BIOLOGY

From the Steinhart Aquarium at the California Academy of Sciences in San Francisco

The great white hope

During the cool, foggy mornings in San Francisco now, several officials of the Steinhart Aquarium are "on call." They are hoping to hear from the fishermen who, enjoying the height of the halibut season, check their gill and trammel nets between 5 a.m. and 8 a.m. Steinhart officials are not particularly interested in the normal catch of the day, but rather in what also might become entangled in one of those nets — a great white shark.

The shark researchers have spread the word that a great white could mean as much as $5,000 to the fisher of halibut who turns it over to a carefully practiced drill team from the aquarium. This team is ready with a special seawater-filled transport box, through which pure oxygen bubbles, and an aquarium holding tank in which the team will literally take the shark for a walk to ensure that oxygen continually moves over its gills. Finally, aquarium director John E. McCosker is prepared to decide when the shark looks healthy enough to proceed to the aquarium's Roundabout — a large, doughnut-shaped, 100,000-gallon tank equipped with a 1 knot current.

McCosker and colleagues know that all this fuss is necessary: Great whites do not adapt well to life in normal aquarium tanks. In fact, all attempts made over the last several years to keep a great white alive in captivity have failed. (Most recently, the death of a great white at San Diego's Sea World ended a reportedly record-breaking 16-day captivity of the shark.)

Meanwhile, McCosker also is preparing to travel to the Azores (islands west of Portugal) where sperm whale fishermen claim to have the remains of a record-breaking 29.5-foot great white. McCosker hopes to encounter other such giants not "for the 'Ripley's Believe it or Not' aspect," but rather for clues as to why such large animals have not switched over to plankton feeding to survive. "The shark can't turn on a dime," McCosker explains, "so it has to have a special mechanism to attack its prey before they realize it. Otherwise, it would be like an underwater Mack truck trying to track down a sea lion."

The Dr. Doolittles of dolphins

Amphi and Thetus emit sounds that have not yet been decoded by humans. Their flippers are not amenable to sign language. But Alexandra Basolo and Lisa Heininger of San Francisco State University still want to communicate with these Steinhart Aquarium dolphins, so they are investigating another possibility — the use of colored geometric shapes.

Basolo and Heininger place a largely plastic "pressing box" in the dolphins' tank. White or black triangles or circles appear on this device. The researchers now are teaching Amphi and Thetus to press against the device regardless of which colored shape appears on the machine. The dolphins are positively reinforced with food or a pleasant sound. Soon Basolo and Heininger will teach both dolphins that only white, for example, is positive and that black is negative.

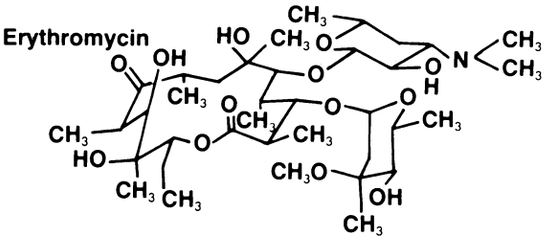
The next step will be to teach one of the dolphins reverse discrimination — that the machine should be pressed when only black shapes appear — and the other dolphin a nonreverse, but new discrimination — that shape, rather than color, now dictates whether the machine should be pressed. The dolphins' performance on these colored shape discrimination studies may provide clues as to what type of human-to-dolphin communication researchers should expect.

"Marine biologists have always said that dolphins are such brilliant animals, that they know so much — if only we could talk to them," says aquarium director John E. McCosker. "Once we *do* learn to communicate with them, however, I think we'll be disappointed." Says McCosker, "They aren't going to recount the history of sea-faring nations or what really happened to Atlantis."

CHEMISTRY

Synthetic triumphs: An antibiotic . . .

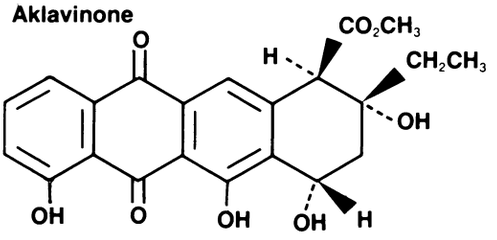
It took eight years and the efforts of 49 scientists but Harvard University chemists recently completed the chemical synthesis of the antibiotic erythromycin. The antibiotic, naturally produced (with much less effort) by the bacterium *Streptomyces erythreus*, is used medicinally to fight a wide variety of bacterial infections. The drug works by inhibiting protein synthesis in susceptible microorganisms. The chemists undertook the task of synthesizing erythromycin in the laboratory in the hope of being able to tailor the drug to have different actions and to



combat bacteria resistant to the natural antibiotic. The strategy for synthesizing erythromycin was devised by Robert B. Woodward, who died during the project in 1979. First a chain of carbon groups was assembled, then the ends were joined (a step requiring about 30 different attempts) to make a ring called a macrolide. After Woodward's death, Yoshito Kishi assumed leadership of the project and accomplished the most difficult task, the addition of two sugar molecules in the proper orientations at the proper locations. The successful synthesis was reported in the June 3 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY.

and part of a promising cancer drug

Four separate strategies have enabled chemists to synthesize the nonsugar portion of a drug that promises to be useful in cancer treatment. Aclacinomycin A is related to the anthracycline drugs, which are currently used to fight certain kinds of cancer, but it appears to be much less toxic. The drug is naturally produced by the bacterium *Streptomyces galilaeus* and was first isolated in 1975 by Japanese scientists. Three research groups now report in the July 15 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY synthesis of aclacinomycin A's nonsugar portion, which is called aklavinone. One group is from Harvard University and was led by Yoshito Kishi, who also directed the final stages of erythromycin synthesis (see above). The other teams are An-



drew S. Kende and James P. Rizzi of the University of Rochester in New York state and Pat N. Confalone and Gicomo Pizzolato at Hoffmann-LaRoche Inc. in Nutley, N.J. Scientists at Syntex Research Center in Palo Alto, Calif., have completed yet another synthesis of the compound, but the work has not yet been published. Although the three published methods of synthesizing aklavinone are quite different, they all assemble parts of the molecule separately and then fuse them. All the approaches allow the scientists to custom build related molecules not naturally available, but which may be of medical value.