



10.13.2020

7th HEALTH CARE ENGINEERING SYSTEMS  
**SYMPOSIUM**

*An OSF HealthCare, University of Illinois at Urbana-Champaign,  
and University of Illinois College of Medicine Peoria Collaboration*

**jump** | ARCHES

# AGENDA

**8:30 - 9:00 a.m.**

## **Welcome & Opening Remarks**

Rashid Bashir - Dean, The Grainger College of Engineering, University of Illinois

Robert Jones - Chancellor, University of Illinois

Robert Sehring - Chief Executive Officer, OSF HealthCare

Michael Cruz - Chief Operating Officer, OSF HealthCare

**9:00 - 9:30 a.m.**

## **Jump ARCHES Review**

John Vozenilek - Vice President & Chief Medical Officer for Innovation and Digital Health, Jump Trading Simulation and Education Center, OSF HealthCare

T. Kesh Kesavadas - Professor, Industrial and Enterprise Systems Engineering, Director, The Health Care Engineering Systems Center, University of Illinois

**9:30 - 10:30 a.m.**

## **Innovation Session**

*Predicting versus Changing Behavioral and Clinical Outcomes using Big Data*

Dolores Albarracin - Professor, Psychology, Business, Medicine, University of Illinois

*Collaborations Between the College of Applied Health Sciences & The Grainger College of Engineering at the University of Illinois at Urbana-Champaign*

Wendy Rogers - Khan Professor of Applied Health Sciences, University of Illinois

*Deep Learning for Health Care*

Jimeng Sun - Professor, Computer Science, University of Illinois

*Modeling COVID-19 Epidemic in a University Environment*

Ahmed Elbanna - Assistant Professor, Civil and Environmental Engineering, University of Illinois

*The Center for Social and Behavioral Sciences and Jump ARCHES*

Eva Pomerantz - Professor, Psychology, University of Illinois

**10:30 - 10:45 a.m.**

## **Break**

# AGENDA

## 10:45 - 11:45 a.m. **Jump ARCHES COVID-19 Award Presentations**

*Towards Secure Federated Learning for Collaborative Diagnostics*  
Sanmi Koyejo - Assistant Professor, Computer Science,  
University of Illinois

*Rapid Detection of COVID-19 using Isothermal Amplification of RNA*  
Enrique Valera - Research Scientist, Micro and Nanotechnology Laboratory, Bioengineering, University of Illinois

*Design and Local Fabrication of Reusable N95 Respirator*  
Lisa Bievenue - Director of Informatics Programs, Illinois Informatics,  
University of Illinois

*Maximizing the Informational Value of PCR-based COVID-19 Test Through Optimal Pooled Community Testing*  
Hadi Meidani - Assistant Professor, Civil and Environmental Engineering, University of Illinois

*Dynamics of COVID-19 Measured at a Chicago Hospital*  
Ravi Iyer - George and Ann Fisher Distinguished Professor of Engineering, Electrical and Computer Engineering, University of Illinois

*Digital Technologies to Manage COVID-19 at UIUC*  
Sanjay Patel - Professor, Electrical and Computer Engineering,  
University of Illinois

## 11:45 a.m. - 12:45 p.m. **Jump ARCHES Ongoing Research Presentations**

*Digitizing the Neurological Screening Examination*  
Chris Zallek - Clinical Assistant Professor of Neurology, Illinois Neurological Institute, OSF HealthCare

*Artificial Intelligence Augmented Photoacoustic Imaging*  
Yun-Sheng Chen - Research Assistant Professor, Electrical and Computer Engineering, Bioengineering, University of Illinois

*Deep Learning Glioma Segmentation for Automatic Creation of 3D VR Models from Patient MRI Scans*  
Chase Duncan - Graduate Student, Computer Science,  
University of Illinois

# AGENDA

*Soft Robotic Cardiac Transseptal Puncture Simulator*

Nicholas Thompson - Graduate Student, Mechanical Science and Engineering, University of Illinois

*Using a Multi-modal Skin Lesion Simulation App in Medical Education*

Scott Barrows, Director, Jump Design Lab, Jump Trading Simulation & Education Center OSF HealthCare

**12:45 - 12:50 p.m.**

*KneeView: Hybrid Models for Musculoskeletal Education*

Mariana Kersh - Assistant Professor, Mechanical Science and Engineering, University of Illinois

**12:50 - 1:10 p.m.**

**Break**

**1:10 - 2:00 p.m.**

**Fall 2020 Request for Proposals Overview**

John Vozenilek

**1:00 - 2:00 p.m.**

T. Kesh Kesavadas

**RFP Matchmaking & 2-Minute Pitches**

**Parallel Sessions: Poster Sessions and Live Demonstrations**

See pages 24-25 for full schedule and how to access these sessions.

