



SAP PRESSURE, 210 YEARS AGO

This figure, from Stephen Hales' "Vegetable Statics," published in 1728, shows how the pioneer plant physiologist set up his manometers to measure the pressure of sap from "bleeding" grapevines trained against a wall.

BIOLOGY

Secret of Sex Determination Sought With X-Ray Studies

Sex Changes in Fish, Vitamin Needs of Plants, Homing Instincts of Toads Discussed at Meeting

SEARCH for the secret of sex determination was described by Prof. J. T. Patterson of the University of Texas, to the American Association for the Advancement of Science. It was a sort of microscopic game of billiards, with X-rays for cues and chromosomes, or rather bits of broken chromosomes, for balls.

Some years ago, Prof. Herman Muller, a former colleague of Prof. Patterson at the University, showed that chromosomes, with the genes or hereditary units they carry, can be broken apart and rearranged by bombarding the cells with X-rays. Prof. Patterson used this technique for the special purpose of locating if possible the sex gene or genes.

According to one of the two alternative theories of sex-gene location, this important hereditary unit is located on one particular chromosome, the so-called X-chromosome. This minute structure Prof. Patterson proposed to shatter with the X-rays. The animals used were the familiar little fruit-flies, classic subject for genetical experiments.

"If the X-chromosome does possess a major sex gene some of the fragments

into which the chromosome can be broken would be certain to contain this gene," Prof. Patterson explained. "By adding separately each of the several fragments to the normal chromosomal complex of the male fly, one can determine whether any one of them possesses the postulated sex gene; for if it does, the male would be changed into a fly with female characteristics. By subtracting the corresponding fragment from the chromosomal complex of the female, a change to maleness would result."

No Verdict

The experiments to date have come to a tantalizing state of no verdict. All fragments of the X-chromosome which have been broken off and re-attached elsewhere in the manner described by Prof. Patterson have yielded no results at all. Evidently the sex gene is not in or on them.

But there is one fragment, from near the middle of the X-chromosome, that has not yet been successfully attached in any male. Instead of surviving and

developing the looked-for female characteristics, the insects simply die.

"The failure of such males to survive may lead some to assume that the small fragment contains a major sex gene," Prof. Patterson stated. "Such evidence is negative and not critical, so that it will be necessary to obtain positive evidence before a final decision can be reached."

Fish Change Sex

Females of Siam's famous fighting fish can be turned into males by surgical operation. If their ovaries are removed, new sex glands may form at the ends of the cut oviducts, but they will be male, not female.

So reported Drs. G. K. Noble and K. F. Kumpf of the American Museum of Natural History, before an audience of experimental zoologists. They obtained seven positive results from 150 operations.

With the growing of the new male sex glands came changes from femaleness to maleness in the external appearance of the fish. The typical trailing, veil-like fins and tails developed.

Three of the seven fish were killed for dissection. The remaining four were given females as mates. Three of them fertilized the eggs in normal manner. The fourth went through normal male behavior, but was unable to fertilize the eggs.

Vitamin B₁ For Roots

Vitamin B₁, preventive of the Oriental disease beri-beri in human beings, is necessary for the production of roots in plants, experiments reported by Dr. James Bonner of the California Institute of Technology have demonstrated.

In the normal seedling (peas were used in the tests) the roots get their vitamin from the cotyledons or thick seed-leaves. But if the root is detached and grown in a nutrient solution, it lives on its reserves of vitamin B₁ for a time, after which the vitamin must be supplied from an outside source.

Dr. Bonner's experiments have shown that two atom-groups in the vitamin's complex molecule are the really necessary parts so far as root growth is concerned. These are known respectively as vitamin thiazole and vitamin pyrimidine.

Toads Want to Go Home

Toads have homing instincts as strong as those of pigeons, though they may not travel quite so fast, Dr. Ray J. Nichols of the University of Mississippi discovered in studies reported.

Dr. Nichols visited a certain area frequently during a summer and fall, marking all toads he could catch with identifying tags and carrying them various distances from the point of capture. Of 141 toads removed one mile or less from "home," 63 were subsequently recovered. Thirty of them had found their way back to the home territory in from 2 1/2 hours to 24 days.

Miniature Cannibalism

Cannibalism is not a monopoly among saw-toothed South Sea Islanders and wild black men of Central Africa. It exists far down in the sub-human world, among the one-celled animals, the protozoa.

Dr. A. C. Giese of Stanford University reported cases of protozoan cannibalism which he has studied. The successful eaters of their brother-microbes frequently become giants of their kind.

Old Fort a Science Outpost

Deep in the heart of Africa stands an old fort, built by the Germans as a World War stronghold. It is now an outpost of science, whence attacks are made on much smaller enemies than soldiers, but in their way deadlier—the dreaded tsetse flies, carriers of African sleeping sickness.

Here labor scientists who are trying to rid Central Africa of this depopulating scourge, stated Dr. P. J. Parrott, vice-director of the New York State Agricultural Experiment Station at Geneva, N. Y. Dr. Parrott saw the fort-laboratory during a recent scientific trip that began at Cape Town and ended at Cairo.

