

Chronic Wasting Disease: research and education update

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CWD Research Activities



Research

- CWD requires an organized research effort
 - Bench-work and boots on the ground
- Organizing the Minnesota Center for Prion Research and Outreach (MNPRO)
 - Vision: multi-disciplinary center that **strategically** focuses on prion and protein-misfolding diseases
 - Research hub for combating CWD and other neurodegenerative diseases (Alzheimer's, Parkinson's, ALS, etc.)







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Minnesota Center for Prion Research and Outreach

The Minnesota Center for Prion Research and Outreach (MNPRO) will be a multi-disciplinary center at the University of Minnesota focusing on the biology and epidemiology of human and animal prion diseases and related protein-misfolding disorders.

MNPRO will be a hub for combating neurodegenerative diseases, and will convene a range of U of M faculty and external collaborators to conduct research with a broad impact on protein-misfolding diseases such as Alzheimer's disease, Parkinson's disease, ALS, and emerging prion diseases such as chronic wasting disease.

A vision for research and outreach

-  **Comparative medicine & biology**
Convening diverse expertise in animal health, cellular and protein biology, ecological modeling, and human and animal protein-misfolding diseases
-  **Think-tank environment**
Creating an incubator for cutting edge science and exploring new ideas to develop innovative strategies for combating neurodegenerative disease
-  **Strategic research priorities**
Developing next-gen diagnostic tools, and leading the charge on genetic testing, environmental studies, and zoonotic risk assessment
-  **Coordination and collaboration**
Aligning efforts of multistate partners, and engaging stakeholders through research and outreach initiatives



CWD has spread to 26 US states since it was first detected in Colorado in the 1960s

CWD: A pressing need for research

Chronic wasting disease (CWD) is a contagious, fatal neurological disease affecting deer, moose, elk, reindeer, and caribou.

CWD is prion disease, and is similar to bovine spongiform encephalopathy ("mad cow disease"), scrapie, and Creutzfeldt-jakob disease.

Currently, there is no evidence that CWD poses a risk for humans; however, the Centers for Disease Control and Prevention recommend that people do not consume meat from animals known to be infected.

Why the University of Minnesota

The University of Minnesota is uniquely prepared to address neurodegenerative diseases. As a comprehensive university with a diverse realm of expertise, the U of M has many of the necessary tools to safely and efficiently address these diseases. Our science is grounded by our location at the intersection of four environmental biomes, making our results relevant to a broad swath of North America.

Minnesota Center for Prion Research and Outreach

College of Veterinary Medicine
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www.vetmed.umn.edu Tiffany Wolf, DVM, PhD, wolf305@umn.edu



Research

- MNPRO
 - Serve as a catalyst for fresh wave of prion research
 - Primary CWD research avenues
 - Next-generation diagnostic tools and biosurveillance
 - Environmental impact, transmission routes, and ecological modeling
 - Vaccines and therapeutics
 - CWD strain identification and zoonotic risk assessment
 - Establish CWD tissue biorepository

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Research and Outreach Priorities

Chronic wasting disease (CWD) is an emerging prion disease requiring immediate national attention. Despite decades of research, many aspects of CWD prion biology and epidemiology remain unknown, and diagnostic tests for the rapid and robust identification of CWD prions are lacking.

CWD WATCH  CWD Watch features a series of resources related to College of Veterinary Medicine research and response to chronic wasting disease. Check it out for scientific and animal health-based evidence to help you understand what is known and not yet known about CWD and its impact.
z.umn.edu/CWDWatch

