57th Annual

Southeastern Michigan Regional

Junior Science and Humanities Symposium

Program
2021

WAYNE STATE UNIVERSITY

Virtual via *Zoom* platform

February 26, 2021

57th Annual

SOUTHEASTERN MICHIGAN REGIONAL

JUNIOR SCIENCE AND HUMANITIES SYMPOSIUM

Friday, February 26th, 2021

SPONSORED BY

WAYNE STATE UNIVERSITY
College of Education

IN COOPERATION WITH

U.S. Army Research Office - Research Triangle, NC

U.S. Naval Research Office

U. S. Air Force Research Office

U.S. Army Development Command (DEVCOM)
Ground Vehicle Systems Center (GVSC)
Warren, MI

National Science Teachers Association, Arlington, VA

National Association of Secondary School Principals

Share on Social Media throughout the day
#JSHSRegionals #JSHSNationals #JSHS
@NtlJSHS @NationalJSHS

OBJECTIVES OF THE JUNIOR SCIENCE AND HUMANITIES SYMPOSIUM PROGRAM

1. *To promote research and experimentation in the sciences, mathematics and engineering at the high school level.*

2. *To recognize the significance of research in human affairs and the importance of humane and ethical principles in the applications of research results.*

3. *To search out talented youth and talented teachers; recognize their accomplishments at symposia and encourage their continued interest and participation in the sciences, mathematics, and engineering.*

4. *To expand the horizons of research-oriented students by exposing them to opportunities in the academic, industrial, and governmental communities.*

5. *To increase the number of future adults capable of conducting research and development.*

In order to accomplish these objectives, we enlist the active participation of our local communities in improving the education of our children.

PUBLISHING OPPORTUNITY

Students who submitted a paper for presentation at this year's JSHS are encouraged to submit their paper for publication in JOURNEYS – *Journal of Youths in Science.* Students planning to submit their paper for publication should first consult with their research mentor(s) and anyone else who collaborated in their research.

Before submitting a paper for publication in JOURNEYS students should check the journal's website at http://www.journys.org/ and closely follow the instructions under "Submission."

ADMINISTRATION OF JSHS

Dr. Sandra Yarema, Regional Director and Coordinator of JSHS
Assistant Professor, Clinical,
Director of Undergraduate Studies & Teacher Certification Programs
College of Education, Wayne State University

JSHS 2021 ADVISORY BOARD

Dr. Matthew Allen
Chemistry, Chair
College of Liberal Arts & Sciences
Wayne State University

Mr. Gregory Chappelle
Michigan DoD STEM Coordinator &
HBCU/MI Liaison Officer,
U.S. Army DEVCOM-GVSC

Dr. Christine Chow
Professor, Chemistry
College of Liberal Arts and Sciences
Wayne State University

Dr. Jeff Conn
Senior Lecturer, Physics
Wayne State University

Dr. Russell L. Finley
Professor,
Center for Molecular Medicine & Genetics
Wayne State University

Ms. Kristie Ford
Detroit Public Schools Community District
Director of Science Curriculum

Dr. Sandra Gonzales
Associate Professor,
College of Education
Wayne State University

Dr. Patricia Hanlan
Detroit Country Day Schools

Mr. Scott Hanson
Battle Creek Area Math & Science Center

Dr. Peter Hoffman
Associate Chair, Physics
College of Liberal Arts & Sciences
Wayne State University

Dr. James Holly, Jr.
Assistant Professor, College of Education
Wayne State University

Dr. Truman Hudson, Jr.,
College of Education & School of Medicine
Wayne State University

Dr. Padu Karur
Associate Professor, Physics
Wayne State University

Dr. Daniel Kashian
Assistant Professor, Biological Sciences
Wayne State University

Dr. Tonya Matthews
Associate Provost for Workforce Development,
Vice President of Academic Affairs,
Wayne State University

Dr. Megan McCullen
Director, Gordon L.Grosscup Museum of
Anthropology & Planetarium
Wayne State University

Ms. Jasmine Roberson
College of Engineering
Wayne State University

Dr. Kate Roberts
Interim Assistant Dean, Teacher Education
College of Education
Wayne State University

Mr. Brandon Schroeder
Michigan Sea Grant Extension Educator
Michigan State University

Ms. Maria Ventimiglia
C_2STEM Pipeline
Wayne State University

Ms. Kendra Welling-Riley
Detroit Public Schools Community District
Secondary Science Curriculum Specialist

Dr. Jennell White
School of Medicine
Wayne State University

Welcome

from the JSHS Director

Dear Students, Teachers, Parents and Colleagues,

It is my great privilege to welcome you to the 57th annual Junior Science and Humanities Symposium (JSHS) of Southeast Michigan. Once again we have a group of very talented young men and women from schools throughout Michigan's lower peninsula, who will share their research with us. I'd like to thank the teachers and mentors for the guidance they provided students throughout the research process and their parents for the support that such activities entail.

An event such as this one cannot be accomplished by one person alone and I would like to express my gratitude to those who help make this event possible each year: the members of the Advisory Board, judges, speakers and the administration of the College of Education at Wayne State University. Special thanks to Ms. Marion Tate for her help in the planning and running of the symposium and to Ms. April Hines-Jenkins for assistance with the Zoom platform, and a special mention of the JSHS partnerships with the COE Upward Bound Program, and the Michigan Sea Grant Extension. We are extremely grateful for the continued support of volunteers from the U.S. Army Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC).

I would like to take this opportunity to give you a short overview of the history of the JSHS, for those who might not be familiar with this wonderful program. The JSHS was established in 1958 by the U. S. Army Research Office. The Office of Naval Research joined the army in funding of the symposium in 1995, followed by the U. S. Air Force in 1997. The Academy of Applied Sciences administered all facets of the program in coordination with the AEOP through 2017, when the National Science Teaching Association assumed administration of all the funds and organizing for the National Symposium.

The primary aim of the JSHS is to promote research among high school students. Every year, more than 10,000 students and their teachers participate in forty-nine regional symposia held on university campuses across the country and in Puerto Rico and the Department of Defense schools in Europe and the Pacific. Students presenting at the regional symposia have the opportunity to receive significant awards in the form of scholarships, payable to the University of their Choice. The first, second and third student finalists at each of the regional symposium receive $2000, $1500, and $1000 respectively, and all five finalists are invited to attend the National JSHS. The finalists at each regional symposium present their research once again at the National JSHS where they have the opportunity to receive additional awards. The three finalists in each of the categories at the National JSHS receive $12,000.00, $8,000.00 and $4,000.00 respectively in scholarships. For additional information about the JSHS please visit: **www.go.wayne.edu/jsh-symposium** and **www.jshs.org**

Thank you for participating in this year's symposium. I hope your experience is memorable.

Dr. Sandra Yarema, Regional Director, SE MI JSHS

Welcome from the Associate Provost

Dr. Tonya Matthews

Associate Provost for Work Force Development
Vice-President of Academic Affairs
Wayne State University

Tonya M. Matthews, Ph.D. is Associate Provost for Inclusive Workforce Development and Director of the STEM Learning Innovation Center at Wayne State University (WSU). In this role, Dr. Matthews is part of the WSU leadership team setting a vision to address the challenge of an inclusive STEM student success pipeline and pathway from "pre K-to-Gray." Matthews is responsible for implementing the vision of the STEM Innovation Learning Center as an interdisciplinary learning center for WSU students and as a hub for WSU K-12 outreach.

