ND EPSCoR
Established Program to Stimulate Competitive Research

News & Notes

August 2019

The importance of mentorship

When I was younger, I had excellent teachers who inspired my curiosity and instilled in me a desire for learning. In college, I had professors who continued to nurture my growing love of science. My graduate advisors taught me how to pick myself up after failure and celebrate success.

During my early career, I looked to my colleagues for support. Now as I progress into "mid-career," I find myself giving back through my own mentorship responsibilities, drawing on what I have learned (and am still learning) from my personal and professional role models.

At ND EPSCoR, we recognize the importance of good mentorship and have an Education and Workforce Development (EWD) team dedicated to providing programming that is focused on building and maintaining a diverse pool of highly trained scientists and engineers. The EWD team supports ND EPSCoR participants along the entire STEM pathway, from elementary school students through early career researchers.

It is well-known that sparking interest in STEM in the early years of education is vital. The NATURE Sunday Academy, a collaboration with tribal colleges, was designed with this in mind and aims to encourage K12 students to engage in science and to pursue STEM careers after high school. We also support teacher professional development projects that provide STEM trainings for educators from rural schools to increase access to the high-quality, authentic science occurring in ND.

Sustaining STEM interests in undergraduate students is the focus of our distributed REU programs. These programs provide students with opportunities to participate in research projects on any campus in ND—including their home campuses—under the direction of faculty they already know and with whom they have existing mentor-mentee relationships.

Graduate students, while progressing along the STEM pathway, continue to be nurtured and guided by faculty through ND EPSCoR programming. We provide awards to graduate students across ND as they work toward earning advanced degrees in science, technology, engineering, and mathematics. Networking and communication skills are fostered through our Annual Conference where students are invited to share their work with others.

The first few independent years for a researcher are vital to success and retention. To help attract new faculty and to assist them in establishing their research programs, ND EPSCoR provides funding to enhance departmental start-up packages. In our latest proposal to the National Science Foundation, the EWD team has increased its emphasis on professional development and career mentoring throughout the early-career years.

As a Biomedical Science faculty member and part of the EWD team in pendng ND EPSCoR proposals, I recognize firsthand how mentors play a key role along the entire STEM career progression. Through programming that includes effective and meaningful mentorship, we strive to help build the research capacity of ND by ensuring there is a diverse pool of talented individuals in STEM.

Sarah Sletten, PhD
Biomedical Sciences, UND

(Guest editor, and part of the EWD team in pending proposals.)

Red wigglers have a fan

She bashfully admits it was basketball that brought her to United Tribes Technical College (UTTC), but her coursework in environmental science made her want to stay. "I fell in love," said K'Lona Lofton (left), "I found my passion."

In her studies, Lofton became fascinated by earthworms. Her summer research project, under the direction of **Mandy Guinn**, CRCS researcher and Environmental Science & Research Chair/Instructor at UTTC, focuses on "organic composting 2.0," she said. Using organic compost and bedding materials along with red wiggler earthworms, Lofton is testing the nitrogen, phosphorus, and potassium content in the vermicast, or the end product created from the earthworms.

Lofton has set up five different composting conditions: a control environment that uses the worms' growing medium; paper products such as recyclable light cardboard; waste vegetables and fruit; buffalo manure that has been dried; and kitchen waste such as egg shells and coffee grounds. By using composting materials from her home as well as the UTTC cafeteria and a local coop, she is trying to build a demonstration of more sustainable and healthy alternatives to chemical fertilizers.

Early results would indicate that the fruits and vegetables (above) were preferred by the red wigglers, since they ate faster in that compost. "These are amazing little creatures," Lofton said. "What they produce from the compost may help the future of organic farming. My next project is to grow plants in the compost, and see which vermicompost performs better."

"Because of my research experience, I want to work toward my bachelor's degree, and go on from there for my master's degree," Lofton said. "Then I'd like to return home (to Eagle Butte, SD) and help people become more environmentally aware, especially with the youth."

The path for each student is unique, but the thrill of discovery is often the first step in a successful research career. ND EPSCoR, through projects like this at UTTC, is helping students find their passion and a path forward that can make a difference.

