Minnesota Center for Prion Research & Outreach:
Chronic Wasting Disease Update

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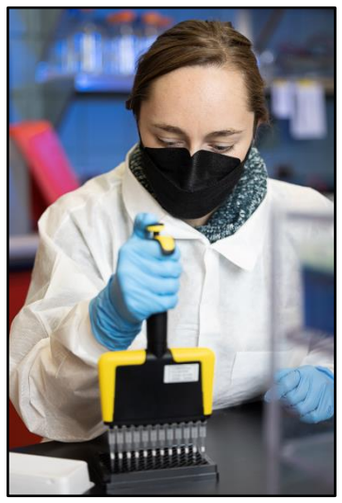
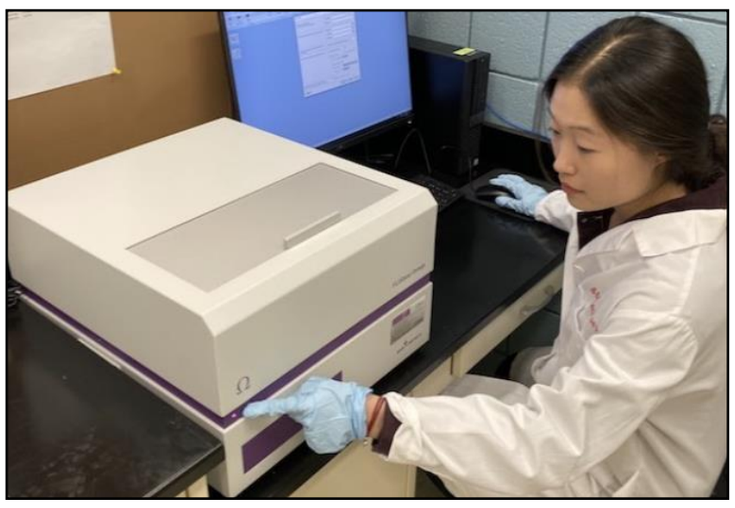
University of Minnesota
Driven to Discover®

- Develop new technologies to fight prion and protein-misfolding diseases (CWD, CJD, Alzheimer's, Parkinson's, ALS)
- New tools and strategies to fight CWD
- Innovative outreach campaigns

MN PRO





Peter Larsen, PhD
Co-director

Tiffany Wolf, DVM, PhD
Co-director

Sang-Hyun Oh, PhD
Director of engineering

Marc Schwabenlander, MPH
Associate director

(Not pictured) Tonya Seiler: Center Administrator

- ~40 research affiliates across multiple universities, state agencies, and tribal nations
- ~23 staff, undergrad, graduate students
- International collaborations with Canada and Norway

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- **Dr. Stuart Lichtenberg, Research Scientist**
- Expert on CWD prions in the environment, **especially soil**
- Leading several research projects focused on the detection and remediation of CWD prions

