

SCIENCE NEWS



MEDITATION INVESTIGATION

books OF THE WEEK

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THE BRAIN REVOLUTION: The Frontiers of Mind Research—Marilyn Ferguson—Tapping, 1973, 380 p., \$9.95. Presents for the general reader an overview of breakthroughs in research concerning altered states of consciousness, the brain, and scientific interest in psychic phenomena.

CERAMIC FORMULAS: The Complete Compendium—John W. Conrad—Macmillan, 1973, 309 p., color chart, \$10.95. Sourcebook for students and professional ceramists, a guide to clay, glaze, enamel, glass, and colors.

THE CHESAPEAKE BAY IN MARYLAND: An Atlas of Natural Resources—Alice Jane Lippson, Ed.—Johns Hopkins, 1973, 11½ x 11½, 64 p., illus. by editor, 26 maps, \$8.95; paper, \$3.95. Documents handsomely a tide-water region rich in oysters, clams and crabs, spawning grounds for valuable fish species, and home to wintering waterfowl.

CONTENT AND CONTEXT: Essays on College Education—Carl Kayser, Ed.—McGraw, 1973, 565 p., \$12.95. Report prepared for The Carnegie Commission on Higher Education, traces the history of the undergraduate curriculum itself, and subjects some of the major divisions to careful scrutiny.

CURRENT RESEARCH TOPICS IN BIOORGANIC CHEMISTRY—Stephen J. Lippard, Ed.—Wiley, 1973, 454 p., diagrams, tables, \$24.95. Covers in depth developments in metalloprotein redox reactions, B₁₂ chemistry, alkali metal ion transport, and lanthanide ion NMR probes.

THE ENVIRONMENTAL REVOLUTION—Richard S. Lewis, Ed.—Science & Public Affairs Bk, 1973, 164 p., illus., paper, \$3.50. Collection of important articles that appeared in the *Bulletin of Atomic Scientists* in the last four years.

EUROPEAN TECHNOLOGY: The Politics of Collaboration—Roger Williams—Wiley, 1973, 214 p., \$13. An assessment of the reasons behind the commitment to collaborate, the process of collaboration, its control and evaluation.

THE FIRST CITIES—Dora Jane Hamblin and Editors of Time-Life Books—Time-Life, 1973, 160 p., color-plates, photographs, drawings, map, \$7.95. Deals with the emergence of the earliest centers of civilization that flourished between 8000 to 1500 B.C. in the land mass between the eastern Mediterranean and India.

THE GENETIC FIX—Amitai Etzioni—Macmillan, 1973, 276 p., \$7.95. Both scholarly and controversial, sociologist presents a timely examination of the broad implications and complexity of issues society must face as technological knowledge advances.

GHAR PARAU—David Judson—Macmillan, 1973, 216 p., colorplates, photographs, maps, \$10. Detailed account of a major cavers' expedition in the deep limestone caverns of the Zagros mountains in Iran.

HOW TO MAKE AND BREAK HABITS—Jhan Robbins and Dave Fisher—Wyden, 1973, 214 p., \$5.95. Systematic attempt to show the reader how to go about applying *behavior modification* techniques to stop overeating, smoking and other undesirable habits.

IMPRINTING: Early Experience and the Developmental Psycho-biology of Attachment—Eckhard H. Hess, foreword by Konrad Lo-

renz—Van Nos Reinhold, 1973, 412 p., illus., \$19.50. Comprehensive reference, reviews the historical development and all that has become known about the imprinting phenomenon, explores future prospects and techniques in imprinting research.

INDUSTRIAL DISRUPTION—C. Northcote Parkinson, Ed.—Leviathan Hse (Hippocrene), 1973, 181 p., illus. by Fran Woy, \$9. Probes with a team of experts the question of why modern society is so frequently disrupted by industrial disputes.

THE RUSSIAN SCIENTIST—Albert Parry—Macmillan, 1973, 196 p., photographs, map, \$5.95. Examines the personalities and contributions of Russian scientists, from Lomonosov in the 18th century, to Kapitsa and Sakharov.

THE SCHOOL IN THE HOME: A Primer for Parents of Preschool Children Based on the Works of Dr. A. A. Berle, Sr.—Thomas W. Evans—Har-Row, 1973, 195 p., \$6.95. Based on the premise that the home is the natural and best place for encouraging a happy intellectual curiosity, fed by questions and answers, the book describes one time-proven method and its application today.

THE SCULPTURE OF LIFE—Ernest Borek—Columbia U Pr, 1973, 181 p., illus., \$10; paper, \$2.95. Precise in meaning, with style and wit, microbiologist tells in layman's terms about current developments in the exploration of cell growth and differentiation.

THE SEVEN AGES OF MAN—Robert R. Sears and Shirley Feldman, Eds.—Wm. Kaufmann, 1973, 145 p., illus., \$7.95; paper, \$2.95. A readable survey of human biological and psychological development, originally published as a series in *New Society*.

THE SOCIAL LIFE OF THE LION: A Study of the Behavior of Wild Lions (Panthera leo massaica (Newmann)) in the Nairobi National Park, Kenya—Judith A. Rudnai—Wash Sq E (Univ. Park), 1973 8x12, 120 p., photographs, diagrams, maps, \$14.50. Field observations on ranges, activity patterns, individual activity, social behavior, reproduction, and predation.

THE SOLID-LIQUID INTERFACE—D. P. Woodruff—Cambridge U Pr, 1973, 182 p., photographs, diagrams, tables, \$10.95. Discusses the state of our knowledge of the solid-melt interface, from basic physical processes underlying all melt growth techniques, to special problems of dendritic, eutectic and crystal growth.

STONE: Properties, Durability in Man's Environment—E. M. Winkler—Springer-Verlag, 1973, 230 p., photographs, diagrams, tables, \$33.70. Reference work appraises the stability and durability of stone, the weathering of monumental stone through moisture, salts and rust, fire resistance, frost action, and silicosis. Discusses stone preservatives.

TO UNDERSTAND IS TO INVENT: The Future of Education—Jean Piaget—Grossman, 1973, 148 p., \$7.50. Written for the general public, book explains the author's concepts of genetic psychology and the stages of learning through which each child must pass.

WHO'S LISTENING? A Handbook of the Transactional Analysis of the Listening Activity—Franklin H. Ernst Jr., M.D.—Addresso'set 1973, 3rd ed., 223 p., diagrams, \$5.95. Synopsis of TA and summary of the activity of listening and hearing, followed by clinical examples of TA applied in treatment.

THE WORLD IN FIGURES—Victor Showers—Wiley-Interscience, 1973, 585 p., photographs, tables, \$14.95. A digest of up-to-date and comparable statistical information about 250 countries, 1600 cities, 2000 other geographical and cultural features, completely cross-referenced and indexed.

THE YOU DON'T NEED A MAN TO FIX IT BOOK: The Woman's Guide to Confident Home Repair—Jim Webb and Bart Housman,

by Edna Donlock—Doubleday, 1973, 240 pp., drawings, \$7.95. Breezily written, very practical handyperson's guide for both sexes.

TEXTBOOKS

BIOLOGY—James D. Ebert, Ariel G. Loewy, Richard S. Miller and Howard A. Schneiderman—HR&W, 1973, 798 p., photographs, drawings, two-color diagrams, tables, \$12.50. Outstanding text, for both student and layman, presents within a comprehensive framework, in depth and with accuracy, a full survey of the life sciences, together with excellent visual material.

THE ELEMENTS OF NUCLEAR POWER—D. J. Bennet—Wiley, 1973, 220 p., diagrams, \$15. Introductory text, deals with the principles of power generation from nuclear fission, discusses theory of nuclear reactors, heat transfer and fluid flow, thermodynamic aspects, and operating characteristics of nuclear reactors.

EXPLORING THE COSMOS—Louis Beran—Little, 1973, 478 p., photographs, drawings, diagrams, tables, \$12.95. Intended to acquaint the general reader or liberal arts student with the role and relevance of astronomy, the history of cosmology, celestial radiation, earth, moon, solar system, sun, galaxies, stellar evolution, and space astronomy.

FINDLAY'S PRACTICAL PHYSICAL CHEMISTRY—Revised and edited by B. P. Levitt—Halsted Pr, 1973, 9th ed., 442 p., photographs, diagrams, \$11.75. Modernized throughout, with new chapter on electrical measurements and transducers; new experiments range from thermistor, and molecular spectroscopy to homogeneous catalysis, and rotational viscometer.

MOLECULAR BIOLOGY OF PLANTS: A Text-Manual—Joe H. Cherry—Columbia U Pr, 1973, 204 p., illus., \$12. Designed to provide students with a wide range of procedures in areas of research, from experiments on enzyme purification, mitochondria isolation, nucleotide identification, to protein synthesis, and bio-assay of plant hormones.

