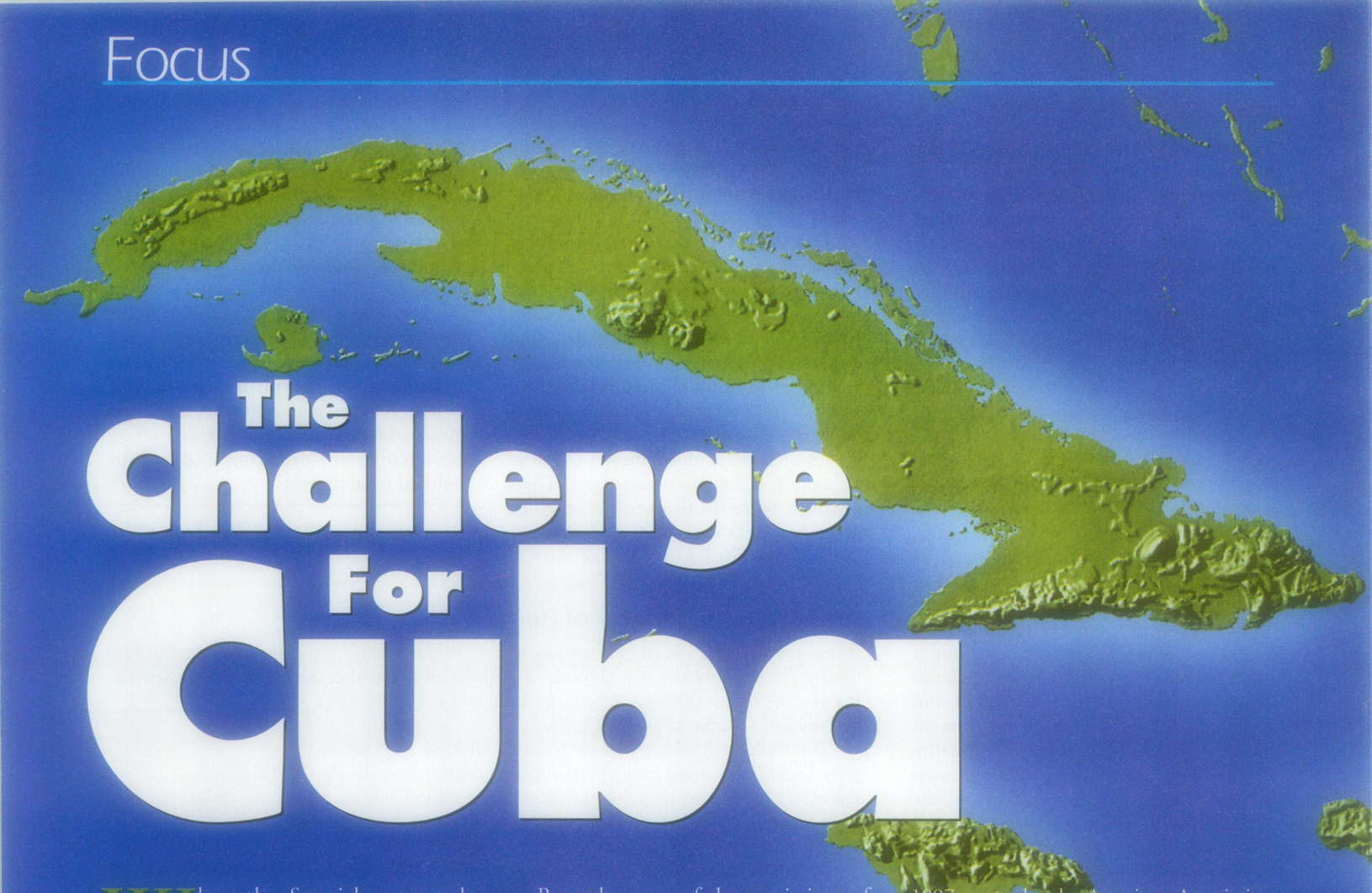


The Challenge For Cuba

When the Spanish retreated before U.S. troops in the 1898 Spanish–American War and ceded the islands of the Greater Antilles, both Cuba and Puerto Rico were among the bounty, but their destinies could not have been more disparate. While Puerto Rico is now a U.S. territory, Cuba has become defiantly independent of its neighbor some 90 miles to the north.

