ND EPSCoR
Established Program to Stimulate Competitive Research

# News & Notes

June 2019

## Rejuvenation and innovation

Schedules are hectic, especially during the school year, and there can be an urgency of pace, coupled with a sense of being behind. With summer comes moments to enjoy warmer weather and different activities, while taking advantage of a much-needed period of rejuvenation.

Why is that pause in our schedules so necessary? What makes it so valuable?

We learn rejuvenation from our seasonal climate and it's reinforced by the living organisms around us. Trees leaf out and blossom, tiny plants sprout from ground that was home to feet of snow just a few months ago, while birds, animals, and people emerge from their winter habitats.

Rejuvenation is an element in natural life cycles, and it finds expression in a host of interesting patterns:

- The start of work adventures for graduates as they leave academic life for new careers
- The opportunity to switch focus from teaching to research efforts
- Considering how new research data can be integrated into upcoming courses
- Renewed attention to grant funding opportunities to expand the research effort
- Considering "what else" could be done in one's research, now that some of the milestones have been accomplished.

Perhaps one of the more important elements of rejuvenation is the time we take to reflect and review. What direction has been chosen? What results have been obtained? What more can be done? What should be continued/discontinued?

As we enter the "no-cost" extension of our current NSF Research Infrastructure Improvement (RII) Track-1 Award, it's important to look at our accomplishments over the past five years, and consider what the next steps might be for sustainability. In short, to rejuvenate.

For the Center for Regional Climate Studies (CRCS), there has been renewed energy from the Stakeholders group, and a commitment to considering another Stakeholders conference next year. Feedback from the Stakeholders and citizens has helped spur added research options for the team. With research ranging from soil to sky, CRCS efforts have benefitted agricultural producers as well as citizens throughout the state.

For the Center for Sustainable Materials Science (CSMS), the emphasis this past year has been on analyzing life cycles of their products. Using agricultural products and byproducts, the CSMS team has "rejuvenated" many ingredients into innovative biobased materials, from polymers to resins, coatings, and other new and sustainable materials that may build new partnerships or have commercial appeal.

Rejuvenation also comes to other ND EPSCoR programs and provides the insights needed for innovation. In this issue, we talk about an expansion of ND EPSCoR's well-known Nurturing American Tribal Undergraduate Research and Education (NATURE) program. Started in the late 90s, NATURE has grown from involving one tribal college to being a resource for all five tribal colleges in North Dakota. From that inspiration grew added innovations:

- Sunday Academies now offer monthly research programs at the individual tribal colleges during the academic year
- Summer tribal college camps help middle and high school students learn about their culture, STEM, and research opportunities at their local institutions
- Bridge camp, a pilot innovation begun this summer, assists recent high school graduates in building life skills that will help them succeed in college.

As we complete another year of research and outreach, the impact for our students and across our state is significant. For the future, we anticipate added benefits from efforts in rejuvenation and innovation.

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

## NATURE opening ceremony

What began in 1999 as a dream, has enabled hundreds of tribal students from around the state to investigate the world of research and advanced education, explained Carol Davis, senior associate with the Tribal Nations Resource Group and former ND EPSCoR Tribal Colleges Liaison. Davis (pictured below) was the keynote speaker at the ND EPSCoR NATURE University Summer Camp opening ceremony, June 3.


Davis was one of the initial dreamers, who wanted to give tribal students the opportunity to learn more about engineering. Thanks to the collaborative efforts of G. Padmanabhan, NDSU professor (retired) in Civil and Environmental Engineering and Davis, along with a host of supporters from the tribal colleges in North Dakota and NDSU faculty, the NATURE program was birthed.

Three innovators attended the 2019 opening ceremony (shown below, l to r), **Robert Pieri**, professor in Mechanical Engineering at NDSU, former NATURE coordinator, and current faculty advisor for NATURE Bridge; Davis; and Padmanabhan.

At the time, "Tribal nations lacked the engineers needed to handle infrastructure, so it was a critical place for us to begin," Davis said. "We wanted to design a curriculum that reflected our culture and history. It is important to have our teaching as the base of NATURE. Our ancestors were scientists—we wouldn't have survived without their knowledge." The team applied for and received a five-year grant from the Office of Naval Research (ONR).

The need was great when NATURE first began, according to Davis. "Out of 800 registered for their Associate degree at our college, we only had 31 students enrolled in science," Davis recalled. "After five years, we had 257 with their Associate degree in science."

