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 combatting 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 similiar 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

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Tiffany Wolf, DVM, PhD, wolfx305@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

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

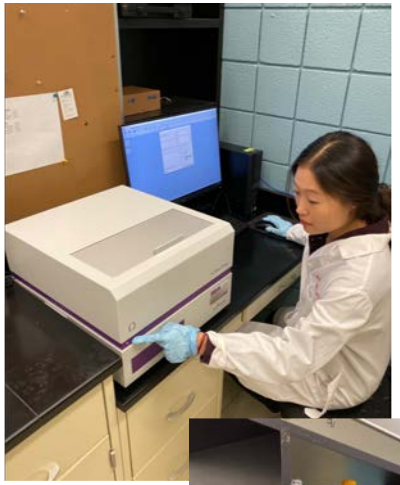
- CWD Diagnostic Development Team
  - Goal: develop advanced CWD diagnostics that are faster, more sensitive, and easier to use
  - Prototype(s) in 2 years
  - Functional with hunter harvested deer, live deer, and environmental samples
  - $2M in July 2019 ($259k Rapid Ag Response Fund, $1.8M MN Legislature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

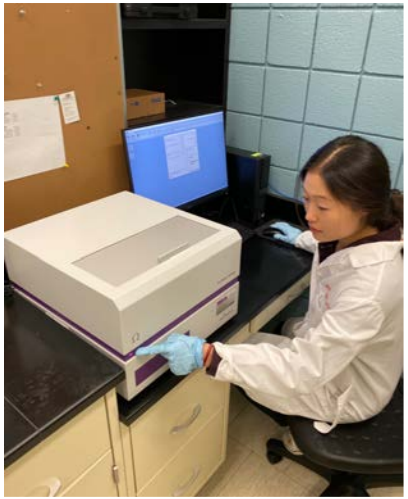


Research Highlights

- 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

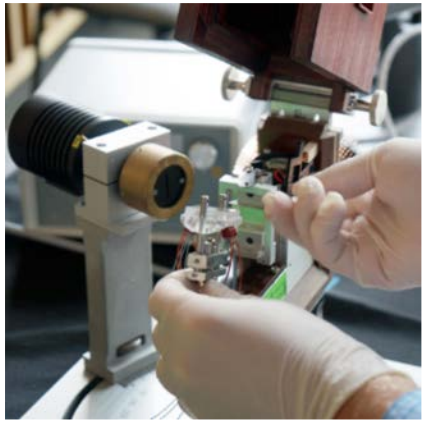
Research Highlights

- Prion Research Lab: RT-QuIC functionality
  - Protein specialists trained at NIH Rocky Mtn. Labs and Colorado State Univ on RT-QuIC (Gage Rowden and Manci 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.

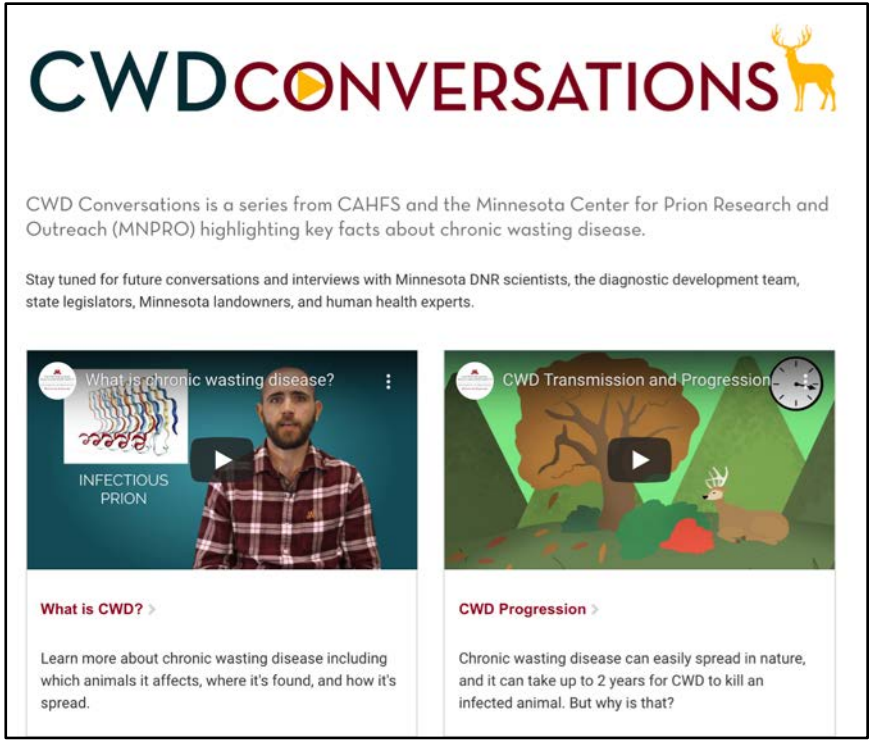
Michigan State University and Michigan Department of Natural Resources scientists are testing a faster, more accurate way to screen and diagnosis chronic wasting disease, or CWD, in deer. The three-year, $900,000 project, funded by both institutions, will use RT-QuIC, a technology known to have better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

