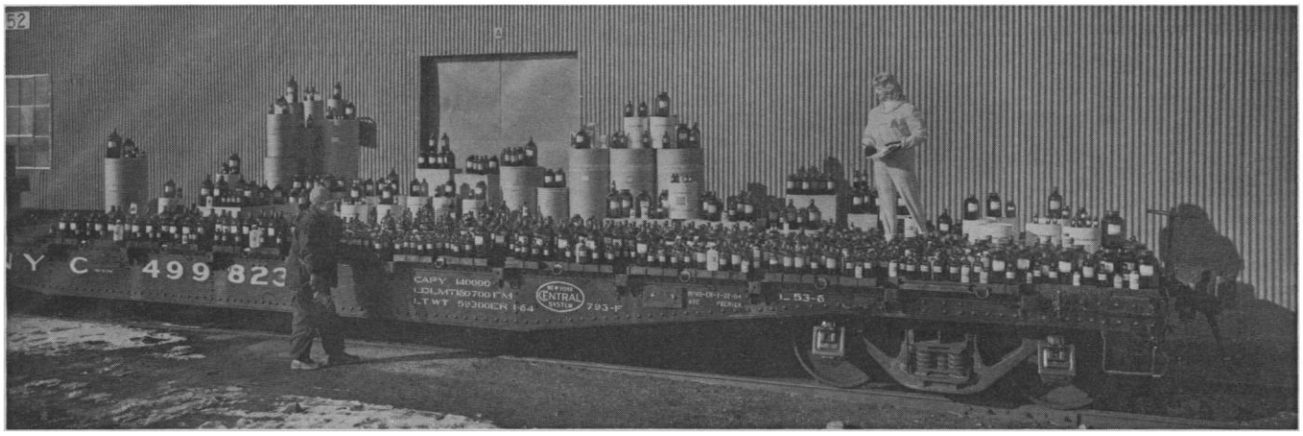

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Kodak

1 June 1973

Volume 180, No. 4089

SCIENCE

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COVER

First complete nucleotide sequence of a molecule capable of extracellular replication. Each complementary strand is 218 nucleotides in length. In the test tube, one molecule will autocatalytically generate one trillion (1×10^{12}) copies in 20 minutes. See page 916. [D. R. Mills *et al.*, College of Physicians and Surgeons, Columbia University, New York City]

AAAS Audiotapes in 1973

Recordings of symposia held during the AAAS Annual Meeting in Washington, D.C., are available as 5-inch open reels (3¾ i.p.s. for standard machines) or as cassettes. Price: single-session symposium, $15; multi-session: $15 first session, $12 each additional session of same symposium. Each session lasts about three hours.

120-72—Cross Cultural Perspectives on Early Development (One Session).
Cognitive growth of children in rural and town settings in Guatemala. The disadvantages of sensory deprivation may be overcome as an innate and highly plastic capacity for learning develops. *Jerome Kagan, Harvard University.*

121-72—Genetic-Physiological Approaches to Animal Improvement (One Session).
Improving animal performance in the production of food from research in the genetic-physiological aspects of livestock production. *Gordon E. Dickerson, Edward G. Buss, H. H. Hafs, B. N. Day.*

122-72—Facts and Fiction with Regard to Sex Differences (One Session).
Facts and fiction with regard to sex differences from the physiological and sociological point of view, and the psychological basis of sex differences as related to ability in science. *Estelle Ramey, Jacqueline J. Jackson, Barbara Bergmann, Deborah Shapley, and others.*

123-72—Ethical, Legal, and Social Issues of Behavior Control (Sessions I-II).
Preliminary findings of the Research Group on Behavior Control of the Institute of Society, Ethics and the Life Sciences, engaged in long-term study of ethical, legal, and social issues of particular technologies, and their interrelationship and cumulative impact. *Herbert G. Vaughan, Jr., Gerald Klerman, Robert Michels, Harold Edgar, Robert C. Neville, and Perry London.*

124-72—Crime Prevention: Heredity and Environment Revisited (Sessions I-II).
Respective roles of "nature" and "nurture" in shaping human behavior receive a careful reexamination in light of current scientific knowledge, with emphasis on prevention before the criminal act, and the use of research from diverse fields such as genetics, architecture, education, and biochemistry. *Nicholas N. Kittrie, David Rosenthal, Leopold Liss, Samuel Corson and others.*

