

Year One Report

Chief Dull Knife College Research Lab Infrastructure Development.

Project Synopsis

Chief Dull Knife College has a number of undergraduate research programs, including long-term research programs, short-term research programs (emphasizing teams of students), and an international research program.

The college has had two long-term collaborative research projects with The University of Montana. The first was conducted from 1997 – 2006, and investigated thermoregulation in honey bee colonies. The second was started in 2006, and involves environmental microbiological research on a number of rivers in eastern & western Montana.

Chief Dull Knife's Science Department has had a long association with The University of Montana (U of M). That association began in 1997, when Bob Madsen spent the summer conducting honeybee thermoregulation research with Dr. Delbert Kilgore and Dr. Jerry Bromenshenk. That research continued through the summer of 2005, with Mr. Madsen and his students conducting honeybee research at the University of Montana. Funding for Mr. Madsen's summer honeybee research came from the NIH and the American Physiological Society. The research supported 12 undergraduate students. Undergraduates presented posters on this research at 5 scientific meetings.

Starting in the fall of 2005, Mr. Madsen used his contacts at The University of Montana to develop a new research project that better integrated into 100 & 200 level science courses taught at Chief Dull Knife College. In the summer of 2006, Mr. Madsen started that new research project with Dr. James Gannon and Dr. Bill Holben at the University of Montana. Mr. Madsen and three students worked in Dr. Gannon's and Dr. Holben's labs on projects that involved the development of low-cost water filters and the characterization of bacterial communities in the Nyack Flood Plane. Mr. Madsen used a variety of funding sources to fund that research including NSF TCUP funds from CDKC, and NIH Bridges and NSF REU funds from The U of M. During the 2006/07 – 2007/08 academic years, Mr. Madsen and Dr. Gannon began to write proposals to the NSF to strengthen their collaboration: Mr. Madsen and Jeff Hooker from CDKC submitted a NSF TCUP II proposal that included a full-time research position for Mr. Madsen and academic year and summer research internships for students in the spring of 2006; Mr. Madsen submitted a DOE Equipment proposal, to equip a PCR lab at CDKC, in the fall of 2006; and Dr. Gannon, Mr. Madsen and Dr. Philip Ramsey submitted a two-year NSF research proposal "Chronic Stress in Ecosystems Project" that included summer research positions for CDKC students at The U of M in the spring of 2007. All of the proposals were funded and came on line in the fall of 2007 (TCUP II and DOD Equipment) and the summer of 2008 (NSF Research).

Dr. Gannon, Mr. Madsen and Dr. Ramsey had planned to begin a research project on the Tongue River (adjacent to the Northern Cheyenne Reservation in southwest Montana) in the summer of 2009. Those plans were accelerated in the spring of 2008 when CDKC received Montana NSF-EPSCoR funds. With those funds, CDKC was able

to purchase a key piece of equipment for Dr. Gannon's NSF Research Project on the Clark Fork River and was able to hire Dr. Ramsey as a part-time Adjunct Faculty Member. EPSCoR funds allowed Mr. Madsen and Dr. Ramsey to train students and begin the Tongue River research in the summer of 2008. Chief Dull Knife College now has an active research project on the Tongue River and a fully functional PCR lab. Students at CDKC are involved in academic year and summer research on the development of low-cost water filters and characterizing the bacterial communities on the Tongue, Clark Fork, and Big Horn Rivers. During the past four years that research has involved 16 students from Chief Dull Knife College, undergraduate and graduate students from Dr. Gannon's lab (including one student working with CDKC students on Tongue River and Big Horn River isolates using EPSCoR funds), and two research professors from The University of Montana (Dr. Ramsey and Dr. Sergio Morales). Mr. Madsen's, Dr. Gannon's and Dr. Holben's labs are linked through joint summer and academic year research projects, research methods classes delivered by Dr. Ramsey and Dr. Morales, and video conferencing capabilities (PolyCom) between the two labs.

CDKC's environmental microbiology research is currently funded through CDKC's TCUP II Grant, Montana EPSCoR's Large Rivers Project, and a NSF SBIR supplemental grant. Dr. Ramsey and Mr. Madsen have submitted a second, three-year, proposal to NSF for continued support of the "Chronic Stress in Ecosystems Project".

The college has participated in two short-term NASA-supported student research programs through NASA's Reduced Gravity Student Flight Opportunities Program. Through this program, teams of students design experiments that fly on NASA's "Vomit Comet" at The Johnson Space Center. The research involved teams of CDKC students, Montana State University engineering students, and 3rd – 8th grade students on the Northern Cheyenne Reservation. CDKC and MSU students travel to Houston, TX and flav with the experiment on the "Vomit Comet". CDKC has taken student experiments twice. In 2000, we flew an experiment on alfalfa leafcutting bee flight behavior in microgravity (The Bee Gs), and in 2003, we flew an experiment on baking soda & vinegar reactions in microgravity (The Fizz Kids). These projects involved 9 CDKC students and 80 3rd-8th grade students.