Prior to joining the WSU community, Matthews served as President and CEO of the Michigan Science Center (MiSci), leading its journey to reclaim Detroit's science center legacy and become a STEM Hub for the state of Michigan. Previously, Matthews has served as Vice President of Museums for Cincinnati Museum Center and as Lead Biomedical Engineer for U.S. FDA Center for Devices and Radiological Health.

Dr. Matthews received her Ph.D. in biomedical engineering from Johns Hopkins University and her B.S.E. in biomedical and electrical engineering from Duke University. Matthews is a member of the National Academy of Sciences Board on Science Education and was recently appointed the Michigan STEM Advisory Council by Governor Gretchen Whitmer. Also, she was appointed under both Democratic and Republican administrations to serve on the National Assessment Governing Board, stewarding the Nation's Report Cards on Math, Reading, and Science.

Dr. Matthews is also a poet, an active mentor, and a community volunteer. She refers to herself as "Detroit on Purpose" and currently lives on the lower east side where she can keep an eye on progress.

Dr. Matthews will provide the opening remarks at the symposium.

Where is She Now?

Astha Dalal
Past JSHS Finalist
2017, 2018, 2019

Astha Dalal is currently a freshman at Michigan State University (MSU), earning her Bachelor's in Science in Neuroscience with a minor in Dance. She has been working as a research assistant at the Henry Ford Health Systems for the past 5 years with Dr. Stephen L Brown. In college she plans on continuing her research pursuit.

Due to the pandemic, the extra-curriculars offered by MSU have been limited; but in high school Astha participated in a wide range of clubs. She competed in science-oriented clubs like HOSA (Health Occupations of Students of America) and also performed and choreographed in clubs like IASA (Indian American Student Association). She has also founded a neuroscience orientated club at her high school known as International Youth Neuroscience Association (IYNA).

Astha has been able to showcase her research experiences and presentation skills at numerous science fairs including the Science and Engineering Fair of Metro Detroit (SEFMD), the Annual Michigan Association for Physicians of India (MAPI) Fair, and of course, JSHS. Astha placed as a finalist in the regional JSHS in 9th, 10, and 11th grades (2017, 2018, & 2019), and had the opportunity to participate in the National JSHS each of those years. Astha was awarded Third Place in the Medicine and Health Category, at National JSHS in 2019.

Astha is now aspiring to a career in Medicine and she hopes that her efforts right now will eventually give her the chance to save someone's life.

Philip E. Pellett, Ph.D.,

Professor and Chair

Department of Biochemistry, Microbiology & Immunology

Wayne State University School of Medicine

https://biochemmicroimmuno.med.wayne.edu/

Dr. Phil Pellett teaches virology and does research on human herpesviruses, of which there are nine. These viruses cause serious diseases, including shingles and encephalitis, plus debilitating damage in newborns. His studies have ranged from learning about the nuts-and-bolts molecular and cellular biology of the viruses, to studies of their roles in human disease, their evolution and migration around the globe, and methods for their prevention and treatment.

Phil was born and raised in Dayton, Ohio. His interest in science started early, triggered in part by evenings gazing at the sky, looking for Sputnik, the first artificial satellite. An affinity for chemistry led to building a laboratory in the basement while in junior high school. In 1980, he earned his Bachelor of Science in Chemistry through the Honors Tutorial College of Ohio University in Athens, Ohio. For his Ph.D., he studied herpesvirus molecular biology at the University of Chicago, and in 1986 joined the US Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia as the Herpesvirus Section Chief. While at CDC, Dr. Pellett's team made fundamental contributions to our understanding of the biology and molecular biology of what were then newly discovered viruses: human herpesviruses 6A, 6B, and 7, and Kaposi sarcoma herpesvirus.

Dr. Pellett left CDC to focus on studies of human cytomegalovirus, a herpesvirus that causes disease in organ transplant recipients and can be transmitted across the placenta to infect the fetus during gestation. These congenital infections cause deafness and a range of serious developmental disabilities. The Pellett lab has been studying how the virus induces changes in the environment inside of infected cells to create factories in which new virus particles can be assembled efficiently. The process has many similarities to the manner in which automobiles are assembled: a factory must be designed and built, assembly line components and instructions are needed, energy and raw materials must be obtained, and a system is needed to enable transport of the new vehicles to destinations outside the factory.

Phil lives on Grosse Ile with his wife of 42 years and their cats and dog. Their daughters are nurses and their son is a brewer. Phil enjoys hiking, skiing, woodworking, and playing guitar, including performing as a member of the Herpetic Legion, a band of virologists who perform for enthusiastic audiences at international virology conferences, and hope to reactivate after the COVID pandemic wanes.

Dr. Pellett's talk, "***Finding My Path***," will recognize teachers who were instrumental in his development, and describe the path he has followed while living as a scientist and exploring the international world of virology.

Campus Tour

The STEM Innovation Learning Center

Regional JSHS participants will have access to a virtual tour of Wayne State University's new STEM Innovation Learning Center; its completion was celebrated October 1, 2020.

The building will serve as a campus hub for multidisciplinary and interdisciplinary teaching and learning innovation, and it features 100,000 square feet of flexible classrooms, seminar spaces and instructional labs that include state-of-the-art technology to support hands-on and project-based learning. To enhance the sparks of creativity and collaboration that the STEM Innovation Learning Center seeks to support, the building also includes a maker space, a hacker space with virtual and augmented reality capabilities, and a 3D printing lab.

For the time being, the building is accessible by reservation only for essential student support services, in keeping with the university's guidelines for campus health and safety during the coronavirus pandemic. In the future, the STEM Innovation Learning Center will provide undergraduate instructional laboratories, classrooms and dedicated student collaboration zones for STEM and STEM-collaborative courses across the 10 Wayne State schools and colleges that support undergraduate education. Additionally, the building will support faculty and graduate students as a unique, inspiring space for seminars, teaching and research presentations.