STTARs at work

Real-world experience, accompanied by mentors who want to help students learn and find their niche: it's the Students in Technology Transfer And Research (STTAR) program, offered by ND EPSCoR as part of their effort to broaden the STEM pathway in North Dakota by cost-sharing interns' salary.

For students, many are not aware of the nationally and internationally important organizations that call North Dakota their home. These internships help students polish their skills, build a resume, and may also provide a glimpse of future careers in their own backyards. Below are some STTAR company stories.

Border States

Eduardo Urbano will be a senior this fall in computer science at NDSU, and interviewed for an internship with Border States Electric. His mentor and supervisor, Daryl Heinen, has provided opportunities for Urbano to get a close-up look at information security, as well as shadow other network and server groups.

"I've learned so much from Daryl," Urbano said. "I thought I was pretty aware of computer security, but I've learned more about how to safely use computers, and about the computer field, and what options might be best for me."

Border States believes in hiring qualified people, and also training them, Heinen said, noting that Urbano is a great example. "He's had customer 'tickets' to resolve, which has helped him learn how to solve problems," Heinen said. "He's also gotten to work on projects, from identifying phishing scams to tracking individual users' software downloads where security

patches may be missing. Recently, he set up a process to check software, and distinguish security threats, errors, or brute force attacks."

Border States mentor and supervisor Daryl Heinen (left), points out a security concern to Urbano (right).

"The EPSCoR funding has been beneficial to Border States since it helped augment the funding available," Heinen noted. "We have been able to keep him on board longer because of the support."

"I wasn't sure what area I wanted to work in," Urbano said, "but this internship has helped me know what I might want to do with my computer science degree. I'm really thankful—it's been a great experience."

Amity Technology

"There's no typical internship," said Michael Anderson, engineering manager and STTAR intern supervisor at Amity Technology. A Fargo-based manufacturing firm with worldwide exports of sugar beet harvesting equipment, Amity provided **Austin Haman** (below) and **Hunter Goerges**, both mechanical engineering students at NDSU, with different assignments that allowed them to focus on areas of interest.

"I wanted to see the whole process from design to testing the product in the field," Haman said. For his assignment, he worked with the Amity team to improve the efficiency and lifetime usefulness of the "scrub" or assembly that allows the dirt to be discarded before the beets are moved up into a basket. "I looked at parts assembly, checked on high performance belts, and even studied the plate design and mechanisms to find ways to make the unit more efficient."

Goerges' work focused on a hydraulic power unit of a soil sampler machine. "Some of the components had changed, so I needed to reconfigure a model of how to put the filters, valves, fuel tank, and motors into the new framework." Goerges (below) said, "I used Solidworks (software) to create a model, then oriented the components in the assembly to be as compact as possible while still allowing accessibility to the components for maintenance."

"This internship has helped me decide what area of engineering I wanted to pursue," Haman noted. "I like the combination of roles: it helped me see the whole process, from design, to manufacturing, to putting the part on a machine and finding out it doesn't work! I like working in a smaller company, where you get better feedback (even from the shop floor), and can take part in the design, testing, and quality control."

"Like many companies, we have more projects than we can handle," Anderson said. "Interns jump in and help, and these two have made these projects their own and have added a lot of value." He also noted that two of the three engineers currently working at Amity started as interns. "We appreciate the STTAR program since it helps us find those individuals who may become candidates for our next engineering positions."

ComDel Innovation

"It's an opportunity for them to use their skills in a business setting, and to learn what industry expects from them," said Tiana Bohn, training coordinator for

ComDel Innovations, a contract manufacturing firm in Wahpeton that specializes in agricultural, medical devices and custom commercial applications. With three STTAR interns this summer, the company has used the students' creativity for a variety of projects.

Reed Albrecht (left), is a mechanical engineer at UND, and has spent his internship investigating process improvements for the company. One major task was to change over an existing measurement machine to a new machine, and do an analysis to compare and contrast. He also helped with a high volume assembly operation to create a best practices model to make tools easily accessible and properly placed, using a 5S process (sort, set in order, shine, standardize, and sustain).

