

# The Emerging Environmental Threat of Chronic Wasting Disease

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UNIVERSITY OF MINNESOTA  
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# Outline

What is Chronic Wasting Disease and how does it relate to water?



# CWD is a progressive and fatal neurodegenerative disease of cervids

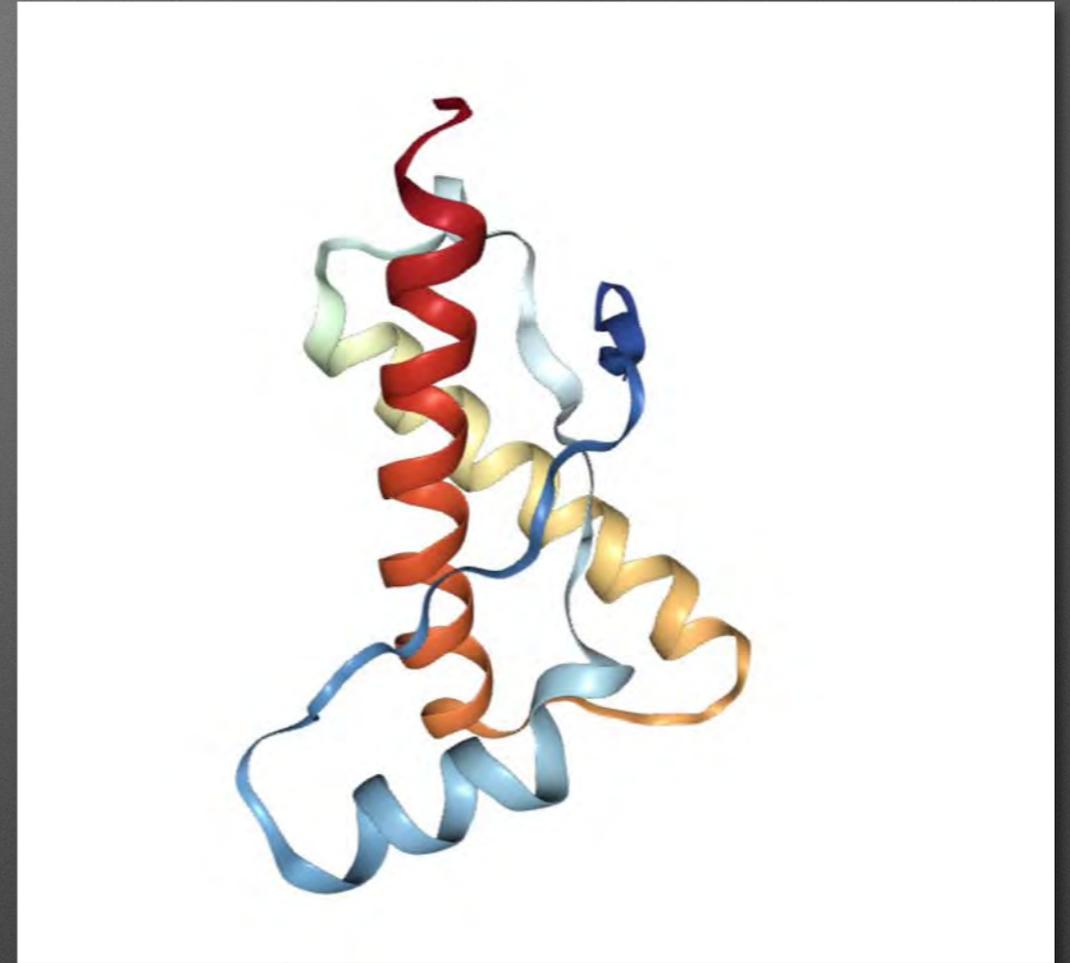


- Impacts all cervids (caribou, elk, mule deer, white-tailed deer, moose, etc.)
- Not caused by a virus or a bacteria. Caused by misfolded prion protein
- First identified in Colorado in 1960's



