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Contributors: Dr. Earle Goodman, Editor. Dr. Leroy Dorminy, Co-Editor.

Note From the Editor

We always appreciate information that would increase our publication's value to our readers. We can use articles, news notes, practical tips, leads on other sources of information and advice that you have found to be successful in your work that might help others. We have free subscriptions to this publication available. We appreciate it when our readers make them available to others in their group or institution. Readers are welcome to copy them.

New Publication

Christian Veterinary Missions has just published a book entitled "Disease and Parasite Prevention in Farm Animals: Ten Major Steps." It is the first in a new series of mini-books that target a specific subject. It has been under development for many years and covers all of the major points on the subject. It includes helpful line drawings and will be an aid to students at all levels in addition to helping farmers make improvements to the health and production of animals on their farms at little cost. To order this book, or any of our other titles, please visit our website at www.cvmusa.org, select "Missions" then "Educational Resources." Click on the link to "Order Books" and you can fill out a form which you can mail or e-mail to us. The cost of "Disease and Parasite Prevention in Farm Animals: Ten Major Steps" is $5.00 plus $3.00 postage and handling each. Free copies are available for book organizations or local community libraries/schools/mission stations where community groups and others who can not afford the books may have access to them.

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Characteristics of BSE

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***Editor's Note**: This article by Dr. Jared Taylor on Bovine Spongiform Encephalopathy (BSE) is the best article on the subject that we have seen. Though much has been written about BSE it is unusual to find an in-depth article that is readable by those with varying backgrounds as well as containing information that applies to almost all areas of the world. Many of our readers over a long period of time had requested an article on the subject but until now we had not been able to find one that we felt was right for this publication. For this endeavor we are greatly indebted to Dr. Taylor.*

Bovine Spongiform Encephalopathy (BSE), commonly called "Mad Cow Disease," is a slowly progressive neurological disorder that affects cattle. It is a transmissible spongiform encephalopathy, related to but distinct from scrapie of sheep, chronic wasting disease of cervids, mink spongiform encephalopathy and several diseases of humans. This class of diseases is characterized by spongiform changes in the brain (vacuolizations resembling holes) that can be readily detected in late stages of the disease (see figure 1).

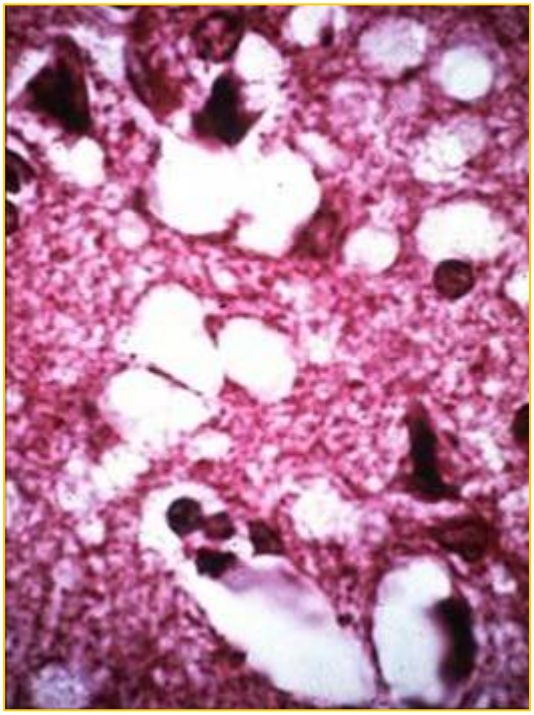

Figure 1: Histologic examination of brain material showing spongiform changes.

Additionally there is an accumulation of an abnormal protein that interferes with brain function. This protein is an abnormally shaped version of a native protein normally found in the central nervous system. Instead of its normal alpha-helix conformation the aberrant protein is dominated by beta pleated sheets. This alteration makes it very resistant to degradation, both endogenously and in the environment. The accumulated protein is referred to as "prion" and is believed by most experts to be the causative agent of the disease.

