

Resilience

COVID-19 ushered in a period of great uncertainty. In the face of this unprecedented time, researchers find deeper resilience and persevere to continue their research amid new challenges. While the pandemic has forced colleges and universities across the country to shutter campus buildings and transform the classroom into a virtual learning space, many research laboratories remain open and researchers continue their important work here in ND and around the world.

Resilience is a treasured skill, both personally and professionally. Resilience improves our ability to cope with the unexpected and recover swiftly from difficulties, skills that are invaluable to have in the workforce of today and tomorrow. This pandemic underscores the importance of preparing our students in the classroom and in the lab to engage their talents in ways that expand and strengthen ND's local communities and economy.

ND EPSCoR leaders and researchers have sought meaningful experiences from these unprecedented circumstances with a new sense of purpose. The unique trials presented by these times build even stronger teams as our research and outreach efforts continue across the state. We are proud of the resilience and accomplishments of our researchers, students, mentors, and staff who work diligently to continue to make a difference even when faced with difficult new challenges and ambiguity.

The Center for Regional Climate Studies (CRCS) research collaborations continue to enhance the educational opportunities on their campuses and across the state. Amid campus building closures, CRCS continues its vital research into developing improved models for agricultural land use, hydrology, climate patterns, soil health, and economic forecasting for various ND crops.

The Center for Sustainable Materials Science (CSMS) remains open and continues its collaborations with researchers in the state and across the nation. CSMS researchers carry on the development of

sustainable materials that have the potential for a positive impact on the state's agricultural community. The insightful and cross-disciplinary collaborative work of the CRCS and the CSMS remains strong because of the resilience of researchers during this uncertain time and their dedication to positively impacting ND and the world. The mission of ND EPSCoR is to broaden and diversify ND's science, technology, engineering, and mathematics (STEM) workforce pathway from elementary through graduate school and to support and grow STEM research capacity and competitiveness at educational institutions across the state.

We learn resilience from examples set by our teachers, colleagues, family, and friends, which result in greater personal and professional development in a multitude of ways. We look to each other to consider the new challenges before us and rise to meet them with creative and innovative solutions.

As ND EPSCoR continues its research and outreach commitments, the impact of COVID-19 on our researchers has been one of positive growth in resilience, which affirms the importance of our mission and the significance of our continued efforts to serve the state. We are also reminded of the importance of resilience in education. Our institutions and research centers instill resilience in our students today that will benefit the future of ND.

I continue to send my earnest words of support to each of you during this time. The COVID-19 pandemic has interrupted our daily lives and demonstrated the important role of fundamental research in our global economy. I hope that you are, and will continue to be, safe and well.



Regards,
Kelly A. Rusch, Ph.D., P.E., BCEE
ND EPSCoR Executive Director

NDSU awarded \$20 million NSF EPSCoR RII Track-1 award

The National Science Foundation (NSF) awarded a new five-year competitive research infrastructure improvement (RII) Track-1 cooperative agreement totaling \$20 million to NDSU on behalf of the ND EPSCoR jurisdiction and all 10 participating institutions: NDSU, UND, Cankdeska Cikana Community College (CCCC), Dickinson State University (DSU), Mayville State University (Mayville State), Minot State University (Minot State), Nueta Hidatsa Sahnish College (NHSC), Sitting Bull College (SBC), Turtle Mountain Community College (TMCC), and Valley City State University (VCSU).

ND-ACES (New Discoveries in the Advanced Interface of Computation, Engineering, and Science) is led by Kelly A. Rusch, Ph.D., PE, BCEE (Executive Director – ND EPSCoR and Professor – Department of Civil and Environmental Engineering, NDSU). Co-PIs on the award are Dr. John Mihelich, Interim Vice President for Research and Economic Development, UND and Dr. Jean Ostrom-Blonigen, CPA, Project Administrator, ND EPSCoR.



