SAES-422

Accomplishments Report

Project/Activity Number: NC1209

Project/Activity Title: North American Interdisciplinary Chronic Wasting Disease Research Consortium (herein, Consortium)

Period Covered: January-June 2023 (annual report date has shifted to coincide with annual meeting shift)

Date of This Report: July 24, 2023

Annual Meeting Date(s): May 30, 2023

Participants: Our current list of members (n=63):
Debbie McKenzie (vice chair), Jason Bartz, Kurt VerCauteren, Hui Li, Mark Ruder, Mark Zabel, Qingzhong Kong, Pam Skinner, David Walter (secretary), Wei Zhang, Scott Wells, Justin Greenlee, Eric Cassman, Allen Herbst, Daniel Storm, David Hewitt, Dwayne Etter, Miranda Huang, Patrice Klein, Steve Demarais, Tom DeLiberto, Jennifer Malmberg, Krysten Schuler, Peter Larsen, Rodrigo Morales, Marc Schwabenlander (chair), Shigetoshi Eda, Tracy Nichols, Michael Zhang, Shuping Zhang, David Schneider, Sonja Christensen, Christopher Jennelle, Daniel Grove, David Williams, Daniel Walsh (past chair), Evelyn Merrill, Julie Blanchong, Kim Pepin, Lisa Muller, Russ Mason, Noelle Thompson, Rachel Ruden, Scott Hull, Tyler Harms, Don White, Mandy Kamps, Bryan Richards, Neelam Poudyal, Rich Stedman, Becky McPeake, Bruce Lauber, Tricia Hebdon, Tiffany Wolf, Binod Chapagain, Tabitha Graves, Michelle Gibison, Will Janousek, Robert Piel, Gavin Cotterill, Stuart Lichtenberg, David MacFarland, Lindsay Parrie

Brief summary of minutes of annual meeting: The Consortium held its annual meeting on May 30, 2023 in Denver, CO, USA. The annual meeting was moved from a fall timeframe to this date as it was scheduled to coincide with the 4th Annual International CWD Symposium. This was a closed meeting for NIMSS members of the Consortium, in which 37 members attended. The executive committee of the Consortium planned the meeting with the guidance of Aimme Cooper, a professional meeting facilitator with the US Geological Survey. This meeting was sponsored/funded by the Legislative Joint Initiative of the Michigan Department of Natural Resources and Michigan State University. (see "Summary_North American Interdisciplinary Chronic Wasting Disease Research Consortium 2023 annual meeting" for full meeting summary)

Accomplishments: In the past 6 months the Consortium continues to build upon past accomplishments and move forward on new ones. We held our annual meeting in-person with 37 members attending (see above). This is the first time since 2019 that we've been able to meet in-person!

The 5 "state-of-the-science" papers mentioned in the previous report have been finalized on the following topics: 1) zoonotic potential of CWD; 2) regulatory requirements for obtaining a USDA approved diagnostic test for CWD; 3) a description of the strengths and weaknesses of real-time quaking induced conversion assay (RT-QuIC); 4) a description of the strengths and weaknesses of protein misfolding cyclic amplification (PMCA); and 5) environmental transmission of CWD. We are looking to identify the optimal peer-reviewed journal for official submission.

