Final Report

Michigan Chronic Wasting Disease Task Force October 15, 2003

Prepared for Governor Jennifer Granholm

Submitted by The Chronic Wasting Disease Task Force

Table of Contents

Executive Order No. 2003 - 5	•	•	•	•	•	•	•	•	1
Executive Order No. 2003 - 13	•	•	•	•	•				5
Letter from the Task Force			•	•	•				6
Executive Summary .	•		•	•	•				7
Background on Chronic Wastin	g Dise	ease	•	•	•	•			9
Introduction to the Recommend	lations	•		•	•	•			11
Recommendations	•	•	•	•	•	•	•		13
Appendix	•	•	•	•	•	•	•		17
Task Force Members									
Acknowledgements									
Outline of the Task Force									
References									

EXECUTIVE ORDER No. 2003 – 5

GOVERNOR'S CHRONIC WASTING DISEASE TASK FORCE EXECUTIVE OFFICE OF THE GOVERNOR

WHEREAS, Article V, Section 4 of the Michigan Constitution of 1963 authorizes the establishment of temporary commissions or agencies for special purposes;

WHEREAS, Section 1 of 1931 PA 195, MCL 10.51, authorizes and empowers the Governor, at such times and for such purposes as the Governor deems necessary or advisable, to create special commissions consisting of as many members as the Governor deems appropriate;

WHEREAS, chronic wasting disease is a neurological disease of deer and elk, a transmissible spongiform encephalopathy similar to mad cow disease in cattle and scrapie in sheep, characterized by loss of body condition, behavioral abnormalities, and death;

WHEREAS, chronic wasting disease can reduce the growth and size of deer and elk populations in areas where the prevalence of the disease is high, and is of increasing concern for wildlife managers across North America;

WHEREAS, there is no reliable live animal testing available for diagnosing chronic wasting disease, nor a treatment available, and information about the spread and long term implications of the disease is incomplete;

WHEREAS, once a disease thought to be limited in the wild to a relatively small endemic area in northeastern Colorado, southeastern Wyoming and southwestern Nebraska, chronic wasting disease has recently been found in new areas of Colorado and Nebraska, among wild deer in Illinois, New Mexico, South Dakota, Wisconsin and Saskatchewan, and among captive herds in Colorado, Nebraska, South Dakota, Minnesota, Montana, Oklahoma, Kansas, Wisconsin, Saskatchewan and Alberta;

WHEREAS, the spread of chronic wasting disease beyond its historic range threatens more than elk and deer in Michigan. If allowed to spread into Michigan, the disease has the potential to negatively impact other wildlife populations, limit interest in recreational and commercial use of deer and elk, and negatively impact rural economies;

WHEREAS, the increased occurrence of chronic wasting disease in regionally diverse locations necessitates a coordinated state response and an escalation in research, surveillance, monitoring, and management activities focused on containing and managing this lethal deer and elk disease and establishing preventative measures to keep the disease out of Michigan;

WHEREAS, the Natural Resources Commission, the Agriculture Commission, the Department of Natural Resources, and the Department of Agriculture have worked well to date to institute policies and procedures for the Departments of Natural Resources and Agriculture to limit the threat posed by the disease; and

WHEREAS, greater partnership among the Michigan Departments of Agriculture, Community Health, Environmental Quality, Natural Resources, State Police, and Transportation, as well as other state, federal, and provincial, and local agencies in the Great Lakes region and beyond is necessary to prevent and control the spread of chronic wasting disease.

NOW, THEREFORE, I, Jennifer M. Granholm, Governor of the state of Michigan, pursuant of the powers vested in me by the Michigan Constitution of 1963 and Michigan law, order the following:

I. GOVERNOR'S CHRONIC WASTING DISEASE TASK FORCE

- A. The Governor's Chronic Wasting Disease Task Force ("Task Force") is created within the Executive Office of the Governor.
- B. The members of the Task Force shall include five members of the public appointed by the Governor.
- C. The Directors of the Departments of Agriculture, Community Health, Environmental Quality, Natural Resources, State Police, and Transportation, or their designates, shall serve as ex officio, non-voting members of the Task Force.
- D. The members of the Task Force shall serve at the pleasure of the Governor.
- E. A vacancy on the Task Force shall be filled in the same manner as the original appointment.

II. CHARGE TO THE TASK FORCE

A. The Task Force shall act in an advisory capacity to the Executive Office of the Governor and shall:

- 1. Review existing state efforts regarding the prevention of chronic wasting disease.
- 2. Develop and make recommendations to implement a comprehensive and coordinated state chronic wasting disease prevention plan.
- 3. Make recommendations on the clarification of enforcement authority to prevent the spread of chronic wasting disease into Michigan, and if ever detected in Michigan, to prevent its spread within this state.
- 4. Recommend a process for the development of a widely-accessible reference database of available and current information concerning chronic wasting disease.
- 5. Identify mechanisms to promote effective communications and coordination of efforts between state, federal, provincial, and local officials regarding chronic wasting disease.
- B. The Task Force shall complete its work and issue a final report and recommendations, including any proposed legislation, to the Governor by September 19, 2003.

III. OPERATIONS OF THE TASK FORCE

- A. The Governor shall designate one member of the Task Force as Chairperson to serve at the pleasure of the Governor.
- B. The Chairperson shall select from among the members of the Task Force a Vice-Chairperson and a Secretary. Task force staff shall assist the Secretary with recordkeeping responsibilities.
- C. The Task Force shall be staffed by personnel from and assisted by the Departments of Agriculture, Community Health, Environmental Quality, Natural Resources, State Police, and Transportation, as requested by the Executive Office of the Governor.
- D. The Task Force may adopt procedures, not inconsistent with Michigan law and this executive order, governing its organization and operations. The Task Force may establish subcommittees as it deems advisable.
- E. The Task Force shall meet at the call of the Chairperson, or the Vice-Chairperson or other designee of the Chairperson, and as may be provided in procedures adopted by the Task Force.
- F. The Task Force shall act by a majority vote of its serving members. A majority of the members present and voting constitutes a quorum for the transaction of business of the Task Force at a meeting.
- G. In developing recommendations, the Task Force may, as appropriate, make inquiries, studies, investigations, hold hearings, and receive comments from the public. The Task Force may consult with outside experts in order to perform its duties, including but not limited to experts at state universities, state agencies, and federal agencies such as the United States Department of Agriculture and the United States Fish and Wildlife Service.
- H. Members of the Task Force shall serve without compensation. Members of the Task Force may receive reimbursement for necessary travel and expenses according to relevant statutes and the rules and procedures of the Department of Management and Budget and the Civil Service Commission, subject to available appropriations.
- I. The Task Force may hire or retain such contractors, sub-contractors, advisors, consultants and agents, and may make and enter into contracts necessary or incidental to the exercise of the powers of the Task Force and the performance of its duties as the Executive Office of the Governor deems advisable and necessary, in accordance with the relevant statutes, rules, and procedures of the Civil Service Commission and the Department of Management and Budget.
- J. The Task Force may accept donations of labor, services, or other things of value from any public or private agency or person.
- K. Members of the Task Force shall refer all legal, legislative, and media contacts to the Executive Office of the Governor.

IV. MISCELLANEOUS

A. All departments, committees, commissioners, or officers of this state or of any political subdivision of this state shall give to the Task Force, or to any member or representative of the Task Force, any necessary assistance required by the Task Force, or any member or representative of the Task Force, in the performance of the duties of the Task Force so far as is compatible with its, his, or her duties. Free access shall also be given to any books, records or documents in its, his, or her custody, relating to matters within the scope of inquiry, study, or investigation of the Task Force.

B. The invalidity of any portion of this Order shall not affect the validity of the remainder the order.

This Order is effective upon filing.

Given under my hand and the Great Seal of the state of Michigan this 28th day of February, 2003.