126-72—Genetic Vulnerability of Crops (One Session).
Study by the National Academy of Sciences on the epidemic of Southern Corn Leaf Blight which created a loss of nearly 15 percent of the corn crop nationwide in 1970, with the suggestion that a much more comprehensive gene pool is needed so that the genetic hazard of vulnerability may be decreased. *James G. Horsfall, Warren H. Gabelman, David H. Timothy, and George F. Sprague.*

128-72—The New Urban Vision (One Session).
A new humanistic architecture seems to be emerging which seeks to design the urban environment with nature, rather than against it, and which makes new, specific, and as yet unmet demands on science and technology. *Wolf Von Eckardt,* The Washington *Post.*

129-72—Changing the Weather (Sessions I-II).
What weather management efforts are in the public interest, involving economic, legal, political, and administrative, as well as scientific and technical considerations. What degree of freedom should be used to manage the atmosphere. *Charles L. Hosler, Thomas Malone, Reid Bryson, J. Eugene Haas, and others.*

130-72—Genetics and Human Disease (Sessions I-II).
Topics include: "Cytogenetics," "Immunogenetics," "Sickle Cell Anemia," "Genetic Counseling." *H. Neil Kirkman, Barbara R. Migeon, Robert F. Murray, Edmond A. Murphy and others.*

131-72—Temperate Climate Forestry and the Forest Ecosystem (Sessions I-II).
Environmental problems facing today's forest manager as he seeks to adjust production and regeneration technology to the broad goals of an environmentally sensitive economy. *Theodore C. Byerly, Gene E. Likens, F. Herbert Bormann, William H. Smith, T. C. Nelson, Arnold Bolle, George Staebler, and Donald Dahlston.*

132-72—Sex Role Learning in Childhood and Adolescence (Sessions I-III).
How sex roles come into being in our culture. Traditional sex roles with attention paid to the concept of self as "girl" or "boy" among children and youths in relation to adult sexuality. *John Money, Walter Emmerich, Eleanor Maccoby, Aletha H. Stein, David Lynn, and others.*

133-72—Human Learning Capacity in Neurobiological Perspective (Sessions I-IV).
Four domains in the neurosciences: the architecture of the brain, the study of learning behaviors in other vertebrates, biological basis of language and communicative behavior, and the relationship of brain characteristics to learning environments. *S. Dillon Ripley, Philip C. Ritterbush, Jerome Kagan, Karl H. Pribram, Mark R. Rosenzweig, Peter Klopfer, Richard Chase, Roger Sperry, and others.*

134-72—Must We Limit Economc Growth? (Sessons I-IV).
Questions discussed: Must we limit economic growth in the United States and other developed countries to avoid a world catastrophe of resource exhaustion and environmental pollution? Would such growth preclude a higher standard of living for the underdeveloped world? Are there positive benefits to continued growth? What is the role of energy in controlling growth? *Edward F. Denison, Dennis L. Meadows, S. Fred Singer, Chauncey Starr, Marc Roberts, and others.*

135-72—Genetics, Man, and Society (Sessions I-II).
Current use of genetic knowledge and its implications for the individual and society in the light of the current biologic revolution of fast accumulating knowledge in genetics, taking into account the means and consequences of accumulating this knowledge and the ways to minimize the likelihood of its misuses. *Mack Lipkin, Jr., David C. Duncombe, Michael M. Kaback, James R. Sorenson, Y. Edward Hsia, Muriel F. Humphrey, and others.*

136-72—Communications Revolution (One Session).
Andrew A. Aines, Office of Science Information Services, National Science Foundation.

137-72—Social Applications of Genetic Knowledge (One Session).
Gene manipulation and some of the individual and societal opportunities and problems that will result when this new technology is fully developed. *E. G. Stanley Baker, Robert G. Martin, William J. Mellman, Harold B. Green, and others.*

138-72—New Approaches to Global Weather (One Session).
Response of the international atmospheric research community to the Global Atmospheric Research Program (GARP). Detailed look at two aspects of the program: new observing systems (especially satellites) and predictability. The question is asked: should we control the weather? *Walter Orr Roberts, Philip E. Merilees, Robert W. Stewart, Edward N. Lorenz, and Eugene W. Bierly.*