# JUMP ARCHES CO-DIRECTORS



**Thenkurussi “Kesh” Kesavadas**

*Director, Health Care Engineering Systems Center  
Co-Director, Jump Simulation Center  
Professor, Industrial and Enterprise Systems Engineering,  
Computer Science, Electrical and Computer Engineering, and  
Carle Illinois College of Medicine  
University of Illinois at Urbana-Champaign*

T. Kesh Kesavadas is the Director of the Health Care Engineering Systems Center at Illinois and Engineer-in-Chief of the Jump ARCHES endowment. Kesavadas holds faculty appointments in the department of industrial and enterprise systems engineering, computer science, electrical and computer engineering, and the Carle Illinois College of Medicine. He is co-director of the Jump Simulation Center and coordinates the Health Data Analytics program for The Grainger College of Engineering. Kesavadas’s research focuses on virtual and augmented reality, simulation, medical robotics, and manufacturing.



**John Vozenilek**

*Vice President and Chief Medical Officer for Simulation  
Co-Director, Jump Simulation and Education Center, OSF HealthCare  
Duane and Mary Cullinan Professor in Simulation Outcomes  
Professor, University of Illinois College of Medicine at Peoria*

As the VP and Chief Medical Officer of Jump Simulation, John Vozenilek provides central coordination and oversight for OSF Healthcare’s undergraduate, graduate, interdisciplinary, and continuing medical education programs. As the Duane and Mary Cullinan Professor in Simulation Outcomes Dr. Vozenilek is actively involved in the academic programs across traditional departmental boundaries and in clinical practice at OSF Healthcare. In addition to his role in simulation, Dr. Vozenilek teaches master’s degree candidates in the fields of simulation, healthcare quality and safety, and is formally appointed in The Grainger College of Engineering at the University of Illinois at Urbana-Champaign to teach biodesign.

# INNOVATION SESSION

## ***Predicting versus Changing Behavioral and Clinical Outcomes using Big Data***

**Dolores Albarracin**

Professor, Department of Psychology  
College of Liberal Arts and Sciences  
University of Illinois at Urbana-Champaign  
*dalbarra@illinois.edu*

This presentation will distinguish between prediction and change of behavioral and clinical outcomes. It will cover the project team's research findings using Big Data to predict behavior and disease prevalence, in addition to the limitations of this approach. It will also cover three current NIH-funded projects in which the team has moved from prediction to intervention and modeling intervention effects, concentrating on the opportunities and challenges faced.

*Dolores Albarracin is an Argentine-American psychologist who studies social cognition, communication, misinformation, and behavioral change. A fellow of APA, APS, and SESP, she is the outgoing editor-in-chief of Psychological Bulletin. Her research spans 180 publications including five books. She is currently a member of the committee evaluating the Trans-NIH Basic Behavioral Research Agenda.*

## ***Collaborations Between the College of Applied Health Sciences & The Grainger College of Engineering at the University of Illinois at Urbana-Champaign***

**Wendy Rogers**

Khan Professor of Applied Health Sciences  
College of Applied Health Sciences  
University of Illinois at Urbana-Champaign  
*wendyr@illinois.edu*

Successful technology design that will improve people's lives requires interdisciplinary collaborations. There are a number of initiatives at Illinois engaging faculty from the human side and from the technology side to ensure that technology innovations are useful to and useable by their intended audience. This presentation will outline three initiatives: CHART (Collaborations in Health, Aging, Research, and Technology), LIFE Home, and the Health Technology Education Program.