Jennifer M. Granholm
GOVERNOR

BY THE GOVERNOR:

SECRETARY OF STATE

EXECUTIVE ORDER No.2003 - 13

GOVERNOR'S CHRONIC WASTING DISEASE TASK FORCE AMENDMENT OF EXECUTIVE ORDER 2003-5

WHEREAS, on February 28, 2003, the Governor's Chronic Wasting Disease Task Force ("Task Force") was established by Executive Order 2003-5;

WHEREAS, in conducting its work the Task Force continues to be presented with a wealth of information and testimony, including testimony from nationally-recognized experts on the prevention of Chronic Wasting Disease;

WHEREAS, the goals of the Task Force can best be achieved by changing the reporting deadline for the Task Force;

NOW, THEREFORE, I, Jennifer M. Granholm, Governor of the State of Michigan, pursuant to the powers vested in the Governor by the Michigan Constitution of 1963 and Michigan law, order that Section II.B Executive Order 2003-5 be amended to read as follows:

"The Task Force shall complete its work and issue a final report and recommendations, including any proposed legislation, to the Governor by Wednesday, October 15, 2003."

This Order is effective upon filing.

SECRETARY OF STATE

Given under my hand and the Great Seal of the State of Michigan this 15th day of September, 2003
Jennifer M. Granholm GOVERNOR
BY THE GOVERNOR:



JENNIFER M. GRANHOLM GOVERNOR

STATE OF MICHIGAN OFFICE OF THE GOVERNOR LANSING

JOHN D. CHERRY, JR.

October 15, 2003

The Honorable Jennifer M. Granholm Governor State of Michigan Lansing, MI

Dear Governor Granholm:

On February 28, 2003, you enacted Executive Order No. 2003 – 5, resulting in the creation of the Chronic Wasting Disease (CWD) Task Force for the State of Michigan. Chronic Wasting Disease, as you know, is a neurological disease of deer and elk that has not been detected to date in Michigan. We hope that the work of this task force will provide valuable recommendations to prevent this devastating disease from entering the state in our captive or wild cervid herds.

The mission of the CWD Task Force was to bring forth recommendations based on the best possible scientific advice as to how the State of Michigan can deal with the prevention, and, if needed, management of CWD in captive and wild herds of white-tailed deer and elk.

The members of the task force would like to thank you for your trust in their abilities to evaluate the science, listen to the stakeholders and the public, to make thoughtful, scientifically based recommendations regarding the prevention and management of CWD in Michigan. We are pleased to present our recommendations to you and would be available to you, Lt. Governor Cherry or your staffs at any time to discuss them in detail.

Howard A. Tanner, PhD (Co-Chair)

William W. Taylor, PhD 66-Chair)

George R. Anderson, DVM

Rosina M. Bierbaum, PhD

Lonnie J. King, DVM

Executive Summary

In February 2003, Governor Jennifer Granholm signed Executive Order No. 2003-5 and announced the formation of the Chronic Wasting Disease (CWD) Task Force, co-chaired by former Michigan Department of Natural Resources Director Howard Tanner and William Taylor, Chair of the Fisheries and Wildlife Department at Michigan State University. The Executive Order charged the task force with several tasks including reviewing existing state efforts regarding the prevention of CWD, and making recommendations based on prevention strategies, enforcement authority, database design, and communication and coordination strategies. The deadline given to the task force for its final report was September 19, 2003; the deadline was extended through Executive Order No. 2003-13 to October 15, 2003.

Five voting members were appointed to the task force, and the directors (or their designees) of the departments of Agriculture; Community Health; Environmental Quality; Natural Resources; State Police; and Transportation served as nonvoting members. The task force met formally four days over a six-month period to consider the issues and discuss recommendations consistent with the charges in the Executive Order. Subgroups of the task force engaged in numerous phone conferences and discussion groups between the formal public meetings.

Michigan provides for an exceptional example of collaboration among agencies, industries, and partners (i.e., universities, NGOs) and this strong mutually beneficial relationship must persist into the future. We must not detract from the current positive relationships, but instead wish to strengthen these partnerships by facilitating the ways and means for all to contribute to having healthy, viable cervids in Michigan's agricultural and natural resources environments.

The task force has made extensive efforts to evaluate all existing information on CWD and place these within the State of Michigan context while devising our recommendations. We have made an extensive review of literature (see Appendix) and we have requested and received the complete cooperation of all state agencies associated with the task force. We have benefited by the presentations of CWD experts and other stakeholders from around the country. We have also gained important perspectives through presentations from representatives of the cervid industry and from interest groups. As a task force, we strived to balance public and private goods in order to maintain the viability of our natural resources and agricultural industry while ensuring the integrity of Michigan's diverse and productive ecosystems. We strongly encourage our agencies and partners to secure additional state, federal, and private funding toward research that can fill the current gaps of knowledge, especially in the areas of rapid, accurate diagnostics in live animals and methods of cleaning, disinfecting, and destroying prions, including the potential serious issue of long-term environmental contamination. The primary recommendations issued by the task force in the report include:

- Appoint a standing committee, including stakeholders and experts, to continuously meet and improve the Surveillance and Response Plan.
- Develop a risk assessment to ascertain both the critical features of a prevention/control strategy and the key priorities from which to direct and allocate resources.
- Maintain and vigorously enforce the moratorium on animal movement, especially from
 other states, until the risk assessment is completed and until other exporting states have
 strong surveillance and detection systems in place.

- Conduct an immediate audit of Michigan's captive cervid industry, not to be punitive, but to find any flaws or weaknesses in the current system.
- Allocate additional resources to both agencies to meet the current enforcement and compliance needs.
- Transfer the license application, registration and fence inspection for the captive cervid
 herds to the MDNR and they should be given resources commensurate with this new
 responsibility.
- Encourage the privately-owned cervid industry to adopt an individual animal ID system, implement a stringent and frequent inspection system, and become a national leader and model for the entire industry.
- Develop and implement a regional plan for CWD with contiguous states to Michigan, and include the USDA and USFWS as active partners in the process.
- Develop and adopt a common database and record-keeping system. The database should be in Lansing and the data needs to be collected and distributed in "real time" on a monthly basis. A lead agency for record-keeping will be named based on the results from the audit. In addition, the record-keeping system will be made fully accessible to MDA, MDNR, law enforcement, and those with a need to know.
- Issue MDNR authority to access private land and facilities to conduct surveillance and to
 achieve compliance with all rules and regulations specified in the license of each facility
 and give the agency permanent authority to regulate feeding for hunting and recreational
 viewing of wild cervids. Any issues related to licensing need to be addressed and
 implemented by MDNR.
- Review and strengthen the current communication activities to ensure that the citizens in Michigan correctly perceive the risks, implications, and issues associated with CWD.
- Combine current CWD website with the MDA and MDNR site so that the public has
 access to our deliberations, current data and reports, and recommendations to the
 Governor.

Background on Chronic Wasting Disease

Chronic Wasting Disease (CWD) is one of the Transmissible Spongiform Encephalopathies (TSEs) which represent a group of neurodegenerative diseases characterized by long incubation periods and lesions of the central nervous system. The disease affects cervids (deer and elk) and the outcome is always fatal; the infected animals exhibit abnormal behaviors, loss of bodily functions, and a progressive emaciation. These diseases are believed to be caused by infectious, self-propagating (prion) proteins. The route of infection is not known at this time, making this a particularly hard disease to manage. Prions are normal cell proteins whose shape has been transformed causing CWD. This disease is closely related to, but different than, TSEs found in other species (i.e., Scrapie in sheep, Bovine Spongiform Encephalopathy (BSE) in cattle, and Creutzfeldt-Jakob Disease (CJD and nvCJD) in humans). To date, there is no evidence that CWD poses a risk for humans, nor has there been verified evidence that CWD can be transmitted to humans. However, as a prevention technique, public health officials recommend to avoid consuming food derived from any animal with evidence of a TSE. Public health officials continue to evaluate any potential health risk of CWD to humans.