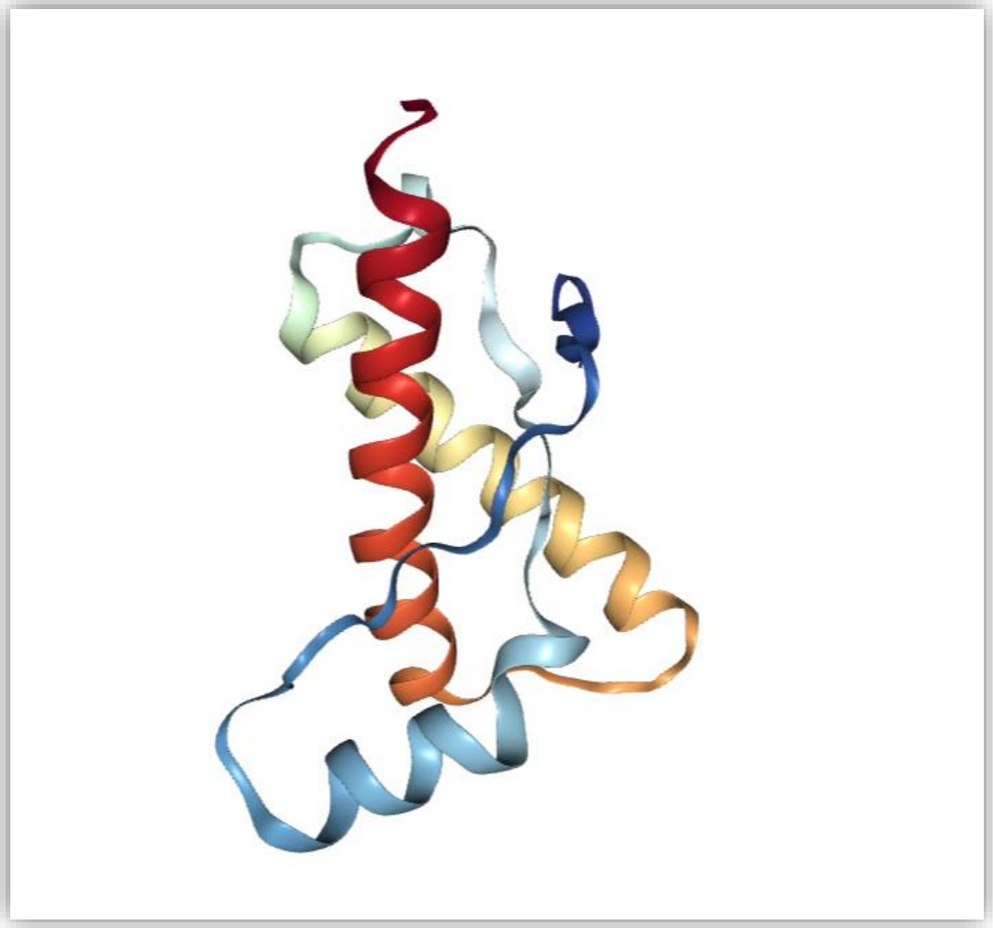
Outline

- What is a prion?
- CWD 101
- Risk to humans?
- How can we fight CWD? MNPRO research highlights

What is a prion?

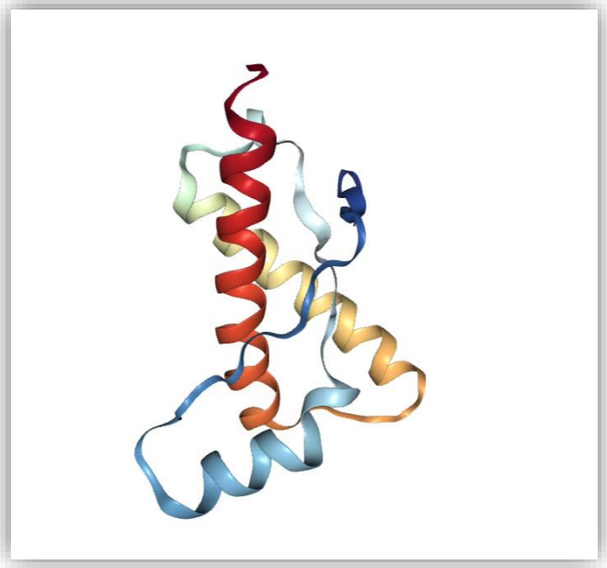
What is a prion?

- All mammals have prion proteins
- Normal cellular function
- Copper, zinc, iron metabolism
- Important functional roles in nervous tissues

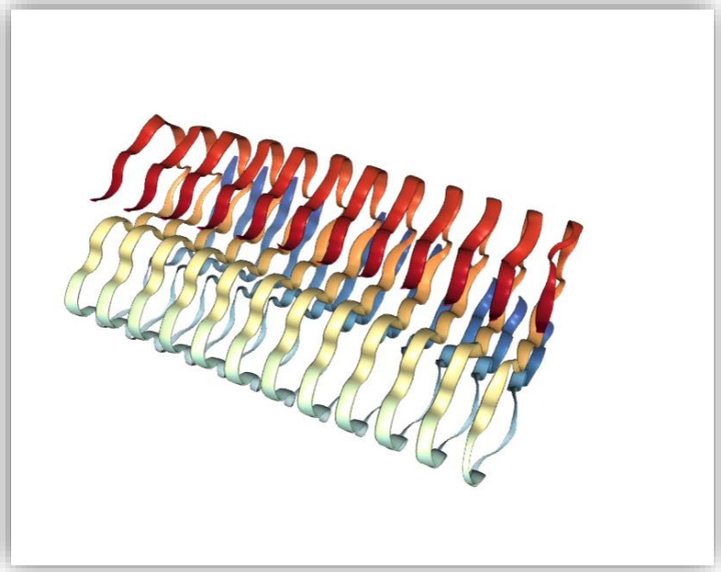


Normal Prion

How do prions become infectious?