ND-ACES focus: a biointerfaces center integrated with statewide education, workforce, and broadened participation to support the emerging bioscience sector.

“North Dakota’s new NSF EPSCoR RII Track-1 award focuses on bringing together researchers in computational science, material science and engineering, and cellular systems,” said Rusch. “An exciting piece of this effort is the contribution from researchers and students across ten different higher education institutions within the state. The long-term goal is for the new discoveries to inform the development of technologies and therapies that better address the treatment of metastasized cancer. However, the research alone does not comprise the complete picture. ND-ACES will allow for increasing

capacity and competitiveness throughout the jurisdiction through numerous workforce and education development programs, broadened K12 STEM pathway activities, expanded collaborations and partnerships focused on moving research findings into the private sector, and bringing an understanding of the research to a statewide audience.”

“This project aims to foster collaboration among several universities within this jurisdiction, including institutions from underrepresented communities, to study and better understand biological interfaces related to cancer,” said NSF EPSCoR program manager José Colom-Ustariz. “Over the next five years, this project will not only increase research capacity and competitiveness within this jurisdiction, but will also address a research area of national importance by helping us understand the physical basis of tumor growth and metastasis.”

ND-ACES funds the Center for Cellular Biointerfaces in Science and Engineering (**CCBSE**), which will be fully integrated with corresponding efforts for PROMoting Sustainable Partnerships in Education and Research (**PROSPER**).

The **CCBSE** is co-led by NDSU University Distinguished Professor Kalpana S. Katti, Ph.D., F. AIMBE and UND Chester Fritz Distinguished Professor Colin K. Combs, Ph.D. The CCBSE will expand ND’s knowledge base and capacity about the growth of breast and prostate cancer cells that mimic primary and metastatic tumors. Researchers will use computational modeling to gather an improved interdisciplinary understanding of biological and engineered materials biointerfaces; expand expertise in novel cellular growth and analysis for mimicking the in vivo environment, catalyze research/computing capabilities; and support the development of research into use through product development. Co-led by a NDSU and a UND faculty member, each of the three CCBSE research pillars will support the expansion of bioscience research capacity and advanced understanding of the biochemistry and cell biology of cancer cells and tumors.

Material designs at biointerfaces. Co-led by Sanku Mallik (NDSU) and Julia Zhao (UND). Team members: Austin Allard (TMCC), Mikhail Bobylev (Minot State), Khwaja Hossain (Mayville State), Kalpana Katti (NDSU), Mike Parker (CCCC), Mohi Quadir (NDSU), Brent Voels (CCCC), and Wenjie Xia (NDSU).

Cellular Systems at materials interface. Co-led by Archana Dhasarathy (UND) and John Wilkinson (NDSU). Team members: Colin Combs (UND), Nicholas Galt (VCSU), Amanda Haage (UND), Kerry Hartman (NHSC),

Kalpana Katti (NDSU), Jiha Kim (NDSU), Joshua Steffan (DSU), and Hilde van Gijssel (VCSU).

Computation, machine learning, and predictive modeling. Co-led by Dinesh Katti (NDSU) and Tao Yu (UND). Team members: Deniz Cakir (UND), Jerome Delhommelle (UND), Svetlana Kilina (NDSU), Lu Liu (NDSU) and Wenjie Xia (NDSU). Support for this pillar will come from the high performance computing centers at NDSU (Dane Skow) and UND (Aaron Bergstrom).

PROSPER, the broadening participation arm of ND-ACES, will provide education and experiences designed to build a diverse workforce, enhance partnerships and collaborations with various stakeholders, and inform ND's residents. The four components of PROSPER include:

Education and workforce development. Led by Rachel Navarro and Sarah Sletten (both UND) and co-led by Shireen Alemadi (ND EPSCoR), this initiative supports faculty professional development, student training, and K-12 student bioscience, engineering, and computational exposure. Ryan Summers (UND) completes this team.