*Wendy Rogers is the Khan Professor of Applied Health Sciences and holds appointments in the departments of kinesiology, community health, and educational psychology. She is an affiliate of the Beckman Institute, Illinois Informatics Institute, Center for Social and Behavioral Science, and Discovery Partners Institute. Rogers serves as Director of the Health Technology Education Program, the McKechnie Family LIFE Home, CHART (Collaborations in Health, Aging, Research, & Technology), and the Human Factors and Aging Laboratory. Rogers's research is funded by NIH and NIDILRR.*

# INNOVATION SESSION

## ***Modeling COVID-19 Epidemic in a University Environment***

**Ahmed Elbanna**

Assistant Professor, Department of Civil and Environmental Engineering

The Grainger College of Engineering

University of Illinois at Urbana-Champaign

*elbanna2@illinois.edu*

COVID-19 has caused an unprecedented disruption in everyday life activities all over the world. College campuses have been exploring the possibility of safe re-opening during the fall semester. A major challenge is that colleges provide opportunities for super spreader events, including large classes and parties in poorly ventilated areas, where coronavirus may have a high attack rate due to its airborne nature. This presentation will outline an agent-based model for COVID-19 transmission in a university environment mimicking UIUC to follow each agent as they move between classes and different social life activities. It will show that with frequent testing, compliance with isolation and quarantine, as well as a hybrid teaching mode, it is possible to find practical scenarios for safe reopening of universities.

*Ahmed Elbanna is currently an associate professor of structural engineering and mechanics and a Donald Biggar-Willet faculty fellow in the Department of Civil and Environmental Engineering at Illinois where he leads the Mechanics of Complex Systems Laboratory. Elbanna's research focuses on problems in theoretical and applied mechanics of solids and other complex systems, with special emphasis on fracture, deformation, and wave propagation problems as they arise in geophysics, soft materials, biological systems, and material design. Recently he has been part of the COVID-19 modeling team and has been working on modeling COVID-19 epidemic in the state of Illinois as well as at Illinois. He is a fellow of National Center of Supercomputing Applications, a faculty affiliate of Beckman Institute of Advanced Studies, a recipient of NSF Faculty Early CAREER award, and the recipient of Journal of Applied Mechanics paper award (2019).*

# INNOVATION SESSION

## ***Deep Learning for Health Care***

### **Jimeng Sun**

Professor, Department of Computer Science  
The Grainger College of Engineering  
University of Illinois at Urbana-Champaign  
[jimeng@illinois.edu](mailto:jimeng@illinois.edu)

This brief overview will highlight a few recent works from Sun's group regarding deep learning for health care applications including clinical predictive models, phenotyping, patient trial matching, and clinical report generation.

*Jimeng Sun is a professor of computer science. He was formerly an associate professor in the college of computing at Georgia Institute of Technology and a researcher at IBM TJ Watson Research Center. His research focuses on artificial intelligence in health care. Sun has published over 120 papers and filed over 20 patents.*

## ***The Center for Social and Behavioral Sciences and Jump ARCHES***

### **Eva Pomerantz**

Acting Director, Center for Social and Behavioral Sciences  
Professor, Department of Psychology  
College of Liberal Arts and Sciences  
University of Illinois at Urbana-Champaign

This brief overview will highlight the key missions of the Center for Social and Behavioral Sciences and how they intersect with those of the Jump ARCHES program and the Health Care Engineering Systems Center.

*Eva Pomerantz is currently serving as acting director of CSBS. She studies the role of parents in children's motivation and learning in school. Pomerantz's work has been supported by NSF, NIH, and the Spencer Foundation. Pomerantz is currently a Provost Fellow working on revision of promotion and tenure guidelines.*



# JUMP ARCHES COVID-19 AWARD PRESENTATIONS

## *Towards Secure Federated Learning for Collaborative Diagnostics*

**Sanmi Koyejo**

Acting Director, Center for Social and Behavioral Sciences

Professor, Department of Psychology

College of Liberal Arts and Sciences

University of Illinois at Urbana-Champaign

*sanmi@illinois.edu*

This update highlights our progress towards a federated learning system for joint learning across hospitals. The project strives to develop an implementation of a federated learning system, including machine learning optimization algorithms, security protocols, and a containerized software implemented on virtual servers and clients. The project also strives to develop a proof of concept application using public data to diagnose COVID-19 from x-rays and classification tasks.