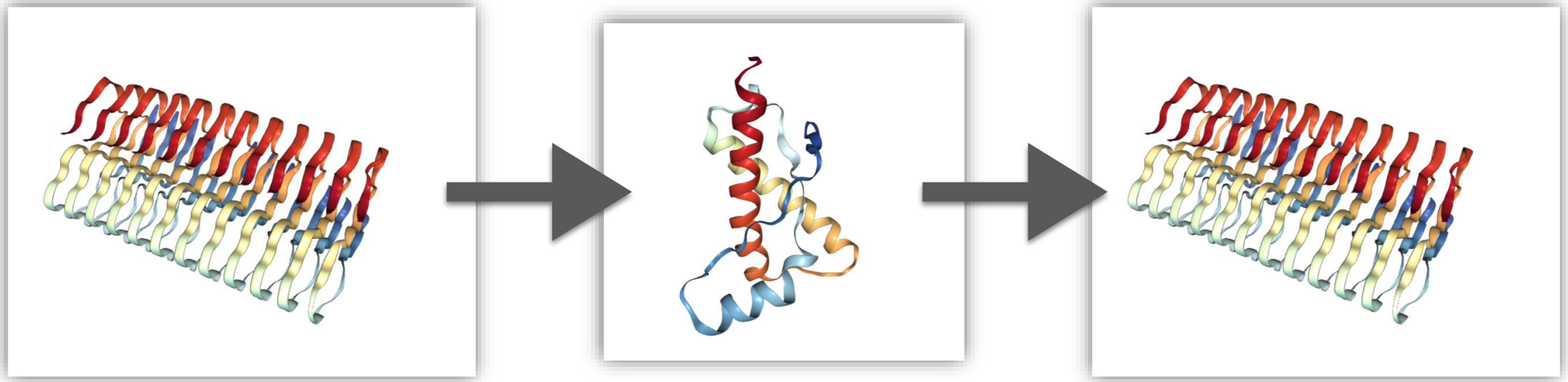
Normal Prion Protein



Infectious Prion

Infectious prions are misfolded, abnormal form

If a misfolded prion interacts with a normal prion, it causes it to misfold



Misfolded

Normal

Misfolded

The Chaos Engine of Prion Diseases

CWD

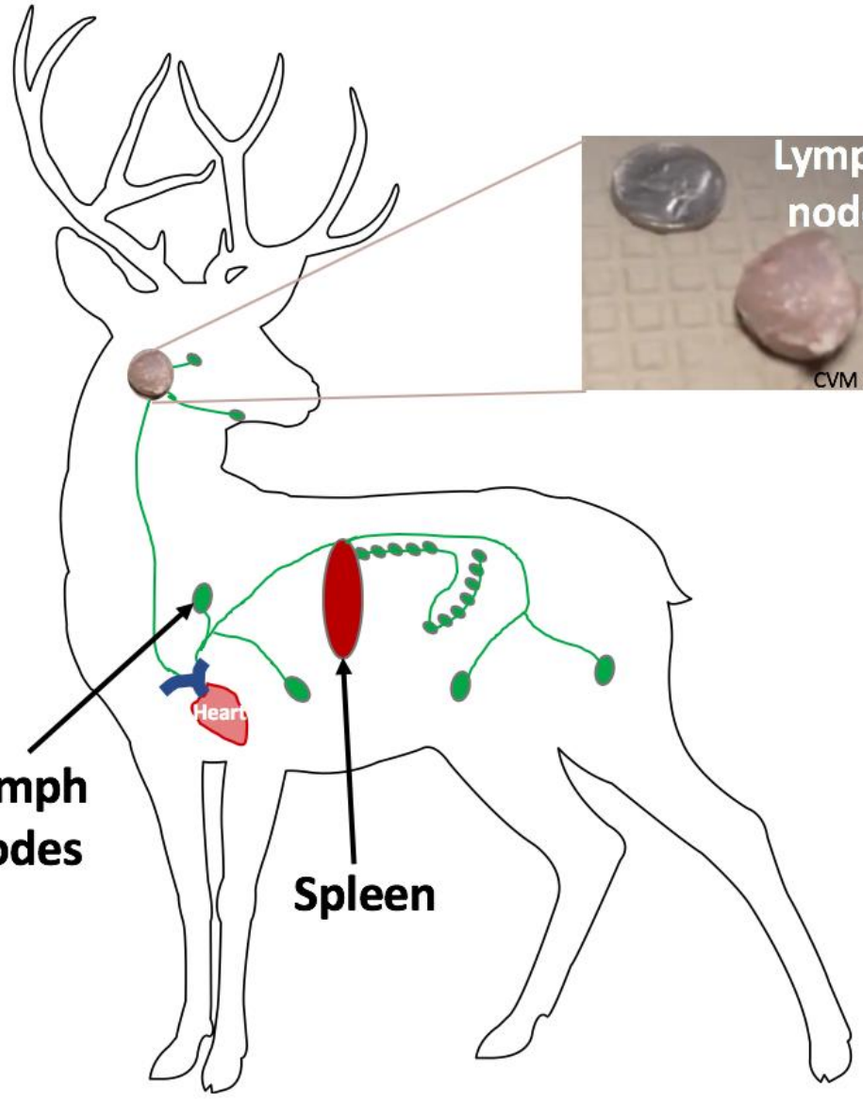
Scrapie

BSE

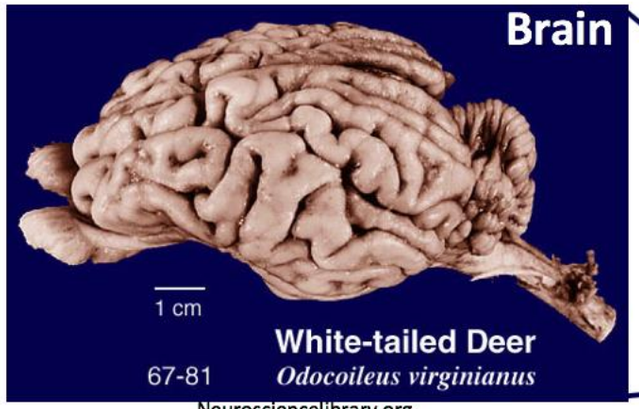