At this time, there is no evidence that CWD can be transmitted to livestock or animals other than deer and elk. That being said, we do not know exactly how CWD is transmitted from one animal to another, but there is strong evidence that there is horizontal, or animal to animal transmission. Research suggests that the most common mode of transmission from an infected animal is via saliva, urine, and feces. It is believed that the agent responsible for the disease may be spread both directly (animal-to-animal contact) and indirectly (soil or other surface to animal). The apparent persistence of the infectious agents in environments contaminated with the agent represents a significant obstacle to the complete eradication of CWD.

The potential spread of disease increases when animals congregate around unnatural (i.e., baiting/feeding) sources of feed. The movement of infected live animals is one of the greatest risk factors in spreading the disease into new areas. Natural movements of wild deer and elk can and has contributed to the spread of the disease, while human-aided transportation, for agricultural purposes, of both privately owned and wild animals are significant risk factors associated with the spread of CWD. Research suggests that the youngest animal diagnosed with clinical CWD was 17 months old, while the maximal incubation period is unknown. Definitive diagnosis of the disease is being determined by immunohistochemical (IHC) testing of brain, lymph node, and/or tonsil tissue from a dead animal. To date, a live-animal test has been developed that uses tonsillar biopsy IHC as a tool for detecting CWD; however, there are no serological tests that can be used in live animals. This live-animal CWD test will only diagnose the disease in more advanced stages and can potentially cause false negatives.

Chronic Wasting Disease was first recognized as a disease in 1967 in captive mule deer at a wildlife research facility in Fort Collins, Colorado (CO). In 1978, scientists in Wyoming first determined CWD to be a TSE. The disease was first diagnosed in free-ranging elk in 1981, mule deer in 1985, and white-tailed deer in 1990. The first diagnosis of CWD in privately owned elk was made in Saskatchewan (SK) in 1996. To date, CWD has been identified in wild deer and/or elk in Colorado, Illinois, New Mexico, Wyoming, Nebraska, South Dakota, Utah, Wisconsin,

and the Canadian province of Saskatchewan. In addition to Colorado, CWD has been diagnosed in privately owned deer and elk herds in Kansas, Nebraska, Montana, Oklahoma, South Dakota, Wisconsin, Minnesota, the Canadian provinces of Saskatchewan and Alberta, and South Korea. Scientific experts are of the opinion that CWD exists in additional areas where it has not yet been detected, due in part to the movement of captive cervids.

The spread of CWD to Michigan would be a major disaster for our wild cervid populations and agricultural enterprises by reducing the abundance of wild deer and elk via lower survival rates for diseased populations and increasing costs and lower acceptance of agricultural farmed cervids worldwide. Additionally, the monitoring and control of CWD would be extremely costly and would divert already scarce funding and staff resources from the farm community, MDA and MDNR.

The potential for CWD to impact Michigan is a real threat to our citizens and its economy as public concerns and perceptions about human health risks associated with all TSEs will likely erode hunter willingness to harvest deer and consume cervid products. Significant reductions in deer hunting would adversely affect Michigan's economy through the loss of revenue associated with hunting in Michigan. Last year this amounted to a revenue stream to the state and local communities of more than \$500 million to the economy of our State. Perceptions about the safety of farmed venison as human food source could cause the collapse of Michigan's multimillion dollar privately owned cervid industry. For these reasons, we need to maintain healthy herds of cervids throughout Michigan and prevent the entrance of CWD by all means possible.

Introduction to the Recommendations

With our current knowledge and background, it is evident that Chronic Wasting Disease (CWD) poses a major threat to Michigan in direct and indirect ways. CWD is also a special challenge because of gaps in our knowledge of this disease. Transmission, pathogenesis, sustainability of the pathogen outside the host, involvement of both captive and free-ranging species, multiple jurisdiction and regulatory authorities, limited diagnostic tools and the public's understanding and perception represent some of the critical challenges. However, animal disease eradication and control programs have been successfully implemented in the past through an understanding of basic strategies and gaining knowledge through epidemiology and research concurrently – CWD is no different in this regard.

In conducting a series of public and task force meetings, it was apparent that there is a difference in culture and perspective with regard to the participants involved with the CWD program in the state. The Michigan Department of Natural Resources (MDNR) and the Michigan Department of Agriculture (MDA) have different experiences and viewpoints. The advocates for the free-ranging cervids and those for privately owned cervids also, at times, have differing views.

The task force is convinced of the need to use the different expertise and perspectives of all six departments to strengthen the prevention and/or response to CWD. The complexity of dealing with CWD and the numerous actions required to be successful, mandates an integrated, cooperative and science-based program. Although differences will continue to exist, the ultimate goals are actually shared – prevent the introduction of CWD into Michigan and if it is here, locate and eradicate it as quickly as possible. The means to these ends involve collaborative approaches, which also must include other state agencies, e.g. Department of Environmental Quality, State Police, as well as universities and the federal government as essential partners. The task force believes that the state's response to bovine tuberculosis has given key participants a distinct advantage. The cooperation of state agencies, wildlife and production agriculture advocates, MSU, and the federal government have achieved a credible and operational TB surveillance and response system, which can serve as a model for CWD.

The task force recommends vigilance and caution in response to the threat of CWD in Michigan. There are many uncertainties associated with CWD, but the lack of scientific certainty should not be an excuse for doing nothing - we must proceed when facing uncertainty and promote a concept called the "Precautionary Principle." The Precautionary Principle states, "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (Rio Declaration, 1992). Preventive actions make sense, even before all of the scientific questions are answered. Absolute scientific certainty is rarely achievable and is not required before taking actions to avoid serious harm. Where the body of scientific evidence shows a likelihood of unacceptable risks, policy makers should consider preventative actions, taking into account economic, social and environmental consequences. The importation and exportation of deer and elk among states and game farms has likely contributed to the spread of the disease by keeping herds in close quarters. Because transmission of CWD is still uncertain, we recommend promoting the Precautionary Principle in order to prevent the spread of CWD to Michigan.

Finally, the task force has worked under the premise that the Michigan free-ranging deer and elk herds represent great value to the citizens of the state and are both a major economic and recreational asset and cultural icon. At the same time, the task force appreciates that economic development and a free market system are also important to Michigan and, as such, believes that privately-owned cervid production represents a form of agriculture and, like any other business, needs to have an optimal environment to succeed. The task force believes that these philosophies do not have to be an either-or proposition. The task force has also strongly adopted the principle of science-based recommendations based on understanding of risk. With these operating principles in mind, the task force has worked together to issue its recommendations to the Governor.

Chronic Wasting Disease Task Force Recommendations Specific to the Charges

- 1. The task force is complimentary of and endorses the MDA and MDNR Surveillance and Response Plan for CWD of Free-Ranging and Privately-Owned Cervids. This plan is comprehensive and well designed. It will need to be consistently updated based on the changing circumstances and understanding of the disease. The task force recommends that MDA and MDNR appoint a standing committee, including stakeholders and experts, to continuously meet and improve this plan. The task force recommends that test exercises be conducted that involve all partners to proactively work out any areas of weakness in the response plan. Test exercises are simulations of disease outbreaks that allow responsible officials and agencies to practice for a real outbreak, such as for CWD entering or being found in Michigan. These mock exercises help participants to work out any problems or issues before the event really occurs. The first test exercises should be conducted in the very near future.
- 2. The task force recommends that a risk assessment be developed as quickly as possible to ascertain both the critical features of a prevention/control strategy and the key priorities from which to direct and allocate resources. The ecological, environmental, population dynamic and epidemiological factors for CWD for Michigan are much different from experiences in the western U.S., where most of our knowledge has been gained. Recent experience in Wisconsin suggests that real differences in risk and approaches exist between habitats of western mule deer and elk, and those of eastern white-tailed deer. The Wisconsin situation is based on a much larger and denser population of deer than in the western United States. The task force also believes that this risk assessment can build from existing assessments, yet should incorporate unique conditions and circumstances in Michigan. The assessment will need to consider prevention and management scenarios, including a social risk assessment. The task force also recommends that a moratorium on animal movement, especially from other states, should be maintained and vigorously enforced until the risk assessment is completed and until other exporting states have strong surveillance and **detection systems in place.** The moratorium should also include wastes and carcasses (including body parts) of cervids from other states, with the exception of de-boned meat, antlers, antlers attached to a skull cap cleaned of all brain and muscle tissue, hides cleaned of excess tissue or blood, upper canine teeth, and a finished taxidermist mount. At the present time, permits are not required for intrastate movement providing that TB testing has been complete; we believe a permit should be required.
- 3. The task force is concerned about compliance and enforcement activities in the current CWD plans and actions. While the actions and responsibilities outlined in P.A. 190 are comprehensive, the task force strongly believes that compliance must be improved and strengthened. The task force recommends that an immediate audit of Michigan's captive cervid industry be conducted, not to be punitive, but to find any flaws or weaknesses in the current system that might lead to the entrance of CWD into Michigan's captive and wild cervid herds. Legislative acts P.A. 190, along with P.A. 466, provide a framework for enforcement requirements; however, the implementation and execution of these requirements