While the facility's primary purpose is to serve WSU students and faculty, it will also serve as a new hub for Wayne K-12 programming, supporting students from the greater Detroit area with experiences in and exposure to hands-on, creative learning situations that ignite their interest in science and technology. Currently, WSU's STEM programs take place in a number of venues across campus. **https://stem-innovation.wayne.edu/**

(Link to YouTube Virtual Tour: https://youtu.be/Rx-TK-ADjoo)

Undergraduate Research at Wayne State University

The Office of Undergraduate Research – Undergraduate Research Opportunities Program (UROP) at Wayne State University provides funds to undergraduate students from disciplines across the university – hard sciences, social sciences, performing arts and humanities – to participate in undergraduate research. Undergraduate research puts theory into practice as students work on projects and are mentored by full-time faculty who are leaders in their field. The funds help cover students' research activities as well as travel expenses to present their research at local, regional and national conferences.

https://urop.wayne.edu/

PROGRAM

Friday, February 26, 2021

8:30 a.m. - 9:00 a.m. **CHECK-IN, CONFIRMATION & *ZOOM* LOG-IN**

Join *Zoom* Meeting
https://us02web.zoom.us/j/89760298443?pwd=b0s1Sjl2cTAzaGdZYUgvUlJQaThwdz09

Meeting ID: 897 6029 8443
Passcode: 803553

9:00 a.m. - 10:00 a.m. **OPENING SESSION**
Zoom Live General Session

PRESIDING:

Dr. Sandra Yarema Director - JSHS
Director Undergraduate Studies & Teacher Certification Programs
College of Education
Wayne State University

WELCOME/OVERVIEW OF WAYNE STATE UNIVERSITY:

Dr. Tonya Matthews
Associate Provost for Work Force Development,
Vice-President of Academic Affairs, Wayne State University

ORIENTATION:

Dr. Sandra Yarema
JSHS Director and Coordinator

10:00 a.m. - 11:45 a.m. **PRESENTATION OF STUDENT PAPERS**
Zoom Breakout Rooms- Assigned by Category

VIRTUAL CAMPUS TOUR

Including STEM Innovation Center
(Link to YouTube Virtual Tour: https://youtu.be/Rx-TK-ADjoo)
For more information: https://stem-innovation.wayne.edu/

STUDENT PRESENTATIONS

BREAKOUT ROOM I: Environmental, Life Sciences & Chemistry

MODERATOR: **Justin Selden,** Michigan Sea Grant Extension

STUDENT PRESENTERS:

Veda Mantena
Comparative Assessment of Antimicrobial Efficacy of Different Hand Sanitizers

Jasmine Wu
Modeling Michigan West Nile Virus Cases Amid Climate Change

JUDGES:

Tracy D'Augustino- Environmental Education**,** Michigan Sea Grant Extension
Vijay George, Environmental Engineering, U.S. Army DEVCOM- GVSC
Dr. Paul Munya, DoD Scientist, U.S. Army DEVCOM-GVSC
Catherine Riseng, Environmental Education, Michigan Sea Grant Extension
Brandon Schroeder, Environmental Education, Michigan Sea Grant Extension

STUDENT PRESENTATIONS

BREAKOUT ROOM II: Biomedical Science

MODERATOR: **Dr. Jennell White,** School of Medicine, Wayne State University

STUDENT PRESENTERS:

Noah Black
Naive Bayes Artificial Intelligence Diagnostic Tool for Lung Nodule Cancer Detection

Tanmai Nimmagadda
Determining whether stressors force changes in COVID19 and other viral receptors in embryonic stem cells and their progeny lineages

Shriya Reddy
A Novel, Noninvasive Approach to Melanoma Diagnosis Using Optical Coherence Tomography and Bioconjugated Gold Nanoparticles

Aryan Singh
Hyperglycemic conditions impair lung epithelial innate response to Klebsiella pneumoniae infection

JUDGES:

Mayuri Aivale, MPH, Henry Ford Health System, Wayne State University
Lt. Colonel (ret.) David Centeno Jr., Biology, U.S. Army DEVCOM -GVSC
Pedro Marrero, DoD Scientist, U.S. Army DEVCOM-GVSC

STUDENT PRESENTATIONS

BREAKOUT ROOM III: Medicine/Health & Behavioral Science

MODERATOR: **Dr. Russell Finley,** Professor, Center for Molecular Medicine & Genetics
Wayne State University

STUDENT PRESENTERS:

Christopher Adam
Deterioration of Mental Health During COVID-19 Pandemic

Keerthana Danasekaran
Comprehensive Analysis of ABCB5 as a Target for Colon Cancer Therapy

Brinkley Drews
What is the most significant consequence for small Michigan companies to switch production to hand sanitizer as a result of the 2020 Corona-virus pandemic

Yousef Emara
Comparison of Reinhard and Macenko Color Normalization Methods for Artificial Intelligence-Based Analysis of Whole Slide Images

Vivian Yee
A Novel Epidemiological Approach to Exploring the Implications of Social Determinants of Health on COVID-19 Spread: A Call to Action for Health Equity

JUDGES:

Ms. Kimberly Derryberry, Behavioral Psychology, U.S. Army DEVCOM-GVSC
Adrienne Jordan, MPH candidate, College of Education, Wayne State University
Mirza Ishrat Noor, MPH, College of Education, Wayne State University

STUDENT PRESENTATIONS

BREAKOUT ROOM IV: Engineering, Technology & Physical Science

MODERATOR: **Gregory Chappelle,** Physics Educator**,** DoD STEM Coordinator & HBCU/MI Liaison Officer, U.S. Army DEVCOM-GVSC

STUDENT PRESENTERS:

Jiawei Chen **
Research on a Basketball Shooting Device Based on Bionic Structure

Willie (Chen) Chiu **
Exploring theoretical uncertainties in the hydrodynamic description of relativistic heavy-ion collisions

Mikul Saravanan
Smart Robot to purify, humidify and disinfect the air

JUDGES:

Dr. Jack Chiu, Mechanical Engineer, U.S. Army DEVCOM-GVSC
Mr. Andrew Kosinski Robotics Engineer, U.S. Army DEVCOM-GVSC
Mr. Mohsen Dianat, Cybersecurity, U.S. Army DEVCOM-GVSC
Erisha Smith, Engineer, U.S. Army DEVCOM-GVSC

STUDENT PRESENTATIONS

BREAKOUT ROOM V: Mathematics & Computer Science

MODERATOR: **Jasmine Roberson**, College of Engineering, Wayne State University

STUDENT PRESENTERS:

Michelle Hua
Dilated Silhouette Convolutional Neural Network for Human Action Recognition

Lucas Longden
Infinite Sum of Arctangents

Avaneesh Prasad
Impact of Social Guidelines on the Spread of COVID-19 Using Machine Learning Models

Abhinav Reddy
Convolutional Neural Networks for Aircraft Identification

Mike Xiangyu Cai **
Predicting Function of Non-Coding DNA

Sonnet Xu
A Machine Learning Approach to Mortality Patients Prediction in Hemodialysis Patients

JUDGES:

Mr. David Brown, Computer Science, U.S. Army DEVCOM-GVSC
Mr. David Daniszewski, AI Machine learning, Electrical Engineer**,** U.S. Army DEVCOM-GVSC
Mr. Jon P. Noble, Engineering Technology**,** U.S. Army DEVCOM-GVSC
Dr. Denise Rizzo, Mechanical Engineer**,** U.S. Army DEVCOM-GVSC
Christopher Scott, Electrical Engineer, U.S. Army DEVCOM-GVSC

STUDENT PRESENTATIONS

POSTER SESSION (1:00 – 2:00 pm)

BREAKOUT ROOM Posters

MODERATOR: **Brandon Schroeder,** Environmental Educator, Michigan Sea Grant Extension, Michigan State University

STUDENT PRESENTERS:

Aanchal Jain
Upregulation of EMP2 and PID1 cell proliferation genes in Lung Cancer

