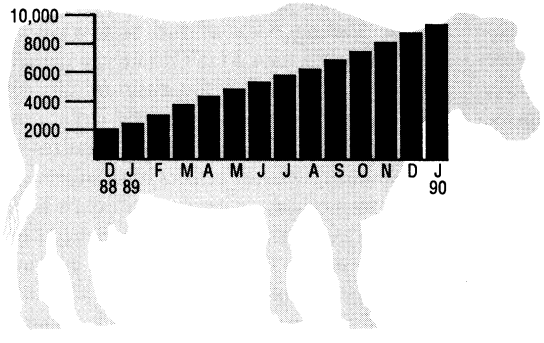
Virus-Like Agent Blamed for Mad Cow Disease

A puzzling brain disease of cattle, seemingly acquired from sheep ground up in their feed, is running rampant through British herds

ABOUT 600 HEAD OF CATTLE a month in the United Kingdom are coming down with a mysterious new disease. The affliction, which seems to have spread to the cattle from sheep, is costing British cattle breeders £50 million a year. Bovine spongiform encephalopathy (BSE)—"mad cow disease"—seems to be caused by a little understood, virus-like agent that causes a brain disease called scrapie in sheep. The United States and the European Community have banned some imports of British cattle and beef while awaiting the results of a research effort in the United Kingdom aimed at finding out whether the disease can spread from cow to cow or, more worryingly, to humans.

Mad cow disease gets its name from the odd behavior shown by a few infected cows. The first manifestation is an abnormal (high-stepping or staggering) gait. Later come anxiety and increased sensitivity; these symptoms are often first noticed when an infected cow kicks out unexpectedly during milking. A small minority of the infected beasts go on to exhibit the full-blown frenzy and aggression that earned the disease its popular name.

In late 1986 a dairy farmer in Kent, in southeast England, noticed several cows with such symptoms in his herd. Tissue samples from slaughtered animals went to the Central Veterinary Laboratory of the Ministry of Agriculture, Fisheries and Food (MAFF) in nearby Sussex. Gerald Wells, head of the neuropathology unit, took one look through his microscope at samples of brain tissue and thought he recognized the appearance of scrapie.



Julie Cherry

More mad cows. *New cases of BSE reported monthly in the United Kingdom.*

Scrapie is related to the human brain diseases kuru and Creutzfeldt-Jakob disease. Both are caused by pathogens whose nature is controversial. Sometimes called "slow viruses" or merely "unconventional agents," they make the brain appear spongy and full of holes. Wells saw this pattern in the cattle brains and dubbed the syndrome BSE. He was confident enough of his diagnosis to tell a colleague he "suspected we had scrapie in cattle."

But if BSE was scrapie how had it gotten into cattle? John Wilesmith, head of epidemiology at MAFF's Veterinary Laboratory, began an epidemiological survey to find out. The few known cases were spread around the country, implying that BSE was caused by a factor in general cattle management rather than by a local condition. It was relatively easy to eliminate an array of possible causes, including vaccines, other biological agents, agricultural chemicals, and direct contact with sheep.

"The thing that we were left with," Wilesmith said, "was the feeding of meat and bone meal in rations." Although it may seem surprising, animal protein is a standard part of cattle rations—especially the "weaner" rations fed to young calves. Wilesmith questioned manufacturers and found that sheep unfit for human consumption (perhaps because they had scrapie) often ended up in cattle rations.

In 1987 MAFF banned the use of ruminant-derived protein in feed for cattle or sheep, which should ultimately put a stop to mad cow disease. Unfortunately, one characteristic of unconventional agents is the lag time—4 to 5 years in cattle—between infection and symptoms. Hence the roughly 600 cases a month now being seen are the result of infection before the ban on ruminant protein in cattle feed.

The fact that the number of new cases is remaining steady is good news, according to most epidemiologists. If the disease were being transmitted directly from one adult cow to another, the curve indicating new cases would probably be climbing much more steeply, researchers say.

Yet questions remain. Can the disease be transmitted from an infected cow to her calf? And what is the risk to human beings? The recently announced U.K. science budget has earmarked £12 million to provide some answers. MAFF has purchased 300 calves born to infected cattle; observation of them should answer the first question.

The second question—the risk to humans—is more difficult to answer. Some diseases caused by unconventional agents can definitely be transmitted to human beings. Kuru, for example, which afflicted natives of New Guinea, seems to have been spread through the consumption of human brains in ritualistic cannibalism.

Whether Creutzfeldt-Jakob disease (CJD) is generally contagious is more problematic. The disease is relatively common among Libyan Jews, who eat sheep's eyes. Anatomically, the eyes are an extension of the brain, and they might contain the scrapie agent. No solid evidence yet supports such a link, however, and CJD has been reported in Japan, where there is little scrapie, and also in a lifelong vegetarian.

In any event, the risk of BSE being transmitted to humans has already been greatly reduced, according to Sir Richard Southwood. Southwood chaired a working party to advise the British government on BSE. The group recommended that all offal from cattle be banned from human food, including brain, thymus, and spleen—the major reservoirs of the scrapie agent. This ban, Southwood said, lowers the odds of transmission to a "very, very low" level.

Why did BSE arise in Britain in 1986? Three factors may have been responsible. In the early 1980s Britain's sheep population was growing rapidly, and an increasing number of the animals wound up as meat and bone meal at rendering plants. At the same time, in the wake of the oil crisis renderers adopted energy-efficient techniques that were less likely to destroy the highly resistant scrapie agent. Finally, government policy encouraged farmers to produce more milk by removing calves from their mothers quickly, and the weaned calves were fed diets containing infected sheep protein.

That constellation of factors seems unique to Britain. Few experts expect outbreaks of BSE elsewhere, although the U.S. Department of Agriculture has set aside funds for increased research on scrapie and BSE. In the meantime, the larger research effort in the United Kingdom proceeds apace, in the hope of assuaging public fears and persuading the United States and Europe to lift their bans on British cattle.

■ JEREMY CHERFAS