Broadening Participation. Led by Van Doze (UND) and co-led by Scott Hanson (ND EPSCoR), this initiative supports American Indian students along the biosciences pathway. Team members include the TCU NATURE Coordinators: Austin Allard (TMCC), Chris Dahlen (CCCC), Kerry Hartman (NHSC), and Mafany Ndiva Mongoh (SBC).

Partnerships and Collaborations. Led by Kelly Rusch (NDSU) and co-led by John Mihelich (UND) and Jean Ostrom-Blonigen (ND EPSCoR), this initiative builds research infrastructure and strengthen ND's research competitiveness through industry partnerships and other collaborations. Team members include the CCBSE leadership. Support for this activity will come from NDSU's Industry Relations and Intellectual Property (Jolynne Tschetter) and UND's Center for Innovation (Amy Whitney).

Communication and Dissemination. Led by Zoltan Madjik (NDSU) and co-led by Cailin Shovkoplyas (ND EPSCoR), this ND-ACES wide initiative keeps all stakeholders informed, supports the harmonious interactions of all ND-ACES groups, assists research and programmatic participants in disseminating their work to legislative, scientific, and citizen stakeholders, and develops materials for consumption by lay audiences.

Tips and tools available for remote undergraduate research and internships

Many students and researchers have found ways to continue to their work remotely. Here are our highlights of two available resources to support remote research and internships:

1. *Virtual Undergraduate Research: "Virtual Undergraduate Research in Action- Highlights and How Tos,"* hosted by the Council on Undergraduate Research and the National Science Foundation- EPSCoR Education, Outreach & Diversity Council.

In the "Virtual Undergraduate Research" webinar, Kymberly Harris (Georgia Southern University), stressed the importance of building a community of inquiry in online spaces. Students should be given the space online to present aspects of their authentic selves, and they should also engage with course content and each other in meaningful dialogue. Many technologies can help teachers meet these goals.

Being more explicit in communications was a method that Jennifer Grewe and Crissa Levin (Utah State University) recommended based on their experience running a distance undergraduate research lab. Learning goals might be similar to the goals in a physical lab, but stressing them becomes even more important in a remote environment where the products of research may not be as apparent to students.

2. *Virtual Internships: "Continuing Internships in a Virtual World,"* hosted by STEMconnector.

In addition to research, upcoming internships may also be moving online. This is an opportunity for companies to expand their pool of internship applicants. While a company may usually limit acceptance to students from nearby schools, an online environment opens up the possibility of participation from students across the state.

For students who had in-person internships that were cancelled, the webinar recommended that students reach back out to the companies. "They should not be afraid to take initiative," said Shireen Alemadi, who manages ND EPSCoR's student internship program STTAR (Students in Technology Transfer And Research). Depending on the context and if the company lost funding for paying interns, students should consider offering "to help [the company] in a different way to still gain some experience."

The story in the soil

The nutrients in North Dakota's soils have decreased significantly over the past 130 years. According to **Dave Franzen** (CRCS, NDSU Professor of Soil Science and Extension Soil Specialist), phosphate levels are so low that it would take about 200 years of continued fertilizer application, plus no soil loss, to reach the same phosphate levels that North Dakota had in its soil in 1890.

In his presentation, "A History of Phosphate Export from North Dakota," delivered on May 5, 2020, as part of the NDSU Extension Soil Health Webinar series, Franzen described the multiple factors that led to North Dakota's soil depletion. Before the European settlers began farming the land in North Dakota, the topsoil had relatively high levels of phosphorus, nitrogen, and potassium. The land was also scattered with bison bones, which are rich in phosphorus. Many of the bones were there due to natural causes or native hunting events, but some were there as a result of the US Government's efforts in the late 1800s to force American Indians onto reservations.



A large pile of bison bones collected by North Dakota settlers and sold for cash. Exporting these bones meant exporting phosphate. This collection was made at Krem, ND, which was located north of Hazen, ND. Photo permission granted from the Germans from Russia Heritage Collection, NDSU Libraries, Fargo – www.ndsu.edu/grhc.

