The senile brain: What's the matter?

One long-standing hypothesis about Alzheimer's disease, a form of senility caused by brain deterioration, is that it is an infectious disease, caused by a very slow-acting virus. But despite considerable effort, scientists have been unable to show that the disease is transmissible to healthy tissue, and in recent years the hypothesis has been largely abandoned. Now a California neurologist is resurrecting the slow-virus hypothesis, and he is suggesting that the conspicuous brain damage associated with Alzheimer's is actually an aggregation of mysterious — and controversial — microorganisms called "prions."

Stanley B. Prusiner, a researcher at the University of California at San Francisco (UCSF), reported this week that an accumulation of prions, the tiniest infectious agent known, appears to be identical to the protein amyloid, which is found within the "plaques" dotting the brains of Alzheimer's victims (SN: 12/10/83, p. 374). Prion — short for proteinaceous infectious particle — was named last year by Prusiner, who extracted it from animals with scrapie, an infectious neurological disease (SN: 2/27/82, p. 135). It is an enigmatic substance, because unlike other viruses, it appears to be composed entirely of protein, lacking the typical core of genetic material.

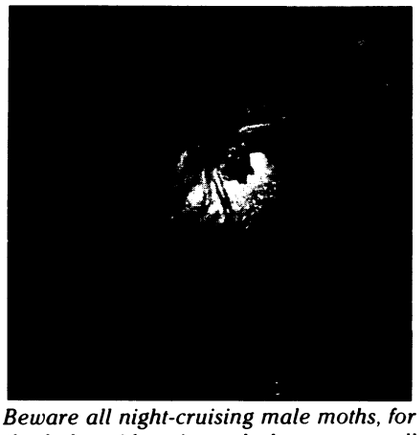
Writing in the December CELL, Prusiner and colleagues at UCSF and UC-San Diego report that assemblages of prions, purified from scrapie-infected brains, form rod-like structures; clusters of these rods, when stained and examined under a microscope, closely resemble amyloid. Amyloid is found in senile plaques, which are thought to be the remains of neurons that, before dying, stimulated the thought and memory structures of the brain. Nobody knows why these nerve cells die, but the amyloid has heretofore been presumed to be a waste product, rather than an agent, of the disease.

Amyloid plaques are also found in association with two other degenerative brain disorders, kuru and Creutzfeldt-Jacob disease, that are known to be infectious; kuru is caused by a slow virus, which several years ago was found to be transmitted among New Guinea cannibals who were eating infected brains. If the plaques do indeed contain thousands of infectious organisms rather than amyloid protein, then it is possible, Prusiner says, that such degenerative disorders — including Alzheimer's disease — are infectious. Prusiner and his co-workers have determined that prions are composed almost entirely of a single protein, which they call PrP (for prion protein); they have already begun to work out the amino acid sequence of PrP, which when completed will allow them to make an antibody to detect the presence of prions. Ultimately, they hope to construct a genetic probe to search for the gene that controls PrP.

Others are much more cautious than Prusiner in interpreting the findings. George Glenner, the UCSD pathologist who worked with Prusiner, says that the staining similarities of the two substances do not prove that they are identical; more exacting chemical analysis is needed, he says, to rule out the possibility that amyloid plaques are composed of abnormal human protein.

Peter Davies, a protein chemist at Albert Einstein College of Medicine in New York City, agrees. "It's very easy to make things look like amyloid under an electron microscope. I can make insulin look like amyloid," he says. "But it requires an conceptual leap to accept the connection to Alzheimer's disease." Others are even more skeptical, suggesting that what Prusiner has isolated from the scrapie-infected brains is actually amyloid, not the infectious agent. But Davies defends the soundness of Prusiner's purification work. "He's certainly purified the scrapie agent and so far noboby has been able to find any RNA or DNA. We're forced to conclude that it's an infectious protein — the first of its kind ever described." —*W. Herbert*

Prey caught with a smell and sinker



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Beware all night-cruising male moths, for the bola spider pictured above may well gobble you up some dark evening. The bola spider lets off an odor resembling that of a female moth. The wing vibrations of the responding males prompt the spider to flick its bola, a sticky glob attached to the spider by a silken thread. The spider eats its snagged prey after hauling it in and wrapping it in silk, according to Mark K. Stowe, a doctoral candidate in biology at Harvard University. Stowe, who has watched some bolas catch eight moths in one night, says, "I've never seen a moth break away from a successful spider strike. ... That glue has physical properties that man would be hard pressed to reproduce. Also, the bola line can stretch out up to six times its original length and absorb some of the energy of the moth's struggle."

Dentists hail sealants for curbing cavities

A thin plastic film painted over the grinding surface of molars could safely and effectively prevent most of the tooth decay that afflicts children and teenagers, suggest dental researchers.

An 11-member panel, sponsored by the National Institutes of Health (NIH), last week urged U.S. dentists to increase their routine use of dental sealants in children, and encouraged health insurance companies to include the plastic sealants in their dental coverage.

The sealants are "highly effective" in curbing cavities, says James Bawden, a professor of dentistry at the University of North Carolina in Chapel Hill, who chaired the NIH Consensus Development Conference. "And yet they are vastly underutilized in the health care system."

The first sealants of the 1960s were less effective than today's brands, which may have discouraged widespread use, Bawden says. But "remarkably consistent and positive" evidence from studies in the last decade indicates that current sealants are 100 percent effective in protecting teeth as long as the plastic film is retained, the panel reports. Studies show more than 80 percent of the newer sealants are still in place after seven years. The sealants seemed to wear off in the remaining patients.

Herschel S. Horowitz of the National Institute of Dental Research in Bethesda, Md., estimates the average charge for sealant application at "$6 or $7 per tooth," though national statistics have yet to be compiled, he says.

Not all teeth need the protection, Bawden says. He suggests that parents consult their child's dentist about sealant application soon after the molars appear — at about age two or three for primary molars and six years for permanent teeth. The panel targeted children and adolescents as a group most likely to benefit from the treatment because of eating and oral hygiene habits that tend to make them cavity-prone, though some adults might also benefit.

U.S. citizens average 10 decayed, extracted or filled teeth by the age of 16, the panel reports, despite the finding that water fluoridation, dental treatments and toothpastes have reduced the incidence of dental caries in the last decade by 50 to 65 percent (SN: 7/10/82, p. 27). About 53 percent of all U.S. residents drink fluoridated water. Fluoride seems to best protect the smooth surfaces of teeth, but leave vulnerable the crevices and pits of molars, while a thin coat of plastic on the uneven surfaces prevents the entrapment of food and bacteria that produce enamel-eating acids. The two forms of treatment "work best in concert," Bawden reports.

—*D. Franklin*