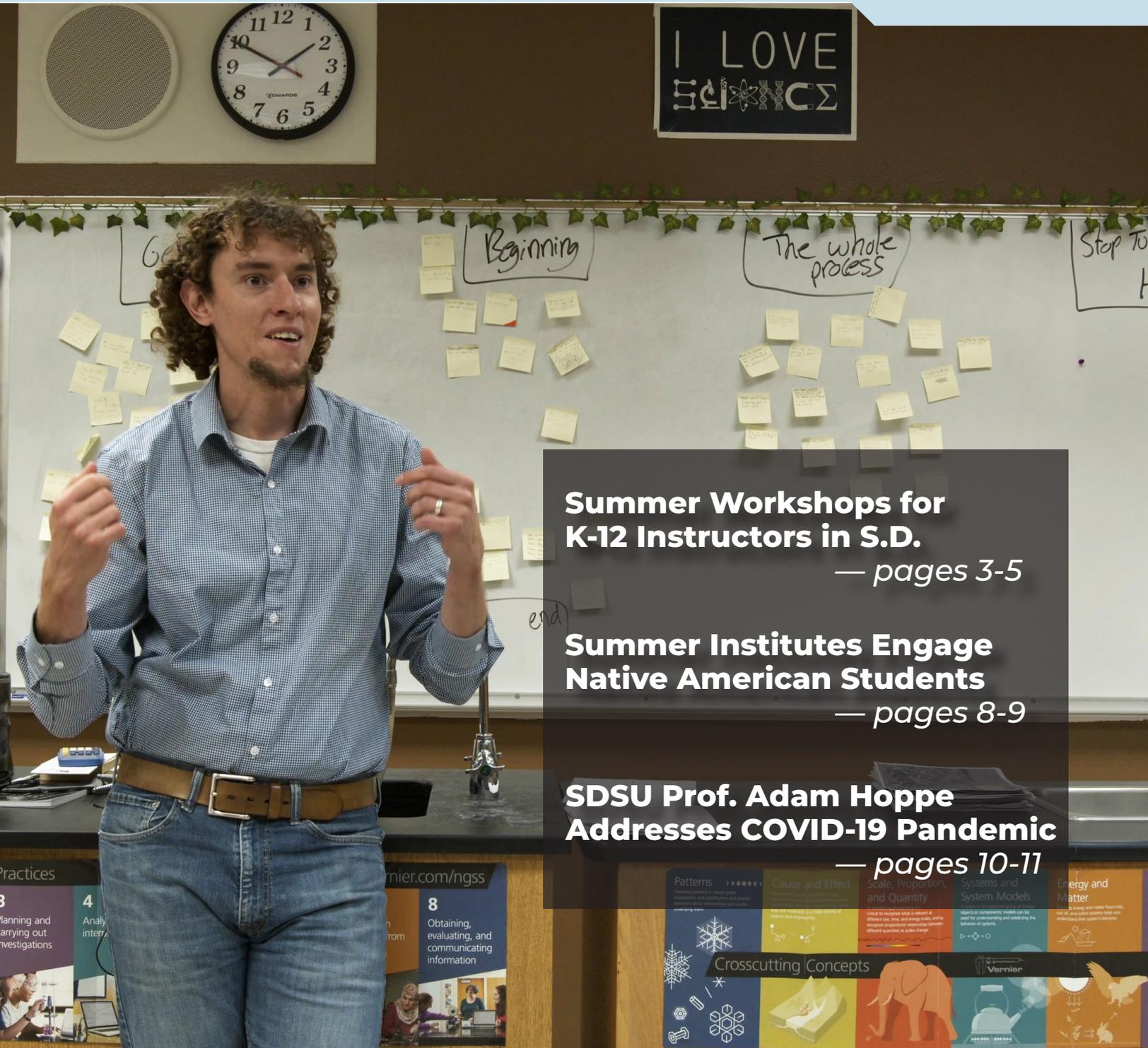




SD EPSCoR UPDATE

Linking South Dakota's Future with STEM Research



**Summer Workshops for
K-12 Instructors in S.D.**

— pages 3-5

**Summer Institutes Engage
Native American Students**

— pages 8-9

**SDSU Prof. Adam Hoppe
Addresses COVID-19 Pandemic**

— pages 10-11

Features



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SUMMER EDUCATION WORKSHOPS



3-5

AT LEFT

In the virtual 3-day 2020 training workshops, South Dakota K-12 teachers received a stipend, graduate credit opportunity, access to curriculum unit materials, and more. See pp. 3-5.