THE PERIODIC TABLE: Experiment and Theory—J. S. F. Podes—Halsted Pr, 1973, 180 p., illus., paper, \$3.75. Short text shows how Mendeleev's ideas correlate the diverse facts of chemistry, then shows how this framework can be accounted for in terms of modern ideas of structure and bonding.

PHYSIOLOGICAL PSYCHOLOGY—J. Anthony Deutsch and Diana Deutsch—Dorsey Pr, 1973, rev. ed., 732 p., illus., \$15. Text organizes experimental findings around questions which arise from the study of behavior, while theories are used to organize and sharpen the basic issues presented.

PHYSIOLOGY OF PLANTS AND THEIR CELLS—James A. Goss—Pergamon, 1973; 457 p., photographs, diagrams, tables, \$15. Introductory text, also useful as general reference to the subject.

PROBLEMS IN MATERIALS SCIENCE, Vol. 1—Harish D. Merchant, Ed.—Gordon & Breach, 1973, 476 p., diagrams, tables, \$29.50. Advanced text, presents mathematical framework to enable the student to solve by himself the analytical problems and calculations at the end of each chapter.

PROBLEMS OF OUR PHYSICAL ENVIRONMENT: Energy, Transportation, Pollution—Joseph Priest—A-W, 1973, 389 p., photographs, diagrams, tables, \$10.95. Intended to teach physical principles using the environment as motivation.

VEGETATION OF THE EARTH in Relation to Climate and the Eco-Physiological Conditions—Heinrich Walter, transl. from 2nd German ed. by Joy Wieser—Springer-Verlag, 1973, 237 p., photographs, diagrams, maps, paper, \$5.90. Text gives an overview of the factors responsible in nature for preserving the physiological integrity of the plant world. An abridged form of the author's original two-volume study (1964, 1948).

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OF THE WEEK

jupiter gets curioiser and curioiser	372
correcting deficient genetics	373
a ferromagnetic organic compound	373
science at the south pole	374
when the doctor should pull the plug	375
through space with mariner	375

RESEARCH NOTES

aerospace	379
science and society	379
physical sciences	380
behavioral sciences	380

ARTICLES

meditating toward inner peace	376
city lights, astronomers' nights	381

DEPARTMENTS

books	370
letters	371

COVER: The growing popularity of meditation has prompted Western scientists to investigate the workings of this ancient Eastern tradition. The lotus position helps meditators sit perfectly still and breathe freely. See p. 378. (Photo: R. J. Trotter)

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Editor	Kendrick Frazier
Senior Editor and Physical Sciences	Dietrick E. Thomsen
Senior Editor and Behavioral Sciences	Robert J. Trotter
Biological Sciences	Joan Arehart-Treichel
Science and Society	John H. Douglas
Space Sciences	Jonathan Eberhart
Writer/Copy Editor	Lisa J. Shawver
Assistant to the Editor	Esther Gilgoff
Production Manager	Davida Daemon
Books	Margit Friedrich
Circulation Manager	Lawrence Cope
Advertising	Scherago Associates, Inc. 11 W. 42nd St., New York, N.Y. 10036 Fred W. Dieffenbach Sales Director

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to the editor**ESP or magic**

Robert J. Trotter's article on ESP and ASC (SN: 11/10/73, p. 298) is a superb piece of reporting on the challenging new development in parapsychology at Maimonides Medical Center in Brooklyn. I especially like the example of the writer (a senior editor himself) serving as a demonstration subject; that would be hard to beat. Also the place and space you gave the article impress me greatly. May this fine piece help these men at Maimonides to support their promising but precarious program!

*J. B. Rhine, Ph.D.
Durham, N.C.*

I was almost ashamed to find an article about ESP featured in your fine magazine. As an amateur magician with a fair background in science I am disgusted.

I know enough about this subject to know ESP "researchers" are being taken in.

*P. M. deLaubenfels
Corvallis, Ore.*

Your article on ESP is most informative. It is my belief, however, that people are attracted to this science more by the wish it were true, rather than by convincing statistics.

*G. A. Baker
Dept. of Psychiatry
New Mount Sinai Hospital
Toronto, Ontario*

In regard to the article on "ESP and ASC" by Robert Trotter, Charles Honorton states that "We will have to adopt the strategies of science rather than the mentality of magicians," in relation to the study of "psychophysical problems." Being a young scientist and amateur magician, I must object to this statement. Professional magicians make their living from their trade and know magic inside and out. Professional psychophysicists are in the same category, but one cannot do the work of another. A good sleight-of-hand man can fool anybody but another sleight-of-hand man. So, the mentality of a magician is not something to be looked down upon since they may be the only people who can pick the psychic fraud from the genuine article and save the researchers much of their valuable time and money. Also, may I remind Trotter that he is a

writer and not a magician and therefore is in no position to judge whether Uri Geller has used magical means to accomplish his feats.

*Steven Okulewicz
Staten Island, N.Y.*

Science and technology

Suggesting that the Opinion Research Corp. poll was flawed by leading questions, Richard W. Lasher (SN: 10/6/73, p. 211) takes exception to the finding that "... the general public feels that science has changed the quality of life." Then, without citing chapter, verse, or other authority, reader Lasher decrees that "... it is not the function of science to change the quality of life." Good Grief! Mr. Lasher would do well to buy some new glasses and some post-Renaissance dictionaries.

First, "science," as a field, is not once referred to in the poll: Every one of the five questions is phrased in terms of "Science and Technology" (emphasis mine). Your article reporting the poll (SN: 9/8/73, p. 151) clearly concerns *science and technology*, those three words appearing together ten times. The word "science" appears alone four times but, within the context, it is obviously interchangeably used with "science and technology." Only once, and quite incidentally, is there even a hinted differentiation ("opinion... depends on the particular field of science or technology...").

Second, "science," as the word is understood and used today, most certainly affects the "quality of life." One need mention only the social sciences, political science, or (for heaven's sake!) even military science. Mr. Lasher may have intended to address himself to "pure" science (defined, not altogether facetiously, as study having no known application to society), but, even there, an attempt to argue that there is no effect on the quality of life is folly, or, at best, an exercise in pedantry. Yesterday's "pure" science is today's way of living: One can trace a direct path from the failure of Michelson and Morley's ether drift experiment to the atomic destruction of Hiroshima. And who, watching a delayed telecast, in color, via satellite, would argue that the semiconductor work of Bardeen, Brattain and Shockley was not scientific, on the one hand, or that it had no effect on the quality of life, on the other?

*Lawson E. Richtmyer
Potomac, Md.*

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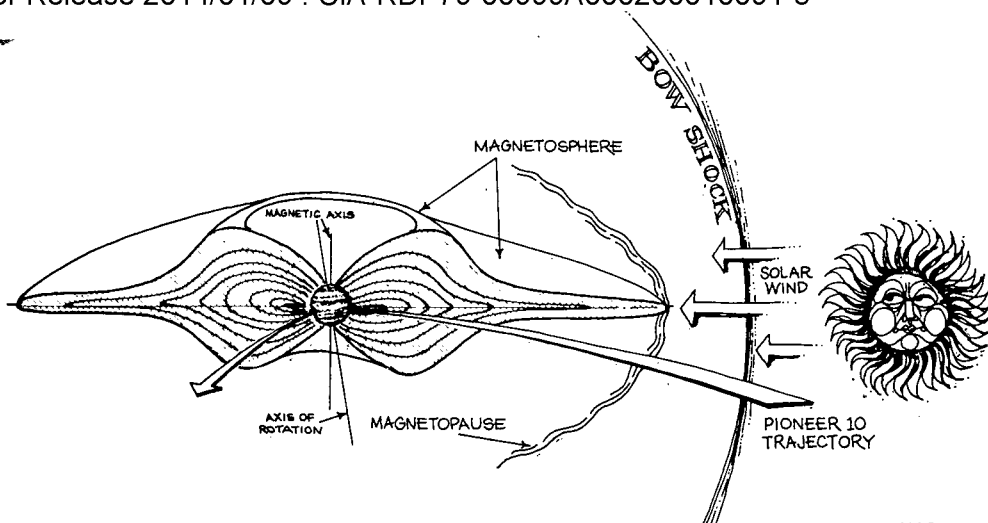
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science news

OF THE WEEK

Digesting the data on Jupiter and its moons



A thick-centered disc of dense, energetic particles rings Van Allen's Jupiter.

Permanently cloaked in impenetrable clouds, Venus has a popular reputation as the solar system's planet of mystery. But for the teams of scientists now poring over data from the Pioneer 10 spacecraft's flight past Jupiter last week, the giant planet might well assume the title.

Even a quick look at the incoming storehouse of information shows a truly alien world (SN: 12/8/73, p. 356). As the researchers begin their months of painstaking analysis, their early impressions are only confirmed.