Mady Jean (right), is getting her chemical engineering major from UND, with an interest in premed. Her project focused on helping a customer develop the procedures and labeling for a new medical device. Bohn said, "She helped with documentation that explained how the device was to be used, and got a first-hand look at the standards that go with medical device manufacturing." Jean's work had to consider the product use, needs associated, potential reuse, and traceability.

The third intern, **Noah Knudson** (left), a mechanical engineer at NDSU, worked on process improvements for an assembly line, "We had a parts line, where parts were molded, cooled, transferred to one location, then moved to another," Bohn said. "The goal was to improve efficiency, so he analyzed the process to reduce the wait times, assessed product shrinkage while cooling, and identified opportunities to reduce the labor while increasing efficiency in moving the parts from one location to another."

"Being able to cost-share (through STTAR) is hugely impactful for us," Bohn said. By accessing the STTAR program, it allowed ComDel to have more than one intern. "We want interns to see how the industry works," she explained. "The classroom theory is done well, but when they get on site, they can experience the quality systems that define, analyze, investigate, and apply to real projects, which are the bones of every project you do."

The other benefit of interns, Bohn noted, was the fresh eyes to look at the operation and find better ways to conduct business. Several former interns have now been hired in a full-time capacity. "We appreciate our ND roots," Bohn said, "and appreciate what we can do here. Ingenuity and entrepreneurship was part of the life of pioneers, and that spirit is still evident in these students."

Creedence Energy Services

Jonathan Patten is a senior in mechanical engineering at NDSU, and has been interested in the oil and gas industry for years. This summer, he interned with Creedence Energy Services, a production chemical company serving the Bakken and surrounding basins, providing custom solutions for oil wells to prolong the life of production.

"I had some experience on the construction side, building facilities, but never on the production side," Patten said. "I soon realized I knew less than I thought, but found it more interesting than construction. It helped me learn about operations, and what it takes to keep production going."

"We like interns at CES," said David McAtee, field engineering manager and Patten's direct manager. "We want to give back to the students, to give them an opportunity to get dirty and see things first hand, to help them see what they like and what they don't."

Patten's duties included field work, understanding the chemical applications and the chemistries used, developing different treatments for individual wells, making recommendations to customers, using scale modeling software to help tailor solutions, as well as being involved in sales and production meetings. "I like the production side," Patten said. "Troubleshooting

with a customer about a problem and giving good service, representing Creedence."

For Creedence the benefit of STTAR is that it allows them to bring in interns, to help bridge between academics and the work world. "We appreciate being able to collaborate with the STTAR program," noted McAtee. "Patten has been a phenomenal intern, doing a lot of projects and doing them well."

Patten (left) explaining an issue with a pipe sample to CES employee, Trish Jungels (right).

Patten echoed the appreciation for STTAR. "It's been a great internship, even better than I thought it would be," he said. "It's different every day, which I enjoy. It's more than something that looks good on a resume, I would love to come back to this type of role once I graduate."

Digging deeper for answers

"Whatever happens above ground impacts what is happening below ground," said **Joshua Steffan**, CRCS researcher and associate professor of Agriculture and Biology at Dickinson State University (DSU). "We're taking the big picture of soil health, and using that framework to create a better understanding about the competition for space, food, and water that is going on in the soil."

Steffan (right), has been sampling and studying soil as a part of the ND EPSCoR CRCS project, looking for changes in the population of soil microbes, such as bacteria, fungi and protozoa. "As the land use on the surface changes, it can change what's happening in the soil," he said.

Adding to the complex analysis has been the weather: 2016 brought a significant hail storm, 2017 was a historical drought, while 2018 went on record as one of the wettest years at the study site. "We've had every extreme," he noted. "But that variation also helps us better understand the influence on the soil."

As the DSU team learns more about farming practices and the impact on the microbe environment, they become a valuable resource for all of ND. Citing one example from thousands of fungi species, Steffan said one of the most studied is the arbuscular mycorrhiza, which helps move nutrients along the fungi to the plant root. In turn the root feeds the fungi.

"You'll see an increase in the fungi when there's not a lot of soil disturbance, such as in no-till agriculture," he explained. "Plowing can break the fungi hyphae, which feeds the plant roots. Fungicides are also a double-edged sword in that they kill both the desirable fungi along with the plant disease-causing fungi."

