



COLLEGE OF ENGINEERING
RESEARCH UPDATE

WINTER 2019



FROM THE COE

ADR



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Hello!

Welcome to the Winter 2019 COE Research Update

It is exciting times at Nebraska and especially in the College of Engineering. Our faculty, staff, and students continue to make important discoveries and develop new and innovative solutions to our world's challenging problems.

As you will see in the following pages, we have had a great year in many ways. Our new awards for projects that will start this year reached the highest level on record. Our students have been engaged in a number of interesting projects and activities. Research has led to the granting of an increasing number of patents and technology transferred to the private sector.

The college is also making plans for our major building projects, which will commence soon. In brief, the CEE Department main office and faculty offices have moved to first floor Nebraska Hall and the ECE Department main office and faculty offices have moved to fourth floor Nebraska Hall. The SEC Link has been demolished and construction will soon begin on a research-focused building of approximately 45,000 net assignable square feet. Soon afterward, renovations will begin on Scott Engineering Center to update teaching laboratories, classrooms, and research laboratories. Eventually the CEE and ECE main offices and faculty offices will move into SEC.

Our faculty also continues to think boldly with a number of large, multi-innovation center proposals, with new partnerships and success with a variety of new innovation awards.

Thanks go to our outstanding faculty, staff and students for their great effort in impacting Nebraska and the world.

For the latest details, see: engineering.unl.edu/construction-central

OUTSTANDING YEAR FOR GARNERING GRANTS

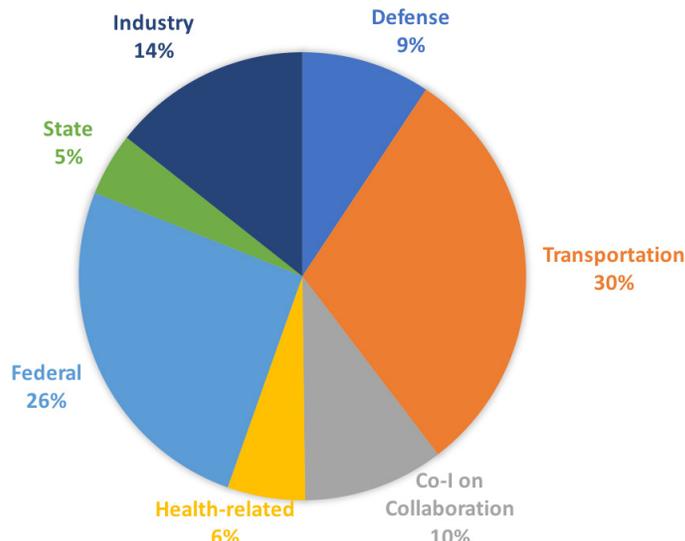
In terms of newly awarded sponsored projects for AY19, the College of Engineering has had a spectacular year leading to our most productive new award year on record.

Faculty, staff, and students garnered over \$44M in new awards, representing an increase by about \$13M over AY18 activity. This eclipses the highest year for new awards obtained in FY10 for \$34M, a year that also included significant support from the federal stimulus package. As an institution, UNL garnered \$164.6M in new awards, a sizeable increase from \$144.3M in AY18.

Highest new award activity on record includes Civil Engineering (\$12.5M), Mechanical and Materials Engineering (\$10.3M), and the Durham School of Architectural Engineering and Construction (in the most recent 10 years, \$2.2M).

New funds are distributed across a number of sources with state Departments of Transportation, numerous industry sponsors, and the National Science Foundation being the largest three by dollar amount.

Source	New Award Amount	%
State DOT's (NE, HA, IA)	\$ 10,312,373	23.4%
Industry (Various sponsors)	\$ 6,336,446	14.4%
NSF	\$ 6,314,092	14.3%
University Collaborations	\$ 4,064,575	9.2%
Federal DOT	\$ 3,045,780	6.9%
DOE	\$ 2,354,279	5.3%
NSRI	\$ 2,285,893	5.2%
DOD	\$ 1,823,987	4.1%
DHHS	\$ 1,550,286	3.5%
USDA	\$ 1,522,207	3.5%
State entities	\$ 1,441,035	3.3%
UNMC Collaborations	\$ 643,756	1.5%
NE Environmental Trust	\$ 563,378	1.3%
Nuclear Reg Commission	\$ 450,000	1.0%
UNO Collaborations	\$ 415,582	0.9%
Various Health Associations	\$ 286,583	0.7%
NASA	\$ 200,000	0.5%
NSF-EPSCoR	\$ 129,150	0.3%
NIST	\$ 115,125	0.3%
Nat Academy of Science	\$ 100,000	0.2%
EPA	\$ 67,254	0.2%
DOJ	\$ 50,000	0.1%
Total	\$ 44,071,780	



I have been asked what is the major factor contributing to such a large increase in new awards. This is due to a number of factors including newly hired faculty with their stride along with experienced faculty gaining traction on topics they have been pursuing.