Research Priorities	Outreach Priorities
 RAPID CWD DIAGNOSTICS AND SURVEILLANCE Develop CWD tests that can be used in environmental samples, live deer, and hunter-harvested deer	 DISSEMINATE RESEARCH TO KEY STAKEHOLDERS Engage stakeholders, such as federal, state, and tribal agencies, to inform, facilitate, and disseminate research
 BIOREPOSITORY FOR PRION RESEARCH Establish a frozen tissue database of samples of North American cervids including CWD positive and negative material	 ENGAGEMENT WITH TRIBAL NATION PARTNERS Collaborate with Native American tribal nations to build surveillance networks and incorporate Tribal priorities into CWD management
 ENVIRONMENTAL IMPACT STUDIES Develop prion control and decontamination strategies, including carcass management and ecological remediation	 DEVELOP PRION-FOCUSED CURRICULA Create educational curricula focused on prion biology, ecology, epidemiology, wildlife management, and public health
 HUMAN DIMENSIONS OF PRION DISEASES Assess the zoonotic risk of CWD and integrate community priorities, human values, and behavior with CWD management	 TRANSLATION OF SCIENCE TO POLICY Transform CWD data into information that informs control policies for decision makers at state and federal levels

MINNESOTA CENTER FOR PRION RESEARCH AND OUTREACH



CWD Research Highlights

- Tiffany Wolf, DVM, PhD
 - Assistant Professor, Dept. Vet Population Medicine
 - Wildlife Epidemiologist
 - Working with Minnesota Grand Portage Band of the Lake Superior Chippewa Tribe to establish a Tribal CWD surveillance network
 - Recently awarded USFWS Tribal Wildlife Grant (~\$200k) to support this effort (2020 and beyond)



CWD Research Highlights

- Scott Wells, DVM PhD
 - Professor Dept. of Vet Population Medicine (epidemiologist)
 - Three forthcoming papers on CWD exposures on 34 cervid farms (MN and WI).
 - **Major finding:** 11 CWD-positive farms that were not considered high-risk farms (i.e., never imported CWD + animals) were located in areas near CWD + wildlife [link](#)



CWD Research Highlights

- CWD Diagnostic Development Team



Dr. Schefers



Dr. Larsen



Dr. Skinner



Dr. Seelig



Dr. Oh

Collaborators: NIH Rocky Mtn Labs, Colorado State Univ Prion Research Center, Univ Of Maryland, Michigan State Univ, Public Health Agency of Canada, Alberta Centre for Prions and Protein Folding Diseases, Midwestern Univ Arizona



Research Highlights

- CWD Diagnostic Development Team
 - Goal: develop advanced CWD diagnostics that are faster, more sensitive, and easier to use
 - Prototype(s) in 2 years
 - Functional with hunter harvested deer, live deer, and environmental samples
 - \$2M in July 2019 (\$259k Rapid Ag Response Fund, \$1.8M MN Legislature LCCMR fund)



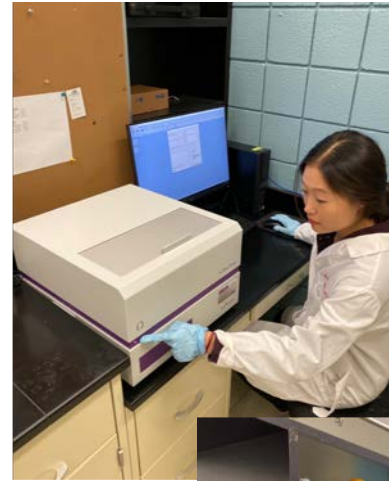
Research Highlights

- CWD Diagnostic Development
 - Four research staff and three graduate students since July
 - Collaborating with DNR, BAH, Oxbow Park, hunters, etc. to secure tissues, fecal samples, etc.
 - Outfitted primary prion research laboratory
 - Cornerstone of MNPRO
 - Wet lab based in College of Veterinary Medicine



Research Highlights

- MNPRO wet lab



Research Highlights

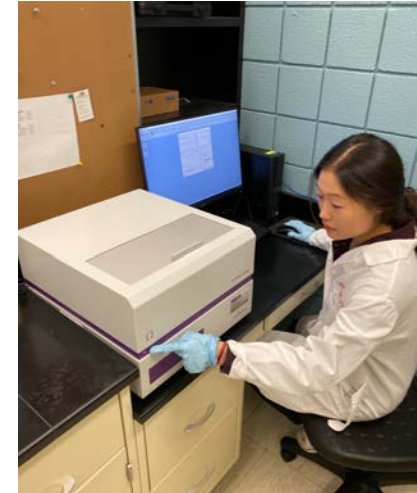


- Dr. Skinner's Lab
 - Blood-based RNA biomarkers that can detect CWD infection
 - Summer 2019: Canadian collaborators have identified diagnostic micro-RNAs for CWD
 - Will test these RNA biomarkers in white-tailed deer of MN
 - Primary Objective: Blood samples from recently harvested or live deer can be used to detect CWD infection



