



**Partnerships to Build STEM Capacity in North Dakota
Version 5**

August 2021

Background and Purpose of this Document

First released in 2016, this document was created to help faculty looking to partner with others to increase STEM research/education capacity within higher education institutions across ND. This document also helps the North Dakota Established Program to Simulate Competitive Research (ND EPSCoR) State Office pursue its mission to provide leadership and coordination to broaden and diversify ND's science, technology, engineering, and mathematics (STEM) workforce pathway from elementary through graduate school; support and grow statewide STEM research efforts (capacity and competitiveness) at participating institutions of higher education, particularly among early career faculty; and, convey the impact of STEM research, outreach, and workforce efforts to ND stakeholders. The up-to-date in this document aids the:

- Preparation of STEM proposals by faculty at institutions in ND to external agencies or sponsors,
- Formation of faculty research and educational partnerships/collaborations between institutions, and
- Establishment of priorities for STEM research and outreach calls for proposals and funding issued by the ND EPSCoR State Office

This document compiles a variety of information from ND EPSCoR State Office survey results and enrollment/demographic data and faculty/instructor research interests from the 11 institutions of higher education that currently partner with the ND EPSCoR State Office. . If you have any questions about this document or would like more information about making connections that build STEM capacity in North Dakota, please contact Jean Ostrom-Blonigen, Project Administrator, ND EPSCoR State Office at 701-231-7516 or jean.ostrom@ndus.edu. For more information about forming partnerships to build STEM resources in North Dakota, see: [Partnerships to Build STEM Resources](#)

ND EPSCoR State Office

Established in 2017 by the North Dakota University System (NDUS)¹, the ND EPSCoR State Office is responsible for developing, implementing, monitoring, and assessing numerous programs tied to the state's STEM ecosystem and administering external awards (Table 1).

Table 1. FY21 State Office (SO) Programming, Administrative Services, and External Award Administration.		
SO Program and Activity Categories	Budget Structure	FY21 Programs and Activities (further described in the narrative section)
SO Activity – Programmatic (* - SO dollars)		
*External Partnerships	Programmatic	STEM programming partnerships with ND-based entities and organizations
*K-20+ STEM	Programmatic	Activities to build the STEM workforce in ND, including: 1) K-12 programming, 2) K-12 Lesson Plan development, 3) K-12 STEM activity video series for STEM projects at home, 4) Undergraduate and graduate student research, training, programming, and professional development
*Innovation and Entrepreneurship	Programmatic	Students in Technology Transfer And Research (STTAR) student internships with ND-based companies

¹ North Dakota received its first NSF EPSCoR RII Track 1 cooperative agreement in 1986. A state appropriation to the NDUS provides the match to the RII Track-1 and funds statewide programs to build STEM capacity and a sustainable STEM workforce within North Dakota. From 1986-2016, North Dakota State University (NDSU) and the University of North Dakota (UND) had duplicative offices managing these programs. Under a memorandum of understanding, the ND EPSCoR State Office is administered by NDSU.

*Broadening Participation	Programmatic	Nurturing American Tribal Undergraduate Research and Education (NATURE) programming
*Communicating Science to the Public	Programmatic	1) Website, 2) Social media, 3) Monthly newsletter, and 4) Communication workshops, and 5) ND EPSCoR Annual State Conference
*Support for EPSCoR-like Programs	Programmatic	1) NSF EPSCoR Track-2 proposals, 2) NSF CAREER proposals, and 3) other EPSCoR-like programs
*Proposal Development Support	Programmatic	1) internal proposal reviews and 2) NSF INCLUDES proposal development
*Participating Institution STEM Seed Funding	Programmatic/ Administrative Services	Competitive STEM research capacity building, education, outreach, workforce development opportunities that are competitively available to all 11 participating campuses
*RII Track-1 match	Programmatic	The National Science Foundation (NSF) requires a 20% state match on each of its 5-year \$20M Track-1 cooperative agreements
SO Activity - Administrative Services (* - SO dollars)		
*Financial, Administrative, and Logistical Services	Administrative	1) Oversight of financial obligations covered by the State Office on behalf of all participating institutions, 2) financial oversight, 3) administrative support, trainings and guidance to all 11 EPSCoR participating campuses, 4) office and program logistics, and 5) campus visits and outreach to ND EPSCoR participating campuses
*ND EPSCoR State Steering Committee	Administrative	Logistical and administrative support
SO Activity – Leveraged (*- SO dollars; ** - NASA EPSCoR dollars from UND)		
*STEM Capacity Building at the RUs	Leveraged	STEM investments at NDSU and UND
**NASA EPSCoR	Leveraged	NASA investments on the NDSU campus
SO Administration of Externally Funded Awards (***) - external dollars)		
***NSF EPSCoR Research Infrastructure Improvement (RII) Track-1 Cooperative Agreements	NSF	New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES, 2020-2025)
***NSF Collaborative Research Grant (2020-2022)	NSF	Cultivating Indigenous Research Communities for Leadership in Education and STEM (CIRCLES) Alliance is a collaboration between six EPSCoR jurisdictions

State Office Broadening Participation and Participating Institution STEM Seed Funding Program and Activity Categories.

The State Office administers statewide programs and activities in support of its mission to *broaden and diversify ND's STEM workforce pathways, support and grow statewide STEM research capacity and competitiveness, and inform and communicate science to ND stakeholders*. The State Office is a key partner in research capacity building and other integrated activities at 11 participating institutions (two RUs, three PUIs, one MCU, and five TCUs – Figure 1). These State Office efforts in partnership with statewide stakeholders help to build a high-

quality, higher education-based research effort that serves as the backbone of the state’s scientific and technological enterprise, ensuring a strong and stable economic base for the future.

