

# The public university in Mexico and science for development

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**W**e are all aware that many of the countries where the great ancient civilizations flourished—and, hence, science and technology—such as the Egyptian, Persian, Indian and Chinese, are currently part of the so-called Third World and that some of them are plunged in poverty.

We shall not forget that it was in these regions where fire was first used rationally and the compass invented; animals were domesticated, farming started, metals exploited, and writing, paper, the decimal system, calculus and gunpowder were created; just to mention some of their achievements.

Nowadays, the more than 120 countries comprising the Third World, with more than two thirds of the world population, import 99% of the scientific and technological knowledge they need, and contribute only 2% to total world spending on science and technology.

The remaining 98% is covered by the developed countries, some of which, in the middle of the last century, had social and economic indicators not so different from those considered today as typical of underdevelopment.

Recent bibliographic studies have revealed that all the less developed countries together generate only 2% of the total world scientific production and all the papers published by them also represent only 2% of the world total. Therefore, we can say that underdeveloped countries invest and generate only 2% of the world's effort dedicated to science and technology.

Some scholars, and politicians as well, underestimate these data. They center their expectations for development only on free trade, markets and investment by rich countries in the land of the poor. They demand from science immediate



*Training human resources require top-level universities.*

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revenues, confusing it, in the best of cases, with technology, and ignoring the fact that without its own science, a country cannot even select, adapt, or consume rationally, the technological products being imported.

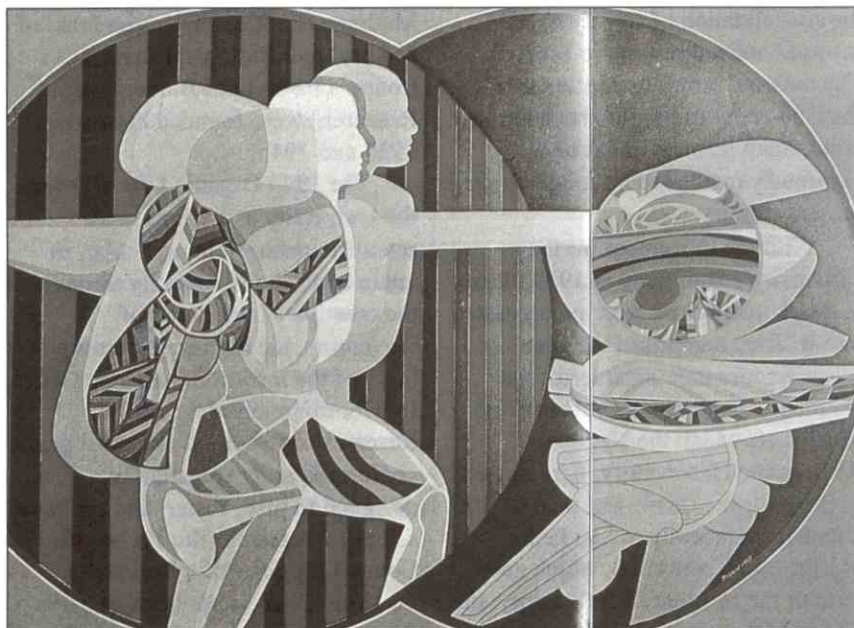
Scientific progress is achieved as part of the long-term impulse given to culture in general. As science ceased to be an individual activity and changed into a socially institutionalized one, universities have played a fundamental role. To illustrate the case of Mexico I shall present a brief historical overview.

In 1543, when Copernicus broke away from one of the most deeply-rooted philosophical conceptions of the Middle Ages by placing the sun in the center of our planetary system and displacing the privileged role of earth in the universe, in our territory a rich tradition, a social and efficient organization and an economic system that responded to the needs of the dominant social structure was being destroyed.

Later on, in 1610, when Galileo proved the Copernican theory by discovering, with his own invented telescope, four of the satellites of Jupiter, and almost simultaneously Kepler established his laws on the movement of the planets, and Bacon explicitly formulated the bases of scientific method and the theory of the inductive procedure, New Spain was ruled by obscurantists, and sustained on a blind and irrational obedience to a distant and decadent monarchy.

