The Oswaldo Cruz Institute and its Importance in the Brazilian Society. Perspectives for the 21st Century

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The Oswaldo Cruz Institute, founded on May 25th, 1900 under the name "Instituto Soroterápico Federal" (Federal Serotherapic Institute), has always played an important role in the Brazilian society. Its foundation aimed at controlling the bubonic plague, the yellow fever and the smallpox, which raged all over the city of Rio de Janeiro at that time. Such diseases were decimating the population, hindering the economic and social development of the country as the foreign ships, the only international means of transport then, were not allowed to anchor in our ports due to their unsanitary conditions.

The two first papers – "Contribution to the study on culicidae in Rio de Janeiro" and "The anti-plague vaccination" , in *Brazil-Médico*, volume 15, numbers 43 and 45 respectively – published in 1901 by Oswaldo Cruz in this Institute, soon after its creation, illustrate the institution's vocation to biomedical research and public health.

The discoveries that took place in this Institute as well as its countless research works helped Brazil to be awarded with the first prize (beating 123 competing countries) at the International Hygiene Exposition in Berlin in 1907. This fact prompted the National Congress to pay homage to Oswaldo Cruz, naming the Institute after him, by official decree number 1802, of December 12th 1907.

The "Temple for Science", symbolized by the Moorish Castle (Fig. 1), was ordered by Oswaldo Cruz as of 1904. It was built on the top of a hill on the Manguinhos Farm in Rio de Janeiro in order to exhibit to the world the new status of the Brazilian public health. Like the Alhambra Palace on the Sabika hills overlooks the city of Granada in Spain, our castle overlooked the sea. As a matter of fact, there are many similarities between the two palaces. The Moorish style – the Spanish-muslim architecture from the period between the 9th and 12th centuries –, the mosaic and pottery features and the sculptured brick and wood work make us think that the castle must have been inspired by The Alhambra palace. However, there is no evidence of Cruz's thoughts at that time.

Our "Temple for Science" today comprises fifteen departments and sixty research laboratories; twelve centers of reference and four institutional collections, with more than 350 researchers (most of whom hold a PhD); it also includes a Teaching Department with over 600 students in post-graduation courses (Master's, Doctorate, intensive and advanced training) as well as scientific initiation and vocation. We also publish the most modern and important scientific publication about biomedical research in Latin America – the *Memórias do Instituto Oswaldo Cruz* – founded in 1909. The Manguinhos Application Course, also founded in 1909 may be considered as the first official post-graduation course in Brazil.

Besides being the pride of Brazilian Science, the Oswaldo Cruz Institute is one of the most productive research institutions in this country. It supports several programs from other institutes inside the Oswaldo Cruz Foundation such as the "Biomanguinhos Institute", which produces vaccines against yellow fever and other important diseases affecting public health; the "Farmanguinhos Institute", responsible for the production of basic medicines for the Ministry of Health; the "Quality Control Institute"; the "Fernandes Figueira Institute", as well as works in cooperation with some national and foreign universities.

The twelve reference centers of the Oswaldo Cruz Institute grant an important support to the National Health Foundation and the Public Health Laboratories from all Brazilian states. Such centers are responsible for the diagnosis of yellow fever, respiratory virus-infections, measles, viral hepatitis, infectious diarrhea (cause of the great infant mortality), leprosy, vectors of malaria, the Chagas disease, schistosomiasis and leishmaniasis.

The Oswaldo Cruz Institute is regarded as a genuine institution of national integration as it develops researches throughout the interior of the country, from the State of Amazonas to the State of Rio Grande do Sul, specially in the northeastern, middle-western and the Amazon regions.

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Fig. 1: main building of the Oswaldo Cruz Institute

For all these reasons, the Oswaldo Cruz Institute is worthy of our deference and support. It is the pride of the country's Ministry of Health and of the Oswaldo Cruz Foundation itself.

HOW RESEARCH IS VIEWED BY THE SOCIETY AND THE GOVERNMENTS

The importance of biomedical research or research as a whole has not always been understood by the society and governments as a social benefit for the people and the community. Not even the public health services have been considered as bare necessity since they produce tardy results, which are only perceived in the long or medium term.

