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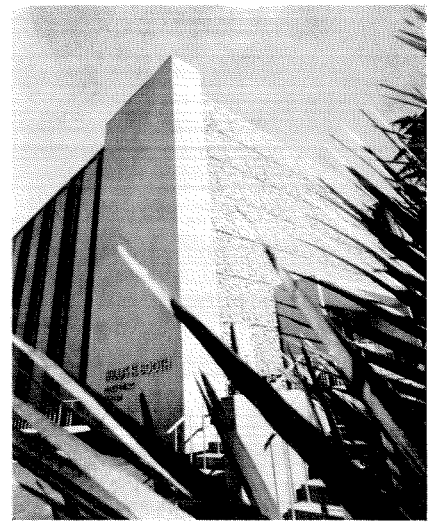
CALTECH'S NEW COMPUTING CENTER



With the dedication of the Willis H. Booth Computing Center on December 9, the Institute launches one of its most significant research efforts. The new center will accelerate Caltech's entire research program, and will make it possible to attack some of the most challenging scientific and engineering problems.

The center, on the northeast corner of San Pasqual Street and Chester Avenue, is a two-story-and-basement building. The computer system occupies the main floor, while the other floors contain offices, classrooms, and laboratories. It is probably the most advanced facility now in use for multiple applications of a single computer system to a variety of research and educational programs.

When the system is operating at full capacity, by next spring, the computing center will be available to any of the 800 research projects on the campus. It will also be available, on a demand basis, to any Caltech classes, or to any of the Institute's 1300 students and 550 faculty members individually.

The center was made possible by gifts from the Booth Ferris Foundation of New York City and the National Science Foundation.

A VERSATILE SYSTEM

The versatile computer system in the new center has been tailored to meet Caltech's specific needs. It is for use on a wide variety of research projects, and is designed to interact with the people, the research, and the educational activities of the Institute.

At the hub of the system are two large IBM computers – a 7090 and a 7040. Caltech electronics engineers, in cooperation with IBM engineers, have linked the two so that the 7040 handles all the "housekeeping chores" – input and output monitoring, printing, file maintenance, and other slower-speed routines. Thus, the 7090 is kept available for high speed calculations.

Just as the 7040 monitors the 7090, so does an IBM 7288 Multiplexor control the traffic of communication between the 7040 and other components. These include consoles remote from the computing center; various display devices, such as printers; a Burroughs 220 computer; and data-gathering units capable of controlling experiments, gathering data from them, and relaying the information to the computing center.

Main computer room of the new center: the 7090 control consoles with magnetic tape units in the background.

Frederick C. Lindvall, chairman of the division of engineering and applied science; G. D. McCann, director of the computing center; President DuBridge; and Kendrick J. Hebert, head of the center's programming group.

SCIENTISTS AND COMPUTERS

"One of the major purposes of the new center is to make it possible for Caltech to undertake big research programs," says Gilbert D. McCann, professor of electrical engineering and director of the center.

"The tremendous data reduction tasks required of many complex modern research programs, such as those involved in understanding the origins and evolution of the universe, the geophysics of the earth, or the workings of the brain, find the human mind incapable of coping with them. Such data reduction tasks are so great that scientists, without computers, could not reduce the data in their lifetime."

The Caltech computer system is designed to handle — simultaneously, if necessary — the problems of many different research projects. Data can be fed into consoles to be relayed to the interplexing system, where the data will be reassigned. Some problems may be referred to the Burroughs 220 for solution. The 7040 may resolve some itself. It will refer complex ones to the 7090. The 7040 may stop the 7090 from working on one problem, direct it to store the information concerning that problem so that it may tackle a more pressing problem, solve it, then resume work on the original one. This may take from a few seconds up to a few minutes.