At the end of the 17th century, the fundamental laws of physics had already been established in Europe and Newton had published his *Principia Mathematica*, while here we were still suffering from a total lack of interest on the part of the Spanish throne to promote the development of its most important colony.

The colonial period is not the only one that can be considered as lost in regard to our scientific development. At the beginning of the last century,



*Copernicus displaced the privileged role of earth in the universe. Painting by Arnold Belkin.*

when Mexico had just achieved its independence, the countries now considered as developed had already established sound institutional structures and were ready for great scientific achievements. The potential interaction between scientific findings and their technological applications fostered the development of high-level research groups, since it was clearly understood that new scientific discoveries provided a good opportunity to produce substantial revenues through their industrial impact.

It was also clear that training human resources for politics, public administration, and industry required top-level universities, that their faculties should be made up of the most distinguished personalities in the sciences and the humanities, and that providing them with the necessary funding was a basic component of national policy. There is no doubt that European and, later on, the US universities were well cared for by the State, and were considered as privileged institutions where the new generations were to be educated, as the future depended on their preparation and talent.

Here, on the contrary, the reluctance of the Royal and Pontifical University to exert its influence against the independence movement of 1810 provoked dispersion of students and teachers by the Spanish Viceregal Government, and the university facilities were turned into military headquarters. A few years later, during the independence period, President Gómez Farías issued the decree abolishing the aforementioned university, creating instead several higher-education establishments.

The following decades were full of upsetting events for our university. It was reestablished by Santana in 1834, but Comonfort closed it in 1857; reopened a couple of years later by Zuloaga, only to be closed again in 1861 by Juárez; the French interventionists opened it again, and finally Maximilian closed it anew in 1865. It is clear from these events that the 19th century was not favorable for our scientific development.

Shortly before the Mexican revolution of 1910 the constituent law of the National University of Mexico was issued. It gave form to the institution and, from then on, allowed

the consolidation of science as an institutionalized activity in Mexico. The national scientific leadership of the University of Mexico began at that point. Such leadership has been vigorously maintained throughout the present century.

With the movement for the University's autonomy in 1929, three research institutions were incorporated into it. They comprised the first scientific research institutes of the National Autonomous University of Mexico (*UNAM*): the National Astronomic Observatory, first located in Chapultepec Castle and then in Tacubaya (currently in San Pedro Mártir, Baja California), which gave birth to the Institute of Astronomy; the General Directorate for Biological Affairs, located in the *Casa del Lago* (House on the Lake, Chapultepec) which included the Botanical Garden, giving rise to the Institute of Biology; and the National Geological Institute, currently the National Museum of Geology, the forerunner of the Institute of Geology.

In 1939, an outstanding group of Spanish refugees arrived in Mexico. Among them was a group of scientists who exerted a fundamental impact on the development of Mexican science. Recently, *UNAM* edited a publication commemorating the 50th anniversary of the Spanish exile. However, I would like to stress that three of the six Rectors of Spanish universities arriving in Mexico were scientists: the physicist Blas Cabrera and the chemist José Giral, who were Rectors in Madrid, and the physiologist José Puche who was a Rector in Valencia. Mathematics, biology, chemistry, physics and medicine received a great impact thanks to the intellectual grafting provided by these Spanish academicians.

The *UNAM* Faculty of Sciences was also founded in 1939. The previous year saw the birth of the Institutes of Geography and Physics, while the Institutes of Chemistry,

Mathematics, Geophysics and that of Medical and Biological Studies (today's Institute of Biomedical Research) were founded between 1939 and 1945.