The public reaction against the effort by Oswaldo Cruz during his sanitation program in Rio in the beginning of this century is clear-cut evidence of this misconception. There was in the press of that time a strong opposition to Cruz's plans, which was visible through the many caricatures, ditties and satirical verses, editorials, scientific criticism, lawsuits, slander, insults and threats. Nevertheless, none of these would undermine Cruz's enthusiasm. He extended his program and even collected the criticisms and caricature published in the press, demonstrating his firm belief in the results of his plans. In 1904, on November 14th, as a consequence of the compulsory vaccination against smallpox, an armed rebellion broke out among the cadets from the Military School against the then president of the country, Rodrigues Alves, which was eventually crushed in three days. The Government, attacked by the press, by the Congress and by the population, managed to resist, due to the total reliance on Oswaldo Cruz.

Conversely, our governments (and this is the reality in developing countries) do not understand the importance of research for the developing of a nation and this results in a cutback of resources for research in the national budget, as it is not considered as a bare necessity and thus can be postponed.

I now recall the words of President Jimmy Carter at the Academy of Science in the United States of America during the centenary celebration of Albert Einstein, when he referred to basic research: "The last president to visit the National Academy of Science was JFK, who spoke about basic research: 'We now understand that progress in technology depends on progress in theory; that the most abstract investigations may lead to the most practical uses and, that the vigor of a scientific community emanates from its passion to answer the most fundamental questions in science'. A month after President Kennedy uttered these words, he was assassinated and then a long traumatic period began in the political history of this country. However, somehow, the following years were very stimulating for science and technology – they were years of major advances in science through the discoveries in molecular biology, in physical particles and in other fields, and also through the technical progress that culminated with the landing of man on the moon. As well as for scientists, for us politicians these were difficult years, too. The American science was hindered by two different types of anti-intellectualism: on the one hand, the reaction against rationalism inspired by the romantic movement of the counter-culture and, on the other hand, the veiled hostility of the Federal Administration that did not trust the scientific and academic community of this country. This attitude caused the most prejudicial effects to our advances. The federal policy on science was influenced by the simplistic search of objectives. The research that seemed to promise quick results was thus more subsidized, whereas basic research received fewer funds. The future of our supremacy in science and technology was threatened. When I took office, I was determined to change this pernicious tendency and now I can reassure you of my commitment to basic research – the ultimatum of our future in science and technology".

THE ONSET OF BIOMEDICAL RESEARCH IN BRAZIL

The evolution of science in Brazil started, in our point of view (Coura 1982), in Pernambuco with Prince Maurício de Nassau, who brought several scientists into this country, among whom the naturalist Georg Marcgraff and the physicist Wilhelm Pies (Piso). These two scientists published in 1648 their observations in the famous book *Historia Naturallis Brasilae*, where they described the Brazilian flora and fauna. Together with artistic movement that flourished at that time, several studies were developed in different areas such as Astronomy, Meteorology, Natural History, Medicine and others.

In Medicine, it is worth mentioning the "Tratado Único da Constituição Pestilencial de Pernambuco" (The Sole Treatise on the Pestilential Constitution in Pernambuco) by João Ferreira da Rosa, in which he describes the yellow fever epidemics that broke out in the northeastern region in the period 1680-1694, with a high mortality rate. Two other descriptive and research studies that are worth mentioning are the "Tratado Descritivo do Brasil" (A Descriptive Treatise of Brazil), published in 1587 by Gabriel Soares de Souza and "Du Climat e des Maladies du Brésil ou Estatistic Médicale de cet Empire" (The Climate and the Diseases of Brazil or the Medical Statistics of this Empire), published in 1844 by José Xavier Sigaud.

The first compilation of the systematic scientific studies of the occurring diseases in Brazil emerged from the "Escola Tropicalista Bahiana" around the year 1850, more than 40 years after the first medicine courses had been created in Bahia (Feb. 1808) and in Rio de Janeiro (Nov. 1808). Such courses had been designed to the practical and symptomatic teaching of medicine and surgery.

