

Program Abstracts:

Addressing the Needs of at-Risk Youth in Public Schools and After-school Programs

Abigail A. Allen

“Efficacy of a Peer Tutoring Application for Word Reading for Early Elementary Students in a Rural High-Poverty School”

Students with reading disabilities receive most of their instruction in the general education setting (U.S. Department of Education, 2018), so elementary educators can expect to have students with or at risk for reading disabilities in their classrooms. This study investigated the effectiveness of a peer tutoring iPad app with auditory prompting on the high frequency word reading of early elementary students. Participants (n = 106; 74 first grade, 32 kindergarten) from one high-poverty (77% eligible for free/reduced lunch) rural elementary school in the Southeast were randomly assigned to either the intervention condition, where they used the peer tutor app with a partner for 10 minutes 3 times per week for 6 weeks, or the comparison condition. Results indicated lower performing readers in the intervention group significantly improved their reading of early high frequency words compared to the comparison group and that the app shows promise to provide support to young struggling readers.

Antonis Katsiyannis

“National Analysis of the Disciplinary Exclusion of Black Students with and without Disabilities”

Using rates and risk ratios, the current study sought to determine the current national results regarding school discipline for Black students. Results indicated that approximately 10% of Black students received a suspension, compared with 2.5% for all other racial/ethnic groups. For students with disabilities, approximately 23% of Black students received a suspension, compared with approximately 9% for Hispanic and White students with disabilities, almost 6% for Asian students with disabilities, and 21% for Native American students with disabilities.

Daniella Hall

“Navigating Rurality, Race, and Community: The Work of Southern School Leaders Building Equitable Schools”

Rural southern school leaders who want to create equitable schooling environments must negotiate contemporary and historical legacies of racial and socioeconomic discrimination, while maintaining support of the local community. This case study examines different expectations rural community members hold for their schools, and how school leaders navigate those expectations in their work to create equitable school environments. Employing critical place-based leadership theory as a framework, we seek to expand the theory by evaluating how dimensions of race and power influence leaders’ work. Our goal is to expose the hidden expectations of rural southern communities, so that school leaders have a guide to address the needs for every student, especially those who have been overlooked by power and privilege.

Edmond Bowers

“Promoting Thriving in "Risk Immersed Youth" in Diverse and Global Contexts”

The purpose of this presentation is to present a set of studies my colleagues and I are conducting in three different contexts (local, national, international) that are linked by the goal to promote thriving in “risk-immersed” youth – young people growing up in environments marked by high levels of adversity such as poverty, substance abuse, community violence, and a lack of academic opportunities. In each of these studies, we take a positive youth development (PYD) perspective to explore the individual strengths and contextual assets that are linked to thriving in diverse young people. These studies include 1. an examination of the predictors of the Five Cs of PYD in a sample of low- and middle-income youth in South Carolina; 2. an empowerment evaluation of a college preparation program for youth of color and youth from high poverty communities in six sites across the U.S.; and 3. the development of a measure of character and thriving for Kenyan youth who live and are educated in a range of contexts, including rural schools, urban schools, and children who are homeless.

Luke J. Rapa

“Critical Consciousness in Preadolescents: Advancing Theory and Measurement”

This presentation will highlight recent work designed to advance theory and measurement of critical consciousness in preadolescent youth. Critical consciousness has three components: engagement in critical analysis of inequity (critical reflection), perceived capacity to promote change (critical motivation), and engagement in activities to foster change (critical action). Critical consciousness has been studied primarily in adolescents and adults, yet there is substantial evidence that those in the preadolescent years have capacities that are linked to or support the development of critical consciousness. Research highlighted in this presentation will include a recently completed theory-building systematic literature review on critical consciousness and a pilot study assessing critical consciousness in preadolescent youth.

Luke J. Rapa (1), Reginald Wilkerson (2), Faiza M. Jamil (3), & Roy Jones (4)

“Center for the Recruitment and Retention of Diverse Educators: Findings from the First Implementation Year”

This presentation will summarize findings to date from the first implementation year of the Clemson University Center for the Recruitment and Retention of Diverse Educators (CREDE), a recently-established Center of Excellence funded by the SC Commission on Higher Education. In particular, we will highlight what we have learned through our initial research and through research conducted this past year regarding minority teacher recruitment and retention--both across the State and within our four partner school districts: Charleston, Cherokee, Orangeburg 4, and Spartanburg 7.

