ponent has eluded standard isolation procedures. Now Vinod K. Shah and Winston J. Brill of the University of Wisconsin have succeeded in teasing from the nitrogenase complex a string of amino acids about 1 percent the size of the enzyme. The surprising cofactor contains not only the metal molybdenum, but also many sulfide groups and iron atoms.

Although the cofactor itself cannot reduce nitrogen, it can repair mutant bacteria lacking that essential component. "The cofactor is like an engine of a car," Brill explains. "It won't run anywhere by itself."

Species differences seem to pose no barrier to the effectiveness of the cofactor, even though the isolated enzyme will not function in different species. Mutant bacteria of one type are made active by addition of the cofactor from any of a number of species with very different characteristics.

The reason that early isolation attempts have failed, Brill told a press conference, is that the cofactor is extremely unstable: Both oxygen and water knock out its activity. The researchers screened numerous solvents before discovering one, N-methylformamide, that preserves the cofactor's activity. Because the intact enzyme system is not harmed by oxygen or water Brill and Shah speculate that the protein core of the enzyme maintains a protective environment for the cofactor.

Cofactors to other enzymes that require molybdenum have also yielded to the new technique. The researchers were surprised to find quite different cofactors in different enzymes. Earlier genetic and biochemical results had suggested that all molybdenum-dependent enzymes share a common cofactor. The amino acid sequences of the cofactor are currently being analyzed. They may contain some unusual amino acids, Brill says.

An understanding of the cofactor and the enzyme that catalyzes biological nitrogen fixation should be an aid to chemists attempting to synthesize ammonia, Brill says. "They can get some idea of how a very efficient nitrogen-fixing system works."

Although other biologists are already transferring the genes for nitrogen-fixing enzymes between bacteria (SN: 8/27/77, p. 138), Newton believes that it will be necessary to understand the mechanisms of the operation at a molecular level before nitrogen fixation can be productively introduced into new crops. Bacterial or plant cells would not be able to handle all the ammonia that would suddenly be produced, he explains.

Besides being useful as a model for chemical nitrogen fixation, knowledge of the structure of this cofactor should be useful for understanding the role of molybdenum at the active site of nitrogenase, the role of ligands close to molybdenum in electron and photon transfer, and the catalytic mechanism of nitrogen fixation, Shan and Brill conclude. □

# IQ, culture and adopted children

Searching for the determinants of intelligence—be they genetic or environmental—is not a favorite pastime of psychologists. For one thing, any results from such studies are usually attacked. Conclusions leaning toward a genetic basis of intelligence are sharply criticized by environmentalists. Results favoring upbringing and surroundings as the major contributors to intelligence, are scored by geneticists. Beyond that, problems in defining intelligence, centering around the cross-cultural adequacy of current IQ measures, have made it difficult to establish solid, empirical data in the field.

Now, almost certain to fuel both sides of the controversy, comes an extensive study of intelligence and school achievement among 324 adopted and 375 "biological" children (living with their natural parents). The study results, presented last week at the American Psychological Association's annual meeting in San Francisco, give evidence that intelligence, as it is measured in the United States, is determined by both strong environmental and genetic components.

"In regard to hypotheses about genetic differences [in intelligence], this is a pretty important study," says Sandra Scarr, a developmental psychologist at Yale University. Scarr's research, performed in the Minneapolis area while she was a part of the University of Minnesota faculty, examined 130 black and interracial children who were adopted by middle-and upper-class white families and compared them to 143 biological children in the same families. Scarr also studied 194 adopted white children and measured them against 232 biological children from similar (again, white middle- and upper-class) families. The black children averaged seven years of age and their adoptive siblings ten, while the white adoptees and their biological counterparts ranged in age from 16 to 22 years. Both the black and white adoptees were born into severely deprived and disadvantaged environments before being put up for adoption. Scarr found that:

- All adoptees attained IQ scores 5 points to 15 points higher than would have been predicted had the children remained in their original, disadvantaged environments. In addition, the adopted black youngsters averaged in the top half of their class on school achievement tests; the average disadvantaged black child in the Twin Cities area usually scores between the 15th and 20th percentile, according to Scarr.
- Beyond those improvements, however, environmental factors apparently had little impact on the youngsters. This points to a definite "genetic component" in intelligence, says Scarr. She estimates that the genetic component accounts for around half, or perhaps more, of a person's IQ score.

