

November 28, 2000

From Jungle to Space in Pursuit of New Drugs

By DINAH ENG

Dr. Franklin Chang-Diaz, a NASA astronaut with roots in Costa Rica, and Dr. Jose Zaglul, president of a university that specializes in agricultural courses for the humid tropics, were driving onto Dr. Zaglul's campus in Mercedes, Costa Rica, one day in 1991 when they had a short conversation that has turned into a big idea.

Dr. Chang-Diaz, who was in Costa Rica to foster greater Latin American participation in space projects, had just met some Chilean scientists who were trying to cure Chagas' disease, a parasitic illness that kills about 45,000 people a year, mostly in Latin America. As leader of Earth University, or Escuela de Agricultura de la Region Tropical Humeda, Dr. Zaglul was passionate about teaching the importance of biodiversity and sustainable development of natural resources.

The two men agreed that somewhere in the diversity of flora and fauna in the tropical rain forest, a cure for Chagas' disease might be hiding, and that the National Aeronautics and Space Administration might be able to help find it. The agency, which is seeking commercial applications for human spaceflight, has been promoting the production of drugs in space since the early days of the space shuttle. For one thing, drugs made through crystallization can be made more uniformly in the microgravity of space.

Chagas' disease, Dr. Chang-Diaz and Dr. Zaglul decided, might be an area of research each could contribute to.

"The bulk of Latin American countries have not been able to work on space activities," said Dr. Chang-Diaz, a physicist who since becoming the first naturalized American citizen to join NASA's astronaut corps has flown on six shuttle missions and runs the space agency's Advanced Space Propulsion Laboratory in Houston.

"The people of these countries may not have a lot of money, but they have brain power," Dr. Chang-Diaz said. "In Latin America's political environment, the correlation between economic development and access to space technology is not yet seen. But the Chagas project could change that."

Dr. Zaglul has organized a Latin American coalition that includes Earth University, two universities in Chile -- Universidad Catolica del Norte and Universidad Santiago de Chile -- and others in Costa Rica, Argentina, Brazil, Bolivia, Paraguay, Uruguay and Mexico.

Dr. Chang-Diaz persuaded Dr. Lawrence J. DeLucas, a biochemistry professor at the University of Alabama at Birmingham who was on leave to NASA as a payload specialist, to join the effort. NASA agreed to fly experiments on the space shuttle for the consortium. "I'd never heard of Chagas' disease before," said Dr. DeLucas, who said Dr. Chang-Diaz persuaded him to visit South America to learn about the disease firsthand. "But in Chile, I saw some people in a village suffering from it, and became involved. Pharmaceutical companies aren't interested because the disease hits people who couldn't pay for a drug if there was one."

The disease, named after Dr. Carlos Chagas, its discoverer, is caused by the parasite *Trypanosoma cruzi*. The parasite, in turn, is carried by insects that live in the walls of mud huts and old houses, and bite victims in the soft tissue around the mouth or eyes. The parasites move through the bloodstream, where they can live for years without causing symptoms. But in about a third of those infected, the parasites eventually cause fatal complications in the spleen, brain and heart. No satisfactory drug has been developed to treat the disease.

Chagas' disease also spreads through blood transfusions, from mother to fetus, and in organ transplantation. Because of those risks, the Red Cross screens donated blood for the parasite in certain states with heavy immigration from Latin America.

In February 1996, Dr. Chang-Diaz and Dr. DeLucas began a string of Chagas experiments on the space shuttle. In the first experiment, they tried to get a clearer picture of a protein made by the parasite, but the flight proved too short, Dr. DeLucas said. Experiments on four later flights focused on crystallizing extracts of an enzyme involved in Chagas' disease and on the development of compounds that might be useful in treating it.

One strategy is to find a substance that will bind with a protein made by the parasite and keep it from multiplying. With that hope, Earth University is concentrating on a protein from a rain forest tree, *Bursera simaruba*, also known as gumbo-limbo.

The effort was supported by the Exposition Foundation in Atlanta, in addition to NASA and the University of Alabama at Birmingham. Dr. Zaglul is seeking additional contributions for the effort, which since 1991 has cost Latin American countries \$300 million for control of the parasite carrier and to combat blood transfusion transmissions.

As part of the collaboration, scientists from Latin America and the United States have conducted numerous exchange visits, and students from Earth University have interned at the Johnson Space Center, producing an atlas of space shuttle photography of Costa Rica that will be used by educators and agriculturists.

"We have combined indigenous knowledge and space technology in a way that utilizes each party's strengths to do together what we could not do individually before," Dr. Zaglul said. "I am sure that the potential of finding a cure for AIDS, malaria, cancer and other diseases are here in the biodiversity of the rain forest."

He went on, "I've been asked by some, 'Why should we help Latin America? Why don't you solve your disease problems yourself,' which are fair questions. But if we all pull together as one race, and help each other, we will be much more positive about how we perceive others. There will be a time when Latin America can help others."

Dr. Chang-Diaz sees another potential benefit. "There is a great connection between the rain forest, biodiversity and space," he said. "Earth University is developing revolutionary techniques for agriculture that take advantage of environmental conditions to grow crops in the framework of environmental wholeness. That's exactly what we must do on long-term duration space missions.

"Manned missions to Mars and beyond, for example, will require crews to grow their own food, recycle oxygen and maintain other environmental life support systems on a ship that must be self-sustaining. Jose moved heaven and earth to bring Earth's resources to the Chagas project. Imagine how much we could do if the whole world worked together like this."

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