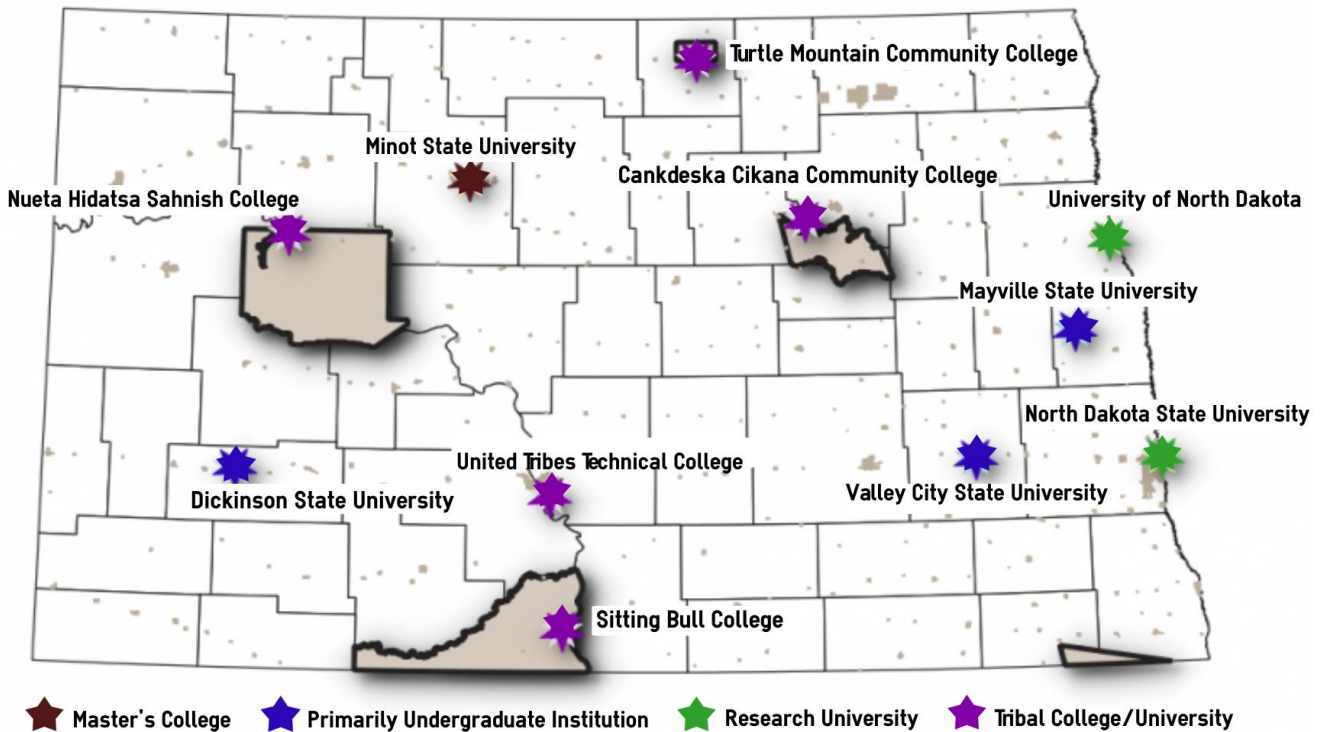


Figure 1. Map of ND EPSCoR State Office Participating Institutions.

Broadening Participation - The Nurturing American Tribal Undergraduates in Research and Education (NATURE) program is a long-standing ND EPSCoR State Office signature program and is a means to grow and diversify the STEM pathway. American Indian students are significantly underrepresented in the STEM ecosystem throughout the country. As a result, NATURE, which began in 1998 and was initially funded exclusively on federal grant dollars, encourages American Indian students to consider STEM degrees and STEM careers. Funding for the NDSU and UND components of this program comes from state appropriated dollars and funding for the TCU components of this programs comes from the NSF RII Track-1. The state-funded Tribal Colleges/Universities Liaison and NATURE Manager, hired in 2015, works to build mutually respectful partnerships between the NDUS institutions and the tribal colleges/universities located in ND. NATURE is critical to growing and enhancing diversity in the STEM pathway. NATURE consists of four programs:

1. The **TCU Summer Camps** are held (mid-June to late-July) at each of the participating TCUs. Planned by TCU faculty during the University Summer Camp, these camps engage middle- and high-school tribal students in STEM. TMCC campuses typically runs more than one summer camp. The funding for these camps comes from the NSF RII Track-1.
2. The **Sunday Academy** program is a series of hands-on STEM activities held one Sunday each month during the academic year (September – March) for 7th-12th grade tribal students at the participating TCUs. During five of those months, research university (RU [NDSU and UND]) faculty travel to each of the TCUs on a scheduled monthly Sunday rotation to deliver STEM modules they created during the University Summer

Camp. During those academic months, RU and TCU faculty deliver STEM modules that they co-created during the University Summer Camp. The materials, mileage, lodging, and per diem expenses of the NDSU and UND faculty are paid by the ND EPSCoR State Office. The salaries of the TCU faculty and the student stipends and meals are paid by the NSF RII Track-1.

3. The **Bridge Camp** is targeted at students who are between high school graduation and the start of their first university/college fall semester. This camp is funded by NSF RII Track-1 funds and includes a structure that mimics key skills for postsecondary education; however, each section of the camp is designed to be self-contained to provide important life skills (i.e.: resume building).
4. The **University Summer Camp** consists of a two-week, residential program for American Indian college students. Typically held the first two weeks in June, the purpose of the camp is to expose and engage American Indian TCU students in STEM activities to generate interest in STEM as a career beyond the TCU degree. Bachelors and graduate programs are promoted at NDSU and UND by engaging the students in a research project. Under the program, five students from each of the participating TCUs are selected and financially supported (by the NSF EPSCoR RII Track-1) to attend the camp. Students visit both NDSU and UND to learn about STEM programs and research during the first week of the camp. Each student selects a faculty researcher with whom they will work during the second week of the camp, performing research in a laboratory setting. The students present their work at the end of the camp. The ND EPSCoR State Office pays the NDSU and UND faculty and student mentor salaries, as well as the housing, meals, travel, and activity costs associated with the program. During those same two weeks, State Office staff and coordinating faculty work with the TCU faculty and K-12 instructors from the communities surrounding the TCUs to plan the TCU Summer camps and Sunday Academies.

Across the 2020 and 2021 reporting periods for the four components of this program, there were 1,226 participants (1,155 of whom were AI/AN [Table 2]).

	TCU Summer Camps	Sunday Academy	Bridge Camp	University Summer Camps	Totals
	Summer 2020/2021	FY20/FY21	Summer 2020/2021	Summer 2020/2021	
# of NDSU/UND faculty (# who are AI/AN)	N/A N/A	9/6 0/0	0/0 0/0	32/23 1/1	41/29 1/1
# of NDSU/UND graduate students (# who are AI/AN)	N/A N/A	3/3 3/0	0/0 0/0	0/3 0/0	3/6 3/0
# of NDSU/UND undergraduate students (# who are AI/AN)	N/A N/A	0/0 0/0	N/A N/A	0/0 0/0	0/0 0/0
# of TC faculty (# who are AI/AN)	14/6 12/6	6/5 4/3	3/1 1/1	1/2 1/2	24/14 18/12
# of TC graduate students (# who are AI/AN)	0/0 0/0	0/0 0/0	N/A N/A	N/A N/A	0/0 0/0

# of TC undergraduate students (# who are AI/AN)	6/0 4/0	3/0 2/0	N/A N/A	N/A N/A	9/0 6/0
# of support staff (# who are AI/AN)	22/6 19/6	3/4 3/4	6/4 4/4	5/0 3/0	36/14 29/14
# of participants (# who are AI/AN)	145/117 138/110	455*/429* 431*/397*	20/3 19/3	13/16 13/16	633*/565* 601*/526*
AI/AN = American Indian / Alaskan Native *Numbers include multiple engagements for single participants					

Participating Institution STEM Seed Funding - To support the efforts of institutions of higher education across the state to increase their STEM research and education capacity, the ND EPSCoR State Office currently offers support in these specific areas: 1) Equipment; 2) Equipment repair; 3) Undergraduate research; 4) Seed awards for faculty to collect preliminary data for the preparation of *federal* STEM proposals; 5) External proposal review for large, collaborative and interdisciplinary STEM efforts; 6) Seed awards for faculty and students to engage K-12 in STEM outreach activities; and, 7) Development of online/virtual modules for STEM courses; 8) Seed award for community-based STEM research; and 9) Electronic STEM data sets.

