DECEMBER 30 1967 / VOLUME 92 / No. 27 P. 625-648

SCIENCE NEWS

Report from Antarctica

index issue

current patents

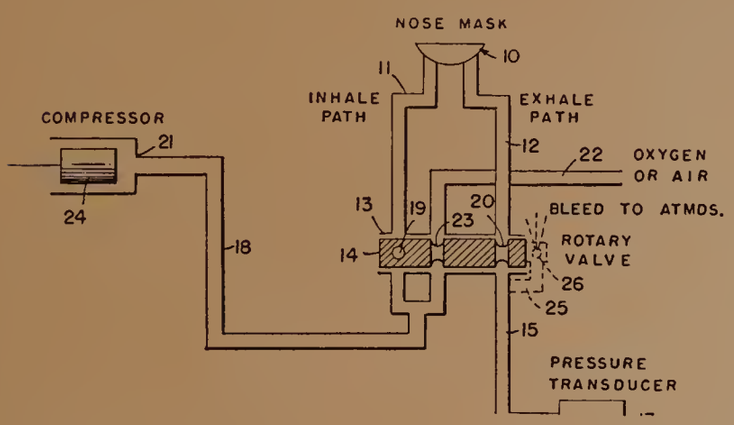
MEDICAL ENGINEERING

Device for Treating Hyaline Membrane

A device that increases respiration in premature infants stricken with hyaline membrane disease and is now in widespread use in hospitals throughout the country has been patented by Dr. David L. Carlson of Iowa State University.

In 1963 the disease killed Patrick Bouvier Kennedy, son of the late President. Each year it affects some 25,000 newborn babies in the United States, mostly premature ones. One out of every 15 babies is born prematurely; the greater the prematurity, the greater the danger that a baby's lungs will not inflate properly.

Dr. Carlson said his respiratory augmentor "is a useful adjunct to the intensive care normally given in the treatment of premature infants with hyaline membrane disease." He stressed, however, that it "is a treatment only, not a cure."



The device, which has been on the market about a year, is made by Bourns, Inc., Ames, Iowa. It consists of a nose mask to which two conduits are attached, one for inhalation, the other exhalation. An electronic monitor and control are used to stimulate the infant to return to the natural breathing rate whenever it falls below that rate.

Although any mask can be used with the apparatus, the preferred one was designed by Dr. Carlson, with John B. Buck, and a patent on it will be issued shortly. Rights to both patents are assigned to the Government through the Department of Health, Education and Welfare.

Patent 3,357,428

SOLID STATE PHYSICS

Radiation Detecting System

Exposure to ionizing radiation, such as X-rays, gamma rays and nuclear radiation, is an increasingly serious hazard to human beings. To avoid excessive dosage, exposed persons must monitor the total radiation they receive.

A relatively new type of dosimeter uses thermoluminescent material to determine exposure. Ionizing radiation causes electrons within the crystal structure to be trapped. They are released with the emission of visible light when the material is heated, and the radiation dosage determined by the amount of light after it is amplified by a photomultiplier tube.

Drs. Kenneth D. Cashion of Friendswood, Texas, and Benny R. Baker of Houston have developed an electronic switching method of measuring this light when the input signal is low, as would be produced by doses of 10 to 500 milliroentgens.

Patent rights were assigned to the Government through the National Aeronautics and Space Administration.

Patent 3,358,145

ACCELERATOR PHYSICS

Variable Bubble Chamber

A two-in-one bubble chamber that is in use at the world's second largest atom smasher, the 33 Bev accelerator at Brookhaven National Laboratory, earned a patent for its director, Dr. Maurice Goldhaber.

He said the device was also in use at several accelerators in Europe and that many institutions in the United States were planning to add it to their auxiliary equipment for studying the structure of atomic nuclei.

Dr. Goldhaber noted that its "two main values are that it allows a single chamber originally built for hydrogen as the liquid to be adapted for heavier liquids without building a special chamber for that purpose and that it combines a whole range of ratios."

These aims are accomplished by adding neon selectively to the hydrogen. A circulating system for the liquid mixture prevents separation of the neon and hydrogen.

As the energies of nuclear particles under study continue to grow higher, larger bubble chambers have been required to record the particle tracks because it takes longer for them to come to rest and react. Dr. Goldhaber's invention makes it possible to provide a bubble chamber for use with higher energy particles without scaling up the size of the chamber.

Dr. Goldhaber assigned rights to the Government through the U.S. Atomic Energy Commission.

Patent 3,358,144

TECHNOLOGY

Measuring Magnetic Materials

A method for measuring the magnetic characteristics of materials faster and more accurately than was previously possible has been devised by three Russions, including Mikhail M. Savkin of Novosibirsk, Russia's so-called science city. Rights were assigned to the Institute Gornogo Dela, part of the U.S.S.R. Academy of Sciences, also in Novosibirsk.

The apparatus, called a ferrometer, includes a magnetizing device, a computer to calculate the flux of the induced magnetic field and a measuring resistor connected to a high current circuit. Results of the ferrometer's measurements are displayed on an oscilloscope screen.

Patent 3,358,224

SCIENCE NEWS®

EDITORIAL

OF THE WEEK

FROM ABROAD

DEPARTMENTS

COVER

A Science News correspondent covering the first half of the summer season of the U. S. Antarctic Research Program reports research on the parental instincts of the Adelie penguin, coring through the ice sheet, geophysics, atmospheric physics and other phenomena under examination on and around the world's southernmost continent. P. 635. (Photo: Leerberger)

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Science News Letter ®

SCIENCE SERVICE

films OF THE WEEK

Listing is for readers' information of new 16mm and 8mm films on science, engineering, medicine and agriculture for professional, student and general audiences. For further information on purchase, rental or free loan, write to distributor.

GETTING THROUGH—M-1520-X. 16mm, b&w, sound, 20½ min. Explores smoking as a complex paradox in our society, and concludes that the final decision for young people about smoking is not up to parents, teachers, medical science, or advertising, but is a personal decision which each must make after weighing the facts. Audience: young adults, teachers, youth workers, parents. Free loan from National Medical Audiovisual Center (Annex), Chamblee, Ga. 30005, purchase from DuArt Film Laboratories, 245 West 45th St., New York, N.Y. 10019.

HAND TOOLS FOR METALWORKING. 16mm, color, sound, 25 min. Discusses the everyday tools of mechanics and craftsmen, including hammers, screwdrivers, pliers, wrenches, files and hacksaws. Purchase information from Bailey Films, 6509 De Longpre Ave., Hollywood, Calif. 90028.

PUTTING SCIENTIFIC INFORMATION TO WORK. 16mm, color, sound, 35 min. Shows methods of attacking the various information bottlenecks which face researchers today. Audience: scientists, engineers, librarians, documentalists. Loan and purchase information from Institute for Scientific Information, 325 Chestnut St., Philadelphia, Pa. 19106.

A RADIO VIEW OF THE UNIVERSE. 16mm, color, sound, 28½ min. Shot on location at the Harvard College Observatory and the National Radio Astronomy Observatory at Greenbank, West Virginia, the work of Dr. Morton S. Roberts is followed and his methods of studying the age and evolution of galaxies are explained. Audience: high school seniors with some mathematical background, but can be used from seventh grade through college. Rental or purchase information from Modern Learning Aids, 1212 Avenue of the Americas, New York, N.Y. 10036.

SCIENCE NEWS

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LETTERS

to the editor

Kudo minus one

Sir:

Congratulations (a bit belated) on the transformation of your magazine from sophomoric to sophisticated, in format and in literary production.

Generally, the articles show competence in presentation of material.

The current issue (Nov. 18) unfortunately opens with a naive and unscientific presentation of the F-111. It's difficult to conceive that your publication would devote virtually the entire article to Mr. Davis and his opinions, rather than to some more objective views on the plane by competent critics.

In all, the magazine is now at an adult level and serves a useful function. Good work!

Louis Singer
Speech Pathologist
Washington, D.C.

SCAT fading

Sir:

You carried an item on a transistor device (SN: 9/16) patented by Dr. William Shockley and assigned to International Telephone and Telegraph Corporation.

The theoretical frequency limit of the Silicon Controlled Avalanche Transistor (SCAT) is greater than 10 gigahertz. The common bipolar transistor has, with present processing technology, frequency capabilities greater than 3 gigahertz.

The initial enthusiasm regarding SCAT has waned because laboratory produced devices have only shown practical power gains at frequencies up to 100 megahertz. If it is accepted that SCAT is not the extremely high frequency device that at first it was thought to be, it is not inconceivable that it may find its place as the solid state answer to high power broadcasting at the megahertz and lower frequency bands, say in the kilowatt or greater range, because of the power considerations mentioned in your item.

W. E. Naugler
ITT Semiconductors
West Palm Beach, Fla.

Thanks

Sir:

I would like to congratulate you on your useful and informative publication.