When the ONR funding ended, ND EPSCoR began to support the program, and the program continued to innovate and develop. Today, students from all five tribal colleges in North Dakota—and nearby high schools—can take part in the NATURE University Summer Camp as well as other NATURE programs.


***Scott Hanson** (left), ND EPSCoR Tribal Colleges Liaison and NATURE Coordinator, welcomed students, mentors, and faculty at the opening ceremony.*

Davis recalled many stories of people who helped NATURE flourish, such as David Givers, the previous EPSCoR co-project director. "He was willing to learn, and he cared about the students," she recalled. Other stories reflected the impact of NATURE on young students, who are now in leadership positions. She said, "These leaders were once sitting in your chairs, learning. They had great potential, just as you do, and they've succeeded."

North Dakota University System (NDUS) Chancellor Mark Hagerott (below), and North Dakota State University President Dean Bresciani, both gave welcome remarks at the NATURE Opening Ceremony. Chancellor Hagerott compared the technology of 150 years ago to today. President Bresciani welcomed the

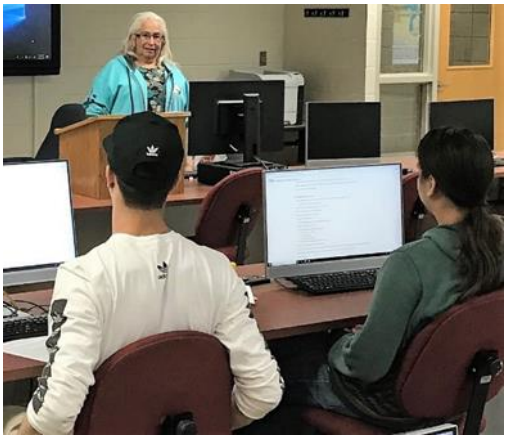
students to the NDSU campus, and encouraged them to ask questions, to seek information, and to enjoy the research experience.

From the early days of NATURE, which started with three students, to today's robust multi-tiered program that impacts over 400 high school and college students each year, NATURE continues to make an impact on tribal youth throughout the state.

## NATURE: Building bridges

Making the transition from high school to college is sometimes difficult. A pilot project, hosted at Turtle Mountain Community College (TMCC), NATURE Bridges Camp, is designed to help students build life skills that will help them be successful in pursuing further education, and gain a better understanding of what STEM majors and careers may be appealing to them.

The first session, held the end of May, focused on gaining a better understanding of various STEM professions, and the education needed to work in those careers. Then the students dived into developing their own vision and goals, learning how to create a resume, and how social media can assist. "One of the key lessons focused on the value of failure and learning how to rebound and go on," said **Scott Hanson**, Bridges coordinator. "In addition, the students spent time working on budgets and discussing how life events, such as school tuition, impact their finances."



Frances Allard-Abbott (left), an elder at Turtle Mountain Reservation, talked to the students about traditional ways of choosing careers.

The theme of the Bridge Camp is sustainability, Hanson said, and embedded in the program is an emphasis on developing cleaner, renewable resources, that incorporate learning about STEM disciplines. Between camp sessions, the students have homework assignments that incorporate the information provided in the previous lesson. A final project will encompass all the elements of the camp.

The next session will be held June 21-22.

## NATURE camp spans time/technology

Carol Davis noted in her opening ceremony keynote that traditional knowledge is important in order to address the challenges of the future. This photo of the assembly of a traditional teepee near the *Grandmother Earth's Gift of Life Garden* on the NDSU campus during the NATURE University Summer Camp, provides a visual illustration of the breadth of scientists' knowledge then (engineering the structural design of the teepee) and now (engineering the structural design of an airplane); thereby informing students' insights into the value of STEM past and present.

## NATURE: Sunday Academy Experience

ND EPSCoR's Sunday Academy is designed to generate interest in STEM among American Indian high school students in North Dakota. Faculty from NDSU and UND are invited to submit modules that are presented during the academic year on Sundays. The faculty chosen to collaborate with tribal college representatives create hands-on activities that help students study scientific problems.

To teach the modules, faculty members from NDSU and UND travel to each tribal college in North Dakota to teach students. More information can be found at https://www.ndepscor.ndus.edu/ndep/nature/sunday-academy/.

