BIOLOGY

Study Cell Differentiation

THE NUCLEUS, the so-called "brain" of a cell, with its genes, can no longer be thought of as the sole determiner of what makes a cell behave as it does or what it will do in future generations.

There is a marvelous system of give and take between the genes and the cytoplasm, or non-nuclear material, a geneticist told the National Academy of Sciences meeting in Bloomington, Ind. Research shows more and more evidence that the gene-carrying chromosomes are profoundly influenced by their exact location within the cell.

This give and take can explain how body cells with the same chromosomes can be as different as a skin cell, a nerve cell or a bone cell. It also points to a revolution in genetics that is now in full swing, Dr. T. M. Sonneborn of Indiana University said.

There is no longer any doubt that the same set of chromosomes shows differences in appearance in different kinds of cells. These differences, he said, may indicate differential activity of the chromosomes and genes. There are several examples of these differences. For instance, one particular chromosome in certain tumor cells looks very different from the same chromosome in normal cells. Also, many kinds of cells in female mammals, including human, show a chromosomal structure not found in the same male cells. Furthermore, this structure is found only in certain kinds of cells.

Some genes may be working all the time. Others have their activity limited by cytoplasmic substances that are themselves formed by the action of controlling genes.

There is one part of the chromosome that may prove to be of supreme importance for gene action in cell differentiation, Dr. Sonneborn said. This is a part called the "H" part. The "H" part or parts contain very few genes.

Researchers studying corn and fruit flies have found that these parts or regions of the chromosomes have strong controlling influences on nearby genes. A recent report, Dr. Sonneborn told scientists, showed that this "H" part was apparently involved in causing a mutation in a nearby gene in the fruit fly.

Now geneticists have this problem to solve: How does this kind of mutation differ from the normal one?

There is also evidence that cell chemistry influences the gene's activities and that nuclei and chromosomes are chemically different in different cells of the body.

There are three main points to the revolution in genetics of cell differentiation, Dr. Sonneborn concluded.

First, the role of the nucleus, through its chromosomes and genes, will vary from cell to cell. Second, more than "mere exact reproduction" of unchanging sets of genes is going on in the chromosomes. Third, the combined sciences of embryology, genetics, cytology, microbiology, biophysics and biochemistry are now being turned on the problems of cell differentiation.

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BIOLOGY

Study Irradiated Flies

TESTS with female fruit flies indicate that intense radiation causes more deadly mutations than do chronic or less intense doses over a longer period of time.

Reporting on his studies, Dr. I. I. Oster of the Institute for Cancer Research, Philadelphia, Pa., warned scientists attending the National Academy of Sciences meeting in Bloomington, Ind., against relaxing efforts to keep human exposure down to as low a level as can reasonably be achieved.

"Despite the reduction brought about in our estimates of the amount of genetic damage from any given radiation dose," he said, "it must be emphasized that the total number of detrimental mutations induced in a large human population such as that of the world today, by a chronic dose of the order of those in question in discussions of medical radiation, industrial radiation or fallout, is still, in absolute terms, extremely large."

This means a radiation level should be "at least as low as that already recommended by national and international advisory bodies and, in time, as means of protection continue to develop, to levels even lower."

Two groups of fruit flies were studied, Dr. Oster reported in describing his work and that of his colleagues, Drs. S. Zimmering and H. J. Muller of Indiana University. One group was irradiated evenly during two weeks at the rate of 11 roentgens an hour; the second received the same dose within 31 seconds at the rate of 460,000 roentgens an hour.

After ten days, offspring were studied that had developed from the mother fly's cells when, at the time of irradiation, they were in the early stage of oogonia or immature germ cells. Compared with seven lethal mutations among 537 flies for the chronic irradiation group, there were 32 lethals among 932 flies receiving intense irradiation.

Earlier research in which mouse oogonia were irradiated, indicated that chronic gamma radiation had a lower mutagenic effect than did acute irradiation. Apparently female fruit flies respond as do mice in this respect, Dr. Oster indicates.

Dr. Oster compared the cell's defenses against radiation damage to a sieve. Some of the dangerous mutation-caused "darts" or radiation products manage to slip through the sieve. Radiation also tends to destroy the sieve as well as the number of point-mutations to the chromosomes.

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