COBRE

Ann Foley

“The role of Map kinases in differentiation of the SAN”

Damage to the cardiac pacemaker in the sinoatrial node severely impacts quality of life by causing a slow heart rate/bradycardia. The goal of this work is to elucidate the molecular mechanisms that direct the differentiation and maturation of pacemaker cells. We have shown that the TGFbeta-activated Map kinase (TAK1/Map3k7), directs cardiac differentiation to the pacemaker fate in pluripotent cells, indicating a role for kinase signaling in cardiac differentiation and/or maturation. We also show preliminary data suggesting that small molecule-mediated blockade of certain kinases downstream of TAK1, is sufficient for cells to adopt a rapid beat rate and other characteristics of pacemaker cells.

Fei Peng

“Development and validation of embedded microstrain sensor array for in vivo characterization of contact stress distribution in hip replacement”

Although detecting the contact patch between acetabular cup liner and femur head has been long desired, the major challenge is to fabricate the strain sensor array that include many sensors, which are small enough and sensitive enough to ensure strain mapping capability. In this study, we fabricated FPI strain sensor arrays using femtosecond laser and attached the strain sensors on the back of the PMMA simulated acetabular liner. We demonstrate the strain mapping capability of the FPI strain sensor array when a small force is applied at certain location on the acetabular cup liner. A FEM model was established to simulate the local strain and validate the sensor sensitivity and contact location mapping capability.

Hai Xiao and Georges Fadel

“The Advanced Fabrication and Testing (AFT) Core of TRIMH”

This talk summarizes the unique research facilities and capabilities of the Advanced Fabrication and Testing (AFT) Core under the TRIMH COBRE Project. The AFT Core has established the centralized resources in 3D model-based designs, rapid prototyping (3D printing, integrated additive and subtractive manufacturing, and laser micromachining), and advanced instrumentation and testing for the TRIMH investigators and Clemson researchers to perform and succeed their translational research activities. The core has two major roles: 1) design and rapid prototyping and 2)

instrumentation and testing. The AFT core aims to emerge as the go-to place for biomedical researchers for expertise and consultation, thereby allowing us to gain regional and national recognition as a valuable resource for researchers wanting to design models, prototype components, test and validate concepts, and build instrumentations.

Hugo Sanabria

“Structural Dynamics with a Molecular Ruler”

Förster Resonance Energy Transfer (FRET) provides distance information between spectroscopic labels that are chemically coupled to a biomolecule of interest. As such FRET is known as the spectroscopic ruler of choice physicist, chemist and biologist alike. For its high spatial resolution, FRET could be considered as a super-super resolution microscopy tool because of its improvement on at least an order of magnitude to other super resolution methods.

James Morris

“Pour some sugar on me: glucose uptake and sub-cellular distribution as targets for drug discovery in the African trypanosome”

The importance of the glucose to the infectious blood stages of the African trypanosome, *Trypanosoma brucei*, suggests that glucose uptake or distribution inhibitors would be potentially useful anti-parasitic compounds. To identify small molecule inhibitors of glucose acquisition, we developed parasites that endogenously express FRET-based protein glucose sensors in different sub-cellular compartments that house components of the glycolytic pathway, including the cytosol and glycosomes. Using these transgenic parasites, we developed a method to screen small molecule collections for inhibitors against live parasites and have completed screening of two collections of ~25,000 compounds. Through this, we have identified inhibitors with useful medicinal chemistry properties that have potential as a new line of lead compounds against the parasite.

Jeryl Jones

“SC TRIMH Pre-clinical Assessment Core”

The Pre-clinical Assessment Core (PAC) for the SC-TRIMH applies the One Health Approach to musculoskeletal health research. The mission of the PAC is to assist translational researchers who are interested in using live animal and/or human cadaver experimental models. The specific aims of the PAC are to 1) provide expertise and support for pre-clinical modeling with a “turnkey” approach; 2) serve as facilitators for junior investigators to develop new models of pre-clinical assessment and 3) enhance the in vivo and ex vivo pre-clinical research capability to foster an increase in awareness of the facilities, increase users focused on musculoskeletal research and support coalescing of the SC-TRIMH center. The PAC is led by Dr. Jeryl Jones (Core Director and veterinary radiologist) and Dr. Michael Kissenberth (Core Co-director and orthopedic surgeon); and supported by Mr. Matt Hoyle (Bioskills Surgical Training Lab Coordinator) and Dr. John Parrish (Clemson University and Attending Veterinarian, and Director of the Godley Snell Research Center).