**Alex Parent**, CSMS researcher and assistant professor in Chemistry and Biochemistry taught a session on "Polymer Synthesis from Common Materials" (right) as one element of ND EPSCoR's Sunday Academy program during the 2018-2019 academic year.

As part of Parent's CSMS focus on sustainable materials, his lab researches green oxidation processes through which biomass-derived feedstocks can be converted into materials used in a variety of applications. Since ND EPSCoR's NATURE program is also a focus for CSMS, Parent taught "Recycling Bioplastics" in 2017-2018, and will be teaching "Gold Nanoparticles" during the 2019-2020 Sunday Academy program.

Other topics from the 2018-2019 Sunday Academy program included:

- *Understanding the Anatomy of the Eye* led by **Ben Balas** (NDSU, Psychology)
- *Digital Preservation of Natural and Cultural Resources* led by **Stephanie Day** (NDSU, Geosciences)
- *Influenza Outbreak* led by **Natasha Petry** (NDSU, Pharmacy)
- *Adaptation and Climate Change* led by **Pam Puppo** and **Jill Hamilton** (NDSU, Biological Sciences)
- All-site module *Hypothesis and Product Testing* developed by **Mafany Ndiva Mongoh** (Sitting Bull College, Environmental Sciences)
- All-site module *Sentiment Analysis* developed by **Ravi Yellavajjala** (NDSU, Civil and Environmental Engineering)

Previous modules can be found through the Sunday Academy link, above.

## Creating a ligonomics toolkit

"We are teaching students to do research and to solve problems," said **Alena Kubátová**, CSMS researcher and Chester Fritz distinguished professor in Chemistry and Chemical Engineering at UND. In the process, she and her lab team have also made interesting discoveries about the properties in lignin, which is derived from plant material such as wood.

"People have been doing research on lignin for a hundred years," she said, "but understanding the chemical characterization and structure is what we're working on now. We need to have a better understanding of how lignin breaks down, what it does in various solvents. Once we have a general understanding of lignin behavior, we'll be able to predict its use for specific applications."

Using gas chromatography with mass spectrometry (GC-MS) with thermal desorption and pyrolytic sample introduction, Kubátová and her group have been able to identify the chemicals released from lignin. Some of the small molecules are useful for creating polymers, she said, while larger molecules may be used as resins or as char that have other applications. "Historically, we made these products using petrochemicals, but now we're trying to replace those harsh chemicals with more environmentally friendly, renewable sources like lignin," she explained.

Her research group is in the process of creating what Kubátová describes as a "lignomics analytical toolkit," where the weights, sizes, and properties of all the chemicals are catalogued. "One of the first steps in any research is to understand what you have," she stressed. "We've been able to develop some analysis tools in my laboratory that have speeded the process of the chemical breakdown."

*Former CSMS graduate student researcher **Anastasia Andrianova** (left) and Kubátová (right) review data on the lignin analysis. (Photo credit: Jackie Lorentz, UND)*

The results of her work will help other researchers in their work. "A researcher wants to know that if they put in 80% or 50% of lignin, this is what they can expect for how the lignin behaves," said Kubátová. "With the solubility studies, we're able to see why some solvents work better than others. It's things that make sense, but just haven't been done before in a comprehensive manner."

Within the lab, Kubátová has several students working on different kinds of characterizations, almost like assembling a jigsaw puzzle. "For lab meetings, it's an opportunity to see what others are doing in a similar area," she said. "Each student can bring their ideas, talk about it, and then see what works in their area of specialty."

The results are promising, for the students who have become skilled researchers, and for the advancement of science. “We are developing and trying to understand and explore the potential of green chemistry,” she noted. “We can grow many different types of biomass, so lignin will always be there as a feedstock since it’s not something you can eat. It can grow quickly and cheaply, and with the land in North Dakota, there are many applications from this research.”

Although in early stages, the research by Kubátová and her students may lead to a host of environmentally friendly products, including coatings, resins, and commercial materials. And it will be because someone took the time to explore how to break down lignin into usable components.

## Impacts to soil health

“If we want healthier plants, we need to have a better understanding of how we’re impacting soil health,” said **Eric Brevik**, Dickinson State University (DSU) professor in Geology and Soils. As a part of ND EPSCoR’s CRCS research, Brevik has been collecting and analyzing data related to soil properties and ecology.

