Biology

From the Third International Animal Sonar Systems Symposium, held in Helsingør, Denmark

Hearing could be herring's red herring

Three years ago, Kenneth Norris and Bertel Møhl suggested that toothed whales — a suborder that includes bottle-nosed dolphins and killer whales — might use bursts of intense sonar to stun elusive prey, making food gathering a cinch. Recently, Norris and Kenneth Marten, both of the Long Marine Laboratory at the University of California at Santa Cruz, reported findings that strengthen this hypothesis, which they named the "big bang theory," after the sonar bursts.

In the July 1983 AMERICAN NATURALIST, Norris and Møhl, who is at Aarhus (Denmark) University, assembled theoretical, observational and anecdotal evidence to earn their hypothesis a hearing. Last month, Marten reported what he believes is a remarkable correlation between the frequency of sounds recorded during killer whales' hunting sessions and the range of aural sensitivity of herring, a favorite entree. The whales seem to emit sounds in the 400-hertz frequency range, exactly the range in which herring hearing works best. Because the fish probably rely on hearing for navigation in the cloudy and dim depths, Marten speculates that the whales might use intense sound to overload their aural systems, making sitting ducks out of the fish.

When bats go fishing

When zeroing in on targets, most bats that have been studied increase the rate at which they emit sonar pulses. This in turn ups the amount of information the bats get from echoes bouncing from objects in the bats' vicinity. But Indiana University graduate student Karen Campbell has found that one species of fishing bat, *Noctilio leporinus,* does not increase the rate of sonar pulse emission.

This doesn't keep them from being extremely successful hunters. In fact, Campbell says, in her studies in the university's "bat lab" in Bloomington, she frequently observes *Noctilio* grabbing moving targets that dip below the water surface. It seems as though the bat can predict where the target should be even after the target "vanishes" from the bat's sonar. How *Noctilio* use sonar to accomplish this feat remains in the dark, Campbell says.

Brain architecture, neoclassical style

Anatomical studies of sonar-using animals reveal a striking architecture in three brain areas, called nuclei, which are devoted to hearing. "Cells in these nuclei form orderly rows or columns that are more uniformly aligned than is found in most" non-sonar-using mammals, reports John Zook of Ohio University in Athens. In addition, these auditory nuclei, which he and his colleagues examined in several bat and dolphin species, appear to be connected by bundles of parallel nerve fibers.

In relation to cells in the first nucleus, cells in the second nucleus were arranged in a "slanted-line pattern," Zook's group observed. Since these two nuclei are connected with parallel fibers of differing lengths, simultaneous impulses traveling from different cells in the first nucleus will arrive in a staggered fashion at the second nucleus. Such an arrangement could "preserve or analyze temporal patterns" in the signals being relayed through the auditory system, they report. For example, the many frequencies in a single sound could be separated if different cells of the first nucleus were frequency-specific.

Zook also found that a third auditory nucleus gets orderly input from both of the other nuclei — a direct line from the first nucleus and an indirect or "delayed line" from the second. He speculates that such a structure could be the place where the brain compares sounds from sonar emissions with sounds from the returning echoes. Using such comparisons, he says, bats and dolphins could construct acoustic images of their environment.

Biomedicine

Joanne Silberner reports from New Orleans at the Interscience Conference on Antimicrobial Agents and Chemotherapy

Zinc and colds

If zinc lozenges do cure the common cold, as one study indicated in 1984, they don't do it by killing the virus directly, according to researchers in Charlottesville, Va. While researchers at several institutions are conducting clinical trials of human reactions to zinc gluconate, University of Virginia's Felicia C. Geist, Judith A. Bateman and Frederick G. Hayden have taken it back to the lab.

They pitted various concentrations of zinc gluconate and other zinc salts against rhinoviruses growing in human cell lines and found that the zinc compounds did not inhibit the viruses. "These results do not exclude the possibility that zinc lozenges have a therapeutic effect in natural colds," says Hayden. Zinc could have an independent effect on the immune system or on the rhinovirus's target cells in the body (as opposed to *in vitro*). The results "do predict that the possible beneficial effects are unlikely to be related to specific antiviral action," Hayden says.

AIDS: A role for CMV?

Over the next five years, 20 to 30 percent of people infected with the human immunodeficiency virus (HIV) are expected to develop AIDS with its associated infections and tumors. Researchers have long sought a cofactor to explain why only some infected people get the syndrome, and the widespread cytomegalovirus (CMV) is a popular candidate.

W. Lawrence Drew of Mt. Zion Hospital in San Francisco now links CMV to a particular manifestation of AIDS, a skin cancer called Kaposi's sarcoma. And Paul Skolnik of Massachusetts General Hospital in Boston reports that infection of a cell culture with either HIV or CMV promotes infection by the other.

Based on epidemiologic evidence, Drew had previously suggested that CMV promotes the progression from HIV infection to AIDS (SN: 8/3/85, p.77). In the current study he reports that a decrease of Kaposi's sarcoma among homosexuals with AIDS has been paralleled by a decrease of CMV in the homosexual community. While in 1981, 70 percent of a group of homosexuals who were CMV-negative became CMV-positive within eight months, in a similar uninfected group in 1985 only about 5 percent have become infected. Meanwhile, the incidence of Kaposi's sarcoma among homosexual men with AIDS has dropped from 63 percent of new AIDS cases in 1981 to 24 percent in 1985.

The association alone is clearly not an indication that CMV causes Kaposi's sarcoma — other venereally spread diseases have also gone down. "But through many threads of evidence CMV keeps popping up," Drew says. Among the threads: Some laboratories have found CMV genes in Kaposi's sarcoma cells; the virus itself can cause cells in culture to become cancerous; cultured cells infected with CMV and implanted into mice will cause tumors; and Kaposi's sarcoma, like CMV, is less common among intravenous drug abusers with AIDS.

Skolnik approached the CMV-AIDS connection in the laboratory, via two experiments. To look at CMV's effect on HIV, he infected a flask of human cells in culture with HIV alone, and infected cells in a second flask with both HIV and CMV. The amount of HIV was one-hundred-fold greater when CMV was present. In a second experiment he infected some cells with HIV followed by CMV and infected some cells with CMV followed by HIV. He found that CMV was able to establish a productive infection only in cultures that had previously been infected with HIV.

The studies may supply a mechanism for CMV as a cofactor, Skolnik says. CMV could allow HIV to establish itself, or could promote HIV. If it comes before HIV infection, treatment or vaccination against CMV may prove helpful against AIDS; if it comes after HIV infection, learning how the two interact would shed light on the virus, Skolnik says.