Migration of Scientists from Latin America

The causes of the migration of Latin-American scientists are analyzed, and some remedies are proposed.

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During the past decade, many Latin-American scientists have left their native countries to settle abroad (*1*). Although their absolute number is small as compared with the number of European scientists who have emigrated, it represents a sizable fluctuation in the tiny "pool" of Latin-American scientific manpower.

The innumerable current proposals in explanation of the European brain drain cannot be applied to Latin America, where conditions are entirely different. The word *exodus* would be misleading: it is not usually applied to people who get dismissed from their jobs or are expelled by brute force.

This article deals almost exclusively with the field of physics—the field with which I am most familiar—and it refers mainly to the situation in Brazil. However, discussions with my colleagues have led me to believe that many problems described here exist in other Latin-American countries, and in other fields of science.

The number of scientists who have left Brazil in recent years is of the order of a hundred; for Argentina, the number is comparable. Insofar as physics is concerned, I would estimate that about 20 percent of all physicists whose training enabled them to look for employment abroad have migrated.

The implications of these figures become even more startling when we realize that they often represent entire research groups, originating from some of the best centers, which were left deserted by their departure. Complete lines of investigation, and even whole institutes and universities, were destroyed. Many years of effort and considerable investments were wasted.

The conditions that led to these results remain unchanged in most cases. Thus, the losses already experienced, with the corresponding curtailment in the training of new scientists, are compounded by the threat of future migrations. Perhaps some governments are beginning to realize the gravity of this situation, but no effective measures to cope with it have been undertaken.

The main factors responsible for the migration are analyzed in the next section; in the concluding section I discuss some measures that might contribute toward a solution of the problem.

Causes of the Migration

In order to understand the reasons for the migration of scientists, one must gain some acquaintance with the typical working conditions that they have to face in Latin America.

Latin-American universities. A typical Latin-American university consists of a group of disjoint schools, set up for the express purpose of granting professional degrees. Most of the degrees granted are in nontechnical subjects, such as law or letters.

Professors are so poorly paid that most of them have to hold one or more outside jobs in order to earn a living. They spend only a small fraction of their time at the university, barely enough for teaching their classes. A few rare individuals, usually ill-regarded by the administration as well as by many of their colleagues, try to devote themselves entirely to research and teaching. Let us consider some of the problems they have to face.

1) Truly full-time positions do not exist in most Latin-American universities (although the name sometimes does). The battle to introduce them began more than 20 years ago, but little ground has been gained so far. It is still not widely recognized in Latin America that part-time jobs do not produce effective teaching or research.

Even an allegedly nominal extra position, such as that of government consultant, may be incompatible with full-time teaching or research if the scientist is critically dependent upon the extra position for his income. The salary for a full-time position should enable him to live decently and support his family, without having to worry about how to make ends meet, or having to depend on political expediency for accumulating extra jobs.

Delays of as much as several months in making salary payments are not uncommon in Latin-American universities. Ravaging rates of inflation, budget cuts, and salary freezes are ever-present threats or harsh realities. For those whose salary is their only source of income, these factors destroy all confidence in "full-time" positions, forcing the individual to look for other solutions.

2) Latin-American universities are generally encumbered with an archaic structure, patterned, in some respects, upon that of European universities but without the benefit of the European scholarly tradition. Let us take the example of Brazil.

There are about 40 universities in Brazil, more than half of which are federal or state universities; the remainder are mostly Catholic universities. Private endowments are almost nonexistent.

Theoretically, federal and state universities are autonomous. In practice, however, they have no financial autonomy; they are entirely supported by government funds. This makes them subject not only to government pressures but also to economy measures, which often lead to substantial cuts in their appropriations.

The teaching of basic subjects is not centralized; thus, for example, the School of Medicine, of Engineering, of Science, and of Pharmacy may each have its own chemistry department, self-contained and impervious to communication with the others. This leads to a proliferation of undernourished departments and to a useless multiplica-

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tion of labor and expense. Efforts toward unification are viewed with suspicion, as an infringement on acquired privileges.