Joshua Alper

“Unique biophysical mechanisms of parasites”

Parasites, by their very nature, live in extreme environments and do so, in part, due to uniquely adapted biophysical mechanisms. Identification of novel biophysical mechanisms represent potential targets for new drugs against these pathogens. The Alper lab takes multiple interdisciplinary approaches to the study of such mechanisms in multiple parasites, including *Trypanosoma brucei* and *Cryptococcus neoformans*.

Kimberly Paul

“The Host is a Harsh Mistress: Fatty Acid Metabolism and Host Adaptation in African Trypanosomes”

Trypanosoma brucei, the parasite that causes sleeping sickness, cycles between its mammalian and tsetse fly vector hosts. Each host presents a distinct environmental niche with different resources and challenges the parasite must overcome in order to grow, evade the hosts' defenses, and successfully be transmitted to the next host. We are interested in how *T. brucei* modulates its fatty acid metabolism in response to different host environments and how this modulation facilitates parasite survival.

Specifically, we will discuss the role of fatty acid synthesis in immune evasion in the mammalian host.

Meredith Morris

“Organelle biogenesis in Kinetoplastid parasites”

Our laboratory studies the biogenesis of specialized organelles called glycosomes in kinetoplastid parasites, which cause significant human and livestock diseases. We use a number of genetic and biochemical approaches to define the processes that regulate organelle formation, proliferation, remodeling and degradation. Currently we are developing flow cytometry protocols to follow subcellular organelles and define organelle diversity.

Sara Sarasua

“Translational Research on Adhesive Capsulitis: Etiology, Epidemiology, and Comparative Effectiveness of Therapy”

Frozen shoulder syndrome (adhesive capsulitis) is a common musculoskeletal condition that creates significant pain and disability, yet the precipitating factors that lead to the joint inflammation and fibrosis are largely unknown. Partnering with faculty from CERortho (Comparative Effectiveness Research in Orthopedics, UofSC) and the Department of Orthopedic Surgery at Prisma Health, we will mine a research database made up of electronic medical records for orthopedic patients across the upstate of South Carolina. We will explore co-morbid conditions, medications, biomedical testing, and imaging data to identify risk factors and precipitating conditions with the ultimate goal of preventing the condition and identifying most effective therapies for subsets of patients. We envision this study establishing a productive multi-institutional collaboration and research framework for more detailed investigations into the pathophysiology of adhesive capsulitis as well as other musculoskeletal disorders.

Will Richardson

“Matrix-Protease Network Model for Predicting Tissue Healing”

Tendons are made mostly of long fibers called collagen, and controlling the amount and organization of collagen is important for restoring normal

function after injury. Collagen structure is determined by a variety of enzymes as well as mechanical tension, which can vary from person to person, or from small injuries to big injuries. We are building a computational model that captures the interaction of collagen with multiple proteases and protease inhibitors in order to predict how a tendon's collagen structure will change given certain drugs and mechanical conditions. This model will allow us to screen many potential therapy options and tailor specific treatments to specific tendon mechanics.

Zhicheng Dou

“Toxoplasma gondii, an Obligate Intracellular Protozoan Pathogen, Relies on Its Own Heme Biosynthesis for Infection”

Toxoplasma gondii, a protozoan human pathogen, causes severe infectious disease in humans. Toxoplasma is able to biosynthesize heme, which is an essential nutrient by serving as a prosthetic group conjugated to many proteins for some fundamental subcellular activities. Our current findings revealed that the parasites rely on their own heme production for their intracellular replication and pathogenesis. Our study will shed light on the development of novel strategies to block heme production and acquisition in order to benefit clinical management of Toxoplasma infection.

Collaboration for Innovation in Healthcare

Amanda Moore

“Impacting Population Health Management through Social Media Listening”

A collaborative research project between Prisma Health and CU's Social Media Listening Center, in which researchers will explore the potential use of social media listening as a tool to positively impact population health management strategies. Evaluating effective social media as an addition to care team engagement. Exploring uses for social media listening in Prisma Health's diabetes care programs and planned steps for implementation and evaluation of this emerging concept.

Chelse VanAtter

“Creating an Arthroscopic Surgery Training Simulator for Assessing Surgical Skill”

The goal of this project is to create an affordable training simulator for basic arthroscopic skills to provide standardized and objective skill assessment. It is envisioned that practice with our simulator platform will help enhance arthroscopic surgical skill in novices and intermediate trainees. Such training holds the potential to decrease risks and errors in arthroscopic surgery, resulting in positive patient outcomes. It is hypothesized that this simulator will effectively determine arthroscopic skill based on data from the sensors incorporated into the simulation.

