

he tested could block out pain with post-hypnotic suggestion. He believes others can be trained to do the same, with important implications for medicine. "It would be a great thing to have," he said.

Hypnosis has, in fact, been used to successfully anesthetize burned patients and women in childbirth. Clinics have a slightly higher rate of success than the 10 percent he found, said Dr. Hilgard, possibly because patient expectations are higher. His own subjects knew they were part of an experiment and may have thought they should feel the pain.

Dr. Hilgard had his subjects immerse their hands in a tub of ice water until they could no longer stand the cold. All had been previously tested for susceptibility to hypnosis and had been told they would not feel pain. Those who responded felt no more pain after 60 seconds than they had after the first five.

One girl was able to block pain on her own, by studying a spot on her skirt. She was, incidentally, not hypnotizable, but could redirect her attention and effectively prevent pain from reaching consciousness. Dr. Hilgard said that probably one in a hundred people are capable of this.

Just what the mental mechanism is for controlling pain remains a mystery, but Dr. Hilgard believes it is located in the higher neural centers concerned with attention and alterations in consciousness.

Helium Near Zero

The strange properties of liquid helium have fascinated and puzzled scientists and laymen alike for some 30 years. At temperatures near absolute zero, liquid helium becomes a superfluid—conducting heat with greater efficiency than metals, flowing up the sides of its container and seeping through holes smaller than the size of a helium atom.

Many, but not all, of the superfluid's properties are understood.

A way to explain one aspect of helium's behavior at temperatures below 2.17 degrees K. was reported to the American Physical Society meeting in Washington last week by Dr. Lyle B. Borst of the State University of New York in Buffalo. A cupful of liquid helium, he said, acts as if it consisted of a collection of constantly changing pairs of helium atoms. Their motion, can be described by the rules of quantum mechanics. As an analogy, he cited the following:

If Niagara Falls were helium, first, they would never freeze; helium freezes only under high pressure. The falls

themselves would not be unusual, but strange things would happen at the Whirlpool below.

If the temperature dropped to just below 2.17 degrees absolute, the form of the whirlpool would not change. The liquid helium would form a vortex at the center. However, any person falling into the liquid would not be sucked under at the center, since the liquid would flow past him without effect.

Moreover, he would be unable to escape, because when he tried to swim his hands and feet would pass through the liquid equally without effect. This unusual behavior, called the Pellam paradox, shows clearly in photographs of an object inserted into the vortex of liquid helium in the laboratory—neither has any effect on the other. In ordinary liquids, the object would be caught and pulled down into the twisting vortex.

Dr. Borst believes the Pellam paradox and many other strange effects can be explained by considering liquid helium as a fluid whose atoms are paired in an endless exchange of partners. In a rotating liquid, the whirlpool of the analogy, a minuet takes place in which the atoms are always paired and always changing partners.

This condition can change only in jumps; an input of energy is required to produce any change at all. If the swimmer in the analogy were strong enough to change the whirlpool, he would immediately be caught by the moving liquid and sucked under.

At lower temperatures, within half a degree of absolute zero, Dr. Borst reports, the liquid can be described by a theory that requires no atomic structure at all. Helium, he says, then shows effects that are inconsistent with the presence of any atoms, a possible first exception to the atomic theory.

Nuclear Theory

A major theory about the structure of the atomic nucleus may have to be refined because of discrepancies in recent experiments. The discrepancies appeared in the observed and theoretical values of the magnetic forces in an isotope of antimony.

According to theory of the atomic nucleus—the so-called shell model—protons and neutrons are arranged in shells or rings. The number of shells depends on how many protons and neutrons it contains.

Various forces—electrical, magnetic, nuclear—act on the nuclear particles. The shell theory predicts how these forces act.

Recent experiments on magnetic forces in antimony, a metal used in

many alloys, qualify the shell theory.

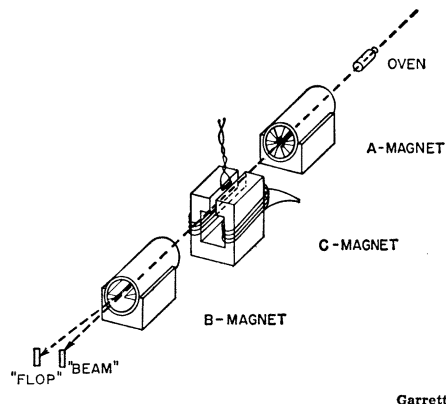
Reporting to the American Physical Society meeting in Washington, Geoffrey J. Garrett of the Palmer Physical Laboratories at Princeton University said values measured for three isotopes of antimony agreed with theoretical values. But for a fourth isotope, antimony 117, experimental values didn't match the theoretical.

