MEDICINE

Living Cell Is Probed

New techniques and new instruments take scientists deeper into the interior of the cell, the basic structural unit of our bodies, to learn more about life's secrets and about cancer.

By WADSWORTH LIKELY

➤ SCIENTISTS ARE probing deeper and deeper into the cell, the basic structural unit of our bodies, to find out how we grow and how our cancers grow.

Powerful new microscopes and delicate new techniques are bringing the scientists closer to the secret of life itself. Before they get there, however, they may find a way to control abnormal growth, which is all that cancer is.

Each one of us develops from a single cell at the beginning. This cell divides and then those two divide, and this process continues. At some point cells begin to be different. Some become the basis of our muscles, others of our bone. Finally a complete human, with all its different parts and different functions, is formed.

These two things, cell division and cell differentiation, may hold the key to why normal cells sometimes change into cancer cells, and then divide and divide until millions of them overwhelm the body and kill it.

In Berkeley, Dr. Daniel Mazia of the University of California and Prof. Katsuma Dan of the Tokyo Metropolitan University have succeeded in isolating the spindle-shaped structure involved in cell division in pure form. And they have isolated the substance, a protein, of which it is composed.

Isolate Mitotic Apparatus

Cell division is called "mitosis," and this structure which has been isolated is called the mitotic apparatus. For 75 years scientists have been studying cell division under the microscope, and for almost that long thev have been trying to isolate the mitotic apparatus. Previously the chemicals used to fix the cells had always destroyed the extremely delicate apparatus.

Detergents were the answer. Drs. Mazia and Dan, with a regular commercial detergent, succeeded in dissolving the membrane surrounding the dividing cell and the stuff inside.

They were able to discover that the mitotic apparatus is a protein of low molecular weight and makes up only about one percent of all the protein in the cell.

For their investigations, the two scientists used the eggs of sea urchins. Sea urchin eggs can be made to divide every hour when kept at constant temperatures. Young eggs undergoing their first rapid cell divisions are particularly useful because this rapid division, which slows down as the organism becomes older, is thought by many to be something like the rapid cell division which is characteristic of cancer.

Three-D on the television screen is entering the fight for cancer and the study of cells. An X-ray scanning microscope which throws a picture on a TV screen has been developed by a young graduate student, Howard Pattee, at Stanford University in Palo Alto, Calif. Also several new X-ray microscopes that utilize reflections of X-ray beams from gold mirrors to make a greatly enlarged photograph have been built at Stanford. While these do not enlarge quite as much as the electron microscope, they will permit scientists to see living things. The electron microscope, most powerful of all, permits seeing objects only in a vacuum; therefore, they must be dead.

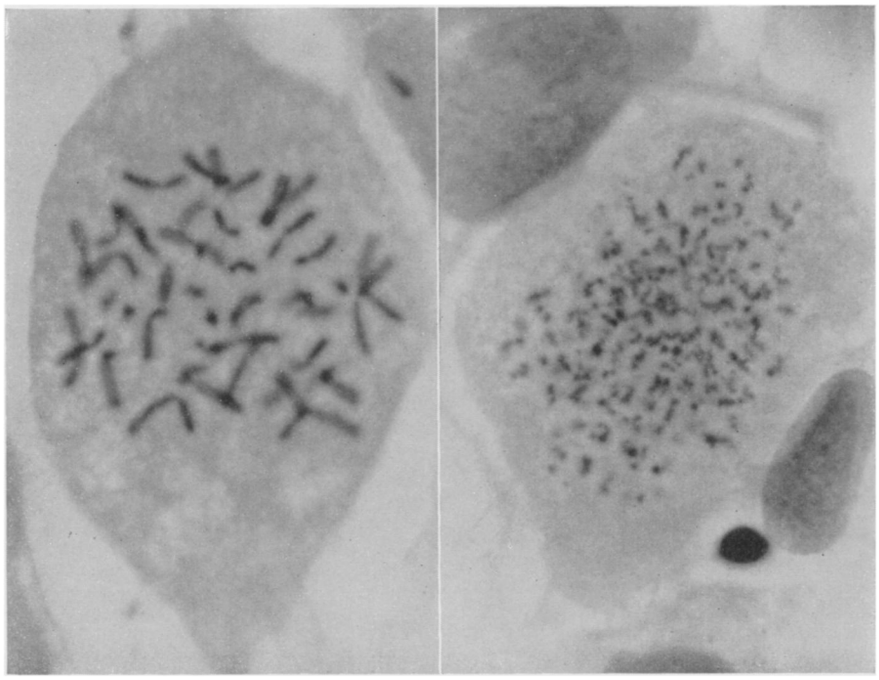
In the TV type, X-rays are produced by an electron beam passing through a tungsten plate. The objects to be studied are placed on the other side of this plate. The rays will penetrate an object with varying intensity, depending on its composition, and then will be picked up by an electronic radiation detection device. This permits the picture they produce to be projected on the screen of an ordinary TV tube. Now plans are underway to add a third dimension to such a picture.