For agriculture to be sustainable, it's important to have a good understanding of how plants use nutrients, what nutrients may be missing and where and how they should be added for maximum effectiveness, and what organisms are most important for soil health, Steffan noted. "We're fine tuning how to make alterations in soil ecosystems for greater productivity as well as soil health."

(Editor's note: Steffan was named the "2019 Best College Professor" by the Dickinson Press in January https://dickinsonstatenews.com/dsus-steffan-wins-2019-best-college-professor-in-dickinson-press-contest/, and was also awarded a "Distinguished Educator of the Year Award" by DSU in May https://dickinsonstatenews.com/dsu-faculty-and-staff-recognized-for-excellence-in-teaching-and-service-at-annual-awards-ceremony/.)

Making a difference

"I didn't get to see, ask, or shadow anyone," **Laine Lyons** recalled of her early childhood years. "I was always interested in health and medicine, but there weren't a lot of people I could learn from or ask. That's why NATURE and Sunday Academy made such a difference for me."

Lyons is one of several former NATURE (Nurturing American Tribal Undergraduate Research and Education) and Sunday Academy students from the Turtle Mountain Indian Reservation, Belcourt, ND, who credits her experience with building lifelong relationships, and encouraging better decisions. "I have great memories of summer camp (NATURE). We

worked hard, but "Dr. Bob" (**Robert Pieri**, former NATURE coordinator) expected a lot and that made me push myself," she said. One of her best memories was being able to choose her research project, and going to a physics and robotics lab. "We got to blow up stuff and measure it," she joked.

Her experience with NATURE helped her transition to UND after taking classes at Turtle Mountain Community College (TMCC). "I knew the campus, and had friends from NATURE, like Tyson (Jeannotte) who also started at the same time, which helped," she said.

In college Lyons (left) changed her major from a medical focus to sociology and chiropractic, and graduated just a few years ago, diving into a job at NDSU as the multicultural recruitment coordinator. A few months ago, she went back to UND as the director of development for the College of Education and Human Development and the College of Nursing and Professional Disciplines.

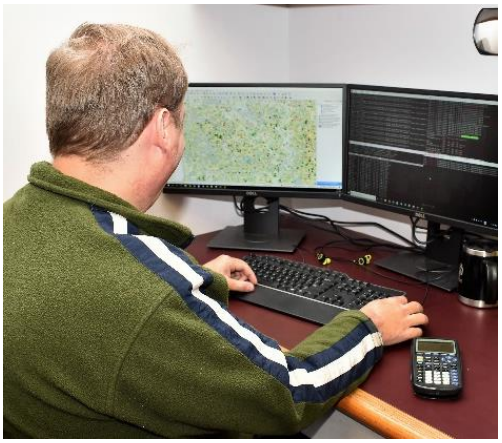
"Sunday Academy and NATURE helped me learn how to develop relationships," Lyons said. "They helped me make better school decisions than I might have otherwise. Today, because of that support, I can focus on a career I enjoy, and help mentor other students."

Grassland management research

Aaron Springer (left), CRCS researcher and Fisheries and Wildlife major at Valley City State University, has been working on the assisted migration plots near UND as part of **Lauren Dennhardt**'s (CRCS researcher and assistant professor in Science) research team. He has spent the summer collecting data on phenology, frequency, and cover at the 60 1m x 1m research plots. Additionally, he has helped collect Kentucky bluegrass plants for a collaborative study at UND assessing epigentic differences between individual grasses that have undergone three different types of management: graze, rest, and burn.

The research will help identify better ways to manage grasslands in the state.

Studying crop types for better models



Jon Starr (left), CRCS researcher and Atmospheric Sciences graduate student at UND, has been studying the impacts of crop type on the reflectance of the landscape. As farmers change their crop selections, leading to year to year acreage changes, the surface will take on different appearances at different times of the year.

Starr's research, under the direction of **Jianglong Zhang**, CRCS co-lead and professor in Atmospheric Sciences at UND, will help other researchers adjust for these changes in a variety of models, from weather forecasting to satellite retrievals. By studying these crop changes and their impacts to the surface the team will provide model creators and scientific users a more accurate baseline to use in their work, which in turn could lead to more accurate weather forecasts and satellite readings.