A heat map of the planet, compiled by the spacecraft's infrared radiometer and impossible to make from earth, verified what is still one of Jupiter's most conspicuous curiosities: that it gives off about two and a half times as much heat as it gets from the sun. Despite the planet's frigid temperatures, says infrared experimenter Guido Munch of California Institute of Technology, if the sun were somehow cut off it would take a week to lose all the heat trapped in the dense atmosphere.

The controversial giant red spot, Jupiter's most prominently visible feature, is still an enigma, but Pioneer 10 has provided more food for thought, thanks largely to remarkable images provided by the photopolarimeter of Tom Gehrels of the University of Arizona as well as to the temperature mapping. The spot, says Munch, may well turn out to be a free-floating vortex born in some Hadean thermal disturbance below. Future investigators may discover that it looks like a giant tower of russet cloud, reaching, says Gehrels, perhaps five kilometers above the rest of the cloud tops. Laborious, computer-assisted efforts by Arizona's William Swindell to refine the pictures may, in fact, reveal that Pioneer managed to record a special prize: an image made at such a low sunlight angle that the red spot is casting a long

shadow, which could reveal the height of its bulge. So great are Jupiter's atmospheric pressure and gravity, and so low its temperature, according to Munch, that such atmospheric "cells," if such they are, probably take hundreds of years to rise to the cloudy summit.

Ultraviolet measurements from Pioneer, again impossible through the blanket of earth's atmosphere, confirm that primeval hydrogen is still in Jupiter's atmosphere, glowing, as expected, about 100 times more brightly than the helium that is also present. The relative amounts of the two gases, however, must be determined from months of detailed computer study by Darrell Judge of the University of Southern California, who also hopes to compare his results with current estimates of the gases' relative abundances in the universe.

The vast magnetic and particle fields surrounding Jupiter are as confusing as the planet itself. An early consensus seems to be that the magnetic field bulges out into what Pioneer project scientist John H. Wolfe of NASA describes as a "soggy doughnut," almost 10 million miles in diameter. The greatest concentrations of the energetic protons and electrons trapped by the field are in a sort of disc that is thicker the nearer it is to the planet's surface, says James A. Van Allen of the University of Iowa, finally expanding to follow the strong inner part of the magnetic lines of force. In this inner section, adds John A. Simpson of the University of Chicago, the particles are strongly bound to the field lines; it is the weaker grip of the outer field that may be letting them break loose, perhaps accounting for some of the turbulence recorded by Pioneer's instruments on the edge of Jupiter's influence.

Jupiter was not the spacecraft's only target, however. Four of its dozen

moons also received their first close scrutiny:

- Io, nearest to the planet, is also so dense, says John Anderson of Jet Propulsion Laboratory, that it is "far out of line" with the rest of Jupiter's satellites. It may have condensed in an anomalously heavy part of the gaseous cloud that formed the solar system or, suggests Anderson, it may even have been born elsewhere and captured by Jupiter's gravitational field (possibly from among the inner planets since its density resembles that of Mars). More important, however, was the discovery that Io has an atmosphere of sorts. It is so rarified, theorizes Arvydas Kliore of JPL, that it may be an on-again off-again feature composed of surface particles that only occasionally get warm enough to evaporate; another possibility is that it is the remainder of an ancient, thicker atmosphere which got so cold in eons past that most of it simply snowed out.

- Europa, second of the four moons discovered by Galileo, was the only one to show an appreciable "sweeping" effect in clearing the energetic protons and electrons from part of Pioneer's path, perhaps because the spacecraft passed closest behind Europa's wake. The effect seemed to occur at all energy levels, at least for the electrons, although its effectiveness in helping Pioneer survive is not yet known. Europa was also found to be slightly denser than earth-based predictions suggested—3.07 grams per cubic centimeter, compared to about 3.00.

- Ganymede was just the opposite—1.93 instead of an expected 2.03—a difference of about a tenth the mass of earth's moon, yet . . .

- Callisto, like Europa, turned out to be denser than anticipated—1.65 grams per cubic centimeter versus 1.3.

And still the decision awaits for Pioneer 11: will it go to Saturn? □

Genetic repair in mammals

In the 1960's Henry Harris of Oxford University came up with an elaborate scheme for fusing different kinds of cells together. It consisted of putting a particular virus with a particular enzyme on its surface in the presence of two kinds of cells to be fused. The viral enzyme fused the two kinds of cells so that the hybrid cells contained the genetic material and the cytoplasmic material from both.

Using this technique, a team of researchers at Duke University Medical Center, Walter Reed Army Institute of Research and the National Institute of Allergy and Infectious Diseases has managed to correct genetically deficient cells in tissue culture, then return the corrected cells to living mammals, where they function normally. This is the first time that such an achievement has been made. It offers a potential course for correcting a number of human genetic abnormalities.

The researchers are Nelson L. Levy and Ralph Synderman of Duke University, Roger L. Ladda of Walter Reed and Rose Lieberman of the NIAID. They report their findings in the latest PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

They corrected a genetic deficiency in a strain of mice that does not make one kind of protein. The protein is the fifth in a series of 11 proteins known as "complement." Complement proteins provide the punch behind antibody reactions. When an antibody recognizes a foreign cell it activates the first protein in the complement series. That protein activates the next protein in the series, and so on. A protein toward the end of the series destroys the foreign cell.

To correct the nonproduction of the fifth complement protein in the mice, the investigators had to first determine which cells in mice usually make the protein. They took various cells from normal mice, cultured the cells, then assayed them to see which made the protein. It turned out to be macrophages from the spleen. They then took splenic macrophages from the mice deficient in the protein and showed that the macrophages were indeed not able to make the protein. The macrophages, then, were the genetically deficient (protein deficient) cells to deal with.

They set about trying to correct the deficiency in the macrophages. Using Harris's cell-fusion technique, they fused kidney cells from normal mice with the protein-deficient macrophages. The kidney cells did not make the protein that the macrophages lacked, but they did have the chromosome that makes the protein. So when the kidney

cells fused with the macrophages, cytoplasmic influences in the deficient macrophages were able to turn on the usually silent chromosome from the kidney cells. Once the chromosome was activated, the hybrid cells started making the protein that the macrophages lacked.

The team took the hybrid cells, now making the desired protein, and injected them into mice lacking the protein. The mice continued to make the protein, and it had all the right properties, including complement activity.

The technique that Harris devised and that the researchers have elaborated "is a potential way to correct human genetic abnormalities," Levy told SCIENCE NEWS. "It could be accomplished in the same way that we did in the mouse, except that in man we would have a problem that we did not have in the mouse, on one hand, and we would lack a problem that we did have in the mouse, on the other."

The problem they didn't have was rejection by the mice that received the hybrid cells. The reason that the mice did not consider the hybrid cells foreign is that the kidney cells incorporated into the hybrid cells came from mice closely related to the recipient mice. If cells from two persons were

and then injected into one of the persons, the recipient would probably reject the hybrid cells as foreign. This is because the two individuals are not related. There is a way around the problem, though. "What you do," Levy says, "is select out populations of cells that are normal, because they make the right protein, but are compatible with the person to whom you want to give them back." When asked whether such selection would be possible, Levy replied, "Oh yes. In fact, experiments like these have been reported from several laboratories."

The advantage Levy said they would have over their mice experiments is that most human genetic deficiencies (protein deficiencies) are partial rather than absolute. Because the complement protein was new to the recipient mice, they made antibodies against it. But if a protein that an individual is partially deficient in is injected into him, he would probably not make antibodies to it because his body is used to it.

A number of protein-deficiency conditions might be corrected by their technique, Levy believes—hemophilia, immunoglobulin diseases, enzyme deficiencies. Ladda and some investigators at Duke University hope to use the technique to correct some of them. □

An organic free-radical ferromagnet

Ferromagnetism is a condition in which all of the elemental microscopic magnets in a sample of a given substance line up in the same direction so that there is a large overall field in the substance. Ferromagnetism is the basis of permanent large-scale magnets. As its name, which contains the Latin word for iron, indicates, it is found mainly in certain metals and minerals.

A long-standing ambition of physicists and chemists has been the discovery of a true organic ferromagnet. Up to now they have found some cases in which the elemental magnets of a substance may line up in pairs or in a one-dimensional line, but a substance with the true three-dimensional, long-range order of true ferromagnetism has eluded them. Now it appears that such a truly ferromagnetic organic substance has been found. The report is by M. Saint-Paul and Cl. Veyret of the organic physical chemistry laboratory of the Center for Nuclear Studies at Grenoble, France.

The substance involved is the crystal of the suberate of bi (2,2,6,6-tetramethyl-4-piperidinol-1-oxyl). In metallic or mineral ferromagnetism the elemental magnets that have to be lined up are either atoms or ions; in the organic case the elemental magnets are

free radical, molecules with an odd number of electrons. The substance in question contains the nitroxide group, a particular combination of carbon nitrogen and oxygen that lends great stability to molecules that contain it. A whole chemistry of such substances has been developed over the last 15 years, but their physical properties are just beginning to be studied: It appears that the process that causes the elemental magnets to line up may proceed by a direct relation between the nitroxide groups rather than by various intermediaries as occurs in other cases. Calculating the mathematical relation involved will give specialists in theoretical chemistry a fine problem to work out, remarks LA RECHERCHE.

