

PHYSIOLOGY

Porpoise: Intelligent Sea Creature

Porpoise studies may result in new designs for ships, a more sensitive sonar system, and a basis for communication with intelligent, non-human creatures, Gloria Ball reports.

► **WHATEVER** the porpoise has, the Navy wants it, and the United States Government is spending \$200,000 to find out what it is and how to copy it.

This frolicsome sea mammal, sometimes called a dolphin, has a sonar (sound-sensing) system that can outdo anything man has devised. It swims with so little effort that ship captains can only watch with envy. And in spite of being an air-breathing creature, the porpoise can stay under 1,000 feet of water for an incredibly long time, and then come up quickly without getting the bends.

As to intelligence, some researchers now believe the chimpanzee is losing ground and that the porpoise is second only to man in intelligence. The porpoise can learn to avoid electric shock by flipping a switch in less than 20 trials, a task that may take many more trials for the chimp.

The porpoise brain is complex, well developed, and larger than man's. In proportion to body weight, however, the porpoise brain is smaller.

One authority on porpoise intelligence is neurophysiologist John C. Lilly, presently working at the University of Miami in Coral Gables, Fla., while new facilities are constructed at St. Thomas in the Virgin Islands. His research has revealed that communication between porpoises consists of several distinct sounds such as squawks, snorts, whistles, gurgles, buzzes and squeaks, used separately or in "word" combinations. At times the animals have imitated, in a Donald Duck voice, words spoken by Dr. Lilly and his helpers.

May Communicate in English

Someday scientists and porpoises may understand each other well enough to communicate in English, porpoise or polyglot. So far, Dr. Lilly has reported understanding of only one porpoise sound. This is the distress signal, a running squeal that rises and falls in pitch. Voiced when the animal is hurt or in trouble, it never fails to summon help from other porpoises.

Equipped with intelligence and a fantastic sonar system, the porpoise is a virtual dead-eye in the water.

So accurate is this object-finding technique that a blindfolded porpoise can navigate unerringly around pipes and bars being moved through the water. It can tell which fish is blocked off by glass and which one is free. It also can distinguish, possibly by the movement patterns, which fish is good eating and which is not. If a half teaspoon of water is dropped six feet into a pool, the porpoise knows. And when the water is slapped with the hand,

a porpoise can swim to the spot from 60 to 80 feet away and not miss it by more than eight or nine inches.

Porpoise sonar is not only more accurate than man-made sonar, but also detects at much greater distances. Obviously the Navy would like to know how the creature does it.

It is known that sonar sounds emitted by the porpoise are different from the whistles and squawks of communication.

One of the first porpoises used for sonar research, about 1955, was a cantankerous old bull who "creaked" as he searched for food. The creaking, similar to the sound of a rusty hinge, is actually a series of clicks repeated 10 to 400 times per second.

This old man of the sea was blind in the right eye and losing sight in the left. This fact helped the researchers, Dr. William E. Shevill and Barbara Lawrence of Woods Hole, Mass., determine how much looking and how much "echo location," as animal sonar was called, was involved in food finding.

Porpoises generally react to sounds up to

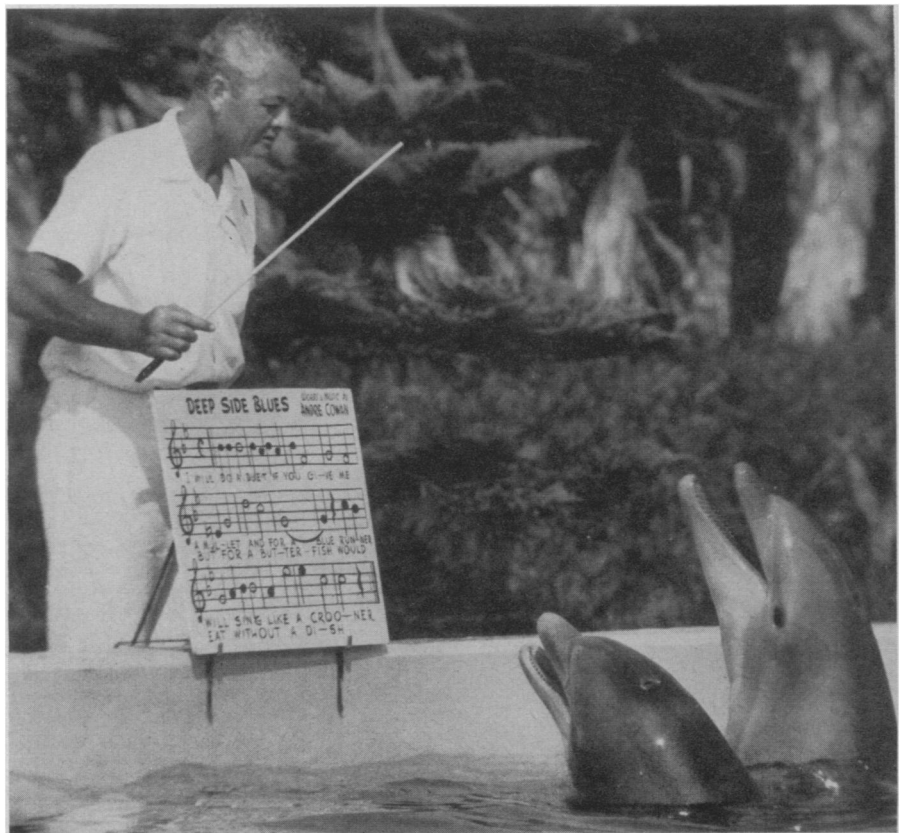
80,000 cycles per second. The upper limit for human hearing is 20,000.