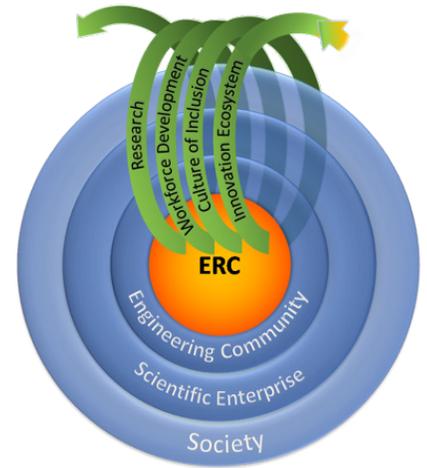
Keep up the wonderful grant productivity. We look forward to seeing the valuable outputs from these innovative research activities.

NSF ERC PROPOSALS SUBMITTED

In the most recent NSF competition for Engineering Research Centers, UNL faculty submitted three separate proposals for the July 15, 2019 deadline. These projects require a substantial effort in development and collaboration particularly for the new GEN-4 ERC, which incorporates NSF's concepts of "Convergent Research and Innovation through Inclusive Partnerships and Workforce Development."

From the RFA: "Convergent research approaches require the deep integration of knowledge, tools, and ways of thinking beyond engineering (for example, from the physical, mathematical, life/health sciences, computational sciences, and social sciences, among others). Purposeful team formation is needed for the convergent approach, supported by diversity and a culture of inclusion where all participants are recognized and derive mutual benefits. The convergent approach supports the strong societal impact expected of each ERC."

The ERC program has strengthened the requirement for demonstrable integration of foundational components. A strong strategic plan for each ERC outlines the interplay between the four foundational components of the ERC, including the convergent research project, engineering workforce development, the development of a culture of diversity and inclusion, and a focus on value creation within the innovation ecosystem. All these foundational components should together support the ultimate impact on society."



CAFE – Center for Advanced Food Engineering (UNL Lead)

Kamlakar Rajurkar (PI)-MME; Terry Howell, Jr.-Food Science and Technology Department; Ali Tamayol-MME; Michael Sealy-MME; Byrav Ramamurthy-CSE; Heidi Diefes-Dux-BSE; Julia McQuillan-Sociology Department; Jennifer Keshwani-BSE; Mark Riley-BSE; Patricia Wonch Hill-SBSRC; Ozan Ciftci-FDST; Andreia Bianchini-FDST; Santosh Pitla-BSE; Yuris Dzenis-MME; Stephen Scott-CSE; Ruiguo Yang-MME; Yugio Lei-CHME; Valerie Jones-Journalism Department; Rojas, Rossana Villa-Rojas FDST.

Partners include Georgia Tech, University of Arkansas, and Navajo Technology University

NSF Engineering Research Center for Precision Meteorology (CPM)

Adam Houston (UNL lead)-Department of Earth and Atmospheric Sciences; Justin Bradley-CSE; Carrick Detweiler-CSE; Brittany Duncan-CSE; Trenton Franz-School of Natural Resources; Joe Luck-BSE; Lisa Pytlik Zillig-Public Policy Center; Mario Scalora-Public Policy Center; Yeyin Shi-BSE; Brian Wardlow-SNR.

University of Kentucky is the lead.

NSF Engineering Research Center for Rural Resilient Infrastructure (Rural RISE)

Laurence Rilett (UNL lead)-CEE; John Anderson-Department of Economics; Chris Cornelius-CHME.

Auburn University is the lead.

OPPORTUNITIES FOR FUNDING

2019-20 Academic Year

The UNL Office of Research and Economic Development is facilitating several internal research funding competitions this academic year.

- **Research Council** competitions include Faculty Seed Grants and Grants-in-Aid (each up to \$10,000), and Interdisciplinary Research Grants (up to \$20,000), with submission deadlines in early October, and funding periods from January-December 2020.
- The **Research Council** also offers funding to support visiting scholars, symposia, and distinguished lecturers (up to \$3,000), with applications due in October and again in March.
- **Layman Seed Grants** (for non-tenured early career faculty) and Layman New Directions Awards (for tenured faculty)
A new application deadline this year is early March 2020, with the funding period from August 2020 - July 2021.
- **Biomedical Research Seed Grants** for faculty preparing NIH R21 or R01 applications remain available, with applications accepted on a rolling basis. Revision Awards also remain available on a rolling basis, for faculty revising a promising federal grant application.
- Awards for the **Biomedical Grants and Revision Awards** are for \$25,000-\$50,000, depending on the size of the planned federal proposal submission.

Contact Jen Nelson in ORED for more information about these internal funding opportunities: jnelson18@unl.edu, 402-472-0321.

Note the change of the Layman Awards application deadline to Spring, with Research Council applications due in Fall with a January 1 start date.