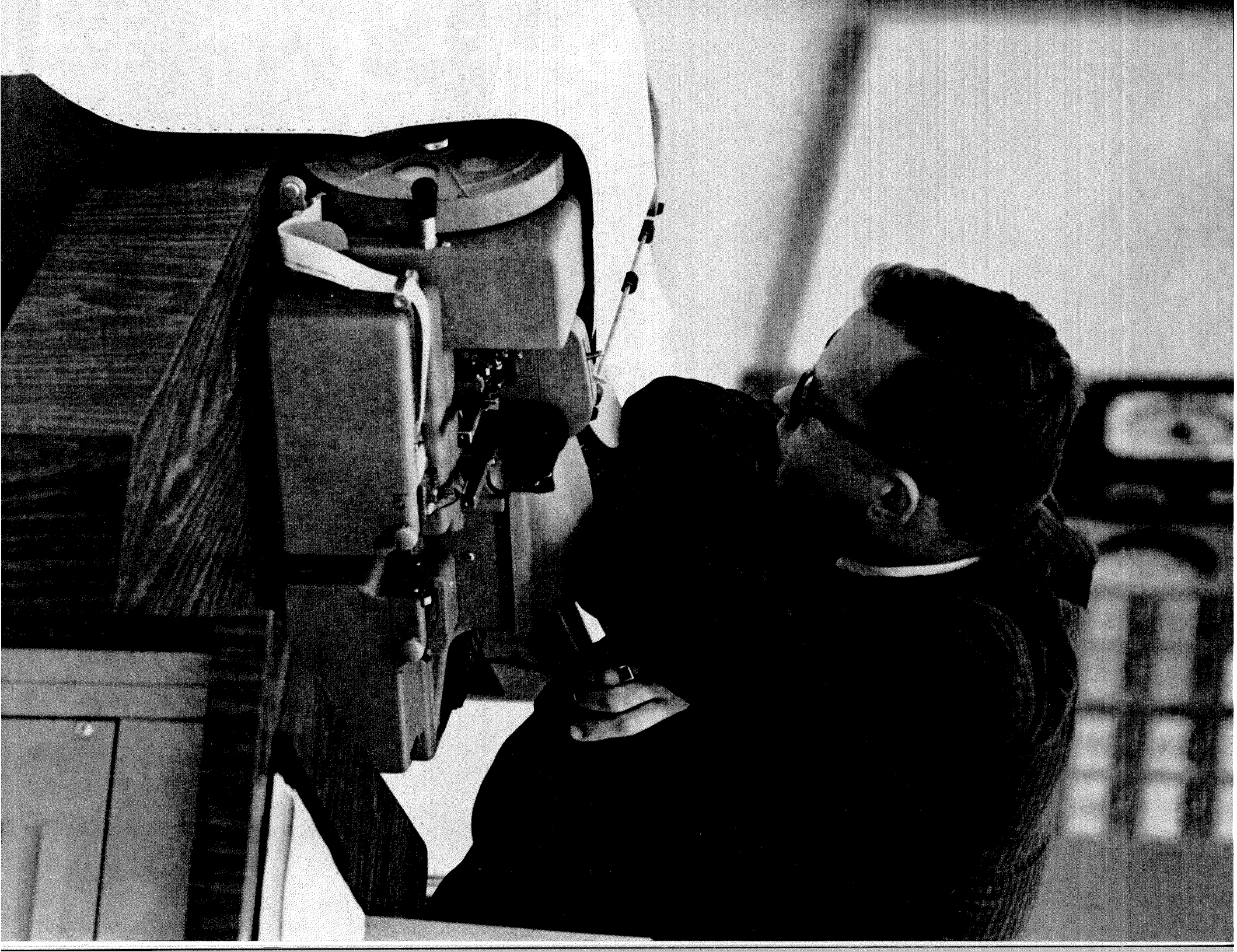
File of IBM punchcards of current computing programs indicates the variety of fields of science and engineering already making use of the center.

800 CUSTOMERS

At any "average" moment, scientists connected with any of the 800 active research projects at Caltech can make arrangements to use the new computing center. Engineers, mathematicians, programmers, and other personnel on the center's staff are available to coordinate with research scientists to adapt computational systems to the requirements of any individual project.

Soon, scientists working on special projects will have consoles set up right in their own laboratories or work areas, so they can enter the factors of their problems and, almost immediately, get the computer's printout on the same typewriter at which the data was entered.

