could not man revert to the cave and survive as once he did by berry picking? The thought ignores that, evolution being irrevocable, steps cannot be retraced in history. Mankind, Georgescu-Roegen believes, has become addicted to his "exosomatic" instruments, those organs which are part of his evolution but not part of his biological constitution. Man's exosomatic instruments, which economists call capital equipment, and which are the ultimate cause of the social conflict that distinguishes the human species (the advantage derived from their improvement became the basis of inequality between individuals and groups), are comforts that man will never give up.

How are we to preserve their share of the terrestrial dowry for future generations? "Standard" economists might suggest that the price mechanism will offset scarcities. But, says Georgescu-Roegen, prices are only a parochial expression of value unless everyone concerned can bid—and future generations are excluded from today's market, which is why oil, for example, still sells for the merest fraction of its true value. The only way to protect future generations from the present spasmic squandering of our energy bonanza is "by reeducating ourselves so as to feel some sympathy for our future fellow humans."

The monopoly of the present over future generations would be substantially reduced in an economy based primarily on the flow of solar energy. Such an economy would still need to tap the terrestrial dowry, especially for materials, and the depletion of these critical resources must therefore be rendered as small as possible. How is this to be accomplished? Georgescu-Roegen has proposed a "minimal bioeconomic program" which, though admittedly utopian, points in what he considers the right directions:

—Production of all instruments of war should be prohibited completely.

—With the productive forces thereby released, industrial nations should help the underdeveloped nations to arrive as quickly as possible at a good (but not luxurious) life.

—Mankind should gradually lower its population to a level that could be adequately fed only through organic agriculture, a burden that will fall most heavily on the underdeveloped nations.

—Until direct use of solar energy becomes a general convenience or controlled fusion is achieved, all waste of energy—by overheating, overcooling, overspeeding, and so forth—should be avoided, if necessary by regulation.

—Consumption for the sake of fashion, such as getting a new car each year, should be regarded as a bioeconomic crime; manufacturers should focus on durability, designing their products for long life and ease of repair.

"Will mankind listen to any program that implies a constriction of its addition to exosomatic comfort? Perhaps the destiny of man is to have a short, but fiery, exciting and extravagant life rather than a long, uneventful and vegetative existence. Let other species—the amoebas, for example—which have no spiritual ambitions, inherit an earth still bathed in plenty of sunshine."

Georgescu-Roegen's bioeconomic program, even if utopian, is a surprisingly practical platform for a man who has spent most of his academic life as a pure scholar. But Georgescu-Roegen has been through some very practical experiences. Born in Constanza, Romania, in 1906, he was turned toward mathematics by his father, a retired army officer. He won a government scholarship to study in Paris, and was advised to choose statistics, a specialty in short supply in Romania. His dissertation was on a method for discovering cycles in irregular phenomena. (He didn't apply it to business cycles, although that was the original inspiration, because of an intuition, which he later proved correct, that business cycles are not truly cyclical.) Georgescu-Roegen then studied in London under Karl Pearson, the founder of mathematical statistics, before returning to Romania where, at the age of 26, he obtained a professorial chair in statistics at Bucharest.

While in London he had applied for a Rockefeller fellowship to study with a program called the Harvard economic barometer. He took up the scholarship in 1934 only to discover on arrival that the barometer had perished long ago: it had issued, on the eve of the Black Tuesday that heralded the great stock exchange collapse, a public prediction that the economy was set fair. Instead, he studied with Joseph Schumpeter, the great economic theorist, and developed an interest in economics.

Despite Schumpeter's pleas, Georgescu-Roegen returned to Romania before World War II. He did statistical jobs for various ministries, acquired some reputation as an administrator, and after the war was appointed secretary-general of the armistice commission, the only Romanian

Briefing

NIH Institute Directors: One Gain, One Loss

The National Institutes of Health (NIH) has had its problems lately in recruiting people from the outside to take jobs as institute directors (*Science,* 3 October). The main impediment has been salary, which tops at $36,000 and is considerably less than senior medical people make in universities. But, where money is not an issue, the challenge of running an institute still has its appeal. No official announcement has been made yet, but next January David Scott, dean of the school of dentistry at Case-Western Reserve in Cleveland, will become director of the National Institute of Dental Research. Scott, whose research interests have been in crystallography and the ultrastructure of calcified tissues, spent 21 years at NIH as a commissioned officer in the Public Health Service before leaving for Cleveland in 1965. Now, he says, he would like to come back to Washington. Having worked both on the inside and on the outside of NIH, Scott is looking forward to the chance to tie his various experiences together. "I think it might be kind of fun. Good for me and good for them," he says. Scott's children are grown, and, even though he is taking a cut in pay to come back to NIH, Scott says that he is "fortunate that finances are not a big problem."

A couple of years ago, Norman Kretchmer said the same thing when he left a high-paying position as professor of pediatrics at Stanford to become director of the National Institute of Child Health and Human Development (NICHD). "I can live on $36,000 a year," he said when he arrived at NIH. Like Scott, he was not supporting a family of young college-bound children. What Kretchmer did not realize until recently was that he was giving up a lot in benefits as well as cash. This summer he was hospitalized for weeks after suffering a severe reaction to aspirin. He discovered that, had he been unable to return to work, he would have received very limited disability benefits because he had not been a federal employee for 5 years. One solution would have been to join the commissioned corps, where benefits are better, but for a number of reasons that was not possible in Kretchmer's case. He will resign as NICHD director, effective in about 8 months. After returning briefly to Stanford, he will move to New York as chairman of pediatrics at Mount Sinai.

—B.J.C.