In the middle of last century John Peterson, Otto Wucherer, Silva Lima and later Pires Caldas, Virgílio Damazio and Pacífico Pereira founded in Bahia the Center of Studies in Tropical Medicine and later the periodical *Gazeta Médica da Bahia*. However, in 1829, Soares de Meirelles, Vicente de Simon, José Francisco Sigaud, Cruz Jobim, Jean Maurice Fever, Pereira Reis and Mariano da Silva founded in Rio de Janeiro the "Society of Medicine", an important forum for study and official counseling on public health problems, especially the endemic diseases that devastated our country, as registered in the *Annaes da Academia Imperial de Medicina* (The Annals of the Imperial Academy of Medicine).

The medical research and the teaching of basic subjects used to be considered either secondary or totally disregarded in our schools of medicine in spite of some isolated manifestations against this policy and harsh reports like the one written by Nuno de Andrade in 1879, which brought about some reforms under the supervision of the Viscount of Sabóia, resulting in the improvement in the physical appearance of the laboratories.

It was only in 1901 that microbiology was officially included as a subject and the attendance to laboratory lessons made compulsory. Nevertheless, the conditions of the equipment were extremely poor, as shown in the 1904 report about our Medical School of Rio de Janeiro, where the microbiology teacher tried to teach his 150 students with only one microscope.

As a consequence of this lack of support and regard, the experimental and the biomedical research in Brazil began out of the schools of medicine and in many cases ahead of them. Such was the case of the Escola Tropicalista Bahiana, the Bacteriological Institute, and the Butantan Institute, founded in São Paulo, respectively in 1893 and 1899, and the Institute of Experimental Pathology of Manguinhos (now Oswaldo Cruz Institute) in Rio de Janeiro in 1900 – all of which independent of the medical schools.

The great epidemics in the end of last century and in the beginning of this century found our schools of medicine unprepared to confront them due to the lack of basic knowledge in microbiology and in public health issues. Besides, there was a sort of discredit in experimental medicine due to the strong clinical tradition, which inhibited its growth. Several events confirmed this posture and among them there was the case of the bacteriological diagnosis of the typhoid fever and of the cholera developed by Adolfo Lutz in 1894 and 1895, facing strong opposition of the Medical and Surgical Society of São Paulo, which insisted on the diagnosis through imprecise signs and symptoms. The same happened with Oswaldo Cruz in Rio de Janeiro in the beginning of this century and even with Carlos Chagas in 1920, when his discovery was contested in the National Academy of Medicine.

The Oswaldo Cruz Institute was a milestone in experimental medicine in Brazil. The first researches developed there were related to the description of the culicidae fauna in Rio de Janeiro and to the enhancement of the vaccine against the bubonic plague, primarily by Oswaldo Cruz and later by Figueiredo de Vasconcelos, the very reason for the creation of the Serotherapic Institute. Other important achievements in the bacteriological area like the development of the vaccine against the *symptomatic carbuncle* (peste da manqueira) and many other pioneer works in virology, protozoology and entomology, turned this Institute into the "mecca" of Brazilian science in the three first decades in this century, as reported in my reviews and those by Olimpio da Fonseca Filho (1974).

THE BIOMEDICAL RESEARCH AS AN ABSTRACTION AND ITS IMPORTANCE IN THE PROFESSIONAL TRAINING

Medical Research is an abstraction – the realities are not the laboratories and hospitals but the men, who search and search again for causes.

(Allan Gregg - 1941)

Whitehead's three stages in Education (1953) – the "romance" stage, the "precision" stage and the "generalization" stage – are equally important as a basis for research in medical training. The

young students are highly sensitive to the learning process and to the spirit of research as a basis for their knowledge. Thus, there is no age limit or any limit in graduation levels for scientific initiation, which can be encouraged even in secondary school. In my own experience and in the experience of all tutors, the earlier the scientific initiation occurs in the life of students, the better results they will achieve, as this initiation will be an incentive for the future researcher. Even the graduation course will gain a deeper meaning because of a more logical and speculative approach in their academic studies.