BSE has a relatively long incubation period which is dose dependent. The youngest cases occurred at the peak of the United Kingdom (UK) epidemic when exposure levels were highest. Since that time, as the amount of infectious material in feedstuffs has decreased the age of onset has increased. The average age of clinical signs is approximately 5 years, with very few cases in animals less than 30 months. Clinical signs begin vaguely and are attributable to CNS disturbance. Signs can include change in behavior or response to common situations, incoordination (particularly in the hind legs), decreased production and weight loss. One study compared confirmed cases to animals that were initially suspected of having BSE but were found to be free of the disease. This study found that the signs that most accurately predicted a case include: kicking in the milking parlor, hypersensitivity to touch and/or sound, head shyness, panic-stricken response, reluctance to enter in the milking parlor, abnormal ear movement or carriage, increased alertness behavior, reduced milk yield, teeth grinding, and change in temperament. Progression of signs is fairly prolonged, as the median length of signs in one study was 30 days and 40 to 80 days in other studies.

Definitive diagnosis can currently only be done post mortem. Lesions found in late stages of disease can be diagnosed by histopathology. However, a variety of techniques can be employed to increase sensitivity. These look for the prion protein in brain material, which can be detected prior to spongiform changes. Methods currently widely available include immunohistochemistry (IHC), western blot and ELISA testing. These techniques have very good specificity if performed correctly. Sensitivity varies depending on stage of

disease; it is estimated that infection can only be detected 4 to 6 months prior to onset of clinical signs. Testing is done on a specific region of the brain stem termed the obex. Fresh tissue is preferred because it can be used for all diagnostic tests. However, if difficulties in transit are likely to result in decomposition of the sample the obex can be fixed in formalin for IHC testing.

History of BSE and vCJD

The first case of BSE was diagnosed in the UK in 1986. The number of cases escalated rapidly and peaked in 1992 with over 35,000 cases diagnosed that year alone (see figure 2). Additionally, it is suspected that many more cases went undiagnosed. It was soon recognized that transmission occurred through feeding of rendered products from infected animals (termed meat and bone meal [MBM]). Restrictions on this practice were put in place beginning in 1988 and incidence began declining in 1992 (approximating the length of the incubation period for exposure at or before 1988). Since tightening of the restrictions cases have continued to decline dramatically.

The origin of BSE is uncertain. It has been speculated that it began with exposure of cattle to MBM from scrapie infected sheep. This is considered a reasonable possibility as the UK population of sheep is quite large and scrapie is well established in the national flock. Moreover, MBM fed to cattle included rendered product from sheep and goats as well as cattle. Nevertheless, if BSE did derive from scrapie it quickly transformed into a new and unique disease, as BSE is certainly not simply scrapie of cattle. It has a different clinical presentation, different means of transmission, different distribution of infectivity and subtle but significant differences in pathology. Another theory is that a spongiform encephalopathy of cattle occurs sporadically in cattle, as it does in humans. New evidence has leant credibility to this theory, as intensive surveillance has discovered an atypical form of BSE in Europe and the US (often referred to as “”BaSE”). This form affects older cattle and has slightly different histopathologic lesions and distribution of those lesions compared to “classic” BSE. Other theories have centered on possible dietary imbalances, or exposure to pesticides. Such ideas have failed to gain much following. While it will likely never be proven what first gave rise to BSE it is certain that its development into a pandemic is due to feeding practices. Due to limited