Emil Alexov

“Revealing the mechanistic effects of genetic variants associated with post-surgery drug addiction”

Opioid medications are useful for treating acute pain, however over the past two decades their use has been liberalized and addictive potential underestimated; this has resulted in approximately 116 million people with opioid-prescription dependency. In this talk we will focus on revealing the mechanistic effects of known genetic variants that are associated with elevated risk of opioid addiction, while our ultimate goal is to identify new opioid-linked variants. Such an analysis will identify what is the major mechanistic effect for given gene/variants that likely influence vulnerability to addiction. The outcome of the study will be used to develop an algorithm that given a patient variant in these opioid-addiction-linked genes, one can predict the addiction risk with respect to specific opioid medications and to possibly select the drug with lowest risk for addiction.

Katherine Weisensee

“3D Methods to Quantify Craniofacial Variation in Disease”

Unique facial features are associated with number of syndromes that have well-characterized genetic abnormalities. Clinical geneticists often base the diagnosis of a particular syndrome on a descriptive characteristic suite of facial features observed in a patient. Three-dimensional methods of examining the face provide an opportunity to quantify and analyze variation that expand upon descriptive methods and improve patient outcomes. This presentation will describe a NIH-funded research project that is applying these methods.

Mary Ellen Wright

“Mothers with Addiction and Recovery”

The opioid epidemic also affects pregnant and parenting women. The unique needs of this population is the focus of the trajectory of work, mothers with addiction. A completed qualitative study of stories of mothers underscores the themes of prior trauma and the need of quality social support for recovery. Balancing the safety and health of the infant with recovery care of the mother will be outlined in this presentation.

Modi Wetzler

“Is Treating the Underlying Cause of Intellectual Disabilities Possible? Creatine Transporter Deficiency as an Emerging South Carolina Success Story”

Intellectual disabilities (ID) affect 1-3 million Americans (depending on the estimates), with not even a single treatment for their underlying causes. An estimated 100,000 Americans suffer from Creatine Transporter Deficiency, a debilitating ID (IQs between 20-50) whose genetic prevalence was identified at the Greenwood Genetics Center. Analogs of creatine that could enter the brain on their own, despite a nonfunctional transporter, could restore function to people suffering from this disease. We have recently demonstrated uptake of our synthetic analogs into zebrafish brains, as a step toward eventual possible clinical use.

Pingshan Wang

“Microwave Lab on Chip”

We present the design and operation of tunable microwave interferometers for the detection and identification of single particles and cells at different physiological states. We also present the design and operation of a compact and high-sensitivity electron spin resonance spectrometer.

Thompson Mefford

“Use of functionalized magnetic nanoparticles as a tool for disease detection and treatment”

We have focused our efforts on three distinct areas: 1.) Nanoparticle synthesis and morphology, 2.) Surface-ligand interfaces, and 3.) Specialized surface moieties for additional imaging, therapy, and targeting. This talk will describe new developments in nanoparticle synthesis via the extended LaMer mechanism for growth, radioanalytical techniques to quantify the surface functionality, and the addition of functional groups for therapeutic applications. These includes the creation of alternatives for antibiotics, multimodal MRI contrast agents, drug delivery for the treatment of hyperplasia, and detection of markers for Alzheimer's and diabetes.

Ecology, Biodiversity and Conservation

Carmen Blubaugh

“Manure cocktails influence top-down and bottom-up pressure on herbivores”

Biodiversity is a major driver of ecosystem function. Diversity in plant communities often enhances productivity, while diversity in predator communities can strengthen trophic cascades, due to niche saturation and efficient exploitation of resources. Although diversity in soil microbe communities is often suggested to promote herbivore resistance in plants as well as productivity, microbial community structure is challenging to manipulate. Here, we attempt to engineer diverse microbial communities in the rhizobiome of broccoli plants by comparing simple and diverse blends of various common organic fertility materials (worm compost, chicken manure, and fish meal) and measuring their singular and combined effects on plant growth, synthesis of defensive secondary metabolites, herbivore growth, and rates of attack by parasitoid wasps.