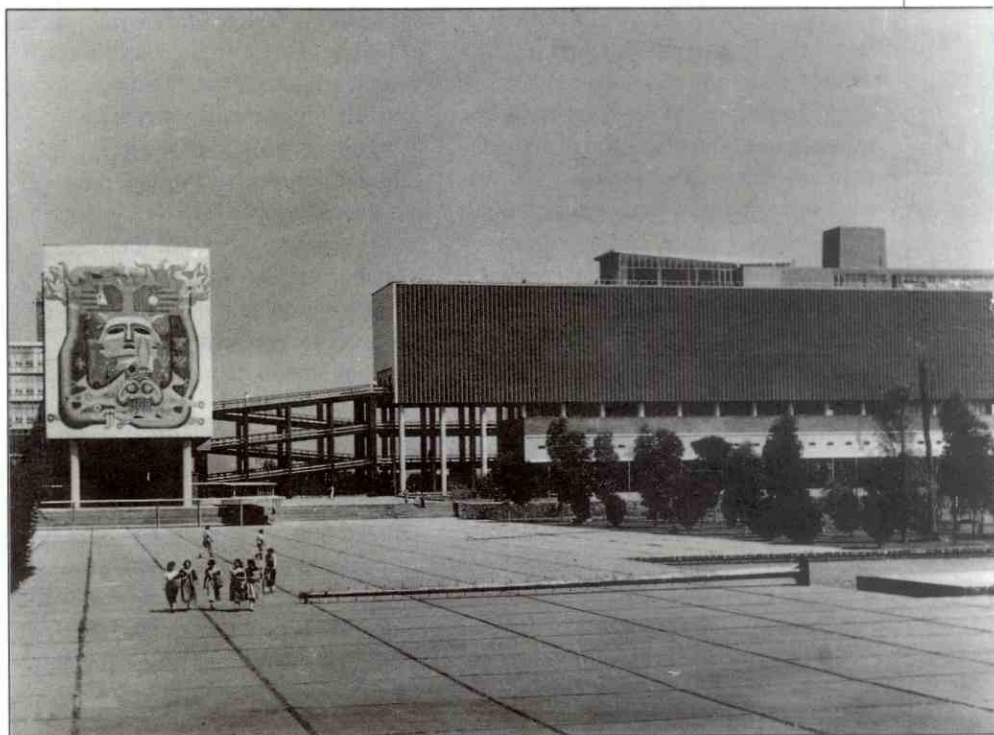
The 1944 Organic Law allowed the University as a whole, and scientific research in particular, to attain institutional stability through the creation of the Board of Governors, the highest governing body of the institution, and the Office for Coordination of Scientific Research together with the first peer-conformed body specifically designed to plan, foster, and evaluate scientific research (the Technical Council for Scientific Research).

This Council has been decisive for the development of science in Mexico, both within and outside the *UNAM*. The Academy for Scientific Research, the National Council for Science and Technology (CONACYT), the National System of Researchers, and the Science Advisory Board to the Presidency of Mexico have all been influenced in

their conception, development, and conformation by the *UNAM*'s Technical Council of Scientific Research.

Almost parallel to the consolidation of the scientific structure at the *UNAM*, and resulting also from the stimuli provided by the Spanish refugees, firm steps were taken, particularly in medicine, to consolidate scientific programs. Noteworthy was the foundation of the National Institute of Cardiology in 1944, which was not only significant for the development of this medical specialty, but was also decisive for the advancement of various biomedical research areas such as physiology and pharmacology.

The leadership of Ignacio Chávez was the milestone for the Institute, which he founded and directed for so many years, creating within it specific facilities for scientific development. The recruitment of Arturo Rosenblueth, formerly of Harvard, to the Institute, was also fundamental. The association of Rosenblueth with the well-known



Faculty of Medicine of the National University of Mexico.



David Alfaro Siqueiros, *The apology of science's future triumph over cancer* (detail).

mathematician Norbert Wiener gave birth to cybernetics.

Arturo Rosenblueth was for several years the Mexican scientist with the greatest international recognition. For two decades, his laboratory was one of the most important pillars of scientific development in this country. In 1962 the Center for Research and Advanced Studies of the National Polytechnical Institute was founded under his leadership, and is doubtless one of the most solid scientific institutions in presentday Mexico.

In 1952 the *UNAM's* new campus at University City was inaugurated. At that time, the center for the nation's scientific activity was an imposing building known as the Tower of Sciences. The move to the new facilities coincided with the designation of Nabor Carrillo as Rector. He had been the Dean of Sciences and had created, in 1954, the

position of full-time investigator. That is, the professional researcher; thus the full-time scientist in this country was born at *UNAM* only 39 years ago.