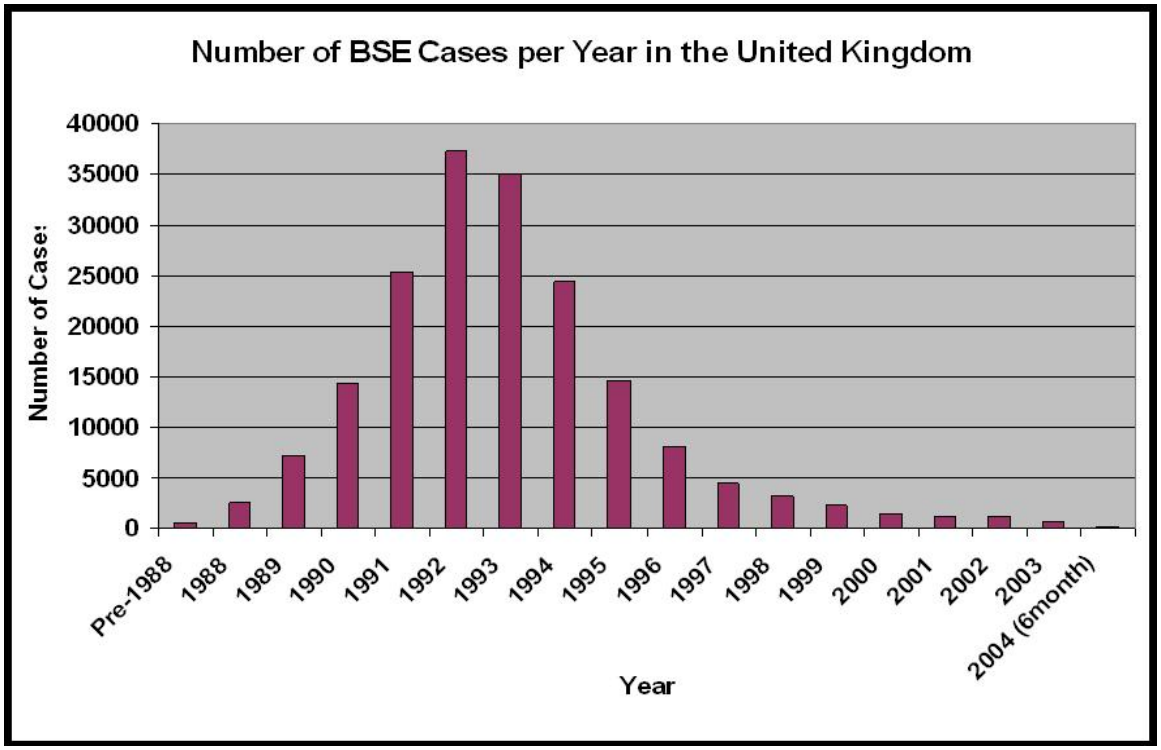

Figure 2: Number of cases diagnosed per year in the UK

plant protein sources the UK had long relied upon MBM for livestock supplementation. Beginning in the late 1970s and early 1980s changes in the rendering industry made it more likely for prions to survive rendering and remain infectious. Feeding of this material (particularly to dairy calves) quickly spread the disease. Once these animals developed disease they would be condemned and excluded from the human food supply and restricted to rendering, greatly amplified the disease.

Once this pattern was recognized restrictions were introduced to prevent the practice in the UK. Unfortunately, this led to an excess of MBM which resulted in large amounts being exported to other countries. Export to the US was stopped in 1989 while export to EU countries ceased by 1991 but other countries continued to permit importation until the late 1990s. This, combined with largely inadequate surveillance allowed the disease to be introduced unknowingly to many nations. Failure to implement control measures then allowed propagation within many of those countries which sometimes wasn't detected until relatively large numbers of cases began occurring. This is the most likely reason for the large number of countries that experienced "explosions" of BSE in the late 1990s. In many cases, the disease had been circulating for some time but inadequate effort had been made to identify it. This is unfortunate, as the extent of effort needed to prevent spread of BSE may be impacted by the prevalence of the disease in the national herd. Those countries with the highest number of cases will need stronger and broader restrictions to eliminate the disease rapidly, while nations with very low numbers of cases may be able to extinguish the disease with fewer restrictions. The broadest ban seeks to prevent all feeding of ruminant derived protein to other ruminants. Exceptions are made for milk and sometimes blood products. The UK instituted bans prohibiting feeding of ruminant protein to any animal species, while the US chose to prohibit importation of MBM from the UK derived from all species (because of fear of cross-contamination). However, the US continues to permit feeding of ruminant protein to poultry and swine.