NSF 19-078 Dear Colleague Letter: Supplemental Funding Opportunity to Support Student Design Projects Directly Related to NSF Research:
[nsf.gov/pubs/2019/nsf19078/nsf19078.jsp?WT.mc_id=USNSF_179](https://www.nsf.gov/pubs/2019/nsf19078/nsf19078.jsp?WT.mc_id=USNSF_179)

NSF will consider supplemental funding requests to support student design projects connected to active NSF grants. The goals of these supplements are:

1. To connect student design projects to innovative, NSF-supported research and the latest advances in engineering science.
2. To expose students to the discovery process of research while preparing them for their roles in the engineering workforce.
3. To provide a team of students with the funds necessary to pursue the design process, from need finding, industry and customer discovery, through prototyping and validation.

The PI of an active NSF award may request supplemental funding to support a mentored, student-led design project that is connected to their NSF award. To be eligible, the design-research connection should meet one of the following two criteria:

1. A project that builds on scientific advances from the research by applying that knowledge to solve a current challenge.
2. A project that challenges students to design a technology, device, or system to complement or augment the methods or aims of the research project.

In addition, eligible projects are expected to meet the following requirements:

1. Projects must be conducted by students, preferably as a team.
2. The solution to the challenge should not be pre-determined (i.e., the students are not simply implementing a design developed by the PI), so that the students go through the complete engineering design process - including development of a prototype or system simulation, as appropriate.
3. The project should require students to consider relevant standards and realistic constraints.
4. Project support from the supplement must be used to support the design process, including need finding, industry and customer discovery, prototyping, and validation/verification, not student time.

The maximum amount of funding per supplement will be \$4,000. If the PI's institution has an established program with documented requirements for minimum funding levels for capstone projects, including from internal and not-for-profit sponsors, then higher amounts for these supplements may be considered. PI's must discuss this in advance with the program director and must include a signed letter from the department chair or dean describing these requirements.



COLLEGE OF ENGINEERING PHASE I BUILDING PROJECT

In August 2018, the NU Board of Regents approved the programming statement for the first phase of a major facilities and building renovation for the college.

This project will provide much-needed updates to support the research of our faculty and enable 21st century graduate education; expected completion is Fall 2022.

The concept for building design is to facilitate interdisciplinary research that is thematically driven and incorporates community spaces for high interactions. Emphasis is placed on high performance spaces to meet the needs of research, today and tomorrow. Organizing principles are connectivity with clear circulation paths, creating an identity for the college, and supporting collaboration with dynamic spaces and optimizing adjacencies.

“We’re building a College of Engineering that will be a major source of economic development in the state and region while addressing problems of global importance.”

Lance C. Pérez, Dean, College of Engineering



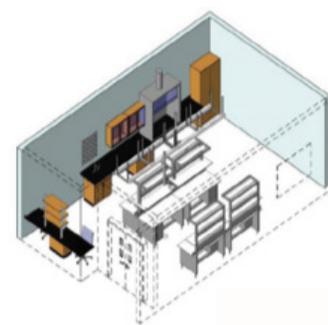
Electronics Lab



Laser Lab



Bioscience & Gen Chemistry



Material Science

Opposite page, top: Outside facade. View from 16th Street, looking east

Middle: Program Validation and Conceptual Design for the Lower Level SEC and Link.

Left: Lab typologies and modules

NEBRASKA CENTER OF ENERGY SCIENCES RESEARCH - NCESR



Michael Nastasi

This summer, Michael Nastasi, MME professor and holder of the Elmer Koch Professorship, announced he was stepping

down as director of the Nebraska Center for Energy Science Research in August, after nearly eight years of leading the center.



Jerry Hudgins

Jerry Hudgins is now serving as interim director until a permanent replacement has been identified.

Nastasi did a tremendous job of leading the center and this is a good time to reflect on the Center's

activities and accomplishments. We thank him for his years of excellent leadership and guidance of energy science research and educational activities on our campus.

Nastasi became director of UNL's Nebraska Center for Energy Sciences Research on January 3, 2012. He came to UNL from Los Alamos National Laboratory, where he was a longtime researcher and, since 2009, directed the U.S. Department of Energy's Energy Frontier Research Center on Materials at Irradiation of Mechanical Extremes. His interest in energy research stems from his work in materials and nanoscience including ion-solid interactions, irradiation induced phase transformation and irradiation effects in nanostructured materials. Nastasi earned doctoral, master's and bachelor's degrees in materials science and engineering from Cornell University.

Hudgins is responsible for leading the center and facilitating its research, operations and resource development activities during his appointment. He is also assisting with the national search for a permanent director, beginning this fall. Hudgins will remain department chair while serving in this role.

Renewable energy is one of Hudgins' longtime research interests. He has been a collaborator on numerous projects funded by the U.S. Department of Energy to develop monitoring systems that could reduce the cost of maintaining wind turbines – powerful renewable energy sources that carry significant costs for utilities to maintain. He also created Wind for Schools, an educational program aimed at preparing K-12 students across Nebraska for careers in the wind energy industry.

The Nebraska Center for Energy Sciences Research (NCESR <https://ncesr.unl.edu/>) is a collaboration between the Nebraska Public Power District (NPPD) and UNL. The mission of the Center is to conduct energy research that produces new technologies, processes, and systems that provide new or significantly enhanced energy sources and improve the quality of life and economic opportunity for all Nebraskans. If opportunities can be created for Nebraskans, opportunities will also be created for the nation and the world.