ON THE COVER

Darin Newton found unexpected fulfillment as a substitute teacher, then made a full career change. More about this Belle Fourche science teacher on pp. 6-7.

BELOW

Doctoral student Md Saddam Hossain loads a sample into a flow cytometer as part of an NSF-funded COVID-19 research project at SDSU. More on pp. 10-11.

ALSO IN THIS ISSUE

CIRCLES Alliance for Indigenous Research in STEM	5
Teacher Embraces New Career, New Concepts	6-7
Summer Research Institutes Engage Students	8-9
SDSU Prof Adam Hoppe's NSF COVID-19 Research	10-11
Native American Graduate Assistantships	11



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10-11



Science Workshops for K-12 Teachers

Five new 2021 workshops related to biofilms are available. The workshops are supported in partnership with the South Dakota Department of Education and through the South Dakota Science Teaching Association. [Learn more and register at sdepacor.org/teachers.](https://sdepacor.org/teachers)

Virtual three-day teacher workshops will again be offered this summer to K-12 instructors in South Dakota. Participants will strengthen their understanding of three-dimensional science teaching and receive support in meeting South Dakota's K-12 Science Standards.

Similar to last year, participants will learn about science and engineering research related to biofilms that is underway at universities across our state. As a platform for both addressing effective science instruction and teaching about the science and engineering research of EPSCoR, last year's workshops featured a brand-new curriculum unit developed by project staff members called "Biofilms — Stuck Like Glue, Stuck on You."

More than 180 teachers participated in 2020 across nine sections — plus nearly twenty SD EPSCoR project staff and undergraduate summer interns.

This summer, teachers will again be offered a \$300 stipend and have the option to take the class for one graduate credit at a highly discounted tuition rate. The virtual workshops are focused on effective science teaching as described in the National

Research Council's "A Framework for K-12 Science Education," (2012) and use a combination of guided independent learning, collaborative online learning, and hands-on science activities and experiences.

Teachers who could not attend the workshops last summer are encouraged to participate this summer.

“

By offering the workshops virtually, we believe many teachers participated who might not have been able to travel to face-to-face offerings due to the rural and remote nature of many South Dakota schools. We also found that the virtual format allowed for the building of relationships among teachers across geographic regions. These relationships have the potential to pay dividends long into the future.

— Dr. Ben Saylor

Director, Center for the Advancement of Math and Science Education

Director, Sanford Science Education Center

Professor, Physical Science & Mathematics at Black Hills State University

”

Five new workshops related to biofilms are available for K-12 teachers to attend in 2021.

VIRTUAL WORKSHOPS

June 29–July 1 (Tuesday–Thursday)

Repeat of Year-1 online workshop

Fundamentals of Three-Dimensional Instruction & Biofilms (previously offered in 2020); participants will also learn about the following curriculum unit:

- Middle School (Grades 6-8):
Stuck Like Glue — Stuck on You

Students are introduced to biofilms, why bacteria form them, and factors influencing organism growth.

The workshops are supported in partnership with the **South Dakota Department of Education** and through the **South Dakota Science Teaching Association**.



July 20-22 (Tuesday–Thursday)

Year-2 workshops

Planning for Sense-Making in Three-Dimensional Instruction; participants will also learn about one of five new curriculum units that they will select on the registration form:

- Elementary (Grade 3): Pond Scum

What is it, why does it grow, and how can we get rid of it without killing other things growing in the pond?

Register at
sdepscor.org/teachers
— *Space is limited in each session,
so register early.*

Summer Science Teacher Workshops

— Featuring:

- Phenomena-based instruction
- Facilitation of classroom discourse
- Attention to equity and cultural relevance
- Access to new curriculum modules

Co-facilitated by teacher leaders across the state of South Dakota

Contact us:

If you have questions, please email
sdepscor@sdbor.edu

-
- Elementary (Grades 3-4):
What's in My Water Bottle?

What develops in a neglected water bottle?
Design a water bottle that would prevent a biofilm from forming.

- Middle School (Grades 6-8): Dead Zones

Discover that actions taken in South Dakota influence an algal bloom in the Gulf of Mexico, creating a dead-zone where oxygen is depleted and many ocean organisms are unable to survive.