Gary W. Hull
Harvey Mudd College
Claremont, Calif.

FROM THE EDITOR'S DESK

science and the salesmen's art

Between "life in the test tube" and "the first successful synthesis of viable DNA" there may be only a semantic difference. They are both phrases employed by the National Institutes of Health, justifiably proud of having supported a significant piece of research—the synthesis of replicating DNA by Dr. Arthur Kornberg and others at Stanford University.

Dr. Kornberg himself said, in answer to a question about what he had done, "You can call it a simple form of life if you want to."

He obviously didn't want to; most journalists did and the public Dec. 14 and 15 was greeted by headlines reading, "Life Created in Lab Test Tube," and "Scientists Create 'Molecule of Life'."

Dr. Kornberg's work is indeed significant. He refined an enzyme that could create from off-the-shelf chemicals a functioning, viable replica of natural DNA. It was a natural, if not inevitable step, in the chain of related steps that have always characterized science.

But there are few single developments, in the logical progress of basic research, that are hailed as "awesome" by the President of the United States, and a "landmark achievement" by Dr. James A. Shannon, the director of NIH.

What is awesome, in fact, is the acclaim with which Dr. Kornberg's work was greeted. Its publication in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES was accompanied by press releases by Stanford University and the Academy itself, and statements issued by the White House and Dr. Shannon's office.

This acclaim may not be unjustified; in fact, it has been said, it is only when a society builds massive public monuments to its scientists and scholars, rather than its soldiers and statesmen, that it can be said to have become truly civilized.

But we suspect that it does not diminish the significance of Dr. Kornberg's contribution to understanding of the life sciences to suggest that the massive outpouring of publicity that accompanied this particular development might not have been wholly ingenuous.

Are the accolades in fact a reward for the meticulous effort that went into this one achievement?

Or do they represent a more cynical juncture of science and public policy? They come at a time when Dr. Shannon has just emerged from a scathing session of Congressional controversy over his fiscal 1968 budget, and is trying to save what he can from Federal planners drawing up next year's budget and more concerned with the costs of Vietnam than with scientific research.

Science itself is a complicated process. So is the public administration and support of science. When the two mix, as they apparently have in the present case, public awareness of science may be enhanced by the salesmen's art, but balanced public understanding of either process, in perspective, is bound to suffer.

Science News' editor and Dr. Kornberg are unrelated.

SCIENCE NEWS
OF THE WEEK

Viable Synthetic DNA

Eleven years' effort brings success and wild acclaim

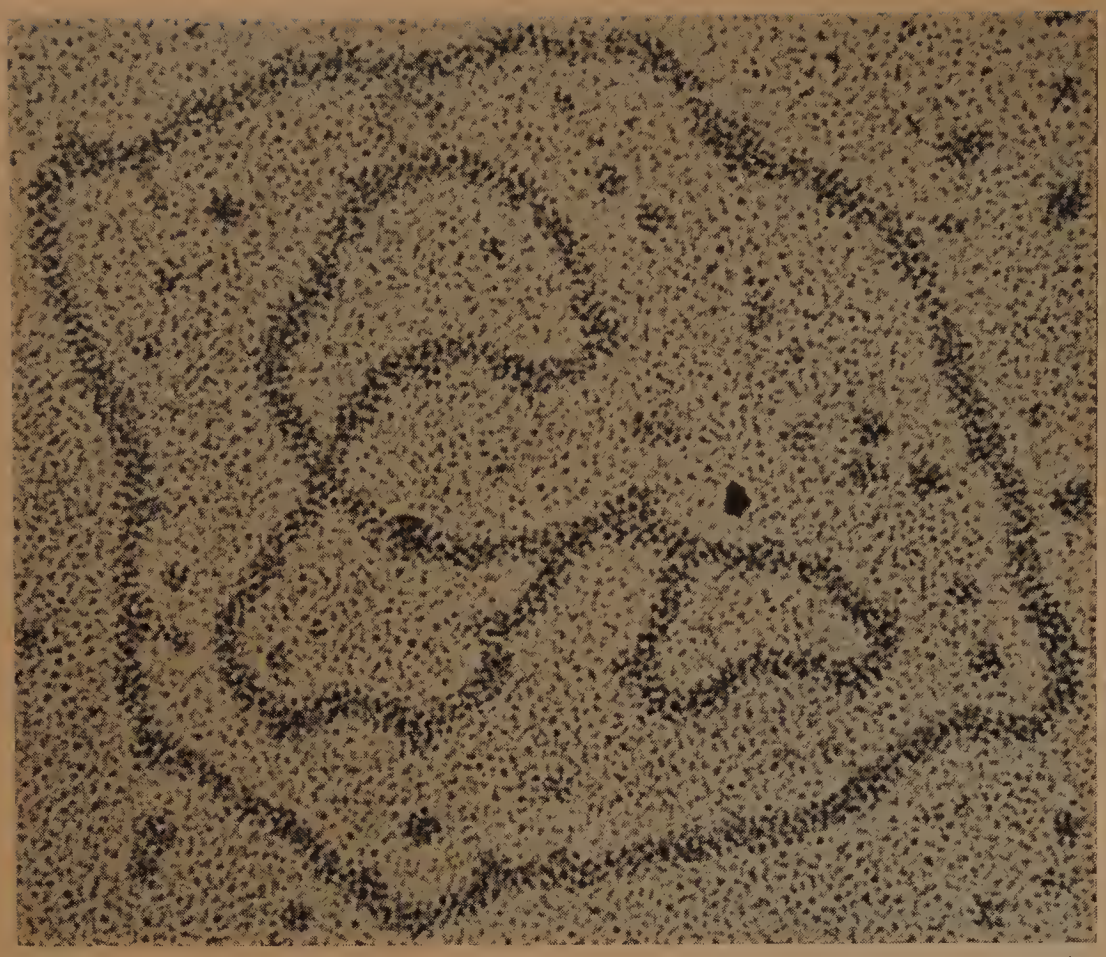
Enthusiastic news reports that three California scientists created a man-made molecule of life's basic genetic material raised at once the spectre and the promise of man's eventual control of his own heredity.

Headlines proclaimed life in a test tube. There were predictions that future generations will see mankind make exact duplicates of its geniuses, that the secret of cancer is near disclosure and that a remedy for inherited diseases will be the next research step.

Though there may be an element of probability in these forecasts, there is no element of immediacy, and the scientists involved said so. Nevertheless, disregarding all the exaggeration, the first synthesis of a biologically active molecule of DNA (deoxyribonucleic acid) is a major event. After 11 years of research on DNA synthesis, Dr. Arthur Kornberg of Stanford University produced in a test tube a totally artificial copy of a type of DNA virus; the copy is every bit as infectious as its natural counterpart.

The DNA core of a virus is the portion of the molecule that attacks and destroys living cells while using their genetic machinery to make copies of itself. The synthetic viral DNA Dr. Kornberg created comprises, in effect, man-made genes. He was assisted by Dr. Mehran Goulian of the University of Chicago, formerly of Stanford, and by Dr. Robert L. Sinsheimer of the California Institute of Technology. They report their success in the December PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

The particular type of viral DNA (called Phi X174) the researchers made is an extremely simple molecule of only five or six genes. Their achievement, however, lays the foundation for eventual synthesis of more complex DNAs —such as those in human cells—by



Stanford University

Rings of viral DNA synthesized in a California laboratory.

proving that active DNA can be produced in the laboratory and by showing scientists how to do it. The key lies in purification and skillful use of the proper enzyme or catalytic system.

It was for the purification of the necessary enzyme that Dr. Kornberg received his Nobel Prize in 1959. The work he reported now was made possible by a refinement of that process.

"If we know how to use an enzyme to copy this particular virus then we can copy other viruses," Dr. Kornberg says. "And we can copy them in ways in which we can modify their genetic structure to make them noninfectious." Such noninfectious viruses could be used as tools to study the replicating mechanisms of disease-causing viruses once they infect a cell; they might also be used as the active ingredient in antivirus vaccines.

DNA has coded within it the information needed to program the development of all hereditary characteristics. Its code contains four words: the names of the chemicals adenine, guanine, cytocine and thymine. They transmit information by the sequence of triplets in which they appear. The possibilities of variation are infinite because DNA molecules can contain hundreds of thousands of words, each in different triplet sequence. Even the simple viral DNA Dr. Kornberg synthesized is 6,000 words long.

An enzyme, DNA polymerase, is the instructor that orders the four-word genetic language into its proper sequence.

To make the synthetic molecule Phi X174 DNA virus, Dr. Kornberg combined in a test tube a natural DNA virus to serve as a blueprint for the artificial copy, molecules of adenine, guanine, cytocine and thymine and some E. coli DNA polymerase to guide the copying procedure.

Dr. Kornberg's first success at creating DNA in a test tube had come in 1959 when he similarly produced a molecule with all of the physical and chemical properties of natural DNA but without its biological activity. In other words, his first man-made virus was like its natural counterpart in almost every respect, but it could not infect a bacterial cell and replicate.

