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MC-NIST Colloquium

- Fall 2024

SCHEDULE OF PRESENTATIONS

WEDNESDAY, DECEMBER 11TH, 3:00 PM, ZOOM CONFERENCE

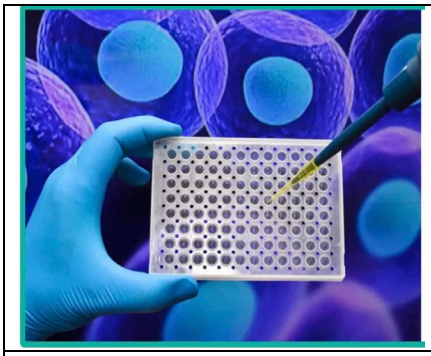
Link: https://montgomerycollege.zoom.us/j/93572720787

Time	Presenter and Topic
3:00	Joory Alasady How Viability Measurements Inform Understanding of Cell Health
3:20	Fatima Mbodji Champlain Towers South Collapse
3:40	Yusuf Mahmoud CAD Updates and File System Reorganization at NCNR

FRIDAY, DECEMBER 13TH, 2:00 PM, ZOOM CONFERENCE

Link: https://montgomerycollege.zoom.us/j/93803468984

Time	Presenter and Topic
2:00	Benjamin Viana Enhancing Accessibility and Impact: The Role of Visual Communication in Scientific Study
2:20	Hadassah Malena Sanders Developing Mammalian Cell Viability Analysis and Real-time 3D Monitoring in Tissue Scaffolds
2:40	Taian Chen Developing a Remotely Operated Camera for Internal Reactor Inspection



NIST-Montgomery College Virtual Student Colloquium

Fall 2024

Name: Joory Alasady

Academic Institution: Montgomery College | **Major: Biotechnology**

NIST Laboratory, Division, and Group: Biomaterials and Biosystems Division, Biomaterials Division

NIST Research Advisor: Laura Pierce MS, Sumona Sarkar, PhD

Title of Talk: How Viability Measurements Inform Understanding of Cell Health

Abstract:

Background*:* Cell Viability is a critical measurement for the release of cell therapy products. The properties of different cell types and the range of intended uses for cell counts within a biomanufacturing process can lead to challenges in identifying suitable counting methods for each potential application. Here, we test a variety of different cell viability measurement techniques and determine their correlation with cell outcome, using a Jurkat leukemia cell line**.**

Methods: Jurkat cells were seeded in 6 media types by changing serum levels and glucose levels (10% FBS with GLC, 2% FBS with GLC, 0% FBS with GLC, 10%FBS with 0% GLC, 2% FBS with 0% GLC, 0% FBS with 0%GLC). Under these conditions, we tracked cell viability and proliferation (NucleoCounter NC-3000), metabolite production and consumption (glucose, lactate, and LDH) (Cedex Bioanalyzer), laser force cytology measurements (LumaCyte Radiance) and apoptosis (Annexin V assay, NucleoCounter NC-3000) over 72h.

Results: After collecting and combining Jurkat cell data:

Cell concentration:

- 10% FBS with glucose condition resulted in two population doublings over 72h.
- 10% FBS with no glucose condition doubled once in 72h.
- 2% FBS with glucose nearly doubled in 72h (similar to the 10% FBS with no glucose)
- 0% FBS with no glucose did not proliferate at all.

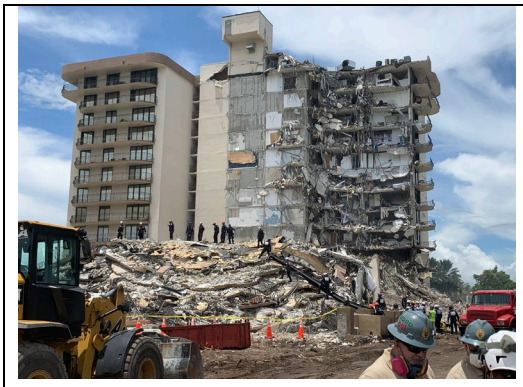
Cell viability

- 10% FBS with glucose condition was almost constant over 72h.
- 10% FBS with no glucose condition start slightly decreasing after 48 h.
- 2% FBS with glucose, the viability starts to decline after 24 h.
- 2% FBS with no glucose starts to decline after 24 h.
- 0% FBS with glucose slightly declined after 24 h, but more decline happened after 48h.
- 0% with no glucose had a significant decline after 24 h, and it reached to almost 20% after 72h.
- We will continue to evaluate the Radiance data to look for population changes based on laser force cytometry measurements.