The big problem with the other X-ray microscope is that it is impossible practically to focus the X-rays with lenses. An ordinary lens, as in a pair of spectacles, focuses X-rays at a distance of about 60 miles.

Focus With Mirrors

But what could not be done with a lens could, it turned out, be done with mirrors. Dr. Paul H. Kirkpatrick, physics professor at Stanford, found he could utilize the reflection characteristics of X-rays by bouncing them obliquely off a series of concave gold mirrors. Thus the X-rays could be bent and focused at practical distances.

The rays first pass through the object to be photographed. Then, changed by the characteristics of the object, they are bounced off as many as four of the gold mirrors before they are allowed to strike the photographic plate. This plate, about the



BEARERS OF HEREDITY—At left is a picture of a cell taken from a human spleen. At right is a human cancer cell. The black rods in the first cell are chromosomes, important in the heredity process. All the little black dots in the cancerous cell are either chromosomes or chromosome fragments. A new process now enables scientists to count the number of chromosomes with ease.

size of a thumbnail, can then be enlarged to convenient size.

Spreading out living cells the way a fried egg spreads out on the pan has shown new facts about the chromosomes in the cells and their relation to cancer. Chromosomes are important in the heredity process.

The spreading-out made it very easy to count the chromosomes. It was discovered that cancer cells had sometimes as many as a thousand chromosomes or chromosome fragments. Normal cells in humans have only about 48.

Spreading out the cells was the result of an accident in the laboratory of Dr. C. M. Pomerat, University of Texas Medical School cytologist. There they grow living cells in single layers in test tubes.

Periodically, the cells are washed in a solution with a salt concentration of 0.8%, the same as the salt concentration of human body fluids. One day, Dr. T. C. Hsu bathed the cells in a solution with only .08% salt. Immediately the cells spread out. In an effort to take in their normal amounts of salt, they took in great quantities of the solution.

Drs. Pomerat and Hsu seized upon the accident and launched a program of counting chromosomes. First they found that human cells frequently have a few more or a few less than the normal complement of 48 chromosomes. Then they examined cells from three kinds of human cancer. A very malignant cancer of the connective tissues showed cells with as high as 80 chromosomes in them.

Less malignant cancers also had more than the normal complement of chromosomes but to a more modified degree.

Thus the happy accident and the detailed planning, the salt solution and the TV screen bring us more of life's secrets and take us further toward the solution to the problem of cancer.

Science News Letter, July 18, 1953

PHYSIOLOGY

Heart Beats, Then Rests

➤ HEARTS WORK eight hours out of every 24. But theirs is not an eight-hour day. They work short shifts with short rest periods right through the 24 hours.

This explains how the heart can continue beating every second or oftener, hour after hour, week after week and year after year over a long life span. The rest period, called the diastole, for the heart muscle between beats usually exceeds the actual duration of the process of contraction, called the systole.