Press release 30 Sept 2019

Education and Outreach

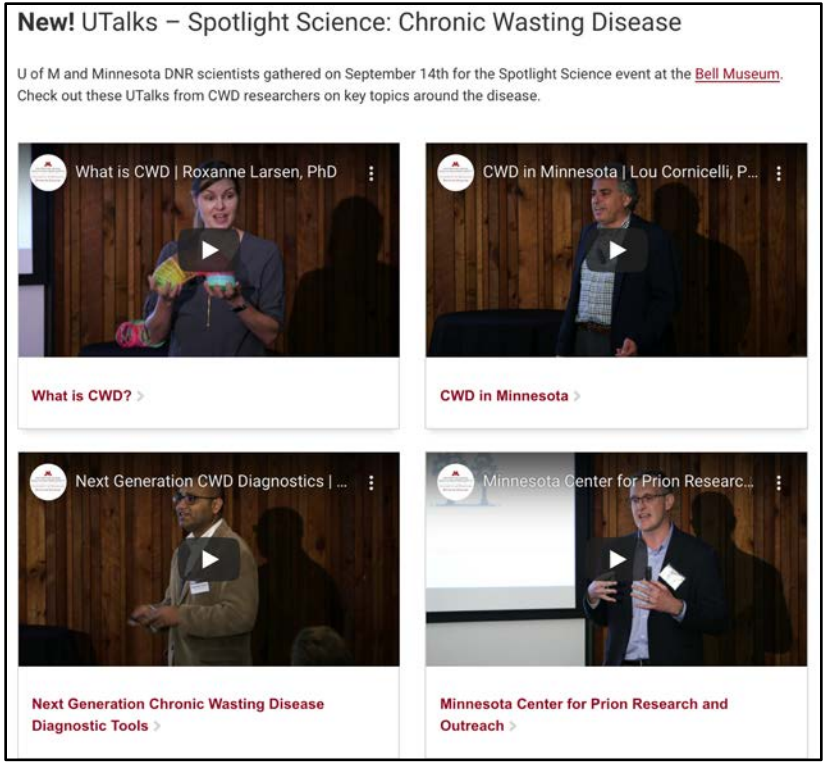
Education and Outreach: websites

- 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



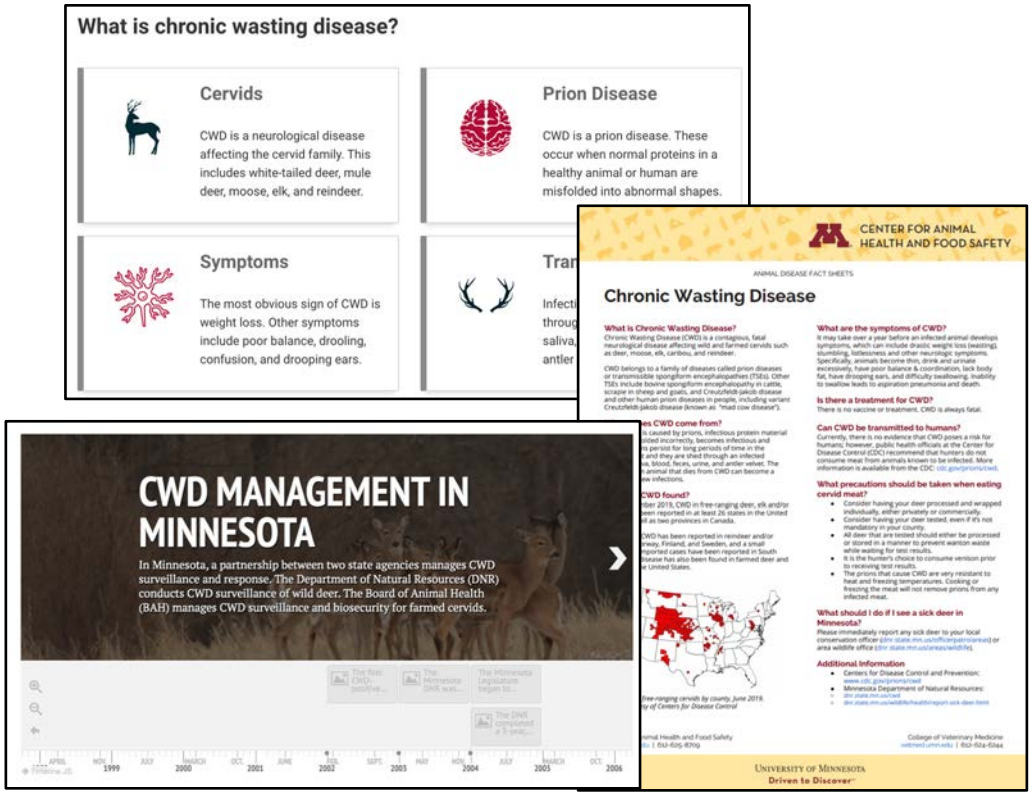
Education and Outreach: websites

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



Education and Outreach: websites

- CWD Watch website
  - Handouts, links to DNR, BAH, maps, etc.
  - Interactive CWD in MN timeline
  - z.umn.edu/CWDWatch



Education and Outreach: websites

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

Education and Outreach

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