### ***Investigators:***

*Sanmi Koyejo, University of Illinois at Urbana-Champaign*

*William Bond, OSF HealthCare*

# JUMP ARCHES COVID-19 AWARD PRESENTATIONS

## ***Rapid Detection of COVID-19 using Isothermal Amplification of RNA***

**Enrique Valera**

Research Scientist, Micro and Nanotechnology Laboratory

The Grainger College of Engineering

University of Illinois at Urbana-Champaign

*evalerac@illinois.edu*

The COVID-19 pandemic provides an urgent example where a gap exists between availability of state-of-the-art diagnostics and current needs. As assay protocols and primer sequences become widely known, many laboratories perform diagnostic tests using methods such as RT-PCR or reverse transcription loop mediated isothermal amplification (RT-LAMP). This project presents an RT-LAMP isothermal assay for the detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus and demonstrate the assay on clinical samples using a simple and accessible point-of-care (POC) instrument. We characterized the assay by dipping swabs into synthetic nasal fluid spiked with the virus, moving the swab to viral transport medium (VTM), and sampling a volume of the VTM to perform the RT-LAMP assay without an RNA extraction kit. The assay has a limit of detection (LOD) of 50 RNA copies per  $\mu\text{L}$  in the VTM solution within 30 min. We further demonstrate our assay by detecting SARS-CoV-2 viruses from 20 clinical samples. Finally, we demonstrate a portable and real-time POC device to detect SARS-CoV-2 from VTM samples using an additively manufactured three-dimensional cartridge and a smartphone-based reader. The POC system was tested using 10 clinical samples, and was able to detect SARS-CoV-2 from these clinical samples by distinguishing positive samples from negative samples after 30 min. The POC tests are in complete agreement with RT-PCR controls. This work demonstrates an alternative pathway for SARS-CoV-2 diagnostics that does not require conventional laboratory infrastructure, in settings where diagnosis is required at the point of sample collection.

### ***Investigators:***

*Rashid Bashir, University of Illinois at Urbana-Champaign*

*Sarah Stewart de Ramirez, OSF HealthCare*

# JUMP ARCHES COVID-19 AWARD PRESENTATIONS

## ***Design and Local Fabrication of Reusable N95 Respirator***

**Lisa Bievenue**

Director, Informatics Programs

Illinois Informatics

University of Illinois at Urbana-Champaign

*bievenue@illinois.edu*

With projected shortages of PPE and respirators, this project set out to develop and fit test a prototype N95 respirator (standard size) and 3D printed end-cap that can accept existing medical respiratory filters, pass a N95 respirator fit test, and be sterilized or sanitized by readily available procedures. This design approach targeted medical respiratory filters which are not expected to be in higher demand due to COVID-19 (e.g., filters used with anesthesia).

## ***Investigators:***

*Jeremy Guest, University of Illinois at Urbana-Champaign*

*Thand H. Nguyen, University of Illinois at Urbana-Champaign*

*Brent Cross, OSF HealthCare*

# JUMP ARCHES COVID-19 AWARD PRESENTATIONS

## ***Maximizing the Informational Value of PCR-based COVID-19 Test Through Optimal Pooled Community Testing***

**Hadi Meidani**

Assistant Professor, Department of Civil and Environmental Engineering  
The Grainger College of Engineering  
University of Illinois at Urbana-Champaign  
*meidani@illinois.edu*

During the present COVID-19 outbreak, the lack of available tests and the resulting inability to broadly test large populations leave officials with almost no information about the overall prevalence of the virus in the general community. This has hindered time-sensitive community testing and mitigation strategies. This project investigates a cost-effective surveillance approach based on pooled testing. In particular, it studies the effectiveness of pooled testing at different pooling ratios using pooled tests performed on NP-swab samples. In this presentation, investigators will show preliminary results from our validation tests carried out at the OSF Microbiology Lab and will discuss how Bayesian inference can be used towards optimal use of pooled testing to estimate and predict the prevalence of COVID-19 in a large population.

### ***Investigators:***

*Hadi Meidani, University of Illinois at Urbana-Champaign*

*Daniel Lakeland, Lakeland Applied Sciences, LLC*

*John Farrell, University of Illinois College of Medicine Peoria*

# JUMP ARCHES COVID-19 AWARD PRESENTATIONS

## *The Dynamics of COVID-19 Measured at a Chicago Hospital*

**Ravi Iyer**

George and Ann Fisher Distinguished Professor of Engineering, Department of  
Electrical and Computer Engineering  
The Grainger College of Engineering  
University of Illinois at Urbana-Champaign  
*rkiyer@illinois.edu*

COVID-19 has shown remarkable diversity in its manifestation. We continue to struggle to understand what factors are associated with its different manifestations as we try to personalize its impact of on different segments of the population. The goal continues to be to enable earlier interventions for at-risk patients and help manage medical resources more efficiently. To study the factors associated with disease progression and provide a prognostic model to triage patients, our multi-disciplinary group of engineers, clinicians and clinical researchers have conducted a retrospective study of over 10,000 patients seen at a major urban hospital in Chicago. The patients were stratified according to the clinical events. We present a staging scheme based on discrete clinical events (i.e., admission to the hospital, admission to the ICU, mechanical ventilation, and death) and study the temporal trend of laboratory tests and the effect of comorbidities in each of those stages. The study developed a machine learning pipeline to identify key risk factors as patients move through the hospital and identifies a prognostic model to predict the course of individual patients through various stages of the disease starting with their entry into the hospital.