From its start in 2006 and continuing through 2019, the Energy Center funded 102 projects. The call for proposals for each cycle evolves from year to year based on changing needs and opportunities. Funding for these projects comes from a major investment starting in 2006 by the Nebraska Public Power District and matching efforts on the part of the University.

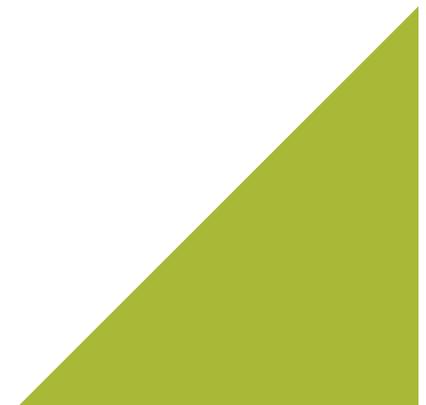
The cycle process first requests short pre-proposals that will be reviewed and ranked by the EC. Full proposals are sent to external reviewers, are reviewed by the EC, and the PIs are asked to share their proposal ideas in a 10-minute presentation to the EC. The EC will use all this information to rank the full proposals, and the ranked list along with the proposals will be submitted to the EAC for their final decision on which projects will be funded. The EAC is at full liberty not to follow the ranking submitted by the EC. The number of projects funded in a given Cycle can range between 4 to 11 depending on the funds available for new projects. Projects can

be funded for a maximum of two years with funding for the second-year contingent on first year performance.

NCESR runs a Summer Internship for Undergraduates a program started by in the summer of 2014. The internship is named after Mr. Darrell J. Nelson, who served 41 years on the NPPD Board of Directors from 1970-2011, and was an advocate of lifelong learning. In 2005, Mr. Nelson proposed NPPD should provide financial support to UNL. The following year, the NCESR was created with that support. Funds are provided to support the salaries for up to 4 students per summer (\$5000/student). The faculty sponsor is expected to cover all additional cost.

NCESR has operated with just under \$11M in investment for its seed grant program (covering Cycles 1-12). These funds have been leveraged by faculty to garner \$89.5M in new awards representing an 8-fold return on investment. New external funds have come from distributed sources including NSF (\$26M), DOE (\$14M), and DOD (\$3.6M).

The scholarly outputs of NCESR supported researchers has been extensive with 223 peer reviewed publications having been cited over 14,000 times; in addition to 167 conference proceedings, 6 books, and 23 other publications. Over the course of the NCESR, 102 projects have been sponsored which supported 247 graduate students and 54 post-docs, 76 undergraduate researchers, and 24 summer interns. Overall 401 individuals have been educated through research opportunities sponsored by the Center.



NU AGAIN LANDS IN WORLD'S TOP 100 U.S. PATENTS

<https://www.nutechventures.org/patents-fy2019/>

The University of Nebraska system ranked among the top 100 academic institutions worldwide in earning U.S. patents during 2018, the second straight year it has received the distinction for legally protecting research discoveries and technological innovations.

A newly released report from the National Academy of Inventors and the Intellectual Property Owners Association lists the NU system as tied at No. 79 for earning U.S. patents. Those patents are awarded through the system's technology transfer offices: NUtech Ventures at the University of Nebraska-Lincoln and UNeMed Corp. at the University of Nebraska Medical Center and University of Nebraska Omaha.

NUtech Ventures works with University of Nebraska-Lincoln faculty to identify opportunities for protecting, marketing and licensing intellectual property. Husker researchers were named on 22 of the 31 NU-led patents earned in 2018. Seventeen of those included faculty in the College of Engineering.

Patents are an early but significant milestone in the process of eventually licensing intellectual property to companies that can include faculty startups, said Brad Roth, executive director of NUtech Ventures.

"The ability to protect new innovations from our university's research is an important first step for commercialization and eventual impact on society," Roth said.

Husker researchers earned patent protection for drone-based technology that can autonomously estimate crop heights; a roadside safety barrier that better resists impact, lengthening the lifespan of concrete beams after crashes; and the genetic modification of soybean to produce better vegetable oil for cooking and baking, among many other advances.

"This recognition, which puts Nebraska among the world's leading institutions for generating intellectual property, is a strong reflection of our research priorities," said Bob Wilhelm, vice chancellor for research and economic development. "We're committed to developing a strong pipeline from research to economic development."