- Cedex: GLC drops fastest in the **10% FBS with glucose condition** due to the population is doubling the fastest so the cells are taking up more nutrients, faster:
    - This population depletes all its glucose in the first 48 h and achieves maximum lactate levels at 48h.
- LDH spikes when the cells start to die so, at 48h the cells are starting to die for the 2% FBS GLC condition; at 72h the 10% FBS GLC cells start to die.

Conclusion: Different viability analysis methods can provide different insights into cell health based on their condition and Radiance data may enable population modeling and prediction of condition.

FBS: Fetal Bovine Serum
LDH: Lactate Dehydrogenate Enzyme
GLC: Glucose



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Name: Fatima Mbodji

Academic Institution: Montgomery College | **Major:** Computer Science

NIST Laboratory, Division, and Group: Engineering Laboratory, Intelligence and Systems Division, Sensing and Perception Group

NIST Research Advisor: Ms. Ann Virts

Title of Talk: Champlain Towers South Collapse

Abstract:

Champlain Towers South was a 12-floor condominium in Surfside, Florida, that partially collapsed on June 24, 2021. The collapse was sudden and unforeseen, resulting in the tragic loss of 98 lives. On June 30, 2021, NIST initiated a technical investigation of the collapse under the authority of the National Construction Safety Team (NCST). The investigation aims to determine the technical cause of the collapse and recommend changes to building standards and enhance structural safety.

During the search and rescue process, a significant amount of data was gathered, including lidar scans, pictures, videos, and satellite imagery. This project focuses on the Remote Sensing and Data Visualization aspects, which aims to identify efficient ways to analyze and tag the collected data using specific software, to extract valuable information that experts can use in their analysis. Additionally, the project involves responding to requests for core samples and structural elements from the collapse. By analyzing that information, investigators can obtain valuable insights to better understand the cause of the building's collapse.

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Name: Yusuf Mahmoud

Academic Institution: Montgomery College | **Major:** General Engineering

NIST Laboratory, Division, and Group: National Center for Neutron Research, Reactor Operations and Engineering, 610

NIST Research Advisor: Andrew Main

Title of Talk: CAD Updates and File System Reorganization at NCNR

Abstract:

At NIST's National Center for Neutron Research (NCNR), I support the Reactor Operations and Engineering (ROE) team by updating and maintaining 2D CAD drawings relative to the Engineering Change Notice (ECN) process. Engineers submit ECNs with drawing markups, which I then incorporate into the drawings using AutoCAD, ensuring the NCNR drawing file system reflects accurate architectural, electrical, and mechanical modifications. Collaboration with engineers involves iterative back-and-forth on ECN markups, as well as site walk-downs and field checks to finalize updates effectively. Collaboration not only honed my interpersonal communication skills but also helped build familiarity with the reactor system. Currently, I am leading a project to reorganize the electrical drawings within the NCNR drawing file system. This involves filtering, categorizing, and creating a unique identifier for each drawing. This process is designed to serve as a standard for other teams to optimize their respective drawing organization. The final stages will involve physical checks through walk-downs to ensure all system drawings are updated and relevant to the current operation of the reactor. This component of the project is critical to the safety and wellbeing of the reactor's operation particularly due to the facility's old age. Since NCNR's February 3, 2021, incident where an unlatched fuel element resulted in a multi-year cease in operation of the reactor, much emphasis has been placed on ensuring an exceptional safety culture. As a result, maintaining an actively updated and accurate drawing system would significantly mitigate potential risks involved in the reactor's use; firstly, an updated drawing system would prevent misunderstandings over discontinued components of the reactor, as well as allow engineers to make critical updates more efficiently by reducing the time needed to locate drawings. Finally, I am on track to draft and submit my own ECN, further contributing to the operational and engineering process at NCNR.