The Curie point for this suberate, the temperature below which ferromagnetism appears spontaneously, is no more than 0.38 degrees K., about a third of a degree above absolute zero. Therefore as LA RECHERCHE remarks, it is hardly a suitable substance for making permanent magnets. However the lowness of the Curie point is something of a benefit to pure scientists studying ferromagnetism since at that level many activities of the crystal that affect magnetism are suppressed so that the study of pure magnetism is facilitated. □

Science at the bottom of the world

Science News Editor Kendrick Frazier is on a reporting trip to Antarctica. These are some of his preliminary impressions after two days there, which included a visit to the South Pole. The story was filed from McMurdo Station, Antarctica, headquarters of the U.S. scientific research effort on the continent. He will report on several of the science programs in detail after his return.

This is the busy season at McMurdo. It is the Antarctic summer, a time of continuous daylight, and scientists pass through almost daily on their way to and from outpost stations or temporary field research sites. The main, and virtually only, activity in Antarctica is scientific research.

Sixty-five projects involving 175 U.S. scientists are under way during the 1973-74 summer. They range from studies of how a protein in fish living in Antarctic waters keeps them from freezing to observations of trace elements and possible global air pollutants at the South Pole, from penguin biology to historical glaciology, from drilling into the continent to triggering electron showers in the atmosphere.

They are being performed not just to better understand Antarctica but also to learn how it affects the global environment and to make special use of the continent's unique capabilities as a natural scientific laboratory. The National Science Foundation funds the U.S. Antarctic Research Program.

McMurdo, the main U.S. station in support of such efforts, is a strange mixture of mundane civilization and raw and beautiful nature. Looking out from any promontory, one can see in the foreground power lines, water pipes, muddy roadways, dirt-covered piles of snow, and a trash dump. But to the west, across miles of glistening sea ice, looms a range of majestic mountains, cold, lonely and formidable, part of the Transantarctic Mountain Range that traverses a large portion of the continent. Beyond them begin the vast expanses of the Antarctic ice cap. Twenty miles to the north of McMurdo, rises snow-covered Mt. Erebus, a 12,400-foot-high volcano, a cloud of smoke hovering over its summit.

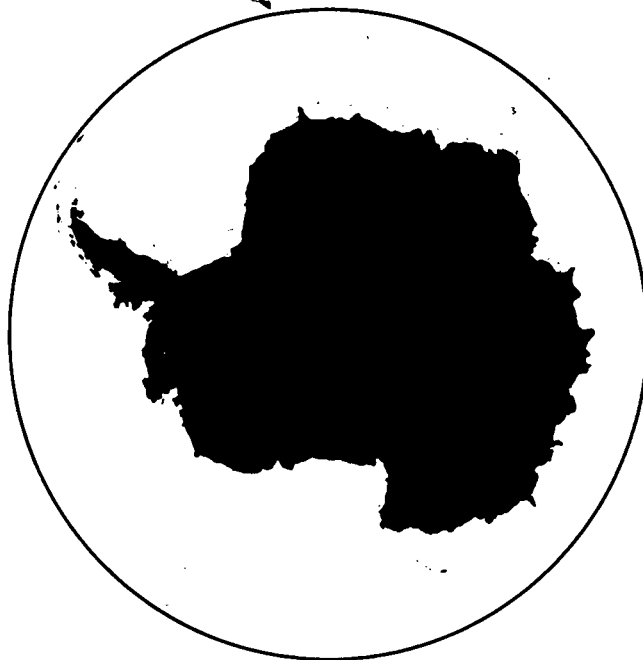
The December temperatures at McMurdo seem unexpectedly mild. It reached a pleasant 33 degrees F. on the day of our arrival. By early January icebreakers will have broken through to McMurdo, and the continent will then soon have its first delivery by ship of cargo and fuel. Until then all supplies and fuel are delivered by air.

For the past decade, the station has had a nuclear generating plant but it has been shut down since last year, when it was discovered that insulation containing chlorides around the reactor pipes had become wet, a condition that could lead to widespread corrosion. The problem is considered too costly to repair. The small, 1,800 kilowatt plant is considered obsolete, and is being painstakingly dismantled and taken away. Under the terms of the Antarctic treaty, all radioactive materials have to be removed from the continent. A conventional power facility is being expanded by addition of two new diesel generators.

In contrast to the diverse natural setting at McMurdo, the South Pole station, 840 miles inland, sits amid a broad, flat, featureless sheet of snow and ice. The elevation is 9,186 feet. Some 8,850 feet of that is ice.

During our visit there this week, the temperature was minus 26 degrees F. but there was practically no wind. That, and the relatively bright sunlight, made conditions more pleasant than bitter.

The United States has operated the station at the South



Pole since 1957, but the accumulation of blown snow is gradually crushing it, so a new station is being built about a half mile away. Its main feature is a 52-foot-high, 164-foot-diameter geodesic dome, housing three individual buildings for scientific laboratories, living quarters, dining hall, meeting hall, post office and other facilities for about 50 persons.

The geodesic dome, built of aluminum struts covered by triangular aluminum panels, is completed. One can climb up the exterior ladder to the top and get a remarkable view of the South Pole ice cover, the telltale signs of the present research station buried beneath the snow, and the construction activity at the new site. The new pole station is being constructed by a 165-man Navy Seabee detachment with additional assistance from a private construction firm that will have the task of getting the new station into shape for occupancy in the 1974-75 season.

Twenty-two men, including nine scientists and technicians and thirteen Navy support personnel, spent the entire 1973 winter at the South Pole station. What's it like? One of the two winter residents still not relieved of duty is Gary Adair, a young seismology technician operating a seismic station that records earthquakes around the world. Since the pole is at the convergence of all lines of longitude, the data help especially to identify their latitude. Adair has been at the subsurface pole station continuously since Christmas Eve of 1972.

"We didn't have a whole lot of problems," he says, "but there's so little variety of where to go and what to do."

It was too cold, he discovered (often around minus 100 degrees) to go outside "just for pleasure." Would he do it again? Not doing the same job, and "not for the next four or five years."

The people at the South Pole station are obviously not working in ideal conditions. But they are well-fed and well-clothed, their quarters and living areas are comfortably warm, and they are supported by modern communications and a massive air logistics effort.

This is the age of systematic scientific study in the Antarctica. One cannot help thinking back almost 62 years to the lonely tribulations of Amundsen and his men, the first to reach the pole, and Scott and his men, who lost their lives after reaching it a month later. One gains an awesome respect.

AMA passes 'death with dignity' resolution

"I request that I be allowed to die and not be kept alive by artificial means or heroic measures. I ask also that drugs be mercifully administered to me for terminal suffering even if . . . they may hasten the moment of death."

At its annual meeting in Anaheim, Calif., last week, the American Medical Association cleared the way for such statements as this to be used in providing "death with dignity" to terminally ill patients. By signing such a statement, the patient, or his family if he is unconscious, can have himself removed from such devices as artificial respirators or kidney machines and allow doctors to administer heavy doses of pain-killing drugs, thus easing and probably speeding his death.

An AMA survey of various churches revealed strong support for allowing a patient to choose his own fate, once a doctor has carefully explained the options, but most rejected the idea of euthanasia and the AMA made no further mention of the subject.

The convention also turned away from a controversial motion by some of its own members urging a legislative definition of death. Again the issue centers around life-prolonging machines that can keep some vital signs going even after the "death" of the brain. Many doctors are eager to have some legislative protection so they cannot be sued for taking an organ for transplant out of a person whose brain has ceased to function but whose heart did not stop until the machines were turned off. The current AMA position is that any legalistic definition of death, such as cessation of brain waves, is "inflexible" and that individual doctors should remain free to define death using "currently accepted criteria."

The AMA resolution marks the first time that the AMA has really faced up to the moral and legal implications of artificial prolongation of life, or tried to establish a uniform policy concerning death. At present, acceptable practice varies widely from "blue-starring" patients beyond help (signifying that "heroic" efforts are not to be made to prolong their lives) to instances of callously keeping the bodies of "gorked" patients functioning until a suitable recipient can be found for organ transplant. Much more discussion like that in Anaheim will have to come before the profession has fully worked out an ethical approach to the challenges of life-prolonging medical technology, or the public has fully understood the technology's implications for the ever-widening region of uncertainty between life and death. □



NASA

Composite lunar photos from Mercury-bound Mariner will aid moon-mapping.

With Mariner 10 en route to Mercury

On its way to Mercury, Mariner 10 has noticed a nebula. A nebula, in fact, which ought to be invisible.