139-72—Conceptions and Alleviations of Aggression and Violence (Sessions I-II).
Symposium represents the First National Congress of the Organization for the Study of Group Tensions. *John E. Exner, Jr., Jerome Singer, Amitai Etzioni, John Speigel, Irving Salan, Robert Reiff, and others.*

140-72—Man-Environment Relations and Health (Sessions I-IV).
Representatives of major conceptual positions discuss the implication of their systems with health professionals and biological and behavioral scientists, with the focus on the consequences of certain theories of man-environment relations for physical and mental health, and the goal of exploring the possibilities of integrating theoretically conceived relations between man and his environment with the changing practices of health care and maintenance. *Aristide H. Esser, Virginia R. Hannon, Charles Ferster, Edwin Williams, William Ittelson, Dorothea Leighton, Viola Bernard, and others.*

141-72—Understanding Parapsychological Phenomena (One Session).
An attempt to integrate results and theory in four important areas of parapsychological research, with emphasis on aspects of internal state and some of the cognitive processing factors involved, and concluding with a discussion of the general effects of cultural differences and personality patterns. *Robert L. Morris, Charles Honorton, Rex G. Standford, Robert L. Van de Castle, Irvin L. Child, and Walter J. Levy.*

142-72—Educational Achievement and Social Indicators (One Session).
Review, interpretation, and relation to current issues in education of assessments in science, citizenship, and reading, and an analysis of the measurement problems and the relationship between national assessment, social indicators, and educational policy. *Wilbur J. Cohen, Selma J. Mushkin, Dorothy M. Gilford, C. Philip Kearney, J. Stanley Ahmann, and others.*

143-72—Limits to Growth of Technology (One Session).
Technological growth, how it interacts with the other variables, and the necessity of such growth if there are any plausible non-catastrophic scenarios for the future of mankind. *Chauncey Starr, Richard A. Carpenter, Roy P. Jackson, Arthur Kantrowitz, S. Fred Singer, W. Hunter II, and Glen P. Wilson.*

144-72—Prison Research (Sessions I-II).
Review of prison research and proposal of methods, patterns, and programs of research for the future, directed to the prison institution, prison processes, and prison behavior in the United States and Europe (especially Sweden). *John P. Conrad, Norman Bishop, Edwith E. Flynn, Nicholas M. Kittrie, Philip G. Zimbardo, and others.*

145-72—Interdisciplinary Approaches to Community Health with Emphasis on Social Sciences and Mental Health (Sessions I-II).
Various programs and approaches to clinical services, research, graduate students in various disciplines working in community health. Effective use of student manpower in delivery of health services. *Jack A. Wolford, Jan Nolan, Tobias Brocher, Mirta T. Mulhare, and others.*

146-72—. . . and shall we have Science for ever and ever? (One Session).
We face today, as in Alexandrian times, disciplinary fragmentation within science and estrangement of many outsiders from its ideals. Unless the barriers of sympathy and understanding between "scientists" and their fellow-citizens are demolished, and the spirit and integrity of earlier "natural philosophy" are restored, a new Dark Age might well overtake science. *Stephen Toulmin, University of California, Santa Cruz.*

147-72—Humanizing the Earth (One Session).
Using knowledge and reason man can improve on nature. Man-made nature can remain ecologically stable, economically rewarding, and esthetically pleasurable for immense periods of time. Civilizations emerge from a creative symbiosis between man and nature. *Rene Dubos, Rockefeller University.*

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that crossed the Bering land bridge toward the end of the last Ice Age. However, there is evidence of a different kind which surely implies that two small bodies of invaders crossed the Bering Bridge in succession, one a substantial time after the other.

The evidence is the unusual distribution of blood groups (*1*) in the surviving Indian tribes of America. There is no native blood group B on the American continent, and blood group A occurs only north of a line that runs across the continent roughly between latitudes 32°N and 33°N. No plausible form of selection could have produced this distribution from a heterogeneous population in the time available—about 30,000 years at most.

The only tenable explanation seems to be that the Indians of Central and South America are descended from a single kinship, all of blood-group O, that crossed the Bering Bridge during the last Ice Age and found conditions to the south that favored the growth and spread of population. However, this is not enough. A second group must have followed substantially later, and found the north now more hospitable and perhaps sparsely populated. The second group must also have been rather homogeneous and small, containing only blood groups O and A —perhaps mostly A, for there are two northern Indian tribes that have the highest concentration of the gene for A in the world (*2*).

