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This elk sick with CWD is in very poor body condition.



By now everyone who watches the news, reads newspapers, or listens to the radio knows that bovine spongiform encephalopathy (also called BSE or “mad cow disease”) was found in a dairy cow in Washington. Many can recite the basics of BSE epidemiology and weigh the importance of this disease alongside their current view of a good steak. It is also widely known that there are other related animal and human diseases that fall into the same family as BSE called transmissible spongiform encephalopathies or prion diseases. Chronic wasting disease (CWD), a prion disease that strikes and eventually kills deer and elk, has been featured in headlines for the last few years. Finding CWD in white-tailed deer in Wisconsin resulted in a burst of media and public interest. In Wyoming

and Colorado, however, CWD has been present and studied for more than 30 years.

In the early years, CWD was thought to be an interesting oddity but of no significant consequence other than locally. That was before its cousin, BSE, was found in the United Kingdom in 1986. A decade later, variant Creutzfeldt-Jakob disease, which is the human form of BSE, was identified. These diseases and another one affecting domestic sheep and goats called scrapie are classified as transmissible spongiform encephalopathies. They are considered to be similar because all are thought to be caused by “prions,” which are unusual infectious agents apparently comprised strictly of proteins.

At the time CWD was identified as a spongiform encephalopathy disease in 1977-78, CWD research was severely constrained by a lack of funding. Because

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there was no evidence linking CWD to diseases of domestic animals or humans, only wildlife managers believed it was an important disease. They were concerned that it might adversely affect populations of deer and elk. To deal with that worry, researchers from the University of Wyoming, the Colorado Division of Wildlife, and the Wyoming Game and Fish Department worked together to study CWD.

Unraveling the mysteries of chronic wasting disease

One of the first projects was to develop a description of the illness (loss of body condition and strange behavior) and the damage that occurs in animals that have the disease. This was important because in order to make a diagnosis of CWD, criteria needed to be established so that veterinarians and pathologists could be consistent in their conclusions. These descriptions have changed over the years as new techniques have improved the ability to diagnose CWD.

The lesions of CWD are literally holes in the head. “Spongiform encephalopathy” tells a pathologist what the damages in the brain and spinal cord look like. Spongiform means sponge like, and encephalopathy refers to a disease of the brain. The holes in the brain occur in specific locations; the damage to these areas results in the signs that are shown by sick ani-

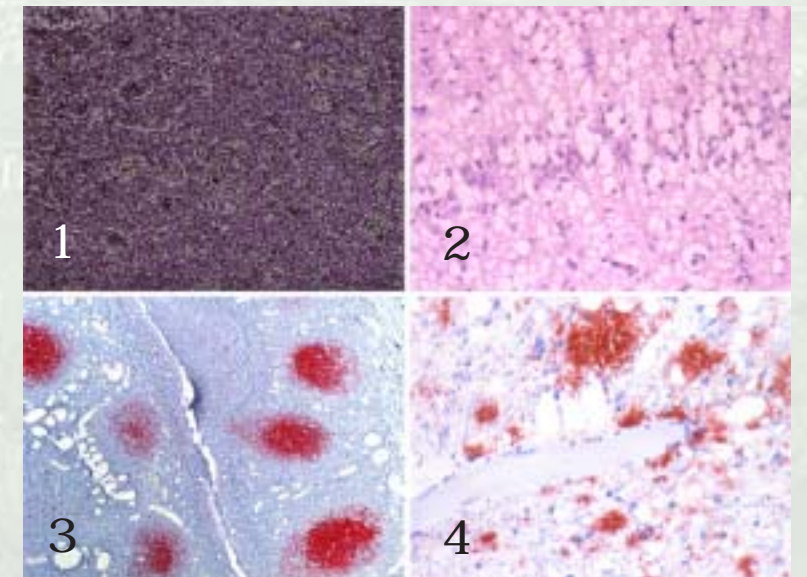
mals. So, for example, if there is damage in a part of the brain that influences water balance (supraoptic nucleus, paraventricular nucleus), the infected deer can no longer concentrate urine, and the sick animal will quickly dehydrate if it cannot drink a lot of water.