- High School (Interdisciplinary): Water Quality

Compare biocorrosion and corrosion, learn standards of water quality, create a filtration system, remove metal ions from water, and create a plan based upon various water quality results.

- High School (Grades 9-12): Biofilms in the Body

A majority of wound infections are caused by bacteria that form biofilms and are especially difficult to treat. This unit addresses mucus, antibiotic resistance, preventative measures, and medical implants.



I came into this thinking, 'For the \$300 stipend, I can sit through six or so hours of PD [professional development] for a couple days.' But, honestly, I think I would do this again without the stipend, because I gained so much insight! I feel sooooo much more confident going into the school year teaching science. There are a few logistical questions I have, but I'll figure them out as I go!

— Middle School Teacher



CIRCLES
ALLIANCE

Cultivating Indigenous Research Communities for Leadership in Education and STEM (CIRCLES) Alliance

Dr. Ben Saylor, from Black Hills State University, led South Dakota EPSCoR's collaboration with Montana, Idaho, North Dakota, Wyoming, and New Mexico to secure a \$739,619 National Science Foundation EPSCoR award, titled, *Cultivating Indigenous Research Communities for Leadership in Education and STEM (CIRCLES) Alliance*.

Through the CIRCLES Alliance, researchers at the University of Idaho, Central Wyoming College, the University of New Mexico, Black Hills State University, North Dakota State University and the University of Montana will build on strong, existing partnerships with tribal communities and colleges to study promising practices and areas of greatest need in STEM education for American Indian and Alaska Native (AI/AN) students. The CIRCLES Alliance states are home to 19 tribal colleges/universities (TCUs) and span 49 tribes/nations.

The project seeks to develop AI/AN-based STEM education activities for K-12 and higher education students, as well as become a model for partnering with tribal communities to advance Indigenous-based STEM education. Ultimately, the project aims to support tribal communities in producing a STEM-ready workforce to meet their communities' unique economic development needs.

Teacher Embraces New Career, New Concepts

Darin Newton found unexpected fulfillment as a substitute teacher, then made a full career change.



Image By
Matthew Kapust



Text By
Constance Walter,
Sanford Lab

When Darin Newton graduated from the University of Montana with a master's degree seven years ago, he fully expected to be working in his area of study: wildlife biology. When his wife, also a wildlife biologist, took a job in the Belle Fourche area, Newton began working as a kindergarten assistant and substitute teacher in the Belle Fourche school district. It was a temporary thing, meant to last only until he found a job in his field. But then something completely unexpected happened.

"I really enjoyed being around the kids," Newton said, smiling broadly. "And then the next two years I moved up in the different grade levels and found that I really enjoyed being in the classroom. I really enjoyed interacting with the students. And that got me thinking, 'maybe this is something I could get into.'"

After his third year as a substitute teacher, Newton applied for a full-time position as a middle school science instructor. He also enrolled at Black Hills State University, where he earned a Master of Science in Education.

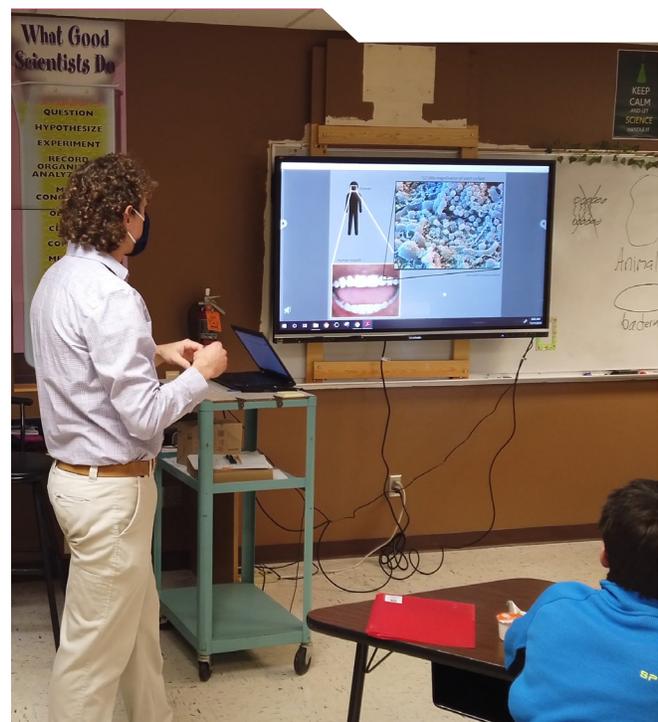
Darin Newton, who has a Master's degree in wildlife biology, found unexpected fulfillment as a substitute teacher, then made a full career change to become a middle school science teacher in the Belle Fourche school district.