Another scourge of Africa, also depopulating in its effects though less directly so than the tsetse fly, is an importation from the New World; the prickly-pear cactus. Tradition says it was originally brought in in 1750 and used for fencing and for its fruits. Now it is ruining thousands of acres of farm and pasture lands, as it did in Australia.

The same means that broke the grip of the Australian prickly-pear plague are being tried against it in Africa, Dr. Parrott reported. The *Cactoblastis* caterpillar and other cactus-eating insects have been imported from Australia. Their success in Africa is proving much less spectacular, however.

Grasshopper Heartbeats

An apparatus that makes a permanent record of the secrets of the heart of a grasshopper was demonstrated by Drs. Frederick Crescitelli and Theodore L. Jahn, of the State University of Iowa. It writes down all oc- (Turn to Page 30)

GEOLOGY

Lost Continent Sought With Artificial Earthquake at Sea

Geologists Hear of Coal Age Dustbowl, Migrating Beaches, Origin of Mountains and Earth Itself

HUNTING for evidence of the lost continent of Appalachia with TNT and a ship-load of instruments has occupied Dr. Maurice Ewing, Lehigh University physicist, for several years. Long believed to be the source of much of the sedimentary rock on the Atlantic seaboard, Appalachia was only a theoretical and unreachable region until recently. Dr. Ewing described to the meeting of the Geological Society of America the equipment which he, cooperating with explosives engineers and geophysicists, has developed to aid in the search.

Adapting for undersea use the "artificial earthquake" methods used by petroleum geologists in the search for concealed oil-bearing structures, Dr. Ewing has designed a complete series of instruments, consisting of two bombs, four seismic listening instruments and a timing and recording device, for use on the sea bottom.

Strung out on a cable, like the knots in a kite tail, the instruments are lowered over the side of a moving ship, and laid out on the ocean floor. Then, after enough time to permit placing, automatic machinery sets off one explosive charge, and the instruments record the vibrations set up by it. Later the second charge is set off, and recorded by the automatic machines. Then the machinery is drawn to the surface, and the records studied.

Sending a sound wave down through the rocks and recording the time between the explosion and the arrival of the reflected waves tells geologists where changes occur in buried structures. By using his newly-developed equipment, Dr. Ewing hopes to find out what rock structures lie below the sea bottom even when three miles of water cover it.

Cooperating in this work were the Geological Society of America, which



SCIENTISTS RELAX

Humorously pondering the fate of the universe, the high priest of Mineralasia, guarded by two stalwart savages, awaits his cue. This scene is part of the annual Pick and Hammer show, at which Washington geologists satirize their profession and tell apocryphal stories of field experiences. The director of the show is in the foreground.

group at Wisconsin, said Prof. Breit, has been possible by the operation of the apparatus within a pressure tank. This tank prevents electrical sparkover and similar losses and permits much more effective operation. Moreover, the unit is very compact for this type of equipment.

An additional refinement in the Wisconsin apparatus has been the discovery that a small amount of carbon tetrachloride (cleaning fluid) or Freon (the new fluid used in electric refrigerators) within the pressure tank will improve the

operation. Now under construction at Washington and at East Pittsburgh are other pressure-tank atom smashers.

The key point of investigations on the forces within atom nuclei, indicated Prof. Breit, is that the apparatus must perform without fluctuation so that the results are quantitative. Only when exact knowledge is attained can theoretical interpretation be made. Qualitative measurements only enable one to make an intelligent guess as to the forces acting within the atom.

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More of the Meetings From Page 21

currences, both mechanical and electrical, which the tiny pump goes through during each pulsing beat.

The apparatus, necessarily exceedingly light and delicate, is made of glass and silver. On one side of a sheet of photographic paper it makes permanent an oscillograph trace responding to the electrical changes. Through the back of the paper it photographs the shadow of a hair attached to the mechanograph.

X-Rays "Paint" Flowers

X-raying flower buds while they were still quite small and closed produced some pronounced changes in color and shape of the flowers when they opened, Dr. Edna L. Johnson of the University of Colorado reported.

White dots, spots, and streaks appeared on the corolla margins of the three species treated—tobacco, phlox, and salpiglossis. The margins in some cases also came out with a dissected or

frayed appearance. In salpiglossis about ten per cent. of the flowers developed as dwarfs.

Buds had to be rayed early in development, or effects were not obtained. Toward the end of the blooming period, normal blossoms appeared in greater number.

Virus Survives Heat

Virus of mosaic, one of the worst diseases that afflicts growing tobacco, is not killed by the heat of flue curing as has been commonly supposed, Dr. J. A. Pinckard of the Tobacco Research Laboratory, Chatham, Va., declared. Laboratory and greenhouse tests with samples of flue-cured tobacco showed the virus to be still alive and ready for action.

The growers themselves are users of flue-cured tobacco for their personal smoking and chewing needs, so that they become "carriers" of the plague to their own fields. Experiments have

shown that young plants infected with the virus from flue-cured tobacco sources actually resulted in losses approximating \$180 an acre in 1937, Dr. Pinckard stated.