Personnel at all 11 ND EPSCoR participating institutions (Figure 1) are eligible to compete for these funds. With the exception of two TCUs, where the same faculty member submitted multiple proposals in a single year, 100% of the proposals from the MCU, PUIs, and TCUs have been funded since this program began in 2020. This amounts to approximately 26.3% of the total available funding, with the remainder split almost equally between the RUs (Figure 2).

The EPSCoR State Office offers this support to institutions statewide to increase STEM faculty capacity and competitiveness; educate the next generation of STEM workers, educators, and researchers; and increase the value that ND citizens place on the STEM ecosystem and economy. For more information about these ND EPSCoR State Office programs, visit www.ndepscor.ndus.edu.

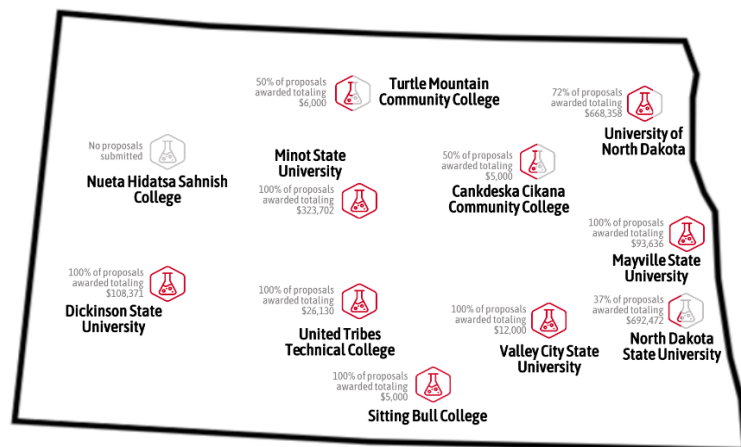


Figure 2. ND EPSCoR State Office funded STEM grants by location (FY20-21; fiscal years award were made). *The shading on each beaker represents the percentage of awards funded on each campus.

ND EPSCoR State Office Administration of Externally Funded Awards

The ND EPSCoR State Office administers two federally funded awards/cooperative agreements focused on building and broadening STEM research capacity throughout ND:

- 1. New Discoveries in the Advanced Interface of Computation, Engineering, and Science (ND-ACES):**

Expands and broadens ND's capacity in biosciences research, workforce development, outreach, and public education. This is a five-year (2020-2025) \$20M National Science Foundation (NSF) Research Infrastructure Improvement (RII) Track-1 cooperative agreement.²

The bioscience research of this agreement is accomplished by the collaborative efforts of researchers within the ND-ACES Center for Cellular Biointerfaces in Science and Engineering (CCBSE)³. The CCBSE has three pillars of scientific inquiry: materials design at biointerfaces; cellular systems at materials interface; and computation, machine learning, and predictive modeling. The CCBSE is also linked to the ND-ACES outreach arm, PROMoting Sustainable Partnerships in Education and Research (PROSPER)⁴; especially in the development of STEM pathways for students. This cooperative agreement will be active through June 30, 2025. In its Year 1 Annual Report filed with NSF on April 1, 2020, ND-ACES included 119 participants, 50 of whom were students. Twenty-two external engagements have been conducted involving 609 event attendees, of which 217 were underrepresented K-12 minority students. There were 13 publications and 22 faculty and student presentations. Collaborations within the state totaled 23 at four institutions. Other domestic collaborations totaled 21 at 15 institutions. Twelve external proposals totaling \$14,368,361 had been submitted. One new faculty (UND) has already been hired under this award. A second new faculty (NDSU) will be hired during Year 2.

- 2. Cultivating Indigenous Research Communities for Leadership in Education and STEM (CIRCLES) Alliance:** Addresses the underrepresentation of American Indian students in STEM disciplines and within the STEM workforce by working within tribal communities to determine STEM education needs. This \$185,330 NSF collaborative research planning grant (2020-2022) is part of a \$770,143 six-state alliance. The other EPSCoR states involved in this effort are Idaho, Montana (prime institution), New Mexico, South Dakota, and Wyoming. The CIRCLES Alliance states are home to 19 TCUs and span 49 tribes/nations. The shared vision for the Alliance is to increase the number of AI/AN students who enter and persist in STEM-related fields and to become a leader in advancing AI/AN preparation and success. The ND EPSCoR State Office also serves as the backbone organization for the Alliance.

The state office carries out its mission by partnering with 11 institutions of higher education in the North Dakota to build STEM capacity via partnerships, collaborations, subawards, and grants to institutions of higher education in the North Dakota (Figure 1). Five of the institutions are tribal colleges/universities (TCUs) that belong to the North Dakota Association of Tribal Colleges (NDATC: Candeska Cikana Community College, Nueta Hidatsa Community College, Sitting Bull College, Turtle Mountain Community College, and United Tribes Technical College) and six of the institutions belong to the North Dakota University System (NDUS: three primarily undergraduate institutions [PUIs: Dickinson State University, Mayville State University, and Valley City State University], one mater's college/university [MCU: Minot State University], and two research universities [RUs: North Dakota State University and University of North Dakota]). The next section describes each of those 11 participating institutions.

² North Dakota became EPSCoR eligible in 1985 and received its first NSF EPSCoR award in 1986, and since that time North Dakota has been continually funded by NSF and continuously funded by North Dakota for the RII Track-1 cooperative agreement.