# What is a prion?

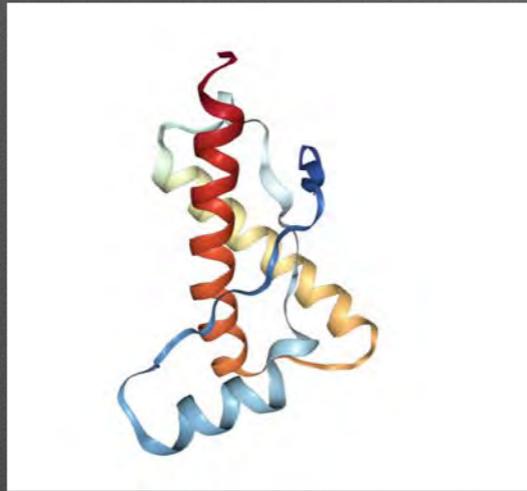
- All mammals have prion proteins
- Normal cellular function
  - Copper and metal processing
- Important functional roles in nerve cells



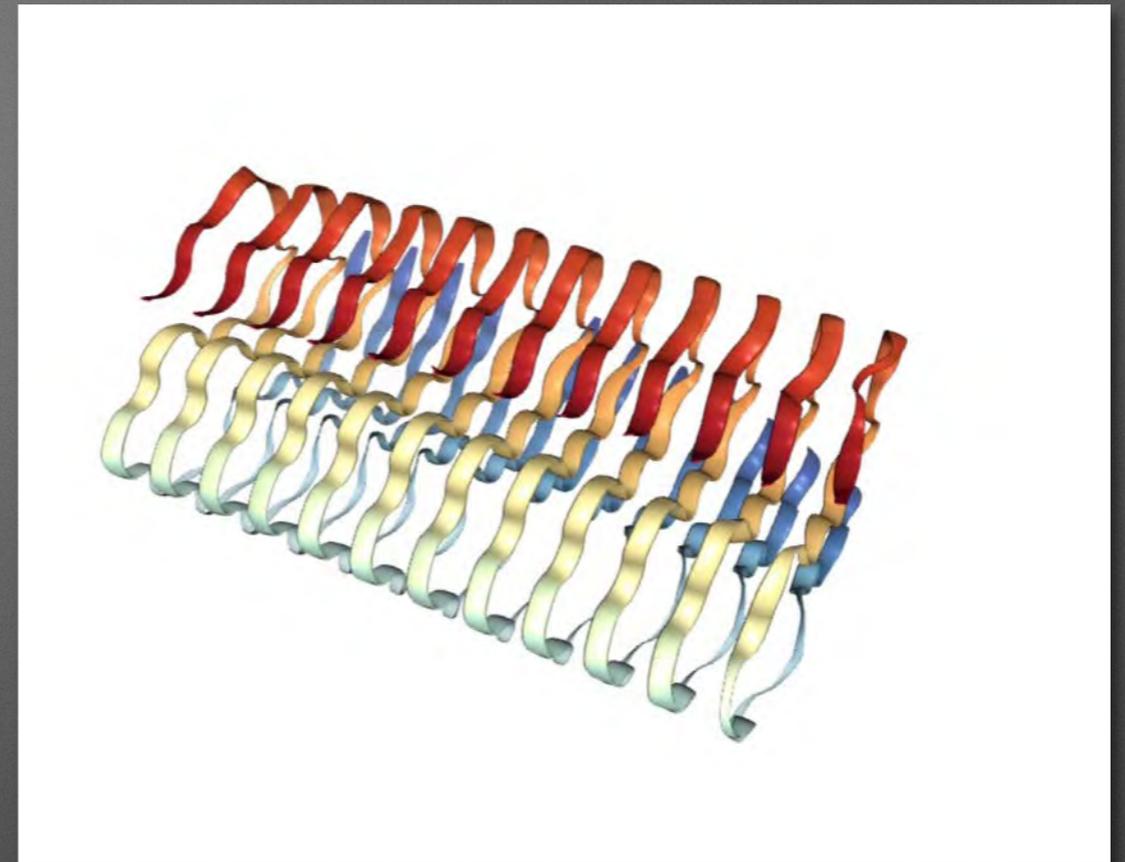
Normal Prion



# CWD Prions



Normal Prion



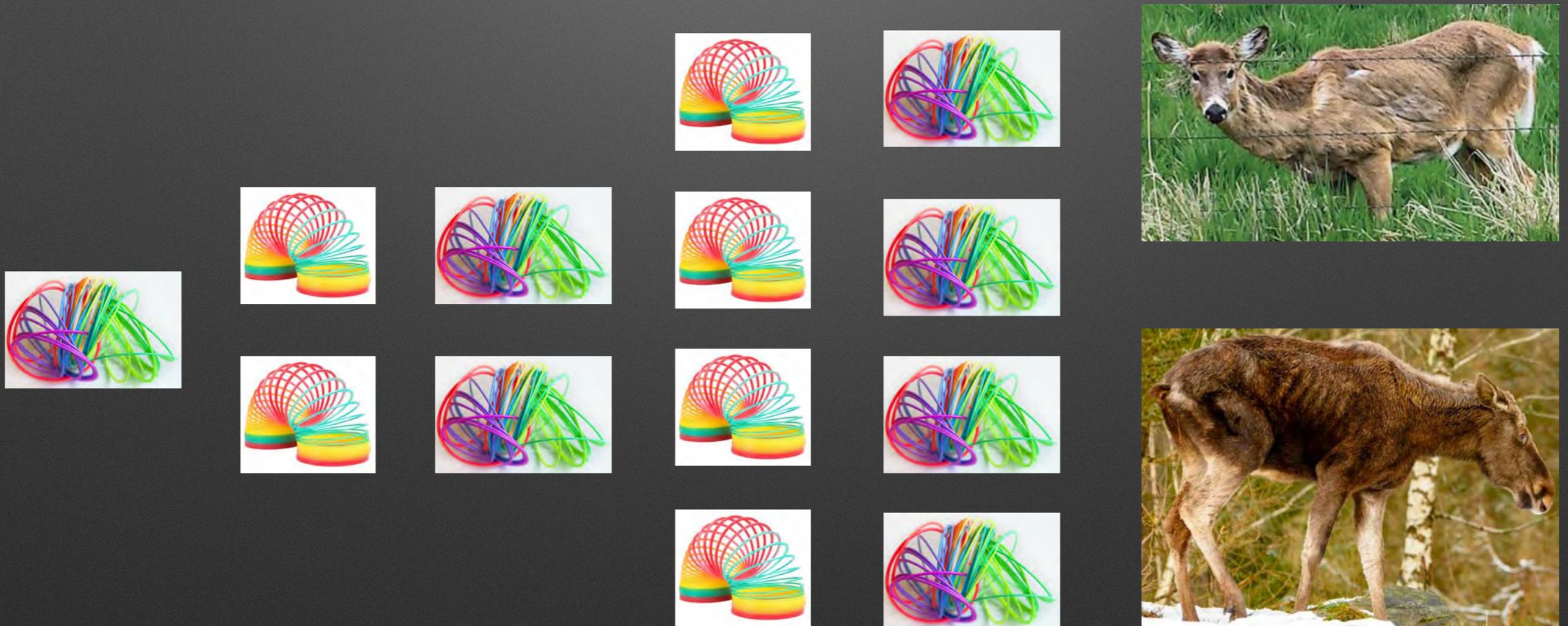
CWD Prions