The result, says Bruce Murray of California Institute of Technology, head of Mariner's scientist team, may be "the start of a whole new field of astronomy."

Launched Nov. 3, Mariner 10 was quietly cruising toward its double goal of close passes by Venus and Mercury early next year, when a peak appeared in the data from one of its instruments, a far ultraviolet spectrometer designed primarily to look for traces of an atmosphere on Mercury. The instrument was turned on because it was being used to chart hydrogen and helium distribution in the solar system, measurable by their ultraviolet glow.

The peak, says A. Lyle Broadfoot of Kitt Peak National Observatory in Arizona, represented "tremendously intense" radiations from the Gum Nebula, a gaseous cloud left by the explosion of a star, some 128 light years away. The radiations indicated temperatures ranging from 50,000 to 100,000 degrees F., 10 times the surface temperature of the sun and about twice as hot as any stellar objects seen by ultraviolet light from earth or even the Orbiting Astronomical Observatory satellite. The hottest point was the star Gamma Velorum.

Yet some astronomers wonder why the Gum Nebula was visible at all to the unmanned space probe, let alone at such blazing temperatures. This particular nebula was thought to be a virtual antique, a cosmic relic so far past its prime that one scientist wondered that it would still be emitting any detectable heat whatsoever.

Mariner's unexpected finding may oblige astronomers to revise their views on the decay of nebulas, as well as on the violence with which a star's internal cycle of fire can keep it going.

Finding the life in the spray, old nebula has not been Mariner's only accomplishment of its journey. Its two television cameras, in test runs to check

them out for their Venus and Mercury roles, have provided about 1,000 surprisingly sharp photos of the earth, moon and stars.

Some of the lunar photos will be used to help pin down surface features on moon maps presently being refined from Apollo and other data. In addition, the views of the moon's virtually airless wastes have given the Mariner experimenters an idea of what they can expect during the Mercury flyby, where fine detail is important to such tasks as crater-counting.

The photos of earth, which show features down to tiny, individual storms, are similarly valuable for comparison with the planned pictures of the cloud structure of Venus.

Mechanically, Mariner seems to be doing well. The two camera heaters which failed to come on after launch are still off, but the camera temperatures have stabilized, and there seems to be no distortion from any temperature differentials in the optical systems.

Scientists at Jet Propulsion Laboratory, from which the mission is being controlled, are, however, studying one seemingly small but puzzling irregularity. On Nov. 21, when they commanded the spacecraft's gyros to turn on in preparation for a rolling scan of the ultraviolet sky, a small drop in power appeared in Mariner's data-processing system, then corrected itself. The roll maneuver was cancelled for the time being, but then when the same gyros were commanded again on Dec. 7, this time with more telemetry channels open to report whether there might be unwanted power surges in some electronic systems, the same thing happened. Now the search is on for a possible short circuit or other "glitch." □

NOTE TO READERS

The Dec. 22 and Dec. 29 issues of SCIENCE NEWS will be combined into a single, expanded year-end issue that will carry a review of the important science stories of 1973.

TRANSCENDENTAL MEDITATION

Meditation is becoming a popular relaxer and escape mechanism in Western societies. Researchers are finding that many of the claims for meditation seem to have physiological correlates.

by Robert J. Trotter

The work ethic was having trouble recruiting jobbers. There were rumors that God was dead. Sancrosanct institutions (big government, big business, higher education, the nuclear family, etc.) were under attack from within and without.

Such was the setting of the sixties that left many young people ideologically aimless and confused. With what were they to fill their time and their heads? Many of these searchers turned to a practice that has been the opiate of the Eastern masses for several millennia—meditation.

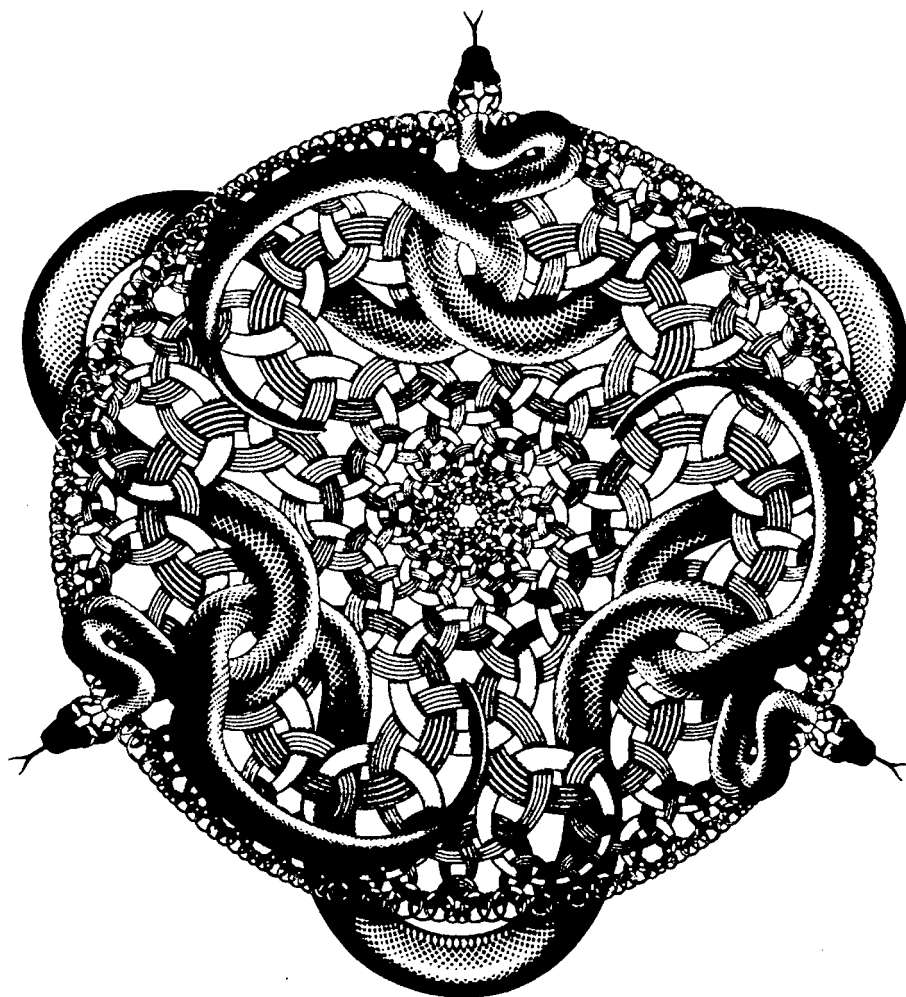
For years, meditation has remained a mysterious, cultist, semi-religious type of experience that had no meaning for the rational Western mind. But meditation is not all that mysterious, and techniques have been developed that can be communicated and learned by anyone. Consequently, in the past few decades, literally hundreds of thousands of Westerners have learned and are using some of the many methods of meditation. The techniques differ but most of them aim at the same goal: achievement of a profound state of rest while maintaining a relaxed alertness. Some attain the goal through physical excesses, as in "hatha yoga"; others concentrate on a particular overt function, such as the respiratory rate; still others require rigorous concentration on a single object or concept as a means of eliminating all contact and flow from conscious experience.

This rather ill-defined and vague "profound state of rest" is not as obscure as it sounds. Everyone experiences a similar state of relaxed awareness during the few moments immediately before going to sleep. With a little training and practice, such a state can be prolonged and reached at will—in a quiet room or even in the midst of a noisy crowd. People who meditate regularly report that it has altered their

lives in a variety of ways. They say they experience greater serenity and inner peace; they frequently mention having more energy and greater steadiness in pursuing goals, and greater efficiency in ordering priorities so that less effort is wasted. They report that anxiety, aggression and hostility are reduced.

But these reports are all subjective, says Edward Taub of the Institute for

Behavioral Research in Silver Spring, Md. In many areas of study, he notes, such subjective reports have been found to have little correspondence with outward reality as perceived by others. "Our traditions of thought, then, compel us to seek verification of the self-reports through more objective measures," said Taub as chairman of a symposium on the psychobiology of meditation at this year's meeting of the



American Psychological Association.

The physiological effects of meditation have always been of some interest to researchers. In 1935 a French cardiologist took a portable electrocardiograph to India in order to check out Yogis who claimed to be able to voluntarily stop their heart beat. One Yogi was apparently able to, but subsequent studies were inconclusive. In recent years more extensive studies have been

performed in the United States.

One of the first of a spate of recent papers was published by Robert Kieth Wallace in SCIENCE in 1970 (SN: 4/11/70, p. 370). He found that meditation is accompanied by a number of physiological changes—decreases in heart rate and oxygen consumption. Wallace, Herbert Benson and Archie F. Wilson of Harvard Medical School followed up in the AMERICAN JOURNAL

OF PHYSIOLOGY in 1971 with the first major study of the physiological effects of meditation.