CWD: Clinical Presentation

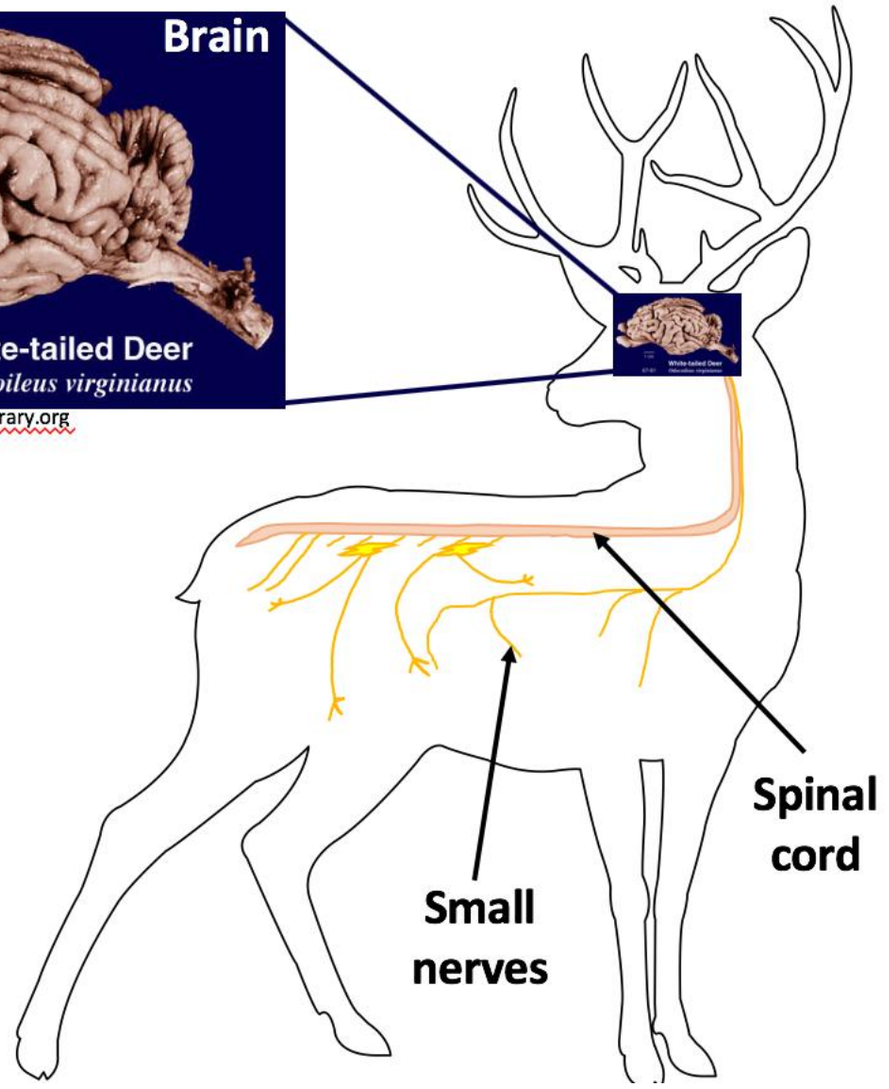
- Can take ~2 yrs before symptoms
  - Almost no immune response
  - This is why CWD+ animals might not "look sick"
- Weight loss, increased drinking and urination, excessive drooling
- Spreads through direct and indirect routes
- Herd health is impacted (~declines of 10 to 20% per year)

