

## Learning transferred in rats

For a decade evidence has been accumulating that memory, like genetic material, is stored in molecules. Much of the original work, done with flat worms, was considered eccentric and, though controversy still rages (SN: 4/20/68, p. 376), tests with rats and mice (more than 2,800 of them) continue to point to molecular storage. Dr. Georges Ungar of Baylor University in Houston says, "The data show an overwhelming probability that learned information can be transferred chemically under appropriate experimental conditions."

Using electric shocks and other painful stimuli, Dr. Ungar trained rats to reverse their natural preference for the dark. After five to eight days of training, when the animals had learned to choose lighted boxes, they were sacrificed. As of November 1, he had injected extracts of trained brain into the abdomens of 638 mice with a proven natural preference for the dark. Brain extracts from untrained rats were injected into 132 controls. Animals that received trained brain spent an average of 63 seconds in the dark, compared to an average time of 118 seconds by control animals. In these second experiments, no painful stimuli were associated with the dark.

Statistical analysis, Dr. Ungar says, shows the time differences between the experimental subjects and controls to be highly significant. The probability that mice with brain extract from trained rats choose the light purely by chance is less than 1 to 5,000.

## ENVIRONMENTAL GEOCHEMISTRY

### Zinc linked to chronic disease

Zinc deficiency retards growth and development, delays wound healing and impairs fertility. Though the early Egyptians used it in the form of calamine to promote healing, its interest to modern researchers dates back only 15 or 20 years.

Now commonly used in treatment of wounds, zinc is also useful in treatment of atherosclerosis, Dr. Walter J. Pories of the University of Rochester reports. Of 36 patients, 30 showed increased tolerance for exercise and improved leg warmth while 14 developed return of previously absent pulses.

There was no apparent change in major blood vessels, he says, but minor, collateral blood channels improved. "These results are very encouraging because atherosclerosis is a disease which generally becomes progressively worse and rarely shows spontaneous improvement."

In addition to artery disease, evidence suggests low zinc levels may also be associated with chronic diseases including cirrhosis and lung cancer.

## SPACE

### Apollo and the pyramids

Dr. Harold C. Urey, Nobel Laureate and authority on the moon, says the Apollo adventure cannot be justified on scientific grounds, but he would be ashamed of this country if it had not accepted the challenge to go to the moon.

The Apollo program is "something like building the

pyramids or the Parthenon," says Dr. Urey. "At least we didn't use slave labor." But he adds, "I would be immensely disappointed if the United States, a nation as rich as this, did not want to be part of such a great adventure."

Dr. Urey challenges critics who say Apollo money should have been used to solve problems on earth. "The reasons we are not solving the problems on earth is because we don't want to. The space program is costing only six-tenths of one percent of the gross national product. I'd be glad to let them take out more from my paycheck to take care of these other things too."

But the University of California Nobelist emphasizes that the public should not be misled as to the moon's scientific importance. He also doubts that the moon could have much industrial value or serve as a platform for space shots and telescopes. The few questions which might be answered, such as the moon's origin, by themselves hardly justifies spending \$24 billion to send men there, he says.

## POLLUTION

### Let the limpets do it

Oil washed onto Cornish beaches from the 1967 Torrey Canyon disaster (SN: 10/7/67, p. 343) was not destructive to marine life. Many molluscs even began to eat the oil cover. But toxic detergents used to clean up the oil mess were "utterly devastating," reports Dr. J. Eric Smith, director of the Plymouth Laboratory in Devon, England.

Some three million gallons of toxic detergents were poured into the sea and over the rocks and beaches of Cornwall. It completely denuded the shores of life, says Dr. Smith. Algae now cover the rocks in place of barnacles, molluscs and other animals and it will be several years before the ecology returns to normal.

In a few places, however, the oil was left untreated and the Plymouth scientists discovered that limpets and other molluscs were eating it. They had cleared large areas of rocks in relatively short time.

"It is probably best to let the animals clear the shores, if you don't have to maintain their economic value," says Dr. Smith. But he does not condemn the use of the detergents. It was a choice between vacationing children and marine life, he says.

## ZOOLOGY

### Jellyfish control tentacles

The jellyfish looks like a glob of protoplasm floating without direction in the surf. But its primitive nervous system is capable of coordinated movement even though the animals lack a brain.

Jellyfish exercise not only gross body control, but selective control over each tentacle, reports University of Wisconsin zoologist Leonard M. Passano.

The nervous system is based on two opposing pacemakers. Located at opposite ends of the body, these pacemakers fire conflicting commands to contract and to inhibit contraction. Periodically, every five or ten minutes, the command to contract overcomes its inhibitor and the animal contracts. Separate firing mecha-

## Gathered at the annual meeting of the American Association for the Advancement of Science in Dallas

nisms in each tentacle cause selective contraction of the appendages.

