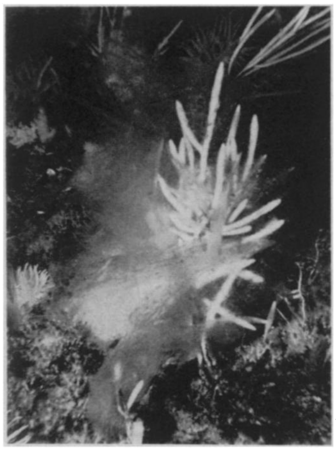
Ice sponging off the Antarctic shelf



Dayton

When rippled by Antarctic ocean currents, the bushy white stalks of the sponge *Homaxinella balfourensis* look like flowers bending in a breeze. Until recently, biologists assumed the creatures increased in number and size as slowly as other Antarctic sponges, many of which grow only 1 to 4 inches in 20 years. But ecologist Paul K. Dayton of the Scripps Institution of Oceanography in La Jolla, Calif., has documented dramatic population shifts — probably triggered by climate changes — that suggest *H. balfourensis* is among the fastest-growing sponge species, gaining 15 inches in a year or two.

In the Sept. 29 SCIENCE, Dayton describes research linking periods of rapid sponge growth to the absence of anchor ice, an accumulation of ice plates up to 2 meters wide in shallow water. The sponge's stalks break off when anchor ice forms around them and then floats away. During the 1960s, when anchor ice was plentiful, *H. balfourensis* populations increased very slowly. But during the mid-1970s, when anchor ice was rare, its population boomed, doubling in one area over a period of two years. The boom led to rapid growth in size and population of a sponge predator, the starfish *Perknaster fuscus antarcticus*. Although anchor ice also kills the starfish, for some reason the return of the ice in the mid-1980s did not diminish the starfish population, Dayton says.

Dayton suggests a major shift in ocean currents under the Antarctic ice shelf triggered the fluctuations in sponge population. When the current flowed south to north, it swept supercooled water under the shelf, spawning production of anchor ice. But when the current came from the north, it brought warmer water that didn't encourage the ice matrices to form. Dayton thinks the current shifts may be connected to the El Niño-Southern Oscillation weather phenomenon, which may affect polar winds.

He says his discovery underscores the value of multidecade ecological research.

Nitrogen fertilizer saps veggies' vitamin C

Time was when chemical fertilizers cost little and farmers didn't worry about putting on too much. But recent research blames excessive nitrogen fertilizer for polluting water and diminishing methane uptake by soil microbes (SN: 9/30/89, p.213). Now a soil scientist has added vitamin C depletion to the list of drawbacks.

Excessive nitrogen fertilizer cut the vitamin C content of three green vegetables in experiments done by Sharon B. Hornick of the USDA's Agricultural Research Service in Beltsville, Md. Hornick set out to test whether organic fertilizers were better than inorganic ones at improving the nutritional quality of produce. As it turned out, too much nitrogen proved bad whatever its source, she says. Chard grown without fertilizers had 81.4 milligrams of vitamin C per 100 grams of leaves, compared with 54 milligrams for the same quantity of heavily fertilized plants. Hornick's work also pinpointed nitrogen as the cause of a vitamin C decline in green beans and kale. She says her findings, which she has submitted to the JOURNAL OF AGRICULTURE AND FOOD CHEMISTRY, support a proposed move toward agricultural methods that limit the use of fertilizers and herbicides (SN: 9/23/89, p.204).

Divvying up a fusion-fund pie

As the cold-fusion drama becomes fodder for social scientists, research into conventional hot fusion plods toward its long-stated goal of harnessing sun-like fusion reactions to meet future electricity demands.

After decades of congressional funding, physicists have greatly refined their ability to predict how superhot, magnetically confined plasmas behave. In parallel, they have been inventing ways of heating fuel to many millions of degrees and using magnetic fields and lasers to confine the hot plasma to small volumes — one of the requirements for fusion to occur. But advances toward the goal of fusion-generated electricity are getting ever more expensive. And that becomes a dilemma in times of ever-tightening national budgets.

Is it time for Congress to begin authorizing additional fusion dollars, starting in fiscal year 1991, for the next research step — the construction of the proposed $1 billion Compact Ignition Tokamak (CIT) — and for the even larger and potentially more costly International Thermonuclear Engineering Reactor (ITER), now in the early phases of conceptual design? Members of the Investigations and Oversight Subcommittee of the House Committee on Science, Space and Technology put this question to more than a dozen prominent members of the fusion research community during three days of inconclusive hearings last week.

The witnesses, assembled from several national laboratories and universities, the Department of Energy and elsewhere, told the committee in various ways that igniting a plasma so that it could burn on its own without additional input of energy would be a historic event and demonstrate the feasibility of fusion power. Harold P. Furth, director of the Plasma Physics Laboratory at Princeton (N.J.) University, said, "Ignition would be a landmark, almost like the arrival of fire."

Decision makers find themselves vexed, however, by an element of uncertainty regarding the CIT's ability to achieve ignition. Although most of those testifying, including Furth and Ronald R. Parker, director of MIT's Plasma Fusion Center, say ignition would be likely with the CIT, they base their predictions on empirical extrapolations — by scaling data from today's plasma experiments to the kinds of reactor-grade plasmas envisioned in the proposed CIT. These scaling trends, positive as they are, lack the backing of a physical theory to explain them. As MIT nuclear engineer Kim Molvig pointed out in written testimony, the same physical laws may not apply beyond the existing range of data, and so do not warrant confident predictions of ignition in the CIT.

Most other witnesses said parallel efforts toward a better theoretical understanding of plasma behavior and the design and construction of a machine such as the CIT to test and refine those theories is the way to move forward and keep U.S. fusion researchers in a leadership role. But Robert O. Hunter, director of the Department of Energy's Office of Energy Research (which ultimately doles out congressionally appropriated fusion funds), also argued that scientists should improve their understanding of the underlying physics before Congress commits more resources to the CIT project or shunts funds away from other fusion projects such as laser-based inertial confinement research, much of which is classified.

Further complicating the issue is the ITER collaboration, envisioned as a step beyond even a CIT-like effort. Some witnesses argued that delaying CIT construction could jeopardize the role U.S. scientists and engineers will play in the ongoing global fusion effort. One witness asserted that a CIT effort would be nice, but not necessary, for the success of the global effort. The United States, the Soviet Union, Japan and West Germany are partners in the ITER project, which could enter its construction phase as early as the mid-1990s.