Margaret Yang
Assembly Efficiency of Multi-scaffolded Enzyme Assemblies (mSEAs) on Yeast Cell Surface for Direct Conversion of Biomass to Ethanol

JUDGES:

Brad Brumm, DoD Scientist, U.S. Army DEVCOM-GVSC
Tracy D'Augustino, Environmental Educator, Michigan Sea Grant Extension, MSU
Dr. Thomas Meitzler, Engineer, U.S. Army DEVCOM –GVSC
Catherine Riseng, Environmental Educator, Michigan Sea Grant Extension, UMich
Justin Selden, Environmental Educator, Michigan Sea Grant Extension, MSU

11:45 a.m. – 1:00 p.m. **VIRTUAL LUNCHEON**
***Zoom* Live**

PRESIDING: **Dr. Sandra Yarema**
College of Education

SPEAKER: *JSHS ALMNI FINALIST*
Astha Dalal – *Where is She Now?*

TOPIC:
Astha Dalal, finalist at the 2017, 2018, & 2019 Regional JSHS, and 3rd Place Award at 2019 National JSHS will talk about her research experiences during high school and how her participation in the JSHS has impacted her college experience and future research interests.

ANNOUNCEMENT OF FINAL STUDENT PAPERS,

The regional finalists will advance to National JSHS,
held virtually April 15 – 17, 2021

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

VIRTUAL CAMPUS TOUR
Including STEM Innovation Center
(Link to YouTube Virtual Tour: https://youtu.be/Rx-TK-ADjoo)
For more information: https://stem-innovation.wayne.edu/

POSTER INTERVIEWS
BREAKOUT ROOM – Zoom Live

2:00 p.m. - 3:00 p.m. **KEYNOTE ADDRESS – (Zoom Live)**

KEYNOTE SPEAKER: **Dr. Philip E. Pellett, Ph.D.,**
Professor and Chair**,**
Department of Biochemistry, Microbiology & Immunology
Wayne State University School of Medicine

TOPIC:
Dr. Pellett will discuss "***Finding My Path***," to recognize teachers who were instrumental in his development, and describe the path he has followed while living as a scientist and exploring the international world of virology.

3:00 p.m. – 5:00 p.m. **FINAL JUDGING (*Zoom* Live)**
Determine National JSHS Finalist Ranking

Moderator: **Dr. Karur Padmanabhan,** Physics Department- Wayne State University

Judges: (Deliberation in Breakout Room after presentations)

Mr. Gregory Chappelle, U.S. Army DEVCOM-GVSC
Dr. James Holly, Jr., STEM Education, College of Education, WSU
Dr. Thomas Meitzler, Engineer, U.S. Army DEVCOM –GVSC
Brandon Schroeder, Biology/ Environmental Science- MI Sea Grant

5:00 – 5:30 p.m.

AWARDS: **Presentation of Student Speaker Finalist Awards and Regional Poster Prizes**
Dr. Sandra Yarema, Director

CONCLUSION- **57th Annual SE MI Regional JSHS**

Congratulations to the regional finalists who will advance to the National JSHS, held virtually April 15 – 17, 2021

All participants will receive Digital Badges to confirm participation and any awards earned as part of the Regional JSHS.

* What are digital badges? Digital badges take the place of medals or medallions. Student winners receive a digital badge issued from JSHS that officially recognizes their achievement. Students can display their digital badge through Facebook, Instagram, LinkedIn, and other social media platforms. What is unique about a digital badge is that they have meta-data to communicate details of the badge to anyone wishing to verify it, or learn more about the context of the achievement it signifies. Some or all of this information will be displayed in a visual format wherever the badge is displayed, but it is also stored within the digital badge's meta-data so it can be verified any time - even if you only have the image.

Student Participants – Evaluation Questionnaire Invitation

Dear JSHS participant,

Evaluators from North Carolina State University are conducting a study to learn about student experiences in Junior Science & Humanities Symposium (JSHS). We are asking you to fill out this survey because you participated in JSHS. Your feedback will be used to help us improve JSHS for students in the future and provide important information about your experiences. The sponsor of JSHS, the Army Educational Outreach Program (AEOP), is paying for this study. In 2021, more than 7000 students and 1000 adults will participate in JSHS and evaluators from Purdue University want to hear from you and your research mentor.

Here's how you can help:

1) *Complete the JSHS Regional Survey using the hyperlink below. Your parent or guardian has already provided permission for us to ask you to participate in the survey. Now, it is up to you to decide whether you want to participate or not. The survey takes 25-30 minutes to complete on average.*

JSHS Regional Student Survey Link:

https://www.cvent.com/d/mjqm05

JSHS Adult Participant/Mentor Survey Link:

https://www.cvent.com/d/njqm0t

If you have any questions about these surveys or your participation in the evaluation study please contact the AEOP Evaluation team at North Carolina State University – Dr. Carla C. Johnson – carlacjohnson@ncsu.edu

Thank you so much for your participation in the evaluation of JSHS!

STUDENT RESEARCH PAPERS PRESENTED

Name	School	City
Christopher Adam	BCAMSC	Battle Creek
Noah Black	Herbert Henry Dow High School	Midland
Jiawei Chen	Cranbrook Schools	West Bloomfield
Cheng (Willie) Chiu	Cranbrook Schools	West Bloomfield
Keerthana Danasekaran	Northville High School	Northville
Brinkley Drews	International Academy	Bloomfield Hills
Yousef Emara	Green Hills School	Ann Arbor
Michelle Hua	Cranbrook Schools	West Bloomfield
Lucas Longden	BCAMSC	Battle Creek
Veda Mantena	Detroit Country Day Schools	Beverly Hills
Tanmai Nimmagadda	Detroit Country Day Schools	Beverly Hills
Avaneesh Prasad	Cranbrook Schools	West Bloomfield
Abhinav Reddy	Detroit Country Day Schools	Beverly Hills
Shriya Reddy	Northville High School	Northville
Mikul Saravanan	Cranbrook Schools	West Bloomfield
Aryan Singh	Troy High School	Troy
Jasmine Wu	Troy High School	Troy
Mike Ziangyu-Cai	Cranbrook Schools	West Bloomfield
Sonnet Xu	Troy High School	Troy
Vivian Yee	International Academy	Bloomfield Hills

STUDENT POSTER PARTICIPANTS

Name	School	City
Aanchal Jain	Okemos High School	Okemos
Margaret Yang	Cranbrook Schools	West Bloomfield

TEACHER/SUPERVISOR/ADMINISTRATIVE PARTICIPANTS

Name	School	City
Ms. Laura Bell	Okemos High School	Okemos
Ms. Rebecca Brewer	Troy High School	Troy
Ms. Ana Calandrino	WSU Upward Bound	Detroit
Mr. Kelly DeLongo	Battle Creek Area Math & Science Center	Battle Creek
Mr. Troy Dostert	Cranbrook Schools	West Bloomfield
Dr. Patricia Hanlan	Detroit Country Day Schools	Beverly Hills
Mr. Scott Hanson	Battle Creek Area Math & Science Center	Battle Creek
Ms. Klaudia Janek	International Academy	Bloomfield Hills
Dr. Stephanie Kokoszka	Cranbrook Schools	Bloomfield Hills
Ms. Karin Nelson	Northville High School	Northville
Ms. Julie Smith	Green Hills School	Ann Arbor