In 1956, a ship carrying 82 revolutionaries intent on overthrowing dictator Fulgencio Batista landed on Cuban shores. Three years later, the revolutionaries marched in victory through Havana. Among them was the leader of the revolution and Cuba's current commander-in-chief, Fidel Castro.

As Castro's government implemented socialist policies, relations with the United States became increasingly strained. With the failed U.S.-sponsored invasion at the Bay of Pigs and the Cuban missile crisis, tensions between the nations grew. The United States imposed restrictions under a trade embargo against Cuba, and Cuba's economy came to depend on trade with its ideological and political ally, the former Soviet Union. Cuba exported tons of sugar, nickel, fruit, and other commodities in exchange for canned meat, wheat, weapons, machinery, and fuel from the Soviet Union.

Recently, some of the restrictions of the U.S. embargo have been eased. In January, President Clinton announced new measures designed to relieve the plight of the Cuban people and increase their opportunities for contact with the outside world without strengthening the Cuban government. These new measures include permission for any U.S. resident to send money to Cuban families and nongovernmental organizations, increased exchanges of athletes, artists, and scientists between the United States and Cuba, and the sale of U.S. food and agricultural supplies to nongovernmental bodies. The effect of this easing of restrictions remains to be seen, but as Felix Vilaplana, a Cuban immigrant who arrived in Florida during the Mariel boat lift of 1980, asks, "How are they going to buy American goods if the country has no currency?"

The Economy and the Environment

The Soviet collapse in 1990 and the restrictions of the U.S. embargo marked the beginning of a period of extreme economic hardship in Cuba. This period, understatedly referred to by the revolutionaries as "the special period in a time of peace," has severely strained the Cuban economy, which hit an all-time low in 1993, when the gross national product declined by almost 15%, according to a 1997 report by the American Association for World Health (AAWH). This economic adversity has had a tremendous impact on all aspects of life on the island, including environmental and public health.

In the 90° heat of the May sugarcane harvest, workers called *macheteros* grab eight-foot stalks of sugarcane with one hand and swing short, sharp machetes close to the ground with the other, cutting down the bamboo-like trees. The island's livelihood has relied upon sugar production; sugarcane is still grown on large, state-owned farms. According to the 1991 *Statistical Yearbook of Latin America and the Caribbean*, Cuba had three times more tractors per hectare of cultivable land than the average for the rest of the Latin American countries. In the late 1980s, sugarcane fields covered close to 40% of the arable land in Cuba. In contrast, only 16% of the land was devoted to staple food crops at that time, according to the 1997 book *Cuban Studies*, edited by Jorge Pérez-López. "It is a cruel irony," says Arnaldo Santos, a Cuban farmer. "We break our backs under the sun planting these cash crops while our families go hungry."

The allocation of agricultural production to cash crops was justifiable during the 1970s and 1980s, when Cuba received an average price for sugar from the Soviet Union that was more than five times higher than the world market price. But the

situation created a pattern of dependency on imported foods, which accounted for over 50% of the total calories consumed by the population by the late 1980s. Ironically, sugar brought in much-needed currency, which was used to modernize the nation's infrastructure and provide services to the point that Cuba is now considered among the most developed of the developing countries, according to basic indicator figures compiled by the United Nations that included life expectancy and child mortality rates.

With the collapse of the Soviet Union in 1990, the delicate trade agreement that supported Cuba's agricultural structure could no longer be sustained. According to an article published in the December 1994 issue of *Rural Report* by Peter Rosset, executive director of Food First, a policy think tank on the causes of world hunger based in Oakland, California, sugar production, which depended on highly mechanized methods and high inputs of imported agrochemicals, dipped to 50-year lows in the two years after the Soviet collapse—less than half the record totals (78 million tons) of the 1980s—and imports of food fell by more than half. Shortages were rampant and still abound; there is often no cooking oil, soap, matches, or meat at the state-run stores. The Cuban State has found it necessary to ration staples such as rice, beans, and flour in order to deal with the severe scarcities. Juan Ramirez Vazquez, an artisan who makes traditional drums by hand in a suburb of Havana, points to a camera case and says, "My breakfast, lunch, and dinner rations for a month could fit in this bag."