When European settlers began farming the land in North Dakota, many of the bison bones had to be removed to make room for the plows. This effort accelerated when industries, realizing their use in products such as fertilizer, began offering to buy the bones from farmers.

Bones became especially valuable for farmers who were just starting out or facing a tough year. These forces combined led to a substantial bone export out of North Dakota. Franzen estimates that about 3,200,000 tons of bones were shipped east, removing about 480,000 tons of phosphorus from the state's ecosystem. "For comparison," Franzen said, "That's about two years of [phosphorus] fertilizer use at present rates, which are at a historic high."

Another factor that has led to phosphorus depletion in the soil is wind erosion. North Dakota is one of the windiest states in the country, and Franzen says that many people underestimate the height of dust storms and their effect. Wind does not simply displace soil from one farm to another; rather, wind can remove nutrient-rich soil from an area completely. For example, during one dust storm on April 22, 1934, aviators in Bismarck, ND, reported dust up to 14,000 feet.



Horses stand in a dust storm near Williston, ND, in October 1937. Strong winds and dust storms are still common in North Dakota today. Photo from Library of Congress, Prints & Photographs Division, FSA/OWI Collection, LC-USF34-030876.

By the late 1930s, North Dakota had lost an average of six inches of topsoil from about 30 million acres of cropland. One analysis estimated that the dust that blew away in the 1930s contained about 19 times more phosphorus than the soil that remained. As another example, in 1980, North Dakota lost about one inch of soil from 2.1 million acres of land.

What can farmers do to help restore their land? Tillage can mask the problems of depleted soils, but it

doesn't restore the land. "The only way to restore soils is through a long-term no-till commitment," Franzen said.

NATURE camps embrace format change to support social distancing

Scott Hanson, ND EPSCoR TCU (tribal college/university) liaison and Nurturing American Tribal Undergraduate Research and Education (NATURE) manager, is working with the NATURE coordinators to set up an online version of the NATURE TCU camps for middle and high school American Indian students.

During the first two weeks in June, ND EPSCoR usually hosts its NATURE University Summer camp on the UND and NDSU campuses for American Indian TCU students. Typically, during this camp, participants tour the NDSU and UND campuses, tour STEM labs, meet research university faculty, and conduct short research projects.

Due to COVID-19, ND EPSCoR cancelled the in-person camp; however, ND EPSCoR will offer a variety of online options for TCU participants this summer which will include virtual lab tours and virtual meetings with faculty.

During the virtual lab tours, each researcher will be able to talk to participants about his/her area of teaching and research and show photos and video of their research process. During the virtual meetings, faculty will have real-time discussions with students about STEM degree opportunities, research prospects, and STEM careers. Participants will be mailed kits and supplies for STEM activities that they can do at home. Camp instructors will interact with them virtually to guide them through the activities and to facilitate discussion and interaction amongst participants.

Similarly, Hanson and NATURE coordinators at Sitting Bull College, Turtle Mountain Community College, and United Tribes Technical College are designing online bridge camps on their campuses. NATURE coordinators will mail participants supplies and instructors will interact with participants virtually.

The online platform will allow the three TCUs to share instructors, activities, and projects. This format will also enable participants from the three separate communities to interact and collaborate. These virtual camp experiences will continue to strengthen the STEM pathways for American Indian youth in ND despite the need for social distancing.

Awards and presentations

Teaching

Paul Barnhart, Center for Regional Climate Studies (CRCS) researcher and Assistant Professor of Biology at Dickinson State University, was awarded the 2020 Excellence in Teaching Award from Dickinson State. Congratulations to Barnhart!