One reason it was inactive, Dr. Kornberg concluded, was that the polymerase enzyme, extracted from the common intestinal bacteria Escherichia coli, was contaminated. Therefore it dictated certain minor but critical mistakes in the copying process it directed.

To create a fully active synthetic copy of the natural DNA, the four chemical bases must be directed to line up against the blueprint model in precisely the correct order. Extraneous material in the enzyme confused the procedure just enough to put a few words in the wrong sequence; hence, no activity.

This time a refined enzyme directed the four bases to fall in line in virtually perfect complement to the natural blueprint; and as a result, the code words in the synthetic spelled viral DNA.

But the natural, infectious DNA virus on which the synthetic was modeled is not a straight molecule. It has a closed, circular form. So Dr. Kornberg added a polynucleotide enzyme called ligase to his test tube; it joined the two ends of the synthetic DNA.

When the synthetic DNA was then separated in a centrifuge from the natural genetic material, Dr. Kornberg added it to a culture of E. coli cells. Within minutes, the man-made DNA virus infected the cells, usurped their genetic machinery and produced more DNA viruses. These viruses then went on to infect other cells and replicate again, producing a second generation of synthetic viruses identical to the original natural virus.

The issue of whether Dr. Kornberg's man-made DNA virus constitutes the creation of life by man seems to be of more concern to laymen than to scientists. Scientists disagree as to whether viruses are alive in the first place.

Cells are able to replicate by themselves. Viruses are not. Viral particles replicate only inside living cells because they do not contain all the machinery necessary to do the job on their own.

However, when scientists take the next step—the synthesis of DNA from a bacterial or animal cell rather than from a virus, there will be neither question nor controversy.

The ultimate synthesis of cellular DNA seems assured; when depends on the intensity of the effort.

Dr. Sol Spiegleman of the University of Illinois believes the speed "really depends on society's interest in spending the money, because it will require massive research efforts."

Using an enzyme called replicase and following procedures similar to those of Dr. Kornberg, Dr. Spiegelman synthesized viral RNA (ribonucleic acid) in 1965. RNA is second-string genetic material. It reads the hereditary message coded in DNA and carries it to the cells' ribosomes, small organelles where proteins are made.

Dr. Kornberg's research was supported largely by funds from the National Institutes of Health and the National Science Foundation. NIH director Dr. James A. Shannon cited Dr. Kornberg's work as a "landmark achievement." His success, he said, "in effect adds up to a handsome reward for the American people as a result of their investment in basic health research through Federal agencies. It seems well to make this point at this time because the end products of basic research, although highly essential to progress in clinical medicine, are seldom so clearly visible in terms of potential health applications as that of Dr. Kornberg and his associates."

President Johnson also lauded Dr. Kornberg for "a spectacular breakthrough in human knowledge. . . ."

SUDDEN WARMINGS

Surprise Answer in the Lab

Sudden warmings are the most drastic large scale phenomena the atmosphere undergoes. Although they occur at high levels, they are apparently connected with surface weather, often resulting in a condition known as blocking that switches the worldwide circulation pattern to very much north-south rather than the more usual east-west. In the United States, this pattern often results in severe cold waves dipping far down into the South.

Until now, the cause of these warmings had been attributed by some to the streams of sun particles loosed by solar flares (SNL: 2/27/54).

But the atmosphere itself contains enough energy to account for the sudden warmings, without any input from streams of extra particles, researchers now find.

Confirming evidence that the high atmosphere can undergo temperature changes as great as 50 degrees C. comes from a computer programmed to make experimental forecasts of circumpolar air flow patterns at nine levels, from the surface to 20 kilometers.

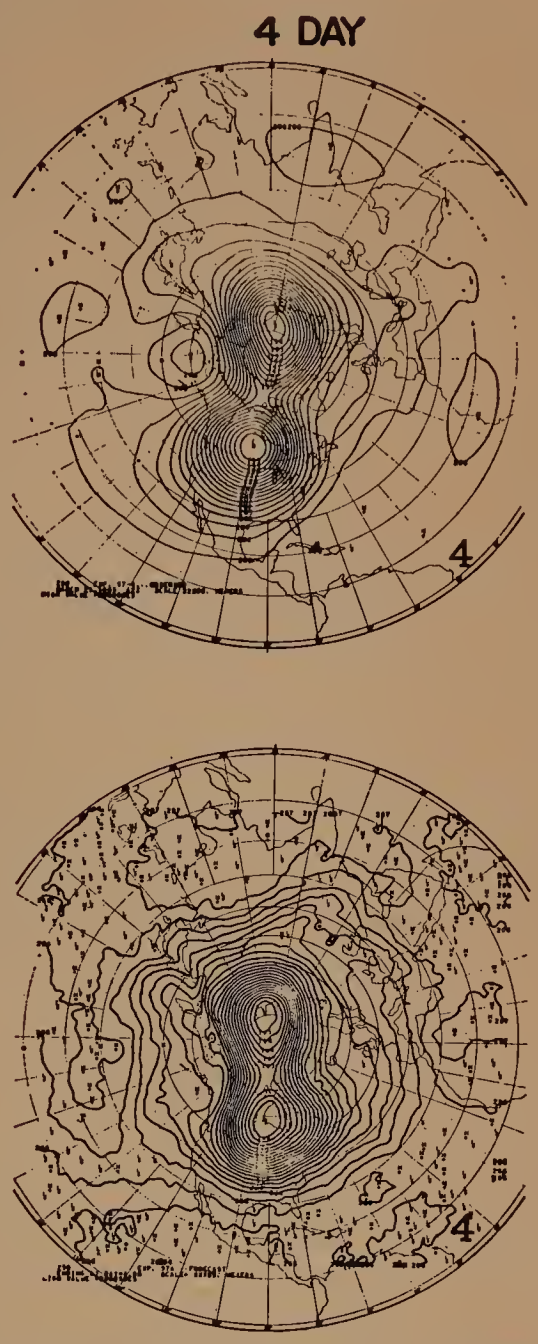
As far as meteorologists know, there have been six such sudden warmings, the first in 1952. Others probably occurred previously but only scattered soundings were then being taken at the extremely high altitudes where they are detected. All those studied occurred between mid-January and early March.

The self-contained nature of the sudden warmings was first found while using a computer at ESSA's Geophysical Fluid Dynamics Laboratory in Washington. It is programmed to predict what meteorologists call the general circulation, the planet-wide pattern of atmospheric motion averaged over a period of time, usually a month, season or year. Although the computer program contains such factors as heat transfer and atmospheric condensation, it does not include any imput for a sudden flow of solar energy from a corpuscular stream.

Nevertheless, a sudden warming was predicted by the computer. These calculations were then checked by the same computer, using a different set of equations that predict the circumpolar air flow patterns. Although the pattern is circular at the start, within a few days it becomes elongated and eventually becomes so unstable that it divides in two.

The two computer calculations show that no outside influence is required to account for sudden warmings and, therefore, that the model of the atmosphere being used to make experimental forecasts of the general circulation actually reflects physical reality even for previously puzzling events.

Dr. Kikuro Miyakoda of the Laboratory believes that the energy for the warming comes from the instability that causes the breakdown of the polar night vortex, which is a large-scale cyclonic circulation at high altitudes centered over the polar regions.



ESSA

Patterns, actual (top) and computed.

THE ELECTRIC MIND

Short Reactions Stay Unconscious

From the way humans behave, it is clear they have some kind of unconscious mental processes. A man can drive without making conscious traffic decisions, or shut out a conversation and still nod his head at the proper time; he can react according to experiences long forgotten, and even perhaps perceive things that are below his threshold of sensation.

From the way the brain behaves, it is now apparent that these unconscious processes do have a neurological basis.

According to work done at the University of California Medical Center in San Francisco, an unfelt sensation can nevertheless provoke a brain response. Moreover, the response is different from those that follow sensations that are actually felt.

Dr. Benjamin Libet, a physiologist who led the San Francisco team, says the evidence may help provide a physical basis for both subliminal perception and the unconscious thought processes.

In eight years Dr. Libet, with neurosurgeon Bertram Feinstein, experimented on more than 100 persons undergoing brain surgery for Parkinson's disease and cerebral palsy. Since the skulls had to be open and the patients unanesthetized for surgery, Dr. Libet was able to work directly with the sensory cortex to pick up signals sent from skin nerves.

Most of the patients were very willing to cooperate, to his surprise. He simply asked each patient to give him a half hour or so before surgery for the experiment, explaining that it was harmless, although of no help in the ailment.

Once the patient had agreed, Dr. Libet placed a flat plate a few centimeters long over the sensory cortex and matched it with a metal disk on the corresponding nerve area of the skin. Both plates had electrical contact points so that impulses could be sent either way.