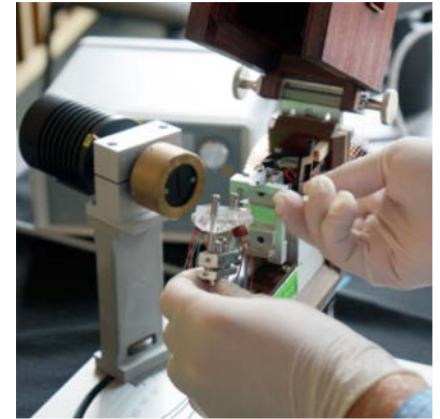
Research Highlights

- Prion Research Lab: RT-QuIC functionality
 - Protein specialists trained at NIH Rocky Mtn. Labs and Colorado State Univ on RT-QuIC (Gage Rowden and Mancini Li)
 - RT-QuIC: Diagnostic method capable of detecting CWD prions in tissues, blood, feces, soil, etc.
 - **College of Vet Med lab will be first in the state of Minnesota to have RT-QuIC (November 2019)**
 - Will use to screen over 500 deer sampled by the DNR (contains CWD + animals, blinded)
 - Diagnostic R&D focused on improving RT-QuIC



Research Highlights

- CWD Diagnostic Development
- Antibody Engineering
 - New method of generating antibodies
 - Likely generate novel binding-affinities for CWD prions
 - Increased functionality and sensitivity for antibody-based diagnostics
 - Microfluidic experiments in Dr. Oh's laboratory ongoing



Research Highlights

- Multiple groups across USA working on developing next-gen CWD diagnostics!
 - This is an area ripe for discovery, not a “moonshot”
- NIH Rocky Mtn Labs, USDA, USGS, Michigan State Univ, North Dakota State Univ, Univ of Texas, Univ of Minnesota, etc.

Michigan State University and Michigan Department of Natural Resources scientists are testing a faster, more accurate way to screen and diagnosis chronic wasting disease, or CWD, in deer. The three-year, \$900,000 project, funded by both institutions, will use RT-QulC, a technology known to have better detection and sensitivity in real time.