³ Center for Cellular Biointerfaces in Science and Engineering (CCBSE) website:

https://www.ndepscor.ndus.edu/ndepscorprograms/track_1_nd_aces_prime_institution_ndsu_2020_2025/center_for_cellular_biointerf_aces_in_science_and_engineering/

⁴ PROMoting Sustainable Partnerships in Education and Research (PROSPER) website:

https://www.ndepscor.ndus.edu/ndepscorprograms/track_1_nd_aces_prime_institution_ndsu_2020_2025/promoting_sustainable_partnerships_in_education_and_research/

Demographics and STEM Programs at EPSCoR Participating Institutions with the North Dakota Association of Tribal Colleges (NDATC) and North Dakota University System (NDUS)

The Tribal Colleges/Universities (TCUs)

The five TCUs in North Dakota (Figure 1 and Table 3) were established between 1969 and 1973. With the exception of United Tribes Technical College (UTTC), each of them is located on a reservation. UTTC, located in Bismarck, was chartered by all of the tribes in North Dakota. The TCUs were created to provide culturally-responsive programs designed to meet the needs of tribal students and to be catalysts of cultural and socioeconomic revitalization for their communities. Although research was not part of the original vision of the TCUs, they began to engage in research as opportunities arose. The amount of research activity has risen steadily since the 1990s, when federal agencies and private foundations began funding STEM capacity-building programs and research at the TCUs. The research conducted at TCUs has always involved students and has always focused on projects that benefit the TCUs' constituent communities.

Beginning in 2014, ND EPSCoR's NSF RII Track-1 cooperative agreement, INSPIRE-ND, included TCU research participants in the research component of those agreements, as well as the outreach component. The current (2020-2025) NSF RII Track-1 agreement, [ND-ACES](#), also includes TCU, PUI, and MCU research participants.

Table 3. Demographics and STEM Programs of the Five TCUs.

(This table and subsequent updates are posted [here](#).)

Cankdeska Cikana Community College (CCCC)	Nueta Hidatsa Sahnish College (NHSC)	Sitting Bull College (SBC)	Turtle Mountain Community College (TMCC)	United Tribes Technical College (UTTC)
CAMPUS DEMOGRAPHICS				
Location: Ft. Totten, ND	Location: New Town, ND	Location: Ft. Yates, ND McLaughlin, SD Mobridge, SD	Location: Belcourt, ND	Location: Bismarck, ND
President: Dr. Cynthia Lindquist	President: Dr. Twyla Baker	President: Dr. Laurel Vermillion	President: Dr. Donna Brown	President: Dr. Leander McDonald
Total Enrollment: 293	Total Enrollment: 252	Total Enrollment: 405	Total Enrollment: 826	Total Enrollment: 528
Student/faculty ratio: 6 to 1	Student/faculty ratio: 9 to 1	Student/faculty ratio: 9 to 1	Student/faculty ratio: 10 to 1	Student/faculty ratio: 8 to 1
<u>by state of residency:</u> in-state: 100% out-of-state: 0%	<u>by state of residency:</u> in-state: 99.5% out-of-state: 0.05%	<u>by state of residency:</u> in-state: 55% out-of-state: 45%	<u>by state of residency:</u> in-state: 100% out-of-state: 0%	<u>by state of residency:</u> in-state: 54% out-of-state: 46%
<u>by ethnicity:</u> American Indian: 88% Asian:	<u>by ethnicity:</u> American Indian: 82%	<u>by ethnicity:</u> American Indian: 90% Asian:	<u>by ethnicity:</u> American Indian: 96% Asian:	<u>by ethnicity:</u> American Indian: 91% Asian:

0% Black or African American: 1% Hispanic/Latino: 1% White: 9% Two or more races: 0%	Asian: 0% Black or African American: 2% Hispanic/Latino: 6% White: 6% Two or more races: 5%	0% Black or African American: 0% Hispanic/Latino: 0% White: 9% Two or more races: 0%	0% Black or African American: 0% Hispanic/Latino: 1% White: 3% Two or more races: 0%	0% Black or African American: 3% Hispanic/Latino: 0% White: 5% Two or more races: 0%
<u>by gender:</u> female: 65% male: 35%	<u>by gender:</u> female: 67% male: 33%	<u>by gender:</u> female: 68% male: 32%	<u>by gender:</u> female: 60% male: 40%	<u>by gender:</u> female: 64% male: 36%
<u>by age:</u> 24 or under: 53% 25 and over: 47%	<u>by age:</u> 24 or under: 51% 25 and over: 48%	<u>by age:</u> 24 or under: 42% 25 and over: 57%	<u>by age:</u> 24 or under: 60% 25 and over: 40%	<u>by age:</u> 24 or under: 51% 25 and over: 49%
NUMBER OF DEGREE PROGRAMS				
Certificate level 3	Certificate level 8	Certificate level 10	Certificate level 13	Certificate level 5
Associate level 18	Associate level 12	Associate level 18	Associate level 11	Associate level 15
Bachelor's level none	Bachelor's level 3	Bachelor's level 7	Bachelor's level 3	Bachelor's level 3
Graduate level none	Graduate level none	Graduate level 3	Graduate level none	Graduate level none
FIVE LARGEST STEM PROGRAMS AND NUMBER OF STUDENTS/PROGRAM				
Nat. Res. Man. AS 2	Pre-Engineer AS 12	Environ. Studies AS 9	Gen. Science AS 32	Environ. Sci. AS 13
Pre-Engineer AS 5	Environ. Studies AS 7	Environ. Studies BS 5	Pre-Engineer AS 6	Environ. Sci. BS 6
Computer Sci. AS 1	Science AS 5	Info. Tech. AS 10	Pre-Environ. Sci. AS 1	Pre-Engineer AS 9
Environ. Sci. AS program furloughed	Environ. Sci. BS 5	Pre-Engineer AS 3	Biology AS 0	none NA
none NA	Mathematics AS 1	Environ. Studies MS 4	Chemistry AS 0	none NA

The Primarily Undergraduate Institutions (PUIs) and Master's College/University (MCU)

The three (PUIs and one MCU [Figure 1 and Table 4] were established between 1889 and 1918. Originally called "normal schools," they were created to produce K-12 teachers for schools in ND, and they each continue to have robust education departments that attract large numbers of students. Over the years, these campuses have

added departments and degree programs in STEM and many other areas. In addition, they produce education majors in STEM fields, thereby helping fulfill STEM workforce needs in the local communities. While some STEM faculty at the PUIs and MCU started conducting STEM research in the 1980s, research really increased in the 1990s, when faculty and administrators began to see the value of adding research to undergraduate STEM education. To continue that trend, ND EPSCoR's NSF 2014 RII Track-1 cooperative agreement included seed award funding for PUI and MCU research participants and the 2020 RII Track-1 researchers specifically named at each institution as senior personnel.

Table 4. Demographics and STEM Programs of the three PUIs and one MCU.

This table and subsequent updates are posted [here](#).

