

Gland dictates death to aging octopus

No old-age loneliness, social security or pension problems for the octopus. Normal octopuses always cut themselves down in their prime. The female inevitably dies soon after her eggs hatch; the male lives only 7 to 9 months after sexual maturity. Jerome Wodinsky of Brandeis University has now identified the octopus's self-destruct system. It involves the hormonal secretions of a pair of endocrine glands (called optic glands because they sit on the optic tract). When Wodinsky removed those glands, both male and female octopuses lived longer than normal.

Secretions of the optic glands seem to affect copulatory, eating and brooding behavior as well as the self-destructive mechanism. Normally the female octopus copulates 2 weeks to 4 months before egg production. After she lays her eggs, she eats less than normal while protecting, cleaning and aerating them. She assists mechanically with the hatching, then dies about 10 days later.

Wodinsky reports in the Dec. 2 *SCIENCE* that when he surgically removes the optic glands of a female, she immediately stops caring for her eggs. She begins to eat again, gains weight and lives an average of 175 days, instead of 42 days, after spawning. The cause of the eventual death is not certain in these animals. Wodinsky found infections and cysts in some octopuses. He suspects deterioration of the recirculating seawater in the tanks.

Not only does the female octopus resume eating after gland removal, but she returns to eating in a distinct, pre-maternal style. Before spawning, and again after surgery, *Octopus hummelincki* bores holes in the shells of prospective snacks. The octopus injects a salivary gland secretion, then pulls out the weakened snail. After spawning, the normal female no longer bores and injects, but rips the snail from its shell.

A longer than normal, but more emaciating, life results from surgical removal of only one of the two optic glands. These females continue to care for their eggs and to decrease food intake, but they survive an average of 35 days longer. As a consequence of increased life-span, they lose almost 50 percent of their maximum body weight before dying. Normal females lose about 20 percent, while those with both glands removed gain about 10 percent before death.

These and other observations lead Wodinsky to believe that death of the normal female octopus is not due solely to starvation, but that optic gland secretions mediate cessation of feeding and death by separate mechanisms.

Wodinsky speculates that the actions of the optic gland hormones may serve several adaptive functions. Loss of appetite may decrease the substantial risk that the female will eat her eggs herself. Also, the



Hormones direct egg care, then death.

time she would otherwise spend foraging will be better spent caring for the eggs. "In the male, the linkage of inhibition of feeding and death to reproductive activities seems to be looser than in the female," Wodinsky says. "However, in both sexes, this mechanism guarantees the elimination of old, large predatory individuals and constitutes a very effective means of population control." □

DOE sets interagency CO₂ research priorities

The Department of Energy (DOE) this week released a study that will serve as the basis for a "focused" interagency campaign to identify climate-altering effects of carbon-dioxide (CO₂) emissions from increased burning of fossil fuels. David Slade, acting director of the agency's fledgling office of CO₂ research, said that his agency is already organizing a national research program and will soon consult with the State Department on development of an international program.

He said that working with a budget of \$1.5 million, the office has already set up an advisory committee to look at the broad research issues and areas requiring immediate action. Members of a separate "scientific directorate" are authoring individual papers in which each must lay out detailed research goals, plans on how to achieve them (including recommendations of which technologies can best achieve the data base sought) and information on what the manpower and funding needs to begin such a program are. Slade said their recommendations would help decide which of the multitude of unanswered questions will be tackled first.

James Liverman, the agency's acting assistant secretary on the environment, said

that how fast and pervasive the impacts of doubling atmospheric CO₂ levels will be cannot be determined from the paltry data base now available, but that current estimates suggest such a doubling would increase surface temperatures an average of 2° to 3° C globally, resulting in major regional climate changes. If the doubling occurs as early as 2030, as some suggest, Liverman says the decision on whether to push something other than coal as a major energy option for large-scale power production must be made by 1985, which is also the earliest date that sufficient data could be available for "guessing" how bad the CO₂ problem is likely to become.

Much of the speculation on CO₂ effects in the new study mirrors findings in the National Academy of Sciences report issued in July (SN: 7/30/77, p. 68). But this one goes further to outline the state-of-the-art for monitoring CO₂ levels, and spells out at least 40 specific research areas where data is needed to accurately define the problem and to pinpoint what the decision-making time frame is before the problem becomes "irreversible." □

China's university reform

A Japanese delegation to China, led by former University of Tokyo President Ichiro Kato, reports that China's university system is undergoing a major reform to promote science and technology and undo some of the changes of the "Cultural Revolution."

The length of a university education will be restored to four years, with some five-year courses in technical subjects. (It had been reduced to three years in the 1960s.) "Revolutionary Committees" now running the universities will be renamed, but their functions are still being debated.

Perhaps most important, a unified examination system for university entrance is being restored and the compulsory two years of work before enrollment is being suspended. About 10 million Chinese students are expected to take the exams in December, and the prestigious Peking and Fudan universities expect as many as 500,000 applicants apiece. □

Scottish soy sauce

Even in science there can be poetic justice. First came Glasgow labor demonstrations protesting the success Japanese engineers had scored in duplicating a Scotch-like whisky at a lower price (see p. 377). Now a Glasgow microbiologist has developed a way to ferment soy sauce in one twelfth the time required by the traditional process. Brian Wood of Strathclyde University says that by precisely controlling the fermentation, he can produce the sauce in about two months, instead of almost two years. □