But Notty, a female porpoise named for the Naval Ordnance Test Station in China Lake, Calif., where she is trained and tested, has broken the record for sounds emitted. She has whistled, buzzed and gurgled at frequencies all the way from 750 cycles per second to 300,000. Some of the sounds come from the blowhole, some are from the larynx, and some are produced by other body organs.

Notty, four years old, 180 pounds, and six feet long, also is being used for hydrodynamic studies. She has been trained to dash off at top speed and to crash stop while wearing either suction cups with electrodes attached or plastic body rings for which drag resistance is known. As she swims by, high-speed cameras record the flow pattern. The patterns may be studied in another way—by painting the animal with dyes that wash off and leave trails in the water.

For some reason the porpoise, which swims by up and down motions rather than sidewise motions like a fish, gets about 10 times as much horsepower per unit of muscle as a man or a dog. Put another way, it gets more miles per wiggle.

Although swimming speeds of 25 to 30 knots have been reported by reliable ship



SING A SONG—Two porpoises at the Marine Studios, Marineland, Fla., sing along in whistles, buzzes and squawks. Will they ever sing in English?

captains, no scientist has verified this to date. Notty has been clocked at 16 knots top speed, and her handlers still do not know whether she is incapable of going faster or whether she is being temperamental.

Whether the porpoise is swimming lazily or bolting to the rescue, there is almost no turbulence or wake, indicating drag, behind the animal. If boats, ships and torpedoes could be made to move with the same ease, sailing and underwater warfare could be revolutionized.

This was the goal of Dr. Max O. Kramer, a German-born expert in fluid dynamics who conceived the idea of applying a porpoise skin made of rubber to the hulls of vessels. This concept is coming to fruition in the form of Lamiflo coatings being developed by the U. S. Rubber Company.

Coatings Not Perfect Yet

The coatings are not yet perfected and scientists are still trying to find out how the real animal gets the very thin layers of water nearest the body to slide smoothly over each other rather than letting them flow at different speeds to produce turbulence and drag.

Smooth flow apparently is enhanced by the two-layered porpoise skin, constructed somewhat like a building with a flat roof resting on millions of flexible pillars.

Skin on the front end of the porpoise, from the nose to about three feet back, has very few blood vessels. Very little drag would be expected here. But toward the tail, where the skin has numerous blood vessels, there is still no drag.

The China Lake team, headed by Dr. Rene Engel, believes the expected tail drag may be reduced effectively by heat transfer or by skin mobility.

One aspect of porpoise physiology, however, really has scientists stumped. This is the question of deep sea diving and the bends, or caisson disease. When a human diver surfaces too fast, the nitrogen dissolved in his blood comes out of solution and forms bubbles. He doubles over with cramps, gasps for breath and finally collapses unconscious.

The porpoise can submerge to 1,000 feet and come up chattering gaily. Its bigger relative, the whale, can perform the same feat from depths of 3,000 feet. Apparently nitrogen bubbles give them no trouble.

Porpoise organs and tissues have been studied for more than 30 years and researchers still do not know how the blood gases are processed. Because these animals can stay under water for long periods, it is suggested that they can store up oxygen, perhaps in the muscles, and eliminate carbon dioxide by some method other than exhalation from the lungs.

Research porpoises, most of which are bottle-nosed porpoises, or *Tursiops truncatus*, work hard. They can be stubborn about refusing to wear uncomfortable blinders and harnesses, but this is actually a help because the porpoise works best when it is comfortable. For the most part they are cooperative. Some even adjust the fit of training gear to their own bodies. They work so many hours a day that they frequently sunburn their foreheads, and handlers have learned that their pupils appreciate an application of petroleum jelly now and then.