Dr. Libet then tested the patient to find his threshold for sensory perception. Although the threshold varies widely among individuals, most patients could not feel an impulse below the one milliampere range. Yet their brains would react with a short, highly localized responses.

On the other hand, when the sensation was felt, this first primary response was followed by a series of complicated waves, says Dr. Libet. Instead of being localized in the sensory cortex, these afterwaves extended beyond to other brain areas and lasted half a second or longer.

Dr. Libet theorizes that conscious experience requires a minimum of at least half a second of brain activity. At shorter durations, the experience will most likely be unconscious, he says.

Dr. Libet's theory is backed further by the action of the brain under direct stimulation. A single, quite strong electrical impulse shot directly into the sensory cortex elicited no sensation in the patient, says Dr. Libet. But repeated impulses at low levels did.

The single impulse could be as much as 20 times stronger and still the patient would say he didn't feel anything, even while his brain was showing a large primary reaction.

The patient, however, did show some reaction to the single impulse—his muscle twitched. In other words, direct

sharp stimulation to a brain area devoted to sensory perception drew out, not a sensation, but a motor response.

Dr. Libet believes the results may explain how persons unconsciously make split-second reactions to danger, yet not realize what has happened until a second or so later.

It is also possible that unconscious experiences are laid down as reflex memories, says Dr. Libet. People could then respond later on the basis of experience of which they were unaware.

Dr. Libet points out that much intellectual activity, even at high levels of complexity, appears to proceed in the brain without conscious experience. Then, not infrequently, an idea springs into the conscious mind and comes under its more deliberate scrutiny.

If it is true that conscious experience requires the brain to continue reacting for as long as half a second, that would impose a certain ponderousness on thinking processes, says Dr. Libet.

But if, in contrast, only short reactions are needed for unconscious experiences, they might provide the kind of quick-acting, marginal thinking that facilitates complex integration in the mind.

"We were not trying to prove or disprove the existence of an unconscious process, we accepted it," says Dr. Libet. From all the evidence, this looks like its physiological basis.

Dr. Libet plans to publish a report of his work in SCIENCE of Dec. 22.

MOON MODEL

Scientists Now Certain of the Maria

Scientists are a cautious breed, and on a subject as publicity-prone as the moon they tend to be downright gunshy. When the Surveyor 5 robot spacecraft analyzed a patch of moon and sent a detailed description back to earth (SN: 10/14), most of the investigators steadfastly refused to admit that they had learned about anything but the tiny area directly beneath Surveyor's feet.

Now the researchers have changed their tune. The relatively smooth lunar maria, or seas, which cover from a fourth to a third of the moon's near side, are essentially the same all over, says Dr. Leonard D. Jaffe of the Jet Propulsion Laboratory in California, which runs the Surveyor flights. The other members of the team echo his confidence.

The turnabout was due to Surveyor 6, the fourth successful probe in the series, which landed on the moon Nov. 9, some 450 miles from Surveyor 5. Equipped with the same kind of automatic chemical analyzer that enabled its predecessor to count the percentages of atoms of different elements in the lunar rock, No. 6 produced a startlingly similar picture. The amounts of aluminum, magnesium and sodium were exactly the same, while oxygen, the most common element, varied only minutely from 58 percent at Surveyor 5's site to 57 percent beneath Surveyor 6. Silicon, the second most abundant element, matched to within experimental error.

Before the Surveyor program, Dr. Jaffe points out, scientific opinion about the moon ranged far and wide. Now there is a good deal of fairly well established knowledge, at least about the maria, where the manned Apollo landings will take place:

- Researchers used to argue over whether the mare rock was acidic or basic, and whether it contained iron deposited by meteorites. Now it is agreed to be basic, much like some earthly basalt, and to have only traces of meteoritic iron.
- Was the surface bare rock, or a porous honeycomb, or was it covered with a layer of coarse or fine particles? The Surveyors have shown that there is indeed a carpet of very fine particles, most of them only one-thousandth of an inch in diameter, almost too small for the spacecraft cameras to see.
- The most pressing differences of opinion were those directly related to manned landing. Would the surface support a man, let alone an Apollo spacecraft? Estimates of its strength covered a million-to-one range, from less than a sixth of an ounce per square inch to some five tons. Radar beams reflected from the moon had indicated solid resistance, but for all anyone knew, the solid layer might have been at the bottom of a mile of powdery dust. Some engineers were visualizing special snowshoes for astronauts, to keep them from disappearing beneath a fluffy surface. Fortunately, it is now known, the surface is easily strong enough, capable of bearing up to eight pounds per square inch after sinking down only an inch or two.

The next direct information from the maria may not be received until astronauts (or cosmonauts) land there, although there is one Surveyor left to go. Surveyor 7, which could be launched as early as Jan. 7, will instead be aimed at a target so inhospitable that the National Aeronautics and Space Administration wouldn't dream of landing men on it.

Located about 18 miles north of the rim of the crater Tycho, the site is a forbidding badlands of rocks, gullies, potholes and ridges. It was picked because it was so geologically different from the maria and also because Tycho is one of the moon's newest major surface features, so that its original appearance would be less worn down by the meteorites that constantly bombard the moon.

It is possible that the area around Tycho will show distinct chemical differences from the maria—higher acidity, more silicon, less iron and calcium —just as do earth's maria (the largely basaltic ocean floor) and highlands (the more acidic continents).

In addition, the 53-mile-wide Tycho may, as it was formed, have thrown out lunar material from as far as 12 miles below the surface, offering a ready-made excavation far down into the moon's crust.

To get the most out of its assignment, Surveyor 7 will have everything its predecessors had, and more. There will be TV, of course, and a chemical analyzer, plus magnets to look for iron, as well as a remote-control scoop like the one with which Surveyor 3 dug troughs and crushed rocks. A knob will be mounted atop the analyzer, so that the scoop can pick it up and set it down in different locations. In addition, there will be several mirrors: One set will enable the TV camera to take pictures looking underneath the spacecraft; another will be photographed only while reflecting the clear sky of space, to show any traces of dust that may be kicked up by Surveyor's activities; a third set will let the camera take stereo pictures without the need for the hazardous hop that was carried out by Surveyor 6. Despite the more elaborate instrumentation, Surveyor 7's payload will only weigh 22 pounds more than that of No. 6.

For the spacecraft to reach its target, a circle only 12.4 miles across, every step of the flight to the moon will have to be letter-perfect. "The scientific gain is worth the risk," says Surveyor program manager Benjamin Milwitzky, "but only if the spacecraft is going to be right on target." If even the slightest thing goes wrong, such as a tiny error in a midcourse correction, the destination will be changed to a safer one, a crater called Fra Mauro.

Almost 700 miles north of Tycho, Fra Mauro is about the same size, but the surrounding terrain is less hazardous for landing a spacecraft. Fra Mauro is also of interest, since it may contain material ejected from deep in the lunar crust during the formation of Mare Imbrium. Such material is likely to be chemically different from the rest of the surface, since the elements would probably have distributed themselves partly by weight during its volcanic past.

natural sciences notes

HYDROLOGY

American Falls to Be Dried

The American Falls of the Niagara River will be dried up for six months next year if plans of the U.S. Army Corps of Engineers go through.

The water would be diverted to Horseshoe Falls near Canada so that U.S. engineers and geologists can study ways to prevent erosion and rock falls above the cataract, as well as remove rubble from previous falls.

The plan is subject to approval by the International Joint Commission, charged with caring for boundary affairs between the United States and Canada. The dates —May to December 1968—may bring repercussions from business and municipalities, for they come at the height of the tourist season.

AGRICULTURE

Corn, Wheat Tested for Cracks

U.S. wheat, corn, soybeans and other grains crack too much in handling and shipping.

In an effort to solve this problem, highlighted some years ago when Russia selected Canadian wheat because U.S. wheat contained many damaged kernels, agriculturalists are studying the stresses that cause cracking.

With X-ray negatives, scientists of the U.S. Agricultural Research Service and Kansas State University can detect internal cracking caused by environmental factors or rough handling. Results of their studies will help farmers use better harvesting methods, and help manufacturers produce better handling equipment.

ZOOLOGY

Male Lizards Unneeded

Fathers are not needed in a strange group of whiptail lizards that seem to reproduce without males, according to scientists at Texas A&M University.

While several lower forms of life, such as algae and aphids, may reproduce offspring from only one parent, these lizards (Cnemidophorus tesselatus) are the highest form yet discovered.

Only an occasional male is found among the whiptail colonies.

Reproductive cells of the female lizards apparently do not undergo the meiosis process that halves the number of chromosomes. The parthenogenic females simply contribute the full number of chromosomes—46, the same as humans—to the offspring.

AGRICULTURE

Cattle Dine on Newspapers

A newsworthy diet of ground-up papers and molasses has been keeping cattle fat and healthy in a 56-day dairy experiment at the Pennsylvania State University.