In this study and in subsequent ones, Wallace and Benson (and many other researchers) have worked with one particular type of meditation—Transcendental Meditation, or TM. They chose TM because consistent physiologic changes were noted during its practice, because subjects found little difficulty in meditating during experimental measurements and because a large number of subjects were available who had received uniform instruction from an organization specializing in teaching TM (student's International Meditation Society, which teaches TM according to a method popularized in this country by Maharishi Mahesh Yogi). Taub agrees with the choice of TM. He explains: TM is said to be an entirely mechanical process which attains its goals automatically with constant practice. It requires no faith or belief and does not involve intense concentration or control of the content of consciousness. TM's practice requires no intellectual analyses and can be learned by people of all backgrounds, ages and education. It does not call for recourse to a reclusive style of living, but integrates well with a normal active life style.

The basic technique of TM can be learned in the course of a 90-minute session of individual instruction. It is then practiced for 20 minutes, twice a day, during which the meditator sits in a comfortable position with eyes closed. The subject has been assigned a suitable sound or thought (mantra). Without attempting to concentrate specifically on this cue, the meditator merely perceives the mantra and experiences it freely. As other thoughts enter the mind, they may be examined and discarded—they are not to be followed logically and allowed to lead to other

विद्यां चाविद्यां च यस्तद् वेदोभयं सह ।
अविद्यया मृत्युं तीर्त्वा विद्ययामृतमश्नुते ॥ ११ ॥

*vidyām cāvidyām ca yas
tad vedobhayam saha
avidyayā mṛtyuṁ tīrtvā
vidyayāmṛtam aśnute.*

vidyām—knowledge in fact; *ca*—and; *avidyām*—nescience; *ca*—and; *yaḥ*—a person; *tad*—that; *veda*—knows; *ubhayam*—both; *saha*—simultaneously; *avidyayā*—by culture of nescience; *mṛtyum*—repeated death; *tīrtvā*—transcending; *vidyayā*—by culture of knowledge; *amṛtam*—deathlessness; *aśnute*—enjoys.

TRANSLATION

Only one who can learn the process of nescience and that of transcendental knowledge side by side can transcend the influence of repeated birth and death, and enjoy the full blessings of immortality.

Mandalas, such as the one at the left, are often used as objects for meditation. Concentration on increasingly complex designs is said to prolong one's experience of time. Mandalas are usually round and, according to Carl G. Jung, represent the unity of the self.

Mantras, such as the one above translated from Sanskrit, are also used as aids to meditation. A mantra can be a complete thought or a single sonorous sound or word (Ommm) that is repeated over and over. Mantras are supposedly assigned according to the user's personality.

meditators report, leads to a finer and more creative level of thinking. The total experience is pleasant and is supposed to produce a state of relaxation that gives rise to dramatic short-term and long-term effects on behavior.

Presuming a physical rather than a spiritual cause for these effects, Benson and Wallace examined meditators on a variety of physiological scales. Results with 36 subjects revealed: blood flow in the arm increases during TM by about 32 percent, oxygen consumption decreases during TM by about 17 percent, electrical resistance of the skin increases by an average of about 200 percent, brain wave patterns indicate an alert wakefulness and carbon dioxide elimination decreases. This seeming "quiescence of the sympathetic nervous system," the researchers note, is the opposite of the fight-or-flight reflex. It is overstimulation of this fight-or-flight reflex by the stresses of modern life that is thought to be a cause of hypertension and some psychosomatic diseases. "It should be well worthwhile,"

activity and greatly decreased hours of psychotherapy. Another therapist has reported success in treating cases of claustrophobia and profuse perspiration. And another report claims that TM can lead to a better marriage by releasing the tensions of daily life. Many of these claims are related to the reduction in anxiety that TM supposedly produces in regular practitioners.

A similar lessening of anxiety is often achieved through drugs, so some researchers have investigated the effects of meditation on drug users. One thing they have found is that meditation, unlike drugs, does not require increased doses as the user becomes habituated. In fact, most steady meditators usually stop drug use. Benson and Wallace conducted a study with 1,862 subjects. They found that after about 21 months of practicing TM, almost 96 percent of those who had been trafficking in drugs had ceased doing so. More than 95 percent of the subjects who used drugs illegally since starting TM had tried to

Los Angeles studied the effects of TM on narcotics addicts in a Federal prison in New Mexico. He found that prisoners become less compulsive and more sociable in their behavior after two months of regular meditation (SN: 9/8/73, p. 152). Orme-Johnson also studied staff members at the Drug and Alcohol Abuse Control and Prevention Center in Fort Bliss, Texas. MMP1 tests before and after 10 weeks of meditation indicated that subjects practicing TM achieve a reduction in symptoms of anxiety, more maturity and more organized thought and behavior.

The results of these and other studies indicate that TM may be a useful tool, but there are some drawbacks. In almost every case, the subjects have been persons who elected to become meditators. This fact alone sets meditators apart from other hypertensives, drug users, neurotics and searchers. Those who decided to become meditators and who followed through had already displayed the will power that is sometimes enough to change a habit or a complete life style. Subjects who did not follow through with TM (even though they originally intended to do so) received none of its benefits. Perhaps they did not really believe in or want the changes that TM is supposed to produce. Perhaps they need another kind of help if some sort of change is really necessary. No one can be forced to meditate. Meditation is not a shot-in-the-arm cure all. For instance, Arthur Vassiliadis of the Stanford Research Institute has found that three months of TM does not produce a statistically important change in a meditator's heart beat. Only after nine months of conscientiously practiced TM is there a significant reduction in heart rate.

While meditation does seem to produce beneficial effects in certain subjects, researchers are still not agreed on how these effects are produced. The original work of Wallace and Benson indicated which physiological processes might be involved but, says Taub, there is no clear interpretation of the data yet. More recent work by Gary E. Schwartz at Harvard, for instance, indicates that Wallace and Benson's findings are not as clear-cut as they seemed. Schwartz points out that the personality of the tester, as well as that of the subject, might be an important variable. (Wallace, an easy-going and interested experimenter, gets somewhat different results than a less sympathetic person does.)

The work of Wallace and Benson is still valid, says Taub, even though newer data are providing a different interpretation. But even without a coherent interpretation, he concludes, the data on TM are "suggestive and exciting." □

Transcendental Meditation

as taught by

Maharishi Mahesh Yogi



Wallace and Benson concluded, "to investigate the possibilities for clinical application of this state of wakeful rest and relaxation."

Such possibilities have since been investigated. Benson and Wallace worked with 22 hypertensive subjects and reported that regular practice of TM resulted in reduced blood pressure. Other researchers have reported that TM appears to be beneficial in the treatment of bronchial asthma and diseases involving inflammation such as swollen gums. TM has even been found to increase auditory ability.

Psychological as well as physiological conditions respond to the practice of TM. On psychological tests, meditators display significantly less verbal hostility than nonmeditators. One psychiatrist has reported that patients who practice TM show a faster-than-average rate of improvement in the course of psychotherapy. With some patients TM has

discourage others from non-medical use of drugs. Prior to TM, 78.3 percent had used marijuana and hashish and 22.4 percent were heavy users. After 22 months of meditation, the number of users of these drugs had fallen off to 12.2 and 0.1 percent respectively. Similar results were reported for LSD, opiates (heroin, etc.), amphetamines, barbiturates, alcohol and tobacco. W. T. Winquist of the University of California at Los Angeles has also examined the relationship between TM and drug use. He found that after at least three months of TM, 84 percent of those who were regular users of marijuana had stopped, 14.5 percent had substantially decreased and only about 1.5 percent increased use of the drug. According to Winquist, 49 percent of the users stated that their use of drugs decreased because life became more fulfilling after starting meditation.

David Orme-Johnson of the Maha-

Whither the aimless astronauts?

With only a single team of U. S. astronauts scheduled to see space in the next six years, the National Aeronautics and Space Administration is tightening its belt, reorganizing and consolidating its manned spaceflight activities.

There are 37 astronauts left on active flight status, but only 10 currently have a mission, the prime, backup and support crews for the three-man Apollo-Soyuz rendezvous plus Apollo Soyuz Test Project Special Assistant Eugene Cernan—and that will begin and end in 1975. Not until the planned space shuttle gets going, in 1979 at the earliest, will any more space berths be open.

As a result, NASA is absorbing its present Flight Crew Operations Directorate, in charge of training, scheduling and other activities, into Flight Operations Directorate, which was formerly concerned only with planning the missions themselves and related procedures. The enlarged FOD will be directed by Kenneth S. Kleinecht, now manager of the Skylab program.

The 11 scientist-astronauts will be assigned to offices in the Science and Applications and Life Sciences Directorates, working on crew aspects of various potential jobs for the space shuttle. Of the 16 pilot-astronauts not working on the Apollo-Soyuz project, 15 will be assigned other shuttle-related jobs by the end of Skylab. The 37th man is Charles Conrad, veteran of Gemini 6 and 11, Apollo 12 and Skylab 1, who is resigning Feb. 1 for a job with a Denver cable television company.