In addition to the associated subcommittees meeting regularly, the Consortium continues to make progress on five focus areas of CWD identified at its inception meeting. These five include i) development of a national CWD tissue and reagents repository, ii) create large-scale research facilities for controlled CWD research, iii) improve CWD diagnostics, iv) evaluate management strategies across state boundaries and v) use social science to inform CWD management. The Consortium has made several accomplishments around these 5 objectives. Under the first objective, members met with USDA-National Wildlife Research Center to discuss the potential for a physical repository at USDA-NWRC in Fort Collins, CO. The USDA-NWRC is allocating considerable funding to purchasing freezer space, developing storage building, and hiring personnel to oversee the new tissue storage facility. This facility would be an option for states that are unable to store large quantities of tissue and would be willing to donate them to USDA-NWRC. Our virtual repository, which is currently undergoing beta testing, could link USDA-NWRC to each states' samples that were stored there. Under the second objective, there were no updates to report. Under the third objective, the collaborative work continues for developing a standardized RT-QuIC protocol by USDA Agricultural Research Service (ARS), the United States Geological Survey, University of Wisconsin Madison, the National institute of Health Rocky Mountain Laboratory, and USDA Veterinary Services. Thus far, the standardized protocols have been utilized to blindly test characterized, white-tailed deer rectal and tonsil biopsies as well as MRPLN samples. Rectal biopsy samples were tested utilizing two different substrates, one from USGS and one from the MNPRO group at the University of Minnesota. The manuscript is currently in preparation. The rectal biopsy data, including the cross- laboratory reproducibility study data, was compiled and reviewed by the National Veterinary Services Laboratories (NVSL) diagnostic review committee. Although the test shows promise, the results are too variable for the USDA to use in the current CWD program across multiple NAHLN laboratories. APHIS is working closely with several partners to evaluate ways to improve the reliability of the assay. RT-QuIC protocol development and testing of blinded MRPLN samples has been completed at USDA ARS Pullman, WA using substrate from MNPRO. Samples that were non-detect by immunohistochemistry (IHC) but positive by RT-QuIC have been inoculated into a transgenic mouse bioassay to differentiate the rate of true false positives versus the rate at which RT-QuIC may detect CWD at an earlier time point than IHC. It will be many months before data is complete. Under the fourth objective, thanks to funding provided by USDA, we have hired a CWD Coordinator, Jess Krohner. She will be helping to move this objective forward by helping lead and coordinate efforts around this objective. Additionally, we have begun to meet regularly and are working through a structured decision-making process to guide the development of a common understanding of what the problem this effort will address, the associated objectives, the potential alternative action plans and how to assess the impacts of our efforts. To accelerate our progress, we have stood up a subgroup of members associated with this objective that is tasked with drafting products that will be vetted by the Members working on Objective 4 before being finalized. Under the fifth objective, The subcommittee met in February 2023 to discuss opportunities to submit collaborative research proposals (with a particular focus on AFWA's Multistate Conservation Grant Program). For a variety of reasons, it was decided not to submit a proposal this year but hope to begin preparing a proposal for next year this summer.

The second main accomplishment of the Consortium is facilitating interdisciplinary collaboration. The continued interactions of Consortium members have led to scientific collaborations that would not have been possible without the Consortium. Members of the Consortium have successfully landed grants and submitted grants to the National Science Foundation, the United States Department of Agriculture, the United States Geological Survey and the National Institutes of Health. The rich output of products from these efforts listed below in "Publications" and provided on the Consortium website demonstrates the importance of the Consortium.

The Consortium also continues to conduct communication and outreach on CWD-related topics. The Consortium has built and maintains a web page (https://www.cwd-research.com) that contains a public facing area with general information regarding CWD, the projects, public outlets of CWD information,

publications, and a members-only section of the web page that houses information and notes about past meetings and other information for members.

Impacts: The impacts of the above accomplishments are multifold. Each of the objectives which are the focus of Consortium activities were selected because they are CWD research priorities and will impact the field. For example, the tissue repository will be a repository of CWD field isolates from a wide-ranging geographic location across North America that will permit the assessment of the distribution and frequency of CWD strains in North America. Second, this repository can provide uniform standardized CWD-infected and uninfected sources of tissue for diagnostic development, mitigation testing and for basic research purposes. The establishment of large-scale CWD research facilities is important for evaluating potential management actions at a scale that will allow for normal ecological and epidemiological processes to occur while still permitting experimental manipulation. The improvement of CWD diagnostics is foundational to answer key questions about the epidemiology of CWD and permitting rapid and efficient detection of CWD prions. Evaluating management strategies across state boundaries is critical to organize CWD response efforts and accelerate the identification of effective CWD management strategies. Lastly, it is becoming increasingly evident that successful CWD intervention strategies require societal support to be effective. The last objective is aimed at improving the social science tools and understanding to allow for successful implementation of CWD management. As the Consortium matures and develops, we have identified other research foci that should be addressed. Therefore, with the addition of sub-objectives - risk of human transmission/zoonotic potential, and environmental contamination and transmission - we adjust course to tackle new questions, while not abandoning the original objectives. Thus, this project is having and will continue to have important impacts for increasing the understanding and management of CWD on multiple levels.

