materials point of view since one could start with the common substance uranium hexafluoride rather than having to refine out pure uranium first, but Snavely is very pessimistic about such a development because of difficulties with uranium chemistry and because the absorption frequencies of uranium hexafluoride overlap so much that laser tuning seems impossible. □

Portrait of a planet

Ever since the first early weather satellites, earthlings have been used to seeing photos of their cloud-streaked planet from space. But never before have there been views showing the fine detail of cloud structure seen in this week's cover photo. Transmitted by the new SMS-1 meteorological satellite in synchronous orbit 22,300 miles above the equator, the data were processed by a laser recorder and other special equipment at the White Sands Missile Range. The ground station there is currently the only station capable of assembling the data into photos with a resolution of a half mile.

The effect of the earth's rotation on atmospheric motion (the Coriolis effect) is illustrated by the counterclockwise rotation of the cloud systems around a low-pressure area in the northern hemisphere (far North Atlantic) and clockwise rotation in the southern hemisphere (South Atlantic). A stationary band of cumulus clouds typical of those frequently positioned over moist tropical regions extends across the central Atlantic.

Lake Titicaca, high in the Andes on the border of Peru and Bolivia, stands out clearly. The lake influences local climate in such a way that it is frequently left cloud-free. Similarly the dark band along the coasts of Chile and Peru may be the result of a cloud-clearing atmospheric effect due to the upwelling of deep, cold ocean water along the coast.

Note the almost three-dimensional sculptured appearance of the clouds at the extreme bottom of the picture.

Since this photo was taken on June 3, the SMS-1 satellite has been moved farther east into its position directly above the equatorial Atlantic to aid in the 14-week GARP Atlantic Tropical Experiment (SN: 6/1/74, p. 354), which began last weekend.

The unmaking and remaking of cells

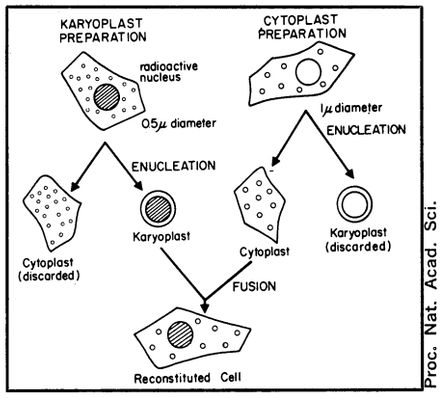
Why do cells develop into different tissues? Why do some of them become cancerous? Why do they grow old and die? It would be easier to answer such questions if cell scientists knew for sure which cellular functions are controlled by the nucleus and which by the cytoplasm. By joining the nucleus of one cell with the cytoplasm of another, for instance, it might be possible to determine which actions the nucleus and cytoplasm are responsible for. Would a cancerous nucleus make a normal cytoplasm cancerous? Could young nuclei rejuvenate old cytoplasts? Researchers have replanted nuclei from one cell to another, but usually in only one cell at a time.

Now a method has been developed for performing this operation on a wholesale basis. It makes feasible the analysis of many interactions between the nucleus and cytoplasm. George Veomett, D. M. Prescott, Jerry Shay and K. R. Porter of the Department of Molecular, Cellular and Developmental Biology at the University of Colorado in Boulder report the process in the May PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

The first step was to take some cells apart. Normal mouse cells were used in the experiment. They were treated with cytochalasin B, a fungus by-product that causes cell nuclei to migrate to one side of the cell where they remain attached to the main body of the cell by only a thin stalk. Centrifuging such cells causes them to separate completely into portions containing only nuclei and portions containing only cytoplasm. The resulting cytoplasts and nuclear structures, karyoplasts, quickly recover from this treatment and are able to function properly for several hours.

Then the cells had to be put back together in new ways. Sendai virus (related to the mumps virus) has been used to make whole cells fuse. In the Colorado experiment inactivated Sendai virus was used to reconstruct whole cells by fusing the previously separated cytoplasts and karyoplasts. Two groups of cells were used. One group, the cytoplast donors, was grown in a solution containing latex spheres of a specific size. Most cytoplasts absorbed five to ten spheres which they carried with them during separation. The spheres served to mark the source of the cytoplasm during the subsequent reconstruction. The other group of cells, the karyoplast donors, were similarly marked with spheres only half the size. In addition, the nuclei of these cells were radioactively tagged.

Both groups of cells were treated with cytochalasin B, centrifuged and



separated into solutions of either cytoplasts or karyoplasts. The large-sphere cytoplasts and the radioactive nuclei were then mixed together, centrifuged and treated with the Sendai virus.

Fusion occurred. New cells were formed consisting of a radioactive nucleus and a cytoplasm with only large spheres. Control solutions were not treated with the Sendai and no fusion took place. Not only had cells been successfully reconstructed, they were living. Some had entered mitosis (cell division) after the fusion, indicating that the reconstructed cells are capable of proliferation.

In conclusion, say the scientists, this experiment "establishes the feasibility of constructing mixed cell types by combining karyoplasts and cytoplasts derived from parental cells of different types." □

Births declining among minorities

Historically blacks, American Indians, Mexican-Americans and the poor have borne substantially more children than urban whites. Two recent but separate studies to be published in the June 24 FAMILY PLANNING PERSPECTIVE, a quarterly of Planned Parenthood's Center for Family Planning Program Development, reveal that this trend has been waning for the past decade.

Using data from the U.S. Census, sociologist James A. Sweet of the University of Wisconsin analyzed the fertility declines of married women from various ethnic groups and compared them with those of urban whites. (Fertility in the United States has been declining for the overall American population since 1957.) Sweet found that fertility has dropped most rapidly for ethnic and low-income families. Whereas childbearing declined 27 percent for white urban women between 1960 and 1970, it declined 45 percent

for American Indians, 37 percent for blacks, and 30 percent for Mexican-Americans. These drops, according to Sweet, are "narrowing the fertility gap between minority groups and urban whites."