Venus drops acid

Droplets of sulfuric acid more concentrated than the acid in a car battery have been identified in the cloud tops of Venus.

The discovery was made using spectra obtained through a 30-centimeter telescope aboard a jet flying at 45,000 feet. Compared with laboratory spectra of clouds containing such materials as iron chloride, liquid water, ice, mercury, ammonium chloride and hydrochloric acid, the Venus clouds best matched sulfuric acid concentrations of more than 75 percent.

James B. Pollack, who headed a nine-person research team from the NASA Ames Research Center in the project, says that the droplets probably lie in the top 10 kilometers of a 33-kilometer-thick cloud layer that extends down to about 32 kilometers above the veiled planet's surface. The brilliance of Venus' cloud tops could be largely due to the fact that the acid droplets seem to be in the highly reflective one-micron size range.

Some theorists have previously pointed out that the presence of sulfuric acid, an effective drying agent, could account for the surprising lack of water vapor in Venus' predominantly carbon-dioxide clouds.

Will Pioneer 10 be found?

The starbound Pioneer 10 spacecraft, already millions of miles beyond Jupiter, carries a message-bearing plaque in case some alien civilization should find it. A 17-year-old student is now working out the chances.

Bruce Allen, of Los Alamitos High School in California, is preparing a series of computer programs to tell him what stars are near Pioneer's path (Aldebaran in Taurus is first), whether they could have life-supporting planets, and even whether the light angles will be right to let strong telescopes see the probe coming.

The chances, he acknowledges, are small.

A warning on disasters . . .

Just before Christmas a year ago, at midnight on the 23rd of December, Managua, Nicaragua was destroyed by an earthquake measuring 5.6 on the Richter scale. By sunrise, one percent of the 420,000 inhabitants were dead, another four percent were injured, 60 percent were fleeing the city and 70 percent were homeless. Among rescue workers from many nations was a group of scientists whose task was to determine the human impact of the quake and recommend ways of reducing the impact of future disasters. The Dec. 7 SCIENCE has their report.

Though civil order broke down almost immediately, resulting in widespread looting, and two full days passed before successful mobilization of local emergency organizations, Managuans were lucky in many ways. Nearly 75 percent of the homeless were able to find shelter with relatives because of an extended family system. The absence of private cars and a large pool of public transportation facilitated rapid evacuation. The international community responded quickly and efficiently, with U. S. Army engineers working alongside a Cuban relief team.

The authors reach some sober conclusions about the implication of the Managuan experience to potential disasters in industrialized countries. So-called "seismic resistant" buildings may not collapse but still become unfunctional, as did the major Managuan hospitals. A breakdown of public order, they say, could easily occur in American central cities. Extended families are not the norm here and large numbers of refugees would have to be evacuated and cared for—a task greatly hampered by a transportation system based on private cars and relatively delicate freeway overpasses.

The Managua earthquake was relatively low-energy, they recall, and another "perhaps 1000 times greater, can be expected on the West Coast of the United States within the lifetime of most readers of this article."

. . . and weapons

In his address accepting the 1973 Charles Lathrop Parsons Award of the American Chemical Society, Charles C. Price warned that as public attention on scientific matters has shifted to concern with energy and the environment, nuclear weapons have greatly proliferated and pose an even greater threat. Price, a past president of the society, said that in just the last three years, U.S. nuclear warheads have increased from 4,000 to 10,000, despite SALT talks.

Particularly objectionable, he said, was the absence of any Government employee with even part-time responsibility for planning total disarmament. "Under President Eisenhower and President Kennedy, the U.S. Government supported a top-level civilian effort devoted to planning for and negotiating the revolutionary goal of general and complete disarmament. . . . After President Kennedy's assassination, planning and negotiation for this goal were abandoned."

* * *

The editors of SCIENCE AND GOVERNMENT REPORT say they have been inquiring among knowledgeable people about the probability that nuclear weapons exist in the Mideast, following the revelation by a highly placed Egyptian spokesman that his country has attempted to become a nuclear power. They conclude that Israel has locally produced enough plutonium to build a bomb more or less anytime they want, while recent efforts to bring home Egyptian scientists working abroad, perhaps to staff the secret Egyptian nuclear research center, look suspicious.

physical sciences

A new solar cycle begins

Down near the sun's south pole evidence of the beginning of a new 11-year cycle of solar activity has been seen. The evidence consists of new sunspots and is reported in the Dec. 1 *ASTROPHYSICAL JOURNAL LETTERS* by Bruce A. Gillespie, Jack W. Harvey and William C. Livingston of Kitt Peak National Observatory and Karen Harvey of the Lockheed Solar Observatory in Burbank, Calif. The observations were done with Kitt Peak's McMath Solar Telescope.

The new cycle will be the 21st since astronomers began recording these things in 1755. As usual, the first evidence for the new cycle appears about a year before the minimum activity point of the previous cycle, which is expected in 1975. Activity belonging to the new cycle begins to appear in the polar regions of the sun, while that of the dying old cycle draws near the solar equator. The cycles thus overlap in time but not in space. The peak of the new cycle is expected about 1980.

Alcator at 100,000 gauss

Alcator, the thermonuclear fusion machine at the Massachusetts Institute of Technology, has achieved a magnetic field of 100,000 gauss according to an announcement by the institute. Alcator is a device of the class called tokamak, in which the magnetic field is used to confine a plasma of ions and electrons in a toroidal space in the hope of inducing energy-yielding fusions among the nuclei of the plasma.

The field of 100,000 gauss, a very high field for any kind of magnetic application, is the highest ever achieved in a fusion device. The previous record was 60,000 gauss, which was reached in a French experiment at Fontenay-aux-Roses near Paris.

It is not expected that a field of such great strength will be needed for the operation of a fusion reactor, if and when one comes to be. Fifty thousand gauss is believed sufficient. The higher fields are being studied to gain an understanding of how plasma confinement varies with increasing magnetic field, information that will be important for the design of eventual fusion reactors. The record field was produced by cooling Alcator's electromagnets to a temperature of 77 degrees K., lessening their electrical resistance and allowing them to carry higher currents and produce the strong field.

A europium gas laser

Efficient and powerful lasers that emit frequencies in the visible part of the spectrum have developed from the use of metal vapors as the active material. Yet, as P. A. Bokhan, V. M. Klimkin and V. E. Prokop'ev of the Institute of Atmospheric Physics of the Siberian Division of the USSR Academy of Sciences, point out in *JETP LETTERS* (Vol. 18, No. 2), there remains quite a number of metals whose possible lasing properties have not been investigated, especially the rare earths.

To fill some of the gaps the three Siberian physicists have been experimenting with the lasing possibilities of rare earths. So far they have succeeded in producing a laser that uses ionized europium vapor. The europium is mixed with helium and energized by an electrical discharge. The lasing comes in pulses of between 3 and 150 microseconds with a maximum power of 50 watts. Radiation at a wavelength of 1.361 microns appears at low helium pressure. At higher helium pressures the spectral lines at 1.002 microns and at 1.017 microns also appear.

behavioral sciences

An antique tool kit

Crudely chipped pieces of volcanic rock have been identified as the earliest "tool kit" used by humans. Anthropologist Glynn Isaac of the University of California in Berkeley has found nearly 600 such tools during four years of field work in Kenya. Last week at the second annual Louis Leakey Memorial Symposium in San Francisco, Isaac explained that the stones, found in patches among groups of broken animal bones, have been dated at 2.5 million years of age.

Isaac, co-leader with Richard Leakey of the Kenya expedition, says the "simple stone implements which took about five or six blows to produce" are very important because they provide information about the origins and life-styles of early humans. Finding the stones among broken bones, for instance, indicates that the primitive tool users were meat eaters who liked to establish central bases of operation and food-sharing collectives. Gazelle, waterbuck, pig, porcupine and hippopotamus may have been part of the meat diet. Bones of all of these animals were found with the stones. Although it is difficult to determine the function of the tools with certainty, Isaac noted that humans have always had difficulties in breaking up animal carcasses without implements.

In addition to the 2.5 million-year-old tools, Isaac has unearthed thousands of tools estimated to be 1.3 million years old. The later implements varied considerably from the early tools in numbers as well as sophistication. Comparing them to the older ones yields more information. The later tools, says Isaac, were made with a definite purpose in mind and took 15 or 20 blows to produce. They also included much larger specimens, which indicate that they were made by a "muscular, beefy character." During the one million years separating the early site from the later one, Isaac says, our ancestors obviously "became quite slaphappy about making tools."