Press release 30 Sept 2019

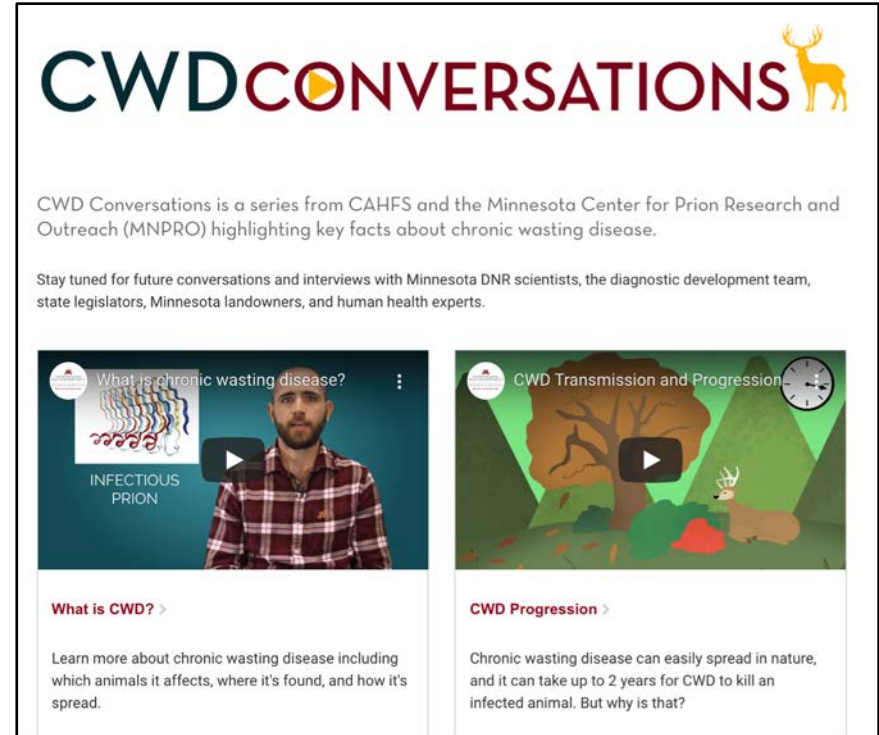



Education and Outreach



Education and Outreach: websites


- College of Vet Med: Center for Animal Health and Food Safety (CAHFS)
 - CWD Watch website and educational materials
 - CWD Animation and videos
 - z.umn.edu/CWDWatch



CWD CONVERSATIONS 


CWD Conversations is a series from CAHFS and the Minnesota Center for Prion Research and Outreach (MNPRO) highlighting key facts about chronic wasting disease.

Stay tuned for future conversations and interviews with Minnesota DNR scientists, the diagnostic development team, state legislators, Minnesota landowners, and human health experts.



What is CWD? >

Learn more about chronic wasting disease including which animals it affects, where it's found, and how it's spread.



CWD Progression >

Chronic wasting disease can easily spread in nature, and it can take up to 2 years for CWD to kill an infected animal. But why is that?



Education and Outreach: websites

- CWD Watch website
 - UTalks (TED style talks from UMN experts)
 - Content will grow in coming weeks, months
 - z.umn.edu/CWDWatch

New! UTalks – Spotlight Science: Chronic Wasting Disease

U of M and Minnesota DNR scientists gathered on September 14th for the Spotlight Science event at the [Bell Museum](#). Check out these UTalks from CWD researchers on key topics around the disease.

What is CWD? >

CWD in Minnesota >

Next Generation Chronic Wasting Disease Diagnostic Tools >

Minnesota Center for Prion Research and Outreach >



Education and Outreach: websites

- CWD Watch website

- Handouts, links to DNR, BAH, maps, etc.

- Interactive CWD in MN timeline

- z.umn.edu/CWDWatch

What is chronic wasting disease?

Cervids
CWD is a neurological disease affecting the cervid family. This includes white-tailed deer, mule deer, moose, elk, and reindeer.

Prion Disease
CWD is a prion disease. These occur when normal proteins in a healthy animal or human are misfolded into abnormal shapes.

Symptoms
The most obvious sign of CWD is weight loss. Other symptoms include poor balance, drooling, confusion, and drooping ears.

Transmission
Infect through saliva, antler

Chronic Wasting Disease

What is Chronic Wasting Disease?
Chronic Wasting Disease (CWD) is a contagious, fatal neurological disease affecting wild and farmed cervids such as deer, moose, elk, caribou, and reindeer.

What are the symptoms of CWD?
It may take over a year before an infected animal develops symptoms, which can include drastic weight loss (wasting), stumbling, listlessness and other neurological symptoms. Specifically, animals become thin, drink and eat excessively, have poor balance & coordination, lack body fat, have drooping ears, and difficulty swallowing, inability to swallow leads to aspiration pneumonia and death.

Is there a treatment for CWD?
There is no vaccine or treatment. CWD is always fatal.

Can CWD be transmitted to humans?
Currently, there is no evidence that CWD poses a risk for humans. However, public health officials at the Center for Disease Control (CDC) recommend that hunters do not consume meat from animals known to be infected. More information is available from the CDC: cdc.gov/prion/cwd/

What precautions should be taken when eating cervid meat?