U.S. PATENTS ISSUED TO UNIVERSITY OF NEBRASKA-LINCOLN INVENTORS IN ENGINEERING DURING THE 2018-19 FISCAL YEAR

- Near-Field Heat Transfer Enabled Nanothermomechanical Memory And Logic Devices: **Sidy Ndao; Mahmoud Elzouka**
- Concrete Mix For Shotcrete Applications For Electromagnetic Shielding: **Christopher Y. Tuan; Lim Nguyen**



- Integrated Vacuum-Ultraviolet Mid, And Near-Ultraviolet, Visible, Near, Mid And Far Infrared And Terahertz Optical Hall Effect (Ohe) Instrument, And Method Of Use: **Craig Herzinger; John A Woollam; Mathias Schubert; Tino Hoffman; Sean Knight; Gregory K. Pribil**
- Robotic Surgical Devices, Systems And Related Methods: **Shane M. Farritor; Dmitry Oleynikov; Ryan L. McCormick; Tyler Wortman; Eric Markvicka**
- Gastrointestinal Sensor Implantation System: **Benjamin S. Terry; Weston Lewis; Wanchuan Xie; Pengbo Li; Alfred Tsubaki**
- Growth Of Nitride Films: **Yongfeng Lu; Yunshen Zhou; Hossein Rabiee Golgir**
- Compliant Surgical Graspers And Methods Of Making And Using: **Carl A. Nelson; Alan Goyzueta**
- Electrically Conductive Concrete Mix For Electromagnetic (Em) Ground Plane: **Christopher Y. Tuan; Lim Nguyen**
- Biomechanical Foot Guidance Linkage: **Judith M. Burnfield; Carl A. Nelson; Cale Stolle**
- Monolithic Heat Transfer Device: **Dennis R. Alexander; Troy P. Anderson; Craig Zuhlke; Sidy Ndao; George Gogos**
- Enforcing Persistency For Battery-Backed Mobile Devices: **Hao Luo; Hong Jiang; Lei Tian**
- Monitoring Aging Of Power Semiconductor Devices Based On Case Temperature: **Wei Qiao; Liyan Qu; Ze Wang**
- Electromagnetic Power Converter: **Haosen Wang; Wei Qiao; Liyan Qu**
- Rechargeable Multi-Cell Battery: **Wei Qiao; Taesic Kim; Liyan Qu**
- Live, Attenuated Vaccines And Methods Of Making And Using: **Wei Niu; Jiantao Guo; Qingsheng Li; Yue Li; Nanxi Wang**

Congratulations to our outstanding researchers!

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA) MEETING

Current DARPA thrust areas run the gamut from advanced manufacturing to new social science tools and methods to quantum sensing and therefore should be of broad interest at UNL.

The Office of Research and Economic Development (ORED) hosted an event for researchers to learn more about how DARPA operates, its current priorities, and what it takes to submit competitive proposals to this particular agency. The visit on August 6 featured DARPA's deputy director, chief-of-staff, and directors of its Biological Technologies Office, Defense Sciences Office, and Information Innovation Office. The goal of this visit by senior DARPA staff was for researchers to learn about how they can help DARPA advance critical capabilities for the DoD and beyond.

Slides from the DARPA presentations are available at: <https://unl.box.com/s/av8gwb6t4fkktsizsq0nbsoou7d03jv>

For more info on DARPA opportunities, see: darpa.mil/our-research





UNDERGRADUATE SUMMER RESEARCH PROGRAMS POSTER SESSION

The college hosted a poster session featuring visiting undergraduate students who were performing research in our laboratories this summer. About 34 students presented their posters on August 6, 2019.

REU and SRP students:

- *Biomedical Engineering (9 students)*
- *Unmanned Systems (10 students)*
- *Sustainability of Civil Infrastructure (10 students)*
- *Yachay Technology University (5 students)*

Biomedical Engineering • Director: Dr. Greg Bashford

Zach Andronaco (University of New Hampshire) Treatment of Low Back Pain Using an Injectable Tissue Specific Scaffold (*Mentor: Dr. Becky Wachs*)

Ashley Babinchak (Clemson University) Modulation of Non-Viral Gene Delivery to Human Mesenchymal Stem Cells via Combinatorial Priming (*Mentor: Dr. Angie Pannier*)

Olivia Cook (Penn State) Early detection of Alzheimer's disease: a new breath-hold index for cerebrovascular reactivity assessment (*Mentor: Dr. Greg Bashford*)

Matt Currie (University of Mississippi) Design of a High Precision XY Gantry for Testing Acoustic Output of Ultrasonic Transducers (*Mentor: Dr. Greg Bashford*)

Anna Jacobsen (University of Utah) Using DNA repair inhibitors to sensitize brain cancer cells to radiation treatment (*Mentor: Dr. Forrest Kievit*)

John Lowery (University of Wisconsin-River Falls) Design of a Modular, Cost-Effective Robot Arm for Increased Dexterity in Laparoscopic Surgery (*Mentor: Dr. Carl Nelson*)

Elizabeth Seidl (Kansas State University) Engineering hepatocyte-stellate co-cultures for investigation of intercellular communication in the liver (*Mentor: Dr. Sri Kidambi*)

Jacob Watson (University of Evansville) Wearable Biomonitoring for First Responders (*Mentor: Dr. Eric Markvicka*)

Sustainability of Civil Infrastructure • Director: Dr. Shannon Bartelt-Hunt

Gabriela Yáñez González (University of Puerto Rico – Mayaguez) Resilience of Rural Infrastructure: Shake Table Tests of Scaled Silos (*Mentor: Dr. Christine Wittich*)