Each department, in turn, can be subdivided into autonomous chairs, dominated by all-powerful professors, who are granted, besides tenure, complete monopoly of the discipline in question: only one full professor can be appointed in each subject. This gives the professor complete control over academic career opportunities for younger people in his field.

The main academic positions are filled by means of contests, involving various examinations and public tests. In theory, this system is supposed to prevent protectionism and to ensure that the fittest candidate will be chosen; in practice, it has often led to the opposite result.

Very few universities offer graduate courses, and most such courses are of recent creation. The number of doctoral degrees awarded is extremely small.

Key positions in the present university structure are often held by the opponents of any true university reform. Ironically, these are also the people who are entrusted with the task of proposing reforms, and the results are predictable.

3) The Brazilian educational system has been compared with a huge pyramid: less than 70 percent of the 7- to 11-year-olds attend elementary schools; less than 20 percent of the 12- to 18-year-olds attend high schools; and less than 2 percent of the 19- to 25-year-olds are enrolled in colleges and universities (*2*) (as opposed to more than 40 percent in the United States). The reasons are primarily economic: most high schools charge high tuition that few people can afford. Less than 10 percent of all college students come from low-income families, and such families constitute about 70 percent of the total population. The number of places available in the universities is about half the number of candidates; each year a large number of students who have passed the entrance examinations cannot find places.

These conditions, among others, have led to protest movements by Brazilian students. Their demands for a reform of the university structure and a very substantial increase in the educational budget are entirely justified. Unfortunately, these demands are often coupled with other, irrational demands, and student pressures may well become a major additional instability factor. The violent repressive measures that are being taken by the present regime can only lead to a more explosive situation.

4) In Latin America the main characteristics of resources for research are their insufficiency and their irregularity. Curiously enough, the most costly items of equipment, such as particle accelerators, seem to be the easiest to get. They may be donated by foreign foundations or institutes, and even the government may be willing to supply them for reasons of prestige. On the other hand, funds for regular maintenance expenses, which represent a significant fraction of the cost of the apparatus, are much harder to obtain.

It is equally difficult to get funds for purchasing more conventional equipment, not to mention the routine supplies required for the upkeep of a laboratory. Funds for smaller expenditures are even harder to get. Typical examples are grants for libraries, publication charges, seminars, travel in the home country and abroad, and participation in scientific meetings. All these are of the highest importance in helping to overcome the isolation of a scientist working in an underdeveloped country. They require small but flexible grants, that may be used without bureaucratic hindrances and delays. In most Latin-American scientific libraries, the collections of scientific periodicals show gaps (several volumes missing) that reflect the fluctuations in available funds.

Another consequence of these fluctuations is the fact that a scientist cannot make any long-term plans, as he does not know how much money he can count on for the following year (or, often, even for the current year). Funds already promised are not granted; those already granted may still be cut. Payments are made only after great delays, which make appropriate utilization of the money very difficult. The efforts required to raise and collect funds may consume more time than is left for making use of them.

Importation of scientific equipment may be hampered by customs or bureaucratic restrictions, precious time being wasted and experiments delayed, when international competition requires ever greater speed in the performance of the experiments.

Latin-American scientists have to cope with a lack of resources in many other sectors. Competent technical and administrative personnel are extremely scarce, especially as the salaries that can be offered are not at all attractive. Thus, the researcher is forced to waste his time in the performance of tasks that he would not have to do were skilled help available.

Telephone and postal services are unbelievably bad. For these reasons and many others, a researcher's efficiency is reduced to a small fraction of what it would be in more developed countries.

5) Foreign scientists have played a major role in the implantation of research groups in Latin America. Physicists like Gleb Wataghin, Richard Feynman, and David Bohm in Brazil, Richard Gans in Argentina, and Guido Beck in both countries have made basic contributions to the development of research groups in physics. Such contributions require a long stay, under favorable conditions. Short visits may benefit mature scientists, but they do not usually lead to the training of new ones.