The first invasion fits Martin's hypothesis well; but does he have room in his time scale for a second invasion?

J. BRONOWSKI

Council for Biology in Human Affairs, Salk Institute, San Diego, California 92112

References

1. A. E. Mourant, A. Kopéc, K. Domaniewska-Sobczak, *The ABO Blood Groups* (Blackwell, Oxford, 1958).
2. Th. Dobzhansky, *Mankind Evolving* (Yale Univ. Press, New Haven, 1962), pp. 260–261.

In reply to Corbett, "There is, however, no known instance in which an animal population has been entirely eliminated by a new disease . . ." (*1*), including the attempt at exterminating European rabbits in Australia by the introduction of myxomatosis. Possibly a virulent disease like rinderpest played a part in the late Pleistocene extinctions. I see no way to test the idea through study of the fossils.

My attempt at modeling overkill by predation alone led to the conclusion that it was not necessary to postulate side effects. A brief but intense episode of hunting and killing of innocent prey is enough. The historical account conveniently offered by Beddall makes it possible to consider much more rapid rates of killing than the one animal unit per hunter per week which I found could eliminate a high biomass in a few years. Her letter also contributes to the neglected subject of kill site visibility. We know so little about it that I cannot agree with Corbett that there are too few associations between man and extinct mammals for overkill to be the only cause of New World extinction.

In reply to Bronowski, I see no need for concern about multiple invasions, as long as a first invasion of big game hunters 12,000 years ago is not disproved.

PAUL S. MARTIN

Department of Geosciences, University of Arizona, Tucson 85721

References

1. R. Fiennes, *Man, Nature and Disease* (Signet, New York, 1964), p. 160.

The Power Wastrels

In a comment by Shannon (Letters, 6 Apr., p. 9) an accusing finger is leveled at the female. It is her "unanalyzable, unscientific, uncontrolled . . . power consumption" which makes the author pessimistic about "retarding the growth of the residential power demand."

Bearing in mind the relation between the size of a population, its material affluence, and the energy it consumes, I would like to pose one question to this concerned citizen. "Were your children, Mr. Shannon, found under cabbage leaves, or was it the stork who brought them?" The matter of biological paternity aside, Shannon's remarks are all too typical of the "buckpassing" which pervades our society. We are seldom responsible; it is the other sex, race, generation, country—whatever. Who is responsible for the upbringing of Shannon's daughters, the power wastrels, and the stocking of their comfortable home with multiple television sets and electrical gadgets? One is left with the impression that their father has washed his hands of any domestic responsibility. If one views household purchasing and the raising of daughters as "women's work," however, Shannon is permitted to go scot-free. Under a thin guise of humor, it

is commonplace in our culture to snipe at the assumed mindlessness and frivolity of women. Quite frankly, when I read *Science* I expect the analysis and humor to be more sophisticated and trenchant than the usual bland, stereotyped fare offered the mass audience.

JEAN LEONARD ELLIOTT
Department of Sociology and Anthropology, Dalhousie University, Halifax, Nova Scotia, Canada

R. H. Shannon's letter castigating the housewife and adolescent female for their "unanalyzable, unscientific, uncontrolled" consumption of power is a frivolous attempt to escape acceptance of an equal share of the blame for the westernized world's current energy crisis. At the research laboratory where I work there is an equally appalling waste of power. This includes everything from burning 200-watt light bulbs and running radios throughout the night when there is no one in the building to neglecting to completely shut off faucets after presurgical scrubbing or washing of glassware. After speaking with some of our maintenance personnel, I find that this is a universitywide situation that exists not because of housewives or nubile daughters, but rather because professors, technicians, and graduate students —all supposedly rational women and men—fail to conserve the energy that appears so unlimited to them. Shannon's indictment of only one segment of the population is therefore unfair and unscientific.

A. H. KATZ
Falls Road, Sunderland, Massachusetts 01375

Last night my husband handed me the 6 April issue of *Science* and called my attention to a letter by R. H. Shannon concerning the energy crisis, which he (Shannon) fears has been precipitated primarily by the practices of his wife and teen-aged daughters.