### ***Investigators:***

*Ravi Iyer, University of Illinois at Urbana-Champaign*  
*Sarah Stewart de Ramirez, OSF HealthCare*

# JUMP ARCHES COVID-19 AWARD PRESENTATIONS

## ***Digital Technologies to Manage COVID-19 at UIUC***

**Sanjay Patel**

Professor, Department of Electrical and Computer Engineering

The Grainger College of Engineering

University of Illinois at Urbana-Champaign

*sjp@illinois.edu*

The Safer Illinois App is a foundational component of the SHIELD Strategy adopted by the University of Illinois at Urbana-Champaign to safely re-open campus for the Fall 2020 semester. The app enables users to securely and privately manage their COVID testing and results, gain access to campus buildings, as well as manage next steps for users who test positive. This presentation will discuss the app and focus on the new technologies funded by the Jump ARCHES endowment that have been integrated into Safer Illinois.

## ***Investigators:***

*Brent Roberts, University of Illinois at Urbana-Champaign*

*Sarah Stewart de Ramirez, OSF HealthCare*

# JUMP ARCHES ONGOING RESEARCH PRESENTATIONS

## ***Digitizing the Neurological Screening Examination***

**Chris Zallek**

Clinical Assistant Professor of Neurology, Illinois Neurological Institute

OSF HealthCare

*chris.zallek@ini.org*

Neurological conditions affect one in three people and are the leading cause of loss of quality of life. Aging also progressively decreases neurological function. Due to a worsening shortage of neurologists and the growing population size, a neurological care crisis is evolving. This leads to delayed care or limited availability of continued care. Telehealth helps to overcome distance barriers but does not increase the number of neurologists. New care delivery models are needed to help triage and provide continuing care for people with fewer neurologists. Digitizing neurological exam information recorded by smartphone/tablet cameras provides an opportunity to develop new care delivery models.

This project is exploring the possibilities and barriers of recording and digitizing neurological screening examinations. Engineering and user workflow implementation challenges are being addressed concurrently. The team is iterating an app for clinicians to record subsections of the neurological exam. Pose estimation techniques are applied to the recordings and features measured and analyzed for correlating clinically. Ground truth comparison studies are to be done. An initial pilot study is planned with healthy volunteers recording their functions at baseline and then with simulated impairments. Providing digitized objective exam information, obtained at time of care or asynchronously, will enable healthcare systems and clinicians to provide better neurological care.

### ***Investigators:***

*Minh Do, University of Illinois at Urbana-Champaign*

*Chris Zallek, OSF HealthCare*

# JUMP ARCHES ONGOING RESEARCH PRESENTATIONS

## *Artificial Intelligence Augmented Photoacoustic Imaging*

**Yun-Sheng Chen**

Research Assistant Professor, Departments of Electrical and Computer  
Engineering, Bioengineering  
The Grainger College of Engineering  
*yunsheng@illinois.edu*

Photoacoustic imaging is a non-ionizing medical imaging technology that is particularly suitable for breast cancer diagnosis. Photoacoustic effect generates ultrasound signals from rapid elastic-thermal-expansion when the tissue is illuminated by lasers. In photoacoustic molecular imaging, contrast agents are used to molecularly identify disease sites. However, photoacoustic signals from regular tissue often mask the signals of contrast agents and reduce the imaging sensitivity. This study demonstrates a new approach that combines a machine learning algorithm and a new photoacoustic physical principle to reduce the background signals from tissue and increase the sensitivity by one order of magnitude.

### ***Investigators:***

*Yun-Sheng Chen, University of Illinois at Urbana-Champaign*  
*Kent Hoskins, OSF HealthCare*



# JUMP ARCHES ONGOING RESEARCH PRESENTATIONS

## ***Deep Learning Glioma Segmentation for Automatic Creation of 3D VR Models from Patient MRI Scans***

**Chase Duncan**

Graduate Student, Department of Computer Science  
The Grainger College of Engineering  
*cddunca2@illinois.edu*

Medical images have a tremendous amount of spatial information for localizing tumors and planning surgical interventions. But viewing the data in 2D, even when using a multiplanar view, has limitations for understanding the anatomy around the regions of lesions. This project is fully developing automated pipelines to build rich 3D virtual reality models from a standard clinical MRI scans of glioma patients using deep learning. The current project uses T1, T1 contrast-enhanced, T2, T2 flair, and diffusion acquisitions to provide a VR model that automatically creates 3D models of gray matter, white matter, blood supply, tumor core, tumor, and white matter fiber tracts. The 3D models can be used in virtual reality to assist in surgical planning and to better understand the extent and arrangement of the tumor relative to other structures in the brain.