need immediate review and attention. The task force is especially concerned about: potential escapes from captive facilities; secure borders to prevent escapes; the limited diagnostic testing that is taking place; the integrity of records; potential illegal movements of animals; the need for permanent and unique animal identification; and issues of carcass disposal and captive facility inspection. An audit is needed to provide a more complete understanding of the captive cervid industry and to provide the basis for assigning agency responsibilities for law enforcement and the development and management of the database and record-keeping system.

- 4. The task force is also concerned about the gap between the fiscal and personnel resources that are needed for an effective CWD prevention and detection program and the actual personnel and time being devoted to these important strategies. Central to this concern are the levels of the current enforcement and compliance activities. The task force believes that both the MDA and MDNR must build up this capacity to implement an effective CWD program. Michigan Department of Agriculture and MDNR will need to carefully evaluate the cross training of existing personnel and existing responsibilities and then make recommendations based on those fiscal and personnel needs. The task force recommends that both agencies be allocated additional resources to meet the current enforcement and compliance needs. The task force further recommends that the license application, registration and fence inspection for the captive cervid herds should be transferred to the MDNR and they should be given resources commensurate with this new responsibility.
- 5. The task force applauds the efforts of the privately owned cervid industry to build a strong program in biosecurity and disease prevention. The task force believes that a proactive and progressive captive cervid industry is not only important to the success of the CWD program but, ultimately, is the foundation to a sound business enterprise in the future. A Michigan industry that is proven to be free of CWD and has an effective ongoing surveillance and detection system will lead to a competitive business advantage with more highly valued products and animals. The task force encourages the privately-owned cervid industry to adopt an individual animal ID system, implement a stringent and frequent inspection system, and become a national leader and model for the entire industry.
- 6. The task force is alarmed with the steadily increasing detection of CWD across the U.S. While states need to take action to prevent the further spread of CWD, there is also a need for regional approaches and a more active role by the federal government, particularly USDA and USFWS. Successful disease eradication and control programs for U.S. livestock have always been conducted as state-federal partnerships. The task force recommends that Michigan assume a leadership role in considering a regional plan with our contiguous states, and that the USDA and USFWS become more active partners in the process.
- 7. The task force recognizes that the lack of knowledge of CWD and other Transmissible Spongiform Encephalopathies (TSE) limits our effectiveness to prevent, detect, and respond to these diseases. There are many questions that need to be answered in order to improve our ability to meet the CWD challenge. Therefore, the task force encourages further state, federal and private funding toward research that can fill the current gaps of knowledge, especially in the areas of rapid, accurate diagnostics in live animals and methods of cleaning, disinfecting, and destroying prions, including the potential serious issue of long-

term environmental contamination, and modes of transmission. The task force also urges that more work be done on risk factor analyses and the use of spatial and G.I.S. technology for population and ecological analyses.

- 8. The task force also recognizes the importance of excellent diagnostic services. With the increase in emerging animal diseases, additional funds are required to support diagnostic and testing facilities and services as the current program is inadequately funded. Having adequate research and operation funds are key to maintaining the viability of our agriculture and natural resources. MSU's Diagnostic Center for Population and Animal Health is a critical asset to animal and wildlife health across the state, not just for CWD, but also for new emerging diseases that not only threaten our wildlife and domestic animal populations, but also are a growing concern as threats to our public and environmental health.
- 9. The task force recommends that a common database and record-keeping system be developed and adopted as soon as possible. The database should be in Lansing, and the data needs to be collected and distributed in "real time" on a monthly basis. "Real time" means that reports are direct and immediate there are no lag times for reporting and mailings. An online database is recommended that would simultaneously link the producer information with MDNR, MDA, and the laboratory. A lead agency for record-keeping will be named based on the results from the audit. In addition, the record-keeping system will be made fully accessible to MDA, MDNR, law enforcement, and those with a need to know. The task force further recommends that the Michigan Department of Community Health (MDCH) partner with the MDA and MDNR in reviewing the data and correlating it with the MDCH data on Creutzfeldt-Jakob Disease and other suspicious neurological conditions in humans. The task force stresses the fact that CWD is not a human pathogen but also believes that based on the BSE experience in the United Kingdom prudence and data sharing are responsible steps.
- 10. The task force is also very concerned that CWD could enter Michigan through the movement of captive cervids. While the risk assessment will be useful in determining the level of risk, the task force believes that several immediate actions are both prudent and essential. Thus, the task force recommends that the MDNR be issued authority to access private land and facilities to conduct surveillance and to achieve compliance with all rules and regulations specified in the license of each facility and that the agency is given permanent authority to regulate feeding for the recreational viewing of wild cervids. Any issues related to licensing need to be addressed and implemented by MDNR.
- 11. The CWD program for Michigan must have two simultaneous goals: (1) the prevention of CWD from entering the state; and, (2) the rapid and reliable detection and effective response should the disease appear. We have addressed issues regarding the former scenario but should not neglect the possibility that CWD may already be present in the State. The task force believes that the highest levels of risk of entry of CWD may have already occurred with movements of cervids into the state prior to the current moratorium or through illegal movements. These could have been either into farms, ranches, or small hobby facilities. **Thus, the task force recommends that surveillance of captive facilities, ranches and free-ranging populations be accelerated and increased immediately.** The task force feels that the frequency of the current

surveillance activities is inadequate to detect the presence of CWD in Michigan. The task force is particularly concerned that captive cervid facilities are not appropriately reporting and submitting escaped, dying, diseased or injured animals, and the levels of surveillance for wild white-tailed deer is too low relative to the risk of having the disease in Michigan. If the disease is present in the State, the ability to detect it and limit its spread is an essential strategy that could determine if we can undertake an eradication strategy vs. a control strategy and be faced with the prospect of living with the disease such as is occurring in Colorado.

12. The task force is concerned about the public's understanding and knowledge of CWD. While the task force wishes to compliment the past and current actions taken in communications, especially in informing hunters and wildlife recreationists, the task force also senses that more should be done with informing and educating a wider audience. Thus, the task force recommends that the current communication activities, by the MDA and MDNR, be reviewed and strengthened to ensure that the citizens in Michigan correctly perceive the risks, implications, and issues associated with CWD. Further, the task force recommends that its current website be combined with the MDA and MDNR site so that the public has access to our deliberations, current data and reports, and recommendations to the Governor.

Appendix

Task Force Members

VOTING MEMBERS

Dr. Howard Tanner – Former Director, Department of Natural Resources (Co-Chair)

Dr. William Taylor – Chair and Professor, Fisheries & Wildlife Department, Michigan State University (Co-Chair)

Dr. George Anderson – Executive Manager, Michigan Association of Public Health and Preventative Medicine Physicians

Dr. Rosina Bierbaum – Dean and Professor, School of Natural Resources and Environment, University of Michigan

Dr. Lonnie King – Dean and Professor, College of Veterinary Medicine, Michigan State University

NONVOTING MEMBERS

The directors of the departments of Agriculture, Community Health, Environmental Quality, Natural Resources, State Police, and Transportation were also appointed to serve on the council as nonvoting members if they were unable to attend the meetings they could appoint a designee.