In general, foreign scientists are not allowed to occupy permanent positions in the universities unless they become naturalized. Salary restrictions make it very hard to hire them unless they are paid by an international organization. On several occasions administrators have shown, by their lack of support and their unsympathetic behavior, that they do not understand the important role played by foreign visitors.

Scientists and industry. Almost no scientists are employed by industry in Latin America. Most industries limit themselves to the duplication of products designed abroad. They are not only not interested in having locally based research and development but sometimes are even explicitly discouraged from having such activities by the foreign companies of which they are subsidiaries. Not only must the Latin-American country pay tribute in the form of royalties, but also this policy prevents the training of specialists in modern industrial techniques.

This lack of stimulation from industry has led to a corresponding lack of interest by Latin-American universities in producing scientists who specialize in applied research. A symptom of the situation is the complete absence of private support and endowments for universities and scientific institutes.

To change the present situation, a judicious government policy seems to be required. State-owned industries should provide the example, by setting up their own research laboratories; at the same time, private industrial research should be encouraged. Taxation

of royalties for reinvestment in local research has also been suggested.

Disrespect for scientific work. Several of the above-mentioned shortcomings can be overcome only through development of the country as a whole.

Scientists who work in underdeveloped countries are usually well aware of the disadvantages of their situation; they know that their productivity falls far below their potentialities, which could be fully developed abroad. Nevertheless, most of the scientists who migrated had been working for many years in their native countries, and they would probably have remained there had it not been for something else. They found a very strong compensation in the feeling that their work was of great relevance to their country. This feeling, hard to find in more developed countries (where the loss of a few scientists might make no noticeable difference), can compensate for many frustrations. The basic factor responsible for the migration of scientists was the fact that this compensation ceased to exist. Instead of supporting their work, government authorities showed complete indifference toward its fate, when they did not actively engage in its destruction. Their attitude indicated an utter disregard for scientific work.

The most flagrant cases were in Brazil and in Argentina. In Brazil, during the Goulart administration, the annual rate of inflation reached almost 100 percent. In several institutes the lack of appropriate budget readjustments led to drastic reductions of the available funds, making it impossible to maintain full-time salaries. As a consequence, several research groups were dissolved and several scientists had to migrate.

Government authorities and agencies responsible for supporting research were alerted many times to the gravity of this situation, but they took no action to save the institutes whose survival was threatened. The amounts required were quite modest, much less than many unproductive expenditures that were then being made.

A good illustration is provided by the Brazilian Center for Physics Research. Founded in 1949, as a private institute, it soon became almost entirely dependent on federal grants, due to the lack of private support. Various successive governments supplied funds, not always in adequate measure but at least sufficient to enable the Center to survive, with passable working conditions. In 14 years of work, based upon the dedication and effort of pioneers, the largest theoretical physics group to date in Latin America was developed, attaining the level of a good department in foreign universities.

The inflation, coupled with the refusal by the Goulart administration to increase federal subsidies accordingly, decreased salaries to the extent that a full professor earned less than $100 per month. This made it impossible for him to continue full-time work, and to accept the responsibility for training young people when there were no foreseeable prospects for their future. The group dissolved, and several of its members migrated. The effort of 14 years was destroyed in less than a year, with no repercussions within the country.

The Goulart administration, which had remained a passive spectator when confronted with the destruction of scientific institutes, was succeeded by the Castelo Branco administration, which took an active part in the destruction. An avalanche of political persecutions was unleashed in many universities and institutes, where military "committees of inquiry" were installed, often subjecting professors to degrading treatment.

Many scientists who had nothing to do with politics were interrogated and arrested. Several were dismissed from their jobs. "Colleagues" who had always been bothered by the presence of research-minded people in their midst hastened to denounce them as "subversive." In several institutes the climate of terror and suspicion rendered all research activity impossible. As a result, many scientists left the country.

The most serious persecutions took place at the University of Brasilia. Founded in 1962, the university was the first one in Brazil to be designed with a modern organizational structure. Some of the top specialists in the country were invited to direct the institutes.