### ***Investigators:***

*Brad Sutton, University of Illinois at Urbana-Champaign*  
*Matthew Bramlet, OSF HealthCare*

# JUMP ARCHES ONGOING RESEARCH PRESENTATIONS

## ***Soft Robotic Cardiac Trans-septal Puncture Simulator***

**Nicholas Thompson**

Graduate Student, Department of Mechanical Science and Engineering

The Grainger College of Engineering

*nthomps6@illinois.edu*

This project seeks to create a novel Soft Active Heart Simulator (SAHS) to train cardiologists and surgeons in a unique surgical operation known as transseptal puncture. Transseptal puncture is used during atrial fibrillation ablation procedures to access the left atrium of the heart through the right atrium by puncturing the fossa ovalis, the membrane that separates the two cavities. Experienced surgeons use a combination of fluoroscopy and ultrasound images together with the force feedback of the pulsating heart transmitted through the needle and sheath to locate the area of puncture. Discrepancies in the process can lead to accidental puncturing of the aorta or other life threatening complications. Currently, the state of the art in training for this process is through image visualization alone, without imparting any force feedback experience.

This project presents the design of the SAHS, which consists of a dynamic right atrium including the fossa ovalis. Novel soft pneumatic muscles emulate the musculature of the heart and mimic the right atrial volume change and the forces on the fossa ovalis. Realism is further improved by optimizing polymeric hydrogel materials to match the material properties of the fossa. Together these features provide accurate feedback forces when a surgeon deforms and pierces the septum with a needle assembly. Users will learn to verify needle position on the fossa ovalis in a simulated ultrasound environment produced by capturing the tenting deformation in the fossa using a sensor and animating it in Unity. The SAHS will undergo thorough validation with experienced and novice surgeons.

### ***Investigators:***

*Girish Krishnan, University of Illinois at Urbana-Champaign*

*Abraham Kocheril, OSF HealthCare*

# JUMP ARCHES ONGOING RESEARCH PRESENTATIONS

## *Using a Multi-modal Skin Lesion Simulation App in Medical Education*

**Scott Barrows**

Director, Jump Design Lab, Jump Trading Education & Simulation Center

OSF HealthCare

*scott.t.barrows@jumpsimulation.org*

Teaching dermatology to medical students, residents, and physicians largely entails lectures, photographs and atlases, and physical examinations to develop an observational appreciation of skin rashes and lesions, their appearance, and their relationship to dermatopathology. With the ever-expansive medical school curriculum, are there better and more efficient ways to successfully teach a comprehensive course in dermatology?

The development of an adaptable interactive smartphone-based skin simulation platform that can collect and store digital images, and then replicate both the appearance as well as the texture or topography of various skin rashes and lesions might be a solution. How might augmented reality add “below the surface” exploration of specific lesions? This has been the focus of an ongoing ARCHES research project developed by the UIUC bioengineering and Jump innovation teams in Medical Visualization and the Design Lab.

In addition, can this new technology be optimized for the medical school classroom by applying hybrid learning? How might this course be designed and integrated into other medical pathology courses? A new course structure is currently in development at the University of Illinois College of Medicine Peoria (in collaboration with Jump Medical Visualization and Design Lab) that might provide some answers.

### ***Investigators:***

*Stephen Boppart, University of Illinois at Urbana-Champaign*

*Scott Barrows, OSF HealthCare*

# JUMP ARCHES ONGOING RESEARCH PRESENTATIONS

## ***KneeView: Hybrid Models for Musculoskeletal Education***

**Mariana Kersh**

Assistant Professor, Department of Mechanical Science and Engineering  
The Grainger College of Engineering  
*mkersh@illinois.edu*

Development of artificial tissue constructs that can simulate musculoskeletal tissues. These constructs have been integrated into a hybrid physical-virtual simulator for knee instruction. The foundation for this work has applications with other joints, research/standardization of testing, and in veterinary education.