The collaborative effort between DSU and other CRCS partners underscores the interconnected natural world: Climate changes impact crop choices and production; conversely, farming practices can impact regional climate and soil health. In the DSU research, Brevik and his students have been collaborating with a local farmer, and comparing soil properties found in land plots that have been in the Conservation Reserve Program (CRP) for the past three decades and left untouched, with CRP areas now being used for no-till crop production with winter feeding of cattle, and no-till production land without winter feeding.

“Our emphasis so far has been on analyzing the phospholipid fatty acids (PFLA) found in soil that indicate the microbial activity,” Brevik said. “It’s an efficient way to get a big picture of how the soil is doing. For example, in our analysis of about 300 soil samples each year for the past few years, we’ve found that the CRP has less microbial activity than the no-till fields. When there are cattle, they add organic material from the cattle’s manure and urine and the hay they’re fed. The microbes use that input. In the no-till farmland, the fertilizer that’s added also feeds the microbes.”

Since all the research land plots are in the same general area, the daily temperatures, rainfall, and snow are similar, which eliminates some of the chance variables. Brevik explained that the lab analysis will help determine if the change in management of the land, from CRP to no-till, has an impact on the health of the soil. After teaching a full course load of 15 credits this spring semester, Brevik said he is eager to get more time in the lab this summer, analyzing the soil samples and comparing the results with past years.


*Brevik, right, shows Karissa Bohn (left) how to work with a soil trap that collects microarthropods.*

The research also has an added benefit: helping students. “The research we do helps students make informed decisions about their education,” Brevik said. The impact is particularly strong for those students who have been or are part of the ND EPSCoR Distributed Research Experience for Undergraduates (REU). “For example, with **Billie Jean Petermann**, a previous REU student, the research helped her zero in on an interest in soil microbial ecology, and she’s now pursuing her doctorate at Texas A&M,” Brevik said. For the current REU student, **Karissa Bohn**, Brevik explained the field and lab research has given her an opportunity to see what a research scientist does, so she can make the best choices when she graduates next year.

As a significant agricultural production state, North Dakota looks to researchers like Brevik for insights on how to be more effective and efficient in producing the state’s valuable crops, and in helping students explore new possibilities for their future.

## Congratulations to STTAR awardees

Several companies around the state have hired interns as a part of the Students in Technology Transfer And Research (STTAR) program. The STTAR program provides juniors through graduate students, who are majoring in STEM disciplines, with an opportunity to use their academic training and experiences to address science and technology-based problems faced by ND companies.

Congratulations to the following students and organizations for their commitment to STEM in ND:

- **Hunter Goerges** and **Austin Haman** (both NDSU) at **Amity Technology,** Fargo
- **Eduardo Urbano** (NDSU) at **Border States**, Fargo
- **Reed Albrecht, Madylyn Jean** (both UND), and **Noah Knudson** (NDSU) at **ComDel Innovation**, Wahpeton
- **Jonathan Patten** (NDSU) at **Creedence Energy Services**, Minot
- **Brett Wensmann** (NDSU) at **WCCO Belting, Inc.**, Wahpeton

## Activities of note

The American Chemical Society has selected **Dean Webster**, CSMS lead, professor and chair of Coatings and Polymeric Materials at NDSU, as a 2019 Fellow in the Division of Polymeric Materials: Science and Engineering. He was inducted into the PMSE Fellows in April, and was recognized for "his dedicated service to the polymer community and his formative contributions and advancement in durable bio-based polymers and biofouling coatings."

**Muneer Shaik,** graduate student in Chemistry, **Guodong Du**, associate professor in Chemistry, (both UND CSMS researchers)**,** and J. Peterson (UND) presented *Cyclic and Linear Polyhydroxylbutyrates from Ring-Opening Polymerization of β-Butyrolactone with Amido-Oxazolinate Zinc Catalysts* at the American Chemical Society Great Lakes Regional Meeting, May 1-4, 2019.

**Srikanth Vijjamarri**, graduate student in Chemistry, and **Guodong Du**, associate professor in Chemistry (both UND CSMS researchers), presented *A Salen Managense (V) Catalyzed Hydroboration of Carbonyls* at the April National Meeting of the American Chemical Society and at the Great Lakes Regional Meeting, May 1-4, 2019.

**Ghasideh Pourhashem,** CSMS researcher and assistant professor in Coatings and Polymeric Materials at NDSU, presented *Sustainability and Coatings: Technology Accomplishments and Accounting* at the 2019 Coatings Technology Conference, April 8-10, 2019.