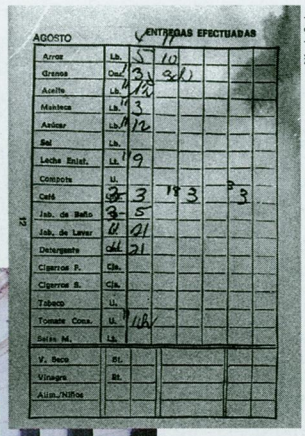
The hardships of daily life in Cuba caught the attention of the international scientific community when food rationing combined with toxic exposures to methanol produced an epidemic of optic neuropathy. In the early months of 1992, 39 patients were admitted to the hospital in Pinar del Rio, complaining of loss of vision in both eyes. Some patients also presented signs of peripheral neuropathy. By the end of 1992, 1,000 cases of optic neuropathy had been reported in Cuba. By April of 1993, the number had reached nearly 50,000. Many of the patients were permanently blinded by the disease.

At the request of the Cuban Ministry of Health, a team of experts from ORBIS International, a humanitarian organization based in New York City that is dedicated to combating blindness throughout the world, and the Pan American Health Organization was assembled in mid 1993 to find the cause of the disease, termed "Cuban epidemic optic neuropathy." The team traveled to Cuba, where they found that 80% of the patients were adult men, each of whom had lost an average of 16 pounds in the previous 12 months. (This was during the time of deepest economic adversity in Cuba, when food was very tightly rationed.) The average Cuban lost 10 pounds between early 1992 and mid-1993, but the patients suffering from optic neuropathy had lost more weight more abruptly, according to a 1994 article in the *Archives of Ophthalmology* by Alfredo Sadun, a professor of ophthalmology and neurosurgery at the University of Southern California in Los Angeles, and his colleagues. The high incidence of the disease in men was partly because the Cuban government allocated the best-quality foods to children, pregnant women, and the elderly. Sadun, the leader of the international team, found that most of the patients had eaten a meal containing some type of meat only three times in the previous six months, and had had no appropriate dietary supplementation.

The Cuban and international researchers discovered that severe malnutrition caused by the food shortages had led to deficiencies in vitamin B complex and folic acid. However, these deficiencies alone could not explain the clinical picture. Sadun and his team found that the optic neuropathy developed in people who were exposed to methanol through the alcoholic home brews that the Cuban people were producing to supplement their diets as well as their incomes. This toxic exposure, combined with the nutritional deficits, caused the epidemic.

The international team recommended vitamin therapy, which the Cuban health care system initiated in June 1993, at which time the number of patients had reached nearly 50,000. By the end of 1993, only 24 new cases had been reported, and many of the patients had recovered at least partial vision. Says Sadun, "The epidemic has been essentially stopped. However, the cost of providing vitamin therapy and prophylaxis has been enormous to an already faltering Cuban economy."

This epidemic prompted members of the scientific and medical communities to plead for an end to the United States' economic embargo against Cuba. In an article



Alfredo Sadun

Luz Claudio

Daily toil for daily bread. Food ration coupons are a part of daily life in Cuba, as is waiting in line to redeem them in stores that offer a very limited number of products and that often have empty shelves.

published in the October 1994 issue of *Neurology*, Gustavo Román, the former chief of neuroepidemiology at the National Institutes of Health, said that the epidemic is "likely to recur if the conditions that favored the original outbreak remain unchanged. Thus, donations of food and vitamins are an insufficient answer to the epidemic in Cuba."