Christopher Sasaki

“The EccDNA Replicon - A self-replicating, extra-nuclear vehicle driving gene amplification and rapid adaptive evolution”

Gene copy number variation is a predominant mechanism by which eukaryotes and prokaryotes respond to selective pressures in nature which often result in genomic expansion and unbalanced structural variations that perpetuate adaptations to sustain life. However, the underlying mechanisms that give rise to gene copy proliferation are poorly understood. I will present

a unique result of genomic plasticity in plants, a massive extrachromosomal circular DNA (eccDNA), that can self-replicate to rapidly increase copy number and expression of crucial genes required for plant survival under stress, and attach to chromosomes as a means of genomic persistence.

Michael Caterino

“Diversity and endemism of arthropods of high Appalachia”

The highest elevation 'sky islands' of southern Appalachia host a rich, ancient, and significantly endemic biota. But the arthropods occurring in these communities are very poorly documented. Through fieldwork and modern phylogenomic approaches, my lab is beginning to address this deficiency for the leaf-litter fauna, sampling across these sites, and using metabarcoding to resolve community diversity and distinctness.

Rob Baldwin

“Emerging problems for biodiversity and protected areas”

50% of the Earth's surface is needed to forestall human-caused biodiversity decline yet only 15% is currently set aside for protection. The paradigm of relying on protected areas may not be adequate especially as most are very small, not distributed optimally in space or by biological characteristics, or managed at the landscape scale to ameliorate ecological isolation.

Furthermore, local and indigenous people who can be important partners in management are left out of the command and control model; this overview of our recent Special Issue highlights new approaches to biodiversity conservation that are more inclusive.

Rongzhong Ye

“Plant-Soil-Microbe Nexus: Towards Better Soil Health, Agronomic Productivity, and Environmental Sustainability”

Soil microbial biomass plays an important role in regulating many ecosystem services that are important to agricultural systems, including, but not limited to, retention and provision of plant nutrients, preservation and decomposition of soil organic matter, and production and mitigation of greenhouse gasses. The talk will cover field and laboratory researches on the interactions between plant, soil, microbe, and the environment, in the

context of improving all the four major components of a given agroecosystem.

Sharon Bewick

“Is Time Running Out for Periodical Cicadas?”

Periodical Cicadas exhibit dramatic, synchronous emergences of adults on 13- or 17 year periods. Evidence suggests that the difference between a 13-year cycle and a 17-year cycle could be 'dropping' the final instar, and that the frequency of this occurring may be temperature dependent. With increasing temperatures due to global change, this could drive a 17-to-13 year shift in 17-year periodical cicadas. However, in undergoing this transition, the periodical cicada population will be continually split into distinct cohorts, potentially leading to increased predation and population decline.

Interdisciplinary Research with Complex Systems and Community Based Problems

Bridget Trogden

“Building and Sustaining Interdisciplinary Community-Based Research”

As a land grant institution, Clemson is a campus that engages not only with research and discovery, but also in application of our intellectual work to benefit humanity. Over the past year, Clemson faculty and staff and students have been working on regional problems with communities through the College/Underserved Community Partnership Program (CUPP), run through EPA Region 4. In this session, I would like to give an overview of how the program works and how it can help Clemson faculty build collaborations with other colleagues and with communities, providing proofs of concept for scalable, sponsored research.

Dave Lamie

“Agency and Organizational Readiness for Addressing Farmer Mental Health Issues”

The agricultural sector is one of the most important economic engines for South Carolina. Agricultural producers are currently under enormous stress,

largely due to circumstances beyond their immediate control. Recent research on South Carolina agency and organizational awareness and capacity to provide support to the expected increase in mental health cases brought on by these stressors indicates a lack of preparedness and the likely need to mount collaborative efforts to remedy this situation.

David A. Ladner

“Improving sanitation in the Black Belt of rural Alabama”

In the rural “Black Belt” of Alabama the existing soil conditions make it difficult or impossible to effectively treat and discharge wastewater using conventional septic systems. To help change this situation, our team of Capstone Design students from the Department of Environmental Engineering and Earth Sciences engaged with the College/Underserved Community Partnership Program (CUPP) to design both on-site and decentralized wastewater systems for rural homes and communities in Marengo county, Alabama. We proposed several regulatory suggestions for the Alabama Department of Environmental Management (ADEM) and Alabama Department of Public Health (ADPH) to help decrease costs while still maintaining effluent quality. Using our detailed designs and cost assessment, we finalized a 15-year general funding plan to give community members options for payment including various loans and grants and addressed the importance of community involvement and public awareness.