**Guodong Du** was awarded $19,035 by the ND Corn Council for work on *Self-healing Polymeric Materials from Corn Sugars*, to make self-healing and recyclable polymeric materials from building blocks derived from corn sugars.

**Jonathon Edstrom** (right), Cyberinfrastructure intern and graduate student in Electrical and Computer Engineering at NDSU, presented a student/ faculty workshop on April 25, 2019, on the value and uses of TensorFlo research software, available through the Center for Computationally Assisted Science and Technology (CCAST).

## Center for Regional Climate Studies (CRCS) publications

*A Climatology of Atmospheric Patterns Associated with Red River Valley Blizzards* by **Aaron Kennedy**, **Alexander Trellinger** (both UND), **Gregory Gust** (CRCS Stakeholder), and Thomas Grafenauer, as the cover story in a special issue of Climate: Climate and Atmospheric Dynamics and Predictability, 2019, 7(5), 66. DOI: 10.3390/cli7050066

## Upcoming events

- **2019 NATURE Tribal College summer camps:**
  - Cankdeska Cikana Community College (CCCC), Fort Totten, will be June 17 – 27. CCCC NATURE Coordinator: **Chris Dahlen**
  - Nueta Hidatsa Sahnish College (NHSC), New Town - NATURE will be July 15 – 19. NHSC NATURE Coordinator: **Kerry Hartman**
  - Sitting Bull College (SBC), Fort Yates, will be June 17 – 28. SBC NATURE Coordinator: **Mafany Ndiva Mongoh**
  - Turtle Mountain Community College (TMCC), Belcourt, will be June 17 – 28, July 1 – 12, and July 15 – 26. TMCC NATURE Coordinator: **Austin Allard**
  - United Tribes Technical College (UTTC), Bismarck, will be June 17 – 21. UTTC NATURE Coordinator: **Julie Stock-Porter**
- **NATURE Bridges pilot camp at TMCC**, June 21 – 22 (Engineering), July 12 – 13 (Science)

- **CRCS and CSMS monthly meetings:** Hosted via IVN to all campuses. Dates are posted for each on their respective websites.

## Funding opportunities

The **ND NASA Established Program to Stimulate Competitive Research (EPSCoR)** is soliciting both research proposals and travel proposals from faculty at ND NASA EPSCoR affiliate institutions (see https://ndnasaepscor.und.edu/about/affiliate-members.html) to conduct NASA relevant research in one or more RFAs that are designed to promote and expand particular NASA research sub disciplines in North Dakota. Travel awards will also be made to collaborate with NASA centers.

One of the primary goals: to assist faculty in developing research programs that can be funded outside of the NASA EPSCoR program in the future. Therefore, proposers should specifically include a plan to develop and expand their proposal into an independently funded research group beyond the timeframe of this funding opportunity. A goal of ND NASA EPSCoR is also to assist the development of multiple NASA relevant research clusters in North Dakota. Proposals involving collaboration across departments, universities, and research groups/scientists at NASA Centers, are strongly encouraged.

The performance period for both travel awards and research awards is: **August 16, 2019 – August 15, 2020**.

**Proposal due date:** Seed research proposals and travel award proposals are due at **noon on July 15, 2019**.

The full research RFP, travel RFP, additional details, and downloadable forms can be found here: http://blogs.und.edu/jdosas/2019/06/nd-nasa-epscor-travel-and-research-rfps/

**Advance notice of upcoming opportunity from DEPSCoR: Defense Established Program to Stimulate Competitive Research.**

In the FY2018 National Defense Authorization Act (NDAA), Congress reauthorized a restructured version of DEPSCoR. The program received $12M in FY2019 appropriations.

The DEPSCoR competition intends to encourage collaborations on basic research projects of interest to the Department. The program is structured to form a 2-person team between 1) an investigator with prior funding from the DoD (within the past seven years) and 2) a researcher who has not previously received funding from the DoD.

The website https://discover.dtic.mil/products-services/ contains a non-comprehensive repository of government-funded scientific, technical, and engineering information for the DoD. Researchers new to DoD (Applicant) are encouraged to visit the site as a starting point for identifying past and present DoD-funded researchers.

The program is sponsored and managed by the Basic Research Office, Office of the Under Secretary of Defense for Research and Engineering and administered through the Air Force Office of Scientific Research.

A pre-solicitation notice for this DEPSCoR-exclusive competition is available at grants.gov.

## Stay in touch

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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
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