### ***Investigators:***

*Mariana Kersh, University of Illinois at Urbana-Champaign*

*Mennakshy Aiyer, OSF HealthCare*

*Tom Santoro, OSF HealthCare*

# JUMP ARCHES 2020 REQUEST FOR PROPOSALS OVERVIEW

## DESCRIPTION

The Jump Applied Research for Community Health through Engineering and Simulation (Jump ARCHES) endowment offers this Request for Proposals to members of the faculty of the University of Illinois at Urbana-Champaign, health care providers of the University of Illinois College of Medicine at Peoria, and/or OSF HealthCare clinicians. The application process opens October 1 and will close October 30 at 5:00 p.m.

## GOALS

The goal of this competitive grant is to improve the quality of health care and safety of patients through collaboration between researchers, engineers, clinicians, and social and behavioral scientists. The award is for 1 year of startup/seed money support up to \$75,000, and requests for continuing funding will be based upon reported progress. Proposals which identify future or matching funding from federal, state, county, or other governmental or non-governmental relief organizations will be regarded most favorably.

To achieve this goal and promote collaboration between institutions, OSF Innovation in Peoria and the Health Care Engineering Systems Center at the University of Illinois at Urbana-Champaign encourage applicants to inquire if their ideas require facilities or technologies that they cannot access at their home institution. Examples of such facilities and technologies may include simulation areas, robotics technology, 3D printing, or other prototyping and manufacturing needs.

## FOCUS AREAS

This Request for Proposals concerns six focus areas: digital health, social and behavioral disparities, autism, neurological sciences, COVID-19, and simulation and education. Your application should address one or more of these areas. Phase II applications in any of these areas that have been previously funded by Jump ARCHES are also encouraged.

- 1. Digital Health:** This area concerns designing technologies to improve tele-medicine, data gathering, sensor design, designing assistive technologies, robotics and advancing the use of data science, AI, and machine learning to augment and assist in improving the costs, quality, and patient/provider experience.
- 2. Social and Behavioral Disparities:** This area concerns mitigating the impact of age, location, and social barriers in delivering quality health care to vulnerable populations. Special emphasis will be given to proposals that address racism, social justice, social and implicit biases, health equity, and access to complement the University of Illinois' Call to Action initiative from the new Chancellor's Research Program to Address Racism and Social Injustice.

# JUMP ARCHES 2020 REQUEST FOR PROPOSALS OVERVIEW

3. **Autism:** This focus area concerns the diagnosis and treatment of Autism Spectrum Disorders (ASDs) through collaborative efforts with the OSF HealthCare Children's Hospital of Illinois. Emphasis will be on early diagnosis of ASDs, enhancement of social skills associated with ASDs, support of children and adults with ASDs as they integrate their unique sensorimotor and information processing patterns while navigating everyday life at home, in school, and in the workplace, and exploration of technologies to utilize unique skills of individuals with ASDs.
4. **Neurological Sciences:** This special focus area addresses technologies to diagnose or monitor treatment of patients. Special solicitations will be offered involving the creation of novel technologies, systems and assistive devices for communication and immobility associated barriers experienced by people with neurological disorders and projects addressing the difficulties of their families and caregivers.
5. **COVID-19:** This area concerns the development of technologies that may address COVID-19, pandemics, or similar health crises. Topics related to diagnostics, sterilization, modeling, artificial intelligence, assistive devices, and surveillance will be of high importance. Social and economic impact on health care post-COVID and effects on children will also be of importance.
6. **Simulation and Education:** This area concerns using simulation and other virtual or augmented reality technologies to train and evaluate current and future medical professionals. New modalities, AR/VR/MR, design of hardware-based simulators with a focus on Human Factors, Interprofessional Education, etc., will be given preference.

Jump ARCHES has over 70 projects at a total of \$4.75 million since 2014. View all funded projects [here](#).

## ELIGIBILITY INFORMATION

The Primary Investigator may be from any discipline. Proposals are REQUIRED to include one investigator from the Grainger College of Engineering at the University of Illinois at Urbana-Champaign and one investigator from either the health care providers of OSF HealthCare or the University of Illinois College of Medicine at Peoria Faculty.

Previously funded proposals which have demonstrated potential for significant impact may submit an application for continued funding.

# JUMP ARCHES 2020 REQUEST FOR PROPOSALS OVERVIEW

Special Consideration to Social Topics: Keeping within the spirit of integrating social and behavioral topics in ARCHES, proposals led by Primary Investigators from social sciences will receive special consideration and additional support in this funding cycle. For more information about submitting to this special topic please contact Professor Eva M. Pomerantz at [pomerantz@illinois.edu](mailto:pomerantz@illinois.edu).

