

BIOLOGY

Heart-Throbs of Cockroach Recorded With Instrument

HEART-THROBS of an insect—even a lowly cockroach—made with an instrument so delicate that it makes the doctor's familiar stethoscope seem clumsy as a steamshovel by comparison were demonstrated at the Atlantic City meeting of the American Association for the Advancement of Science by Dr. J. Franklin Yeager, U. S. Department of Agriculture entomologist.

The much-magnified photographic records, many times bigger than the insect itself, traced in even lines the normal rhythm of dilation and contraction. Then they turned ragged and irregular, as the heart was drugged with nicotine. Then the records showed the slow return to normalcy, as the tiny organ gradually wore off the poisonous shock.

Sometimes the heart, quite in its normal state, would reverse itself and beat backwards. Hearts of many—perhaps all—insects often do that, for no known reason. Insect hearts and circulatory systems in general are not built at all like those of human beings. One of the things Dr. Yeager hopes to investigate with his newly developed super-sensitive instrument (which he calls a "mechanocardiograph") is this heart-reversing habit.

Even more important, for eventual practical purposes, is his ambition to try out many other drugs, and to get at the basic facts of insect heart action. Finding out the fundamental things that make insects tick of course in time helps other researchers to find out what can make them stop ticking, when they become too bothersome.

The principle of Dr. Yeager's instrument is fairly simple; its adjustment is the delicate job, requiring more than a surgeon's skill. He anesthetizes his cockroach, pins it down in a hollowed-out block of paraffin, cuts open the body, exposes the heart.

With a single hair, exceedingly fine, he attaches the heart to a delicately balanced needle of glass, itself almost as fine as a hair. A spot on its tip has been darkened. Light, shot across that tip, casts a moving shadow as the needle moves under the heart-impulses.

The shadow passes into the lens of a microscope, is magnified many times, passes on with its movement thus vastly enlarged into a camera, where it plays

over a slowly moving sheet of photographic paper. There it traces its record of everything that is happening to the cockroach's little heart.

Fatherless Rabbits

Unfertilized eggs of rabbits were sent into the first stages of development and growth when placed in contact with the sperm of rats, reported Dr. Gregory Pincus of Harvard University. Yet these early-stage rabbit embryos did not have rat male cells as fathers; they were as strictly fatherless "bottle babies" as were the rabbit eggs stimulated into development by treatment with heat and chemicals, which caused something of a sensation when Dr. Pincus first announced them some months ago. The rat sperm, like the chemicals and the heat, only "activated" the virgin eggs and initiated parthenogenetic or fatherless development. None of the rabbit eggs thus "activated" in Dr. Pincus's experiments got further than the very earliest stages of prenatal growth.

In other experiments by Dr. Pincus and his colleague Dr. N. T. Werthessen, fertilized rabbit eggs were permitted to reach an early stage of development, and then the mother's ovaries were surgically removed. Thereupon the incipient embryo in the uterus stopped growing. Growth could be started again by injections of the female sex hormone progesterin.

Similar early-stage embryos kept in glass vessels of serum grow to the point where they are hollow balls of cells, then collapse. This collapse could be prevented, it was discovered, by increasing the amount of the serum many thousand times, especially if it were kept circulating and well aerated.

Unpollinated Flowers

Fruits without seeds were caused to form from flowers never touched by pollen, when they were treated with chloroform extracts made from pollen, in experiments reported by Dr. Felix G. Gustafson of the University of Michigan. The seedless fruits formed even when the extract used was of pollen of a different plant species: seedless cucumbers were started with extract of Hubbard squash pollen; seedless peppers with extract of petunia pollen. Not all



MEASURING INSECT PULSE

The insect, secured at the bottom of a paraffin-block "bath-tub," receives a dose of nicotine solution from Dr. Yeager's medicine dropper; its heart responds to the drug, and makes an automatic record of its action.

the alien pollen extracts stimulated fruit formation, but enough were effective to demonstrate that there is some kind of chemical substance in pollen that can act to start fruit formation, quite independently of the male sex nucleus from the pollen grain that starts seed formation.

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PSYCHOLOGY

Robot "Brain Machine" Corrects School Exams

A ROBOT "brain" that corrects school exam papers at the rate of 900 an hour with more than human accuracy is education's latest tool, Prof. Ben D. Wood of Columbia University, New York, announced before the American Ass'n for the Advancement of Science.