CWD Prions Enriched in Lymph and Nerve Tissues



Lymph Tissues

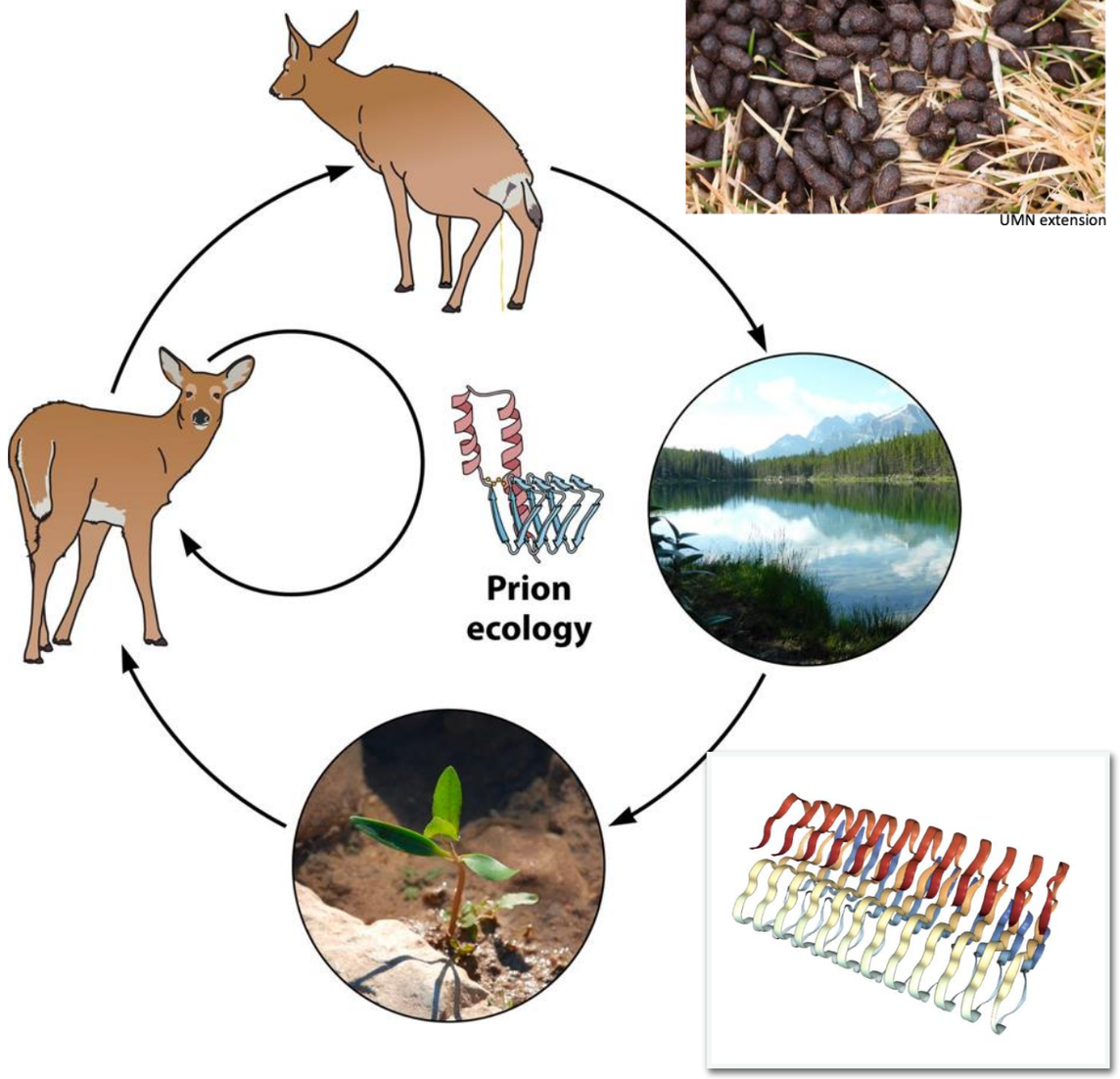




Nervous System

CWD Prions: Environmental Contamination

UMN extension

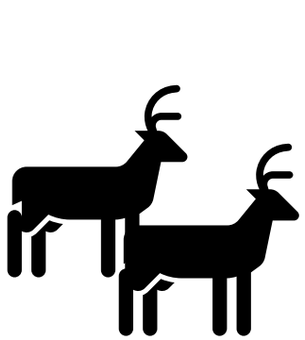


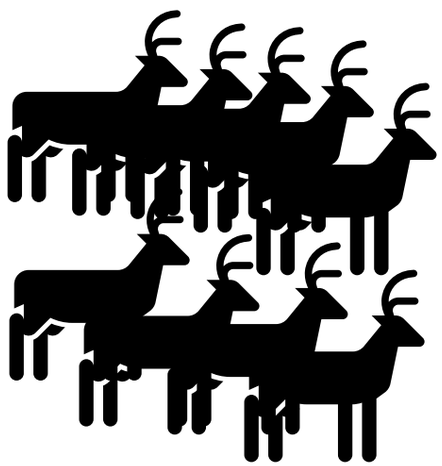
Zabel and Ortega 2017

- Infected deer spread into the environment (feces, bodily fluids, carcasses)
- Potentially remain infectious for years (soil, vegetation, etc.)
- Lab data show plants and mushrooms uptake CWD prions
- Detectible in water