Facing the Challenge

The crisis of the early 1990s necessitated emergency increases in the local production of food crops. As Rosset described it, Cuba "was faced with the challenge to double production [of food] with less than half the inputs [of agricultural supplies]." During the early years of the revolution, the state had occupied 75% of the agricultural lands. As Antonio Alonso-Pérez, vice president of the National Alliance of Independent Farmers of Cuba, says, this "changed the concept of property of the land, and instead of making the land the property of all, it made it the property of no one, so that there was no incentive to protect the environment." In 1993, the government restructured the state farms, aiming to increase agricultural output, stimulate private initiative, and promote environmental conservation. A measure was approved to subdivide the country's huge state farms into smaller cooperatives. Two years later, 52% of the land was managed by cooperatives, 33% by the state, and 15% by private farmers.

There is much concern about what effects the massive production of cash crops has had on the environment in Cuba. Hector Saez, a professor of economics at Wagner College in Staten Island, New York, has analyzed environmental policies in Cuba. He says, "The [Cuban] government's almost single-minded focus on production makes conservation a lesser goal than output maximization." Cuba's own agricultural leaders have also been critical of the effects of cash crops. According to Rosa Elena Simeón, Cuba's minister of science, technology, and environment, "The sugar industry is the biggest source of industrial pollution. Cuba's sugar refineries produce nearly two million tons of waste for every one million tons of sugar."

According to the 1994 book *The Greening of the Revolution* by Peter Rosset and Medea Benjamin, pesticide imports in Cuba reached $80 million in 1989. The use of pesticides and fertilizers was particularly high in the production of sugarcane. With the move to produce more food crops that was prompted by Cuba's economy, scientists began working on alternative agricultural methods. They used biotechnological advances and principles of organic farming to combat effects such as crop infertility and depletion of organic matter due to the heavy use of chemical fertilizers and pesticides on the state-owned farms, which had grown most of the cash crops. Organic farming strategies also became essential because importation of agrochemicals was severely reduced after the Soviet collapse. For example, imports of fertilizers and pesticides plummeted by 77% and 62%, respectively, in 1992, and continued to decline thereafter. Scientists began to seek the knowledge of *campesinos*, small farmers who still enjoyed relatively high crop yields (compared to state-owned farms) because they did not depend on mechanization or agrochemicals.

These collaborations between scientists and traditional farmers have revolutionized how agriculture is conducted in Cuba. Indeed, Cuba represents the world's largest attempt at conversion from conventional agriculture to organic or semiorganic farming. Biotechnological advances such as the mass production of the biopesticide *Bacillus thuringiensis*, combined with the use of traditional farming techniques such as the use of insects in the control of pests, composting strategies, and crop rotation, have enhanced crop production in Cuba. Cuban farming cooperatives now have on-site biotechnology laboratories to produce biological pest controls. Due in part to these efforts, by 1995 the majority of the population no longer suffered drastic reductions in their diet, although some shortages still persist today. Says Martin Bourque, the director of the Sustainable Agriculture Program at Food First, "The Cubans faced many of the same problems we face in the U.S. in the use and abuse of agrochemicals, and they have advanced in solving these problems."

The shortage of pesticides is not the only lack that has spurred innovations. Dependency on imported fuel that is no longer available from the Soviets has made the country vulnerable to many other shortages as well. Cuba imported approximately 13 million metric tons of petroleum annually from the Soviet Union prior to 1990. These imports were reduced by more than half in 1992. This precipitated gasoline shortages and electricity blackouts throughout the island. Due to a lack of fuel, tires, and spare parts for tractors, farm managers hired *campesinos* as consultants in the use of oxen and began using these traditional farm animals. Now farmers can not only plow the land, they can also do it during the rainy

An Island and Its Agriculture

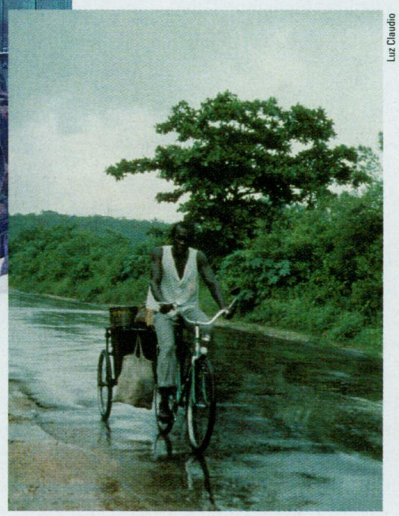
Source: Graphic illustration by Jill Gregory. Adapted from: White P. Cuba at a crossroads. Natl Geogr Mag 180(2):94–120 (1991).

season when tractors get stuck in the mud, increasing farming efficiency.