- CWD prions are misfolded
- Stick together to form tangles
- Misfolded form is almost indestructible and can remain infectious in the environment



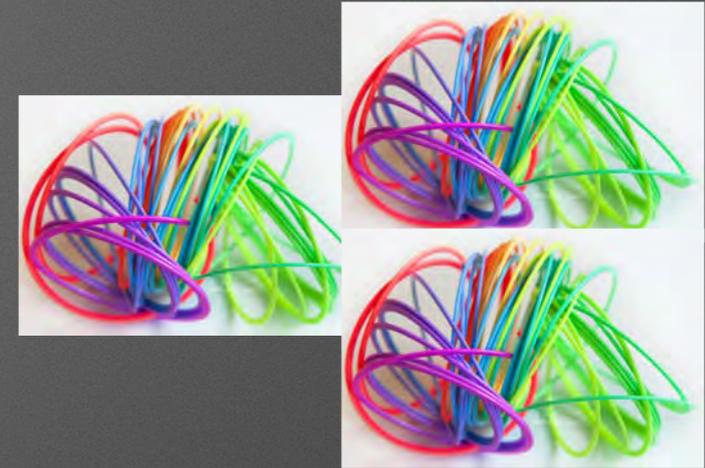
# The Chaos Engine of CWD

CWD-prions cause normal prions to misfold. The reaction spreads through the animal, colonizes the brain, and begins to kill neurons.