It was therefore during the second half of this century that Mexico finally reached its first scientific research achievements of international projection: at the *UNAM* with its research centers and institutes and, on a more circumscribed scale, at the National Institute of Cardiology.

In late 1972, Guillermo Soberón became the Rector of the University. He too had formerly been Dean of Sciences, and as such, had faced intelligently the conceptual problem posed by the foundation of CONACYT at the end of 1970 and its relation with the research system formed by *UNAM's* scientific research institutes and centers.

Soberón successfully promoted actions to prevent CONACYT from affecting —through its “priority

programs”— the scientific freedom prevailing at the *UNAM*. The greater experience and scientific tradition of the University allowed him to act efficiently and to formulate an institutional scientific and technological development program, which, among other effects, included internal planning within the research institutes and centers, and provided more structure to the coordinating tasks exerted by the Technical Council.

He also fostered the construction of new facilities for scientific research which not only changed the physical appearance of the university research system, but the new buildings were planned according to specific needs, overriding the old-fashioned and no longer functional concept of the Tower of Sciences.

The mature, strict, but at the same time open and progressive, policy of the *UNAM's* Coordinating Office for Scientific Research has allowed the



*In the colonial period our scientific development was lost. Painting by Diego Rivera.*

development of new scientific centers outside of Mexico City. The Center for Nitrogen Fixation and the Institute for Biotechnology, both in Cuernavaca, Morelos, constitute the most successful models for the decentralization of research in our country.

It has now been well documented that around 50% of all Mexican scientific research is carried out at the UNAM. However, the figures fluctuate; for example, in astronomy it is almost 100%; in physics around 80%; in biomedicine approximately 65%. The fact is that the UNAM is the only institution that has cultivated science in Mexico over the last 60 years, and that has systematically studied the nature of our land and our society.

UNAM researchers are dedicated to a great extent to the study of the conditions of our country: they study our soil and our subsoil, and have drawn up the National Geological Chart and the National Geographic Atlas among others. UNAM manages the National Seismologic Service and owns the two oceanographic vessels that systematically study the economic zones of the Mexican

seas, both on the Pacific coast and in the Gulf of Mexico; in addition to which it manages the National Mareographic Network.

UNAM conducts all the research projects at the National Center for Disaster Prevention, and is in charge of studying and protecting the vast biological diversity of our country. UNAM manages the National Herbarium, the Botanical Garden of Mexico, and the most important biological and paleontological collections in Latin America.

Unquestionably, this public university is the cornerstone of Mexican science. But if we are to consider science as part of culture, we cannot overlook the fact that the UNAM also houses the National Library, sponsors the best philharmonic orchestra in the country, and its activities in the sphere of theater, dance, concerts and literature are at least as diverse and prestigious as those of the National Institute for Fine Arts.

I have been referring to the UNAM as the paradigm of the public university; but actually we cannot speak of the Mexican public university as if it were unique or a group of homogeneous institutions. Only the biological diversity of our country surpasses that of our public universities. Some have the best of the aforementioned attributes; but others have little to offer. Here is where the need for academic and administrative evaluations arises, as well as serious consideration of whether students, according to their possibilities, should contribute to protecting their institutional heritage.

In Mexico, science and public higher education have been and still are closely linked. There is little participation by the private sector in national scientific development, either through educational institutions or enterprises. If Mexican science is to survive, the contribution of private investment in science and technology has to increase, and for this to happen

it is necessary to induce in society a real awareness of the importance of the continuation of research activities for future development.

Let us remember that Mexico will enter the next century with more than 100 million inhabitants, and that almost half of them will live in cities of more than a million people. Prospectively, lack of adequate housing and sanitation can be anticipated as well as the urgent need to generate a million and a half new jobs per year. In this context, we must anticipate forthcoming problems, propose possible solutions, and be very precise as to what science can offer and what it cannot promise.

The future of a society depends on the concern of one generation for the next. The future of Mexican science depends, to a large extent, on the capacity of the UNAM to adapt, as a public institution, in a changing country.

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