- Consider having your deer processed and wrapped individually, either privately or commercially.
- Consider having your deer tested, even if it's not mandatory in your county.
- All deer that are tested should either be processed or stored in a manner to prevent water waste while waiting for test results.
- It is the hunter's choice to consume venison prior to receiving test results.
- The prions that cause CWD are very resistant to heat and freezing temperatures. Cooking or freezing the meat will not remove prions from any infected meat.

What should I do if I see a sick deer in Minnesota?
Please immediately report any sick deer to your local conservation officer (lco) or state ins surveillance personnel or state wildlife officer (lco.stateins@mn.dnr.state.mn.us).

Additional Information

- Centers for Disease Control and Prevention: www.cdc.gov/prion/
- Minnesota Department of Natural Resources: dnr.state.mn.us
- dnr.state.mn.us/cwah/healthreport/sick-deer.html

Center for Animal Health and Food Safety
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CWD MANAGEMENT IN MINNESOTA

In Minnesota, a partnership between two state agencies manages CWD surveillance and response. The Department of Natural Resources (DNR) conducts CWD surveillance of wild deer. The Board of Animal Health (BAH) manages CWD surveillance and biosecurity for farmed cervids.

Emerging trends by County, June 2019

Timeline: 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Key events:
• The first CWD positive...
• The Minnesota DNR was...
• The Minnesota Department of Natural Resources (DNR) begins to...
• The DWD is...
• The prion is...
• The DWD is...
• The prion is...



Education and Outreach: websites

- Center for Infectious Disease Research and Policy
- CWD information, news, maps, etc.
- <http://www.cidrap.umn.edu/cwd>

The screenshot shows the CIDRAP website's navigation bar with links for 'News & Perspective', 'Infectious Disease Topics', 'Antimicrobial Stewardship', and 'Ongoing Program'. Below the navigation bar, the 'TRENDING TOPICS' section lists 'Ebola', 'Measles', 'Antimicrobial Stewardship', and 'Chronic Wasting Disease'. The main content area is titled 'Chronic Wasting Disease Resource Center' and features a deer icon. It includes sections for 'CWD Response, Research, and Policy Program', 'Expert Advisory Group', and 'About CWD'. The 'About CWD' section contains detailed text about the disease, its transmission, and public health recommendations. A photograph of a deer in a snowy field is also visible.

CIDRAP Center for Infectious Disease Research and Policy

News & Perspective Infectious Disease Topics Antimicrobial Stewardship Ongoing Program

TRENDING TOPICS Ebola Measles Antimicrobial Stewardship Chronic Wasting Disease

Chronic Wasting Disease Resource Center

CWD Response, Research, and Policy Program

The Chronic Wasting Disease (CWD) Response, Research, and Policy Program addresses the transmission of CWD in cervids and its potential for spread to humans and other animal species. The program supports current and reliable information on CWD for the public, including hunters; the medical, veterinary and public health communities; wildlife scientists and managers; and public policymakers.

[About CIDRAP's CWD Program](#) [About CWD](#)

Expert Advisory Group

The program includes 49

About CWD

Chronic wasting disease (CWD) is a prion disease that affects several cervid species: deer, elk, reindeer, sika deer, and moose. CWD was first identified in 1967 in a captive mule deer living in a Colorado research facility. In 1981, CWD was detected for the first time in a wild cervid. Since these initial detections, CWD has been identified in 26 states and three Canadian provinces. It has also been detected in Finland, Norway, South Korea, and Sweden.

CWD is believed to be transmitted horizontally (i.e., animal-to-animal contact) through infectious bodily fluids such as saliva, urine, and feces. Once excreted into the environment, CWD prions can persist for years and withstand extremely high levels of disinfectants such as heat, radiation, and formaldehyde. CWD prions also are capable of binding to certain plants, with the ability to be transported while still remaining infectious. CWD is increasing in cervids as more animals come into contact with infectious prions, usually via direct contact with an infected cervid and its bodily fluids, although viable CWD prions in the environment can also infect animals. As more cervids become infected, the frequency of these exposures and subsequent environmental contamination grows. Evidence also suggests that vertical transmission (i.e., parent to offspring) can occur, although its overall impact on the ecology of CWD is not entirely understood at this time.