CWD Prions: Environmental Contamination

CWD+ Herd

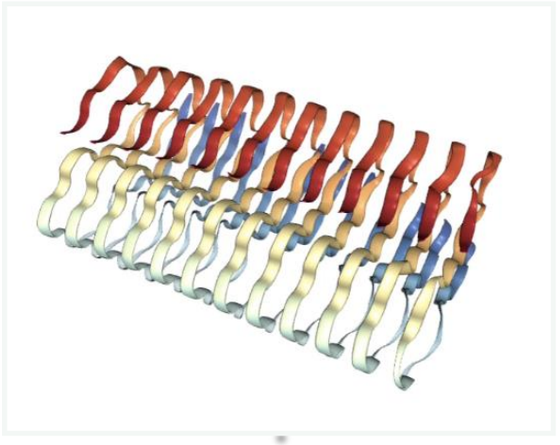




Low **High**

Prion Output

UMN extension



- CWD+ herds continually output CWD prions into environment
- Environmental “hotspots” that persist for years
- Soil data show CWD prions remain at detectible levels 15 years post depopulation *(S. Lichtenberg; active research project)*

Genetics of CWD

- Deer genetic background (DNA) influences susceptibility to CWD. Some deer are more susceptible and some less susceptible to CWD.
- **Individuals that are less susceptible still get infected**, it just takes longer for them to die.
- **MNPRO's conclusion:** Active herd-level surveillance and routine live animal testing must be in place before any breeding effort. **Must confirm that CWD prions are not being deposited into the environment.**

CWD Prions Are Detectible in Muscle

Article | Open Access | Published: 18 August 2021

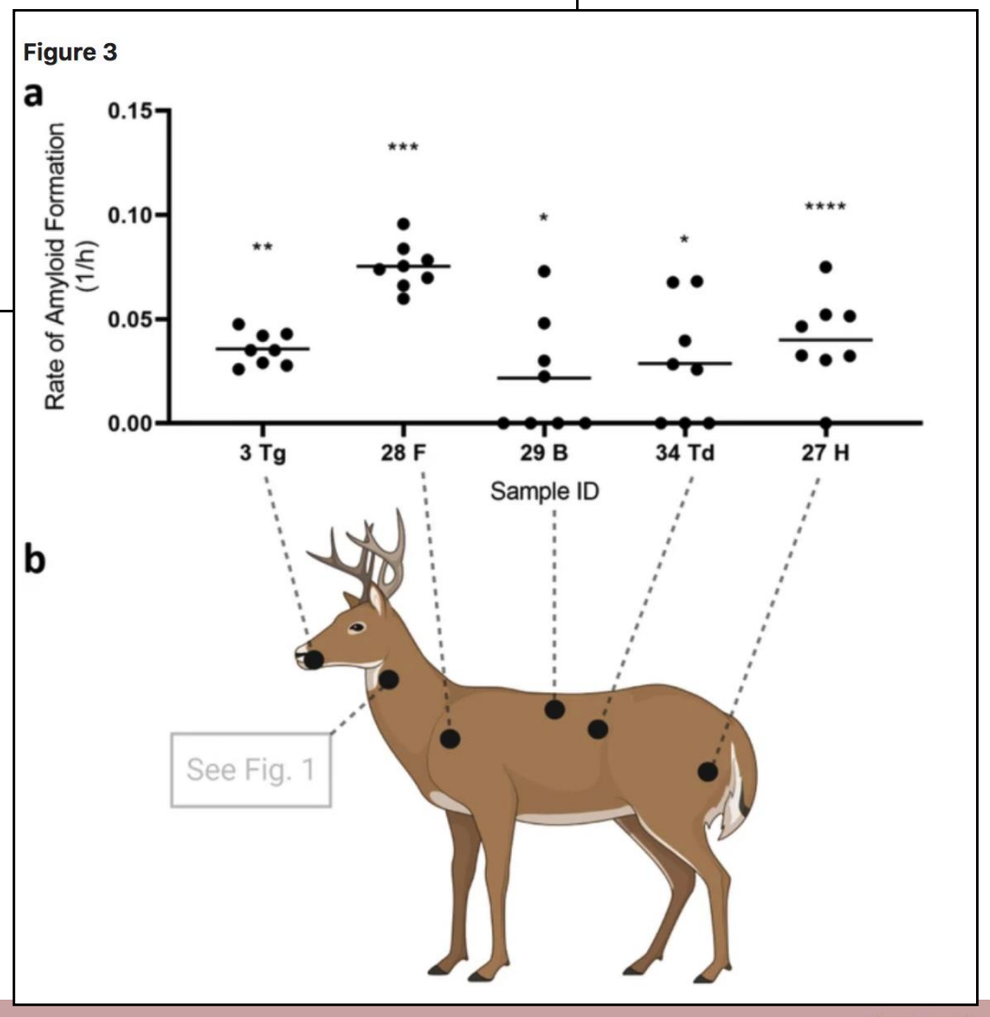
RT-QuIC detection of CWD prion seeding activity in white-tailed deer muscle tissues

