Antonio Lazcano, Student of the Origin of Life

Young Mexican biologist says science is ship-wrecked in this country.

It's no secret that there are now bacteriological weapons that are much more terrible than even the atomic bomb. The industrialized countries have placed great importance recently on microbiological research and prioritized its application in the development of arms technology.

Nonetheless, science, just like art, always escapes from reductionism and utilitarianism. Microbiology, beyond its uses in weapons development, is also providing important new insights into the fascinating question of the origin of life and fresh, new approaches to understanding the many ecosystems now threatened by urban and industrial growth.

Microbiology in Mexico is contributing to solving problems related to health, the protection of endangered ecosystems, the utilization of natural resources and even the definition of our culture.

Antonio Lazcano, young Mexican biologist dedicated to the study of the origin of life, is convinced of the importance of microbiology for the country's development. He, like many other scientists in the country, is committed to supporting work in this field, despite the obstacles created by the economic crisis and the resulting lack of resources.

Lazcano worked with Oparin (1896-1980), a Soviet scientist reknown for his theory on the origin of life and a pioneer of modern biology. He has also collaborated with other distinguished scientists in the field, including Lynn Margulis, one of the most important microbiologists in the U.S., best known for her work on the evolution of cells, and Juan Oro, a Catalonian working at the University of Houston on NASA projects related to the origin of life on earth and other parts of the universe.

Despite the many opportunities offered him through his international experience, Lazcano has chosen to stay in Mexico. He will not become a part of the "brain-drain", as he describes it, "the emigration of scientists to the First World due to better job offers and working conditions."

Lazcano has his laboratory at the National School of Biological Sciencies, which was closed for 14 months after being seriously damaged in the 1985 earthquake. He is both a teacher and a researcher, in a country where these two activities are often unrelated and where bacterial microbiology is still not fully appreciated.

Lazcano's team of biologists is working to recover the tradition begun by Alfonso Herrera, an early 20th century Mexican scientist who developed an original theory on microorganisms, based on some 40 years of research. Herrera developed an integrative theory that sought a physico-chemical explanation for biological, social, psychological and other phenomenae. For Antonio Lazcano, the recovery of Herrera's work represents an important contribution to the history of science in Mexico.

Another part of their work also deals with the microbial mats found in the country's different ecosystems. "We have discovered that microbial mats are much more abundant than what we had thought. We want to understand the nature of the ecological relationships in those communities and extrapolate the findings to the study of fossil residues.* All of us who work on the early evolution of life believe that the present-day microbial mats are models of past ones."

Their third project, and Lazcano's specialty, is to understand how the first proteins were formed, using the study of ribonucleic acid. "Together with students at the National Autnomous University (UNAM) and the National Polytechnical Institute, we have already identified the first protein. Living beings have used it for more than 3.5 billion years. This finding will help us to establish an evolutionary marker and develop phylogenetic trees.** We will get an idea of the evolutionary relationship between quite separate groups of organisms, which we wouldn't be able to do otherwise. Some people have asked if anyone is going to pay for this. That's absurd."

Antonio's enthusiasm for his research has not diminished despite the scarcity of resources; he continues to explain his work, holding a small fragment of material from the Guerrero Negro swamps in Baja California. "See this rock? This green color is from a kind of bacteria. They are the present day representatives of the first organisms that freed oxygen on the earth. Plants and animals owe their existence to the grandparents of these bacteria. This red layer indicates the presence of another bacteria that lets off sulfuretted acid, indispensible for the formation of amino acids that all of us need. The integration of all these organisms is what makes life on earth possible. We believe that for about 3 billion years the only life on earth was bacterial. That gives us an idea of their importance."

Two decades ago, the study of bacteria was simply aimed at being able to prevent their pathogenic effects. Today scientists consider bacteria to be a special kingdom among living things, the same category given to plants and animals, and their study has taken on important new dimensions.

In addition, modern food processing and packing techniques, including conserving, canning, dehydration and pasteurization, have all but eliminated the danger of contamination from even a single bacteria. But very few people know that the number of bacteria in our mouth is greater than the total number of people who have ever lived on the earth; or that in a small scratch of the gum, there can be 109 bacteria in each square centimeter of tissue.

"Microbiology," explains Lazcano, "has become a basic field from an agricultural point of view. Bacteria cycle elements such as nitrogen, oxygen and sulfur, which are essential for crops. It's become an indispensable tool in genetic engineering. Usually when we think about bacteria, we think about infections. But we don't think very much about the fact that we descended from bacteria. We are really highly inter-related bacterial communities."

* The microbial mats in question are the contemporary equivalents of the fossil micro-organism communities that dominated the earth for some 2.5 billion years.

** That is, the marker will allow them to follow the evolutionary past of groups of organisms, and even some viruses, and to develop detailed evolutionary histories of the interrelationships between them.

The study of the early forms of life has few direct applications to industry or agriculture. In Mexico, there is a strong belief that the country's many needs and problems demand a very strong emphasis on applied science research. Antonio explains, "I can't expect immediate, practical fruits from my work. But it would be a mistake to only support projects that can be quickly applied. The division between pure science and applied science is a false dichotomy, an unnecessary divorce that should be avoided. Some mathematical techniques were considered to be absurd just a few years ago. Now it turns out that they are indispensible for developing new information and computer technologies."

Nonetheless, the distinction between basic and applied science is less and less an issue in Mexico. Now, the question is whether any kind of scientific research will be able to survive.

