

## Rapid Identification of Scrapie-Infected Animals

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Scrapie in sheep and goats is an example of Transmissible Spongiform Encephalopathies (TSEs), a degenerative form of neurological disease that occurs in several animal species and humans. This group of diseases includes chronic wasting disease and bovine spongiform encephalopathy (BSE), also known as mad-cow disease. The human disease is known as Creutzfeldt-Jacob disease (CJD).

At present, a definitive diagnosis of these diseases is possible only after death. Therefore, tests to identify cases early, during disease development and progression, are desperately needed to prevent and control the transmission of TSEs. Currently, the diagnosis of TSEs is made by clinical presentation wherein the diagnostic error is more than 25%.

What is needed is a test that can be performed on blood or other body fluids for the purpose of detecting the disease before the onset of clinical symptoms. With early detection, the possibility exists for developing drug treatments that may avert or control the disease.

In order to develop a diagnostic test early during progression of TSEs, we investigated the usefulness of two biochemicals, named 14-3-3 and S-100, which are released into the brain fluid, the cerebrospinal fluid (CSF), or serum. These proteins are usually present inside the brain cells but invariably absent in CSF and serum.

The proteins are released from the brain cells into cerebrospinal fluid and serum when there is damage to the cells, such as during the progression of TSEs. Therefore, the presence of these chemicals, albeit in very small quantities, is indicative of brain damage consistent with TSEs.

## OBJECTIVES

The objectives of this work were to design, develop, and evaluate an accurate assay to detect the presence of two biochemicals in cerebrospinal fluid or serum and evaluate a rapid test device for TSEs.

## CHALLENGES

At present, the diagnosis of TSEs — which include bovine spongiform encephalopathy, known as mad-cow disease, and the human disease known as Creutzfeldt-Jacob disease — can only be done after death. Early detection of TSEs is the essential first step toward the development of control strategies.

## ACHIEVEMENTS

Two techniques were developed to detect proteins in the cerebrospinal fluid (CSF) and serum of scrapie-infected and normal sheep. A western-blot technique that detects the presence or absence of proteins, based on reactivity to specific antibodies, was first developed. In order to facilitate quantitation of both S-100 and 14-3-3, an enzyme-linked immunosorbant assay (ELISA) was developed. The data revealed that levels of S-100 in serum and 14-3-3 in serum or CSF are potentially useful as surrogate markers of neurological damage early in scrapie infection.

## THE FUTURE

The data from this project and data gathered from an RECGP Interdisciplinary Grant were used to write a successful Department of Defense proposal for \$375,000. This will enable additional studies using large sample sizes to validate the markers for routine diagnostics of TSEs in field animals. This is a critical step forward in meeting the needs for an accurate diagnostic test for TSEs prior to death of the animal.



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