The importance of BSE extended beyond agricultural economics in 1996 when it was linked to disease in humans. This disease, termed variant Cruetzfeldt-Jakob disease (vCJD) is a spongiform encephalopathy that resembles a spontaneous disease of humans that has been recognized since 1921. However, while the original CJD occurs sporadically throughout the world, vCJD was closely linked geographically with BSE. Comparing CJD and vCJD, the variant form typically affects younger individuals and has a longer duration of clinical signs. Both are ultimately fatal. Bioassay strongly supported a link between BSE and vCJD (mice inoculated with brain material from vCJD patients developed lesions indistinguishable from mice inoculated with material from cattle with BSE). It is therefore assumed that consumption of beef products containing the prion agent introduced the variant form. A genetic predisposition emerged, where all individuals affected by foodborne route have been homozygous for the amino acid methionine at codon 129. This relationship is obviously significant as this genotype represents only 39% of the population. However a new concern emerged when a methionine/valine heterozygous individual developed vCJD, which appeared to be obtained through a blood transfusion. Almost all cases of vCJD have occurred in the UK (or in people who previously lived in the UK). To date, the number of definitive and probable vCJD cases in the UK is 162. The number of vCJD cases peaked in 2000 with 28 deaths and declined to 3 in the first 9 months of 2006. Occurrence of the disease certainly appears to be in decline, although some argue that a second wave may eventually develop among methionine/valine and valine/valine population. Indeed, some evidence suggests that infection is possible in these individuals. It remains to be seen whether such people eventually develop the disease or are "silent carriers" who may transmit it to susceptible individuals through donation of blood or other tissue.

Protecting Cattle and Humans

While preventing feeding of MBM to cattle is effective in preventing dissemination among cattle, public health measures must be more refined (otherwise they would simply prohibit eating beef). Fortunately, extensive research has demonstrated that not all proteins from infected animals pose a risk. In fact, significant levels of infectivity have

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been consistently found only in the brain, spinal cord, dorsal root ganglia, distal ileum and tonsil. Other tissues that have been found to be potentially infectious include the vertebral column, spleen, eyes and remainder of head, and bone marrow (only found to be infective in one animal of one study). These few tissues pose the greatest risk of transmission; therefore most governments have created a definition of "Specified Risk Materials" (SRM) to be excluded from the food chain. Similar to feed restrictions, SRM definition can be refined depending on the level of risk present in the cattle population. For example, age of the animal is one method of refinement since levels of infectivity increase with age. In the UK no meat from cattle over 30 months of age was permitted to enter the food supply (this was changed in November of 2005, so that animals born after August 1996 can now be used for human consumption after testing negative). Also excluded was CNS material from all cattle over 12 months of age (changed to 24 months in October 2005) and tonsils and intestine from all ages of cattle. The US has used 30 months in defining most SRM material although tonsil and distal ileum of all cattle are excluded from food.

Controlling and/or eliminating the risks associated with BSE typically takes a 3 prong approach. The first is preventing infection in cattle. This previously involved importation restrictions from countries with BSE (this is becoming less common with the decline in cases and standardization of other protocols). More important than preventing introduction of a single case is eliminating the potential for amplifying the disease if it is present. Ruminant to ruminant feed bans are the primary means of accomplishing this. The second goal is protecting public health. This requires appropriately defining SRM for the risk present in the cattle population and subsequently removing these materials from the food chain. The final prong involves verifying the effectiveness of the control measures. This relies upon inspection of the food supply and targeted testing of the cattle population. Meat inspection monitors removal of SRM, the most important means of minimizing risk to consumers. Testing monitors the effectiveness of the feed ban by (hopefully) documenting decreasing occurrence of the disease. If testing fails to show declining incidence the effectiveness of the feed ban must be questioned. Of course, this must be done in light of the long incubation period, as cases detected today reflect events 2-5 years ago.