My husband has always been aware of the careless use of our precious natural resources and routinely snaps off the porch lights which I have left on for dinner guests or a late-returning child. (Fortunately, all injuries so far have been minor.) After reading Shannon's letter I realized that I too must face the reality of our dwindling energy supply and do what I can to conserve it. Surely I can do without a washer or dryer when a scrubboard and a clothesline will suffice. The refrigerator will cause something of a problem because I am having difficulty locating a man to deliver ice. The electric stove must also remain because I have not been able to convince my husband to chop wood for a woodburning stove. We will fill the bathtub on Saturday and draw lots for the order of bathing. Think what fun that will be for the family. Of course, the second car must go. I plan a monthly trip to the market to replenish the larder (sugar, flour, and so forth). The rest of our food will come from a home garden—perhaps I can keep a few chickens and a cow.

When I consider how my husband (already a careful consumer) can stave off the energy flow, I meet with greater difficulties. He, of course, must continue to drive himself to work (the bus for the laboratory leaves at an unconscionably early hour, and car pools are so inconvenient). It would be difficult for him to perform his experiments without the use of the cyclotron (that's only a few million watts), vacuum pumps, drying lamps, electronic counters and calculators (whatever happened to the slide rule and a bit of paper?). He could not be expected to work without air conditioning in his office. I know how uncomfortable he is when he leaves the office to come home in the summer.

Since we cannot cut down (energy-wise) in the laboratory, we must concentrate on the home, therefore today I am placing an advertisement in the paper offering for sale his power saw, drill press, lathe, shop vacuum, several power sanders, and paint compressors. Think how much fun he will have now that he is back to basics with just a hand saw and a plane. I know that both he, and Shannon, will be proud of me.

BETTY G. HULET
Calle los Collados, Diablo, California 94528

Analysis of Anthropological Data

For the last several years anthropology has been undergoing evolutionary change. One used to be able to analyze data in any way he saw fit, but now it is considered useless to perform an analysis simply because one has available computer time. Because of the debatable value of anthropological data, it is also desirable that any problem-oriented analysis be conducted within as rigorous a scientific, methodological framework as possible. Unfortunately, the article by Alan Lomax with Norman Berkowitz

(21 July 1972, p. 228) fulfills neither requirement and is, therefore, less acceptable as anthropology. The following points should be considered.

Lomax and Berkowitz add factors to their analysis until the results conform to their model. One cannot help but wonder what the results would have been if one more factor had been added, or if human communication had been the first factor to be analyzed.

An alternate hypothesis for the similarities found between cultures is that they represent ecological adaptations to roughly similar environments. This hypothesis was not suggested, and certainly not tested. The climatic similarities which exist between Patagonia and the North American Plains would certainly suggest to ecologists that they look for similar adaptations. No contact would be necessary.

An association of human subspecies with culture types is unacceptable, not simply because of sociological pressures present today, but because there is no support for the statement.

KENNETH A. WOLFE
Departments of Anthropology and *Biology, University of Oregon, Eugene 97403*

Wolfe seems vaguely to resent the use of computers in our work, although comparison and clustering of such multiparameter profiles (for example, the sets of norms that structure culture) is otherwise impractical. He doubts the validity of anthropological data in general, and our methodological rigor in particular, without specifying his standards of validity or rigor, or saying where we failed. This seems an unfair tactic.

He confounds our specialized use of the term "factor" with *vector* (or index) when he charges us with adding "factors . . . until the results conform to their model." Actually, we *discovered* the cultural "factors" (sets of similarly acting vectors are indices of social and communication structure), by means of cluster analysis of the reliable scalar indices available to us for a large sample of world cultures. The results of many other trial runs with somewhat different groups of indices were strikingly similar—about 14 main factors of social and communication structure involving the indices always showed up.

Our finding is that these 14-plus factors are sufficient to describe the main variations in human culture patterns. Operations with measures of other kinds of human performance (such as dance, speech, and breathing rate) reveal similar geographic distributions. It seems likely that (i) every cultural tradition consists of a stylistic core that is reinforced in every aspect of cultural activity; and (ii) these dynamic culture styles have continuous distributions. Ultimately these regional styles are hooked into environment, but it is eminently clear that environment biases rather than forms culture style. The successful interzone migration of cultures is proof of that.

The environment, Earth, has not changed drastically in the last 20,000 years, whereas in that time the human race has developed many cultural styles that differ from each other as profoundly as do the subspecific habits of other kinds of animals. Our finding that these cultural styles have clear-cut geographical distributions, which account for the fact of human history, reinforces the main thesis of anthropology. In man, culture (inherited, learned norms and skills) replaces genetic inheritance and enables human societies to adapt more flexibly than animal groups. In this (metaphorical) sense, human subspeciation *is* cultural. In fact the key element seems to be man's keen esthetic sense of the culturally appropriate, which provides the baseline for cooperative endeavor in all human societies.