Dickinson State University (DSU, a PUI)	Mayville State University (Mayville State, a PUI)	Minot State University (Minot State, an MCU)	Valley City State University (VCSU, a PUI)
CAMPUS DEMOGRAPHICS			
Location: Dickinson, ND	Location: Mayville, ND	Location: Minot, ND	Location: Valley City, ND
President: Stephen Easton, J.D.	President: Dr. Brian Van Horn	President: Dr. Steven Shirley	President: Dr. Alan LaFave
Total Enrollment: 1441	Total Enrollment: 1168	Total Enrollment: 2920	Total Enrollment: 1953
Student/faculty ratio: 13 to 1	Student/faculty ratio: 13 to 1	Student/faculty ratio: 11 to 1	Student/faculty ratio: 13 to 1
<u>by state of residency:</u> in-state: 60% out-of-state: 34%	<u>by state of residency:</u> in-state: 61% out-of-state: 49%	<u>by state of residency:</u> in-state: 79% out-of-state: 21%	<u>by state of residency:</u> in-state: 74% out-of-state: 24%
<u>by ethnicity:</u> American Indian: 1% Asian: 1% Black or African American: 4% Hispanic/Latino: 6% White: 79% Two or more races: 3% Nonresident Alien: 3%	<u>by ethnicity:</u> American Indian: 1% Asian: 2% Black or African American: 6% Hispanic/Latino: 6% White: 81% Two or more races: 4% Nonresident Alien: 7%	<u>by ethnicity:</u> American Indian: 1% Asian: 1% Black or African American: 4% Hispanic/Latino: 8% White: 70% Two or more races: 6% Nonresident Alien: 9%	<u>by ethnicity:</u> American Indian: 1% Asian: 1% Black or African American: 2% Hispanic/Latino: 5% White: 85% Two or more races: 4% Nonresident Alien: 2%
<u>by gender:</u> female: 59% male: 41%	<u>by gender:</u> female: 62% male: 38%	<u>by gender:</u> female: 62% male: 38%	<u>by gender:</u> female: 60% male: 40%
<u>by age:</u>	<u>by age:</u>	<u>by age:</u>	<u>by age:</u>

24 or under: 79% 25 and over: 21%	24 or under: 70% 25 and over: 30%	24 or under: 77% 25 and over: 23%	24 or under: 75% 25 and over: 25%
NUMBER OF DEGREE PROGRAMS			
Certificate level 6	Certificate level 7	Certificate level 7	Certificate level 1
Associate level 5	Associate level 3	Associate level 1	Associate level 0
Bachelor level 52	Bachelor level 34	Bachelor level 56	Bachelor level 38
Graduate level 2	Graduate level 1	Graduate level 8	Graduate level 1
Graduate Certificates 0	Graduate Certificates 2	Graduate Certificates 9	Graduate Certificates 0
FIVE LARGEST STEM PROGRAMS AND NUMBER OF STUDENTS/PROGRAM			
Biology BS 62	Biology BS 33	Mathematics BS 11	Fish & Wildlife Man. BS 73
Computer Science BS 18	Mathematics BS 32	Biology BS 123	Health Science BS 52
Comp. Tech Mgmt BS 10	Chemistry BS 5	Chemistry BS 40	Biology BA/BS 20
Mathematics BS 6	Computer Science BS 2	Geology BS 15	Software Eng. BA/BS 15
Environ. Science BS 5	none	Comp. Science BS 65	Comp. Info. Sys. BA/BS 14

The Research Universities (RUs)

The two RUs were founded in 1883 and 1890 [Figure 1 and Table 5]. As North Dakota’s public land-grant research university, the role of North Dakota State University (NDSU) included an emphasis on agricultural programs and a network of agricultural research extension centers throughout the state. Whereas the University of North Dakota (UND) was founded as a liberal arts university, including North Dakota’s schools of medicine and law. From the beginning, both RUs’ goals included research and teaching in service of the entire state.

Table 5. Demographics and STEM Programs of the two RUs.	
North Dakota State University	University of North Dakota
CAMPUS DEMOGRAPHICS	
Location: Fargo, ND	Location: Grand Forks, ND
Dr. Dean Bresciani	President: Dr. Andrew Armacost
Total Enrollment: 12,846	Total Enrollment: 13,615
Student/faculty ratio: 16 to 1	Student/faculty ratio: 17 to 1
<u>by state of residency:</u> in-state: 42% out-of-state: 58%	<u>by state of residency:</u> in-state: 34% out-of-state: 66%
<u>by ethnicity:</u> American Indian: 0.6% Asian: 4.7% Black or African American: 3.2%	<u>by ethnicity:</u> American Indian: 1.5% Asian: 2% Black or African American: 3%

Hispanic/Latino: 2.8% White: 83.5% Two or more races: 3.6%	Hispanic/Latino: 4% White: 76% Two or more races: 4%
<u>by gender:</u> female: 49% male: 51%	<u>by gender:</u> female: 49% male: 51%
<u>by age:</u> 24 or under: 83% 25 and over: 17%	<u>by age:</u> 24 or under: 65% 25 and over: 35%
NUMBER OF DEGREE PROGRAMS	
Certificate level undergrad: 6	Certificate level undergrad: 36
Certificate level: graduate: 25	Certificate level graduate: 26
	Certificate level professional: 2
Associate level: 0	Associate level: 0
Bachelor's level: 146	Bachelor's level: 179
Graduate level: 135	Graduate level: 104
	Professional level: 2
FIVE LARGEST STEM PROGRAMS AND NUMBER OF STUDENTS/PROGRAM	
Mechanical Engineering: 797	Commercial Aviation: 1562
Biological Sciences: 458	Mechanical Engineering: 654
Computer Science: 453	Biology: 449
Civil Engineering: 366	Civil Engineering: 355
Electrical Engineering: 278	Electrical Engineering: 331

STEM Needs of the NDATC and NDUS Institutions

Faculty and administrators at TCUs, PUIs, and MCU were asked to describe and prioritize the STEM needs on their campuses (Table 6 [TCU STEM needs] and Table 7 [PUI and MCU STEM needs]). Because STEM needs can change from year to year, the ND EPSCoR State Office periodically asks each institution to update its list of STEM needs.

STEM NEEDS	CCCC	NHSC	SBC	TMCC	UTTC
Date updated	Feb. 2021	Feb. 2021	Jan. 2021	Feb. 2021	Feb. 2021
Scholarships for junior and senior STEM undergrads	13	3	4	12	2
Tutoring for STEM students	3	13	11	4	1
More research opportunities for STEM faculty	6	2	7	6	7
Summer bridge camp for graduating high school seniors	12	11	12	2	8
Transfer specialist at each campus	1	9	14	11	13
K12 STEM outreach coordinator at each campus	2	4	13	10	9
Release time for STEM faculty to conduct research	7	8	5	7	5
Scholarships for graduate STEM students	14	14	3	14	10
Research facilities and infrastructure development	9	5	2	1	3
Grant writing and networking facilitation	8	6	9	5	4
K12 outreach activities	4	1	10	3	11

Renovating labs	10	12	8	13	6
Graduate student teaching interns	5	10	6	8	12
A sponsored programs office	11	7	1	9	14

Table 7. STEM needs at the PUIs and MCU and their priority rankings (1=highest priority).