The first finding shows dramatically that "there is an advantage in being brought up in a higher socioeconomic environment . . . a different culture," Scarr says. "Genetically average children are performing above average when brought up in an advantaged environment." The average "adjusted" IQ score for a black child in Minnesota is around 90, Scarr notes. The adoptees in her study attained average scores of 106 to 110. Almost identical improvements were registered by the white adoptees. (Adoptive parents IQ's averaged 116 to 119 in the two studies—in both cases, well above those of the parents who gave up the children for adoption.)

Scarr's results help document the importance of environmental factors, but there were two major findings indicating strong genetic determinants for intelligence. Despite the improved scores, adoptees still averaged about six points lower in IQ than the biological children of their adoptive parents; the adopted youngsters' intelligence measures did not appear to correspond to their adoptive educational and economic levels. The adoptees' IQs ranged from 75 to 150, but Scarr says those who scored highest were not necessarily those placed with the most affluent, well-educated parents. Some children adopted by skilled working-class families—at the lower end of the adoptive parents spectrum but still much more advantaged than the youngster's original parents—scored much higher than many of those placed in families headed by doctors, lawyers or other professionals, Scarr reports.

The performance of the biological children, though, did correlate with the IQ levels of their parents. That, combined with the slight but consistent score superiority of the biological youngsters, leads Scarr to conclude that "there are genetic differences." Beyond the basic reculturation of adoption, she says, "it is not justified to believe that all parents should raise their children as professionals would. We may be trying to create unnecessary homogeneity—it may not make any difference whether you take the child to a ballgame or to a play."

Scarr emphasizes that her results have practically nothing to do with race. In fact, she reports that the black and interracial adoptees scored slightly higher IQ readings than the white adoptees. "I'm not saying that black families are bad—the children we looked at never had a chance to live with their [real] parents, so it was not a question of shifting them from black to white upbringing." The problem, she says, is cultural rather than racial. And the crux of the problem lies with the school systems to which IQ tests are geared. In that context, she says, "white families do a better job of preparing youngsters for the system"—an observation that by no means justifies the systems—"but that's the way it is," says Scarr.

In the end, do the results of the study provide any practical clues to parents on how they should raise their adopted or biological children? "No one has a prescription on how to be a really good parent," Scarr says. "But you [should] provide a humane environment ... and provide what the child wants." □

# Ecology: Some historical perspective

Ecology, the study of living organisms in their environment, is a hot scientific discipline these days. Yet what the public, and even most members of the scientific community, fail to realize is that ecology is largely a product of the latter 20th century—a teenager compared to molecular biology; a child next to Mendelian genetics; a great, great grandchild beside the august sciences of mathematics and physics. Both scientists and society might keep this short lifespan in mind as they criticize ecology's limitations or ask its help in formulating environmental impact statements, saving dwindling natural resources, listing endangered species or in solving other complex life-environment problems.

This message was brought home last week at the annual meeting of the American Institute of Biological Sciences in East Lansing, Mich., at a symposium entitled "History of Ecology."

First off, the ancient Greeks tended to believe that living organisms are determined more by their biology than by their environment, as F. N. Egerton of the University of Wisconsin, Parkside, points out. For instance, the Greek philosophers Plato and Aristotle held that animals' reproductive abilities are determined by their anatomy and physiology rather than by their interactions with their physical environments or with each other. However, Hippocrates, a Greek physician and the father of medicine, did note the effects of celestial events on living organisms.

Still further conjecture about the impact of the environment on life emerged in subsequent centuries. A 17th century statistician stated that interactions among species regulate their numbers. The Dutch naturalist van Leeuwenhoek calculated the rate at which various animals could increase their numbers under specific conditions. The 18th century Swedish botanist Linnaeus believed that species are protected from extinction by niche diversity. The 19th century English naturalist Darwin believed that species must compete with each other for survival. Finally, 1891 saw one of the first references to ecology per se, and during the early years of the 20th century, the science of ecology gradually became an established science.