Judges

Mayuri Aivale
MPH, Henry Ford Health Systems
Wayne State University

Mr. David Brown
Computer Scientist/Adjunct Professor
US Army DEVCOM GVSC
DoD Personnel

Mr. Brad Brumm
Scientist/Engineer
US Army DEVCOM GVSC
DoD Personnel

Lt. Colonel David Centeno Jr. (retired),
Biologist/Military Science
U.S. Army DEVCOM GVSC
DoD Personnel

Mr. Greg Chappelle
STEM Coordinator/STEM Educator/Physicist/Chemist/ Electrical Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Dr. Jack Chiu
Mechanical Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Mr. David Daniszewski
Computer Scientist/Adjunct Professor
U.S. Army DEVCOM GVSC
DoD Personnel

Ms. Tracy D'Augustino
Environmental Science Educator
Michigan Sea Grant Extension
Michigan State University

Ms. Kimberly Derryberry
Psychology/Public Affairs
U.S. Army DEVCOM GVSC
DoD Personnel

Mohsen Dianat
Cybersecurity/Technology
U.S. Army DEVCOM GVSC
DoD Personnel

Dr. Russell Finley
School of Medicine
Wayne State University

Mr. Vijay George
Mechanical Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Dr. James Holly, Jr.
Engineer/STEM Education
Wayne State University

Adrienne Jordan,
MPH candidate,
College of Education
Wayne State University

Mr. Andrew Kosinski
Mechanical Engineering/Robotics
U.S. Army DEVCOM GVSC
DoD Personnel

Mr. Pedro Marrero
Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Dr. Thomas Meitzler
Engineer, Physical Science
U.S. Army DEVCOM GVSC
DoD Personnel

Dr. Paul Munya
Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Mr. Jon P. Noble
Computer Science/Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Mirza Ishrat Noor
MPH, College of Education
Wayne State University

Dr. Karur Padmanabhan
Physics Department
Wayne State University

Ms. Catherine Riseng
Environmental Science Educator
Michigan Sea Grant Extension
University of Michigan

Dr. Denise Rizzo
Engineer
U.S. Army DEVCOM GVSC

Ms. Jasmine Roberson
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Electrical Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Mr. Justin Selden
Environmental Science Educator
Michigan Sea Grant Extension
Michigan State University

Ms. Elisha Smith
Engineer
U.S. Army DEVCOM GVSC
DoD Personnel

Dr. Jennell White
School of Medicine
Wayne State University

RESEARCH ABSTRACTS

Participant Name	Abstract
Christopher Adam	*Deterioration of Mental Health During COVID-19 Pandemic* This study analyzed the significance of the suicide rate for 2020, and whether the unemployment rate and Internet usage correlate with the suicide rate. The hypothesis is that 2020 has experienced a significantly higher suicide rate—leading to the deterioration of mental health—and the unemployment rate and Internet usage are correlated with this deterioration in mental health. A 1 Sample Z-Test for Population Mean and two Spearman Rank-Order Correlation Tests were conducted, and the data were analyzed to test the hypothesis. There were statistically significant results, leading to the rejection of the null hypothesis for all three tests at the 95% confidence level. At a 95% confidence level, the suicide rate was statistically significantly higher than previous suicide rates, while a direct, positive relationship was established between the unemployment rate and suicide rate as well as between Internet usage and the suicide rate. Although the results were statistically significant, experimental testing should be conducted to determine whether the unemployment rate and Internet usage cause a deterioration in mental health
Noah Black	*Naive Bayes Artificial Intelligence Diagnostic Tool for Lung Nodule Cancer Detection* Lung nodules pose a substantial risk to patients. Lung nodules are ovular masses of tissue that propagate in the lungs of many patients. It's key that malignant nodules are detected early because mortality rates rise dramatically with the size of the tumor. Typical diagnoses can take months to a year of repeated CT scans. Our research aims to curtail the time from recognition to diagnoses by using a cost-effective protein analysis of peripheral blood. By analyzing the blood protein expression levels of patients with malignant and benign lung nodules with a publicly accessible dataset on Gene Expression Omnibus, we created a Naive Bayes artificial intelligence (AI) capable of predicting the cancer status of patients with a lung nodule. The data was organized in R and Python. And, by using third party packages, we developed the AI in python. Ultimately, the AI had an efficacy of over 80%, which as a diagnostic tool categorizes it from "good" to "very good."
Jiawei Chen	*Research on a Basketball Shooting Device Based on Bionic Structure* With basketball becoming more and more popular around the world, people start to focus more attention on this sport. Shooting basketball into the basket is the only way to score in a game. However, because of variable aspects such as distance, speed, and angle involved, maintaining a high percentage of hits is extremely hard. Therefore, research on basketball shooting is needed to help people better understand what is the best condition to hit precisely. This paper devised a research on a basketball shooting device which is based on bionic structure of a human's arm. The device consists of three parts: a supporting base, a control module based on Arduino, and an arm structure powered by 3 pneumatic cylinders. The total height of the device reaches about 2.45 meters when the arm is folded. The experiment results show that the shooting device is capable of hitting either a free throw (about 3.225 meters from the basket) or a three-pointer successfully as it is improved, implying our research on bionic basketball shooting device to be effective.
Cheng (Willie) Chiu	*Exploring theoretical uncertainties in the hydrodynamic description of relativistic heavy-ion collisions* We explore theoretical uncertainties in the hydrodynamic description of relativistic heavy-ion collisions by examining the full non-linear causality conditions and quantifying the second-order transport coefficients' role. The causality conditions impose physical constraints on the maximum allowed values of inverse Reynold's numbers during the hydrodynamic evolution. For large Au+Au collisions, we find the variations of final observables are small with and without imposing the causality conditions, suggesting a robust extraction of the transport coefficients through model-to-data comparisons. However, sizable sensitivity is present in small p+Au collisions, which poses challenges to studying the small systems' collectivity.