Steven Chester – Director, Michigan Department of Environmental Quality

Designee - Tim McGarry – Enforcement Coordinator and Litigation Specialist,

Michigan Department of Environmental Quality

K. L. Cool – Director, Michigan Department of Natural Resources
 Designee - Becky Humphries – Chief Wildlife Division, Michigan Department of Natural Resources

Gloria Jeff – Director, Michigan Department of Transportation

Designee - Larry Tibbets – Chief Operations Officer, Michigan Department of Transportation

Janet Olszewski – Director, Michigan Department of Community Health

Designee - Bridget Patrick – Bovine T. B. Eradication Coordinator

Tadarial Strudivant – Director, Michigan State Police **Designee - James Bennett** – Sergeant, Michigan State Police

Dan Wyant – Director, Michigan Department of Agriculture
 Designee - Joan Arnoldi – State Veterinarian, Michigan Department of Agriculture

Acknowledgements

The Chronic Wasting Disease Task Force members would like to recognize the individuals and organizations that have provided information and assistance during the Task Force's term. The Task Force greatly appreciates the valuable insight and information that contributed to the development of this report. A list of reference materials generated by the Task Force is provided in the Appendix and is also available on the CWD website (www.michigan.gov/cwd/).

GROUPS & INDIVIDUALS WHO PROVIDED INPUT TO THE TASK FORCE

Mr. Eric Antisdale

Hunting Ranch Owner

Dr. Matthew Boulton

State Epidemiologist

Michigan Dept. Community Health

Dr. Tom Cline, DVM

Assistant State Veterinarian

South Dakota Animal Industry Board

Mr. George Cullers

Michigan United Conservation Clubs

Dr. Wayne Cunningham

State Veterinarian

State of Colorado

Mr. Alex Draper

Michigan Deer & Elk Farmers Association

Mr. Daniel Eichinger

Marketing and Membership Director

Michigan United Conservation Clubs

Mr. Bob Filbrandt

Bob's Processing, Inc.

Michigan Meat Association

Lt. David Ford

Michigan State Police

Mr. Noah Hall

National Wildlife Federation

Dr. Doug Hoort

U.S. Dept. of Agriculture

Mr. Kenneth Keeley

Michigan Deer and Elk Marketing Program

Dr. Matti Kiupel

Assistant Professor and Veterinary

Pathologist

Michigan State University

Ms. Tonia Koppenaal

Associate Legislative Counsel

Michigan Farm Bureau

Dr. Julie Langenberg, VMD

Wildlife Veterinarian

Wisconsin Dept. Natural Resources

Captain Tim Nixon

Michigan Dept. Natural Resources

Mr. Dan Marsh, Executive Director

Michigan Deer & Elk Farmers Association

Dr. Mike Miller, DVM

Wildlife Veterinarian

State of Colorado Division of Wildlife

Mr. Bill Murphy

Michigan Resource Stewards

Dr. Dan O'Brien, DVM

Wildlife Veterinarian

Michigan Dept. Natural Resources

Mr. Bill Osterman

Meat Processor

Ironwood, Michigan

Mr. Brian Preston

Regional Organizer

National Wildlife Federation

Lt. Dave Purol

Michigan Dept. Natural Resources

Dr. Shawn Riley

Assistant Professor

Michigan State University

Mr. Al Rodriquez

Compliance Officer

Michigan Dept. Agriculture

Dr. Steve Schmitt, DVM

Wildlife Veterinarian

Michigan Dept. Natural Resources

Mr. Sam Washington

Executive Director

Michigan United Conservation Clubs

Dr. Beth Williams, DVM

Wildlife Pathologist

University of Wyoming, Laramie

EXECUTIVE OFFICE

Dana Debel

Environmental Advisor

Office of the Governor

Dennis Fox

Conservation Policy Advisor

Office of the Lt. Governor

TASK FORCE FINANCIAL LIAISON

Anastasia Gormely

Michigan Dept. Environmental Quality

CWD TASK FORCE SUPPORT STAFF

Betsy Clark Zebulon Kennedy Jordan Pusateri

Outline of the Task Force's Activities

February 28, 2003	Executive Order No. 2003-5, Chronic Wasting Disease Task Force
April 30, 2003	Task Force Planning Meeting, Living Oceans (Task Force Members and staff)
June 2, 2003	Public Meeting, The Michigan Historical Museum and Library (Task Force Members, Ex-Officio, staff and the public)
July 17, 2003	Team Meeting, The Pavilion at Michigan State University (Task Force Members, Ex-Officio and staff)
July 25, 2003	Team Meeting, The Michigan Historical Museum and Library (Task Force Members, Ex-Officio and staff)
July 29, 2003	Team Meeting, The Pavilion at Michigan State University (Task Force Members, Ex-Officio and staff)
July 29, 2003	Public Meeting, The Pavilion at Michigan State University (Task Force Members, Ex-Officio, staff and the public)
August 19, 2003	Task Force Meeting, Living Oceans (Task Force Members and staff)
August 19, 2003	Team Meeting, The Pavilion at Michigan State University (Task Force Members, Ex-Officio and staff)
August 19, 2003	Public Meeting, The Pavilion at Michigan State University (Task Force Members, Ex-Officio, staff and public)
September 8, 2003	Task Force Meeting, Living Oceans (Task Force Members and staff)
September 15, 2003	Task Force Meeting, Michigan State University (Task Force Members and staff)
September 16, 2003	Team Meeting, Clarion Hotel (Task Force Members, Ex- Officio and staff)
September 16, 2003	Public Meeting, Clarion Hotel (Task Force Members, Ex- Officio, staff and public)

^{*}The agenda, minutes and public comment from the public meetings can be found on the CWD Task Force Website (www.michigan.gov/cwd/).

References

- Bahmanyar, S., E. S. Williams, F. B. Johnson, S. Young, and D. C. Gajdusek. 1985 Amyloid plaques in spongiform encephalopathy of mule deer. Journal of Comparative Pathology 95 1-5
- Ball, K. 2002

Chronic wasting disease in a Rocky Mountain elk. Can Vet J 2002 Nov;43(11): 880-2

Barret, A., F. Tagliavini, G. Forloni, C. Bate, M. Salmona, L. Colombo, A. De Luigi, L. Limido, S. Suardi, G. Rossi, F. Auvré, K. T. Adjou, N. Salès, A. Williams, C. Lasmézas, and J. P. Deslys 2003

Evaluation of Quinacrine Treatment for Prion Diseases Journal of Virology Vol. 77, No. 15 p. 8462-8469

Bartz, J. C., R. F. Marsh, D. I. McKenzie, and J. M. Aiken. 1998

The host range of chronic wasting disease is altered on passage in ferrets. Virology 251:297-301

Belay, E. D., P. Gambetti, L. B. Schonberger, P. Parchi, D. R. Lyon, S. Capellari, J. H. McQuiston, K. Bradley, G. Dowdle, J. M. Crutcher, and C. R. Nichols. 2001

Creutzfeldt-Jakob disease in unusually young patients who consumed venison. Archives of Neurology 58:1673–1678

Bosque, P. J. 2002

Bovine spongiform encephalopathy, chronic wasting disease, scrapie, and the threat to humans from prion disease epizootics. Curr Neurol Neurosci Rep 2002 Nov;2(6): 488-95

Bounias, M., M. Purdey. 2002

Transmissible spongiform encephalopathies: a family of etiologically complex diseases--a review. Sci Total Environ 2002 Oct 7;297(1-3): 1-19

Bruce, M. E., A. Chree, E. S. Williams, and H. Fraser. 2000

Perivascular PrP amyloid in the brains of mice infected with chronic wasting disease. Brain Pathology 10:662–663