David Vaughn & Paris Stringfellow

“A Pilot Effort to Evaluate an Integrated Community Resilience Assessment for Laurens County, SC”

In May 2017, a pilot program launched in Laurens County, SC called Practical Community Resilience which was designed to improve the disaster resilience of economically disadvantaged communities using best practice methodologies to inventory, assess, manage, and reduce long-term risk. This program derived from The Infrastructure Security Partnership (TISP) that commissioned a subcommittee over four years earlier to develop a strategy to help disadvantaged communities develop resiliency plans by leveraging existing successful programs. This approach uses a low-cost execution model for determining the current resilience of community systems and

works to create operational resilience by engaging all four sectors—public, private, citizens, & insurance. This presentation evaluates the successes, failures and potential future applications of this model.

Linking Laboratory and Field Scale Experiments Examining Water-Energy-Environment Nexus

Brian Powell

“Laboratory and field studies of neptunium and plutonium migration in the environment”

The migration of trace elements in the environment is dependent on the chemical species which dominate under given geochemical conditions. The mobility can be enhanced or retarded by altering the oxidation state or forming soluble organic ligand-metal ion complexes. This work examines three case studies to evaluate the impacts of these changes in chemical speciation on the transport of trace elements through soil. Our approach seeks to characterize the time and length scales over which non-equilibrium states are maintained by rate-limiting (or rate-enhancing) reactions between radionuclides and co-reactants due to interactions between physical mass-transfer processes (i.e., flow, advection, diffusion) and (biogeo)chemical reactions.

Christophe Darnault

“Flow and Transport in the Natural Environment: Advances and Applications in Water, Energy and Food Systems”

Understanding flow and contaminants transport processes in the natural environment is critical for the mitigation of their impacts, the development of effective remediation procedures, the exploitation and management of subsurface resources –aquifer systems and petroleum reservoirs, a sustainable agriculture, and the protection of the environment and public health. To study the flow and the fate and transport of contaminants in the natural environment, we have investigated the flow and the behavior of contaminants under different hydrodynamic and biogeochemical conditions found in the environment. To elucidate the individual contribution of the mechanisms and parameters affecting the flow phenomena, and fate of these contaminants, as well as to quantify and visualize them, we have

developed monitoring methods and tools using physical, chemical, microbiological, molecular, and non-intrusive technologies. Our research results will contribute to the development and validation of flow, fate, and transport models of contaminants from pore scale to watershed scale for management and protection of soil and water resources, agricultural and ecosystem sustainability, petroleum reservoirs, public health, risk assessment, and life-cycle analysis.

Qiushi Chen

“Computational modeling of granular and porous materials”

Natural and engineered granular and porous materials are ubiquitous in various engineering applications. Our recent research efforts on computational modeling of such materials will be discussed in this talk: (1) imaging-based and machine learning-enabled characterization of biocemented Martian regolith simulant (a new R-initiative project); (2) discrete element modeling of deformable biomass particle flows for bioenergy applications.

Sarah White

“Floating treatment wetlands aid in contaminant removal from surface waters”

Floating treatment wetlands are new type of constructed wetland that float on the surface of water bodies with the plant root system extends into the water column. Roots filter the water and serve as surface area to support the growth of microbial communities. Removal of nutrient and plant pathogen contaminants from water is aided by floating treatment wetlands. We are interested in furthering the understanding the microbial communities, evapotranspiration differentials, plant-specific performance differences, and potential for biofuel biomass production in these complex ecologically-based treatment systems.

Sudeep Popat

“Anaerobic membrane bioreactors for domestic wastewater treatment”

Anaerobic membrane bioreactors (AnMBRs) are bioreactors in which anaerobic microorganisms break down wastewater organics to produce

methane as an end-product. AnMBRs could potentially help replace the activated sludge process for wastewater treatment that relies on anaerobic microorganisms, and requires significant energy input, as well as produces excess solids to handle. In this presentation, I will describe the research efforts in my lab, and along with a team of faculty collaborators at Clemson, on overcoming some of the key challenges to AnMBR implementation at large scale. These challenges include, reliable operation at low temperatures, finding innovative methods for fouling control, and post-treatment of AnMBR effluents to remove and recover dissolved methane and nutrients.

Tom O'Halloran

“Measuring water and greenhouse gas fluxes in forestry and bioenergy projects”

Developing a sustainable future requires a systems approach to natural resource management. To that end we must quantify and understand the processes controlling the cycling of water, greenhouse gases and energy between natural resources and human systems. Here I review my research experiences and capabilities in making in situ field observations of the fluxes and cycling of water, energy, carbon dioxide and other gasses between the land surface and the atmosphere.