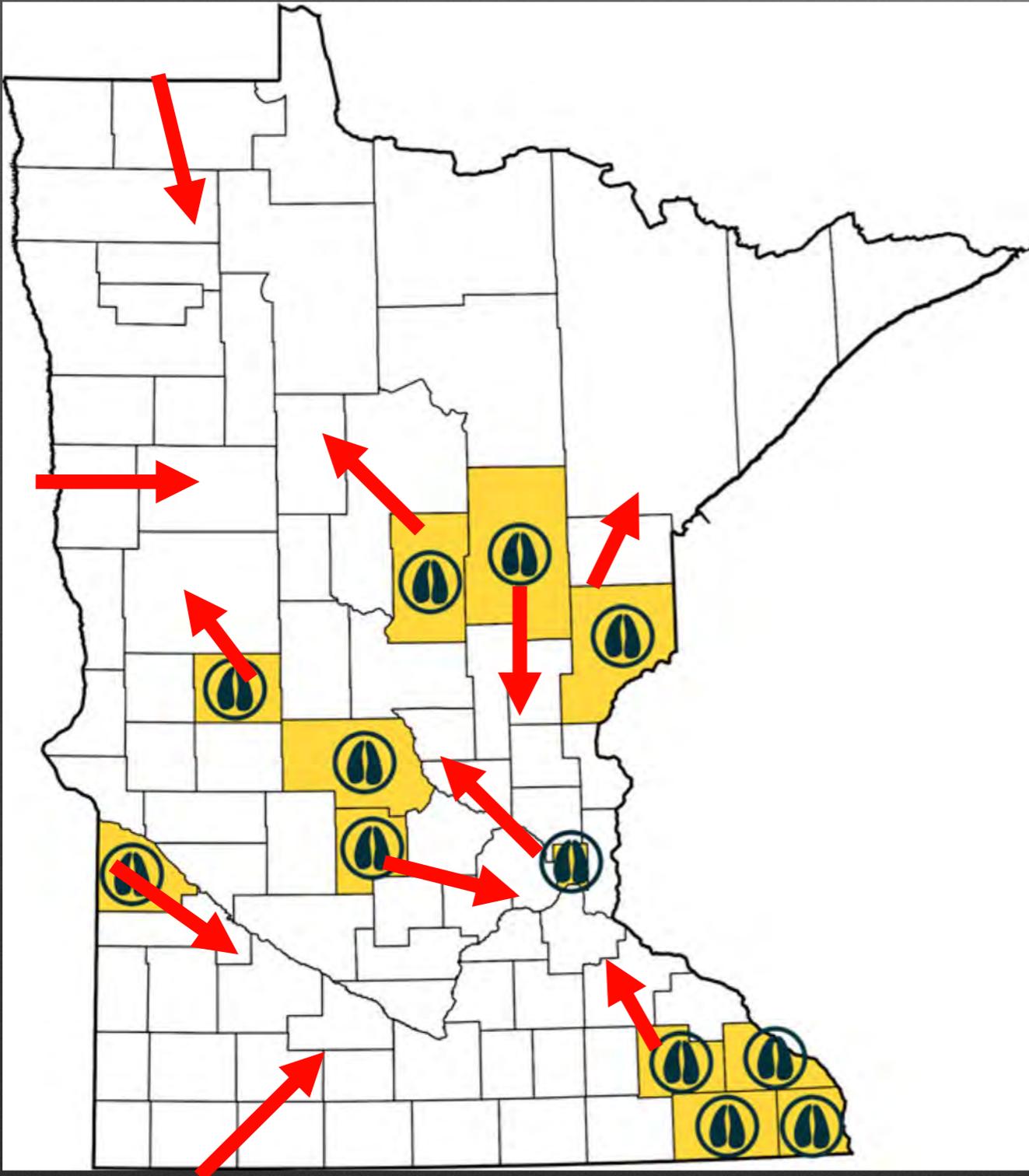


# How is CWD Transmitted?

- Misfolded prions in saliva, semen, blood, urine, feces, carcass
- Remain infectious in soil for years. Transported by water runoff from CWD positive areas.
- Plants can uptake the CWD prions and deposit them in their leaves



# Where is CWD in Minnesota?



- Spread of CWD
- Flow along riparian zones and where deer congregate
- CWD+ areas are potential point sources for new infections
- Must conduct research on the ecology of CWD in MN