Since CWD is now an established wildlife disease in North America, proactive steps, where possible, should be taken to limit transmission of CWD among animals and reduce the potential for human exposure. Although CWD has not yet been found to cause infections in humans, numerous health agencies have taken the stance that people should not be consuming CWD-positive animals. Since 1997, the World Health Organization has recommended that agents of any prion disease should not enter the human food chain. Likewise, the US Centers for Disease Control and Prevention, Health Canada, and multiple provincial and state health and natural resources agencies recommend that people should not consume the meat of an animal found to be positive for CWD.

Given the typical ten year or longer incubation period of prion-associated conditions, improving public health measures now to prevent human exposure to CWD prions and to further understand the potential risk to humans may reduce the likelihood of an event like bovine spongiform encephalopathy (BSE). In BSE, also known as "mad cow" disease, some British officials in the 1990s declared there was no risk of transmitting BSE prions through the consumption of contaminated beef, only to confirm related human cases of a similar prion disease in the ensuing years.



Education and Outreach

- Augmented Reality CWD Displays (College of Vet Med and Center for Animal Health and Food Safety)



Bell Museum (14 Sept 2019)



Education and Outreach

- Augmented Reality CWD Displays
 - Portable, easy to setup, travel around the state!



Winona State Univ. (10 Oct 2019)

Phone / Tablet App to interact with display for more info

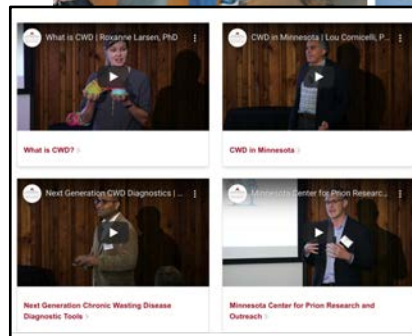


Video



Education and Outreach

- Bell Museum of Natural History CWD Event (14 Sept)
 - Organized by CAHFS
 - DNR, BAH, Elk Breeders Assoc.
 - TED style talks, interactive displays, facilitate CWD discussion
 - Talks available at:
 - z.umn.edu/CWDWatch



Education and Outreach

- CWD Seminars
- Prion biology and the science of CWD
 - CVM Agents of Disease
 - Eagle Bluff Nature Center
 - Red Wing Rotary Club
 - Winona State University
 - 4 planned in coming months

Chronic Wasting Disease in SE Minnesota

September 16, 2019 by Rich Wicks – Leave a Comment



The Eagle Bluff Learning Center in rural Lanesboro hosted an educational talk September 8, on the topic of Chronic Wasting Disease (CWD). The speaker, Peter A. Larsen, PhD, works at the University of Minnesota's Department of

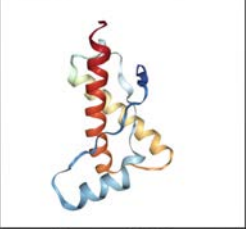


Summary: Education and Outreach


- Critical need for additional prion science outreach!!!
- Misunderstanding and fear of CWD
 - Causative agent
 - Not a bacteria or a virus, but a prion
 - What is a prion?
 - Risk to humans
 - Requires understanding of diversity of prion diseases
 - No known human transmission but there is risk! Why?

What is a prion?

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



Normal Prion



Can humans get CWD?

Lessons learned: BSE and Scrapie



BSE "mad cow"
UK outbreak in 1986
177 people died (1995 to 2014 +)

Scrapie
Known since 1732
No evidence of human transmission

Slides from P. Larsen



Potential confusion with respect to
CWD...

Emerging virus impacting deer:
Epizootic Hemorrhagic Disease (EHD)



EHD and CWD: What's the Difference?