Manci Li, Marc D. Schwabenlander, Gage R. Rowden, Jeremy M. Schefers, Christopher S. Jennelle, Michelle Carstensen, Davis Seelig & Peter A. Larsen

Scientific Reports **11**, Article number: 16759 (2021) | Cite this article

412 Accesses | **15** Altmetric | Metrics

- Monkeys fed CWD+ venison contracted prion disease (Canadian Agri-Food Policy Institute)
- CDC recommends not consuming CWD+ venison



Can humans get CWD?

Can humans get CWD?

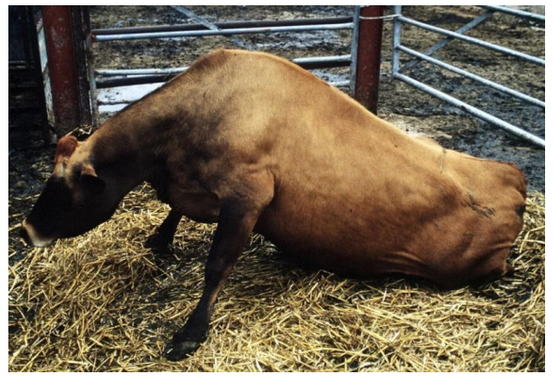
- No confirmed cases of CWD in humans. Evidence that it can be transmitted to other species (pigs, rodents, monkeys).

- There is growing concern of human transmission. Why?

CWD strain variation

CWD prions have different shapes in different deer populations, so do human prions. If there is a “match” between the two shapes, then it could cause human disease.

Lessons learned about human exposure to misfolded prions



Must reduce consumption of CWD+ venison

Scrapie

Known since 1732

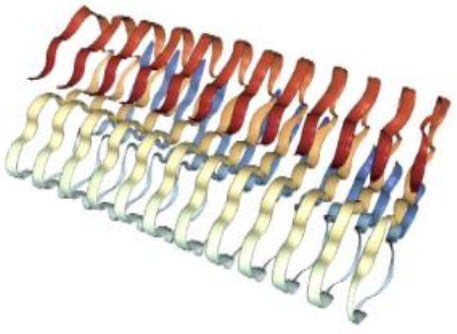
No evidence of human transmission

BSE "mad cow"

1986 UK outbreak

230+ people died after consuming BSE-contaminated food

This is the enemy!
How do we fight it?



- Targeted management, advanced surveillance, and increased hunting.

- Strategic funding for innovative CWD research and public outreach!

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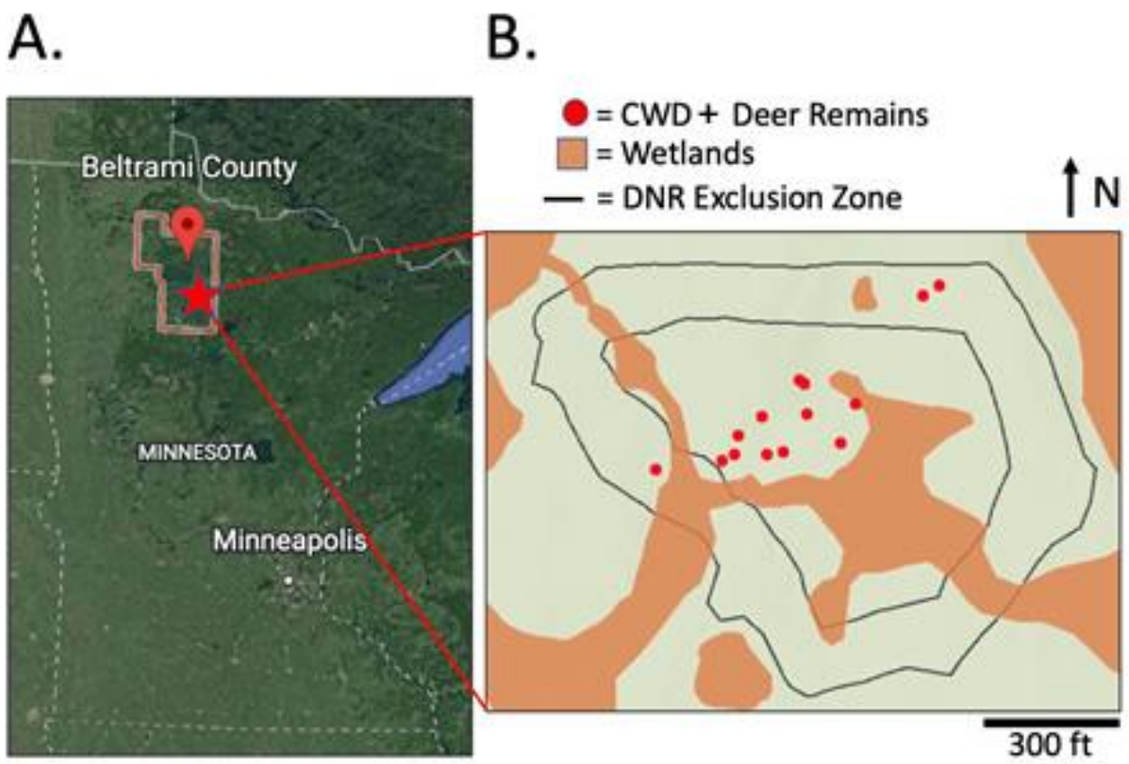
MNPRO, DNR, BAH Collaboration: Beltrami County Carcass Dump-site