Most experts agree that testing should not be viewed as a food safety measure. The infectious dose for vCJD is unknown; therefore it is uncertain whether testing can detect an animal early enough to prevent a risk to humans that consumes infective material. The only way to ensure safety is removal of potentially infective material from all carcasses. Because testing is viewed as a monitoring tool rather than a public safety issue, most countries seek a cost effective means of getting the most information out of testing the fewest animals. This typically means focusing on high risk animals. Such an approach takes advantage of the fact that positive results are more likely to be found in animals showing clinical signs than in apparently healthy cattle (see figure 3). For example, in the EU one case of BSE was found for approximately every 2600-3000 head tested that were true clinical suspects. This is limited to cattle with clinical signs strongly suggestive of neurologic disease in the absence of other explanations. Fallen stock and emergency slaughter cattle required even fewer testings per positive. Testing of healthy cattle at slaughter yields a much lower percentage, requiring more than 30,000 tests for each positive.

Trends in test results are often more important than absolute numbers. A steady increase in the number of cases per 100,000 animals tested

Population	**2002**	**2003**
Clinical suspects	2,646	2,890
Fallen stock and emergency slaughter cattle	1,085	1,656
Healthy cattle at slaughter	32,258	33,333

Figure 3: Number of Animals Tested /Positive Test Result: EU Experience

should be a cause for concern (unless testing shifts from low risk populations to high risk cattle). Even more concerning would be a decrease in the average age of affected cattle. A distinct decrease in cases is reassuring even if the number of cases remains relatively high.

Responding to Confirmed Cases

The nature of BSE makes response to a case unique. Detection of a case does not necessarily indicate a threat to animal or human health. As long as SRM were removed from the carcass no risk should be posed (although it is typically preferred that the entire carcass be prevented from entering the food or rendering supply). Therefore no immediate response is necessary as in other diseases. Rather, effort is focused on identifying possible sources of exposure for the affected animal and locating all other animals that may have been similarly exposed. This is greatly facilitated by comprehensive animal identification and records. The fear of vertical transmission often results in culling of offspring of the affected animal (if the case is in a cow). However, because horizontal transmission does not occur, there is no need and no justification for slaughter and testing of current cohorts (unless they may have been exposed at the same time as the affected animal). Virtually all countries have measures in place to prevent transmission of BSE whether or not an indigenous case has occurred. Identification of the first case may justify re-evaluation of those measures and further tightening of protective measures but this is not always necessary. Moreover, as stated above, additional cases do not necessarily indicate the current system is inadequate; the infection occurred years earlier when control measures may have been significantly weaker. Indeed, the increased testing that often follows discovery of early cases may identify many more affected animals, particularly if previous testing was inadequate or did not focus on the most appropriate population of cattle.

Conclusions

BSE is a unique disease that presents a real threat to human and animal health. However, the fear resulting from the disease is arguably more significant than the actual threat to human or cattle wellbeing. Indeed, the number of people afflicted with vCJD to date is dwarfed by the number killed by *E. coli*, *Campylobacter*, and other foodborne bacteria. Additionally, while there are many aspects of the disease that remain unexplained, enough is known to mitigate the risks. Currently it appears that enforcement of relatively simple measures may well lead to eradication of this disease. These include preventing feeding ruminant derived protein to other ruminants and removal of high risk material from the human food supply.

Despite these reassuring facts, BSE continues to garner attention throughout the world. This is likely due to the many characteristics of BSE that make it particularly unnerving to the public: It is a novel and mysterious disease; it causes a slow and debilitating death, often affecting young individuals; it is contracted from an act essential to life (eating); it has a long incubation period ("what you ate today may cause you to die 10 years from now"); and it has been associated with "factory farming" practices that are perceived to be more concerned with profit than safety. Policy makers should rely on science to guide regulations and safety measures. But effective risk communication is needed to assist the public in understanding the rationale of these decisions in order to maintain their trust in the food supply. As experts in animal health and food safety, veterinarians are uniquely qualified to play a critical role in providing this information to the public. Veterinarians should also embrace their role in ensuring appropriate precautions are taken to prevent or eliminate BSE. This includes being familiar with the disease's presentation and epidemiology as well as their country's control and testing policies and actively participating in reporting or submitting for testing all suspected cases.