The novel diet may help alleviate food shortages in an increasingly populated world, and reduce competition for food now existing between man and cattle, researchers believe.

Each of the six experimental heifers daily munched two and a half pounds of cut and ground paper—either ordinary newspaper or slick magazines—which provided the necessary fiber roughage. To this was added nearly as much molasses, now in plentiful supply and soybean meal. They were also fed conventional corn silage. The experimental cows appeared to digest the paper-molasses diet as well as six other control cows digested usual cattle feed.

AGRICULTURE

Record Peanut Crop

More peanuts are being produced this year than ever before. A possible crop of more than 20 million tons—including the shells—is forecast by Department of Agriculture researchers. This mountain of peanuts is expected to be 14 percent larger than last year's crop.

Much of the added nuts will come from India which increased production this year, as did Senegal, South America, and possibly mainland China. A record crop in the United States helped boost peanut production in North America by four percent. Production in Brazil and Argentina, declined.

ORNITHOLOGY

Hawaiian Nukupuu Not Extinct

A small perching bird with a long, down-curving bill, considered extinct for 71 years, has recently been discovered alive in the Kipahulu Valley on Maui Island, Hawaii.

The sighting of the Maui nukupuu, was announced by Stewart L. Udall, Secretary of Interior, which co-sponsored a scientific expedition with The Nature Conservancy, a private organization in Washington, D.C.

Three other birds on the endangered species list of the International Union for the Conservation of Nature and Natural Resources were also sighted by expedition members—crested honeycreepers, Maui creepers, and Maui parrotbills. Discoveries of these and other rare animal species have led The Nature Conservancy to organize a project to acquire the 9,600-acre Haleakala area for protection of natural surroundings and wildlife.

POLLUTION

Water Limits Set on Lake Erie

The Public Health Service has warned mariners plying Lake Erie against drinking or cooking with any water taken aboard within five miles of the Lake's coast line. Water should not be used if taken from within 20 miles of metropolitan areas, or from other polluted sectors.

Most of the water in the Great Lakes can be adequately disinfected by chlorination, recent investigations show. Most lake vessels use this method. City water supplies generally receive more extensive treatment.

The other partially contaminated areas defined by the Health Service include parts of Lake Erie that lie east of the boundary between Pennsylvania and New York, and west of Pelee Point. Green Bay and Saginaw Bay have also been judged too impure for general use.

medical sciences notes

INFECTION

Travel Spreads Scleroma in U.S.

Approximately 171 cases of a chronic infection of the respiratory tract called scleroma, which is often fatal, have been reported in the United States and Canada. Increased travel from Europe, Asia and Africa, where the disease has been primarily confined, is blamed.

The increase is much greater in South and Central Americas, a team of physicians at Columbia-Presbyterian Medical Center in New York says in the December issue of THE AMERICAN JOURNAL OF ROENTGENOLOGY, RADIUM THERAPY AND NUCLEAR MEDICINE.

X-ray studies show hardened patches of nose and throat tissue that can extend down the respiratory tract including the bronchial tubes. Duration of the disease, which occurs mainly at ages 16 to 35, has a 14-year average, but it can last as long as 46 years.

Antibiotics seem to offer the best hope of successful treatment, but the doctors say the relapse rate, chronic duration and deaths remain high.

Drs. Frieda Feldman and William B. Seaman, radiologists, and Dr. Daniel C. Baker Jr., ear and throat specialist, report the study. Scleroma was first diagnosed in 1870 as a manifestation of syphilis, but is now generally regarded as an unrelated infection.

ATHEROSCLEROSIS

Fat-free Diet Ups Artery Hardening

If humans are like rabbits, a low-calorie diet will only make their artery-clogging worse.

A low-calorie diet forces the body to draw on its fat reserves, but it does not cause the break up of fatty atherosclerotic deposits. So part of the stored fat released into the blood may actually be deposited in the arteries.

This finding has been reported by two George Washington University physicians, working under grants from the National Heart Institute.

First the researchers put 37 rabbits on a high-cholesterol diet for 12 weeks. Postmortem examination of 10 of the rabbits revealed atherosclerosis covering one-fourth of the aorta. The remaining animals were placed in two groups, one receiving a normal diet of 100 grams of food pellets daily, the other receiving only 50 grams.

Postmortem examination of these two groups showed increased atherosclerosis in both, but the fatty deposits now covered considerably over half of the aortic surface of the rabbits on the low-calorie diet. Animals on the normal diet showed an increase of the deposits up to one-third.

Rabbits are peculiarly sensitive to the development of hardening of the arteries when placed on high fat diets, but similar experiments are now being conducted on sub-human primates, which will show a closer comparison with man.

Drs. J. Martyn Bailey and Jean Butler report the study.

SYNTHETIC PLASTIC

New Material Used in Heart Pump

Calves have been tested with an experimental heart pump that contains tubing made of a synthetic plastic used in women's girdles. The trade name of the material is Lycra, produced by E. I. du Pont de Nemours & Co., Inc.

Dr. Lester Goodman of the National Institutes of Health, Bethesda, Md., says the material appears to be biologically inert so far, having been used in animals for 11-day periods.

Dr. Goodman is chief of the biomedical engineering and instrumentation branch of the NIH division of research services.

RHEUMATIC DISEASES

Rheumatics Get Spanish Trip

The Swedish Association against Rheumatic Diseases will send groups of 90 rheumatism patients to the Southern coast of Spain near Gibraltar for periods of six weeks beginning Jan. 12.

The association has rented a hotel in Fuengirola on Costa del Sol, where the climate is reported dry and even and said to be "just right for easing rheumatic ailments."

The association is employing a Spanish doctor part-time and a Swedish physician full time to supervise treatment. There will also be Swedish nurses, physical therapists and work therapists on hand. Necessary medical equipment has already been installed, and a separate building set aside for doctors' offices and treatment rooms.

The patients will be selected by their physicians. It is hoped that the project can be extended in future to take 400 patients in each six-week group.

BEAUTY MARKS

Goiter Pleased Raphael, Rubens

When a doctor looks at a Raphael or Rubens painting in an art gallery he sees something besides beauty in the large necks of some of their models. Their thickness indicates goiter, caused by an enlarged thyroid gland.

Dr. John R. K. Preedy, professor of medicine at Emory University, Atlanta, Ga., says goiter must have been fairly common in the early 16th century, judging from the thick-necked ladies in the paintings. Their particular type of large neck was a mark of beauty in their day.

The thyroid is an endocrine gland in the neck that secretes a hormone called thyroxine, which affects some aspects of growth and development as well as the metabolic rate that regulates body processes.

The Rubens and Raphael ladies were not necessarily hyperthyroid, Dr. Preedy explains. A goiter may also occur when the thyroid ouput is normal.

Leerburger

Adèlie penguin singles out its own chick from hundreds of thousands.

Massive scientific effort

Biologists, atmospheric physicists, psychologists from many nations work through the summer 40 feet beneath the ice cap

From deafened penguins, unborn seals, a hole 8,000 feet down and balloons 50,000 feet above, American scientists, with colleagues from 11 countries, are extracting the secrets of the Antarctic.

Representatives of more than 50 colleges, universities and Government laboratories are currently working on 60 different scientific projects as part of the 1967-68 U.S. Antarctic Research Program.

These projects are all part of a $7.7 million program of the National Science Foundation. While NSF supplies the science money, the Navy is spending $19.8 million in logistic support. Close to 1,100 scientific and military personnel are participating in this year's Operation Deepfreeze.

Antarctica, which is more than one and a half times the size of the United States, first became an important scene in America's scientific effort with the beginning of the International Geophysical Year in 1957. Since then, NSF has had an annual Antarctic research program.

Although the majority of the work is carried out during the summer months (October-February), close to 300 scientific and military personnel "winter over" in one or another of America's six stations on the continent. McMurdo Station, on the coast, is the largest support and research facility. Fifty scientists and 150 support personnel spent the winter at McMurdo in 1967.

Eerie, ice blue tunnels lead to the various wooden structures beneath the ice. Scientists live in small but comfortable quarters. Most men have private rooms decorated with personal pictures. According to one psychological study of the men who spend up to a year in isolation, the first pictures to appear on the walls are pin-ups. These begin to be covered by travel posters after several months. Pictures of sun-flooded beaches and mountain scenery remain until about two or three months before the men are due to head home; then the pin-ups return.

An extremely close relationship between the men beneath the ice; a feeling of great comradery. Although the prime interest is science, each station has a club room complete with bar. Some stations have pool tables. During the last winter season, a scientist at the South Pole station appeared with a small, gold earring in his left ear. By winter's end, nearly all the scientists had pierced left ears and a single gold ring. This symbol of esprit de corps was abandoned when the men left the station.