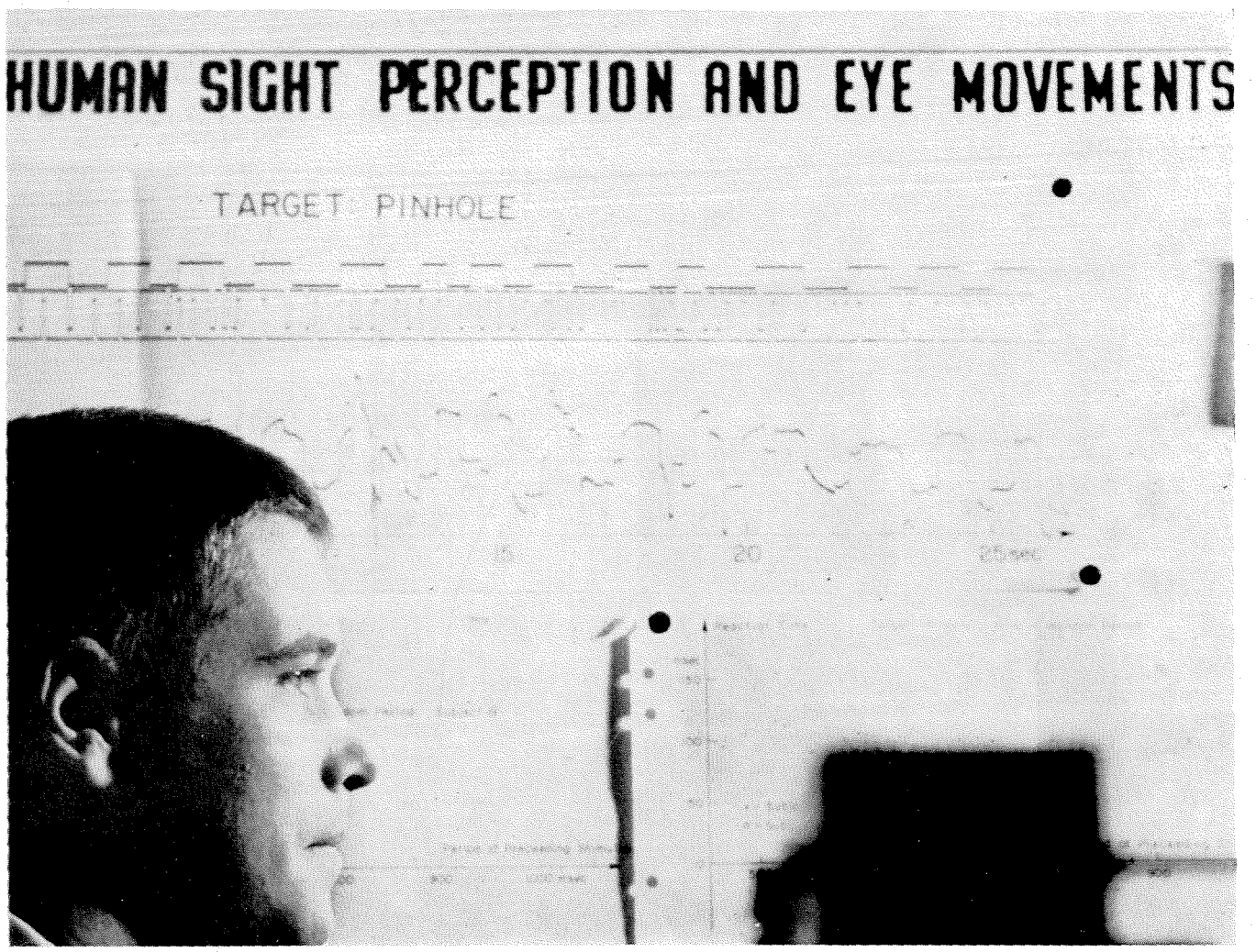
Remote console, designed and built under the direction of Charles B. Ray, electronics engineer, has been installed in the computing center for use by faculty and students. Several such consoles will soon be in operation on the campus, each specially designed to meet the needs of the scientific discipline which will utilize it.



BIOLOGICAL SYSTEMS

Research interest in living nervous systems has grown rapidly in the past few years. Now it is not only the field of the biologist and the experimental psychologist; it is receiving the interest of systems, communications, and computer engineers.
In the new computing center, electrical engineers and biologists work together in a joint research program on the nervous system and sensory perception.
Since 90 percent of all sensory information in the nervous system is received by man through his eyes, the Caltech scientists are concentrating their efforts on many forms of eye structures, from the simple light receptor cells in worms, flies, and crabs to the highly complex human eye. The light-perception nerves are connected directly to the central cortex of the brain, so this research promises to yield much-needed information on brain functions.