Equine Viral Arteritis (EVA)

Abstracted from Veterinary Quarterly Review, Texas A&M University Extension Veterinary Medicine, College of Veterinary Medicine. Vol. 22 No. 2 Summer 2006

Detailed information on the history, transmission, symptoms, clinical signs, treatment, prevention and control of EVA is available at www.aphis.usda.gov/lpa/pubs/fsheet_faq_notice/fs_ahequineva.html

From Holly Wiemers, Communications Director, Equine Initiative, University of Kentucky College of Agriculture, N 212G Ag. Sciences Bldg., North Lexington, KY 40546-0091, main office 859-257-3333.

AVMA Brochure Aims to Reduce Incidence of Dog Bites

Adapted from the Journal of the American Veterinary Medical Association July 2006, Vol 229, No. 1

Many millions of people are bitten by dogs annually. To help educate the public about dog bites, the AVMA has developed a brochure, "What you should know about dog bite prevention," offering tips on how to avoid being bitten, what dog owners can do to prevent their dogs from biting, and how to treat dog bites.

The brochure's release preceded National Dog Bite Prevention Week, May 21-28, sponsored by the AVMA, American Academy of Pediatrics, and U.S. Postal Service.

"There are 'good' dogs," AVMA president, Dr. Henry E. Childers added. Responsible pet ownership and education have been shown to be the key factors in reducing the number of bites that occur in the community. Dog owners must understand the importance of appropriate behavioral training and supervision of contact between their dogs and children or strangers. To access the dog bite brochure online, visit www.avma.org/press/publichealth/dogbite/mediakit.asp.

EDN Now Available in French

Adapted from ECHO Development Notes, Issue 93, October 2006

ECHO is pleased to report that *ECHO Development Notes* is now available in French. Currently one issue (*EDN* 91) has been translated, but more will be coming. As new issues are completed, they will be translated into French (Spanish issues have been available for over 10 years). ECHO is also working on translation of the most important articles from past issues of *EDN*. If you would like to receive *EDN* in English, Spanish or French, write to ECHO with your full name and address and specify which language(s) you would like to receive and whether you prefer airmail or a text-only email version. If you have not done so already, please also fill out the registration form (available from their website; click on ECHO Documents and then Forms).

Subscriptions are free to workers helping small farmers or urban gardeners in Developing Countries. You may receive both English and Spanish/French if you work in both languages. Other individuals may subscribe for US $10 per year.

French, Spanish and English versions of *EDN* and other articles are also available on the web from a link on ECHO's agricultural homepage (www.echotech.org).

ECHO is a Christian non-profit organization whose vision is to bring glory to God and a blessing to mankind by using science and technology to help the poor.

CAPC – Companion Animal Parasite Council

Adapted from Penn State Veterinary News July-August 2006

Although safe and effective treatment and control methods exist for many internal and external parasites, countless animals continue to suffer from preventable parasitic infections. Dogs and cats also are commonly infected with intestinal parasites, some of which may be transmitted to people. This jeopardizes the health of pets and creates a significant risk to the public. Because of the impact on pet and human health, it is incumbent upon veterinarians to make comprehensive parasite control a priority in preventative pet health care.

The goal of the www.capcvet.org site is to provide easy-to-access parasite management resources for animal care practitioners, as well as any others interested in seeking information on the proper control of the most common parasites of pets and people. CAPC has developed the www.petsandparasites.org site for owners as an information resource and starting point for discussions with their veterinarian.

Guidelines for the control of internal and external parasites have been developed to protect the health of pets, enhance the safety of the public and preserve the bond between pets and people. The Guidelines are revised and updated by respected veterinary colleagues to provide you with the latest information and recommendations on the prevention and treatment of Companion Animal Parasites. Some features of the web sites include:

pertinent articles written by CAPC members; photos and descriptions of each parasite, including geographic distribution, prevalence, transmission, diagnosis, treatment, and control; and descriptions of products available for treatment of parasites in dogs and cats.