The new test scoring machine promises to make it possible for teachers to give daily or weekly tests to their pupils and yet not spend as much time as they do now correcting the papers.

But there is one note of joy for the pupil. The testing robot demands that the examinations be in form of "right" and "wrong" questions, answered by blackening the proper vertical space on an answer form with a lead pencil. The pupil does not have to write anything, just make a mark.

Perfected by a leading business machines company, it has been used to score about 400,000 New York State objective tests for intelligence, achieve-

ment, interest and personality. In this work it saved \$15,000 in labor of scoring alone.

In the coming year it is planned to produce the robot examination machine in quantity and begin its widespread introduction into schools throughout the nation.

Mechanically the testing machine is able to function because a soft lead

pencil mark conducts electricity. The pupil marks his answers on a special blank. This is slipped in the robot tester and covered by a mask that allows only the right answer marks to be recorded electrically on a dial. Since the machine "sees" as many as 150 answers at one time and grades them instantly, it works very fast.

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MEDICINE

Theory Tells How Radiations Kill Cancer and Other Cells

A THEORY explaining the fundamental mechanism by which X-rays, gamma rays of radium and the still newer and faster neutron rays destroy cancer and other cells was advanced by Dr. G. Failla, of Memorial Hospital, New York, at the American Association for the Advancement of Science meeting.

A cancer cell that has been irradiated, it appears from the new explanation, is something like a man in a leaky lifeboat without means of bailing out the incoming fluid. "Direct hits" from X-rays, gamma rays and other ionizing radiation further add to the cell's danger by partially puncturing the cell wall as bullets shot at the lifeboat would weaken its hull and add dangerous weight if they collected inside.

Cells have ways of eliminating some kinds of foreign materials that get inside them, but they are not equipped to rid themselves of the ionized particles produced within their walls by radiation. Following irradiation there are at first the same number of ionized particles inside and outside the cells. But the constant flow of fluids bringing food to the cells and removing waste products carries away the ions on the outside, as water might wash off barnacles on the outside of the lifeboat but could not remove any that might grow inside of it.

When the number of ions becomes greater inside the cell than outside it, the flow of fluid into the cell increases. All this causes a more or less permanent swelling and dilutes the substances essential to the life of the cell. Such dilution may injure the cell.

In addition the excessive number of ions and the presence of foreign material may also interfere with the life processes of the cell. If the dose of radiation which brought about these

harmful conditions has been large enough, the cell eventually dies.

Cancer cells and skin cells which are rapidly growing cells are more sensitive to radiation than other cell types. Dr. Failla explained this by pointing out that rapidly growing active cells have a greater flow of fluid bringing food into them and removing waste products.

The fluid flow is essentially and fundamentally the thing that makes irradiation dangerous for cell life. Dr. Failla calls his new theory the "fluid-flow" theory. With its aid he explains many known facts about the effect of radiation on living tissues. For example,

animal tumors are killed more readily when they are irradiated within the animal's body than after removal from the body. This, according to the fluid-flow theory, is because tumors removed from the body lack circulation and consequently there is no constant flow of fluid to and from the cells. It takes longer, therefore, for the fatal swelling to take place in the cell.

A new type of inheritance or transmission of cancer from one generation to another which may prove of far-reaching importance in the control of human cancer was reported by Dr. Clarence Cook Little, director of the Roscoe B. Jenkins Memorial Laboratory, Bar Harbor, Maine.

Some influence transmitted directly from a female mouse to her female descendants is of prime importance in determining whether these descendants will have cancer of the breast, Dr. Little found.

"A new type of either transmission or inheritance which is not Mendelian is thus demonstrated for the first time in mammals," Dr. Little said. "If the same situation exists in humans as in mice it should prove to be a most important practical principle for guidance in cancer control. Study of the question should be begun at once to determine whether or not the facts hold true in humans."

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EXTRAORDINARY APPARATUS

Dr. Yeager's "mechanocardiograph" is made of a fine-drawn hollow thread of glass, a hair to hook it up to the heart of the insect (the white spot near the head of the insect in the paraffin "bath-tub"), a pair of common bent tweezers to hold it up; a projection lamp on one side, a microscope lens on the other. Movements of a shadow of the glass thread are projected on a screen.