Alpha Helix returns home

December 16, 1967

The Alpha Helix, experimental biological laboratory vessel of Scripps Institution of Oceanography, University of California, San Diego, tied up Saturday, Dec. 16, at her Nimitz Marine Facility on San Diego Bay to conclude one of Scripps' most ambitious and fruitful biological and physiological research efforts.

She left San Diego last Feb. 3 for the upper reaches of the vast Amazon River basin. Between mid-March and late October, when she left for home, an international team of 82 scientists from 12 countries and representing 39 institutions, studied, among other subjects:

The insect-free Rio Negro River, where the Alpha Helix was moored; the singing habits of the cicada; the hallucinogenic snuff used by South American Indians; the slothful manner of the sloth; habits of electric eels and the allegedly vicious piranha fish; sounds of fresh-water dolphins; infrared sense organs of the boa constrictor; the possibility that crude petroleum may originate from smog particles given off by jungle trees; physiology of salt and water in animals; respiratory mechanisms in Amazonian cultivated and indigenous fruits; moisture-secreting aspects of jungle trees; the nature of sap pressure in the "drowned" forests of Brazil; and the metabolism of fish muscles and respiration of Galapagos Island marine iguanas.

En route home, Alpha Helix scientists also did deep-sea marine life research off the Galapagos Islands in November. In all, the ship logged 17,610 miles under Capts. James Faughn and Robert Haines.

"The exciting, basic research conducted aboard the Alpha Helix and at our laboratory-equipped shore camp on the Rio Negro, 200 miles above Manaus - itself 1,000 miles up the Amazon from Belem - far exceeded our expectations," Dr. Per F. Scholander, expedition coordinator and director of Scripps' Physiological Research Laboratory, reported.

"The cooperation of the Brazilian government and of Brazilian scientists was all that could be asked for. We are especially grateful for the excellent work of Navy Cmdr. Manoel Perez, himself a physical chemist, who was the Brazilian liaison officer with the expedition."

The expedition was funded by a $600,000 grant from the National Science Foundation. NSF also will fund the Alpha Helix's work next year in the Gulf of Alaska and Bering Sea, where scientists will study warm- and cold-blooded animals, problems relating to freezing, and athersclerosis in migrating salmon.

The 82 scientists, including some ten graduate students, who took part in the Amazon Expedition represented the United States (51), Brazil (20). England, Canada, Germany, Norway, France, New Zealand, Sweden, Australia, Japan, and Russia.

The Amazonian research fields and their leaders were (1) behavioral studies of fish and animal life, directed by Dr. Theodore H. Bullock, professor of neurosciences at the University of California, San Diego School of Medicine; (2) evolutionary transitions experienced by fish moving through various environments such as salt and water, headed by Dr. Knut Schmidt-Nielsen, Duke University, Durham, N.C.; (3) studies of insects and insect-repelling qualities of plants, headed by Dr. Carroll M. Williams, biologist from Harvard University, Cambridge,

Mass.; and (4) research into tropical fruits and their commercial potentialities, directed by Dr. Jacob Biale, botanist and plant physiologist, University of California, Los Angeles.

The Galapagos Island work was led by Dr. Malcolm Gordon, UCLA zoologist.

Research by the scientists on work done in the Amazon and off the Galapagos undoubtedly is continuing in their home laboratories, Dr. Scholander said. He stressed that final results of work accomplished will be published in scientific journals.

Preliminary reports, however, indicate these findings of general interest:

Galapagos Islands Research

In the Galapagos Islands operation, some ten specimens of a rare, deep-sea scorpion fish, Ectreposebastes imus, were obtained. They were identified aboard ship by Dr. Richard H. Rosenblatt, Scripps' curator of marine vertebrates. He said the only previous similar specimens taken from the Pacific were collected by the U.S. Fish Commission's Albatross Expedition in 1891. Dr. Rosenblatt also collected small shore fishes of many kinds and determined the thermal tolerance ranges for several which have evolutionary relationship with tropical or subtropical mainland groups.