Agronomists note that switching to traditional farming techniques has also lessened erosion of the land. Erosion is the biggest environmental problem in Cuba, according to the Environmental Agency of Cuba (AAMEC). In a 1997 report on the state of the Cuban environment, the AAMEC estimated that half the arable land in Cuba is eroded to some degree. Deforestation is the biggest culprit, with rates increasing due to cutting trees for fuel and lumber. The AAMEC calculates that 15% of the original Cuban forests remain today. To address deforestation, the government has implemented an aggressive reforestation campaign with a goal of restoring 27% of forests by the year 2015. But so far, the survival rate of the tree seedlings has been disappointingly low because they were planted when they were still too young to survive.

There is a growing realization of the need to protect the environment in the midst of economic hardship, and this realization has spurred legislation. The Cuban Constitution declares in its 27th article that the state must protect the environment. However, until fairly recently, Cuba had no comprehensive legislation for environmental protection. On 11 June 1997, the Cuban government instituted Law 81 of the Environment, which requires the issuance of environmental impact statements, establishes a centralized system of environmental information, and includes provisions for environmental education. These reforms had been sorely lacking, according to Carlos A. Sotuyo, a representative of the AAMEC. Implementation of Law 81 is moving forward. According to Simeón, more than 20 licenses for development projects have been denied under the new law.

In addition to the rise in food crops, the tobacco industry has gained in recent years in Cuba, offsetting some of the economic losses in the sugar industry. Cuban cigars, regarded as the finest in the world, are coveted by a new wave of fashionable aficionados. According to statistics from the Cuban Workers Confederation published in a 5 January 1999 report by the Associated Press, official projections call for Cuba to produce 200 million cigars this year, double the amount produced in 1997. This increased cigar production is mostly geared towards exportation; however, cigar-smoking rates are traditionally high in Cuba. A June 1993 study by the International Agency for Research on Cancer found that tobacco-related cancers in Cuba were among the highest for both men and women, as compared to 14 other countries in Latin America.



Luz Claudio

Back to basics. A shortage of spare parts due to the economic embargo has forced Cubans to resort to basic solutions, such as bikes for transportation.

The Health of Cuba

Although universal health care and education are regarded as constitutional rights in Cuba, economic decline, fuel shortages, and nutritional deficiencies have converged to affect health care on the island. Bob Schwartz, executive director of the New York-based Disarm Educational Fund, which ships donated medical supplies to Cuba, has observed doctors and nurses washing their latex gloves after treating each patient, and sterilizing and reusing syringes because of a shortage of supplies. According to figures from a 1997 study conducted by the AAWH, the U.S. embargo prevents Cuba from obtaining nearly one-half of the new drugs on the market. This is because U.S. pharmaceutical companies have merged with or acquired many international companies, resulting in the application of embargo restrictions to the medical goods that they produce. The effect of the scarcity of drugs is obvious in many medical settings. For example, the AAWH report cites the case of one Cuban pediatric ward where children undergoing chemotherapy vomited up to 30 times a day because of the lack of antinausea drugs. It remains to be seen whether President Clinton's easing of some of these restrictions will have any impact on the availability of medicines in Cuba.

Against all odds, however, Cuba has gained and maintained health statistics that surpass the average for all Latin American countries. During the 1960s, following the revolution, almost half of Cuba's physicians emigrated to the United States, leaving the country with only 3,000 doctors and 16 medical school professors. In response, free medical training was offered to selected students in exchange for their service to populations in need. Many students were trained in Eastern Europe. By 1989, Cuba had 1 doctor for every 333 people. In comparison, the United States had 1 doctor per 438 persons, according to World Health Organization figures. In a 1991 article published in the *Journal of Public Health Policy*, Margaret Gilpin stated, "By the end of the first decade [since the revolution], a unified Cuban national health care system had been created and was firmly in place. The efforts paid off in changes in major health indicators, reductions of infectious diseases, and improved hygienic and environmental conditions."