Aleece Barnard (University of Nebraska-Lincoln) Scaled Shake Table Tests of Free-Standing Structures with Varying Interface Geometry (*Mentor: Dr. Christine Wittich*)

Josh McCann (University of Nebraska-Lincoln) Characterization of Municipal Solid Waste (MSW) using Membrane Interface Probe (MIP) and Hydraulic Profiling Tool (HPT) (MiHpt) (*Mentor: Dr. Jongwan Eun*)

Victoria Chan (Missouri University of Science and Technology) Predicting Rural and Environmental Water Quality (*Mentor: Dr. Yusong Li*)

Guadalupe Reyes (University of the Pacific) Rural Bridge Management (*Mentor: Dr. Daniel Linzell*)

Christina Galanis (Clayton State University) Exploring Accessible Technology for Photogrammetry as a Civil Engineering Educational Tool (*Mentor: Dr. Joshua Steelman*)

Meredith Sutton (University of Virginia) Occurrence of Microplastics in Freshwater Sediments in Omaha, Nebraska. (*Mentor: Dr. Shannon Bartelt-Hunt*)

Norel McAdoo (Tennessee State University) Change Detection Analysis of Aerial-derived Point Clouds (*Mentors: Dr. Richard Wood and Dr. Christine Wittich*)

Juan Pablo Pérez Garfias (Portland State University) Unintended Composite Action in Bridges: Investigating how uncertain composite effectiveness affects load ratings (*Mentor: Dr. Joshua Steelman*)

Ryan Haggerty (Goshen College) Advancing Implementation of Geosynthetically Reinforced Soil-Integrated Bridge Systems (*Mentor: Dr. Seunghee Kim*)

Samantha Pérez (St. Mary's University) Removing Pesticides from Lake Water using Floating Treatment Wetlands (*Mentor: Dr. Tiffany Messer*)

Alexis Laurent (University of Louisiana-Lafayette) Error Propagation in Aerial Derived Point Clouds for Gravel Roads (*Mentor: Dr. Richard Wood*)

Kevin Ohm (Humboldt State University) Effects of Essential Oil in Feed on the Presence of Antimicrobial Resistance in Cattle Manure (*Mentor: Dr. Xu Li*)

Unmanned Systems • Director: Dr. Brittany Duncan

Andrew Dalbol (University of Jamestown) Developing a Sensor Dispenser for UAV Dependent of Sensor Networks (*Mentor: Dr. Brittany Duncan*)

Nina McPhaul (Howard University) How to Elicit the Desired Responses for Non-Anthropomorphic Unmanned Autonomous Systems Studies (*Mentor: Dr. Brittany Duncan*)

Arsha Ali (Oakland University) Failure Detection and Correction for Aerial Autonomous Systems (*Mentor: Dr. Brittany Duncan*)

Stefania Esquer (The University of Texas at El Paso) Radiation mitigation techniques for small satellites (*Mentor: Dr. Justin Bradley*)

Jake Chanenson (Swarthmore College) Exploring Design Methodologies to Create Expressive Drone Flight Paths (*Mentor: Dr. Brittany Duncan*)

Christopher Morse (University of Minnesota Twin Cities) Real-Time Unmanned Drone Detection: Optimization Through Data Augmentation and Transfer Learning (*Mentor: Dr. Carrick Detweiler*)

Christina Youn (University of Notre Dame) Identifiable Flying Objects: Distinguishing Aerial Entities in Real-Time (*Mentor: Dr. Carrick Detweiler*)

Karissa Jelonek (Bloomsburg University of Pennsylvania) Altitude-Controlled Balloon System (*Mentor: Dr. Carrick Detweiler*)

Paul Fletcher (Bunker Hill Community College) Wait, Who's Flying This Thing: A Learning Approach for UAV Operator Mode Classification (*Mentor: Dr. Brittany Duncan*)

Alex Yen (University of Massachusetts Amherst) Feasibility Study for Altitude Control of Balloons in the Atmospheric Boundary Layer (*Mentor: Dr. Carrick Detweiler*)

Yachay Technology University • Coordinator: Dr. Daniel Linzell

Fernando Alexander Pesantez Torres Cationic Conjugated Polyelectrolyte Decorated Silica Nanoparticles to Fight against Antibiotic Resistance (*Mentor: Dr. Shudipto Dishari*)

Carlos Andrés Brito González Democratization of Wireless Networks: a Software-Defined 5G System Solution for the Andes (*Mentor: Dr. Hamid Sharif*)

Evelyn Carolina Mollocana Lara Sutureable Scaffold with Sustained Protein Release to Treat Volumetric Muscle Loss (*Mentor: Dr. Ali Tamayol*)

Francisco de Jesús Quinga Socasi Determination of the Optimal Photo Sampling Height for Lake Boundary Extraction and Water Sampling (*Mentor: Dr. Justin Bradley*)

Selena Leonor Tinoco Valencia Comparing Antibiotic Resistance Genes and Metagenomics in Composting vs Stockpiling (*Mentor: Dr. Xu Li*)

WALLY BUCHHOLZ

RETIREMENT

Dr. Wallace Buchholz, who joined UNL as director of the Bioprocess Development Facility (BPDF) and professor in Chemical and Biomolecular Engineering in 2013, retired in August 2019.