One of the brightest students, of whom I had the privilege to be the tutor, came to me at the end of his second year in the medicine graduation course, still a student in the basic course.

This young man wanted to work as an intern at the Pavilhão Carlos Chagas, at the São Francisco de Assis Hospital, where we had the Department for Infectious and Parasitic Diseases of the Medical School, Federal University of Rio de Janeiro. However, he could only work after 4 o'clock in the afternoon. Against my staff's opinion, I allowed him to have his training during the period from 4 p.m. to 8 p.m. I still remember finding him many nights working after 9 p.m. examining patients, collecting material or working in the laboratory, doing experiments with the newborn mice for his first experimental work on the action of the macrophage system on the *Plasmodium berghei*. He was then in the "romance" stage. He was a brilliant student at college and was the only of my students to get an "A" in all subjects in the post-graduation course. His excellent thesis in the master's course can be matched to any other doctorate's thesis. When he was doing his doctorate course in England, he used to cooperate with his tutor, who was a referee for a well-known scientific journal, by giving his specialized opinion on the articles about immunology that his tutor had to work on. I am certain that there must be many other examples of talented young interns who have worked or still work with us during their graduation course.

The "precision" stage is not necessarily a privilege of the older. It simply reflects one of the scientist's quality. According to Moshe Prywes (1963), former rector of the Hebrew University of Jerusalem, such qualities are: imagination, curiosity, spirit of criticism, determination, the passion for accuracy and last but not least, the ability to overcome the disappointment for not having one's hypothesis confirmed or for not having achieved the expected results.

The joy expressed by my partner Sune Bergstron in the Committee for Research of the World and Pan-American Health Organizations when he received the news that he had been awarded the Nobel Prize of Medicine together with John Vane and his student Bengt Samuelson is a episode that illustrates that in research there is no age limit. "This is wonderful! There is no generation gap in science and there is no greater satisfaction than seeing one of our students triumph", he said at the occasion.

At last, the "generalization" stage, or the stage of scientific diversity, is the phase that all the brightest minds inevitably have to experience, although some refuse to do it. It is after all the synthesis of a lifetime, the global view of our world and other worlds, which is achieved through profound meditation, transcendental, almost divine meditation, as demonstrated in Albert Einstein's "The World as I See it".

There is nowadays an excessive concern about the academic curriculum as if this would solve the problem of learning and education. But, in fact, the excessive number of subjects may be prejudicial. Students learn through the example, through observation and through their own experience. Our duty is just to select them, create an infra-structure that favor their work and their observations and foster opportunities of contact with qualified and stimulating teachers, who should have a speculative and an inquiring spirit, and who usually transform the clinical diagnosis and a patient's treatment into a research action. This will give the students a more logical and deeper sense of their learning process and will promote a more speculative attitude towards their studies in the "romance" stage.

The medical education should be regarded with the same depth and scientific precision in the basic course as well as in the clinical laboratories, in hospital wards, in the operation and emergency rooms, and in ambulatory services for the community. There is no need for the students to learn absolutely everything, but it is important that the topics that they are taught should be well mastered, so that this knowledge can be a sort of model to be applied to all subjects, specialty or position that they might take on. I feel great pride when I find my ex-interns from the Pavilhão Carlos Chagas or from the Department for Infectious and Parasitic Diseases of the Medical School of the Federal Fluminense University and Federal University of Rio de Janeiro, all of them now good professionals in basic or clinical medicine, in several specialties, in medical education or research, in the public health service or health administration. We did not teach them everything, we just taught them a sense of criticism and critical observation of everything themselves included. They have learnt

to pursue the excellence in everything they do.

The developing of the spirit of research that we referred to will only be possible through the unrestricted assistance to the matrixes – individuals and institutions qualified to reproduce scientifically, as in the case of the Instituto de Patologia Experimental de Manguinhos (Institute of Experimental Pathology of Manguinhos) at that time under the administration of Oswaldo Cruz.