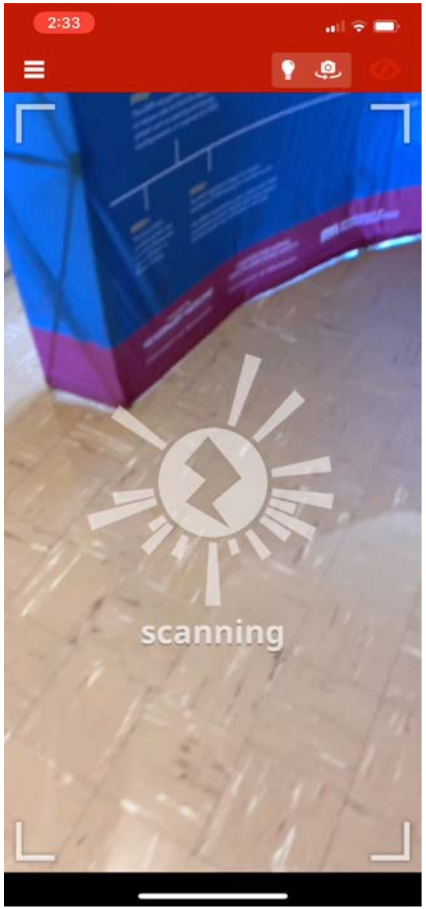
Bell Museum (14 Sept 2019)

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

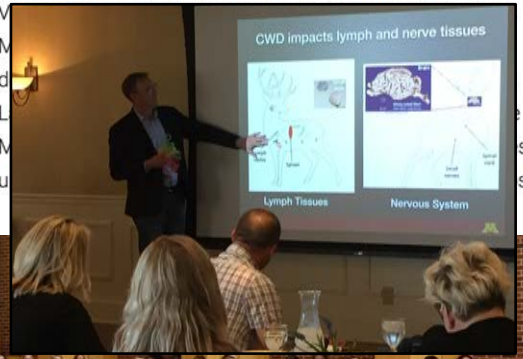
Education and Outreach

- 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

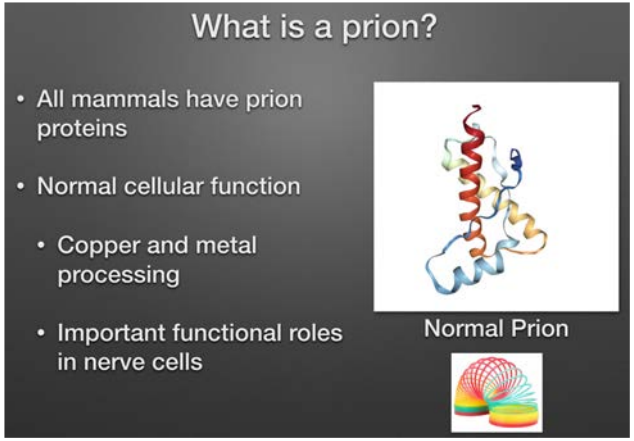
September 16, 2019 by Rich Wicks — Leave a Comment

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?



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 envionment 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.

Credit: Quality Deer Management Association

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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