Dr. Malcolm Gordon of UCLA measured the metabolism rate, at different temperatures, of red and white muscles from six species of inshore and free-swimming fishes, and noted a higher rate of oxXgen uptake by the red muscles than the white. A fish uses the red muscles for steady swimming, but the reason for an increase in red muscle metabolism over that of the white muscles is still under investigation.

Drs. Frank Carey and John Teal of Woods Hole Oceanographic Institution, Woods Hole, Mass., studied various aspects of respiratory physiology in diving marine iguanas. These iguanas are the only lizards in the world that go into the sea, as Darwin noted years ago. They eat algae and concentrate in great herds on the Galapagos rocks. Several of them were strapped to boards with a tube lowered into their lungs and then immersed for an hour in tide pools to measure the oxygen and carbon dioxide concentration in their lungs.

The effects of pressure on the oxygen consumption in fish muscle in order to better understand the adaptation of deep-sea fishes to their environment were researched by Dr. Alexei Kuznetzov, a member of the Soviet Academy of Sciences from Moscow's Institute of Oceanology. He is in this country at the invitation of the U. S. National Academy of Sciences.

Dr. Fred White, of the UCLA medical school, studied the heart rate and temperature adaptation of marine iguanas sunning themselves on the Galapagos rocks and again after they slithered into the ocean. While the animals were in the sun, their temperature measured 38 deg. Centigrade; this dropped to 21 deg. Centigrade when they were in the water. It was observed that warm marine iguanas are tolerant of human beings, who can approach to within ten feet and not alarm the animals, but that the colder the animals get, the more wary they become of intruders.

Dr. Kenneth Norris, UCLA zoologist, continued his work on porpoise echo-location problems; that is, how porpoises transmit sound to their inner ear. This is not achieved by the usual "hole" in the ear, and Dr. Norris is trying to determine whether the sound is transmitted through the animal's lower jaw or the fatty lump in its head.

Many Galapagos Island penguins were observed, according to Dr. Rosenblatt. These are the most northern penguins known to man and they have adapted themselves to the area, which lies on the Equator, because the cold Peru Current sweeps by the islands, whose temperatures are generally mild as a result: 71 degrees in the water and in the high 60s and lower 70s in the air at this time of year.

Amazon Basin Research

Dr. Williams reported that hormones he took from the Rio Negro may be used as the basis for insecticides that could either destroy any insect or be adapted to destroy one particular specie. He feels the Rio Negro is the locale for great reservoirs of plant-produced "juvenile hormones" that are similar to the juvenile growth-regulating hormones secreted by all insects at certain stages in their development. The Rio Negro's waters are black from plant extracts washed out of the surrounding rain forests. Working with Dr. Williams was his assistant, Dr. Fotis Kafatos, a former student.

Prof. Hebe L. Martelli, a biochemist from the University of Brazil at Rio de Janeiro, discovered that bacteria from the upper reaches of the Amazon can break down sulphur-containing compounds that are related to commercial detergents. Our polluted streams have no bacteria that can destroy this menace, Dr. Scholander said.

Dr. Richard Schultes, curator of Harvard's Botanical Museum, and Dr. Bo Holmstedt, chairman of the Department of Toxicology of Sweden's Karolinska Institute, were able to test a resin from the Virola tree that Amazonian Indians use to make a hallucinogenic snuff they blow into their nostrils, with LSD-type effects. The scientists feel their studies will help them to learn more about the mechanism of the central nervous system, after they discover what the hallucinatory substances are.

Dr. Bullock reported that boa constrictors and anacondas have highly sensitive heat receptor systems in their lips and can sense bodies warmer or colder than surrounding objects, an ability that helps them find food.