Keerthana Danasekaran	*A Comprehensive Analysis of the ABCB5 Stem Cell Gene as a Target for Colon Cancer Therapy* The 5-year survival rate for Colorectal Cancer (CRC) is 63% and combined with its high incidence rate, it is the third leading cause of cancer-related deaths within the United States. Although CRC exhibits a 90% survival rate for patients with Stage I disease, the survival rate for patients with Stage IV disease is a mere 14%. Unfortunately, many people fail to get screened for CRC until they begin to experience late stage symptoms such as unintentional weight loss, frequent abdominal pain, and bloody stools. Current treatment options include surgery, chemotherapy, and radiation therapy, but ~90% of patients with metastatic colon cancer experience resistance to these forms of systemic therapy. It is clear that further research is desperately needed to improve overall survival rates for Colorectal Cancer. The overarching goal of this research project is to provide novel insight into CRC and identify newer ways to treat this disease. Utilizing the NCBI GSE71670 dataset, we found that ABCB5, a stem-cell inducing gene, mediates cancer progression by inhibiting apoptosis in CRC cell lines. According to the Human Protein Atlas, low ABCB5 expression significantly correlates to favorable overall survival compared to high ABCB5 expression. Through our analysis, we found several underrepresented genes within the literature, like XCL1, SERPINB4, WFDC6 and TNFSF4 that were significantly upregulated in ABCB5 positive CRC cells. This upregulation leads to increases in inflammatory processes and DNA damage repair via p53. We propose that targeting ABCB5 may serve as a possible therapeutic strategy for CRC and requires further preclinical investigation.
Brinkley Drews	*What is the most significant consequence for small Michigan companies to switch production to hand sanitizer as a result of the 2020 Corona-virus pandemic?* When the Coronavirus started to spread in the US and restrictions were created in March 2020 to August 2020, it affected many aspects of life. One effect was the increased demand and need for many products, and companies worked to fill that demand. There was a large increase in demand for personal protective equipment (PPE), ventilators, hand sanitizer, etc. This research will investigate the question, what is the most significant consequence for small Michigan companies to switch production to hand sanitizer as a result of the 2020 Corona-virus pandemic? This topic is worthy of investigation because it is important to understand why a company would switch production and the consequences of a switch in production during a pandemic, as well as how different industries respond to a pandemic. On Thursday, March 12th I went to school like any other day, having no thought that it would be my last normal day of high school. Living in Michigan, I experienced all the restrictions and effects of the Coronavirus specifically in Michigan. On March 23rd, Michigan went under a stay-at-home order lasting until mid-May. During this time, all restaurants and bars were closed and could only do carryout. From there, there were still very strict restrictions on bars and restaurants and there still are. Living through this historic event made me want my question to be related to the pandemic. This question is interesting to me personally because my dad is a firefighter/ Paramedic, so he has been on the front lines during this pandemic. He has not run out of PPE nor hand sanitizer due to companies stepping up to produce these necessary products. This research question stemmed from him telling me about how they have been receiving hand sanitizer in spirit bottles from distilleries

Yousef Emara	*Comparison of Reinhard and Macenko Color Normalization Methods for Artificial Intelligence Based Analysis of Whole Slide* Pathologists thoroughly scan tissue slides containing millions of cells to identify areas of abnormality within a short time frame. This increases the risk that cancerous cells are undetected, affecting patient survival rates. The bioinformatics team at the University of Michigan is using artificial intelligence to aid pathologists in the diagnostic process. These programs, known as Clinical Decision Support Systems, review patient histology slides and identify areas requiring further examination by a pathologist, improving efficiency and accuracy. Before analysis, tissue samples are stained to distinguish cellular tissues and structures and then converted into digital images known as Whole Slide Images. For whole slide images to be analyzed by Clinical Decision Support Systems they are corrected for color variations resulting from tissue staining and preparation through a process called normalization. This research used Python code to compare the effect of two prevalent color normalization methods, Reinhard and Macenko, on a set of whole slide images from The Cancer Genome Atlas Melanoma Dataset. For whole slide images with significant whitespace, Macenko normalization produces more accurate results than Reinhard normalization. Reinhard normalization is more accurate for contrast; the nuclei appear more distinct. This research is a new contribution utilizing The Cancer Genome Atlas Melanoma Dataset and is an important step towards appropriate selection of color normalization methods within a standardized system.
Michelle Hua	*Dilated Silhouette Convolutional Neural Network for Human Action Recognition* With a wide range of applications in artificial intelligence, human action recognition is one of the most attractive yet challenging research fields. Action recognition has the potential to foster natural human-computer interaction, increase public safety, aid in physical therapy, conduct sport analysis, etc. Human action is a spatio-temporal sequence with strong inter-dependencies between the spatial geometry and temporal dynamics of motion. Many artificial intelligence-based methods have been proposed for human action recognition; however, in existing literature, there is a lack of synergy in investigating spatial geometry and temporal dynamics in a joint representation and embedding space. In this paper, we propose a novel dilated Silhouette Convolutional Neural Network (SCNN) for the action recognition from a monocular video. We model the spatial geometric information of the moving human subject using silhouette boundary curves extracted from each frame of the video. The silhouette curves are stacked to form a 3D curve volume with the time axis and resampled to a 3D point cloud as a unified spatio-temporal representation of the video action. With the dilated silhouette convolution, the SCNN is able to learn co-occurrence features from low-level geometric shape boundaries and their temporal dynamics jointly and construct a unified convolutional embedding space, where the spatial and temporal properties are integrated effectively. The geometry-based SCNN significantly improves the discrimination of learned features from shape motions. The experiment results on the JHMDB, HMDB, and UCF101 datasets demonstrate the effectiveness and superiority of our proposed representation and modeling method, outperforming all other state-of-the-art methods.
Lucas Longden	*An Infinite Sum of Arctangents Equal To π/2* This paper explores the creation of an infinite summation for , based on a geometric 2 π shape of a right triangle inscribed within a rectangle. The infinite series builds on a developed formula for the sum of three arctangents equal to using an approach inspired by Hiyashi 2 π (2003). Geogebra.org and Desmos.com were used to study the pattern of the side lengths of the geometric figure. Additionally, a reverse telescoping approach, through the tan (a) an ( ) identity, was used. Both assisted in concluding that −1 + t −1 a 1 = 2 π ∑ rctan( ) can be generated by the shape and repeated replacement in the telescoping ∞ c=0 a 1 c +c+1 2 = 2 π sum. The identity occurred through repeated addition of the bottom right arctangent of the geometric shape, as the shape grows according to its relationship with the scaling factor c. Research can be continued by generalizing the geometric figure used and the sum of three arctangents for . This allows the reverse telescoping method to be implemented on the top left 2 π arctangent, or the use of different starting values for the side-lengths, to create many different identities of π relating to this shape.