Throughout, the porpoises maintain their sense of humor and each is a pet to its own group of scientists. No one minds when an animal flings a fish back in his face. This is par for the playful, puzzling porpoise.

• Science News Letter, 79:202 April 1, 1961

MEDICINE

Migraine Sufferers Bright

► PERSONS SUFFERING from migraine headaches are almost without exception intelligent, regardless of the schooling they have had, Dr. Charles D. Aring, director, University of Cincinnati department of neurology, told a symposium on cardiovascular diseases in Louisville, Ky. However, they are tense and inflexible.

"Migraine victims are tense, striving, perfectionistic and orderly people," Dr. Aring said, going on to point out that such patients are not only overly conscientious about the performance of their own "duties" but in their requirement of behavior from others.

These attitudes are bound to be frustrating, the neurologist added, since their requirements cannot be met consistently.

However, there are persons of this pattern who never have migraine, he noted, commenting that the disorder is not that simple.

"Drugs that constrict blood vessels may be helpful in treatment," he said "but analgesics, sedatives and 'tranquilizing' drugs have limited uses."

He explained that "psychotherapy is usually required in any thorough-going treatment," and that perhaps re-education is the most useful single factor in relieving symptoms.

The sufferer is dependent upon others for approval, Dr. Aring reported, instead of depending on valid self-approval.

"The hard work that he is willing to do to garner such approval is a reflection of the magnitude of the need," he said. "His meticulous and effective performance under these circumstances exacts an undue toll on what we may call his energy stores."

While these energy stores are strong, as in childhood, such a pattern can be supported, he said, but migraine usually makes its appearance during adolescence or later when, with increasing responsibility or decreasing energy, a difficult way of life becomes harder to maintain.

Migraine is either becoming increasingly prevalent or is increasingly recognized in early childhood, Dr. Aring said.

• Science News Letter, 79:203 April 1, 1961

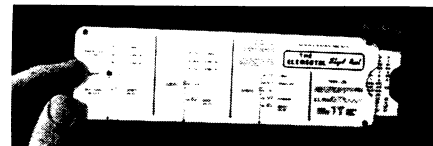
For the young MICROSCOPIST

HAND MICROTOME/SECTION CUTTER

When used with only a simple razor blade, cuts transparent slices of most soft opaque materials. Thus, every structural detail can be seen under your microscope. Not Japanese! Excellent U.S.A. workmanship. A must-have accessory. Free instructions with each. Model A @ \$3.00 p.p. Model B @ \$5.00 p.p.

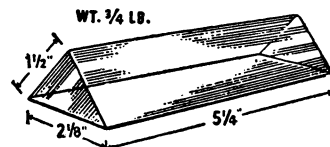
HARRY ROSS Scientific & Lab Apparatus
61-L Reade St., N.Y. 7, N.Y.

A MUST FOR CHEMISTRY & PHYSICS STUDENTS



The Elemental Sloyd-Rul tells you, at a glance, symbol, weight, density, number, valences, color, melting and boiling point in °C for 98 elements. An ideal educational aid for science, physics and chemistry students. \$1 postpaid. Student rate: 12 or more, 75¢ ea. Money-back guarantee. Sorry, No C.O.D.'s. The Sloyd-Rul Co., 1040 W. Broadway, Woodmere, N.Y.

PRISMS \$1.50



Made for U. S. govt. for tank periscopes. Fine optically ground, big precision prisms with silvered base. Terrific for all types of spectrographic work, in homemade telescopes & other optical systems for bending rays. Makes unusual paper weight (paint your name on it) or conversation piece for mantel. You'll find many other uses. NEW, PERFECT! Cost U. S. govt. \$25 ea. NOW—\$1.50 ea. p.p. or 4 for \$5.00. Same as above—1" long (no silver backing) \$1. ea. 5 for \$4. Postage paid on prepaid orders. Calif. res. add sales tax.

Volume Sales Co., War Assets Div., Dept. C131
3828 Sunset Blvd. Los Angeles 26, Calif.

FREE

THE NEXT ISSUE of SCIENCE NEWS LETTER to one of your friends

SCIENCE NEWS LETTER
1719 N Street, N.W.
Washington 6, D. C.

Please send the next issue
of SCIENCE NEWS LETTER, FREE,
as a sample, to:

Name _____

Address _____

City _____ Zone _____

State _____

4-1-61