The evolution of the Cuban health care system has an impressive history. In the 1970s, primary health care was delivered using community clinics, or *consultorios*. The clinic system expanded its role to include health education, prevention, and environmental monitoring. In the 1980s, Cuba instituted the Family Doctor Program, which emphasizes primary care and preventive medicine. The system deploys physician and nurse teams to live in the neighborhoods of the people they are assigned to serve and to be responsible for the health of a set number of families. Throughout the country, family doctors have living quarters within the *consultorios*.

These arrangements are part of a three-year residency training program in family medicine, after which the doctors may choose to continue in family practice or go on to specialty training. All medical training is free of charge in Cuba and open to all races and socioeconomic levels, although it is rationed according to the country's needs. Cuba invests heavily in human resources, allocating 10% of its gross national product to education. The population of Cuba constitutes only 2% of the Latin American population, yet it has 11% of its scientists. Comparative figures

Luz Claudio

Family values. Maternal and child care is a priority of the Cuban State, which provides free pre- and postnatal care and preventive health services.

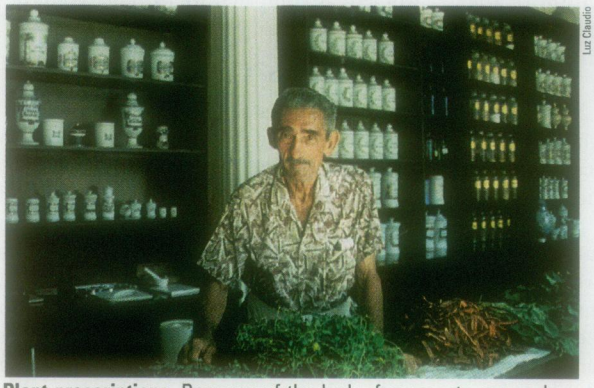
compiled by UNICEF in 1996 show that 98% of the Cuban population enjoyed access to health services, while 73% of the overall Latin American population had access to such services.

Family doctors are also supported by a network of referral centers, laboratories, academic consultants, access to research information, polyclinics (or multiple care facilities), and hospitals. Doctors are required to see each of the patients in their care at least twice yearly and record all medical data into a national database. This practice of community-based family practice has improved epidemiologic surveillance and public health activities, according to an article by Howard Waitzkin of the University of New Mexico in Albuquerque that was published in the September 1997 issue of the *Journal of Family Practice*.

The Cuban health care system has also placed a strong emphasis on maternal, child, and elder health. It provides nationally subsidized child care with one trained employee for every two children enrolled. Childhood immunization programs have maintained 99–100% immunization rates among target populations. There are also state-run centers where expectant mothers who live in the countryside may stay to receive prenatal care free of charge. And for the elderly, there are day care centers that provide meals, medical care, and recreational activities.

A Revolution in Science

As a scientist at the Havana Center for Studies in Sustainable Agriculture observes, "If necessity is the mother of invention, we Cubans have struck the mother lode." Confronting the "lack of everything," as she puts it, has motivated Cuban scientists and medical professionals to come up with innovative ways to address the pervasive scarcities and medical needs of the population. As conventional medicines have become scarce, the medical establishment has now institutionalized "green medicine" by promoting the use of herbal medicine in nonlife-threatening conditions. Taking advantage of the already-widespread use and knowledge of medicinal plants by practitioners of Santería, a syncretist Afro-Cuban religion, the Ministry of Public Health compiled a formulary of medicinal plants that have proven safe and effective in the treatment of many conditions, from gastritis to musculoskeletal pain. The formulary is distributed widely among hospitals, clinics, doctors, and patients by FITOMED, an agency within the Ministry of Science and Technology. This agency also conducts research on the efficacy and use of medicinal plants, their properties, where they can be located, and their uses, doses, and recommended preparations. The ministry has reported "satisfactory results" with the green medicine program and continues to expand its work of discovery of botanical formulations for the treatment of a variety of diseases.