Studies of the human eye in the computing center reveal that the constant movement of the eyes in higher animals and humans is necessary for sharp vision.



Housefly, attached to torque meter which measures wingbeat response as the fly tries to follow a visual target

HOUSEFLY

The optic system of a fly is sufficiently complex to be challenging and yet sufficiently simple to be useful in visual research. In neurobiological studies at the center, houseflies are attached to ultra-sensitive torque meters which measure the flight and activity of a fly as it responds to light in a controlled environment. Because the electrical "noise" generated by the nervous system makes many of the directly-read signals unintelligible, it takes a computer to analyze these signals. The simple flight of a housefly, for example, may require literally millions of calculations by the computer before scientists can analyze the data.

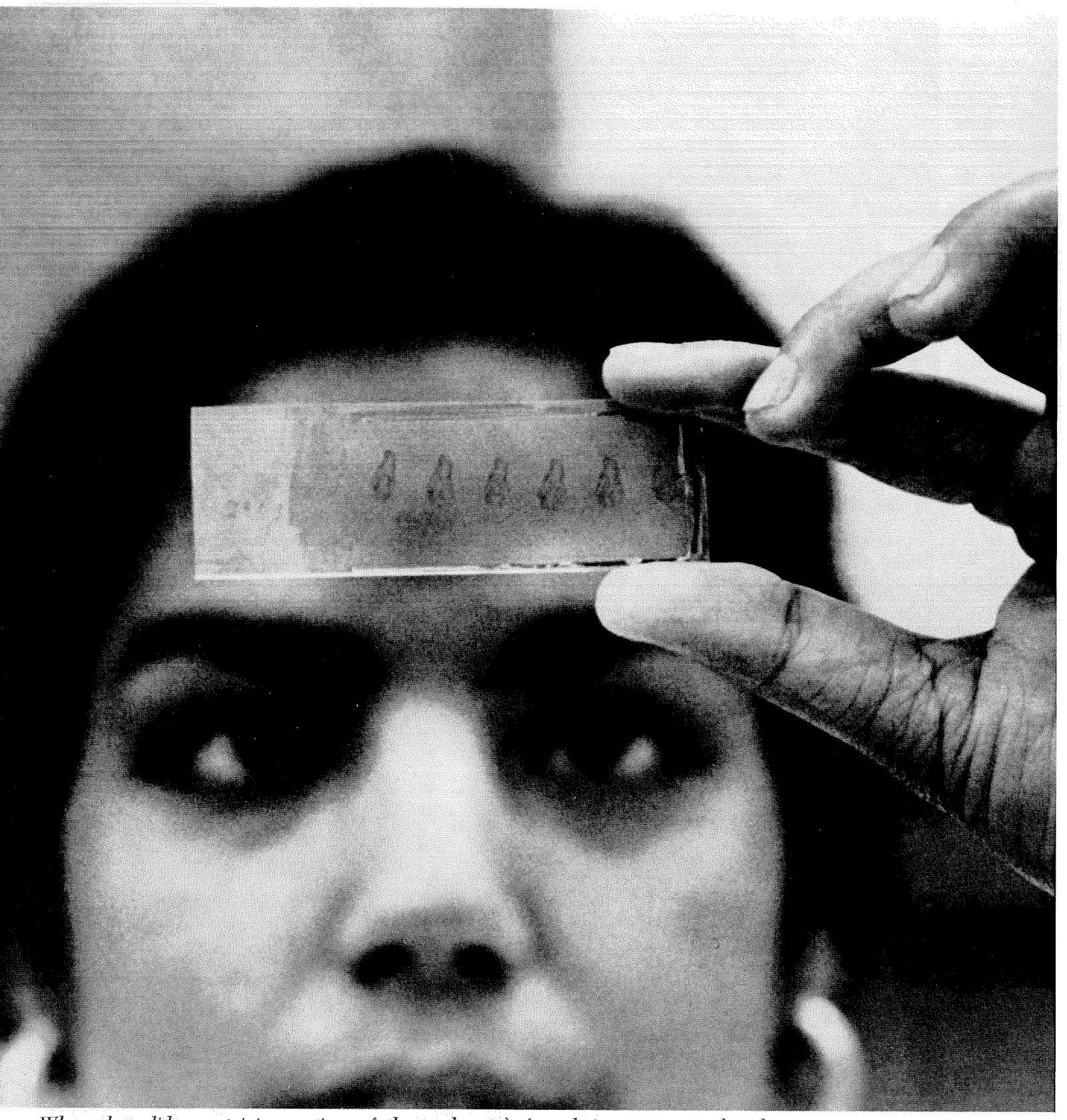
EARTHWORMS

Earthworms are used in experiments with light perception because their frontal tips have a great concentration of light sensitive cells which are relatively simple to study. The cells contain nerve fibers which connect the light-sending portion of the worm's anatomy with the animal's brain.

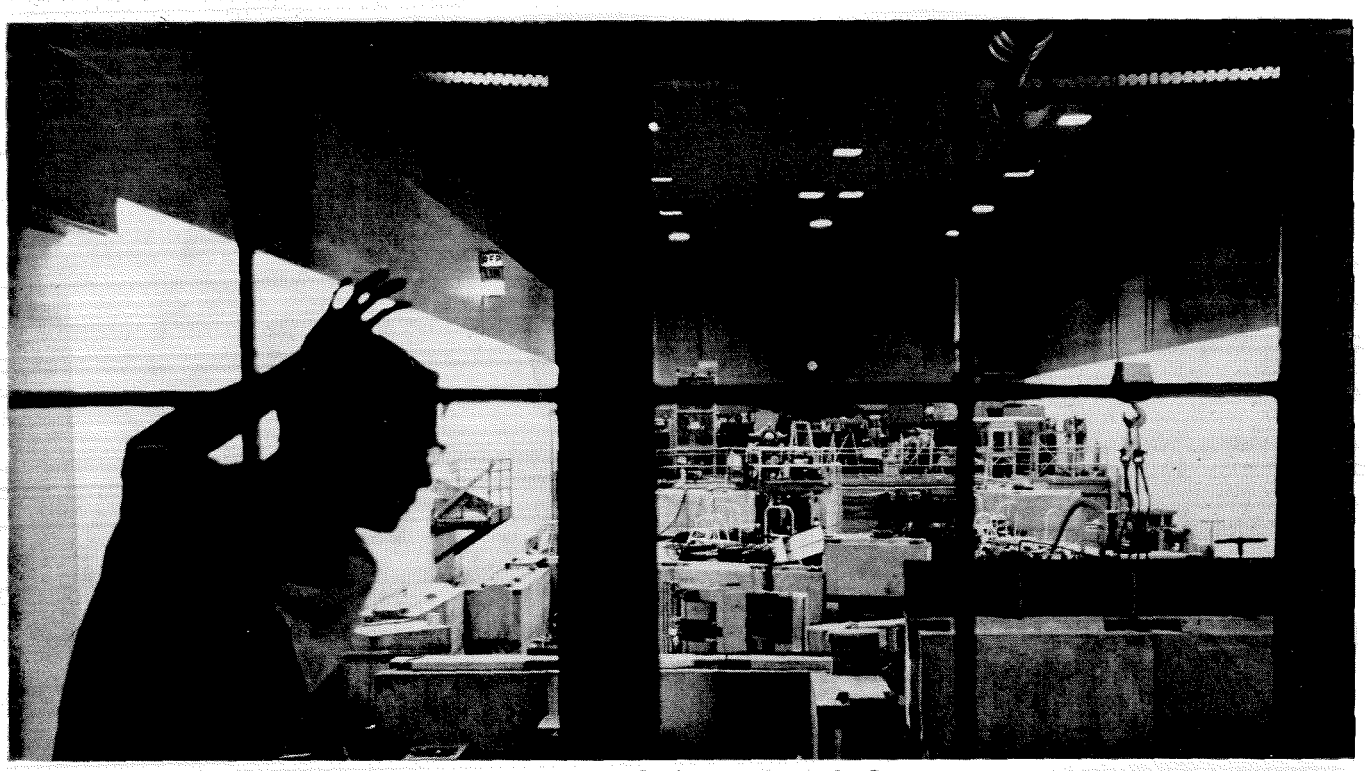
Although scientists cannot isolate single nerve fibers mechanically, the computer can isolate the responses of one tiny individual fiber out of the recorded activity of an entire bundle of fibers.