He holds a Ph.D. in Microbiology and a B.S. in Bacteriology and Public Health from Washington State University. His tenure at the BPDF oversaw the commissioning of the newly built GMP suite in 2014 and diversification of bioprocess development and GMP manufacturing projects ranging from an HIV prophylactic to XTEN™ in vivo drug stabilizer to biologic blood factors and anti-cancer therapeutics and vaccines.



Before joining the BPDF, he served as the Microbiology Program Manager at the Army Research Office (ARO) from 2007-2013. During his tenure at ARO he reinvigorated the fundamental microbiology research program and focused funding towards microbial adaptation, which underpins microbial forensics capabilities. Prior to ARO, Buchholz tested and validated new biological agent detectors and trained first responders at Dugway Proving Grounds, isolated and identified high-containment infectious agents at the Alaska Public Health Laboratory, and worked for 15 years in plant biotechnology.

The Biological Process Development Facility offers biopharmaceutical process development designed for successful technology transfer from the bench to large-scale GMP manufacturing, and manufactures material suitable for non-clinical and clinical studies. Specializing in recombinant peptides and proteins, the BPDF has produced GMP materials since 1998. During this time, processes for over 50 products including vaccines, other biotherapeutics, chemokines, and agricultural/industrial enzymes have been developed. BPDF fermentation processes focus on optimizing and controlling high cell-density fermentations of *Pichia pastoris*, *Saccharomyces cerevisiae*, and *Escherichia coli* for recombinant protein production. Current clients include government, industry, and philanthropic organizations. Most recently, the BPDF developed and scaled-up a process for GMP production of 5P12-RANTES, a microbicide effective in preventing transmission of HIV in vitro.

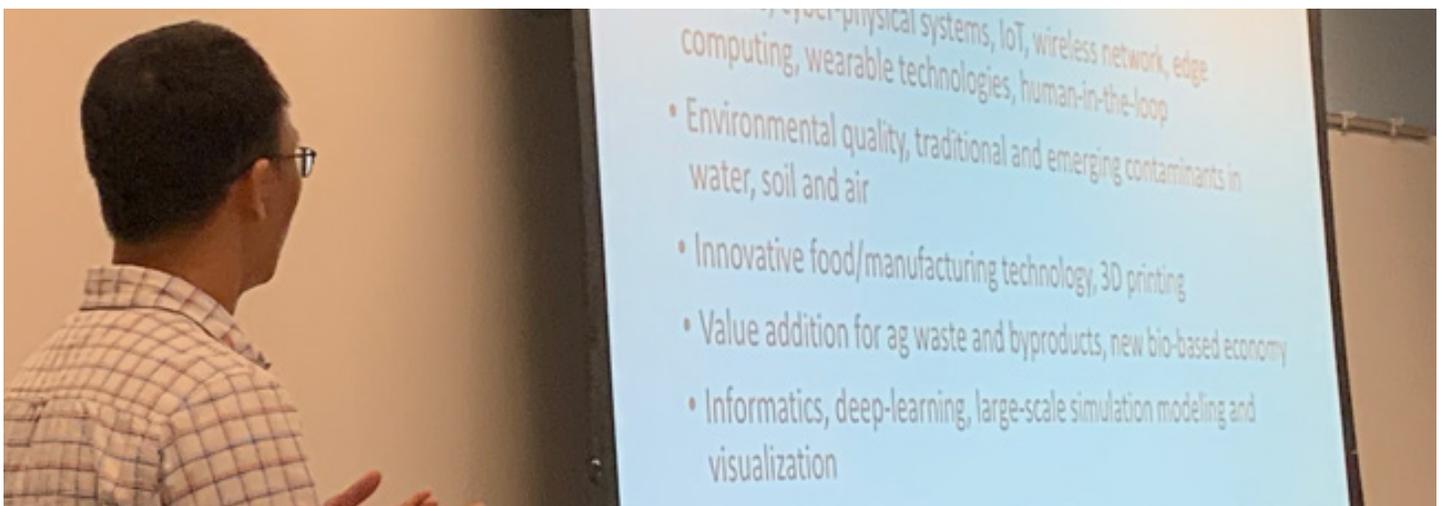
IANR / COE COLLABORATION FACULTY LUNCHEON

On August 21 we held our first IANR / COE Collaboration Faculty Luncheon - Innovation in Agricultural Sciences & Engineering in the Digital Age. The meeting had a full room of around 60 researchers interested in identifying partnerships and a great discussion on creating new innovative transdisciplinary research.

Purpose: Solving complex problems requires transdisciplinary teams: our aim is to provide a forum for faculty to get to know each other and discuss research and technical capabilities, and funding opportunities in topics on the spectrum from agriculture, natural resources, social sciences, engineering, data science, and informatics.

Schedule: Meet once a month over lunch time for discussions and informal presentations. Alternate locations between East Campus, City Campus, and NIC. We will typically have two faculty give informal presentations for 15 minutes each followed by group discussion on topics that address the opportunities and challenges that limit their research. Ideally the discussion will include people from divergent areas.