How Leaves Keep Cool

Leaves and coolness have long been practically synonyms: photographic studies with the invisible infra-red rays at Iowa State College, by Drs. W. E. Loomis and P. H. Carr, have shown why. Leaves reflect almost all of these heat-engendering rays, instead of absorbing them, as has always been supposed. Thereby they save their own lives; if they absorbed all of the infra-red radiation it would literally cook them.

A curious special condition was observed for the leaves of evergreens, like spruce and pine. In summer they reflect infra-red as all leaves do. In winter, however, they change in some way and absorb it. In this way they are able to keep warm enough to manufacture food on days when they would otherwise be frozen.

Cancerous Protoplasm Thicker

Protoplasm in cancerous and other tumor cells is more viscous, or "thicker," than it is in normal cells, Drs. M. F. Guyer and P. E. Claus of the University of Wisconsin demonstrated before a group of zoologists.

This was shown by whirling cells of both types in an ultra-centrifuge to a force many thousand times gravity. The contents of normal cells separated out into layers or strata much more readily than did those of the diseased cells.

When cancer cells were whirled at a force of 400,000 gravities for an hour, their nuclei frequently divided without the rest of the cell following suit, so that cells with two or more nuclei resulted.

Strange Tadpoles

White tadpoles, two-tailed tadpoles, and other abnormalities were hatched from frog eggs that had been whirled in an ultra-centrifuge and thus subjected to a force many thousand times gravity, Drs. H. W. Beams and R. L. King of the State University of Iowa reported. They suggested that the abnormal color was due to disturbed development of the hypophysis, one of the internal glands.

Two Heads—Two Minds

Two heads are not better than one, if both are on one body and both try to govern it. Being of two minds about what to do in an emergency may result in no action at all, which may result in disaster if danger is impending.

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Two-headed snakes are not uncommon, Dr. Bert Cunningham of Duke University reported. He has been fortunate in having opportunity to watch the behavior of a number of living specimens.

The two heads may play with each other, or compete for the same piece of food, or even engage in desperate battle to the death. In the latter event, it quite literally amounts to biting the other's nose off to spite your own face.

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MEDICINE

Cause of Scarlet Fever Believed To Be Virus

A DISCOVERY which seems to upset current ideas of the cause of scarlet fever and which may go far to bring the disease under control was reported by Prof. Jean Broadhurst of Teachers College, Columbia University, and Miss Gladys Cameron of Washington Square College, New York University, to the Society of American Bacteriologists.

They found in the blood and in the throats and noses of scarlet fever patients, small bodies that appear as black dots under the microscope. These black dots—the black color comes from a stain or dye called nigrosin—are called virus inclusion bodies. They are visible evidence of the presence of otherwise invisible viruses.

Scarlet fever is therefore caused by a virus, the scientists believe as a result of their findings. If these findings are confirmed, they will lead to new and probably more successful methods of treating and preventing this serious childhood plague.

Blame for causing scarlet fever has heretofore generally been placed on a different kind of germ, the streptococcus, although some scientists have held that both a streptococcus and a virus, acting together, were responsible for the disease. At present, the streptococcus theory is so widely held that streptococcus toxin is used to test individuals to see if they are immune to scarlet fever, to vaccinate persons against scarlet fever and to inoculate horses in order to secure from them antiserum (antitoxin) against scarlet fever.

"The results in all such control work," Prof. Broadhurst and Miss Cameron pointed out, "are not so satisfactory as with the use of diphtheria in testing, vaccinating and treating diphtheria patients, and this difference is interpreted by some investigators as indicating that streptococci are not the cause, or at least not the sole cause, of scarlet fever."

Some institutions have found blood serum from patients recovering from scarlet fever more successful in treating the disease than the antitoxin made from the streptococcus. The new findings indicate that this may be because the disease is due to the virus, which would be in the blood but would not be in the streptococcus antitoxin. Further evidence in support of this is the fact that virus inclusion bodies were found in the blood of patients who had been given streptococcus antitoxin as well as in the blood of those who had not been given the antitoxin.

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PALEONTOLOGY

Ball-and-Socket Joint Found in Dinosaur Skull

WHAT use was there for a ball-and-socket jointed bone at the back of a dinosaur's skull?

Charles W. Gilmore, curator of vertebrate paleontology at the U. S. National Museum, would like to know.

At the back of the skull of a hadrosaur, a rooster-crested monster that once lived in Montana, he has found a bone arrangement that has never been found in any other kind of skull. A relatively small, triangular bone bears on its front edge a socket or cup, which fits neatly over a ball-shaped projection on the bone in front of it.

Whatever was the use of this unique skull-joint, it could hardly have been to make room for the hadrosaur's massive brain. For the hadrosaur's brain was anything but massive. It couldn't have weighed more than two or three ounces. It was enough to see, hear, and probably smell with, but that was about all. But then, very likely a dinosaur never bothered to think—except possibly once in a while about another dinosaur.

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