Veda Mantena	*Comparative Assessment of Antimicrobial Efficacy of Different Hand Sanitizers* Good hand hygiene is extremely important as hands get contaminated easily from contact with microorganisms from coughs and sneezes and by touching various surfaces. Practicing proper hand sanitization plays a crucial role in interrupting transmission chain of the virus (or) bacteria especially in situations like a global pandemic outbreak. The ongoing COVID-19 pandemic has brought out many hand sanitizers with varying smells and efficacy. The success of the hand sanitization depends on the use of effective sanitizing agents in the formulation of the compound. The project's purpose is to study the efficacy of a variety of alcohol-based and nonalcohol-based hand sanitizers in the fight against microorganisms.
Tanmai Nimmagadda	*Determining whether stressors force changes in COVID19 and other viral receptors in embryonic stem cells and their progeny lineages* Embryonic stem cells (ESC) make all cell types in vivo during embryonic development and can be cultured and make all cell types in development. During normal culture, differentiated cell types arise in temporal sequence, but past data suggests that stress added to normal stemness culture changes the sequence and magnitude of differentiated tissues arising from ESC. The experiment previously done by Dr. Daniel Rappolee from Wayne State University included culturing ESC and exposing them to three stimulus variables: Normal Stemness, Normal Differentiation, and Stress Forced Differentiation. After 72hr exposures, cells are lysed, mRNA reverse transcribed and amplified and then each gene in the genome is sequenced to test for the transcriptomic outcomes for expression of the stemness/differentiation status, proliferative and metabolic status, and the general cellular host cell resistance, or susceptibility viral receptor genes, and other genes necessary for the virus uptake in the cell. I hypothesize through the data given to me by Dr. Rappolee that stress-forced changes in ESC stemness and differentiation balance will change general host cell viral resistance and specific expression of viral receptor and uptake gene expression and enhance or change tissue-specific viral susceptibility. Through the use of Microsoft Excel and multiple program analyses, the goal of the experiment is to test whether environmental stresses decrease the general viral resistance and increase expression of genes that mediate viral uptake and calculate the statistical significance of said genes.
Avaneesh Prasad	*Impact of Social Guidelines on the Spread of COVID-19 Using Machine Learning Models* COVID-19 (SARS-CoV-2) has run rampant for months across the world. Several solutions have been attempted to slow down the pandemic, including lockdowns, social distancing restrictions, and school shutdowns. More effective ways of reducing COVID-19 cases can be determined if one can visually examine how effective these measures are. Machine learning models can be used to analyze COVID-19 data along with social measures to predict future cases. This case study has been narrowed to the State of Michigan. I compiled data from the COVID Tracking Project, which gives data of the total number of cases, mobility data, and population density data. I used Linear Regression and Support Vector Regression (SVR) to predict what would happen if social restrictions in Michigan were or were not instituted, and what would happen in the future. I ran my SVR model from varying points in time to give graphical representations of possible outcomes from different time periods with and without certain social restrictions. In this study, I found that Michigan's March to June lockdown potentially prevented a large spike of COVID-19 cases, I found that the easing of several social restrictions in the late summer led to a sharp rise in COVID-19 cases, and I found that Michigan's November to December lockdown was not as effective as the previous.
Abhinav Reddy	*Convolutional Neural Networks for Aircraft Identification* This project applies a convolutional neural network to various images to place them in one of seven classes. All code pertaining to the project can be found here: https://github.com/areddy2022/CNNAircrafts . The project aims to create an algorithm for an image based guidance system on a missile that augments the tracking of infrared, radar, or opto-electrical missile to an aircraft.

Shriya Reddy	*A Novel, Noninvasive Approach to Melanoma Diagnosis Using Optical Coherence Tomography and Bioconjugated Gold Nanoparticles* Melanoma is one of the deadliest skin cancers with over 15,000 deaths per year. However, melanoma detected at an early stage results in over a 90% chance of cure. Currently the most common method of melanoma diagnosis is a biopsy, which can take 1-2 weeks to receive results and cost hundreds of dollars. Biopsies are also invasive, by resecting a portion of the skin tissue, which may be traumatizing and intimidating to patients. Thus, there is an unmet clinical need for a noninvasive, quick, and inexpensive diagnosis of melanoma. Optical Coherence Tomography (OCT) is relatively new non-invasive imaging technique which is cost-effective and requires fewer resources than most other imaging systems. However, without contrast agents, OCT's use in biological imaging is limited. This study explores a novel use of gold nanospheres as contrast agents by conjugating with proteins as cellular melanoma biomarkers and their use for imaging precancerous and cancerous lesions. The nanospheres will be bound to Galectin-3 antibodies which are predicted to bind to melanoma cells at a significantly greater rate than normal skin cells. It was concluded that a concentration of 18,000 nanoparticles/cell and nanoparticles 10nm in diameter would create the optimal conjugates for OCT contrast. In addition, methods to improve skin penetration and thus transdermal delivery of the contrast agents were explored. Several standard chemical penetration enhancing solvents and novel method for enhancing skin penetration by conjugating hyaluronic acid to gold nanoparticles was compared. The gold nanoparticles were tracked though ex-vivo rat skin over regular time intervals. My study has laid the groundwork for the use of this novel contrast agent and OCT technology in the early detection of melanoma in a clinical setting. Ultimately, this approach represents a new paradigm whereby noninvasive screening yields a greater incidence of early, cost-effective skin cancer diagnosis, saving thousands of lives globally.
Mikul Saravanan	*Smart robot to purify, and humidify and disinfect the air* Maintaining good indoor air quality (IAQ) is a critical aspect of improving overall health. Low IAQ can lead to respiratory problems, including asthma aggravation and discomforts like sleeplessness, headaches, irritation to the eyes, nose, and throat. Low humidity causes dehydration, increased chance of infection, and dryness leading to bloody noses, cracked lips, and eczema. LowIAQ and humidity concerns have been addressed to a limited extent by using stationary air purifiers and humidifiers. Due to people's movement regularly and inadequate air circulation, the air quality is uneven and poor in some areas, which need to be addressed. These critical issues were solved with this smart moving robot containing an air purifier, UVC lamp, and humidifier. The moving robot was built using various parts, including a Raspberry Pi, camera, and sensors for air quality and humidity. The UVC lamp disinfects the air by killing 99.99% of bacteria and viruses such as Covid-19. The optimal design for the robot's air handling was created in Computer-Aided Design and analyzed with Computational Fluid Dynamics to find the optimal placement of the air purifier system and UVC lamp. The robot was programmed to move around until it detects people to purify near them or has found dry air to humidify or poor air to purify and disinfect the air. The detection of people was done using an object detection algorithm with TensorFlow Lite. The experiment shows that the robot was able to humidify a room more evenly than a standalone or central humidifier.

