Long Lab Celebrates a Decade of Research

by Rick Hildreth and Leigh Parker

WHEN Long Marine Lab personnel hold their annual open house this weekend, a few thousand people will wander through the squat buildings, ogling dolphins and sea lions listening to researchers and docents tell about projects at the lab and exotic locations like Antarctica and the tropics.

But few will comprehend how rare a facility the 10-year-old lab is. When most people think of a marine lab, giant amusement park-like aquariums come to mind.

Yet most research conducted at places like Monterey Bay Aquarium is done behind closed doors. Labs devoted solely to research are usually closed to the public, like Stanford's Hopkins Marine Center. UCSC's Long Lab is an anomaly, a pure research facility that welcomes public viewing and participation.

"This is a research facility that opens its doors to the public and that's extremely rare," said researcher Mary Silver, a biologist and oceanographer.

There are three main research areas: marine mammals, marine biology and marine toxicology, said researcher Don Potts, an Australian studying coral. Long Lab has "probably the largest concentration of marine mammal work anywhere in the world," he said.

Teaching Sea Lions

One marine mammal project hopes to find how well sea lions think. Ron Schusterman and Bob Gisiner have been teaching hand signals to represent objects and actions to sea lions, then combining those signals in increasingly complex chains of commands.

They've discovered the animals are capable of understanding the instructions to a high degree (for example, they can select a large white cube over a small white cube when instructed to do so, or bring a white ball to a black pipe rather than a white pipe). "They act very much like a computer would act," said Schusterman. "You give them a series of if/then proposition statements and they carry those things out."

On the surface, this project might seem to resemble the tricks sea lions do in aquarium shows, but the resemblance is superficial.

"If you want a sea lion to leap over a ball, you just pick a ball out there and give the animal one signal and it leaps over it," said Schusterman. "I call this a holophrastic phrase; the signal is just leap over the ball."

In Schusterman's experiment, the commands are broken down into a series of signals representing each element of the command. Whereas the sea lions at Sea World know a hand signal means "jump over the ball," Schusterman's animals understand instructions like "white small cube — flipper touch." They are capable of differentiating between several similar objects given specific instructions to do so.

The most difficult task for Schusterman's sea lions is to create a relationship between two objects, such as "small white cube — fetch to — black pipe." The second object seems to "knock the first object out of the short term memory."

This is not unlike what happens when humans go back to a room to get "your pills, and you go up into the room and you suddenly see a set of keys you need, so you take the keys and then say to yourself, 'Why did I come up here in the first place?'" Schusterman said.

A Weird Squirt

Mary Beth Saffo's research involves both marine biology and marine toxicology. Saffo is probably one of the world's leading experts on sea squirts, sluglike creatures that seem to thrive in highly polluted areas. "I'm interested in them because they do everything wrong," she said.

One of the oddest things about sea squirts is that although they are technically invertebrates, their physiology is very similar to that of vertebrates; they even have a mitochondria (a sort of proto-spine) when they're young. They have a thyroid gland, although there's no apparent purpose for it.

Another odd thing about sea squirts is their renal sac, a proto-kidney that accumulates uric acid rather than eliminating it. "It's really weird for a kidney in that it has no openings at all, and the whole point of a kidney is to get rid of your waste," said Saffo.

This fascinated Saffo, who refused to accept the standard "it's primitive" explanation. The renal sac "is a large organ that takes up a whole bunch of the animal's body. They also excrete things like ammonia that you expect marine mammals to get rid of, their nitrogen waste products."

Saffo discovered that some fungus-like organisms (she stressed that a taxonomist might argue that this new creature isn't really a fungus) lives in the squirts' renal sac, along with several types of bacteria, all of which seem to thrive on the uric acid.

"There's a real nest of creatures within creatures, within creatures within creatures, but always associated with each other," she said. "So it's gotten to this point where if you try to think about this particular family of sea squirts, it's pretty clear that they co-evolved, they evolved in concert with a whole other group of organisms."

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Rocky the Sea Lion says "hi' in any language to a Long Marine Lab staffer helping conduct research on the marine mammals