NATURE Sunday Academy sessions

One of the popular NATURE programs is designed to encourage American Indian high school students to explore math, science, technology and engineering. Once a month during the academic year, high school students gather for Sunday Academy (SA) at their local tribal college, and are presented with practical problems involving biological sciences, engineering, geosciences, math, computer and information systems, physical sciences, and technology, in an informal, friendly atmosphere.

The various modules help students to think, analyze, and seek solutions. ND EPSCoR sponsors the SA program, directed by **Scott Hanson**, ND EPSCoR tribal colleges liaison, and coordinated by **Julia Bowsher** and **Britt Heidinger**, both associate professors in Biological Sciences at NDSU.

The program includes several specialized features:

- Cultural connection to better integrate students' traditional knowledge with current science and technology research
- Hands-on activities

- Multiple sites at the same time
- Participation and collaboration between cultural experts, high school teachers, tribal college instructors and university professors from conception to delivery of the instruction modules
- Incorporation of ND EPSCoR funded research topics in learning modules, including CRCS and CSMS.

Mafany Ndiva Mongoh (above), SBC Ag/Science instructor, presents his topic in an SA planning session.

The topics rotate to all TC campuses, and are an informal learning environment. The topics selected for the 2019-2020 year are as follows:

Water is Life led by **Ali Alshami** (UND)
September 15, 2019 Cankdeska Cikana Community College (CCCC)
October 6, 2019 Nueta Hidatsa Sahnish College (NHSC)
November 17, 2019 (UTTC)
December 8, 2019 (TMCC)
March 1, 2020 Sitting Bull College (SBC)

What Lives in Wetlands? led by **Jon Sweetman** (NDSU)
September 15, 2019 (SBC)
October 6, 2019 (CCCC)
November 17, 2019 (NHSC)
December 8, 2019 (UTTC)
March 1, 2020 (TMCC)

Winter Weather led by **Aaron Kennedy** (UND-CRCS)
September 15, 2019 (TMCC)
October 6, 2019 S (SBC)
November 17, 2019 (CCCC)
December 8, 2019 (NHSC)
March 1, 2020 (UTTC)

Synthesis of Gold Nanoparticles led by **Alex Parent** (NDSU-CSMS)
September 15, 2019 (UTTC)
October 6, 2019 (TMCC)
November 17, 2019 (SBC)
December 8, 2019 (CCCC)
March 1, 2020 (NHSC)

Oxygen Sensing in Water led by **Julia Zhao** and **Steve Wu** (UND)
September 15, 2019 (NHSC)
October 6, 2019 (UTTC)
November 17, 2019 (TMCC)
December 8, 2019 (SBC)
March 1, 2020 (CCCC)

Senses and Perception in Nature led by **Mafany N. Mongoh** (SBC)
January 12, 2020 Topic for all sites

Native Achievements in STEM led by **Charles Okigbo** and team (NDSU)
February 9, 2020 Topic for all sites

Activities of note

The UND Center Of Biomedical Research Excellence: Epigenomics of Development and Disease was awarded $10,425,000 by the National Institutes of Health (NIH) to **Archana Dhasarathy** (AURA and DDA advisor), **Sergei Nechaev** (DDA advisor), **Manu** (new faculty startup), **Barry Milavetz** (former co-PI), along with Roxanne Vaughan, Keith Henry, and Diane Darland (all UND), to support research projects on the identification of mechanisms and potential treatments of human diseases caused by epigenetic processes. The award is from July 11, 2019 to June 30, 2024.

Plant Oil-Based Polymers for Personal Care Products was awarded $30,000 by the North Dakota Agricultural Products Utilization Commission to **Andriy Voronov**, (CSMS researcher and professor in Coatings and Polymeric Materials at NDSU) for research from July 26, 2019 to August 1, 2020.

Xuefeng Chu (CRCS researcher and professor in Civil and Environmental Engineering at NDSU) was awarded $92,335 for the Water Resources Institute by the North Dakota Water Resources Research Institute 104 (B) Program of the U.S. Geological Survey.