"I think there's a very uneven distribution of resources," states Antonio Lazcano. "University schools, even though they integrate teaching and research, have only a minimum of equipment, libraries, full-time faculty, etc. compared to specific Mexican research centers like the ones for Nitrogen Fixation, Genetic Engineering, Physics, Astronomy or Mathematics. It is also true that there are a number of researchers, who because of their age, experience or membership in some professional association simply don't think about the crisis because it hasn't meant a significant decline in their own resources. This isn't the responsibility of those privileged research centers, but rather a reflection of the country's general structure."

"I think," he adds "that Mexico never prepared for the crisis. There was never any collective spirit to suggest creating huge libraries for everyone's use, for lots of people and institutions. To the contrary, we're now having to cancel subscriptions to journals, can't buy books, and that isolates us from scientific production. It is a serious problem since our own capacity to develop new knowledge is truly less."

From Lazcano's point of view, science is shipwrecked in Mexico. The research budget in the country is now less than the minimum recommended by UNESCO. The national productive plant depends on technological patents developed in other countries. Educational possibilities are more and more limited. "I think the crisis is producing a contraction in the Mexican educational system, in its scientific apparatus."

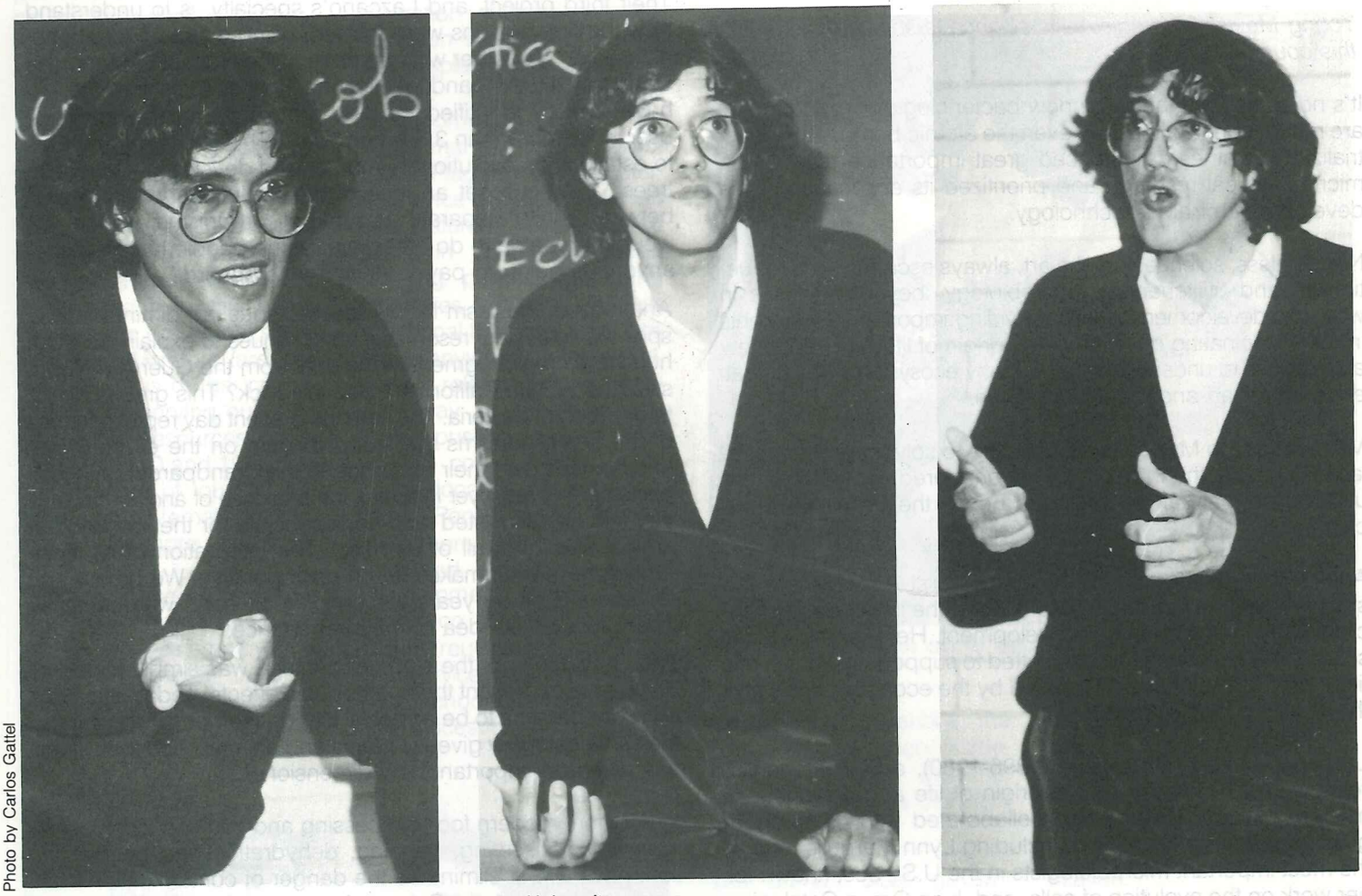

Photo by Carlos Gattel

Antonio Lazcano. Teaching at the National Autonomous University

This situation has become a national concern. "Our natural resources are under-utilized," he points out. "We don't know our own flora, our fauna, the species of microorganism that exist or our soil systems; we don't even know all there is to know about our country. This is being translated into serious disasters. Mexico's jungles are being lost at a frightening pace, and there are other grave problems like malnutrition, pollution, the lack of alternative energy sources other than oil, all of which have a direct impact on national development.

"I believe that the Mexican government should support research. And Mexican scientists have the obligation to demonstrate that the development of a scientific tradition is indispensible for creating our own cultural consciousness. Schools, research centers and universities are essential components of our nationality." ★

Jorge Luis Sierra Guzmán