Soon after taking power, the Castelo Branco government intervened in the affairs of the university. The campus was occupied by military troops. A new rector was appointed; he succeeded in keeping the university functioning for another year. However, by direct order from the government, new attempts to end the autonomy of the university were made. The rector was replaced by another, whose mission, apparently, was to liquidate the university. This objective was accomplished soon enough, with the resignation of almost the whole faculty. Many decided to migrate, including the coordinator of scientific institutes, who had spent many years in Europe, and whose attempt to return to his country cost him his former permanent position at the European Center for Nuclear Research.

A similar intervention, on a still larger scale, took place in Argentina. Soon after the rise to power of the Onganía government, the University of Buenos Aires issued a proclamation protesting the disruption of constitutional order. In my opinion it was a mistake to issue such a proclamation officially, in the name of the university, rather than in the name of the people who signed it, as individual citizens with a university affiliation. However, this did not by any means justify the ensuing government reaction. The government intervened in the affairs of the university, and a police raid on the campus was ordered, which led to violence and brutality against several professors. Not even foreign visitors were spared. There was also intervention in other universities.

As a consequence of these events, a large number of scientists left the country. The University of Buenos Aires physics department, which had a faculty of almost 80 people, was virtually destroyed. Only 2 out of 14 professors decided to stay. Once again, more than 10 years' work, representing the efforts of many researchers and considerable investment, was wasted.

The latest large-scale government intervention has just taken place in Brazil. Invoking the exceptional powers he assumed last December, President Costa e Silva issued a decree at the end of February regulating "disciplinary infractions" in all Brazilian schools, public or private, at all levels, from elementary schools to universities. Faculty members found guilty of such infractions, which include taking part in any movement leading to a strike or demonstration or "possession of subversive materials" (*3*), are summarily dismissed and cannot hold any other educational position for 5 years. For students, the penalty is suspension for 3 years.

Charges can be brought against a faculty member by any person. The director of the school must then institute summary proceedings, to be concluded within 20 days. The accused is immediately suspended from his functions and has 48 hours to prepare his defense. The proceedings are conducted by a school employee named by the director. After receiving the final report, the director must pass judgment

within 48 hours, under penalty of being subject to the same sanctions as the accused. The only possible appeal is to the Minister of Education.

At the end of April, 68 professors at two of the country's principal universities, the University of São Paulo and the Federal University of Rio de Janeiro, were forced into retirement by two successive presidential decrees. No explanation was given, no charges were made, and no opportunity was offered for a hearing or appeal. The retirement pension for full-time positions is about one-third the regular salary.

The list of professors retired ranges over a broad spectrum of ages and political opinions. It included the acting rector of the University of São Paulo, the scientific director of the São Paulo State Research Foundation, the chairmen of several departments, and the president and the vice president of the Brazilian Physical Society. These people were champions of university reform and pioneers in the establishment of research groups in their specialties; they had devoted a substantial part of their lives to this objective and had remained in Brazil under the most adverse conditions; several of them have international reputations in their specialties.

One can only guess at the possible motives for these actions, since none were mentioned, but the available evidence makes it fairly certain that they include personal vendettas, the university reform issue, and what was described by the Baltimore *Sun* correspondent as "the influence on the government of a right-wing lunatic fringe."

The foregoing examples should suffice to illustrate the reasons for the migration of scientists from Latin America. They lead us to raise the following questions.

1) Can one accept responsibility for training new scientists when conditions are so unfavorable for their staying in their native country and contributing to its development? What can result from such an effort, other than a new generation of frustrated scientists and an increase in the brain drain?

2) Who will be willing to spend 10 or more years of his life in forming a new research group, fighting against adverse conditions and sacrificing his own work, without any guarantee that all his effort is not subject to immediate destruction at the whim of the next government?

3) To what extent does the solution of these problems depend on the Latin-American scientists?

In my opinion, these are the crucial questions that must be answered in the search for a solution.