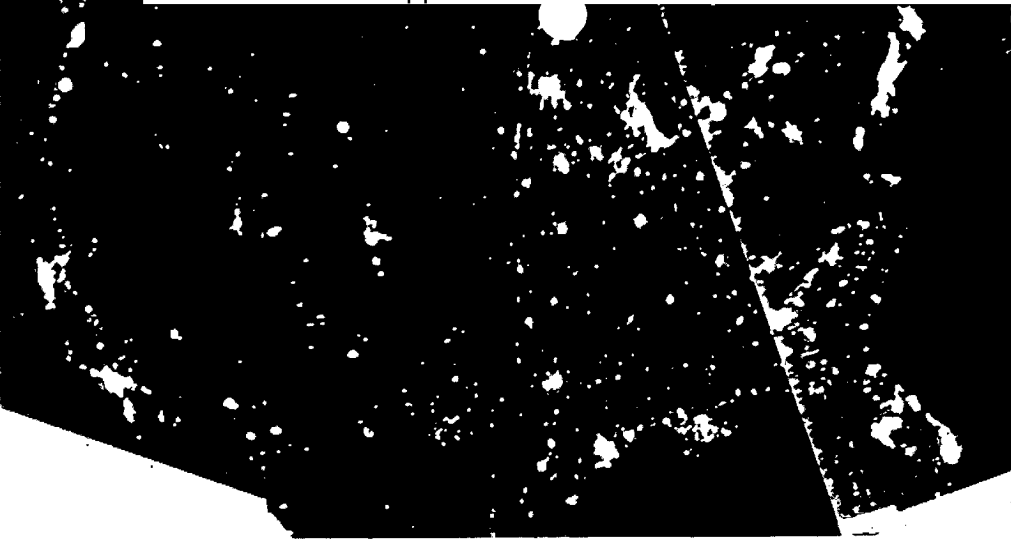
Suicide: An occupational hazard?

Suicide rates are highest among job holders who have the least opportunity for significant social contact, says Leonard L. Linden of the University of Georgia's Institute for Behavioral Research. He examined national death rates and found that professionals with opportunity for deep, meaningful relationships in the course of their work, such as doctors and lawyers, were less suicide prone than others, such as farmers, who lacked these social opportunities and had the highest suicide rates. "The most important factor," he stresses, "is not occupation per se, but how the work affects individual social contacts."

Tackling football fever

Just in time for the Super Bowl, the American Medical Association has published *Comments in Sports Medicine*. The volume, edited by Timothy T. Craig, warns coaches to take it easy on their teams during halftime. Stimulating an athlete, it says, is one thing, but when the excitement reaches an anxiety level, player performance is likely to be adversely affected. The event itself and the spectators will usually create enough psychological arousal for any athlete, says the AMA.

In addition to supplying psychological, nutritional and physical fitness facts for coaches and players, the book urges that sports arenas have facilities available to cope with the spectator who becomes overexcited and suffers a heart attack.



sites Walker prepared maps of California and Arizona on which he drew exclusionary circles around regions where urban light pollution was too strong for good observatory siting. The limits he used for sky illumination were those—still tolerable—found at Palomar: a sky brightness of 0.1 magnitude at the zenith and 0.2 magnitude at 45 degrees above the horizon in the direction of the nearest city. The resulting maps exclude vast segments of territory, and when they are combined with the other criteria for a good astro-

nomical siting—lots of clear weather and low atmospheric turbulence—very few places remain. That is why Walker urges a program to identify good sites and preserve them from light pollution. Both the American Astronomical Society and the International Astronomical Union have appointed committees for this purpose.

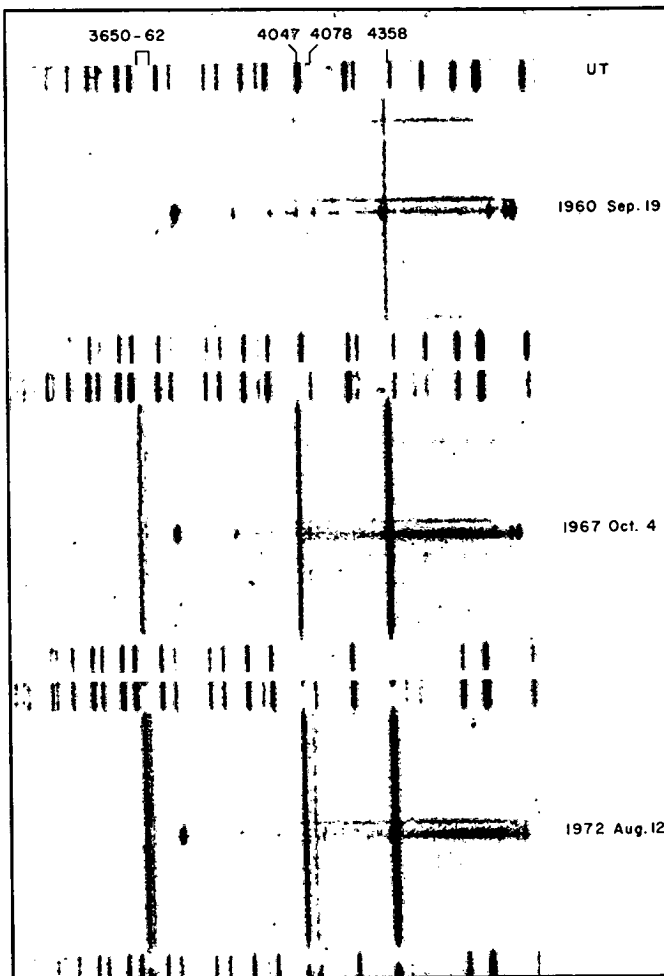
The place the Lick people favor most as an escape hatch is Junipero Serra Peak in the Santa Lucia Mountains, somewhat south of Lick's present location. Junipero Serra lies between the

Southern California and the San Francisco Bay Area conurbations, both of which are reaching toward it. At the moment the observatory has no money and no plans to build anything there, and thus is in a bad situation to try to affect what happens there. There are also potential problems because the location is in a national forest and there are conservationist groups that would like to see nothing at all built there, not even an observatory.

To preserve Junipero Serra would require control of lighting in the Salinas Valley. That might be achieved by legislation on lighting similar to that adopted in Tucson, where, as Hoag, Schoening and Coucke point out: "... astronomers have taken the perhaps quixotic view that something can be done about the lighting situation."

Tucson is surrounded by observatories (including Kitt Peak, the Smithsonian Astrophysical Observatory's southern station and the Steward Observatory of the University of Arizona), and it takes its "astronomy industry" seriously. The Tucson astronomers succeeded in getting the city to require the shielding of outdoor lighting so that it shines down but not up and to require that the spectral characteristics of outdoor lighting be such that emission of wavelengths shorter than 4,400 angstroms is curtailed. (Ultraviolet light is particularly bad for astronomers.) Lately the Arizona astronomers have persuaded the state legislature to pass enabling legislation so that counties and unchartered municipalities could enact similar ordinances. Now they are trying to get Pima County to pass such an ordinance. A county regulation would cover suburbs outside the city's corporate limits and the territory immediately adjacent to the observatory mountains themselves. "The ordinance won't reduce the light," says Hoag, and the light will continue to increase as a function of time. What the ordinance will do is reduce the slope of the increase. With this, good conditions can be preserved at Kitt Peak "not indefinitely" but for some time to come. The brightening at the zenith over Kitt Peak is now about 0.1 magnitude and more subtle features such as the gegenschein and the zodiacal band are easily seen at appropriate times, which means that the environment is quite acceptable for observations.

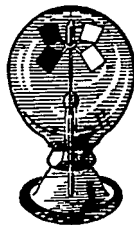
In places that are not as lucky and that have no controlling legislation, the situation will probably deteriorate even if the energy crisis shuts off a few lights and urban growth slows. Municipalities are moving from incandescent lamps to the brighter mercury-vapor lamps and the even brighter sodium-vapor ones. If something isn't done, American astronomers may wind up without a place to stand. □



USAF DATA Acquisition and Processing Program

Above: The United States lit up at night as seen by an Air Force satellite. Left: Spectral lines of mercury vapor (numbered) from the streetlights of San Jose appear in the spectrum of the nebula at FG Sge taken with the Lick Observatory's Crossley reflector. The intruding lines get darker as time goes on.

Walker/Publ. Astron. Soc. Pac.



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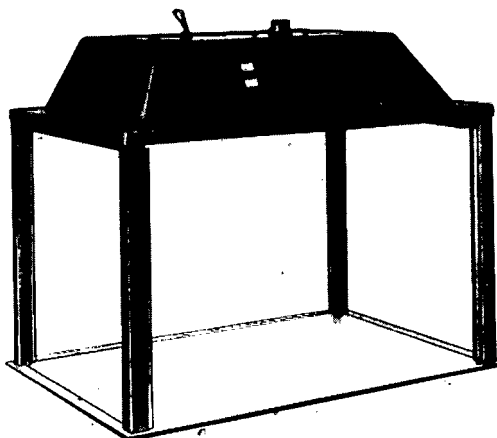
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