Bruce, M. E., R. G. Will, J. W. Ironside, I. McConnell, D. Drummond, A. Suttie, L. McCardle, A. Chree, J. Hope,
C. Birkett, S. Cousens, H. Fraser, and C. J. Bostock. 1997
Transmissions to mice indicate that 'new variant' CJD is caused by the BSE agent. Nature 389:498–501

Cervenakova, L., D. C. Guiroy, P. Brown, E. S. Williams, E. J. Nagle, E. K. Lau, L. G. Goldfarb, J. C. Gibbs, and D. C. Gajduse 1997

High sequence homology of the PrP gene in mule deer and Rocky Mountain elk. Lancet 350:219-220

Conner, M. M., C. W. McCarty, and M. W. Miller. 2000

Detection of bias in harvest-based estimates of chronic wasting disease prevalence in mule deer. Journal of Wildlife Diseases 36:691–699

Doster, Gary L., Editor 2002

Southeastern Cooperative Wildlife Disease Study- Quarterly Newsletter: Special CWD Issue Southeastern Cooperative Wildlife Disease Study Briefs 18:1

Gross, J. E., and M. W. Miller. 2001

Chronic wasting disease in mule deer: Disease dynamics and control. Journal of Wildlife Management 65:205–215

Guiroy, D. C., E. S. Williams, K. J. Song, R. Yanagihara, and D. C. Gajdusek. 1993
Fibrils in brains of Rocky Mountain elk with chronic wasting disease contain scrapie amyloid. Acta

- Guiroy, D. C., E. S. Williams, P. P. Liberski, I. Wakayama, and D. C. Gajdusek. 1993
 Ultrastructural neuropathology of chronic wasting disease in captive mule deer. Acta Neuropathologica 85: 437-444
- Guiroy, D. C., E. S. Williams, R. Yanagihara, and D. C. Gajdusek. 1991

 Topographic distribution of scrapie-amyloid immunoreactive plaques in chronic wasting disease in captive mule deer (Odocoileus hemionus hemionus). Acta Neuropathologica 81: 475-478
- Guiroy, D. C., E. S. Williams, R. Yanagihara, and D. C. Gajdusek. 1991 Immunolocalization of scrapie amyloid in chronic wasting disease of Rocky Mountain elk and hybrid captive mule deer and white-tailed deer. Neuroscience Letters 126: 195-198
- Guiroy, D. C., P. P. Liberski, E. S. Williams, and D. C. Gajdusek. 1994 Electron microscopic findings in brain of Rocky Mountain elk with chronic wasting disease. Folia Neuropathology 32: 171-173
- Guiroy, D. C. 1990
 Amyloid plaques in chronic wasting disease. Master's Thesis, Hood College, Frederick, Maryland. 50 pp.
- Guiroy, D. C., E. S. Williams, R. Yanagihara, and D. C. Gajdusek. 1993
 Amyloid plaques in chronic wasting disease. In: Light and Electron Microscopic Neuropathology of Slow Virus Disorders. P. P. Liberski (ed.). CRC Press, Boca Raton, Florida.test 430 pp.
- Guiroy, D. C., P. P. Liberski, E. S. Williams, R. Yanagihara, and D. C. Gajdusek. 1993 Localization of sulfated glycosaminoglycans in scrapie-amyloid-immunoreactive plaques in slow virus diseases. In: Light and Electron Microscopic Neuropathology of Slow Virus Disorders. P. P. Liberski (ed.). CRC Press, Boca Raton, Florida. 430 pp.
- Guiroy, D. C., E. S. Williams, and D. C. Gajdusek. 1992

 Neurodegenerative and immunocytochemical changes of chronic wasting disease in captive mule deer.

 Keystone Symposium. "Advances in understanding neurodegenerative disorders." Big Sky, Montana. Journal of Cellular Biochemistry, Supplement 16E:211.
- Guiroy, D. C., E. S. Williams, P. P. Liberski, and D. C. Gajdusek. 1993 Ultrastructural neuropathology of chronic wasting disease in captive mule deer and Rocky Mountain elk. Clinical Neuropathology 12: 247
- Guiroy, D. C., P. P. Liberski, E. S. Williams, and D. C. Gajdusek. 1993
 Ultrastructural findings in brain of Rocky Mountain elk with chronic wasting disease. 118th Meeting of the American Neurological Association, Boston, MA. October. Abstract
- Hadlow, W. J. 1996
 Differing neurohistologic images of scrapie, transmissible mink encephalopathy, and chronic wasting disease of mule deer and elk. in Bovine spongiform encephalopathy: the BSE dilemma. C. J. Gibbs, Jr. (ed.).
 Springer?Verlag, New York, New York, Pages 122-137
- Hadlow, W. J., and L. Karstad. 1968
 Transmissible encephalopathy of mink in Ontario. Canadian Veterinary Journal 9:193–196
- Hamir, A. N., R. C. Cutlip, J. M. Miller, E. S. Williams, M. J. Stack, M. W. Miller, K. I. O'Rourke, and M. J. Chaplin. 2001

Preliminary findings on the experimental transmission of chronic wasting disease agent of mule deer to cattle. Journal of Veterinary Diagnostic Investigation 13:91–96

Hibler, C. P., K. L. Wilson, T. R. Spraker, M. W. Miller, R. R. Zink, L. L. DeBuse, E. Anderson, D. Schweitzer, J. A. Kennedy, L. A. Baeten, J. F. Smeltzer, M. D. Salman, and B. E. Powers 2003

Field validation and assessment of an enzyme-linked immunosorbent assay for detecting chronic wasting disease in mule deer (Odocoileus hemionus), white-tailed deer (Odocoileus virginianus), and Rocky Mountain elk (Cervus elaphus nelsoni) Journal of Veterinary Diagnostic Investigation Vol: 15, Number 4, 311-319

Joly, D.O., Ribic, C.A., Langenberg, J.A., Beheler, K., Batha, C.A., Dhuey, B.J., Rolley, R.E., Bartelt, G., Van Deelen, T.R., Samuel, M.D. 2003

Chronic wasting disease in free-ranging Wisconsin white-tailed deer Emerging Infectious Diseases Vol. 9 No. 5

Liberski, P. P., D. C. Gajdusek, P. Brown. 2002

How do neurons degenerate in prion diseases or transmissible spongiform encephalopathies (TSEs): neuronal autophagy revisited. Acta Neurobiol Exp (Warsz) 2002;62(3): 141-7

Liberski, P.P., D.C. Guiroy, E.S. Williams, A. Walis, H. Budka. 2001

Deposition patterns of disease-associated prion protein in captive mule deer brains with chronic wasting disease. Acta Neuropathol (Berl). 2001 Nov;102(5) 496-500

Miller, M. W., and E. S. Williams. 2002

Detecting PrPCWD in mule deer by immunohistochemistry of lymphoid tissues. Veterinary Record 151:In press

Miller, M. W., E. S. Williams, C. W. McCarty, T. R. Spraker, T. J. Kreeger, C. T. Larsen, and E. T. Thorne. 2000 Epizootiology of chronic wasting disease in free-ranging cervids in Colorado and Wyoming. Journal of Wildlife Diseases 36:676–690.

Miller, M. W., M. A. Wild, and E. S. Williams. 1998

Epidemiology of chronic wasting disease in Rocky Mountain elk. Journal of Wildlife Diseases 34:532-538

Miller, M. W. 1994

Spongiform encephalopathy in free-ranging deer and elk. United States Animal Health Association. Grand Rapids, Michigan. Report. Pp. 581

Miller, M. W. 1996

Update on chronic wasting disease in free-ranging deer and elk. United States Animal Health Association. Little Rock, Arkansas. October.

Miller, M. W., E. S. Williams, C. W. McCarty, T. R. Spraker, and E. T. Thorne. 1996

Chronic wasting disease in free-ranging deer and wapiti: Epizootiological observations. Spongiform encephalopathies: Generating rational policy in the face of public fears. The Ceres Forum, Center for Food and Nutrition Policy, Georgetown University, Washington, D.C., Abstract #202

Miller, M. W., M. A. Wild, E. S. Williams, and E. T. Thorne. 1996

Chronic wasting disease of deer and elk: Epizootiological evidence of lateral transmission. Wildlife Disease Association Annual Meeting, Fairbanks, Alaska. July. Abstract # 44.