Garrett said the reason for the discrepancy isn't understood yet. Either the theory will have to be revised or the experimental technique will have to be refined.

The four isotopes tested—antimony 117, 118, 119 and 120—were produced by bombarding tin with high-energy protons from the Princeton cyclotron.

The atoms were heated in an atomic oven to 1200 degrees C. At this temperature, they shot out of the oven through the fields of three test magnets.

The first magnet lined up the atoms so that all had a magnetic force pointed in the same direction. The second



Magnetic test setup flips antimony.

magnet had a variable field, and the frequency of the variation could be adjusted. At the right frequency, the magnetic force of the atom would flip to the opposite direction.

The third magnet sent the flipped atoms to one detector, and the unflipped atoms to another.

From the shell theory, it is possible to compute what frequency the variable magnetic field should have to flip the atoms of each isotope of antimony that was measured.

In three isotopes, the experimental frequency matched the computed value. But in antimony 117, the experimental value was off by more than 25 percent.

The calculated values depend on the magnetic properties of the neutrons and protons that make up the nucleus. According to the shell model, the magnetic effects of the protons and neu-

trons of the inner shells tend to cancel each other, and only those particles in outer shell have to be taken into account in computing the magnetic force of the whole nucleus.

In view of new discrepancy, it may be necessary to alter theory to take into account magnetic effects of interior rings, or to theorize different arrangements of the particles in the outer rings, said Garrett.

Ocean Center Site

Location of the Environmental Science Services Administration's East Oceanographic Research Facility near Miami will make that semi-tropical port one of the major world centers for ocean research.

The new laboratory and its ship facility will be built on Virginia Key and Dodge Island respectively.

The decision ended a year-long search during which practically every seaport on the East Coast did its best to lure the ESSA lab. Site selection teams inspected 115 proposed locations, a great many of which offered extremely tempting deals such as free land and tax breaks.

Treaty Ratified

The United States Senate last week joined the bridgebuilders, voting unanimously to ratify the space treaty that prohibits military exploitation of the high ground above the atmosphere.

Under it, when approved by the Soviet Union, Great Britain, and two other nations, atomic bombs will stay on earth and no nation will claim dominion of the moon. Spy satellites, however, will continue to fly. (SN 12/24/66).

Surveyor Reports

Beneath its loose surface layer, the moon appears firm enough to support a spacecraft more than twice as heavy as the Apollo, according to Surveyor 3 and its robot claw. Scientists at the University of California's Jet Propulsion Laboratory instructed Surveyor last week to dig with its claw, a five-foot extendable scoop that cuts two-inch-wide trenches in the lunar soil.

About six inches down, the shovel came to a layer of what seem to be pebbles. "They aren't large pebbles, but they don't appear to be just lumps of sod, either," one scientist said.

The deeper the claw went, the more trouble it had dragging itself back toward the spacecraft, a clear indication that the subsurface soil was stronger than that on top.

Besides photographing its own diggings, Surveyor took pictures of the surrounding terrain for scientists hunting Apollo landing sites. In addition, it sent back photos of the earth, of Venus, and even, when the earth got between the spacecraft and the sun, of a solar eclipse. During the eclipse, Surveyor photographed the moon through red, blue and green filters over the



Eclipse of the sun by the earth. NASA

camera lens, in order to see what color the lunar surface might be in that kind of lighting. Scientists also hoped to get accurate measurements of the moon's surface temperatures during the eclipse.



Moon dirt: strong enough for two. NASA

The spacecraft excited observers early in the week by showing signs of the same stubborn resistance to the moon's extremes of heat and cold that made such a success of Surveyor 1, which took more than 11,000 pictures.