New techniques for the description and diagnosis of prion diseases were then applied to the study of CWD. These improvements required the development of specific antibodies that could detect accumulations of prion agent, and these antibodies worked well with CWD. One of the most useful techniques was immunohistochemistry. Accumulations of the prion protein stain bright red in central nervous tissues and lymphoid tissues, allowing the tracking of the protein in tissues of the body and greatly assisting in the diagnosis of animals infected with CWD.

Mapping the locations of the damage in the brain also resulted in some practical techniques for diagnosing the disease in surveillance. It was found that a specific area of the brain called the obex, which is found near the attachment of the spinal cord,

can be examined from an animal to check for CWD. These areas are now tested by immunohistochemistry to see if the prion protein is present.

Understanding how, when, and where the prion protein occurs in the body of the natural



1. A histologic section of a normal deer brain as viewed under a microscope is shown.
2. A histologic section of a deer brain with CWD as viewed under a microscope is shown.
3. A histologic section of a tonsil from a deer with CWD shows an accumulation of abnormal protein (red stained material) in lymphoid follicles.
4. Through the use of immunohistochemistry, an accumulation of abnormal protein (red stained material) is revealed on this histologic section of a brain from a deer with CWD.

hosts of CWD, mule deer, white-tailed deer, and elk has been the focus of much of the research. Because the incubation period of CWD is very long, this kind of study requires years to conduct. Animals are experimentally exposed to CWD, and then they are monitored until they get sick. Much has been learned from this research about incubation periods (years), the distribution of prion pro-

tein in the body (primarily tissues of the lymphatic system and the central nervous system), and the sequence of involvement of different tissues. An outcome of this work was the recognition that there is early and extensive involvement of the lymphoid tissues even before the brain is affected. This was a very useful finding because it meant that the sensitivity of the diagnostic tests could be improved by testing the lymph nodes. Currently the retropharyngeal lymph nodes (lymph nodes in the neck) are the best samples to col-

lect for CWD testing in deer.

Surveillance for CWD in free-ranging deer and elk in Wyoming has been ongoing since 1983. It was started by gathering a few hundred heads from hunter-harvested deer. CWD was not found right away in the wild in Wyoming. Large scale surveillance by the Wyoming State Veterinary Laboratory and the Wyoming Game and Fish Department was begun in 1997, and since that time CWD has been recognized in a large portion of the southeastern quadrant of Wyoming. Long-term surveillance is important so that changes in the distribution and amount of CWD can be tracked.

Are cattle susceptible to CWD? Obviously this question is of great concern because of the serious effect BSE has had on the cattle industry and the fact that CWD and BSE are related diseases. In 1997, researchers began a collaborative study to evalu-

ate the potential of cattle becoming infected with CWD through natural routes. A group of cattle was given an oral inoculation of CWD, and two other groups of cattle are living with deer and elk infected with CWD. As of January 2004, these cattle will have been exposed for more than six years, and there is no indication that they have contracted CWD. However, because prion diseases have a long incubation period, these studies will continue for a total of 10 years.

Figuring out how CWD is transmitted is a major focus of the research now being conducted in Wyoming. Working with the Colorado Division of Wildlife, the Wyoming Game and Fish Department, and researchers in the departments of veterinary sciences, molecular biology, and zoology and physiology, a team of experts has been trying to determine how the CWD agent is shed from an infected deer or elk, how

susceptible deer and elk become infected with the agent, and how CWD infections spread in populations of deer and elk. This interdisciplinary work spans the spectrum from the study

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of prion genetics to monitoring the movement of deer across the landscape. Obviously this is long-term research; scientists will not be able to unravel all the features of transmission for a long time.

It is clear from three decades of research on CWD that without an interdisciplinary and interagency approach to these studies, investigators will not be able to understand and ultimately manage or control the disease. The expertise of protein biochemists, toxicologists, ethologists, landscape ecologists, molecular biologists, geneticists, wildlife managers, pathologists, and veterinarians have been brought to bear on CWD during the last 30 years, and similar contributions from individuals in these disciplines will be needed in the next 30 years of CWD research.



Cattle are also being used in research determine if they are susceptible to CWD.