The importance of doctors of high scientific quality as members of our medical school boards was very well represented by Oswaldo Cruz, Carlos Chagas, Adolfo Lutz, Vital Brasil, Arthur Neiva, Rocha Lima, Lauro Travassos, Miguel Osório de Almeida, Carlos Chagas Filho and many others who constructed the biomedical science in Brazil.

The need of highly qualified academic staff as an incentive to the developing of the new generations was clear in the example given by Moshe Prywes, above mentioned, who, during the International Symposium on Biomedical Research held in 1963 at the National Institutes of Health, reported a fact that happened during Hitler's occupation in some European countries. He said that university professors that had been lowered in their position had to find a job teaching in secondary schools. The students in these schools benefited greatly from this fact and many of them became excellent students. This and other examples of great schools of researchers from different generations all over the world show how important it is to value the human being and the researcher as the fulcrum of the growth in science and knowledge.

THE OSWALDO CRUZ INSTITUTE IN THE YEAR 2000

The Oswaldo Cruz Institute is now, as it was in the past, one of the most important institutes for the biomedical research in Latin America. It is certainly the most diversified, as shown in its organization charts (Fig. 2), covering basically all subjects in the biomedical area, specially those related to the basic aspects of parasitic and infectious diseases.

The Bacteriology Department with its laboratories of physiology, bacterial zoonosis and enterobacteria develops the diagnosis of enteropathogens, a characterization of the *Bacillus*, involving the production of biological insecticides and many important research works in epidemiology and ecology of *Listeria*, *Yersinia* and *Campylobacter* as well as other relevant studies about leptospirosis. It has recently started a line of study about *Neisseria meningitidis* and *Homophillus influenzae.*

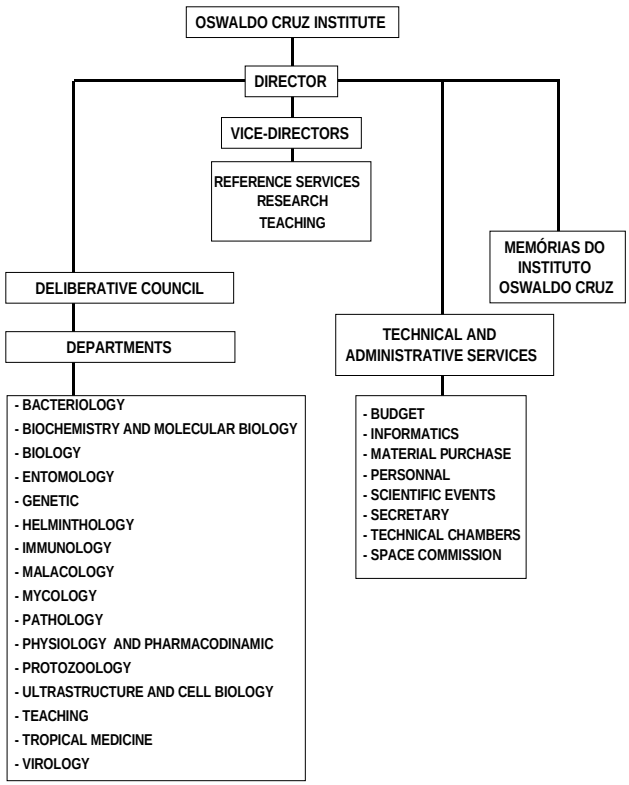

Fig. 2: organization of the Oswaldo Cruz Institute

Our Biology Department, unlike the traditional models in biology, has a peculiar organization, comprising laboratories of ecology and control of insects and mollusk vectors and a segment for Environmental Health and Education. It develops lines of research in ecology, epidemiology and the control of schistosomiasis and other helminth-caused diseases, the *Trypanosoma cruzi* biology and the behavior of its vectors, biosystematics and the control of diptera and ectoparasites in human and veterinary medicine. It is also engaged in Health and Educational strategies studies and scientific diffusion, health and ecosystems and cronobiology applied to health of the working population.