CDKC is currently conducting NASA-supported research through the Montana Space Grant Consortium and the NASA/AIHEC Tribal College and University Summer Research Experience Program. These programs have supported one CDKC faculty member and two students to do GIS/GPS and remote sensing research projects on the Northern Cheyenne Reservation. CDKC students used a tethered blimp, supplied by the Montana Space Grant Consortium, to conduct research on distribution of noxious weeds during the summer of 2009 and will conduct research to locate abandoned homesteads during 2010 summer. CDKC and Montana State University are developing and testing a near IR camera system to be used on a new "Kingfisher" tethered balloon (again supplied by the Montana Space Grant Consortium) for the 2010 research program. The "Kingfisher" and near IR camera will also be used to support Mr. Madsen's and Mr. Stiff's research (see below).

CDKC international research is supported through a Montana State University USDA Challenge Grant and through CDKC's TCUP Grant. Through this program, CDKC students travel to Mali, West Africa to research the effectiveness of integrated pest management strategies delivered by Peace Corps Volunteers to Malian farmers. Students spend 10-12 days in Mali working with Malian agricultural researchers, Malian

farmers, and Peace Corps Volunteers. Eleven CDKC students have traveled to Mali as participants in this program (2003, 2005, 2006, 2007, 2008 & 2009). Four students have returned to Mali for a second time.

Additional CDKC faculty have become involved with projects related to Mr. Madsen's research. Mr. Jim Bertin (math instructor, funded by The U of M's Chemistry REU) has worked with Mr. Madsen, Dr. Ramsey and chemistry faculty at The University of Montana for the past three summers. Mr. Vince Hurtig (math instructor) was the faculty member working with students on the GIS/GPS remote sensing project in the summer of 2009 and he will continue to work with students on this project in 2010. Mr. Brian Stiff (science instructor) is starting a research project on West Nile Virus funded by the Montana INBRE Program (NIH).

Mr. Stiff's research is a collaborative effort between Chief Dull Knife College, two other Montana Tribal Colleges, Montana State University, and Carroll College, located in Helena, Montana to determine the spatial temporal risk of exposure to West Nile Virus (WNV). The original research proposal, "*Spatial Epidemiology of West Nile Virus Infection Risk across Montana*," was developed by Dr. Grant Hokit of Carroll College and submitted to the Montana INBRE program. The primary goal of this project is to develop a landscape-scale model of West Nile Virus (WNV) infection risk for the state of Montana. A null model of WNV infection risk for Montana will be constructed using a geographic information system (GIS) and landscape modeling techniques to create a spatially explicit model of *C. tarsalis* populations, the primary mosquito vector in Montana. Further mosquito sampling at both the microhabitat and landscape scales will help validate the model and augment current mosquito surveillance efforts in Montana. RT-PCR and a TaqMan assay will be used to test for the presence of WNV in pools of 50 or fewer mosquitoes. Blood meals from engorged mosquitoes will be used to isolate the DNA of hosts and identify the bird species at risk for WNV infection. To characterize the spatiotemporal variation in genetic structure of WNV, RNA from samples testing positive for WNV will be sequenced and analyzed using phylogenetic techniques.

Throughout this project, undergraduate researchers will be trained in the techniques of spatial epidemiology, molecular biology, and phylogenetics. Chief Dull Knife College was funded in year-one to develop the infrastructure necessary to participate as an effective collaborator in this research project. The College provided the space and the INBRE grant funded the basic setup for the new West Nile Virus Laboratory however to produce a fully functional, multipurpose laboratory facility requires additional funding for specific equipment, materials and remodeling of the facility.

Year One Results and Expenditures

The primary activities for year one were organizing the laboratory itself and offering some training to the paraprofessional and intern students in the science program. During the first year five students worked with three professors and doctoral candidates from the University of Montana to develop expertise in sampling techniques and laboratory analysis of water samples taken from the Tongue River in Southeastern Montana. Sean Gibbons, now at the Argonne National Labs, visited the campus and worked with students to establish collection protocols on the river and then gave instruction in the proper preparation and handling of the samples. Samples were subsequently sent to the national labs for final live-PCR analysis. Sergio Morales also came to the Chief Dull Knife campus and worked directly with students on "traditional" PCR techniques and use of the metagenomics database. Five student interns and one Microbiology science class were impacted by his visit.

Three laboratory tables and two glassware cabinets were purchased using grant monies during the year one period as well. Total for these expenditures was \$5,776.62 and allowed the researchers additional storage and working space in the labs for specimen examination and documentation. These expenditures represent the beginning of laboratory upgrades necessary to continue research in the areas mentioned in the "Project Synopsis" above.

Travel funded by the grant in year one included trips to the Lame Deer campus from the University of Montana by Sergio Morales and Phillip Ramsey, both contributors and adjunct faculty to the college. A third trip was funded to Argonne Labs for Sean Gibbons. Argonne Labs has since agreed to process future specimens from Chief Dull Knife College in an ongoing collaboration with Labs.

The total expenditures for adjunct faculty, lab furnishings and travel for this grant period (year one) is \$13,753.77. Much of the work has experienced a delay in start date but is now underway. As you may know the college has lost the Principal Investigator (due to death) but the project has continued under new supervision.