STEM NEEDS	DSU	Mayville	Minot	VCSU
Date updated	Dec. 2020	Feb. 2021	Feb. 2021	Dec. 2020
Scholarships for junior and senior STEM undergrads		3	2	1
Tutoring for STEM students	2	12	6	8
More research opportunities for STEM faculty	5	1	5	3
Summer bridge camp for graduating high school seniors		6	8	9
Transfer specialist at each campus		14	14	12
K12 STEM outreach coordinator at each campus	6	8	11	10
Release time for STEM faculty to conduct research		5	1	5
Scholarships for graduate STEM students		13	12	2
Research facilities and infrastructure development		4	3	7
Grant writing and networking facilitation		11	9	8
K12 outreach activities	1	7	7	4
Renovating labs	3	2	4	14
Graduate student teaching interns	4	9	10	11
A sponsored programs office	7	10	13	13

STEM Research at the NDATC and NDUS Institutions

Although the main focus of the MCU/PUI/TCUs is teaching, many of the STEM faculty at those institutions also conduct research. In order to facilitate research collaborations and aid in proposal preparation, we are listing faculty research interests in this section (Table 8 [TCU faculty research and outreach interests], Table 9 [PUI and MCU faculty research and outreach interests], and Table 10 [RU faculty research and outreach interests]).

Table 8. TCU STEM faculty research and outreach interests.
This table and subsequent updates are posted [here](#). If you would like to be added to this table, please complete [this form](#).

Campus	Faculty Name and Department	Research/Outreach Interest
Cankdeska Cikana Community College	Michael Parker Pre-Engineering	Mushroom biology and 3D printing
	Brent Voels Science	Molecular genetics, mushroom physiology, 3D printing, and undergraduate research
Nueta Hidatsa Sahnish College	Tanya Driver Environmental Science	Environmental science
	Amber Finley Environmental Science	Environmental science
	Kerry Hartman Environmental Science	Juneberry ecology, air quality, water quality, cellular systems, and K-12 outreach (NATURE)
	Israt Jahan Science	Computational algorithms and data mining

Sitting Bull College	Dan Buresh Environmental Science	General ecology, wetland ecology, aquatic ecosystems, and environmental health
	Gary Halvorson Environmental Science	Soil chemistry, water quality, soil fertility, and land reclamation
	Joshua Mattes Environmental Science	Robotics, physics, and engineering
	Mafany Ndiva Mongoh Environmental Science	Animal health/epidemiology, microbial ecology, climate change, and K-12 outreach (NATURE)
	Francis Onduso Environmental Science	Forest ecology, range ecology, riparian ecology, fire ecology, mycology, and genomics
	Rena Schmitt Environmental Science	General ecology, grassland ecology, avian ecology, and invasive species ecology
Turtle Mountain Community College	Austin Allard Math, Engineering, and Science	Nondestructive testing, smart structures, 3D printing, and K-12 outreach (NATURE)
	Lyle Best Math, Engineering, and Science	Human genetics
	Stacie Blue Natural Resources	Plant phenology and water quality
	Deborah Hunter Math, Engineering, and Science	Molecular genetics and water quality
United Tribes Technical College	Sajjad Abdullajintakam Environmental Science	Geology and Geochemistry
	Alexa Azure Pre-engineering	Environmental engineering
	Alicia Andes-Buysse Environmental Science	Wildlife ecologist
	Anna Bahnson (staff) Environmental Science	STEM education and community outreach
	Boampong Asare Environmental Science	Statistics
	Linda Black Elk Environmental Science	ethnobotany
	Emily Biggane Environmental Science	Environmental toxicology and cell biology
	Gurjot Dhaliwal Environmental Science	Manufacturing of composites and polymers, computational modeling and materials testing
	Jeremy Guinn Environmental Science	Wildlife biology
	Mandy Guinn Environmental Science	Bat ecology, population genetics, and K-12 outreach (NATURE)
	Dennis Lowman Computer Information	Cyber security
Niranjan Warnakulasooriya	Physics and Applied Mathematics	

Table 9. PUI and MCU STEM faculty research and outreach interests.

This table and subsequent updates are posted [here](#). If you would like to be added to this table, please complete [this form](#).

Campus	Faculty Name and Department	Research/Outreach Interest
Dickinson State University	Paul Barnhart Biology	Wildlife biology, specifically bats
	Katsu Ogawa Chemistry	Computational modeling of nano-bio interfaces to characterize nanomaterial scaffolds with applications in biochemical and biotechnological areas
	Shivangi Nangia Chemistry	Chemistry, specifically theoretical physical chemistry
	Craig Whippo Biology	Botany
Mayville State University	Andi Dulski-Bucholz Education	K-12 outreach
	Thomas Gonnella Chemistry	Enzyme biochemistry
	Khwaja Hossain Biology	Plant-based biocomposites; plant uptake and translocation of micronutrients and drugs; and undergraduate research
	Michael Kjelland Biology	Biomedical, biotechnology, cryobiology, cell culture, flow cytometry, assisted reproduction research, and porcine collagen matrix scaffolding
	Joseph Mehus Biology	Invertebrate ecology and parasitology
	Jeni Peterson	K-12 STEM lesson plan development and K-12 outreach
Minot State University	Lucy Bobyleva Chemistry	Design and synthesis of environmentally friendly agrochemicals and safe pharmaceuticals based on natural templates
	Mikhail Bobylev Chemistry	Design and synthesis of environmentally friendly agrochemicals and safe pharmaceuticals based on natural templates and K-12 outreach
	Joseph Collette Geoscience	Arthropod evolution
	Robert Crackel Chemistry	Absorption spectroscopy, water quality studies, and chemical education and K-12 outreach
	Alexandra Deufel Biology	The function and evolution of the snake feeding apparatus

	Rahul Gomes Computer Science	Big data, machine learning, and K-12 outreach
	Thorpe Halloran Biology	Physicochemistry of aquatic ecosystems
	Chris Heth Chemistry	Conjugate polymers
	Kathryn Kilroy Geoscience	Vertical hydraulic conductivity, vertical Gradients, and aquifer recharge in the Missouri Couteau of North Dakota
	Paul Lepp Biology	Microbial ecology and evolution
	Draza Markovic Physics	Evolution of Rossby-Alfven waves in rapidly rotating, magnetized neutron stars
	Bryan Schmidt Science	Allosteric disulfide bonds in proteins
	Darren Seifert Computer Science	Cyber security and K-12 outreach
	Heidi Super Biology	Cancer genetics, in particular, chromosome abnormalities associated with leukemias
	John Webster Geoscience	Igneous petrology and geochemistry
	Naomi Winburn Chemistry	K-12 outreach
Valley City State University	Sabrina Brown Geology	Diatom assemblages
	Andre DeLorme Biology Prairie Waters Education/Research Center	Macroinvertebrate bioassessment, aquatic insect species ranges in response to climate change, toxicity testing, and K-12 outreach
	David DeMuth Physics	K-12 outreach (Geodome)
	Nicholas Galt Biology	Stress physiology and regulation of gene expression; educational computer models and simulations
	Kevin Murphy Chemistry	Computational chemistry
	Susan Pfeifer Computer Science	Virtual reality
	Hilde van Gijssel Biology & Chemistry	Fruit fly genetics and cellular systems
	Casey Williams Biology	Native fish
	Jamie Wirth Mathematics	K-12 outreach

Table 10. RU STEM faculty research and outreach interests.