Luz Claudio

Plant prescriptions. Because of the lack of access to many pharmaceuticals, Cubans have developed an extensive program of herbal medicine research and usage.

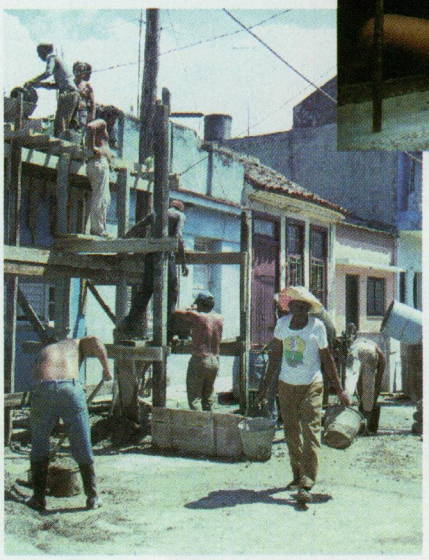
The Cuban scientific community has also achieved great advances in the biotechnology arena. Members of a study group from the American Public Health Association (APHA) visited Cuba in 1995 and 1996 to assess medical advances in Cuba. Their report was published in the September 1997 issue of the *Journal of Family Practice*. The group found that pharmaceuticals have become the third most important export, just behind sugar and nickel. One unique Cuban pharmaceutical product is policosanol, a derivative from sugarcane that lowers atherogenic lipoproteins. It is used to treat lipid disorders in Europe and Latin America, and it produces high benefits with a low rate of side effects. One apparent side effect is increased libido, which has raised sales in some countries.

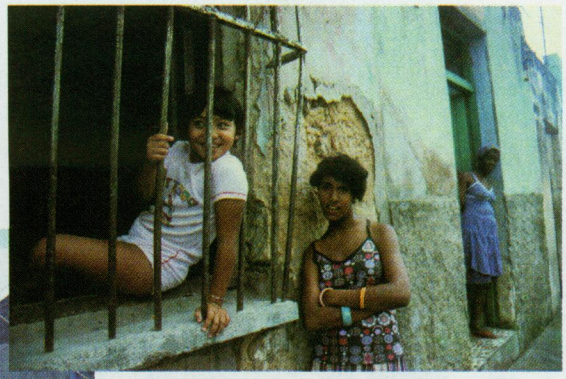
Cuba has also advanced in the cost-effective mass production of biomedical products such as interferons, interleukins, thrombolytic agents, and monoclonal antibodies, which are used to prevent rejection in organ transplantation. The APHA study group found that Cuba's organ transplantation program has attained a high reputation among many countries that refer their patients there. Cuba's bone marrow transplantation program donated its services to 4,000 children who developed leukemia after the Chernobyl nuclear disaster. Other Cuban advances in biomedicine include the production of an innovative vaccine against meningococcus strain B and a surgical approach for the treatment of retinitis pigmentosa.

The Crisis in Infrastructure

Cuba built an effective health care system from the ground up. Now, the significant advances in health care delivery strategies are threatened with being overwhelmed by the deterioration of the Cuban infrastructure. The quality of housing is the primary community concern in major urban centers, according to a preliminary collaborative study by Annalee Yassi, director of the occupational and environmental health program at the University of Manitoba in Canada, and Pedro Mas, director of the National Institute of Hygiene, Epidemiology, and Public Health in Havana. In Cayo Hueso, for example, 70% of the houses have been classified by the Municipal Department of Housing as inadequate and 38% are uninhabitable. The index of overcrowding is 7 persons per room. More than half the population in the urban areas does not have daily access to potable water. Only the commercial zones have daily garbage collection, and treatment of water wastes has been reduced. Many residences depend on water wells for potable water, particularly in the rural areas. Wells can be contaminated with high levels of pesticide runoff from agricultural enterprises. In the 1998 book *Contribucion a la Educacion y la Proteccion Ambiental: Hombre y Medio Ambiente*, Miriam Martinez-Varona and colleagues at the National Institute of Hygiene,

Epidemiology, and Microbiology in Havana described a study in which they detected levels of the pesticide aldicarb at 8–64 mg/L in drinking water samples. The researchers suspect that these pesticide residues in the drinking water may be the cause of neurological symptoms reported by people who had consumed water from these contaminated wells, but conclusive evidence is still lacking.





