



# High-Stake Steaks: the science of prions, Mad Cow, and other neurologic diseases



November 15th, 2017

## Introduction

For a decade between the mid-1980's to the mid-1990's, the outbreak of Mad Cow disease shook up the meat industry and the scientific community. How Mad Cow disease could spread from cow to cow, and from cow to humans puzzled scientists and ultimately led to the identification of a new type of infectious agent: prions. In this lecture, we will cover the story from mystery to discovery and the agent behind it all: prions. At the end of our talk, we will discuss how insights from studying Mad Cow disease has informed our approach to tackling other neurological diseases, such as Alzheimer's Disease and Parkinson's Disease.

## Speakers



**Noah Bloch** is a second year graduate student in the Biological and Biomedical Sciences PhD program. He works in the lab of Dr. Loren Walensky at the Dana-Farber Cancer Institute where he investigates programmed cell death. Before Noah began studying cancer biology, he completed his undergraduate research thesis modeling Parkinson's Disease in worms. In addition to research, Noah enjoys playing intramural sports and has contributed to the Dudley Review, a graduate student literary journal.



**Vicky Chou** is a second year student in the Biological and Biomedical Sciences program. She works in the lab of Dr. Tracy Young-Pearse at Brigham and Women's Hospital where she is studying the role of microglia in Alzheimer's Disease. Outside of lab, Vicky is involved in Harvard's Health Profession Recruitment and Exposure Program as a Curriculum Director. In her free time, she draws a biology webcomic titled *Cellular Scribbles* and competes with the Harvard archery team.

## Glossary of Important Terms

**Protein:** Proteins carry out a myriad of functions in our cells and throughout our body. Most of the activities that cells perform are the result of actions by proteins.

**Amino acid:** Proteins are chains of amino acids and in this way amino acids are considered the building blocks of proteins. Each amino acid is defined by its unique chemical properties established by the "variable group".

**Hydrophobic:** Greek for "afraid of water", hydrophobic amino acids have variable groups that repel water.

**Protein folding:** The process by which a protein acquires its three-dimensional shape, which is critical for function.

**Protein misfolding:** Protein misfolding occurs when a protein adopts a fold (or shape) that cannot carry out the protein's function.

**Aggregate:** A clump of proteins. In our talk, aggregates are made of misfolded proteins that stick together.

**Templating:** The process by which a misfolded protein causes normally folded protein to also become misfolded.

**Prion:** A prion is an infectious protein. Prions are misfolded aggregates that template the misfolding of other proteins.

**PrP:** PrP is the prion that is responsible for Mad Cow disease.

**Amyloid beta:** The protein that forms aggregated in the brains of Alzheimer's patients. Its role outside of the disease is not understood.

**Alzheimer's disease:** A neurological disease in which the death of specific neurons in the brain result in the loss of memory. Protein aggregates, primarily composed of amyloid beta have been found in the brain of affected patients.

**Parkinson's disease:** A neurological disease in which the death of specific neurons in the brain result in the loss of motor coordination. Protein aggregates, primarily composed of alpha synuclein have been found in the affected neurons.

**Alpha synuclein:** The protein that forms the aggregates found in the brains of Parkinson's patients. Its role outside of the disease is not completely understood but seems important for neuron-neuron communication.

**Antibody:** A type of protein used by the immune system to detect pathogens and substances foreign to our bodies.

## ***Resources to learn more***

SITN article on protein folding: <http://sitn.hms.harvard.edu/flash/2010/issue65/>

Scientia article on studying protein aggregation:

<http://www.scientia.global/professor-robert-fairman-twists-turns-protein-assembly/>

SITN article on prions: <http://sitn.hms.harvard.edu/flash/2013/prions-friend-or-foe/>

SITN article on Alzheimer's disease: <http://sitn.hms.harvard.edu/flash/2015/the-spreading-confusion-rethinking-alzheimers-disease/>

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