This table and subsequent updates are posted [here](#). If you would like to be added to this table, please complete [this form](#).

Campus	Faculty Name and Department	Research/Outreach Interest
North Dakota State University	Adnan Akyuz Climatological Practice	Climatology and climate change (NATURE)
	Laura Aldrich-Wolfe Biological Sciences	Community ecology, mycorrhiza and plant-fungal interactions
	Dante Battocchi Coatings & Polymeric Materials	Electrochemical analysis and characterization of corrosion events on metal surfaces and protective coatings
	Peter Bergholz Microbiological Sciences	Adaptive variation in microbial populations, with a specific focus on bacteria that cause foodborne disease
	Marisol Berti - Plant Science	Industrial crops, crop rotation and life cycle analysis of crops
	Julia Bowsher Biological Sciences	Evolutionary and developmental biology of insects, and K-12 outreach (NATURE)
	Uwe Burghaus Chemistry and Biochemistry	Model catalysts, nanotubes, alkaline earth oxides, and K-12 outreach (NATURE)
	Dong Cao Electrical Engineering	Power supplies, solar panel technology (NATURE)
	Nilanjan Caudhuri Electrical and Computer Engineering	Wind farms and power grids
	Yongki Choi Physics	Developing an electronic platform that can selectively detect individual target biomarkers of pancreatic cancer.
	Xuefeng (Michael) Chu Civil and Environmental Engineering	Measurement and modeling of multi-scale watershed hydrology and topography
	Stephanie Day Geosciences	Using lidar and terrestrial laser scanning to understand how landscapes change (NATURE)
	Anne Denton Computer Science	Data Mining, Bioinformatics, Scientific Informatics, Databases, Geospatial Data, Cloud Computing (NATURE)
	Ned Dochtermann Biological Sciences	Ecological and evolutionary maintenance and consequences of phenotypic variation, in particular behavioral variation and behavioral correlations.
	David Franzen Natural Resource Sciences	Soil fertility and nutrient loss from wind erosion
	Erin Gillam Biological Sciences	Evolution and Behavioral Function of Communication Signals Using Bats as a Model
Timothy Grieves Biological Sciences	Physiological and evolutionary mechanisms regulating life-history transitions in seasonal environments.	

Ademola Hammed Agricultural and Biosystems Engineering	Food and bioporducts engineering, valorization of agriculture bioproducts and wastes, and biotechnology engineering (NATURE)
Britt Heidinger Biological Sciences	Physiological ecology, senescence, stress physiology (NATURE)
Ying Huang Civil & Environmental Engineering	Smart materials, structural health, smart cities & autonomous systems, intelligent transport systems, pavement & traffic monitoring, pipeline corrosion protaction & mitigation, K-12 outreach (NATURE)
Leah Irish Psychology	The interplay of sleep and waking health behaviors and the promotion of sleep health in the general population.
Long Jiang Mechanical Engineering	Nanoscale materials synthesis and applications, materials from renewable resources, nanocomposites, carbonaceous materials, polymeric materials processing and functionalization
Dinesh Katti Civil & Environmental Engineering	Geotechnical engineering, constitutive modeling of geologic materials, expansive soils, multiscale modeling, steered molecular dynamics, computational mechanics, nanocomposite, and bio-nanocomposites. computational biophysics
Kalpana Katti Civil & Environmental Engineering	Advanced composites, nanomaterials, biomaterials, biomimetics, materials characterization and modeling, analytical electron microscopy, and microspectroscopy, bone tissue engineering
Svetlana Kilina Chemistry and Biochemistry	Nanomaterials and computational chemistry
Jiha Kim Biological Sciences	Cross communications between cancer cells and tumor microenvironment focusing on vascular and immune components, identifying a mechanism to reprogram the perivascular signature to promote vascular functionality and enhance drug delivery
Trung Bao Le Civil & Environmental Engineering	Computational algorithms and data mining
Zhibin Lin Civil and Environmental Engineering	High-performance resilient and sustainable civil infrastructure systems
Lu Liu Computer Science	Bioinformatics, data mining, machine learning and computational biology and K-12 outreach (NATURE)

Ganapathy Mahalingam Architecture & Landscape Architecture	The design of proscenium-type auditoriums based on object-oriented computing technology.
Zoltan Majdik Communication	Communicating science
Sanku Mallik Pharmaceutical Sciences	Synthetic medicinal chemistry, bio-organic chemistry, liposomes, and drug delivery
Lisa Montplaisir Biological Sciences	Science education, teaching and learning, curriculum development; and research experiences for undergraduate students
Lokesh Karthik Narayanan Industrial and Manufacturing Engineering	Additive manufacturing for tissue engineering and regenerative medicine
James Nyachawaya Education/Chemistry and Biochemistry	Chemistry education and research experiences for undergraduate students
Alex Parent Chemistry & Biochemistry	Development of catalyst systems using earth abundant metals and chemical processes using benign solvents and reagents, such as water and air; and K-12 outreach (NATURE)
Ghasideh Pourhashem Coatings and Polymeric Materials	Environmental impact assessment to inform decision making, life cycle assessment and techno-economic analysis of bio-based products, industrial ecology, and bio-based product policy
Mohiuddin Quadir Coatings and Polymeric Materials	Organic polymer chemistry, functional self-assembly of polymers, biomaterials, application-guided modification of polymers for pharmaceutical and medical use, and bio-based materials
Bakhtiyor Rasulev Coatings and Polymeric Materials	Cheminformatics, computational chemistry of polymers and coating materials, quantitative structure-activity relationship, molecular modeling, nanoparticles, physico-chemical properties and toxicity
David Roberts Agribusiness and Applied Economics	Econometric analysis on the impacts of agricultural production methods on environmental resources
Mukund Sibi Chemistry and Biochemistry	Catalysis and organic synthesis
Todd Sirotiak Construction Management and Engineering	Construction administration improvement and construction process improvement
Jessica Striker Mathematics	Enumerative, geometric, and dynamical algebraic combinatorics
Chad Ulven Mechanical Engineering	Advanced composites materials development, environmentally friendly