Photo by Matthew Kapust

"I did a complete career shift. I wasn't super confident about it — it was a leap. But, yeah, after five years of teaching, I'm really glad I did," Newton said.

About the time Newton began teaching full time, the school district implemented the new South Dakota science standards, which emphasize three-dimensional learning. Our understanding of science and engineering changes all the time. Three-dimensional learning shifts science education from rote memorization to thinking and acting like a scientist to application and problem-solving.

It was a new way of teaching and, like other teachers, Newton was struggling. That's when he signed up



for the teacher professional development program offered by the Sanford Underground Research Facility's Education and Outreach (E&O) Department. The educational concepts directly leverage the science taking place at Sanford Lab. Educators can use the real phenomena and unsolved questions being explored underground to generate student interest, allowing student questions to drive the learning, as they master South Dakota science standards.

"I saw this opportunity, and I jumped on it. I'm really glad I did," he said. "I had some 'Aha!' moments as I was going through that professional development." Newton began to see how three-dimensional learning might look and began applying it in his classroom. Later, Newton signed on to help facilitate professional development programs with E&O.

"Darin embraces every challenge and every opportunity with hopeful optimism," said Nicol Reiner, STEM educator development specialist with E&O. "He is thoughtful and curious, which means he is a great leader, and he asks really good questions." One of the participants in the program said Newton had "a wealth of experience, enthusiasm, and commitment to transformative ways of teaching science."

Currently, Newton is piloting a new curriculum unit, "Biofilms — Stuck Like Glue, Stuck on You," which focuses on biofilms, as illustrated by dental plaque. The module was developed by Becky Bundy, E&O education specialist, with input and feedback from her team members and teachers.

"As you can imagine, that got some interesting reactions from the students," Newton said, laughing. "They have a lot of fun with the activities and show a lot of excitement."

Currently, Newton is piloting a new curriculum unit, "Stuck like Glue, Stuck on You," which focuses on biofilms, as illustrated by dental plaque. Read more about the K-12 science training on pp. 3-5.

"Darin seemed a perfect fit for piloting the new Biofilms unit as he had also helped lead the summer professional development workshops that featured the unit," Bundy said. "So, unlike other piloting teachers, he already had some familiarity with the content, the strategies used, and how the lessons tie together to tell a story."

And it's the idea of a "story" that most interested Newton. "In the last couple of years, I've really gotten interested in the concept of storylines and how three-dimensional teaching can improve the experience for students," Newton said, adding that students learn in different ways.

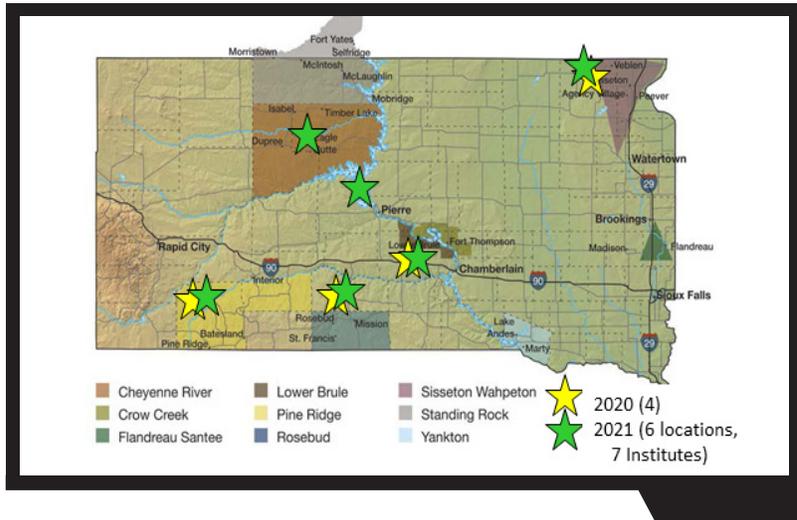
As part of EPSCoR, Newton and a partner were tasked with developing a concept into a unit. Their goal? To create wonder and generate curiosity using a phenomenon that was connected to South Dakota. They chose to explore "dead zones" in the Gulf of Mexico.