Marisol Berti, (CSMS researcher and professor in Plant Sciences at NDSU) was awarded $22,000 for the *Evaluation of Ecosystem Services Provided by Camelina Sativa as a Cover Crop for Northern Climates* by the USDA Agricultural Research Service.

Britt Heidinger (NATURE Sunday Academy coordinator and associate professor in Biological Sciences at NDSU), received an NSF Career award of

$507,532 for the *Rapid Phenotypic Divergence and Insulin-like Growth Factor 1 (IGF-1) Signaling in a Widespread Songbird.*

Sima Noghanian (DDA advisor), **Ali Alshami** (new faculty startup, REU advisor and Emerging Areas Seed recipient), **Ala Ali Alemaryeen** (DDA student), and **Meysam Haghshenas** (new faculty startup), along with A. Tesser and J. Lewis (all UND), presented an abstract *On the Development of a Bio-based Dielectric Material* at the URSI Commission B International Symposium on Electromagnetic Theory May 2019.

Center for Regional Climate Studies (CRCS) publications

Characterization and Application of Artificial Light Sources for Nighttime Aerosol Optical Depth Retrievals using the VIIRS Day/Night Band by **Jianglong Zhang** and **Shawn Jaker** (both UND), along with Jeffrey Reid, Steven Miller, Jeremy Solbrig, and Travis Toth in Atmospheric Measurement Techniques, 2019, 12, 3209-3222. DOI: 10.5194/amt-2018-424

Doctoral Dissertation Assistantship (DDA) publications

Strain-Spintronics: Modulating Electronic and Magnetic Properties of Hf2MnC2O2 MXene by Uniaxial Strain by **Edirisuriya Siriwardane**, **Pragalv Karki**, **Yen Lee Loh**, and **Deniz Cakir** (all UND) in The Journal of Physical Chemistry, 2019, 123, 12451. DOI: 10.1021/acs.jpcc.9b00594

Upcoming events

- **CRCS and CSMS monthly meetings:** Hosted via IVN to all campuses, with dates posted on the websites.
- **ND EPSCoR Annual Conference:** April 21, 2020 at the Alerus Center, Grand Forks.

Funding opportunities

ND EPSCoR State Office STEM RFP 2019

The ND EPSCoR State Office has a mission to support the efforts of ***EPSCoR-participating institutions*** across the state that result in increased STEM faculty capacity and competitiveness and a stronger STEM pipeline that produces our next generation workforce, educators, and researchers.

To help support the efforts of faculty and students engaged in STEM research and education, the ND EPSCoR State Office is requesting proposals for activities in the following categories:

- equipment,
- student travel to present at national conferences,
- seed awards for faculty to collect preliminary data in preparation of federal STEM proposal,
- faculty/student awards to engage K12 in STEM outreach activities,
- awards to fund external peer review of large collaborative/interdisciplinary proposals prior to submission to a federal agency, and
- undergraduate research.

The link to the RFP and necessary forms can be found at: https://www.ndepscor.ndus.edu/funding-opportunities/resind/ndus-stem-rfp-2019/.

For full consideration, proposals must be submitted by **noon on September 20, 2019**.

DoD DEPSCoR regional meeting information

ND EPSCoR was informed of an opportunity with the recently reinstituted DoD Established Program to Stimulate Competitive Research (DEPSCoR). As one of the five EPSCoR-like entities, this invitation applies to EPSCoR-eligible states like North Dakota. The DoD is hosting a meeting to present funding opportunities. Please look for more information below and share with colleagues who may be interested: https://www.ndepscor.ndus.edu/fileadmin/ndus/ndepscor/News/DEPSCoR_DoD_Day_9-26-19.pdf

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- For a link to ND EPSCoR's prior newsletters, https://www.ndepscor.ndus.edu/news/news-and-notes-newsletter/
- To submit a story or idea by the end of the month to joyce.eisenbraun@ndus.edu, please complete: https://www.ndepscor.ndus.edu/fileadmin/ndus/ndepscor/documents/NewsTemplateFillable_2018-10.pdf
- To be added to the newsletter mailing list, please email ndepscor@ndus.edu, subject line: newsletter.

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