The Department of Biochemistry and Molecular Biology is one of the biggest and most modern sections in our Institute. It comprises nine laboratories, most of which develops research works using advanced techniques in molecular biology applied to agents of infectious and parasitical diseases, in biochemistry and physiology of insects, in genes regulation and expression, in immunology, in biochemistry of proteins and peptides and in biochemical systematics.

The Entomology has surely been the oldest and the most traditional segment in the Oswaldo Cruz Institute since its creation. This department, reformulated by Leonidas Deane in the 80's, consists of the laboratories of Diptera, Ixodides, Leishmaniasis transmitters, Onchocerciasis and Hematozooan, a center of excellence in triatomines and a famous entomological collection with almost 2 million samples along with a collection of Trypanosomatidae with 370 samples of several species.

The Department of Physiology and Pharmacodynamics is one of the most compact and productive in our Institute. It consists of the laboratories of Inflammation, Neuro-cardiovascular Pharmacology, Immuno-pharmacology, Natural Products, and Toxinology and keeps boundary lines of research in these areas.

Genetics is one of the newest areas in this Institute. This department comprises the laboratories for Congenital Malformations – a center of reference for the World and Pan American Health Organizations – , the laboratory of Human Genetics and the Molecular Genetics of Microorganisms laboratory. Over the two last years this Departament has been considered the most productive, in proportion to the number of researchers.

The Department of Helminthology is one of the most traditional in this institution, which, together with the segments of protozoology, entomology, bacteriology and virology, formed the first nucleus of our Institute. Today it is composed of the laboratories of Helminths of Vertebrates, Helminths of Fish and Experimental Schistosomiasis, the two first working with taxonomy and systematics and the last one with immunology, aiming at a vaccine to schistosomiasis and *Fasciola hepatica*.

Although it has been developed since the foundation of the Institute as a support to the production of vaccines, the Department of Immunology is the one which is also involved with the most modern technology. It consists of the Aids laboratory as well as the laboratories of Molecular Immunology, Immunochemistry of Trypanosomidae, Clinical Immunology, Leishmaniasis, Malaria, and Thymus Research, Self-immunization and Immunoregulation.

The Department of Malacology is the smallest in number of researchers and because of its characteristics it should be a division of the Biology or Tropical Medicine departments. However, for operational reasons and due to the high qualifications and international influence of its leader Lobato Paraense, it was created separately as an autonomous department. It is a reference center for the World and Pan American Health Organizations for neotropical planorbidae, working with taxonomy, systematics, genetics and ecology of mollusks.

The Department of Tropical Medicine received its name when we arrived in this Institute in 1980. Nevertheless, since its foundation, the Oswaldo Cruz Institute has been famous for its field research which has integrated the whole country not only through the scientific exploratory expeditions but also due to the advanced research stations in many states in Brazil. The Departament includes laboratories of Parasitical Diseases, Leprosy and Biology and Control of Schistosomiasis, with lines of research on Chagas disease, leprosy and schistosomiasis. It also maintains an important post-graduation course for master and doctorate's degrees.

The Mycology Section at the Oswaldo Cruz Institute was one of the most important all over Latin America; however, for many years it had been abandoned by researchers and it has become a very modest department. Now the researchers are gradually coming back and, owing to its association with the mycology team of the Evandro Chagas Hospital; so this Department is becoming a respectable center of study, which contributes greatly with its young researchers in their degrees.

The Department of Pathology was one of the pioneering areas in this Institute. It has also been deserted by researchers, but under the influence of Drs (Mr and Mrs) Lenzi, it has been recuperating and turning into one of the most modern and best equipped research center in the dynamic pathology of the parasitical and infectious diseases, extracelular matrix and immunopathology.

The Protozoology has been one of the most traditional areas in this Institute since the pioneering

works of Carlos Chagas, Henrique Aragão, Gaspar Vianna and Magarinos Torres. In the 80's it was redesigned by Maria Deane and now it comprises the laboratories of Biology of Trypanosomatidae and Immuno-modulation and it develops important lines of research in dynamics of Chagas disease transmission, its reservoir and the characterization of strains of *Trypanosoma cruzi*, cellular immunity and congenital toxoplasmosis.