Peter Hartline, a UCSD graduate student, also discovered that boas can hear airborne sounds. He obtained readings from electrodes placed in the boa's brains after they had been insulated against earth vibrations.

Dr. Bullock and Hartline placed some electric eels in separate tanks connected by a pair of electric wires. They observed that when the eel in one tank was stimulated by food or disturbance, the eel in that tank communicated its unrest to the eels in the other tank. This is done by accelerating the discharge of weak, signalling pulses and thereby attracting attention in the other eels.

Dr. A.B. Steinbach of Rockefeller University learned that some types of electric eels function best in water that is neither too salty nor too soft (as in the Rio Negro). Salty tidal water short circuits the eel's current and nearly pure rainwater has too poor a conductivity.

Also working with eels, Dr. Thomas Szabo of the National Center for Scientific Research, Paris, and Dr. Per S. Enger, University of Oslo, Oslo, Norway, found that certain species of electric fish use electroreception to help them see, by setting up weak electrical force fields around themselves. The fish sees any distortion in the lines of force and thus is aware of what is ahead.

The scientists hope by studying the numerous species of electric fish to learn some principles applicable to how the human brain codes and decodes electrical nerve signals.

Dr. Frits Went, of the University of Nevada, spent considerable time filtering the air around Manaus, seeking submicroscopic particles to measure impurities in the air. He believes petroleum has evolved from the turpines given off by plants that form what is called "summer haze" and that produce pine and meadow odors. He believes these vapors are comparable to low concentration gasoline vapors that rise in the air and are concentrated in the clouds, carried to earth by rain, and washed to delta areas to collect in pools where, after millions of years, they turn into crude petroleum. Went says the haze is made up of microscopic particles closely related to city smog. He does not predict the results of his research at this time, however.

As for the so-called vicious piranha fish, Dr. Hubert Markl, an ethologist from the University of Frankfurt, West Germany, discovered that most species are somewhat timid, will attack an abnormal-looking object, such as a sick fish, rather than a normal one, and hesitate to attack anything larger than themselves.

In his cicada studies, Dr. David J. Aidley, of Oxford University, England, learned that these relatives of the American seven-year "locusts" have drums on both sides of the abdomen that are sounded by rapid tightening and releasing of the membrane. The drumbeats alternate between the two sides of the body, each at a rate of 100 beats a second. This rhythm is generated in the muscle, not in the brain.

In his own investigations, Dr. Scholander, together with Cmdr. Manoel Perez of the Brazilian Navy, studied the sap pressures measured in the "drowned" forests under flooded conditions that existed when they were on location on the Rio Negro. This situation was an "interesting contrast" to the arid conditions Dr. Scholander said he found during the Alpha Helix's 1966 expedition to the Great Barrier Reef. Off Australia he learned that mangroves were able to develop enough negative pressure or suction to desalt the water, whereas on the Rio Negro, the hydraulic systems of plants in fresh water provided the contrasting conditions.

Working with sloths, Dr. Robert B. Livingston, chairman of the Department of Neurosciences of UCSD's School of Medicine, and Dr. Donald B. Lindsley of UCLA discovered the slowness of the three-toed sloth to be related to its central processes but not enough to explain the animal's entire slow-motion system. In one experiment, a light flash was followed by a puff of air near the sloth's eye. The idea was to see how long it took the animal to blink his eye after the flash and before the puff. The blinking reflex would develop if the sloth had nothing else to do. The sloths also learned to maneuver through a maze if their desire was to escape, but neither sex nor hunger could lure them through it.

As for the dolphins, UCLA's Dr. Kenneth Norris discovered that the Amazonian pink, fresh-water creatures have higher-pitched voices than their salt-water contemporaries. Once thought to be silent, they actually make yelps and barks. Dr. Norris recorded their sounds for further study.

Dr. Biale and his colleagues researched the problems connected with the ripening and preservation of fruits and studied the time sequences occurring in their development. They discovered what appears to be a new strain of cacao.