Miller, M. W. 1990

Animal and pen support facilities for mammals research Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-3, WP1a, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA. 45-63

Miller, M. W. 1996

Monitoring and managing wildlife diseases in Colorado. In Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W-153-R-9, WP1a, J6. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Miller, M. W., and R. Kahn. 1999

Chronic wasting disease in Colorado deer and elk: recommendations for statewide monitoring and experimental management planning. Unpublished report, Colorado Division of Wildlife, Denver, USA.

- Miller, M. W., C. W. McCarty, C. A. Mehaffy, R. Ford, and E. S. Williams. 1995

 Monitoring and managing wildlife diseases in Colorado. Pages 142-150 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W-153-R-8, WP1a, J6. Colorado Division of Wildlife, Fort Collins, Colorado, USA.
- Miller, M. W., C. W. McCarty, D. M. Getzy, C. A. Mehaffy, M. L. Stevens, E. S. Williams, W. J. Adrian, and T. R. Spraker. 1994

Monitoring and managing wildlife health in Colorado. Pages 91-102 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-7, WP1a, J6. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

- Miller, M. W., M. A. Wild, B. J. Maynard, and G. A. Stout. 1991
 - Animal and pen support facilities for mammals research. IssPages 73-84 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-4, WP1a, J1, Wildlife Research Report, Part 2. Colorado Division of Wildlife, Fort Collins, Colorado, USA.
- Miller, M. W., M. L. Stevens, W. J. Adrian, T. R. Spraker, and E. S. Williams. 1992 Monitoring and managing wildlife health in Colorado. Pages 141-150 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-5, WP1a, J6. Colorado Division of Wildlife, Fort Collins, Colorado, USA.
- Miller, M. W., M. L. Stevens, W. J. Adrian, T. R. Spraker, E. S. Williams, C. W. McCarty, and D. M. Getzy. 1993 Monitoring and managing wildlife health in Colorado. Pages 151-159 in Wildlife Research Report, Part 2, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-6, WP1a, J6. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Neil, P. H. 1985

Animal and pen support facilities for mammals research. Pages 99-102 in Wildlife Research Report, Part 2, Federal Aid Projects, 01-03-048, 15080, Mammals 2, Job Progress Report, WP1, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Neil, P. H. 1986

Animal and pen support facilities for mammals research. Pages 159-162 in Wildlife Research Report, Part 2, Mammals 2 Research, Federal Aid Project FW 26 P, Job Progress Report, Project 01-03-048, WP1, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

O'Rourke, K. I., T. E. Besser, M. W. Miller, T. F. Cline, T. R. Spraker, A. L. Jenny, M. A. Wild, G. L. Zebarth, and E. S. Williams. 1999

PrP genotypes of captive and free-ranging Rocky Mountain elk (Cervus elaphus nelsoni) with chronic wasting disease. Journal of General Virology 80:2765–2769

- Peters, J., J. M. Miller, A. L. Jenny, T. L. Peterson, and K. P. Carmichael. 2000 Immunohistochemical diagnosis of chronic wasting disease in preclinically affected elk from a captive herd. Journal of Veterinary Diagnostic Investigation 12:579–582
- Prusiner, S., and W. J. Hadlow, editors. 1979 Slow transmissible diseases of the nervous system. Academic Press, New York, USA

Purdey, M. 2000

Ecosystems supporting clusters of sporadic TSEs demonstrate excesses of the radical-generating divalent cation manganese and deficiencies of antioxidant co factors Cu, Se, Fe, Zn. Does a foreign cation substitution at prion protein's Cu domain initia Med Hypotheses 2000 Feb;54(2): 278-306

- Quirk, M. 2002
 - CWD and neurological disease cluster link investigated. Lancet Infect Dis 2002 Nov;2(11): 652
- Race, R. E., A. Raines, R. Cutlip, M. W. Miller, A. Jenny, and E. S. Williams. 2002

 Disease associated prion protein immunoblot profiles in brain and lymphoid tissues of CWD affected deer and elk, and brain of scrapie affected sheep and cattle. Journal of Virology: In press
- Race, R. E., A. Raines, T. G. Baron, M. W. Miller, A. Jenny, E. S. Williams. 2002 Comparison of abnormal prion protein glycoform patterns from transmissible spongiform encephalopathy agent-infected deer, elk, sheep, and cattle. J Virol 2002 Dec;76(23): 12365-8
- Raymond, G. J., A. Bossers, L. D. Raymond, K. I. O'Rourke, L. E. McHolland, P. K. Bryant, III, M. W. Miller, E. S. Williams, M. Smits, and B. Caughey. 2000
 - Evidence of a molecular barrier limiting susceptibility of humans, cattle and sheep to chronic wasting disease. European Molecular Biology Organization Journal 19:4425–4430
- Safar, J. G., M. Scott, J. Monaghan, C. Deering, S. Didorenko, J. Vergara, H. Ball, G. Legname, E. Leclerc, L.
 Solforosi, H. Serban, D. Groth, D. R. Burton, S. B. Prusiner, R. A. Williamson. 2002
 Measuring prions causing bovine spongiform encephalopathy or chronic wasting disease by immunoassays and transgenic mice. Nat Biotechnol 2002 Nov;20(11): 1147-50
- Schmerr, M. J., A. L. Jenny, M. S. Bulgin, J. M. Miller, A. N. Hamir, R. C. Cutlip, K. R. Goodwin. 1999
 Use of capillary electrophoresis and fluorescent labeled peptides to detect the abnormal prion protein in the blood of animals that are infected with a transmissible spongiform encephalopathy. J Chromatogr A 1999 Aug 20;853(1-2): 207-14
- Schreuder, B. E. C. 1994
 Animal spongiform encephalopathies an update. Part I. Scrapie and lesser known animal spongiform encephalopathies. Veterinary Quarterly 16: 174-181
- Sigurdson, C. J., C. Barillas-Mury, M. W. Miller, B. Oesch, L. J. van Keulen, J. P. Langeveld, E. A. Hoover. 2002 PrPCWD lymphoid cell targets in early and advanced chronic wasting disease of mule deer. J Gen Virol 2002 Oct;83(Pt 10): 2617-28
- Sigurdson, C. J., E. S. Williams, M. W. Miller, T. R. Spraker, K. I. O'Rourke, and E. A. Hoover. 1999 Oral transmission and early lymphoid tropism of chronic wasting disease PrPres in mule deer fawns (Odocoileus hemionus). Journal of General Virology 80:2757–2764
- Sigurdson, C. J., T. R. Spraker, M. W. Miller, B. Oesch, E. A. Hoover. 2001 PrPCWD in the myenteric plexus, vagosympathetic trunk and endocrine glands of deer with chronic wasting disease J Gen Virol 2001 Oct;82(Pt 10): 2327-34
- Sohn, H. J., J. H. Kim, K. S. Choi, J. J. Nah, Y. S. Joo, Y. H. Jean, S. W. Ahn, O. K. Kim, D. Y. Kim, A. Balachandran. 2002
- A case of chronic wasting disease in an elk imported to Korea from Canada. J Vet Med Sci 2002 Sep;64(9): 855-8 Spraker, T. R., K. I. O'Rourke, A. Balachandran, R. R. Zink, B. A. Cummings, M. W. Miller, and B. E. Powers. 2002
 - a. Validation of monoclonal antibody F99/97.6.1 for immunohistochemical staining of brain and tonsil in mule deer (Odocoileus hemionus) with chronic wasting disease. Journal of Veterinary Diagnostic Investigation 14:3–7
- Spraker, T. R., M. W. Miller, E. S. Williams, D. M. Getzy, W. J. Adrian, G. G. Schoonveld, R. A. Spowart, K. I. O'Rourke, J. M. Miller, and P. A. Merz. 1997
 - Spongiform encephalopathy in free-ranging mule deer (Odocoileus hemionus), white-tailed deer (Odocoileus virginianus), and Rocky Mountain elk (Cervus elaphus nelsoni) in northcentral Colorado. Journal of Wildlife Diseases 33:1–6