# Hydrology of CWD

Research Paper

## Detection of protease-resistant cervid prion protein in water from a CWD-endemic area

T.A. Nichols, Bruce Pulford, A. Christy

Pages 171-183 | Received 20 Mar 2009, Accepted

## Survival of infectious prions in water

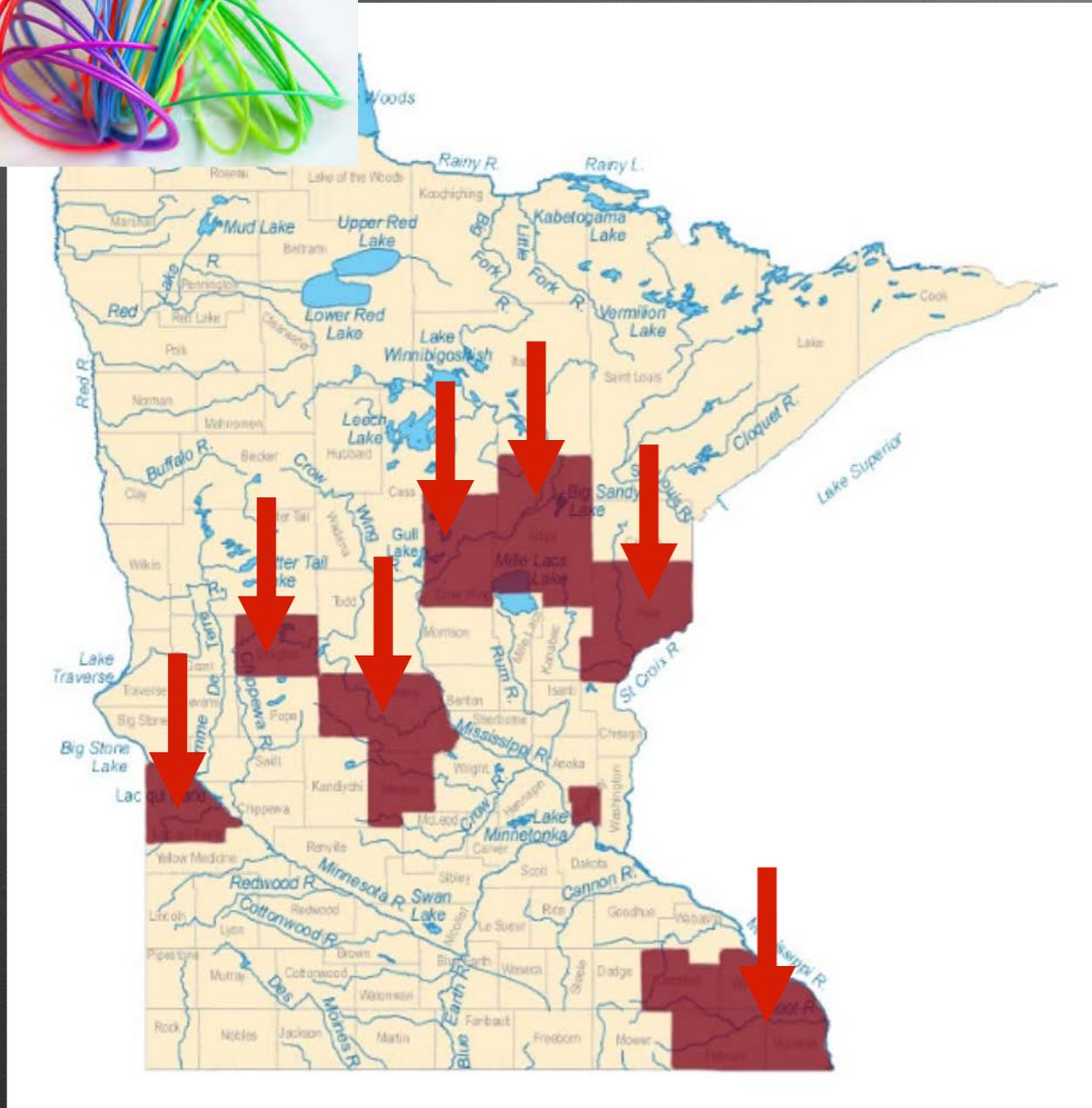
SYREETA L. MILES, KAZUE TAKIZAWA, CHARLES P. GERBA and IAN L. PEPPER

*Soil, Water, and Environmental Science Department, University of Arizona, Tucson, Arizona*

- CWD prions detected in snowpack melt runoff and at a water treatment facility downstream of CWD endemic area