Plugging Humans into the Digital World

Brygg Ullmer

“Enodia: new research tools for highly reconfigurable, many-screened, collaborative interactivity”

We have grown comfortable with moving about tables and chairs, as well as laptops and tablets, to meet evolving needs surrounding collaborative research and education. The recently-funded Enodia NSF MRI is bringing such reconfigurability to groups of large screens; and creating interaction technologies to allow groups to flexibly invoke and engage with diverse content upon them. We will introduce the project and several early example applications, including tangible interaction with Clemson's full ensemble of NSF-funded research; and interaction with mammalian bioinformatics, both for scientists and school children

Dani Herro

“Engaging Youth in Real-World Problem Solving through STEAM Education”

This presentation will detail a research-based instructional model used with more than 150 K-12 teachers to create STEAM learning activities based on scenarios aligned with real-world problems that incorporate mentors, and draw on students’ interest in digital technology activities such as games, media, and video development as part of the problem-solving process. I will also discuss an assessment rubric, Co-Measure, used to assess student collaboration in related technology-enabled making-activities that is currently being revised to assess collaboration related to computational thinking in K-12 computer science courses. The work aims to (1) assist teachers in offering opportunities during the school day to all students as one way to broaden participation, (2) assist teachers in offering collaborative problem solving, and (3) assist students in ways to become aware of, and connected to, future STEM-related careers.

Patrick Warren

“Touched by the Trolls”

But about half of the output of the Internet Research Agency's recent coordinated propaganda operation were retweets of other accounts, overwhelmingly from outside the network. About 19 percent mentioned other accounts, mostly from outside the network. Nearly 100,000 were replies to outside accounts. In this paper, we focus attention on the other Twitter users with whom the trolls interacted. We analyze the characteristics of outside accounts that were targeted by the trolls, in order to infer what role contacts with outsiders might have played in the trolls' propaganda strategy.

Hudson Smith

“Fruitful undergraduate research and education through applied machine learning”

The Watson-in-the-Watt Creative Inquiry program equips an interdisciplinary group of undergraduate students with practical machine learning skills while partnering with researchers at Clemson to solve real problems pursuant of

scientific publication and funding. Simultaneously, students engage with a novel discussion-based curriculum dealing with the diverse implications of AI on society. In this presentation, we summarize the Watson-in-the-Watt educational program and describe several of the exciting applied machine learning research projects being conducted by these students.

Public Humanities and Public History

Joshua Catalano

“Digital Public History at Clemson”

This presentation will discuss two digital history projects created with Clemson students. The first, Local History Matters, is a website featuring short essays as part of online exhibits. The second, Upcountry Historical, is an app for hosting stories about the history of the South Carolina Upcountry. These two projects are ongoing, and students can continue to populate them with additional content in future semesters.

Lee Morrissey, and Rhondda Thomas

“Creating Humanities Communities: Call My Name”

With support from an NEH “Creating Humanities Communities” Challenge Grant that Clemson English department colleagues Lee Morrissey and Rhondda Thomas were awarded in 2017, they have been working with three local community partners (the Bertha Lee Strickland Cultural Museum in Seneca, the Clemson Area African-American Museum, and the Pendleton Black History and Culture Foundation) to find, document, and preserve the African American heritage of Clemson University and the towns that surround it. Their presentation will examine the local, state-wide, national, and international scope of this history.

Resilient Infrastructure and Environmental Systems (RIES) NSF NRT

Andrew Brown

“Functional Calibration of Computer Models”

In this talk, I will give a brief overview of the computer model calibration problem in which we search the inputs to a black-box computer code to find settings which make the computer model most consistent with observed

data while quantifying its associated uncertainty. This idea can be extended to "functional calibration" in which some inputs can be thought of as functions rather than constant values. This latter approach allows calibration to be used to estimate unknown / unobservable constituents in coupled systems.

Bing Li

“Automated Robot and Deep Learning Inspection for Spatial–temporal Infrastructure Health Monitoring”

The aging problem of civil infrastructures such as bridges, tunnels, and dams requires efficient and effective structural health monitoring (SHM). Conventional hand-operated inspection approaches are costly and time-consuming, and the detection data analysis is not able to incorporate the large volume spatial-temporal information effectively. We propose an automated robot inspection solution by leveraging simultaneous localization and mapping (SLAM) techniques for 3D structural modeling. Convolutional deep neural network and machine learning-based bridge concrete flaw recognition approaches are proposed to achieve semantic detection result to be overlaid with the 3D structural model.