## **EVALUATION CRITERION**

Proposals will be specifically evaluated for their respective alignment to program goals (relevance), the potential impact on patient and/or learner outcomes (impact), and the proposed plan and quality of the proposed team (approach). Proposals must include a brief (one paragraph) statement on the project's expected societal impact.

For the preparation of a responsive application, please contact Antonios Michalos, M.D., M.S., Associate Director (217) 244-4563, [michalos@illinois.edu](mailto:michalos@illinois.edu)

For questions on the submission of the application, please contact Seth Stutzman, SS, BS, BS, ARCHES Program Coordinator (309) 308-9409, [seth.t.stutzman@jumpsimulation.org](mailto:seth.t.stutzman@jumpsimulation.org)

# AFTERNOON SESSIONS:

## RFP MATCHMAKING & 2-MINUTE PITCHES, POSTER PRESENTATIONS, & LIVE DEMONSTRATIONS

Please join the RFP Matchmaking & 2-Minute Pitch Session with this link: <https://illinois.zoom.us/j/84449943991?pwd=dGpCeDI3SmdPTEErV2oycjdiYWU1QT09>.

Copy and paste into your

Poster presentations and live demonstrations will be happening concurrently. Each poster session and live demonstration has a separate Zoom link. Feel free to drop in and out of poster sessions, live demonstrations, and the RFP Matchmaking session at your leisure.

Please visit: <https://healthengsymp.illinois.edu/poster-demo-session/>.

### POSTER PRESENTATIONS

*Pediatric Sepsis Guidance System*, Paul Jeziorczak, Maryam Rahmaniheris, Lui Sha

*Development of a Heart Failure Mobile App for Patient Engagement*, Scott Barrows

*Virtual Reality to Deliver Psychotherapy to Lung Cancer Patients with Depression*, Rosalba Hernandez

*Robotic Arm Training Simulator for Mimicking Rigidity*, Maxine He

*Mask Decontamination with a Plasma Generated in a Microwave Oven*, David Ruzic

*A Testing Facility to Measure the Size-Segregated Aerosol Filtration Efficiency of N95 Respirators*, Joseph Puthussery

*The Self-Tracking Kiosk*, Ramavarapu Sreenivas and Harris Nisar

*Virtual Reality Based Prelearning Module for Extracorporeal Membrane Oxygenation Procedures*, Harris Nisar

*The Promise of Digital Fall Risk Assessment and Prevention Tools for Rural Older Adults*, Chen Lingjun

*The Development of Measures of Handoff Quality Using Theories of Team Cognition*, Sondria Cottrell

*A Human Factors Approach to Food Security: Methodology and Study Design*, Abigail Wooldridge



# AFTERNOON SESSIONS:

## RFP MATCHMAKING & 2-MINUTE PITCHES, POSTER PRESENTATIONS, & LIVE DEMONSTRATIONS

*Negotiating time and space: Investigating the pediatric code cart augmented reality application, Widya Ramadhani*

*Surgical planning via preoperative surgical repair of next-generation 3D, patient-specific, cardiac mimic, Joanne Hwang*

*Skills Assessment in Surgery and Microsurgery, Hajar Sharif*

*Soft air cell bed mattress to address pressure relief, repositioning, and transfer, Mahshid Mansouri*

*Multivalent Simulation for Safe Use of Ventilator on Multiple Patients, Jarron Roy*

*Optimal Deployment of Pandemic Health Workers, a Model for Community Health Workers, Sarah Stewart de Ramirez*

*A single step 10-minute amplification free detection of COVID-19 using CRISPR based Activate Cleave & Count (ACC) technology, Shreya Ghosh*

*A Bayesian Hierarchical Model for Estimating True Prevalence from Apparent Prevalence, Xiaoqi Bi*

*Healthier Homes: Managing Pressure in the Home, Paul Francisco*

*A rapid and affordable virus test for early warning of a pandemic, Wen Ren*

*MedLang: Transforming Medical Informatics, William Cope*

*Automated Grading of Post Simulation Written Chart Notes, Razan Baltaji*

*3D Printed Tough Hydrogel-based Heart Mimics for Surgical Simulation, Hyunjoon Kong*

*Improving Outcomes and Training of Pectus Excavatum, Inki Kim*