Publications (selected; Consortium members in bold):

Rowden GR, Picasso-Risso C, Li M, **Schwabenlander MD, Wolf TM, Larsen PA**. Standardization of Data Analysis for RT-QuIC-Based Detection of Chronic Wasting Disease. *Pathogens*. 2023; 12(2):309. https://doi.org/10.3390/pathogens12020309

Kuznetsova A, **McKenzie D**, Ytrehus B, Utaaker KS, Aiken JM. Movement of Chronic Wasting Disease Prions in Prairie, Boreal and Alpine Soils. *Pathogens*. 2023; 12(2):269. https://doi.org/10.3390/pathogens12020269

Egan, Michael E., **Pepin, Kim M**., Fischer, Justin W., Hygnstrom, Scott E., **VerCauteren, Kurt C.**, and Bastille-Rousseau, Guillaume. 2023. " Social Network Analysis of White-Tailed Deer Scraping Behavior: Implications for Disease Transmission." *Ecosphere* 14(2): e4434. https://doi.org/10.1002/ecs2.4434

Amritha Mallikarjun, Ben Swartz, Sarah A. Kane, **Michelle Gibison**, Isabella Wilson, Amanda Collins, Madison B. Moore, Ila Charendoff, Julie Ellis, Lisa A. Murphy, **Tracy Nichols** & Cynthia M. Otto (2023) Canine detection of chronic wasting disease (CWD) in laboratory and field settings, Prion, 17:1, 16-28, DOI: 10.1080/19336896.2023.2169519

Peter R. Christenson, Manci Li, Gage Rowden, **Peter A. Larsen**, and Sang-Hyun Oh. Nano Letters 2023 *23* (9), 4074-4081 DOI: 10.1021/acs.nanolett.3c01001

Caitlyn N. Kraft1, Nathaniel D. Denkers, Candace K. Mathiason1, **Edward A. Hoover**. Longitudinal detection of prion shedding in nasal secretions of CWD-infected white-tailed deer. Journal of General Virology. 2023 104 (1). https://doi.org/10.1099/jgv.0.001825

Thompson, N. E., Huang, M. H. J., Christensen, S. A., and Demarais, S.. 2023. Wildlife agency responses to chronic wasting disease in free-ranging cervids. *Wildlife Society Bulletin* e1435. https://doi.org/10.1002/wsb.1435

Justin J Greenlee, S Jo Moore, **Eric D Cassmann**, Zoe J Lambert, Robyn D Kokemuller, Jodi D Smith, Robert A Kunkle, **Qingzhong Kong**, M Heather West Greenlee, Characterization of Classical Sheep Scrapie in White-tailed Deer after Experimental Oronasal Exposure, *The Journal of Infectious Diseases*, Volume 227, Issue 12, 15 June 2023, Pages 1386–1395, https://doi.org/10.1093/infdis/jiac443

Schneider DA, Lehmkuhl AD, Spraker TR, **Dittmar RO**, Lockwood MA, Rollo S, and **Nichols TA**. (2023) Tonsil biopsy to detect chronic wasting disease in white-tailed deer (*Odocoileus virginianus*) by immunohistochemistry. PLoS ONE 18(3): e0282356. https://doi.org/10.1371/journal.pone.0282356

Schultze, Dr. Michelle and Horn-Delzer, Dr. Amy and Glaser, Dr. Linda and Hamberg, Dr. Alex and Zellner, Dr. David and **Wolf, Tiffany M.** and **Wells, Dr. Scott J**., Herd-Level Risk Factors Associated With Chronic Wasting Disease-Positive Herd Status in Minnesota, Pennsylvania, and Wisconsin Cervid Farms. Available at SSRN: https://ssrn.com/abstract=4401784 or http://dx.doi.org/10.2139/ssrn.4401784

Inzalaco, H.N., Bravo-Risi, F., **Morales, R., D. P. Walsh, D. J. Storm, J. A. Pedersen**, W. C. Turner & **S. S. Lichtenberg**. Ticks harbor and excrete chronic wasting disease prions. *Sci Rep* 13, 7838 (2023). https://doi.org/10.1038/s41598-023-34308-3

Burgener KR, **Lichtenberg SS**, Lomax A, **Storm DJ, Walsh DP, Pedersen JA** (2022) Diagnostic testing of chronic wasting disease in white-tailed deer (*Odocoileus virginianus*) by RT-QuIC using multiple tissues. PLoS ONE 17(11): e0274531. https://doi.org/10.1371/journal.pone.0274531