		materials processing, nondestructive evaluation, and impact/high strain rate characterization of advanced materials
Sathish Venkatachalem Pharmaceutical Sciences		Human lung diseases such as asthma, chronic obstructive pulmonary disease, lymphangioleiomyomatosis (LAM) disease and pulmonary hypertension
Chrysafis Vogiatzis Industrial and Manufacturing Engineering		Sensors in Transportation and Logistics Networks, in Sensors: Theory, Algorithms, and Applications, Springer Optimization
Andriy Voronov Coatings and Polymeric Materials		Polymer synthesis, micellar self-assembly, sustainable biobased polymeric materials, responsive polymers for biomedical applications, polymers for biomimetic conversion of biomass, polymer latexes, polymer hydrogels, and polymer thin films
Dean Webster Coatings and Polymeric Materials		Polymer synthesis, thermosets, polymerization reactions, bio-based materials, marine coatings, and combinatorial and high throughput methods
John Wilkinson Chemistry and Biochemistry		The roles of cellular metabolism and apoptosis in cancer pathogenesis
Wenjie Xia Civil & Environmental Engineering		Multiscale modeling and computational design of soft matters, polymers, and biological/bioinspired materials that are broadly applied in structural/infrastructural, mechanical and bioengineering applications
Mijia Yang Civil & Environmental Engineering		Structural health monitoring; new materials for sensing, excitation, strength and stiffness enhancement, material self-healing, and energy harvesting; K-12 outreach (NATURE)
Zhongyu Yang Chemistry		Structure-function relationship of proteins upon conjugation with synthetic materials using bioanalytical chemistry and EPR spectroscopy
Ravi Yellavajjala Civil & Environmental Engineering		Experimental and theoretical mechanics, constitutive modeling of materials, numerical methods, sensitivity analyses of structural response, forensic failure analysis and advanced visualization techniques
Wenfang Sun Chemistry & Biochemistry		Materials chemistry

	Pinjing Zhao Chemistry & Biochemistry	Inorganic and organic chemistry; synthesis and mechanistic organometallic chemistry; homogeneous catalysis
University of North Dakota	Ali Ahshami Chemical Engineering	Bio-based dielectric substrates (NATURE)
	Tamba-Kuii Bailey Education, Health & Behavior	Vocational psychology of rural populations (farmers)
	Wayne Barkhouse Physics & Astrophysics	Astrophysics, galaxy clusters, galaxies, cosmology
	Frank Bowman Chemical Engineering	Atmospheric aerosols and assessment of K-12 STEM outreach
	Deniz Cakir Physics & Astrophysics	Nanowires & clusters, metal-organic interfaces, thermal properties of materials, organic electronics
	Qianli (Rick) Chu Chemistry	Synthesis of nanofibers from bio-based monomers
	Colin Combs Biomedical Sciences	Neuroimmune interactions during aging and neurodegenerative diseases
	Tristan Darland Biology	Genetic and epigenetic effects on developmental neurology
	Diane Darland Biology	Neural-vascular development, epigenetic regulation of vascular-microenvironmental interactions
	Jerome Delhommelle Chemistry	Machine learning, crystallization, molecular simulation, adsorption, nucleation, rheology, water (NATURE)
	Archana Dhasarathy Biomedical Sciences	Chromatin, molecular biology, epigenetics, cancer, next-generation sequ
	Daba Gedafa Civil Engineering	Pavement strength and traffic safety
	Guodong Du Chemistry	Catalytic and stereoselective synthesis of biodegradable polymers that are based on renewable raw materials
	Surojit Gupta Mechanical Engineering	Sustainable materials, high temperature ceramics and alloys, nanotechnology, additive, and green manufacturing
	Amanda Haage Biomedical Sciences	Anatomy & physiology, diversity & equity in STEM, cell migration & adhesion, and cancer metastasis
	Meysam Haghshenas Mechanical Engineering	Physics & astrophysics
	I-Hsuan Ho Geology & Geological Eng	Geotechnical/geological/civil engineering, unsaturated soil, buried culverts
	Mark Hoffman Chemistry & Biochemistry	Computational chemistry

Bethany Klemetsrud Chemical Engineering	Renewable energy, thermochemical conversion, life cycle assessment, and K-12 outreach (NATURE)
Yun Ji Chemical Engineering	Carbon capture, utilization, and storage; biofuels; and biochar
Cindy Juntunen Education and Human Development	Vocational psychology of rural and underrepresented groups
Aaron Kennedy Atmospheric Sciences	Numerical modeling of convective cloud dynamics, stakeholder engagement, and K-12 outreach
Bethany Klemetsrud Chemical Engineering	Renewable energy, sustainability assessment, and K-12 outreach (NATURE)
Alena Kubatova Chemistry	Analytical chemistry, valorization of lignins, chromatographic and mass spectral analysis
Taufique Mahmood Geological Engineering	Wetland dynamics, watersheds, and nutrient transport
Manu Manu Biology	Gene regulatory networks and gene regulation during hematopoietic cell-fate specification.
Rachel Navarro Education, Health & Behavior	STEM interest/persistence, counseling psychology, multicultural vocational psychology, Latina/o psychology, rural psychology, and quantitative methods
Robert Newman Biology	Ecology, population biology, wildlife, conservation, remote sensing, UAS, amphibians, grazing mammal
Stephan Nordeng Geological Engineering	Petroleum geology
Sima Noghianian Electrical Engineering	Bio-Based dielectric substrates
Minou Rabiei Petroleum Geology	Petroleum Geostatistics
Sougata Roy Mechanical Engineering	Tribology, surface engineering, failure analysis, rolling contact fatigue, metal additive manufacturing, ionic liquid and nanofluid lubrications
Wayne Seames Chemical Engineering	Renewable energy, biofuels, carbon capture, process engineering, novel reactions, scale-up, chemical
Sarah Sletten Biomedical Sciences	Active learning, flipped classrooms, problem-based learning, girls in STEM, K-12 STEM teacher professional development
Binglin Sui Chemistry & Biochemistry	Materials design
Ryan Summers Teaching and Learning	Teacher education and professional development and K-12 outreach

Motoki Takaku Biomedical Sciences	Chromatin regulators in cancer, early cancer detection
Dongmei Wang Geology & Geological Engineering	Enhanced oil recovery, PetroPhysics, numerical simulation, economic evaluation on EOR
Feng (Frank) Xiao Civil Engineering	Environmental engineering, environmental chemistry, water treatment, emerging contaminants, and carbonaceous materials
Cai Xia Yang Mechanical Engineering	Stability analysis, fault detection
Jianglong Zhang Atmospheric Sciences	Satellite remote sensing of atmospheric aerosols and data assimilation
Julia Zhao Chemistry	Nanoscience, nanotechnology, and K-12 outreach (NATURE)
Haochi Zheng Earth Systems Science & Policy	Environmental and natural resource economics