Luz Claudio

The threat of decay. Although attempts are being made to improve housing conditions, a crumbling infrastructure threatens to overwhelm progress in Cuba.

The Cuban government has invested considerable amounts of resources in pilot projects to renovate community-based housing and conduct health profiles and needs assessments for environmental and health interventions. Also, according to *Cuban Studies*, the government is trying to relieve the urban overcrowding by constructing high-quality housing and cultural centers in rural communities to make rural living more desirable and to stimulate reverse migration. Cuba ranked fifth among Latin American countries in numbers of people living in urban centers. With the importance of more labor-intensive agricultural practices, there is even more need for people to live in the rural countryside.

Welcoming Visitors

A renewed nonagricultural industry may also help reduce both the need for planting cash crops and their effects on the environment and health. In 1998, tourism overtook the sugar industry as the biggest source of revenue in Cuba. Tourists spent $1.8 billion last year, generating more hard currency than all of Cuba's exports combined. According to a January 1999 report by the Reuters News Agency, the tourism industry projects that visits to Cuba by foreign tourists will reach around 1.7 million in 1999, a 21% increase over 1998. Tourists are attracted to Cuba because of its Caribbean beaches, its culture, and the socialist mystique. "Traveling in Cuba is still wonderful, even with the power and water shortages," says Andrew Schloss, a professor at the University of Victoria in Canada and a frequent visitor to the island.

Tourism may present its own environmental problems, though. Garbage has increased in some areas because tourists purchase more packaged goods, adding to the strain on an already faltering waste collection system. Also of concern is the fast rate of development of tourist resorts. Cuba went from having only 5,000 hotel rooms in 1987 to about 28,000 today, and plans for more expansion are under way. In their 1999 book *The Environmental Legacy of Socialism in Cuba*, Sergio Díaz-Briquets and Jorge Pérez-López expressed their concerns about development, writing, "While some efforts are being made to develop ecologically-friendly or ecotourism, focusing on small sites and strong interactions with communities, it is clear that the leadership is thinking in terms of mass tourism that maximizes short-term revenue." The full environmental impact of the rapid increase in tourism is yet to be determined.

Tourism has also generated some societal changes. With increased government tolerance for the private enterprises that supply foreigners with goods and services, Cuban society is becoming somewhat divided between those who have some and those who have less. According to an 11 January 1999 article in *The New York Times*, educated professionals such as engineers and teachers supplement their salaries by serving as tour guides and cab drivers for the burgeoning tourism industry. They do this not only for extra income, but also to obtain U.S. dollars, which can be used to buy consumer goods in the dollar-only stores that cater mostly to tourists.

The embargo goes both ways; it not only prevents U.S. goods from reaching Cuba, but also is effective in blocking Cuban innovations from reaching the United States. The APHA group stated that "aside from the U.S. embargo's deleterious effects in Cuba, we became more aware of its adverse impacts for medicine in the Unites States." This sentiment underscores the political convictions of some U.S. scientists who are trying to increase exchanges with their counterparts in Cuba by sending scientific journal subscriptions and maintaining correspondence. As Sadun recalls of his visits with Castro during his work on the optic neuropathy epidemic, "Castro and I were able to put our political ideologies aside to effectively deal with the problem at hand."

While Cuba's resilience and creativity in dealing with its problems are tested time and again, scientific innovations that protect health and the environment are offering new hope. With the new, less restrictive provisions of the trade embargo, scientific exchange may flourish as well, leading to a better life for Cubans.

Luz Claudio

Open arms. Cuba welcomes tourists to its sandy beaches and historical sites in hopes of supplementing the island's economy, but this burgeoning industry may present environmental problems as well.