More opportunities to connect will be forthcoming.



GROWING THE GOOD LIFE

Working to create a new standard of sustainable economic prosperity for all Nebraskans.



BLUEPRINT NEBRASKA REPORT RELEASED

In July 2019, a state-wide commission released the Blueprint Nebraska report

(available free to download at: blueprint-nebraska.org)

Blueprint Nebraska is an organization of business, industry, and civic leaders who worked for over a year to develop a statewide economic development plan for the next decade. Their recommendations, based on feedback from nearly 5,000 participants, led to recommendations for the key drivers of economic growth: talent, innovation and entrepreneurship, business climate, sectors and clusters, and infrastructure. The growth themes center on powering Nebraska's economy by reimagining places, building more effective government, and growing our most promising industry sectors. Of most interest to the UNL College of Engineering are the plans focused on growth in manufacturing, agricultural technology, transportation, and entrepreneurship.

To reignite the state's industry sectors as a growth engine, they propose high-priority initiatives:

- 1) "Diversify, expand, and **improve the productivity of Nebraska's agri-business cluster** (e.g., ag-tech, food manufacturing, and machinery industries) to increase demand for production and to create global leadership in value-added, 21st-century agriculture".

"This initiative will require investing in bio-based feedstock manufacturing, promoting research partnerships, and providing support services to stimulate investment and to help encourage agricultural producers to diversify crops and expand into higher-value-added downstream products with agricultural inputs. This will increase bio-based feedstock manufacturing in the state, such as co-location of fermentation, green chemicals, and bioplastics production. This effort will also expand the supporting value chain of agricultural machinery, equipment, and technology. This effort will

increase R&D investment and public-private collaboration to improve efficiency, water quality/quantity, digital agriculture, and production and processing and find new uses for commodities.”

- 2) Build a pipeline of founders in tech sectors linked to Nebraska’s core industries — med-tech, ed-tech, design-tech, fin-tech and insure-tech, ag-tech, and transportation and logistics technologies — **to create the Midwest’s leading tech cluster of R&D and innovation.**

“Support university and business R&D efforts. Expanding on existing strengths in medical research and defense, this effort will create a centralized resource to help university and local business researchers apply for funding (e.g., federal grants),” (page 43). This initiative will invest in local technology startups by committing venture capital to local startups to seed early stage organizations and their innovation. “The effort will also support local technology startups’ proof-of-concept to provide a live testbed for their ideas. The effort will explore increasing the Business Innovation Act budget that assists startups in Nebraska and it will develop a model for identifying and mentoring entrepreneurs,” (page 43).

- 3) **“Create a multi-partner manufacturing innovation center of excellence,** focused on Industry 4.0/automation to make Nebraska the Midwest leader in next-generation manufacturing,” (page 41).

Some manufacturing sub-sectors – primarily advanced manufacturing — have seen massive growth across the U.S. and has great potential for growth in Nebraska. This initiative will establish a leading manufacturing center of excellence to advise on applied research and process efficiency; launch a venture capital investment fund focused specifically on innovative, next-generation manufacturing companies and adoption of advanced manufacturing technology; create productivity incentives to promote the development of disruptive advanced manufacturing technology and reward companies for realizing efficiency gains from their investments; and provide resources and technical support (e.g., infrastructure and training) to boost the

adoption of advanced manufacturing technology. Such manufacturing centers of excellence are finding favor because in other states that have garnered millions of dollars of investment and generated thousands of high-paying jobs while reduce costs for new manufacturing activities.

Several other notable points from the report:

“Nebraska owes much of its success to a strong educational system. Ranked #6 in education, Nebraska boasts stable school districts and strong post-secondary options through community colleges and four-year colleges and universities. We propose scaling public-private partnerships that create more internships and apprenticeships per capita and customized workforce solutions than any state in the Midwest to meet the needs of expanding and relocating companies. When successful, this partnership will give our young people the best odds in the country of securing an internship or apprenticeship.”

“Home to the largest railroad in the nation and two of the top 10 trucking companies, Nebraska has long attracted companies seeking a strategic location near distribution channels. Today, Nebraska boasts one of the highest concentrations of Fortune 500 companies in the country,” (page 8).

Nebraska needs to increase efforts in last-mile broadband connectivity to provide infrastructure support for ag-tech and to invest in data to create a statewide initiative to consolidate business and economic data from diverse sources and transform it into powerful tools for decision-making, profitability, and communication with consumers and influencers.

Nebraska should “encourage the private sector to lead by committing to increasing diversity and inclusion. The effort might, for example, promote flexibility (e.g., changing policies and mindsets to make flexibility the assumed starting point for all roles, not the exception), goals and progress indicators tied to incentive structures, “shared care” parental leave policies (e.g., overhauling parental leave programs to encourage men to take primary responsibility for care and help women reduce the career and financial impact of unpaid parental leave and part-time work), companywide unconscious bias training, or formal sponsorship programs to improve retention of women,” (page 22).



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