- Prion Forensics: confirmed at least 6 CWD+ white-tailed deer were dumped on public land
- DNA Forensics: confirmed carcasses originated from the depopulated herd (DNA extracted from remains and herd animals)

CWD Diagnostics

CIDRAP
Center for Infectious Disease Research and Policy

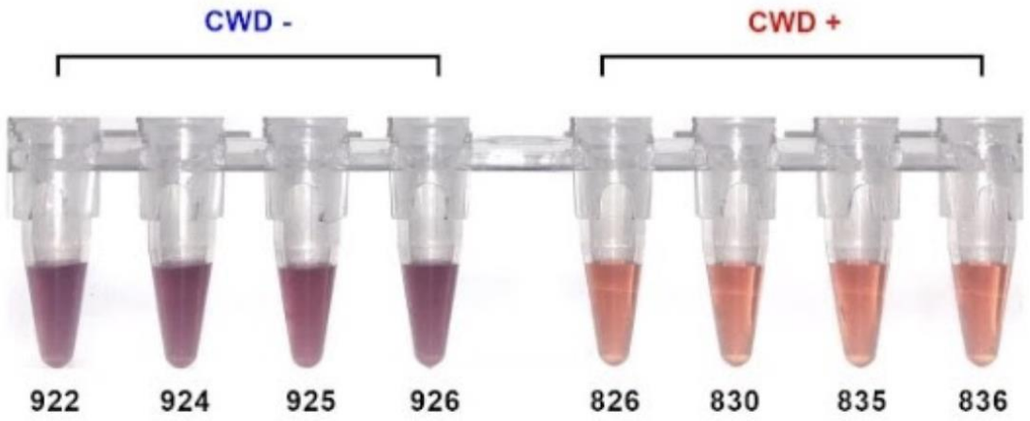
US experiencing nationwide shortage of tests for chronic wasting disease

News brief | February 2, 2023

- Major limitations attend existing tests (long wait times, limited throughput and sample types).
- Testing must increase across the state in order to better understand where CWD is and to prevent consumption of CWD+ venison.
- RT-QuIC is an ultra-sensitive and robust assay with increasing usage (globally) for prion surveillance.
- **Diagnostic labs across the world will offer RT-QuIC services in coming years. RT-QuIC is the future of CWD surveillance.**

MNPRO: Diagnostic Advancements

- Supporting international RT-QuIC network (labs in Mississippi, Wisconsin, Iowa, Nebraska, New York, Canada, Norway, etc.)
- In 2019 the MN Legislature tasked us with developing new tools for CWD testing, including for live animals. **We have accomplished this:**
  - Live animal testing using skin biopsies (95% to 100% accuracy)
  - Environmental surveillance options
  - Minnesota-QuIC: portable, cost-effective 24hr test
  - Prototype of portable 4hr test



Minnesota-QuIC Test Provides Visual Output

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Priogen

University of Minnesota Spin-off Company

www.priogen.bio

Our goal is to actively fight the spread of CWD and safeguard the rich tradition of deer and elk hunting across the United States of America by revolutionizing prion diagnostic services and technologies.

- Provide advanced highly-sensitive CWD testing to general public, state and tribal agencies
- PrioSense CWD product line with muscle and skin testing options. Muscle kits available now, skin kits in coming weeks
- Rapid and portable testing options available in the future

THANK YOU!

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