- The more organic material in water the longer the prions remain infectious



# Hydrology of CWD in Minnesota?



- Zero data exist on the hydrology of CWD in Minnesota
- Distance that prions are transported from CWD+ regions?
- Are water-transported prions infectious?
- Are prions ending up in wells or water treatment facilities?



# Environmental Contamination Concerns and the Hydrology of CWD in Minnesota



Diana Karwan  
PhD



Tiffany Wolf  
DVM, PhD



Elizabeth Boyer  
PhD



Eric Seabloom  
PhD



Marc  
Schwabenlander  
MPH

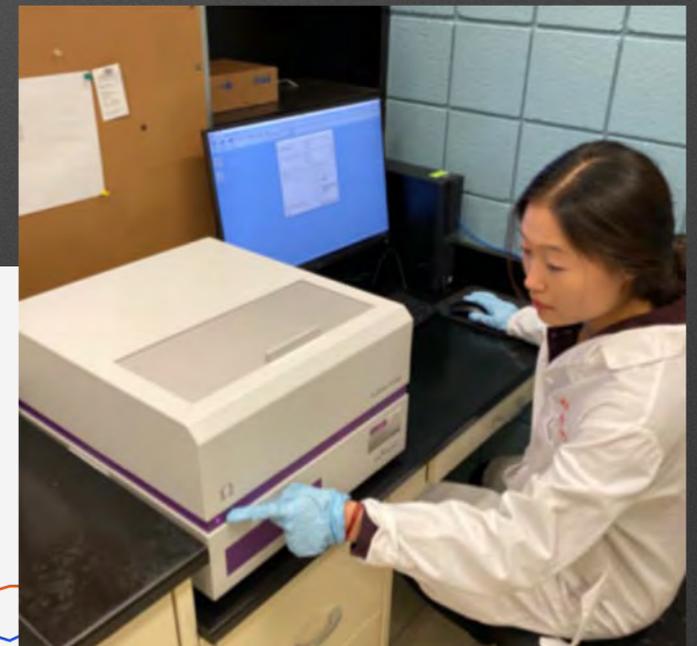
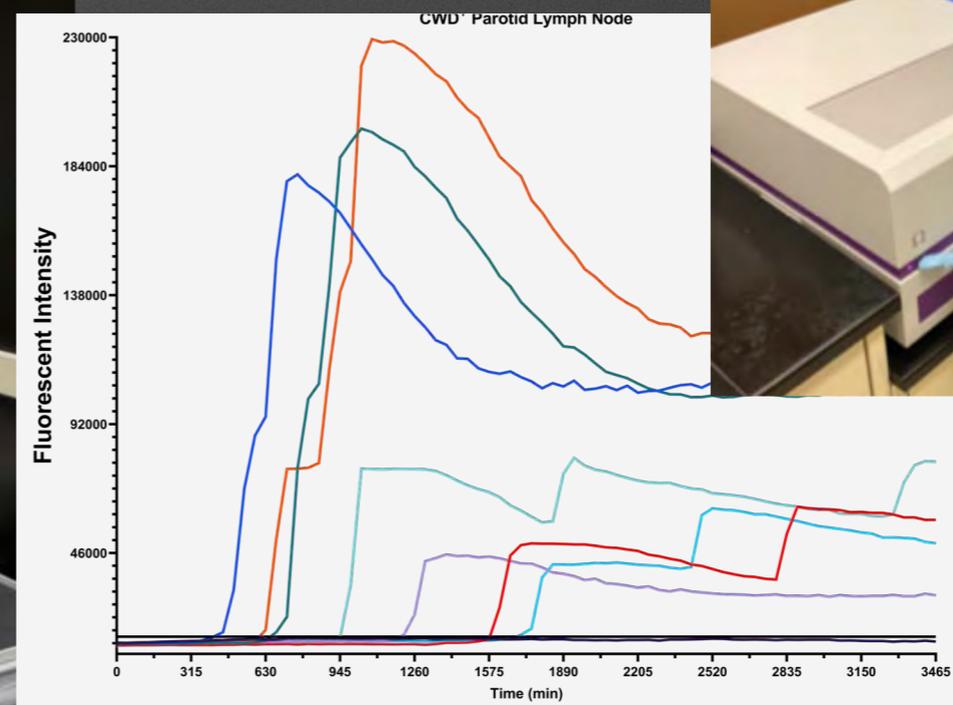