Sweet also examined birth rates between low-income and high-income groups among white city dwellers and observed that among women whose husbands earned less than $3,000 a year (in constant dollars), the fertility decline was more than 30 percent. For those families in which the husband's income is $4,000 or more, the decline was 26 percent. Furthermore the decline was especially rapid for third and higher-order births, suggesting that more people are limiting family size to two children.

Among the implications of these findings, Sweet says, are that "a smaller share of American children, and perhaps a substantially smaller share, will be growing up in impoverished settings with large numbers of siblings"; the total number of families in poverty should diminish; there is likely to be "a rather substantial increase in investment" in education for each child without increasing overall educational expenditures; and there may be widened opportunity for women in the labor market.

A second fertility study, based upon a different method of analysis and conducted by Frederick S. Jaffe, director of the Center for Family Planning Program Development, substantiates many of Sweet's findings. Jaffe also found that the fertility rate among poor single and married women is declining faster than for nonpoor, with the most rapid decline occurring among low-income nonwhites. Nevertheless, his study shows childbearing among the poor to be 53 percent higher than for nonpoor. □

Which came first: Clay or plants?

The chief constituent of clay is a crystalline substance called kaolinite. It has an irregular six-sided shape and contains alternating layers of gibbsite (aluminum hydroxide) and silica. Silicate crystals usually are formed in the presence of high temperatures and pressures, yet kaolinite occurs in a sedimentary substance, presumably formed without these conditions. Scientists had been successful in synthesizing kaolinite only in closed-reaction vessels under high temperature and pressure until Spanish investigators were able to crystallize it from an aqueous solution at room temperature in 1971.

John D. Hem and C. J. Lind, water chemists at the U.S. Geological Survey in Menlo Park, Calif., report a similar room-temperature synthesis of kaolinite in the June 14 SCIENCE, but with much better yield and with the addition of the yellow plant pigment quercetin.

In their system, quercetin was added to approximately neutral aqueous solutions containing silica and aluminum. After waiting from six to sixteen months, kaolinite crystals formed.

The work may shed light on the origin of clay crystals in nature, and also help other scientists fight water pollution, make aluminum and determine the evolutionary age of living things.

Clays tend to contribute aluminum and silicon into natural waterways. Clays also have the property of providing a sorption site for heavy metal pollutants in rivers. Heavy metals, such as lead, will travel along, sorbed to clay particles until separated out with the suspended solids during water purification. "One of the objects of our study of clay minerals is to determine, given a certain quantity of them, how much of a substance will adsorb to the clay," says Hem. This may lead to more efficient water purification and pollution control.

The successful use of quercetin may yield some evolutionary answers. Quercetin is one of the products formed during the decomposition of yellow leaves in the autumn. The fact that quercetin facilitates the formation of kaolinite crystals may mean that clay formation occurred after the evolution of plants. "Because clays tend to attract certain types of organic reactions, it has been suggested that perhaps clay surfaces played an important role in the evolution of lower forms of life," Hem says. Quercetin involvement may show that "clay didn't occur until a supply of organic materials was already available." This supposition may influence current dating systems, which link the ages of various types of rocks with the evolutionary ages of life forms.

In the newly derived Toth aluminum process, soon to be used by the Toth Aluminum Corp. of New Orleans, aluminum will be extracted from clay. This has not been done extensively in the past, but should result in a large savings of electricity during aluminum production. Understanding the possible mechanism for kaolinite synthesis in nature may give a better idea of where purer forms of clay can be found. "Where there has been little exposure to organic materials, as in the tropics or cold climates, rich clay deposits" may be less likely to occur, Hem says.

Bacteria's chemical decision-maker

When humans are confronted by a situation with a good side and a bad side, they wring their hands, think a lot, and try to decide whether the good outweighs the bad or vice versa. A report in the June 21 SCIENCE by University of Wisconsin biochemists Julius Adler and Wung-Wai Tso indicates that in the world of bacteria, organisms faced with approach-avoidance situations make their decisions automatically through a chemical "data processing system."

Study of the chemotactic responses (movement toward or away from chemicals) in bacteria has shot forward in the past three months, with reports by several researchers, including Howard Berg and David Koshland, appearing in major journals. Evidence has been presented that (1) bacteria such as *Escherichia coli* have a "memory," albeit short, that allows them to compare one chemical environment with another and choose the more favorable of the two, and (2) that *E. coli* flagella are caused to rotate in a counterclockwise direction when an attractant is present, propelling the cell toward the chemical, and that repellants cause the clockwise rotation of flagella, propelling it away from the offending chemicals.

Adler and Tso have now added information on bacterial decision making. They exposed *E. coli* to gradients of L-aspartate (a growth promoter and thus an attractant) and L-valine (a growth inhibitor and thus a repellant). When the concentration of the attractant and repellant is about equal, both positive and negative signals are sent to chemoreceptors. These send information to a "data processing system" that determines which signal is most effective. It then sends a message to the flagella to rotate one way or the other. The animal thus moves toward the chemical mixture or away from it.

This work, the researchers state, puts to rest some previous misconceptions about bacterial chemotaxis: one, that bacteria will always move toward the attractant, regardless of how much repellant is also present; two, that bacteria will always move away from a repellant regardless of how much attractant is present; and three, that when both are present, the bacteria can't make up their minds and just swim around confused.

Researchers are studying chemotaxis in bacteria because it is the simplest form of animal behavior known. Knowledge about it could provide clues to the basis of behavior in higher animals. □