- Spraker, T. R., R. R. Zink, B. A. Cummings, C. J. Sigurdson, M. W. Miller, K. I. O'Rourke. 2002 Distribution of protease-resistant prion protein and spongiform encephalopathy in free-ranging mule deer (Odocoileus hemionus) with chronic wasting disease. Vet Pathol. 2002 Sep;39(5): 546-56
- Spraker, T. R., R. R. Zink, B. A. Cummings, M. A. Wild, M. W. Miller, and K. I. O'Rourke. 2002 b. Comparison of histological lesions and immunohistochemical staining of proteinase resistant prion protein in a naturally-occurring spongiform encephalopathy of free-ranging mule deer (Odocoileus hemionus) with those of chronic wasting disease of Veterinary Pathology 39:110–119
- Spraker, T. R., M. W. Miller, E. S. Williams, W. J. Adrian, G. G. Schoonveld, and R. A. Spowart. 1995 Spongiform encephalopathy in free-ranging cervids in Colorado. Proceedings of the Joint Conference of the American Association of Zoo Veterinarians, Wildlife Disease Association, and American Association of Wildlife Veterinarians. Page 515.
- Spraker, T. R., Miller, M. W., E. S. Williams, D. M. Getzy, W. J. Adrian, G. G. Schoonveld, and R. A. Spowart. 1994

Chronic wasting disease in free-ranging deer and elk in Larimer County, Colorado, 1981-1993: Clinical, pathological, and epizootiological observations. Wildlife Disease Association Annual Meeting, Asilomar, California. August. Abstract.

- Thackray, A. M., M. A. Klein, R. Bujdoso 2003 Subclinical Prion Disease Induced by Oral Inoculation Journal of Virology p. 7991-7998, Vol. 77, No. 14 p. 7991-7998
- Wechselberger, C., S. Wurm, W. Pfarr, O. Hoglinger. 2002
 The physiological functions of prion protein. Exp Cell Res 2002 Nov 15;281(1): 1-
- Weissmann, C., M. Enari, P. C. Klohn, D. Rossi, E. Flechsig 2002 Transmission of prions. J Infect Dis 2002 Dec 1;186 Suppl 2: S157-65
- Weissmann, C., M. Enari, P. C. Klohn, D. Rossi, E. Flechsig 2002 Molecular biology of prions. Acta Neurobiol Exp (Warsz) 2002;62(3): 153-66
- Wild M. A., T. R. Spraker, C. J. Sigurdson, K. I. O'Rourke, M. W. Miller. 2002

 Preclinical diagnosis of chronic wasting disease in captive mule deer (Odocoileus hemionus) and white-tailed deer (Odocoileus virginianus) using tonsillar biopsy. J Gen Virol 2002 Oct;83(Pt 10): 2629-34
- Williams, E. S. 2002

The transmissible spongiform encephalopathies: disease risks for North America. Vet Clin North Am Food Anim Pract 2002 Nov;18(3): 461-73

- Williams, E. S., J. K. Kirkwood, and M. W. Miller. 2001 Transmissible spongiform encephalopathies. in E. S. Williams and I. K. Barker, editors. Infectious diseases of wild mammals. Iowa State University Press, Ames, USA. Pages 292–301
- Williams, E. S., and M. W. Miller. 2002 Chronic wasting disease in deer and elk in North America. Revue Scientifique et Technique 21: 305-316
- Williams, E. S., and S. Young. 1980
 Chronic wasting disease of captive mule deer: a spongiform encephalopathy. Journal of Wildlife Diseases 16:89–98
- Williams, E. S., and S. Young. 1982 Spongiform encephalopathy of Rocky Mountain elk. Journal of Wildlife Diseases 18:465–471
- Williams, E. S., and S. Young. 1992

Spongiform encephalopathies of Cervidae. Revue Scientifique et Technique 11:551-567

Williams, E. S., and S. Young. 1993

Neuropathology of chronic wasting disease of mule deer (Odocoileus hemionus) and elk (Cervus elaphus nelsoni). Veterinary Pathology 30:36–45

Williams, E. S., M. W. Miller, T. J. Kreeger, R. H. Kahn, and E. T. Thorne. 2002

Chronic wasting disease of deer and elk: A review with recommendations for management. Journal of Wildlife Management 66:551–563

Williams, E.S., M.W. Miller and E.T. Thorne 2002

Chronic wasting disease: implications and challenges for wildlife managers. Transactions of the North American Wildlife and Natural Resources Conference 67:in press

Williams, E. S. 1996

Chronic wasting disease and TSEs in exotic species. Spongiform encephalopathies: Generating rational policy in the face of public fears. The Ceres Forum, Center for Food and Nutrition Policy, Georgetown University, Washington, D.C.

Williams, E. S., and M. W. Miller. 2002

Chronic wasting disease: implications and challenges for wildlife managers. Transactions of the North American Wildlife and Natural Resources Conference 67:In press.

Williams, E. S., and P. Neil. 1985

Epizootiologic features of chronic wasting disease in mule deer and elk. Proceedings of the American Association of Zoo Veterinarians, Scottsdale, Arizona.

Williams, E. S., and S. Young. 1980

Chronic wasting disease of captive mule deer. Wildlife Disease Association Conference, Baton Rouge, Louisiana. Abst. p. 24.

Williams, E. S., and S. Young. 1980

Neurohistopathology of a spontaneous spongiform encephalopathy of mule deer. Annual Meeting of the Conference of Research Workers in Animal Disease. Chicago, Illinois. Abst. #140.

Williams, E. S., E. T. Thorne, M. Miller, T. R. Spraker, and P. Neil. 1990

Epizootiology of cervid spongiform encephalopathy (chronic wasting disease). 6th International Conference on Wildlife Diseases, Berlin, G.D.R. Abstract.

Williams, E. S., M. W. Miller, S. Young, and E. T. Thorne. 1992

Chronic wasting disease: A spongiform encephalopathy of mule deer (Odocoileus hemionus) and Rocky Mountain elk (Cervus elaphus nelsoni) in Colorado and Wyoming, USA. New and Emerging Infectious Diseases. 12th International Symposium. Proceedings of the World Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases. B. Osburn, G. Castucci, and C. Schore (eds.). Pp. 249-252.

Williams, E. S., S. Young, and R. F. Marsh. 1982

Preliminary evidence of transmissibility of chronic wasting disease of mule deer. Wildlife Disease Association Conference, Madison, Wisconsin. Abst. #22.

Wild, M. A. 1995

Animal and pen support facilities for mammals research. Pages 119-135 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153?R?8, WP1a, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Wild, M. A., and J. L. Schaefer. 1996

Animal and pen support facilities for mammals research. In Wildlife Research Report, Mammals Research,

Federal Aid Projects, Job Progress Report, Project W?153?R?9, WP1a, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Wild, M. A., and W. S. Graffam. 1994

Animal and pen support facilities for mammals research. Pages 65-80 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-7, WP1a, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Wild, M. A., M. W. Miller, B. J. Maynard, and D. R. Magnuson. 1992
Animal and pen support facilities for mammals research. Pages 109-122 in Wildlife Research Report, Mammals Research, Federal Aid Projects, Job Progress Report, Project W?153-R-5, WP1a, J1. Colorado Division of Wildlife, Fort Collins, Colorado, USA.

Wolfe, L. L., M. M. Conner, T. H. Baker, V. J. Dreitz, K. P. Burnham, E. S. Williams, N. T. Hobbs, and M. W. Miller. 2002

Evaluation of antemortem sampling to estimate chronic wasting disease prevalence in free-ranging mule deer. Journal of Wildlife Management 66:564–573