The Department of Ultra-structure and Cellular Biology – originated from the Center of Electronic Microscopy created in the 70's in association with the Bernard Nocht Institute of Hamburg and with the Institute of Biophysics of the Federal University of Rio de Janeiro – is today a compact and productive group of researchers from the laboratories of Cellular Biology, Ultra-structure and Biology of Microorganisms, with several lines of research associated with biology and ultra-structure of Protozoa, drug action and citotoxicity, penetration and cellular evasion of parasites, and others of great importance.

Last but not least, there is the Department of Virology, the biggest and most complete, with laboratories of technological development in virology, enterovirus, flavivirus, viral hepatitis, retrovirus, immunology and viral ultra-structure, viral respiratory infections and measles, molecular virology and comparative virology. This Department develops countless lines of basic research and epidemiological research, with various national and international centers of reference. It would be impossible to give a detailed list of all the activities carried out by this and other departments in our institute.

PERSPECTIVES FOR THE 21st CENTURY

Brazil is an ever-changing country with a population over 160 million people spreading an area of 8,500,000 km^2. It is the 5th largest country in the world and has the 4th biggest population, 80% of which live in urban areas. The nation's economy has oscillated between the 8th and 10th world's rank. It's a land of contrasts, with vast empty areas in the Northern and Middlewestern parts of the country; a highly urbanized and industrialized region located in the South and Southeast, and large "poverty belts" on the outskirts of big cities and in the states on the northeastern coast.

Although the country is divided into five geographic and political areas: South, Southeast, North, Northeast and Middlewest, it could as well be divided into three "different Brazils": the rich one, which is industrialized with fertile land and mild climate, located in the South and Southeast and in a part of the Middlewest; the poor one, with arid or semiarid soil and high temperatures in the Northeast, and the third one, the empty, humid and hot areas in the North and parts of the Middlewest (Fig. 3).

Fig. 3: region and avarege temperatures in Brazil

Our country has one of the greatest biodiversity and sociodiversity on this planet. Its complex biodiversity extends from the Amazon rainforests, which comprise over a third of the country's geographical area, to the "pampas" in the State of Rio Grande do Sul; from the lowlands of Mato Grosso to the barren lands in the Northeast; from the Atlantic forests to the "cerrado" (an extensive tract of waste land composed of stunted twisted trees) in the central plateaus, going through the "Serra do Mar" (Sea Mountain Range), the "Serra do Espinhaço" (Backbone Mountain Ridge) and the "Serra da Canastra" (the Canasta Mountain Ridge), respectively in the Southern, Southeastern and Midwestern regions in Brazil. It seems that 500 years have not been enough for learning all about this complex country.

This is the greatest challenge for the 21st century and fortunately we have the technology and knowledge to meet it. However, it is imperative that we are able to attenuate the social inequalities, to promote equal access to high quality education to all the population and not to the rich, and invest in science and technology, the greatest force that countries must have in order to face the world in the third millennium. The countries that have not yet been aware of this fact will be doomed. Economic globalization will not make us equals, on the contrary, this is a fallacy that is impoverishing the developing countries, and enriching the powerful nations, placing them in a position of superiority in international business. This does not mean we should be cut off from the economic or scientific world. Indeed, this will not be possible or desirable, but we must invest massively in education and in science and technology; otherwise, we will not have a place in the future.

Our Institute is preparing for this challenge. I have requested that all departments conduct workshops aiming at a deep analysis of their present status and future expectations in as regards to the changes in our society and the need of new working strategies both in basic research and applied research, in the centers of reference and in the administrative area.

In the second semester of this year we will meet with our entire board, represented by the head of departments and research laboratories, head of management and all the board of directors in order to devise a development program for the next century. We hope that in the year 2001, we will be able to pass on the Institute's administration filled with new perspectives and new programs integrated to the new millennium.

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