"Thus at a heart rate of 60 per minute, the heart is active for one-third of each second and rests two-thirds of each second, which makes a workday of eight hours out of the 24. At faster rates the periods of work and rest both shorten but the latter more than the former."

This explanation of the heart's workday is given by Dr. Paul D. White, famed heart specialist of Boston, in a report in the *American Scholar* (Summer). Other facts about the heart rate given by Dr. White follow:

"There is a familiar dictum (saying) that the heart rate, and therefore the pulse rate, of the normal human adult at rest should be 72 beats per minute. This is so fixed in the minds of many persons that they are unduly worried if they find on some occasion or other that their pulse rates are in the 40's or 50's, or in the 80's or 90's.

"For their reassurance, I state at once that I have myself found that at physical rest a person in excellent condition may have a pulse rate as low as 38 beats per minute, and another person equally fit may have a rate of 118 (under some excitement, however); this is a difference of 80 beats a minute."

"A newborn baby has at rest a heart rate of 120 or a bit more, and this rate drops in the first few years of life more than in later years. Not only is there a considerable range in pulse rate between different individuals, but also it is true that any one person normally shows, in the course of a single day, a wide range of heart rate: when one first awakens in the morning, the heart may beat only 45 or 50 times a minute, but by midafternoon on a busy day the rate may have increased to 80 or 90.

"The blood pressure levels may vary normally also, though not to the same degree. A slow or a fast heart rate sometimes runs in certain families."

Science News Letter, July 18, 1953

BOTANY

Chlorophyll Releases Water From Leaves

➤ CHLOROPHYLL, THE green substance in plants, does more than promote the capturing of energy from the sunlight in the manufacture of food out of carbon dioxide and water. It promotes the release of water vapor from the leaves.

For nearly 60 years this notion of chlorovaporization, as it was named, has been in dispute because the amount of water given off is so small that it is difficult to demonstrate experimentally. Now a French scientist, Dr. Joseph Sivadjian of the Institut Pasteur, Paris, has worked out a very sensitive and simple means of demonstrating the phenomenon by a photographic process.

Mercury and silver iodide gelatin photographic films or plates are used. Normally yellow, they blacken when exposed to light. Moisture instantly discolors the emulsion blackened by exposure. Leaves put in contact with such plates form images that show that chlorophyll aids water vapor release.

Science News Letter, July 18, 1953

NUTRITION

Bread Has Fresh Feeling With Two Soy Products

➤ BREAD CAN have that fresh feel the housewife tests for by squeezing the loaf if either of two soy products is baked into the bread, Dr. C. W. Ofelt, A. K. Smith and P. A. Belter of the U.S. Department of Agriculture declared at the meeting of the Institute of Food Technologists in Boston.

The two soy products are "Gelsoy" and soybean whey products.

The fresh quality is called "crumb softness" in the baking industry. Two classes of chemicals, monoglycerides and polyoxyethylene monostearate, give this crumb softness. Polyoxyethylene monostearate, however, is prohibited by the federal bread standards from being put into bread shipped in interstate commerce.

Because the soy products are food products rather than chemicals, many people may consider them more desirable additives to bread. Low cost and the facts that the bread is easy to handle in the dough stage and springs back after handling, instead of getting deformed, are further advantages.

Production of the new softeners has not yet gone beyond the pilot plant stage.

Science News Letter, July 18, 1953

TECHNOLOGY

Microwaves Control Company Operations

➤ MICROWAVE RADIO has been licensed for the first time to help a company control several far-flung operations from one office.

Based on the same principle as the microwave systems that relay TV programs from coast to coast, the radio network links Freeport Sulphur Company's production headquarters in New Orleans with its shipping point, a sulfur mine, a "floating" plant and a plant under construction.

The electronic system is particularly valuable because the company's mines are in marshy land too soft to support telephone poles. The area also is lashed periodically by hurricanes and high winds.

Science News Letter, July 18, 1953