Work on the jellyfish, most primitive animal with any kind of a nervous system, is expected to aid understanding of more complex systems. Opposing systems of activators and inhibitors, for instance, are thought to be a basic principle of the human brain.

### STATISTICS

#### Predicting Nobel Prize winners

"Out of the world's population of more than one million scientists, it is now possible to select a group of individuals who are the most likely candidates for Nobel and other prizes in science," two Philadelphia statisticians declare. Such predictions are important, according to Drs. Eugene Garfield and Morton Malin of the Institute for Scientific Information, because improved ability to spot creative researchers early in their careers could lead to more rational distribution of increasingly scarce money.

The method of identifying these persons involves counting the number of times a scientist's papers have been cited by other scientists, thus showing their impact on the research community. "Almost without exception, Nobel Prize winners have total citation counts approximately 50 times higher than the average scientist," before they were awarded the Prize. In addition, highly creative researchers usually have published one or more key papers that have extraordinarily high impact.

### ECOLOGY

#### Vietnam herbicide study planned

The AAAS Board of Directors has resolved to study the long-term effects of the military defoliation program in Vietnam, but deliberately avoided any mention of Vietnam by name in its resolution.

Herbicides have been used heavily on some 2,300 square kilometers in South Vietnam, in addition to the demilitarized zone, and scientists expect that such widespread spraying will have long term consequences on the country's ecology.

The AAAS is expected to organize an ad hoc group drawn from about eight different organizations in the next three months, says Dr. Don K. Price, board chairman. The actual study, however, is not likely to begin until hostilities cease.

The board members have widely varying opinions on the defoliation program. A minority believes it could possibly have beneficial results in clearing the jungle, except for the fact that arsenic compounds, principally cacodylic acid, which are being used, might be converted in the soil to other, highly toxic, arsenic compounds. Others view the possibility of benefits as vanishingly small.

### ANTHROPOLOGY

#### The Nile's prehistory

The Nile Valley experienced the same sequence of prehistoric human development as did the Levant in the Middle East. This discovery, a result of concentrated

exploration over the past six years before flood waters from the Aswan Dam cover the area, has overturned the old concept that the Nile Valley was a retarded backwash of human development during Stone Age times.

Details of the complexity and sequence of Nile prehistory were presented in a special AAAS symposium. The new knowledge establishes the Nile Valley as an important link between Sub-Sahara Africa, North Africa, the Levant and Europe.

It was previously thought that the desert in this area far up the Nile could not have supported cultural development. But tools found there now show a complete sequential development, ranging from 70,000 years ago to the present. They suggest that the Nile Valley paralleled Europe and the Middle East at a time when modern man was emerging.

### EXOBIOLOGY

#### Protein building blocks on Jupiter

Experiments simulating conditions on Jupiter show that molecules of biological significance as precursors of life could be formed on the planet. Its atmosphere of methane, ammonia, water and hydrogen may be similar to the presumed primordial atmosphere of earth.

According to Dr. Cyril A. Ponnamperna and Fritz R. Woeller of the Ames Research Center at Moffett Field, Calif., new studies that take into account the condensation of ammonia and water vapor imply the presence of liquid water. "If organic chemicals are produced from a mixture of methane and ammonia, the layer of water would provide them with a medium for interaction to give rise to larger polymers necessary for life," Dr. Ponnamperna suggests.

In experiments in a simulated Jovian atmosphere, he reports, several nitriles were identified, among them alpha-aminonitriles, the precursors of the amino acid molecules that link to form proteins. "A possible sequence of reactions in the Jovian atmosphere which might give rise to protein-like structures has thus been established."

### IMMUNOLOGY

#### Second immune system

Experimental activation of what appears to be a second immune system in the body, located on mucous membranes and in secretions of glands rather than in the lymphocytes or in the blood, is reported by Dr. Robert Genco of the State University of New York at Buffalo. If it proves to be an independent, second system, then vaccines against respiratory diseases may be sniffed or sprayed into the nose, rather than injected into the bloodstream, for greater effectiveness.

In recent tests, Dr. Genco shows that an antigen, injected directly into the mammary gland of a rabbit, induces large numbers of so-called secretory antibodies. Only small numbers of other types of antibodies—those that occur in the bloodstream—appear. Preliminary evidence shows secretory antibodies to be about three times more effective in fighting certain infections than others. To protect against disease-causing organisms that invade through the mouth or nose, stimulation of these secretory antibodies is probably the thing to aim for.