Possible Solutions

It is far from clear that the problems have any feasible short-term solution. Their long-range solution may be identified with the development of Latin-American countries—with a complete transformation in the social and economic structure of these countries, leading to a degree of stability that does not now exist.

Here I discuss only some short-term palliative measures. Their adoption depends basically on the governments of Latin-American countries; they are all feasible, and they do not require any major expenditures.

The first objective would be to make the best possible use of existing research institutes. It is important not to waste any effort in trying to tackle problems on an overambitious scale, with minimum chances of success. Thus, it is not realistic to plan entire universities or to attempt to solve all educational problems.

What can be done, at present, provided the necessary support is obtained, is to develop small research institutes of good quality, preferably associated with existing universities. The nature of this association is a very delicate problem, requiring careful consideration. Only when a sufficient number of such institutes in different specialties exists will it become possible to group them together, to form a true university. It is important to have at least two high-level centers in each specialty, not only to encourage competition but also to provide a refuge within the country when the survival of one center is threatened. On the other hand, the number of such centers must be kept small in order that a critical mass may be attained, given the small size of the scientific community.

This proposal also implies that the resources that may be put to effective use are rather modest. They would not represent a heavy financial burden for any Latin-American country. But they have to exist, to be readily accessible, and to possess a measure of stability.

It is necessary to create permanent funds, whose growth must be tied with that of the country. I believe that the responsibility for the distribution of research funds should be allocated primarily to the National Research Council of the country in question. This is usually the government agency in closest touch with scientists. In most cases, this will require a substantial increase in the budget of the National Research Council, which ought to constitute a fixed percentage of the gross national product. The present system, whereby the budget has to be set each year and is subject to large cuts, renders long-term planning impossible.

A commendable experiment that is now being undertaken in Brazil is the establishment of a Research Fund by the National Bank for Economic Development. The bank levies a tax on each industrial development loan, and the proceeds go to the fund, to be used for research grants.

All research appointments should be on a full-time basis, and salaries should be adequate, with suitable compensation for inflation. The National Research Council of the country should be able to contribute either partially or in full to the payment of such salaries. It should also be able to come to the rescue of any research institute threatened by financial difficulties.

It is of the greatest importance that scientists who work in underdeveloped countries have as much contact as possible with scientists abroad. This allows them not only to endure the poverty of the local scientific climate but also to keep abreast of recent developments in their field. Institutes such as the International Theoretical Physics Center at Trieste play a significant role in promoting such contacts. However, they can absorb only part of the personnel, and they are restricted to a few specialties. Therefore, it is important to establish new programs of collaboration with other universities, in the United States, in Europe, and within Latin America itself, that allow for an ample interchange of personnel. These programs should include the possibility of joint appointments with foreign universities, enabling scientists to spend a few months abroad each year. Appointments of foreign professors should also be encouraged, through attractive offers and permission to occupy permanent positions in the universities.

The policy concerning fellowships abroad should be as liberal as possible. The specter of the exodus often tends to produce a contrary reaction—a policy of closed doors, of not allowing young people to get their graduate training abroad, of keeping them unaware of the better working conditions outside their country. Not only would

such a policy be doomed to failure, it would also be suicidal.

In the few institutes where a high-level graduate program is already a possibility, students should be encouraged to stay until they get their Ph.D.'s. In the majority of cases, however, it is still necessary to offer fellowships for graduate study abroad. It is also important, at the postdoctoral stage, to give a young scientist the opportunity to work on his own and gain confidence in himself, instead of overloading him with responsibilities immediately after he receives the Ph.D., as is often the case.

Finally—and this is one of the most fundamental points — Latin-American governments must learn to respect the autonomy of universities and research institutes, as part of the respect for scientific work. Scientific research flourishes in a climate of full intellectual freedom. Universities should not get mixed in politics, but individual rights and freedoms must be protected. Intervention in the affairs of universities cannot be tolerated. The researchers who have been the victims of such attempts in the past should be invited to return to their positions, without any discrimination.