Chris Kitchens

“Sustainable Building Materials”

Design of Magnesium Oxycloride cement composites for sustainable building materials.

Cole Smith

“Resilient Infrastructure and Environmental Systems NRT Introduction”

Sriparna Bhattacharya

“Phonon Anharmonicity and thermoelectric properties of single crystalline SnSe”

Thermoelectric (TE) materials are capable of direct conversion of “waste” heat to electricity, where the energy conversion efficiency is gauged by the dimensionless figure-of-merit, or ZT, consisting of interrelated material parameters, viz., the Seebeck coefficient, electrical and thermal

conductivities. Recently, single-crystalline SnSe has attracted much attention for its record high $ZT \approx 2.6$ that was debated in subsequent reports due to the low mass density of these single crystals. We performed structural, electrical, and thermal transport measurements on high-quality fully dense SnSe single crystals over a wide temperature range along the major crystallographic directions, that yielded a maximum $ZT \approx 1$ along one of the major crystallographic directions. Furthermore, we performed temperature-dependent polarized Raman spectroscopy on fully dense single-crystalline SnSe that provided a deeper understanding of the role of phonon-phonon scattering and anharmonicity leading to the favorable thermal transport properties of SnSe.

Federico Iuricich

“Topology-based scientific visualization”

Visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively. In this talk, we will discuss the rationale behind topology-based techniques for the analysis and visualization of scientific data. Moreover, we will show the results of our recent work on the analysis of multivariate data.

Mik Carbajales-Dale

“Energy-economy-environmental (E3SA) systems analysis”

The E3SA group’s research focuses on building decision-support tools to reduce the environmental impacts of technology systems and to understand the structural transformation necessary to navigate a peaceful transition to a prosperous and sustainable future. Specifically, we model energy and material resource requirements at three distinct levels: micro, the device/facility level, using engineering-based, bottom-up life cycle assessment and techno-economic modeling tools; meso, the industry/local level, using multi-layer, network-analytic techniques; and macro, the regional/national/global scale, using geographic information systems (GIS) and environmentally-extended input-output models.

Prasad Rangaraju

“Developing a Rational Method to Proportion Cementitious Mixtures for Application in Additive Manufacturing”

We are developing a rational approach to developing cementitious mixtures that are most suitable for use in additive manufacturing (3D Printing). For this purpose we are developing a framework of material characteristics and test methods that enable us to characterize the rheological and early-age properties and examine how these properties relate to the delivery method in additive manufacturing. We will explore collaborations with other researchers in ME, MSE, Chemistry and ChE to add new functionalities in this process.

“Effect of Nucleating Agents on Hydration Behavior and Microstructure Development in Portland Cement and Geopolymer Systems”

Our investigation focuses on the influence of C-S-H nano-particle (seeds) on the nucleation of hydration products in systems comprising of clinker and Portland cement, with particular emphasis on kinetics of hydration, microstructure development, phase evolution and the mechanical response. We are primarily using Isothermal Calorimeter in these studies at the present time with plans to examine other aspects through QXRD, SEM, TGA and AFM. This area of research will likely enable us to explore nano-engineering of the structure of cement hydration products and thus significantly engineer the behavior of cementitious matrices. Collaborations with other departments such as MSE, ChE and Chemistry will be valuable.

“Enhancing the Properties of Portland Cement Concrete through Use of Sustainable Modified Biosilica”

Biosilica produced from pyro-processing of rice husk has a significant potential to reduce the carbon foot-print of Portland cement based construction materials, as Biosilica is a carbon-neutral material. The use of Biosilica in blended cementitious systems has been known to enhance the properties of cementitious matrices, however, the variability in the composition of Biosilica increases the variability in the performance of the blended cementitious systems. This study focuses on use of a Modified Biosilica (MB) produced treating Biosilica with a dilute hydrochloric acid to produce a high purity amorphous silica source with a very low loss-on-ignition value. The influence of MB on the kinetics of hydration,

microstructure development, shrinkage behavior, mechanical behavior, transport properties and durability properties viz. resistance to alkali-silica reaction & sulfates are being studied. Furthermore, the potential nucleation effect of MB and its use in high-performance high-strength cementitious systems is being investigated. Initial results suggest that use of MB has a potential of achieving very high performance with long-term strength development. Future research will also investigate the applicability of vesicular nature of the MB to serve as a carrier of chemical admixtures into concrete and deliver the chemical admixture on a time-delayed basis.

This publication is available in alternate formats upon request. Please contact Penny Reid, 656-7701, penny@clemsn.edu.