"We used that because South Dakota is connected to those zones through agricultural and sewage runoff which runs through our waterways and into the Gulf of Mexico," he said. "It helps students understand that even though we are as interior in the United States as you can get, there still can be major impacts on places that are hundreds of miles away."

Teaching three-dimensionally taught Newton something else.

"It opens the door to all sorts of learning opportunities for students. It allows students who might be struggling with traditional methods to grasp concepts and then be able to show you what they learned," he said. "And that's what you want to see in your classroom."

Summer Institutes Engage Students



Summer Institute experiences engage Native American graduate students in teaching and research activities. The graduate students gain valuable teaching experience while also being role models and mentors for the younger Native American students.

Native American high school and undergraduate students complete a dual-credit STEM course and participate in a research experience. The 4- to 8-week experiences allow students to work in their community and then visit partner universities to utilize research facilities as part of the research experience.

GOAL/OBJECTIVES

- Support Native American students to transition from high school to college.
- Increase the number of Native American students attending college.

ACTIVITIES/AIMS

- Deliver STEM course to Native students in an engaging mode of instruction.
- Engage Native students in hands-on research experiences.
- Familiarize students with college opportunities.

While COVID 19 caused the Summer Institute research experience for Native American students to be virtual, 28 students participated in 2020.

Students participating in and completing the institute receive a \$1,000 stipend. Details on the 2021 summer institutes can be found at sdepscor.org/institutes.

New Faculty Hires

Robert Walsh, Sisseton Wahpeton College, Director of Educational Programs — Dr. Walsh's current research projects highlight teaching and learning for blended and flipped pedagogy; Asian models of education; transformative learning and identity; service learning; and local food systems initiatives.



Jeffrey Buffkin, Sinte Gleska University, Assistant Professor of Mathematics — Buffkin has designed and implemented curricula for the purpose of increasing engagement in STEM education and maintains aspirations of pursuing a Ph.D. of mathematics and/or becoming a CFP.



**Register at
sdepscor.org/
institutes**

— *Space is limited,
so register early.*

Elisha Yellow Thunder, an SDSU graduate student, taught and served as a role model for the seven Oglala Lakota College 2020 participants and will assist with the 2021 summer institutes.



2021 Summer Institutes are scheduled at these six S.D. locations:

— Oglala Lakota College (in Kyle):
HS students will engage in authentic, hands-on interdisciplinary research experiences **June 14-July 1**, and **July 26**. College students will take part in authentic, hands-on interdisciplinary research experiences and outreach activities **June 7-July 30**.



— Lower Brule:

The Lower Brule Summer Institute will offer area high school students the opportunity to take part in one of three research projects involving data collection and analysis, with presentation of results **in June and July**.

— Sisseton Wahpeton College
(in Sisseton): *Information to come.*



— Sinte Gleska University (in Mission):

Botany (BI 245) will be offered **in June** for area **high school and undergraduate students**. Graduate teaching assistants Dera Iyotte and Krista Horvath will assist in delivering the courses and will incorporate Lakota cultural knowledge.



NEW FACES AT THE SD EPSCOR OFFICE

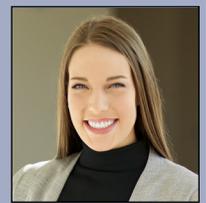
Leon Leader Charge, Intern

Currently a graduate student at the University of South Dakota (USD), Leon Leader Charge is studying a Master of Arts in Addiction Counseling and Prevention. Upon graduating from USD in spring of 2022, Leader Charge plans on continue working in treatment, prevention, and research in tribal communities. He is supporting the SD EPSCoR staff by expanding tribal research and assisting with the creation of written communications from the department while working remotely from the Rosebud Indian Reservation.



Hailey Nold, Intern

Nold is a senior psychology and Spanish double major with an emphasis in clinical counseling at Augustana University. As a part of her university experience, she has found a passion for mental health advocacy. Her recent research focuses on how systemically non-dominant students perceive Augustana's on-campus counseling clinic through measures of awareness, efficacy beliefs, and willingness to engage. She will attend graduate school for clinical mental health and plans on becoming a licensed psychologist. Nold supports SD EPSCoR by assisting with social media and website content.





SDSU Professor Adam Hoppe indicates which single cells are being sorted to analyze their properties to see if the genes inhibit or contribute to viral infections.