Davis Seelig  
DVM



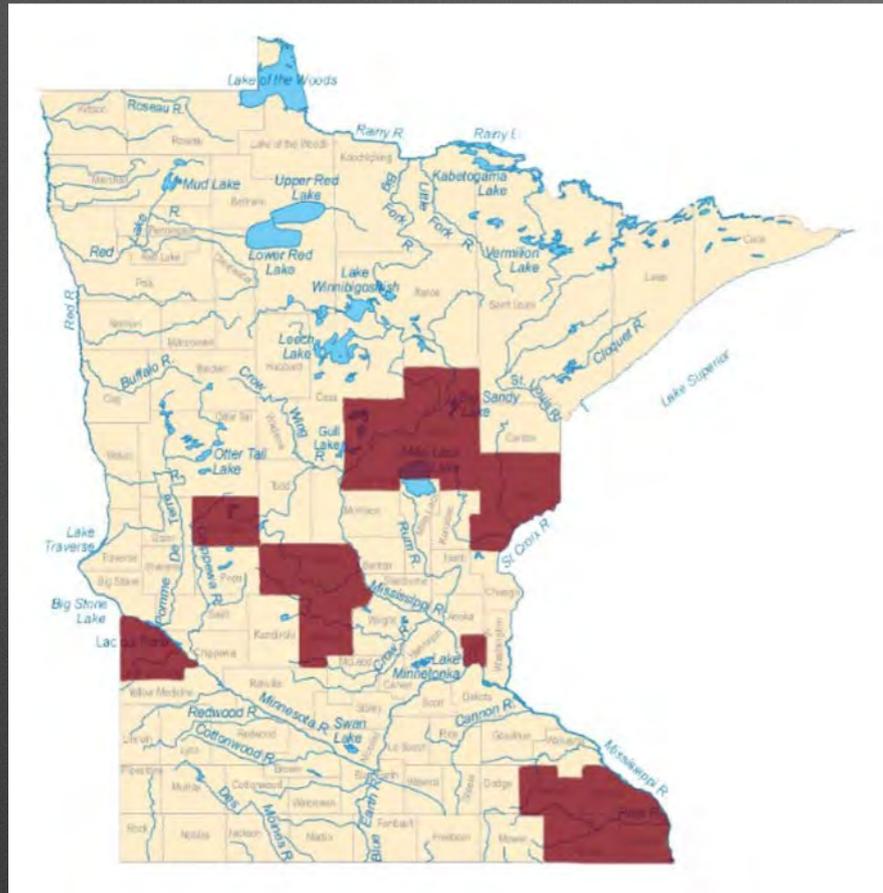
# Minnesota Center for Prion Research and Outreach (MNPRO)