Each base believes it's kitchen serves the finest food in Antarctica. The chef at Byrd Station explained, "Food is most important to the men here. We have a greater variety of frozen gourmet foods in our tunnels than any other base on the ice. Our menu can include trout from Denmark, Hawaiian duck, the best American steaks or New Zealand lamb. Occasionally, during the summer, a plane brings in fresh lettuce and tomatoes. We have a problem rushing the fresh foods from the sub-zero temperatures above the ice to the warmth of our refrigerator."

Although Antarctica contains the world's largest supply of fresh water, it's all frozen. At Byrd Station, the personnel are divided into seven "water crews." Each crew spends several hours a day each week chopping and sawing ice and depositing it in the station's ice melter. The melter is heated by the exhaust pipes from the fuel powered electric generators. The reward for "water duty" is the privilege of taking a weekly shower.

The inland stations include Byrd Station, Plateau Station and the Geographical South Pole. (There are two additional summer stations on the coast.) Because of brutal weather conditions, the majority of the working areas and all the living sections at the inland stations are about 40 feet beneath the continental ice cap. In August 1966, Plateau Station recorded a temperature of minus 121.4 degrees F.

At Byrd Station, a two-year supply of food is piled in one long ice tunnel. Temperature remains at about minus 20 degrees F; spoilage is no problem.

Antarctica has been one of the few areas in the world in which complete, free and open cooperation exists between the United States and the Soviet Union. During the winter of 1967, E. Everett McNamara, Arctic Institute of North America, studied soils and weathering processes at the Soviet coastal station of Molodezhnaya. The same year, Petr. G. Astakhov of the Arctic and Antarctic Institute in Leningrad conducted ionospheric studies at the U.S. South Pole Station.

Astakhov, a slight, spade-bearded researcher, was a most popular figure at the Pole Station. He worked closely with the American scientific leader, Richard B. Weininger of the Institute of Telecommunication Science and Aeronomy. "Although we worked on different projects, we became quite involved in each others' work," said Weininger. "In fact, we discussed several projects we'd like to pursue together. Peter and I became very good friends and I know we'll keep in touch after we return to our own countries."

Said Astakhov, "You can't live and work as closely as I've done with these American scientists without developing a close, personal friendship. We may have our political differences, but that never affected our relationship as scientists and friends. Dick has taught me a great deal of English, and I've tried to teach him a little Russian. I've invited several of my new associates to visit me and my family in Leningrad." However, as one of Astakhov's American associates said, "Sure, Peter is a great guy and I'd love to visit him in Russia, but I wonder what would happen to my security clearance if I ever did?"

One of the more dramatic scientific programs being carried out at Byrd Station this year is the drilling of an 8,000-foot hole through the continental ice sheet. Under the direction of B. Lyle Hansen, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H., scientists will analyze the ice cores in an attempt to learn more about the history of Antarctica and the climatic changes that may have affected glacial action in the rest of the world as far back as 30,000 years ago (SN: 12/16).

In another major research project, James R. Barcus, University of Denver, is using balloon-borne instruments to detect auroral and solar electrons and solar nuclear particles during the period of maximum solar activity. The program includes 15 launches at Byrd Station and 5 at McMurdo, about 850 miles away. The balloons fly at 50,000 feet and contain automatic self-destruction mechanisms to be activated if they fall to aircraft-route altitudes.

Several other upper atmospheric physics studies will utilize the laboratories at the Geographic South Pole. An observatory at the Pole, on the earth's spin axis, has the advantage of being stationary relative to other points on the rotating globe, thus affording a continuous look at the same point on the celestial sphere.

With the cooperation of Soviet scientists, a major program to study the density and height of the E-layer of the earth's ionosphere is beginning. Expectations are that the E-layer, 50 to 85 miles above the earth, will provide information about concentrated influxes of solar radiation in the polar area. By using a forward scatter technique, radio signals are bounced off the ionosphere and recorded at widely separated Antarctic receiving stations. One is at the Soviet Antarctic base, Vostok, located at the Geomagnetic South Pole. Soviet scientists are using American-made equipment to record the radio signals.

Most of the biological research is taking place at the coastal stations. Scientists hope that several penguin studies will reveal more about the Adèlies' embryology as well as the adult penguin's ability to recognize its own offspring. Very little is known about the discrimination or learning process of penguins.

The Adèlie penguin feeds only its own offspring and rejects any foster chick. How the parent is able to recognize its own chick in a milling rookery of thousands of young penguins is the question being studied at Hallott Station by Dr. David H. Thomson of the University of Wisconsin.

In 1964, Dr. Richard L. Perry of the New York Zoological Society found that the recorded sounds of the female Adèlie penguin would attract only her own offspring. Dr. Thomson will reverse the procedure to determine if the recorded voice of a chick will evoke a parental response. He will also test visual response by deafening the parent and determining whether she can identify her chick by sight alone.

Leerburger

No cold war under the ice. Soviet scientist Petr. G. Astakhov and American Richard B. Weininger.

Seals are under study at McMurdo Station. Robert W. Elsner, University of California, San Diego, is leading a project to investigate the Weddell seal's cardiovascular adjustments during deep dives in the frigid Antarctic waters. He hopes to determine the seals' natural diving time, the circulatory changes that occur in both fetal and maternal seals during dives, as well as the seal's heart rate and blood flow. It is hoped that these studies may shed light on the problems of human asphyxia (lack of oxygen) after birth.

Perhaps the most arduous project is the 1,200-mile traverse over the vast, windswept plateau of Queen Maud Land. This year's expedition is the third leg of a four-year 5,000-mile South Pole-Queen Maud Land Traverse. Norman W. Peddie of the U.S. Coast and Geodetic Survey is leading the party of 10 explorer-scientists. The team is taking periodic seismic, gravitational and electro-magnetic soundings.

Benedict A. Leerburger Jr.

technology notes

TRANSPORTATION

300-MPH Magnetic Train Proposed

A 300-mph train suspended above the ground by magnetic forces has been proposed by two scientists at Brookhaven National Laboratory, Upton, N. Y.

The high-speed train would contain superconducting loops which would act on aluminum wire tracks to create a magnetic repulsion between train and track. The train could be driven by turboprop engines, or by some type of magnetic propulsion, say the inventors, Drs. J. R. Powell and G. R. Danby in the November MECHANICAL ENGINEERING.

Small auxiliary wheels would support the train at station stops. Once the train started moving, the current flowing through the superconducting loops would induce a current in the track loops, and the magnetic repulsion between the two currents would lift the train off the ground. Lift-off speed would be about 20 mph.

Two tracks about 10 feet apart would keep the train from rolling. A separate track loop would be provided to keep the train from moving sideways: if it got a few inches off center a restoring force half as large as the train's weight would be induced.

On the economic side, the two inventors estimate that track material would cost less than $200,000 a mile, and the superconductor for a 100-passenger train, the major cost, would come to $200,000. This should make a magnetic train far cheaper than air travel, they estimate.

POLLUTION

Sensitive Gas Tracer System

An air pollution tracer system sensitive enough to pick up a gas in concentrations of one part per 100 trillion parts of air has been developed by the National Center for Air Pollution.

The tracer system can be used to map the way air pollutants are distributed in the atmosphere and measure the effectiveness of antipollution dispersion devices on tall smokestacks.

The system uses sulfur hexafluoride gas, which is usually absent from the atmosphere. The gas is released at a point where pollutants are emitted, and the air is sampled miles downwind to see how much of the tracer has been transported. This gives information on the transportation of the pollutants.

Development of the tracer system was under the direction of Dr. A. P. Altshuller and Lawrence E. Neimeyer. The National Center is part of the U.S. Public Health Service.

RADIOACTIVITY

Anti-Smuggling Device in Sweden

A radioactive detector is being used by Swedish customs authorities to spot abnormal shapes in autos where narcotics could be hidden.

Radiation from the isotope contained in the lead-lined detector is reflected off the auto body and measured by a receiver inside the instrument. If the radiation hits a foreign body hidden in a fender or fuel tank, for example, the detector shows it.

Although the instrument can't tell what a hidden object is, it does tell the searcher where to look. The device works best, says the Swedish International Press Bureau, when operated by "an experienced officer familiar with the construction of various motor vehicles."

PROCESSING

Fish Dust Eliminated

Sawdust is usually a negligible loss, but when the dust come from sawing frozen fish for fish sticks the waste means considerable cost.

A heat treatment developed by the British Ministry of Technology's Torrey Research Station in Aberdeen, Scotland, eliminates the sawdust problem. The fish slabs, about an inch and a half thick, are placed between heated platens and brought quickly to 12 degrees F. In that condition they can be chopped without waste.

Before the new technique was developed, the fish had to be warmed gradually for 48 hours, and losses occurred from soft fish flaking off from the edges.

AUTOMATIC HANDLING

Memory Belt Sorts Mail

A long conveyor belt with a built-in "shredded wire brain" is now speeding up mail sorting at the San Francisco Air Mail Facility in California.