As the cells are stimulated by light, their electrical responses are fed directly into the computer, which analyzes the data and enables scientists to learn how light stimulus is converted into nervous energy.

The common earthworm makes a good subject for light stimulation studies.



When glass slides containing sections of the earthworm's frontal tip are examined under a microscope, it is possible to follow the pathway of the nerve axons which connect the light sensitive cells with the brain.



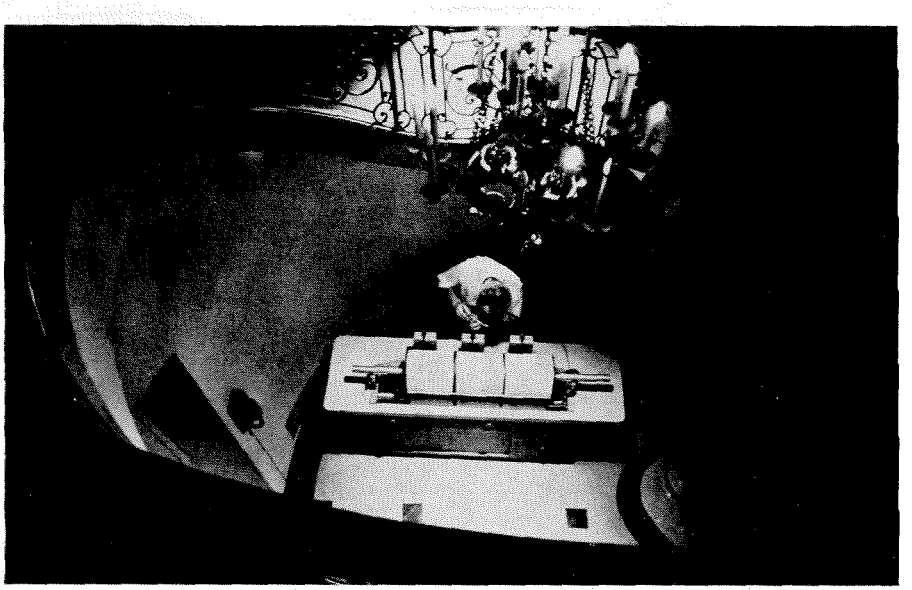
Caltech's synchrotron is now linked directly with the computing center.

NUCLEAR PHYSICS AND SEISMOLOGY

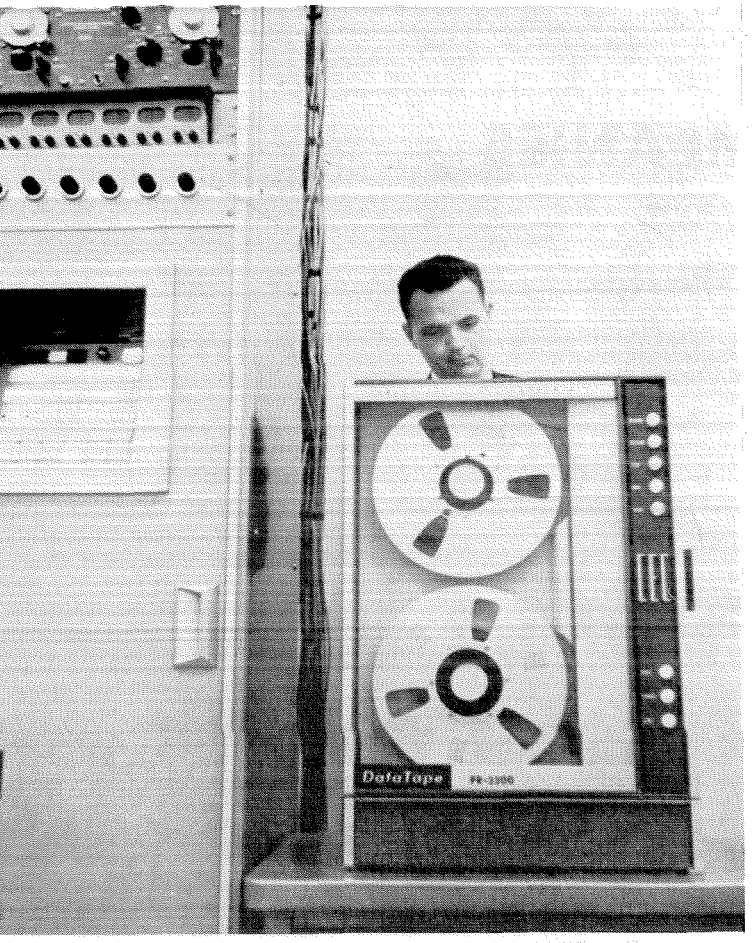
The computer system is already directly linked to other research facilities on the campus, such as the synchrotron.