Undergraduate research

Under the STEM Research and Education RFP, ND EPSCoR awarded **Brent Voels** internal state funding to promote undergraduate research at Cankdeska Cikana Community College (CCCC). Voels teaches science at CCCC, and ND EPSCoR funds allowed him to hire CCCC student Alexis Lohnes as a student researcher, who worked on research during the fall of 2019 through spring of 2020. Lohnes researched the role of the SLFN12 protein in human urothelial cancer. This type of cancer is strongly linked to environmental causes; smoking and exposure to arsenic are "clearly implicated" in causing urothelial cancer, Voels said. In contrast, the SLFN12 protein is "poorly understood" and needs more research. Lohnes measured the expression levels of SLFN12 in metal transformed UROtsa cells by using western blotting protocol. Western blot is a common technique used to detect and analyze proteins. Lohnes "optimized the western blotting protocol several times," becoming "very skilled in executing the protocol," Voels said.

Coatings

"Towards Sustainability in Coatings Technology: Progress, Opportunities, Barriers" presentation by **Dean Webster** (Center for Sustainable Materials Science [CSMS] researcher and professor and chair of NDSU Coatings and Polymeric Materials), 47th Annual International Waterborne Symposium, School of Polymers and High Performance Materials at the University of Southern Mississippi, Feb. 16-21, 2020.

Webster was the plenary speaker at this year's annual symposium held in February 2020. The Waterborne Symposium is a forum for "environmentally friendly coatings technologies," according to the [Coatings World April 15, 2020 article about the event](#). Webster's talk focused on how the coatings industry has been working toward making more environmentally sustainable products. For example, the industry has been moving toward waterborne and powder coatings as a way to reduce the unstable, harmful chemicals found in paint. How far "we can go in creating a fully sustainable coatings industry" is a question that remains to be answered, Webster said.

Chemistry

“An Improved Method of Synthesis of a Key Precursor for Multitarget Drugs against Alzheimer’s Disease” presentation by **Alexandria Hamm** (CSMS), the Council on Undergraduate Research’s 24th annual Posters on the Hill, April 21, 2020.

Hamm is an undergraduate student majoring in biology and mentored by **Mikhail Bobylev**, CSMS researcher and chemistry professor at Minot State University. The in-person Posters on the Hill event was moved to a virtual format due to COVID-19, and [Hamm shared her research via Twitter on April 21](#). Her research developed a new method to synthesize “a precursor for multitarget drugs for Alzheimer’s Disease...This new method is simple, fast, and produces little to no waste,” Hamm said.

Funding opportunities

DEPSCoR Regional DoD Day

Congress recently re-established the Defense Established Program to Stimulate Competitive Research (DEPSCoR) Program. The Department of Defense (DoD) has asked the University of South Dakota to host a regional DEPSCoR DoD Day, where DoD program managers will provide information about the DEPSCoR program as well as general information about working with the DoD. The regional DEPSCoR Day will be held **September 10, 2020**, in Vermillion, SD. For more information or to register for the event, please see:

[DEPSCoR Regional DoD Day](#)

DEPSCoR Funding Opportunity

The funding opportunity announcement for the FY20 DEPSCoR Competition is now available. DEPSCoR is a capacity building program designed to support the research capabilities at institutions of higher education to perform competitive basic research in science and engineering that is pertinent to the DoD mission and reflect national security priorities. The deadline for paper submissions is **September 21, 2020**. For more information, please see:

[DEPSCoR Funding Opportunity](#)

EPSCoR Workshop Opportunities

EPSCoR is designed to fulfill the mandate of NSF to promote scientific progress nationwide, and NSF EPSCoR welcomes proposals for workshops in **Solicitation NSF 19-588**. These workshops focus on multi-jurisdictional efforts of regional to national importance related to EPSCoR's goals and NSF's mission.

For more information, please see the RFP: [EPSCoR Workshop Opportunities](#)

K-12 STEM needs survey

To facilitate bridges between K-12 and higher education, ND EPSCoR is working to produce an in-depth report on K-12 STEM needs. The goal: to better prepare our students for careers in STEM fields.