- How to detect prions in environmental samples?
- New MNPRO prion research lab with advanced CWD diagnostics (RT-QuIC technology)
- Facilitates environmental research and infectivity studies



# Hydrology of CWD in Minnesota

## 5 Year Research Project (HF 3591)



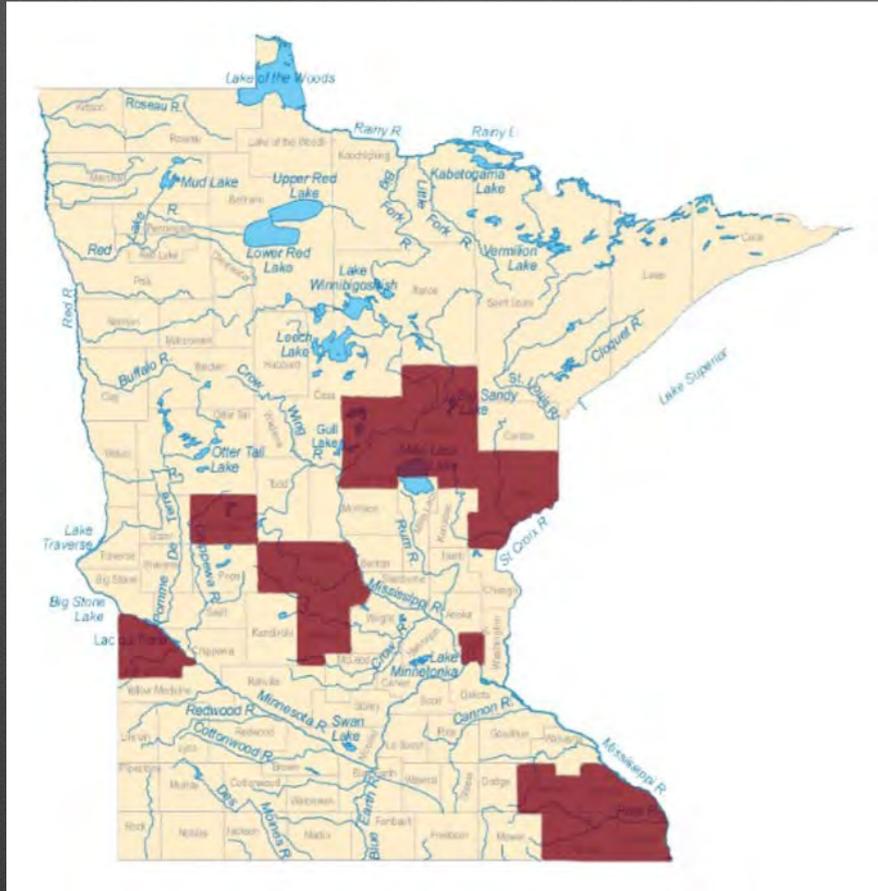
### Key Research Areas

- Identify mechanisms for environmental spread of CWD
- Quantify prion abundance on and downstream of CWD point sources
- Forecast CWD contamination and spread
- Develop remediation strategies



# Hydrology of CWD in Minnesota

## 5 Year Research Project (HF 3591)



### Budget

| Item   | Average annual cost | Quantity (years) | Estimate cost      |
|--|---------------------|------------------|--------------------|
| UMN Personnel  |                     |                  |                    |
| Key PIs (n=6)  | \$66,515            | 5                | \$332,577          |
| Support staff and students (n=8; lab, sample collection, modeling) | \$409,781           | 5                | \$2,048,905        |
| Direct costs   |                     |                  |                    |
| Equipment  | \$67,000            | 1                | \$67,000           |
| Sample collection (travel)   | \$3,000             | 4                | \$12,000           |
| Experiment supplies and materials                                  | \$53,000            | 5                | \$265,000          |
| Publications   | \$3,000             | 4                | \$12,000           |
| <b>Total</b>   |                     |                  | <b>\$2,737,482</b> |



**Thank you!**