Produced by Goodyear Tire and Rubber Co., the rubber and fabric belt contains millions of tiny pieces of fine wire. As each sack goes by, a human operator pushes a button corresponding to the sack's destination in the facility. A signal from the operator's console implants a magnetic address in the belt under the sack.

At each choice-point in the belt's route, automatic devices read each sack's address and send it on its proper course, until it reaches its destination. There a blade extends to scoop the sack off the belt, and the address is automatically erased.

Similar, but smaller, belts are in use at post offices in Memphis, Tenn., and New York City.

HOLOGRAMS

Laser Light Further Purified

A major limit in the size of objects that can be holographed has been the quality of laser light available for the process. Because some variation is usually present in the wavelength of the light emitted, its coherence tends to become too weak for good holograms of objects more than a foot in size.

A method of purifying argon laser light so that it is essentially all of one wavelength has made it possible to make holograms of much larger objects, according to RCA engineers Dr. Istvan Gorog and Dr. Fred W. Spong. The system substitutes an electronically-controlled three-mirror unit for the reflecting mirror ordinarily used at one end of the laser.

With the purified laser, says Dr. James Hillier of RCA Laboratories at Princeton, N.J., the limiting factor now is reduced to keeping the object free from vibration when it is being holographed.

aerospace notes

APOLLO ADVANCES

Fireproof LM, Extra CMs, Strong Booster

• NASA engineers who tried more than 40 times to set fire to an Apollo moon landing module declare it to be "almost completely safe from fire." The tests, conducted over several months at the Manned Spacecraft Center, included all of the items which would be carried on a space flight, such as paper flight plan books and food. Tests this month and in January were also scheduled for an Apollo command module.

• A new contract, calling for "improved plans for quality . . . reliability and safety," has been negotiated with North American Rockwell Corp. for construction of 16 Apollo spaceships, four more than originally planned. The company's original contracts totaled $2.2 billion.

• NASA says that although the uprated Saturn 1 booster, which will carry the first Apollo lunar module into space next month, has almost 140,000 pounds of added thrust in its first stage alone, it still has a safety factor of 1.4 for its entire structure. This means that the rocket could withstand 40 percent greater stress than the worst environment it is expected to encounter.

• A recovered command module, first flown in February 1966 to test the Apollo heat shield at near-reentry speeds, is being used again, this time for land drop tests. The module is the first of four, all recovered from previous tests, which are being modified and reinstrumented for investigations of impact damage in case some returning astronauts should come down on land.

SATELLITE-SPOTTING

Moonwatch Breaks Its Record

Moonwatch, that worldwide, semiformal, civilian satellite-spotting organization, set a new record for itself with 3,143 observations in a single month, October.

The previous total, 2,690, was set back in September 1960, the month following the Aug. 12 launch of the Echo 1 satellite. The silvery Echo balloon is the most visible satellite ever launched, and its passings are often visible to the naked eye.

COMMUNICATIONS

Antenna Links Subs with Satellites

An experimental antenna has been designed that allows submarines to communicate via satellite with suitably equipped submarines, ships, aircraft and fixed or mobile land stations thousands of miles apart.

Designed by International Telephone and Telegraph Corp.'s Defense Communications Division, the antenna is steerable in both azimuth and elevation, yet compact enough to fit in the superstructure of a submarine. Limited space has been a particular problem in the design of submarine-to-satellite antennas. This one was designed under contract from the U.S. Naval Ships Systems Command in Washington, D.C.

SPACE SIMULATION

Russians Affected by Long Cabin Test

Three Soviet scientists reportedly suffered hallucinations and psychological changes during a 70-day experiment in a cramped compartment that may have resembled a simulated long-term space flight.

The Soviet newsagency Tass, which repored the experiment, did not say it was connected with space research, but did describe crowded living conditions such as would be found in a space capsule.

Besides the psychological changes, not further described, the scientists lost weight, and their muscle tone deteriorated despite daily stints on an exercise bicycle. All three men reportedly returned to normal following completion of the test.

Food during the test, Tass said, was "dehydrated meat, cottage cheese, various tinned foods and concentrates."

METALLURGY

New Alloys to Be Cold-Tested

A new technique for predicting crack formation in metals will be used in low-temperature tests of three new alloys for the National Aeronautics and Space Administration.

The materials include two high-strength weldable aluminum alloys and a stainless steel, the latter fabricated by an advanced method called cryogenic stretch forming, which increases the metal's yield strength by a factor of four. Doing the testing will be Martin Marietta Corp.'s Denver, Colo., division.

Two phenomena will be studied: the resistance of the metals to brittle fracture at minus 320 degrees F. (cold space temperature), and their resistance to crack growth at the same low temperatures under both sustained and cyclic loads. The new analytical method to be used in the tests is called linear elastic fracture mechanics. It enables the strength of a material to be predicted in the presence of minor cracks and defects which are inherent, says Martin, in all metals and engineering structures.

AIRCRAFT NOISE REDUCTION

Computer Program Measures Booms

A computer program has been developed for determining how changes in an aircraft's design will affect the force of its sonic boom over a range of flight conditions.

Developed at the University of Georgia for the space agency, the program bases its computations on a series of measurements of the cross-sectional area of the plane at different points along its length. Also included is a distribution of equivalent cross-sectional areas according to lift.

Two preliminary programs provide the input data. The main program is written in Fortran IV to run on an IBM 7094 computer.

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ideas OF THE WEEK

An editorial service to readers; more information on items can be secured from the manufacturers.

Thin-gauge laminater

Available in thicknesses from 0.00088 to 0.002 inch, this extruded high-clarity acetate sheet for manufacturers is made in mill rolls from 48 to 53 inches wide. The sheet is suitable for laminating printed menus, album covers, children's books and school book covers.

Price 80¢ per pound.
Eastman Chemical Products Inc.
Plastics Div.
Kingsport, Tenn

Liquid nitrogen container

Lightweight and mounted on casters, this rugged liquid nitrogen container comes in three capacities, 110, 160 and 210 liters. Easy to move about with safety, the low-temperature vessel comes with an outer casing either stainless steel or carbon steel and includes a direct reading liquid gauge, pressure gauge, safety valves and drain and vent valve.

Prices Vary with size.
Sulfrian Cryogenics Inc.
391 East Inman Ave.
Rahway, N.J. 07065

Digital analytical balance

Especially suitable for use in routine, repetitive weighing of similar samples in laboratory of industrial plant, this 100-gram capacity printing and indicating analytical balance reads and automatically prints the weight of up to 12 specimens per minute. The digital data may be fed directly to a computer if desired. Any suitable readout system may be used.

Price $4,500
Cahn Instrument Co.
7500 Jefferson St.
Paramount, Calif.

Fluidic connector kit

Everything needed for product development, prototype and limited production work in fluidics is contained in this connector kit consisting of a setting machine, setting tools and 500 fluid flow connectors. The flair setting of the connectors eliminates the need for threading and adhesives in amplifier connections, useful in miniturization and automatic operation.

Price: $99.50
USM Fastener Co.
Fluidic Products Dept.
Shelton, Conn. 06484

books OF THE WEEK

Listing is an editorial service for readers' information. For convenient purchase of any book listed or any U.S. book in print, remit retail price (we pay postage) plus 25c handling charge if price is less than $2 to Book Order Service, Science News, 1719 N St., N.W., Washington, D.C. 20036. Prices subject to publishers' changes. Be sure to include zip code in your address.

ADVANCES IN ASTRONOMY AND ASTROPHYSICS, Vol. 5—Zdenek Kopal, Ed.—Academic Press, 1967, 355 p., illus., $16. Contains reports on zodiacal light, secular variation of mass, periodicity of sunspot groups, and on compact and dispersed cosmic matter.

THE APES: The Gorilla, Chimpanzee, Orangutan and Gibbon, Their History and Their World—Vernon Reynolds—Dutton, 1967, 296 p., 110 plates, drawings, maps, $10. Comprehensive study of the surviving world of the great apes, their evolution, physiology and behavior, distribution and conservation.

BASIC SAFETY STANDARDS FOR RADIATION PROTECTION, 1967—International Atomic Energy Agency—Internat'l Pubns., N.Y., 1967, 79 p., paper, $2. Revised regulations and tables concerning limitation of controllable radiation doses for workers and population, and intakes of radioactive materials through external and internal exposure.

THE CEREBELLUM AS A NEURONAL MACHINE—John C. Eccles, Masao Ito and Janos Szentagothai—Springer-Verlag N.Y., 1967, 335 p., illus., $17. An analytical study of cerebellar structure and function, gives insights into the design and mode of operation of neural machinery, with emphasis on recent investigations in the laboratories of the authors and their collaborators.

ELECTRICAL POWER SYSTEMS ENGINEERING: Problems and Solutions—Alvin H. Knable—McGraw-Hill, 1967, 249 p., diagrams, $9.95. A collection of worked out problems in areas of heavy electrical engineering such as circuit analysis, symmetrical components, flux-linkage calculations and overvoltages.