Yet this science was truly in an infant stage, R. P. McIntosh of the University of Notre Dame stresses. Ecology consisted mostly of field observations and descriptions of those observations. Only after 1950 or so did ecologists start testing hypotheses extensively. And only during the 1970s have ecologists become sophisticated enough to frequently formulate theories, or general principles, about living organisms in their environment. (Back in 1941, a young Yale ecologist, Raymond Lindeman, had trouble publishing one of the first ecological theories ever proposed in the journal ECOLOGY—a theory that has since become a classic in its field. Journal referees suggested that he gather more field research to support his theory and resubmit it 10 years later, reports R. E. Cook of Harvard University.)

The current trend among theoretical ecologists is to draw up a picture of the whole, say of a prairie, forest, tundra or other ecosystem, from field observations of its many parts. Ecologists may even use computers and math modeling to achieve such pictures or theoretical representations. Some of the more ambitious efforts along these lines were the International Biological Program biome studies, completed in 1974 (SN: 9/8/73, p. 156). But do such theoretical or mathematical depictions really correspond to how organisms behave in their environments? McIntosh suspects not, largely because such organisms are so dynamic and variable. "Physical entities are relatively homogeneous, but biological entities are more heterogeneous and tend to have a mind of their own," he asserts. Thus he doubts whether ecology will ever be able to draw up a set of rigid theories as mathematics and physics have done.

Other ecologists, however, believe that such modeling corresponds closely to reality, and some are even confident that someday they will be able to devise a general theory of how organisms interact in the world environment, a theory that can be used to predict how various changes might alter these interactions. □

# Antibiotics in animal feed: Bans planned

Since the discovery in the 1950s that antibiotics promote the growth of livestock, antibiotics in animal feeds have become a multimillion dollar industry and have undoubtedly helped feed the world's population. At the same time there has been a swell of evidence that antibiotics in animal feeds are helping bacteria in humans build resistance to antibiotics, a trend that might possibly result in vulnerability to deadly and once-conquered infectious diseases (SN: 9/18/76, p. 183).

The U.S. Food and Drug Administration has finally announced this week, on the basis of the above evidence, that it plans to ban the use in animal feeds of certain antibiotics that are also used to treat bacterial infections in humans.

The first ban would be against penicillin, which would mainly affect feed for 35 percent of the nation's swine and for 10 percent of its chickens and turkeys. Bans would then follow for tetracycline and other antibiotics routinely used in feed. The FDA would allow those antibiotics less likely to produce resistance to be substituted in animal feeds. The agency believes that the substitutes would be just as effective as the others in promoting livestock growth.

The FDA is allowing 30 days for comments on the proposed bans from antibiotic manufacturers and from agricultural and commercial interests affected by it. If the proposed FDA ban on penicillin is challenged in the courts, it could take a year to be implemented. □

# Pesticide watch

The U.S. Environmental Protection Agency will step up investigation of dibromochloropropane (DBCP) and ethylene dibromide (EDB), two pesticides linked with sterility and suspected of causing cancer. Dow Chemical Co., one of the two chief DBCP manufacturers, reports reduced or absent sperm counts in roughly half of its tested workers that were associated with the chemical's production. Shell Oil Co., the other firm, has yet to submit test data on its employees. Both companies have stopped production of the chemical. EPA is looking for data on farmworker exposures and hopes to measure whether DBCP is passed on to consumers as a plant residue. Meanwhile, the U.S. Food and Drug Administration is looking into whether the chemical is carried on to other parts of the food chain. □

# Italian satellite

SERIO, besides being Italian for Sirius, the "dog star," stands for Satellite Italiano Ricerca Industriale Orientata, or industrial-research-oriented Italian Satellite. And, like Sirius, it now has its place in the sky. Launched by NASA for the Italian government on Aug. 25, SERIO is Italy's first experimental communications satellite, designed to study radio propagation at frequencies above those of the increasingly crowded bands in common use.

From a position over the equator at 15°W, the probe will try out transmissions in the SHF (super-high frequency) bands from 12 to 18 gigahertz during the worst weather conditions it can find—rain, snow and fog. It is only one of several attempts (the Canadian satellite CTS-1 is another) to explore the possibilites of widening the available communications bands as satellite-borne telephone, video and data traffic grows by leaps and bounds. □