UNUSUAL SCIENCE BARGAINS

WAR SURPLUS AMERICAN-MADE 7 x 50 BINOCULARS

Big savings! Brand new! Crystal-clear viewing—7 power. Every optical element is coated. An excellent night glass—the size recommended for satellite viewing. Individual eye focus. Exit pupil 7 mm. Approx. field at 1,000 yds. is 376 ft. Carrying Case included. American 7 x 50's normally cost \$274.50. Our war surplus price saves you real money.
Stock No. 1544Q\$74.80 Ppd. (tax included)



SCIENCE TREASURE CHESTS For Boys—Girls—Adults!



Science Treasure Chest — Extra-powerful magnets, polarizing filters, compass, one-way-mirror film, prism, diffraction grating and lots of other items for hundreds of thrilling experiments, plus a Ten-Lens Kit for making telescopes, microscopes, etc. Full instructions included.

Stock No. 70,342Q\$5.50 Ppd.
Science Treasure Chest Deluxe.....\$10.50 Ppd.
Stock No. 70,343Q

CRYSTAL-GROWING KIT

Do a crystallography project illustrated with large beautiful crystals you grow yourself. Kit includes the book "Crystals and Crystal Growing" and a generous supply of the chemicals you need to grow large display crystals of potassium aluminum sulfate (clear), potassium chromium sulfate (purple), potassium sodium tartrate (clear), nickel sulfate hexahydrate (blue-green) or heptahydrate (green), potassium ferricyanide (red), and copper acetate (blue-green).
Stock No. 70,336Q\$9.50 Ppd.



GIANT WEATHER BALLOONS

Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Blow up with vacuum cleaner or auto air hose. Sturdy enough for hard play; all other uses. Filled with helium (available locally) use balloons high in the sky to attract crowds, advertise store sales, announce fair openings, etc. Amateur meteorologists use balloons to measure cloud height, wind speed, temperature, pressure, humidity at various heights. Photographers can utilize for low-angle aerial photos. Heavy duty neoprene.
Stock No. 60,568Q.....8' Diam.....\$2.00 Ppd.
Stock No. 60,632Q.....16' Diam.....\$7.00 Ppd.



WOODEN SOLID PUZZLES

12 Different puzzles that will stimulate your ability to think and reason. Here is a fascinating assortment of wood puzzles that will provide hours of pleasure. Twelve different puzzles, animals, and geometric forms to take apart and reassemble, give a chance for all the family, young and old, to test skill, patience and, best of all, to stimulate ability to think and reason.
Stock No. 70,205Q.....\$3.50 Ppd.



NEW WORKING MODEL DIGITAL COMPUTER

Actual Miniature Version of Giant Electronic Brains

Fascinating new see-through model computer actually solves problems, teaches computer fundamentals. Adds, subtracts, multiplies, shifts, complements, carries, memorizes, counts, compares, sequences. Attractively colored rigid plastic parts easily assembled. 12" x 3 1/4" x 4 3/4". Incl. step-by-step assembly diagrams, 32-page instruction book covering operation, computer language (binary system) programming, problems and 15 experiments.
Stock No. 70,683Q.....\$5.98 Ppd.
Detailed Programming Booklet For Experiments
Stock No. 9080Q.....(50 Pages).....\$1.00 Ppd.



'FISH' WITH A WAR SURPLUS MAGNET

Go Treasure Hunting on the Bottom

Great idea! Fascinating fun and sometimes tremendously profitable! Tie a line to our 5-lb. Magnet—drop it overboard in bay, lake, river or ocean. Trawl it along the bottom—your "treasure" haul can be outboard motors, anchors, fishing tackle, all kinds of metal valuables. 5-lb. Magnet is war surplus—Alnico V Type. Govt. cost \$50. Lifts over 150 lbs. on land—much greater weights under water.
Stock No. 70,571Q—5lb. Magnet\$12.50 Ppd.
Stock No. 70,570Q—3 1/2-lb. size\$ 8.75 Ppd.



Order by Stock No.—Send Check or M.O. Shipment same day received—Satisfaction or money back.

TEACHERS: Write for Educational Catalog Q-2
Edmund Scientific Co., Barrington, N.J.

MAIL COUPON for FREE CATALOG "Q"



EDMUND SCIENTIFIC CO.
Barrington, New Jersey 08007
Completely new 1967 Edition, 148 pages. Nearly 4500 BARGAINS.
Please Rush Free Catalog "Q"

Name.....
Address.....
City.....State.....Zip.....