Scientists Examine How Coronavirus Infects Cells

Identifying the mechanisms through which the new coronavirus enters and infects cells can help scientists combat COVID-19 – and perhaps other emerging viruses.



**Images and Text
By
SDSU Marketing &
Communications**

Professor Adam Hoppe of the South Dakota State University Department of Chemistry and Biochemistry will identify genes that inhibit or contribute to viral infections through a one-year, \$200,000 National Science Foundation grant. Hoppe is the second SDSU researcher to receive funding through NSF's Rapid Response Research mechanism to address the COVID-19 pandemic.

The goal of the project, which began in July, is to figure out "how the coronavirus gets into cells to initiate infection," said Hoppe, describing the work as "a very basic science approach, aimed at broadly identifying all of the cellular machinery that affects viral entry."

Hoppe, a cell biologist, is also director of the South Dakota BioSystems Networks and Translational Research center, known as BioSNTR.

For the NSF grant, Hoppe and his team of one research associate and one doctoral student will determine how each gene in the human genome affects the new coronavirus' ability to enter the cell. The SDSU genome sequencing facility, led by professor Jose Gonzalez, will also play an integral role.

Other research groups have identified two gene-encoding proteins to which the novel coronavirus binds — ACE2 and TMPSS2. However, Hoppe said, "We will

use the CRISPR gene-editing tool and an unbiased approach to identify what host cell factors either allow the virus to enter the cell or, perhaps, prevent it from entering the cell.”

What they learn may help scientists develop antivirals and therapeutics to combat COVID-19. “Our findings could have implications for coming up with prophylactics to prevent viral entry and treatments to activate some of the genes that prevent the virus from getting into the cell,” Hoppe said.

To study the severe acute respiratory syndrome coronavirus 2, Hoppe and his team will develop a pseudovirus they can work with in the lab. “We transfer the (SARS-CoV-2) spike protein, which is responsible for allowing the virus to enter the cell, onto the pseudovirus to study how the protein gains entry into the target cell,” he explained.

The researchers will then use CRISPR gene-editing tools to shut off a single gene in a human cell using a technique Hoppe developed. They then will expose the cell to the pseudovirus. “We will screen 20,000 different genes, all at once, and ask if each of their

functions is associated with helping or inhibiting virus entry,” Hoppe said.

The cells they study will be human epithelial cells that line the nasal passages and the lungs, as well as immune cells called macrophages. “Macrophages are constantly cleaning debris and bacteria that get into the lungs,” explained Hoppe, noting his lab specializes in macrophage research.

“The virus does not likely replicate in these immune cells, but if the virus gets into the cytoplasm, it may change the macrophage’s ability to function — that is our hypothesis,” he said. During the 2003 SARS outbreak, researchers found the virus was able to infect the macrophages as they tried to gobble up the virus. This portion of the project will help determine if the SARS CoV-2 virus has this capability.

Through this project, Hoppe said, “We hope to learn something specific to help with COVID-19, but also to generate knowledge that is applicable to new viral infections, as well as the tools to do this type of screening for other viruses, such as influenza.”

See details at
sdepescor.org/diversity

NATIVE AMERICAN GRADUATE ASSISTANTSHIPS

South Dakota’s National Science Foundation (NSF) EPSCoR RII Track-1 project supports Native American students attending graduate school in South Dakota and supporting Track-1 project activities. These students have been supported:

- **Travis Grablander**, SDSMT Research, Graduated Dec. 2020
- **Tanner Hall**, USD Research
- **Krista Horvath**, SGU Teaching
- **Dera Iyotte**, SGU Teaching
- **Joseph Laubach**, SDSMT Research
- **Leon Leader Charge**, USD Diversity & Education
- **Shane Star**, SDSMT Research
- **Elisha Yellow Thunder**, SDSU Research & OLC Teaching



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SAVE THE DATES AND REGISTER

Giant Vision Competition

April 28: Sioux Falls Convention Center.
sdeprior.org/giantvision

Virtual Professional Development

K-12 science educator training.

- **June 29-July 1:** Repeat of Year-1 online workshop
- **July 20-22:** Year-2 workshops for K-12 teachers featuring the new curriculum units (five options)

sdeprior.org/teachers to register.

2021 Undergraduate Research

Symposium: July 29, virtual.
sdeprior.org/symposium

Find research and funding opportunities — at sdeprior.org. Have news to share? Contact sdeprior@sdbor.edu.

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