These are only a few of the many measures that must be taken as a first step. They do not depend on the scientists; rather, they depend on the government and on public opinion in Latin-American countries.

The scientists of Latin America have already demonstrated that they can build good research institutes, given enough resources and government support over a period of at least 10 years. Once this point is reached, the problem is no longer in their hands. If their work is respected and encouraged, its continuity and long-term stability may eventually be guaranteed, and a few high-level institutes may gradually lead to the formation of true universities. Development, in the last analysis, is a synonym of education, and good universities are the foundation of any educational system.

On the other hand, experience unfortunately indicates that, if lack of respect for science continues to dominate, the difficulty and effort required for building good research institutes will be matched only by the ease with which they can be destroyed.

It is up to the governments and peoples of Latin America to decide which road they are going to follow. We should be ready to contribute as much as we can to the great task of their development.

References and Notes

1. For numerical data, see "Migration of Health Personnel, Scientists, and Engineers from Latin America: Report Prepared by the Pan-American Health Organization Sub-Committee on Migration for the P.A.H.O. Advisory Committee on Medical Research," *Pan.-Amer. Health Organ. Sci. Publ. No. 142* (1966). See also, W. Adams, Ed., *The Brain Drain* (Macmillan, New York, 1968).
2. These figures, which are based on data supplied by Brazilian government sources, should be regarded only as upper bounds. The actual values may be well below those given. Reliable statistical information on this and other subjects is very scarce.
3. Samples of "subversive materials" apprehended after the 1964 revolution included Stendhal's *The Red and the Black*, Tolstoy's *War and Peace*, and Diderot's works.

NEWS AND COMMENT

NIH: Agency and Clients React to Retrenchment

When the Presidential committee chaired by Dean E. Wooldridge reported on its study of the National Institutes of Health (NIH) in 1965, it urged that NIH prepare to deal with problems the agency would face when it reached "maturity," an oblique allusion to the time when NIH's fast-rising budgets leveled off. What neither the committee nor almost anyone else anticipated was the abruptness with which the day of reckoning would arrive. The Vietnam war and accompanying inflation and competition for funds within the health budget have put heavy stress on NIH and created unprecedented strains between the agency and its clients.

In August, NIH began its second year of austerity by announcing an across-the-board, 20-percent cut in research grants up for renewal; this sent shock waves through the biomedical research community. Just as cries of dismay from angry grantees were gathering force, the cuts were reduced to the order of 5 to 10 percent by NIH's superiors in the Department of Health, Education, and Welfare (HEW).

The incident not only dramatizes the fact that NIH has moved from an era of expansion to one of decline in terms of what money buys but also demonstrates that the basic relationships and assumptions with which NIH operated during its period of growth have changed decisively.

To a much greater extent than in the past, decisions made elsewhere, particularly in the upper echelons of the Executive, where budget issues are settled, crucially affect NIH. The agency's special relationship with Congress has eroded since the death of Representative John Fogarty and the retirement of Senator Lister Hill and NIH director James A. Shannon. And NIH's traditional powers of self-determination have been further diminished by a shift in the balance of control over expenditures from Congress toward the Executive. Last year, when Congress passed the revenue and expenditures act, it told the President to designate which expenditures were to be cut below budget levels. And Congress, which has still not acted on the $1-billion-plus NIH research budget for the current year, now finds itself in the position of appropriating funds which the Administration may decide not to spend. This has happened to NIH.

The 20-percent cut in research grants was decided on by NIH officials to hedge against a stiff limit on spending which they expected HEW to impose. According to NIH and HEW officials, the downward revision of the cuts that was announced 12 September was made possible by a decision high up in the Administration to insulate biomedical research and other HEW activities by treating Medicare, Medicaid, and Social Security costs separately. HEW Secretary Robert Finch had campaigned hard for the ruling, and some HEW officials who are delighted that he won also admit surprise that he did, since the control of expenditures is a top-priority matter in Washington today.

While the Executive is primarily concerned these days with expenditures—