	Hemorrhagic Disease (EHD, Bluetongue)	Chronic Wasting Disease (CWD)
Basics	EHD: Viruses spread by biting gnats in late summer. Symptoms include fever and internal hemorrhaging.	CWD: A syndrome of the central nervous system in which the brain deteriorates. Caused when normal proteins called "prions" become deformed.
Pathway	EHD: Cannot be spread from deer to deer, only through bites from infected insects.	CWD: Spread deer-to-deer through direct contact, or contact with the saliva, urine, feces, blood, and body parts of infected deer or infectious materials in soil.
Victims	EHD: Bucks and does of all ages are equally susceptible to being bitten by infected insects.	CWD: Higher infection rates among bucks, particularly mature bucks, most likely because they cover more ground and contact other deer more often.
Location	EHD: The viruses are present everywhere in North America, but outbreaks are associated with drought and extreme heat, usually in late summer.	CWD: Present in deer or elk herds in 23 states and two Canadian provinces. Preventing CWD's spread to new areas is critical. Transportation of live, infected deer/elk or their parts is the primary long-distance pathway.

Credit: Quality Deer Management Association



EHD vs CWD

Mortality rate	EHD: Some deer survive infection. Herd immunity/survival is higher in areas with longer historical exposure.	CWD: Always fatal.
Speed of death	EHD: For those deer that die, death usually occurs within a few days of infection.	CWD: Incubates in infected deer for an average of around one to two years before symptoms appear. During incubation, deer can spread CWD to other deer.
Durability	EHD: Viruses cannot survive outside the bodies of the insect vector or the deer/elk host.	CWD: Infectious materials remain viable indefinitely (years) in the environment and are shed in feces, urine, saliva, blood and carcasses of infected animals.
Human health	EHD: Cannot infect people, either through insect bites or by consuming infected deer.	CWD: No evidence that it is a health issue in humans, but the Centers for Disease Control and Prevention urges caution in handling venison in infected areas, and suggests hunter-harvested deer be tested for CWD before being consumed.
Long-term	EHD: Outbreaks vary locally from mild to serious, but deer populations rebound. Whitetails have lived with and adapted to these viruses for decades.	CWD: Infection rates at some outbreak sites are climbing slowly but steadily, and the long-term impact is still not clear. Over time, CWD may alter the social structure of deer herds by eliminating mature animals.



Recent CWD Publications

- Reviews
 - [CWD: current assessment of transmissibility \(Sakudo, Cur Issues Mol Biol\)](#)
 - [CWD: emerging prions and their potential risk \(Hannaoui et al, PLOS Pathogens\)](#)
 - [CWD in Cervids: prevalence, impact and management strategies \(Rivera et al., Vet Med\)](#)
- Opinion/Hypothesis
 - [CWD in Cervids: implications for prion transmission to humans and other species \(Osterholm et al., MBIO\)](#)



Recent CWD Publications

- Research
 - [Inactivation of CWD prions using sodium hypochlorite \(Williams et al., PLOS One\)](#)
 - [Detection of CWD in cervids by RT-QuIC assay of third eyelids \(Cooper et al., PLOS One\)](#)
 - [Sodium hydroxide treatment effectively inhibits PrPCWD replication in farm soil \(Sohn et al, Prion\)](#)
 - [Insights into the bidirectional properties of the sheep-deer prion transmission barrier \(Harrathi et al., Mol Neurobiol\)](#)



Recent CWD Publications

- Research cont.
 - Rapid recontamination of a farm building occurs after attempted prion removal (Gouch et al, Vet Rec)
 - Transmission studies of CWD to transgenic mice overexpressing human PrP using the RT-QuIC assay (Race et al., Vet Res)
 - Spatial heterogeneity of prion gene polymorphisms in an area recently infected by CWD (Miller and Walter, Prion)



Thank you!

- Minnesota Agricultural Experiment Station: Rapid Agricultural Response Fund
- Minnesota Legislature, LCCMR
- Grand Portage Band of Chippewa, USFWS
 - Seth Moore and Tiffany Wolf
- AGREETT (Agricultural Research, Education, Extension and Technology Transfer Program)
- DNR, BAH, Elk Breeders Association, Oxbow Park and Zollman Zoo





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