The synchrotron, which can accelerate electrons to energies of a billion and a half electron volts, makes it possible for nuclear physicists to produce and examine some of the most fundamental particles of matter. It takes hours – and sometimes days – to set up each experiment. By taking data directly from the synchrotron, the computer system makes results available immediately.

In much the same way, the system enables Caltech's seismologists to obtain more precise information concerning earthquakes, and will make possible more detailed analyses of the structure of the earth's crust and interior.



Worker adjusts recording drums in the lobby of the Caltech Seismological Laboratory, which is linked by magnetic tape digitizer with the computing center.



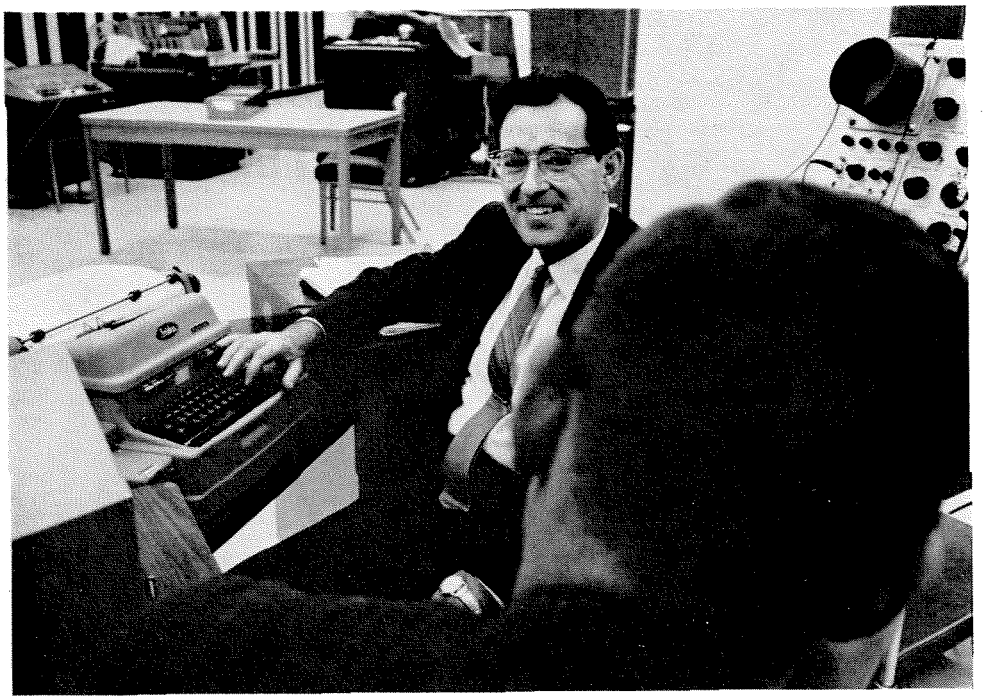
Research laboratories in the computing center use remote data transmission stations like this one to send data directly from the laboratory to the central computer system.

EDUCATIONAL TOOL

With computers becoming more and more useful in science and engineering, the need to understand their theory and operation becomes urgent. Caltech students are being taught how to program and operate computer systems as an important part of their technical education.

Dr. McCann proposes to put the computer system to work to foster creative thinking. The computer may provide the mathematical insight, he says, for beginners in a field of creative research to follow their curiosity beyond their present limits.

Although the system is sophisticated, it is simple to use. Thus scientists and engineers who make use of it do not have to take time to study computer programming.



Gilbert D. McCann, director of the Willis H. Booth Computing Center.