ALAN LOMAX
Cantometrics and Choreometrics Project, Columbia University, New York 10025

Doctorate Output

I wish to note for the record a regrettable error in my article "Shifts in doctorate output: History and outlook" (9 Feb., p. 538). In table 2 of the article, the University of Pittsburgh should have been listed as a public university, and among the 60 universities ranked highest for the article.

The University of Rochester should be counted as granting about 2.6 doctorate degrees in 1969 for every 1 in 1960, rather than the 3.6 multiple shown in the article. The 3.6 figure resulted from an unusually low number of degrees granted in 1960 and an unusually high number in 1969.

CHARLES V. KIDD
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The Support of Science

The results of the massive support of biomedical science during the past 20 years have exceeded even the most optimistic predictions. No one imagined that we would acquire so quickly the firm grasp we have today of the basic designs of cellular chemistry and its regulation. The nature of heredity, clouded in abstract genetic language only 20 years ago, can now be described in explicit chemical terms. In the next 20 years application of chemistry of genes could transform the image of health and disease as dramatically as any advance in the history of medicine.

Nevertheless, those of us who do research in medical science and train young people for such work have witnessed in recent weeks the most calamitous decision a government of the United States could make for the future of medicine and the welfare of our country. Were there an intentional effort to undermine the health and economic welfare of this country for the coming generations, I could imagine nothing more devastating than to stop training our best young people to do research in basic medical science. Yet this is precisely what has been done, and the consequences of the decision have not been foreseen.

In my scientific lifetime I have seen a very low tide of science support during the 1930's before World War II. Then there followed a strong high tide for 20 years after that. For the past 5 years, the support of science has been visibly ebbing. Funds for important research have been cut at a time when inflation and advanced technology require increases; the support for the training of our best young scientists has been abruptly eliminated. This support for research and training cannot be finely regulated. When the flow of science support is turned down, the stream of progress dries up and cannot be restored for years.

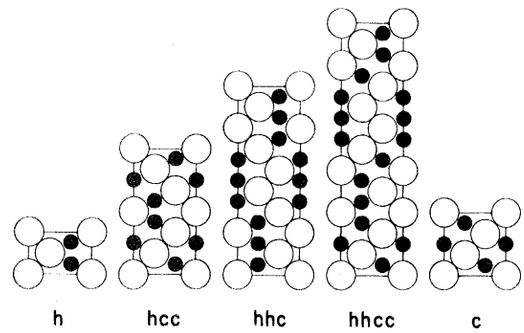
Surely the decision cannot be ascribed to economy. The science training programs cost about $300 million annually. This is less than one-half of 1 percent of the budget for welfare or for defense. For weapons research and development alone, $20 billion a year is being spent. This is to protect us against the *possibility* of attack by a hostile country. But now we have been told we can't afford to spend even 1 percent of this amount to train young people to fight diseases for which crusades have been proclaimed and that we know for *certain* will kill millions of our citizens each year.

Although in the past 20 years some scientists were influential in advising the government, the major forces in urging the support of science came from the Congress and citizens testifying before its committees. The support of science, so absolutely vital to our future, has been and must remain the responsibility of society. It is too important and too complex a problem to be left to scientists.

There are two compelling reasons why society must support basic science. One is substantial: The theoretical physics of yesterday is the nuclear defense of today; the obscure synthetic chemistry of yesterday is curing disease today. The other reason is cultural. The essence of our civilization is to explore and analyze the nature of man and his surroundings. As proclaimed in the Bible in the Book of Proverbs: "Where there is no vision, the people perish."

America's strength is not in mineral resources, in hydroelectric power, or in agriculture. It is not in the accumulation of a huge weapons arsenal either. America's strength is in the moral and intellectual resources of the people.—ARTHUR KORNBERG, *Department of Biochemistry, Stanford University Medical Center, Stanford, California, 94305*

Adapted from an address delivered on 15 March 1973 at the Sixth International Cystic Fibrosis Congress, Washington, D.C., held under the auspices of the National Cystic Fibrosis Research Foundation.



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