ENERGETICS IN METALLURGICAL PHENOMENA, Vol. III—William M. Mueller, Ed.—Gordon & Breach, 1967, 193 p., diagrams, $12.50; paper, $7.25. Deals with such topics as rate theory in solids, condensed-state reactions at high pressures, and stochastic processes and chemical kinetics.

GEOMETRY REVISITED—H. S. M. Coxeter and S. L. Greitzer—Random House, 1967, 193 p., diagrams, paper, $1.95. At the advanced high school level, the book deals with properties of circles, collinearity and concurrence, transformations, inversive and projective geometry.

GIFT FROM THE SKY—Lorus and Margery Milne—Atheneum, 1967, 141 p., photographs, $3.81. Story about a wild white swan that chose to rest on a New England millpond and was adopted by the whole town.

GOVERNMENT IN SCIENCE: The U.S. Geological Survey, 1867-1894—Thomas G. Manning—Univ. of Kentucky Press, 1967, 257 p., $7. Documents the politically involved early history of an important branch of government research and services.

THE HUMAN ORGANISM AS A PERSON—S. Howard Bartley—Chilton Bk. Co., 1967, 221 p., diagrams, $8.50. A text of particular interest to optometrists and others primarily interested in vision, the author attempts to bridge the gap between biology and psychology, stressing throughout that vision is related to the complete physiological state.

THE IMPACT OF TELEVISION: Methods and Findings in Program Research—W. A. Belson—Archon Bks., 1967, 400 p., $10. Stressing the need for more factual research measuring the effects of programs, the writer describes in detail techniques for conducting such research, illustrating with actual inquiries conducted under his direction.

IN THE SERVICE OF MAN: Technology and the Future of Human Values—J. V. Langmead Casserley—Regnery, 1967, 204 p., $4.95. Essays concerning social and personal values under the impact of social, political and economic changes.

INTRODUCTION TO SPECIAL RELATIVITY—Herman M. Schwartz—McGraw-Hill, 1967, 458 p., diagrams, $14.75. Presents the principal ideas, methods and results of the special theory of relativity, and attempts to develop an appreciation of the conceptual and mathematical structure and applicative possibilities of this theory.

KNOW YOUR SKIN—John H. Woodburn—Putnam's, 1967, 159 p., illus. by Lee Ames, $3.49. Explains to the adolescent how the skin functions, its pigment, blisters and blackheads, allergies and infections.

THE MAMMALS: Young Readers Edition—Adapted from text by Richard Carrington, Eds. of Time-Life Bks.—Time Inc., 1967, 128 p., illus. $3.95. Short, dramatic survey of the diversity of mammals.

MASERS: Selected Reprints with Editorial Comment—J. Weber, Ed.—Gordon & Breach, 1967, 848 p., illus., $15. Collection of original papers which contributed to the development and growth in microwave amplification by the stimulated emission of radiation.

PATIENTS ARE PEOPLE: A Medical-Social Approach to Prolonged Illness—Minna Field—Columbia Univ. Press, 1967, 3rd ed., 294 p., $7.50. Includes the latest research and improvements in the field of social medicine and nursing education, with emphasis on total restoration of the patient.

THE PHILADELPHIA NEGRO: A Social Study—W. E. B. DuBois, introd. by E. Digby Baltzell—Schocken Bks., 1967, 520 p., maps, charts, $8.50; paper, $2.95. Reprint (1899), example of engaged sociological scholarship with 44-page new introductory chapter.

THE PHILIPPINE ISLAND WORLD: A Physical, Cultural and Regional Geography—Frederick L. Wernstedt and J. E. Spencer—Univ. of Calif. Press, 1967, 742 p., photographs, maps, $20. An authoritative, comprehensive study of the island archipelago that is scattered over some 500,000 sq. mi. and consists of some 7,000 islands, islets and rocks.

PROGRESS IN OCEANOGRAPHY, Vol. 4: The Quaternary History of the Ocean Basins — M. Sears, Ed.—Pergamon Press, 1967, 344 p., illus., $16. Contains 20 symposium papers dealing with the Plio-Pleistocene boundary, with the polar and the temperate seas, and the Quaternary sea level.

THE PSYCHOANALYTIC STUDY OF SOCIETY, Vol. IV—Warner Muensterberger and Sidney Axelrad, Eds.—Internat'l Universities Press, 1967, 350 p., $8.50. Aimed to provide a meeting ground for the work of the social scientist and the psychoanalyst, this volume contains studies in social pathology and acculteration, and psychobiographies.

THE RADIOBIOLOGY OF CULTURED MAMMALIAN CELLS—Mortimer M. Elkind and Gordon F. Whitmore—Gordon & Breach, 1967, 615 p., illus., ref. ed. $32; prof. ed. $13.50. Papers deal with survival curve theory, *in vitro* survival curves, influence of chemical and physical factors, recovery from radiation damage, chromosome damage, and biochemical effects.

RIVER PLAINS AND SEA COASTS—Richard J. Russell, foreword by Carl O. Sauer—Univ. of Calif. Press, 1967, 173 p., photographs, maps, $8.75. Informal, yet scholarly account of investigations in alluvial morphology, stream patterns, coastal morphology and tropical island problems.

SCIENCE EXPERIMENTS AND AMUSEMENTS FOR CHILDREN, formerly entitled SCIENCE GAMES FOR CHILDREN—Charles Vivian—Dover, 1967, 96 p., photographs by S. A. R. Watts, paper, $1.25. Reprint (1963), offers 73 easy experiments illustrating important scientific principles.

SEAWATCHERS: Oceanographers in Action—William Bixby—McKay, 1967, 215 p., illus. by John Flynn, $4.25. Describes a typical oceanographic voyage using the new technology to explore and analyze the sea.

SECOND DECENNIAL REVIEW CONFERENCE ON CELL TISSUE AND ORGAN CULTURE—Benton B. Westfall, Ed.—Nat'l Cancer Inst. (GPO), 1967, 429 p., 61 plates, diagrams, $4. Covers broadly research concerned with the relationship between the cultured cell or tissues and its *in vivo* progenitor.

THE SOCIAL PROGRAMS OF SWEDEN: A Search for Security in a Free Society—Albert H. Rosenthal—Univ. of Minn. Press, 1967, 193 p., $6. Annotated, thorough examination of Sweden's achievement in social security, public health and welfare programs, evaluated and compared with their U.S. counterparts.

SPACE SCIENCE FOR THE LAYMAN—Lawrence D. Ely, foreword by B. A. Schriever—Thomas, C. C., 1967, 200 p., illus., $6.75. A popular, concise summary of some of the main goals and aspects of space missions.

STELLAR EVOLUTION—A. J. Meadows—Pergamon Press, 1967, 169 p., diagrams, $4.50; paper, $1.95. Authoritative treatment for the layman.

THEY DARED THE DEEP: A History of Diving—Robert F. Marx—World Pub. Co., 1967, 160 p., illus., $3.95. A short historical review of underwater projects and pioneers.

THE UNITED STATES AND EASTERN EUROPE—Robert F. Byrnes, Ed.—The Am. Assembly (Columbia Univ. Press), 1967, 176 p., map, $4.95. Background studies by economists and specialists in international relations providing insight into the complex problems facing the United States as it reviews its policies towards Eastern Europe.

THE WAY THINGS WORK: An Illustrated Encyclopedia of Technology—Simon & Schuster, 1967, 590 p., 1071 two-color diagrams, $8.95. Designed to give the layman an understanding of how things work, from electric bell to color printing, from ballpoint pen to electrocardiograph.

WEIGHTS AND MEASURES: Their Ancient Origins and Their Development in Great Britain up to AD 1855—F. G. Skinner—HMSO (Brit. Inform. Service), 1967, 117 p., photographs, illus., paper, $3. A science museum survey publication.

THE WORLD OCEAN: Man's Last Frontier—Vernon Pizer—World Pub. Co., 1967, 192 p., photographs, illus. by Lewis Zacks, $4.95. Tells young people about the scientific interest man has in exploring the ocean depths.

TEXTBOOKS

ATOMS TO GALAXIES: A Textbook in the Physical Sciences—William Leader—Burgess, 1967, 227 p., illus., paper, $4. Designed to supplement courses intended for the nonscience major.

STATISTICAL METHODS—George W. Snedecor and William G. Cochran—Iowa State Univ. Press, 1967, 6th ed., 593 p., $8.50. A text for introductory statistics courses and a reference for research workers in the interpretation of their data. Extensively revised, includes a number of new topics and statistical tables are now placed in the appendix.

STRUCTURE OF THE HUMAN BODY—Weston D. Gardner and William A. Osburn—Saunders, 1967, 417 p., illus., $8.75. Text written to meet the needs of the student preparing for one of the modern health fields. provides verbal and visual description of body structure including only the facts of human morphology which can be related to the living body.

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