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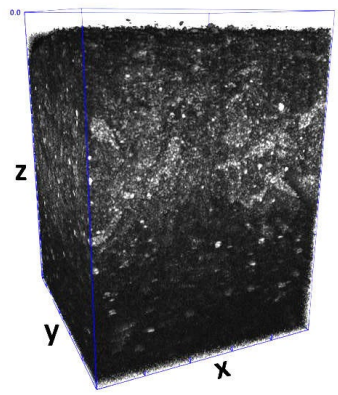
Name: Benjamin Viana	
Academic Institution: Montgomery College	**Major:** Graphic Design
NIST Laboratory, Division, and Group:	Public Affairs
NIST Research Advisor:	Natasha Hanacek & Brandon Hayes
Title of Talk:	Enhancing Accessibility and Impact: The Role of Visual Communication in Scientific Study

Abstract:

The following abstract identifies the ways in which design and visual communication serve as a crucial part to scientific study in their capabilities for making complex research approachable, engaging, and influential. Good data visualization lets researchers and officials, along with the public, interpret findings more effectively. Infographics transform scientific discoveries into easily understandable information for all kinds of audiences. For conferences and events, clear and striking presentations are essential as visual elements leave a visible mark and allow the clear communication of big ideas. Animations and illustrations, especially in biology and chemistry, help in the vivid depiction of a process, otherwise unfamiliar or difficult to visualize. Additionally, inclusive and accessible design practices ensure scientific information reaches all demographics and audiences with disabilities. Scientific organizations can build trust in the public through clear and effective design, resulting in a wider influence and outreach. By integrating all these approaches to visual communication, scientific discovery becomes more accessible, memorable, and impactful to audiences of many cultures.



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Name: Hadassah Malena Sanders

Academic Institution: Montgomery College | **Major:** Biological Science

NIST Laboratory, Division, and Group: Material Measurement Laboratory, Biosystems and Biomaterials Division, Biomaterials Group

NIST Research Advisor: Greta Babakhanova

Title of Talk: Developing Mammalian Cell Viability Analysis and Real-time 3D Monitoring in Tissue Scaffolds

Abstract:

Accurately assessing cell viability is a critical step in the development of tissue-engineered medical products (TEMPs) for regenerative medicine. Current methods, which often rely on destructive or invasive 2D techniques, fail to account for the complexity of 3D tissue structures. This project focuses on developing non-invasive, label-free methods to measure cell viability using Optical Coherence Tomography (OCT) and Digital Holographic Microscopy (DHM). These advanced imaging techniques offer the potential for real-time monitoring of cell health without compromising sample integrity.

As part of this work, I encapsulated two types of cells—Jurkat (suspension) and HEK293 (adherent)—within various biomaterials to create controlled test systems. These systems included live cells, heat-shocked dead cells, fixed dead cells, and gels without cells. I utilized OCT to detect time-dependent changes in the refractive index caused by intracellular movements, which are absent in dead cells. DHM also allowed continuous imaging of cells within their preferred environment to quantify viability and distribution.

This project contributes to the development of non-destructive, label-free, real-time techniques for assessing cell viability in 3D constructs, a critical need for biofabrication. Future work will incorporate bioprinting to extend these methodologies, ultimately supporting the standardization and clinical translation of TEMPs.

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Name: Taian Chen

Academic Institution: Montgomery College | **Major:** General Engineering

NIST Laboratory, Division, and Group: NIST Center for Neutron Research, Reactor Operations and Engineering

NIST Research Advisor: David Hix

Title of Talk: Developing a Remotely Operated Camera for Internal Reactor Inspection

Abstract:

The National Bureau of Standards Reactor (NBSR) is a tank-type research reactor at the NIST Center for Neutron Research. The reactor, based on the Argonne CP-5 design, has operated since 1969 and currently serves as the facility's neutron source. It uses fuel elements that are designed to be inserted into a grid array of slots inside the reactor. The elements are then secured in place using a latching mechanism.

On February 3rd, 2021, upon attempting to restart the NBSR after routine refueling and maintenance, an incident occurred that led to damage of one of 30 fuel assemblies. Subsequent investigation revealed that the affected assembly was not properly secured inside the reactor, and upon shifting, cut off the flow of coolant, resulting in partial melting of the assembly. As part of recovery and corrective efforts following February 3rd, it was proposed that a new inspection tool should be designed, for visually verifying the proper insertion and latching of fuel assemblies inside the reactor, in order to prevent a similar incident from occurring again in the future.

A prototype version of this device was rapidly designed and commissioned to allow restart of the reactor. However, usage has generated feedback regarding potential improvements to the design. A project was initiated to explore these Improvements.

This project includes the design of a watertight housing that is compatible with the existing fuel management infrastructure inside the reactor, custom electronics for handling power management, illumination, and wireless communications, and software systems for negotiating client-server control and managing internal hardware. Due to the non-trivial environment that the inspection tool is required to operate in, there are several points of discussion regarding pressure and thermal safety, and software architecture techniques that support resilience against technical faults and defects within software systems.