Shireen Alemadi, ND EPSCoR STEM Manager, is looking to K-12 teachers, administrators, and other personnel (e.g., guidance counselors) to provide information, and she is asking all K-12 faculty and staff to complete an anonymous survey, either through this QR code (left) or by completing the [survey](#).

By gathering this important information, ND EPSCoR will be able to compile a comprehensive report of what ND K-12 is doing in STEM and reviewing how higher education can support these STEM efforts.

For more information, please contact Shireen Alemadi at shireen.alemadi@ndus.edu.

ND EPSCoR partnering to create STEM lesson plans for high school teachers

By **Shireen Alemadi**, STEM Manager (*right*)



Over the last few months ND EPSCoR has been working on ways to connect STEM opportunities to more K-12 teachers across the state. One of the ways we will be doing that, come this fall, is by having full STEM lesson plans available for high school teachers. ND EPSCoR will be working with K-12 outreach professionals from various universities in North Dakota to identify their top STEM outreach activities, and ND EPSCoR will then partner with ND teachers who graduated from those universities to develop those activities into full lesson plans. Scott Hanson, the ND EPSCoR Tribal College Liaison and NATURE Manager, is also working on taking the Sunday Academy activities from past years and partnering with ND teachers to flesh out the activities to full lesson plans. The Sunday Academy activities were created by NDSU, UND, and TCU faculty in collaboration with TCU faculty, cultural experts, and K-12 teachers from tribal communities. The lesson plans from the K-12

and Sunday Academy outreach activities will allow ND K-12 teachers to connect to the ND college/university faculty who are working in a variety of STEM areas. Students in K-12 will be able to connect with ND STEM professionals in a new and exciting way.

All lesson plans created will be available for free through an online education portal on the ND EPSCoR website. We are currently vetting software companies and plan to have the site live by the time school starts in fall of 2020. If you have any questions, feel free to reach out to Scott Hanson (scott.martin.hanson@ndus.edu) about the Sunday Academy lesson plans and Shireen Alemadi (shireen.alemadi@ndus.edu) about the K-12 outreach activity lesson plans.

Award extensions for internal funding from ND EPSCoR

By **Janelle Smith**, Business Manager (right)



It seems COVID-19 and the many impacts on our daily life are front and center on everybody's minds right now. Work situations are disrupted, students are off campus and adjusting to online courses, and faculty are navigating the transition to fully online learning instead of face-to-face interactions. While we are all dealing with the uncertainty of the current situation, I've also seen an incredible resiliency in the entire research community.

ND EPSCoR understands the challenges of operating under our present conditions and wants to help. The awards given under the August 2019 ND EPSCoR STEM Research and Education RFP (internal funding) were set to end on May 31, 2020. Because of the anticipated impacts of COVID-19 on students, travel, supply chains, etc., ND EPSCoR extended most of these awards through the fall semester. If you still need an extension on your STEM award, please contact me at: janelle.smith@ndus.edu

At this time, awardees are also encouraged to review their budgets, given the change in circumstances, and submit a rebudget request if it is deemed necessary. Costs must still be allowable, reasonable, allocable, and treated consistently. There are still restrictions on certain categories of expenses but we are happy to help you find a solution that will work during these challenging times.

Welcome new Communication Manager

By **Jean Ostrom-Blonigen**, State Project Administrator

Please join me in welcoming ND EPSCoR's new Communication Manager, **Cailin Shovkoplyas** (right). Originally from Federal Way, WA, with a Master's Degree in Business Administration, Cailin worked as the Business Grant Writer at Fargo Public Schools after moving to Fargo three years ago. Prior to that, Cailin worked for Simply Placed Professional Organizing and Productivity Consulting in a dedicated marketing role.



In her ND EPSCoR role, Cailin will lead all communication efforts.

If you are interested in connecting with Cailin, please reach out to her at cailin.shovkoplyas@ndus.edu or 701.231.8109.

Stay in touch

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