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. □