Aryan Singh	*Hyperglycemic conditions impair lung epithelial innate response to Klebsiella pneumoniae Infection* Bacterial pneumonia is a leading cause of mortality in adults with increased disease severity and complications in diabetic individuals. We hypothesize that hyperglycemic conditions impair pulmonary innate immune response to bacterial infection. In this study, we used human bronchial epithelial cells (16HBE and BEAS-2B cell lines) and challenged them with a standard strain of Klebsiella pneumoniae (KP) under normal (5mM, NG) and high (25 mM, HG) glucose conditions. Our data showed that KP grew more and proportionately caused more cell death under HG conditions. The qPCR and ELISA analyses revealed that KP infection increased the expression of inflammatory cytokines (IL-6, IL-8, & TNF-α) at both mRNA and protein levels in lung epithelial cells. However, the inflammatory response was higher under HG conditions which coincided with induced expression of Toll-like receptor 4 (TLR4), a key receptor involved in Gram-negative bacterial infection. The pharmacological inhibition of inflammatory signaling, NF-kB, MEK, and p38 attenuated KP-induced inflammatory response in NG but to less extent in HG cells. In addition to inflammatory cytokines, epithelial cells trigger the production of antimicrobial peptides (AMPs) to limit bacterial growth. Unexpectedly, we found that HG cells produced more AMPs (LL-37, HBD2, & HBD3) in response to KP infection. Finally, like ATCC strain, clinical isolates of KP evoked increased inflammatory response under HG conditions. Collectively, our study shows that hyperglycemic conditions dysregulate the innate response of lung epithelium by promoting an inflammatory milieu. These findings may assist in the development of therapeutic targets to treat bacterial infections in diabetic patients.
Jasmine Wu	*Modeling Michigan West Nile Cases Amid Climate Change* Scientists recognize that arboviruses and their respective vectors have been largely impacted by the effects of climate change, but attempts to accurately predict and model their relationship has proven notoriously difficult and widely varied across research papers. This is especially compounded as arbovirus transmission depends on both climate and intrinsic factors, such as avian carrier immunity and the prevalence of diseases in mosquitoes. Creating models that take these factors into account will require years of diligent and accurate surveillance methods and a thorough understanding of the transmission process that the scientific community hasn't mastered yet. How has climate change affected West Nile Virus incidence in Michigan? Creating arbovirus prediction models for Michigan is especially difficult, as climate change has a surprising effect on precipitation and moisture levels -- two important environmental predictors of mosquito populations -- in the Great Lakes region. However, it remains vital, as West Nile Virus (WNV) (the focus of this research paper) can result in severe neurologic symptoms and fatality. By using mean monthly temperature, mean total precipitation in inches, and drought data, a model that predicts disease incidence has been created that accounts for 72.3% of the variation in annual WNV cases. Having such a model can provide public health authorities with information and preparation time and elucidate trends in order to effectively prevent West Nile Virus outbreaks exacerbated by climate change, especially during global pandemic and after climate scientists' warnings that climate change will increase the risk of pandemics.
Mike Ziangyu-Cai	*Predicting Function of Non-Coding DNA* The topics of the research is the predicting the function of non-coding DNA with deep learning. The purpose of it is to provide a better understand about the effects of non-coding DNA and dig deeper into the application of deep learning on analyzing the effects. The research includes background research about the non-coding DNA and learning of deep learning based on an already established function predicting model with effort of improving it. As a result, the model is adjusted to fit into more diversify working environment and is also compared with a model applying linear algorithm. As expected, both the accuracy and time of the deep learning model is better than the machine learning, which proves the deep learning is the most appropriate choice.

Sonnet Xu	*A Machine Learning Approach to Mortality Patients Prediction in Hemodialysis Patients* Objectives: To establish a predictive algorithm to determine mortality risk and predictors of mortality in African American (AA) patients receiving maintenance hemodialysis (MHD). Methods: A secondary analysis of baseline data collected from 101 AA subjects participating in the Palm Tocotrienols in Chronic Hemodialysis (PATCH) Study (NCT02358967), was conducted to implement a random forest method on 60 variables to predict death among study participants using demographic, diet, clinical, and mortality data (collected during a three year follow-up). Analytical methods (regression, mean, standard deviation) were also applied to the data after the model, to confirm and visualize the effects of the various factors. Results: The algorithm predicted mortality with an accuracy of almost 90%. Dialysis vintage, interdialytic weight gain, and atherogenic phenotype were the largest mortality predictors, while tobacco use was shown to have a low association with mortality among study participants, and did not improve the model's predictive accuracy. Body mass index was shown to regress the model's predictive ability by about 20%. Conclusions: Using a novel machine learning technique, we found that dialysis vintage, interdialytic weight gain, and atherogenic phenotype were the largest predictors of mortality for AA patients undergoing MHD. Results may not be generalizable to other ethnic groups, and may be skewed as a result of the small dataset, a limitation of this research. This algorithm can be used to help clinicians identify risk factors associated with mortality in the ESRD AA population, but requires further validation in a larger patient population.
Vivian Yee	*A Novel Epidemiological Approach to Exploring the Implications of Social Determinants of Health on COVID-19 Spread: A Call to Action for Health Equity* Healthcare disparities predominantly affect socially vulnerable populations nationally and internationally. During the COVID-19 pandemic, social determinants of health (SDOHs) have played a significant role in COVID-19 incidence and fatality. However, the impacts of general social vulnerability and government intervention on COVID-19 outcomes are not well understood. Here the correlation between the twin pandemics of adverse SDOHs and COVID-19 and the efficacy of public health intervention in mitigating this double hit on vulnerable communities are shown. Utilizing the United States Centers for Disease Control and Prevention's Social Vulnerability Index (SVI), the New York City counties were categorized into three vulnerability cohorts. Data on daily cases, deaths, and hospitalization by county reported by the New York City Department of Health and Mental Hygiene for the months of March and May 2020 were analyzed and a Susceptible-Infected-Recovered-Deceased (SIRD) model was fitted to them. These results demonstrate that more socially vulnerable populations appear to experience greater COVID-19 cases and mortalities and that specific city, state, or US federal government intervention correlated with reduced disparities in COVID-19 outcomes. Moreover, moderately vulnerable communities observed the greatest rate of COVID-19 cases and deaths and highly vulnerable communities exhibited the greatest cumulative number of COVID-19 cases and deaths. These findings identify potential public health interventions that can increase health equity in various settings. In addition, the SVI-Stratified SIRD model technique offers a more comprehensive methodology for exploring the role of social vulnerability on communicable disease spread and can be applied to future disease outbreaks.

RESEARCH ABSTRACTS

POSTER SESSION	
Aanchal Jain	*Upregulation of EMP2 and PID1 cell proliferation genes in Lung Cancer* Lung cancer is one of the leading causes of cancer deaths in the United States. Although there are many treatments, they can be expensive and can have long-lasting effects. Being able to treat cancer based on a Personalized Medicine approach could revolutionize medicine. The main purpose of this study was to identify genes upregulated in Lung Cancer patients. Through using Gene Expression Omnibus (GEO), the publicly available dataset GSE10072 was found to be related to Lung Cancer. The dataset compares healthy control patients (with healthy lungs) with lung cancer patients (adenocarcinoma in the lung). Using GEO2R, many genes were found to be upregulated in the Lung Cancer group. To further analyze the differentially expressed genes (p-value <0.05), String-DB was used to find commonly grouped genes for many biological processes. The biological process Regulation of Cell Population Proliferation had 47 differentially expressed genes associated with it. It was found that the two genes out of the 47 were of interest - EMP2 and PID1 - both upregulated in the lung cancer tumor group. Both EMP2 and PID1 share roles in cell proliferation, with PID1 specifically having functions in preadipocyte proliferation. These genes hold importance in tumor growth in Lung Cancer since they are related to the Regulation of Cell Population Proliferation pathway. Since EMP2 and PID1 were upregulated in the tumor group, they are sure to have some role in tumor growth. Identifying these genes now can provide insight into the future of Lung Cancer and Personalized Medicine.
Margaret Yang	*Assembly Efficiency of Multi-scaffolded Enzyme Assemblies (mSEAs) on Yeast Cell Surface for Direct Conversion of Biomass to Ethanol* Lignocellulosic biomass is the most abundant and sustainable resource for the production of biofuels and other biomaterials in the world. However, cellulose which is the primary component of lignocellulosic biomass is highly recalcitrant. Breaking down cellulosic biomass into fermentable sugar is a key limiting step in the production of bioethanol from lignocellulose. Engineering baker's yeast Saccharomyces cerevisiae represents a promising strategy to overcome this bottleneck. In this study, I designed and assembled multi-scaffolded enzyme assemblies (mSEAs) complexes on the yeast cell surface to enable the direct conversion of cellulose to ethanol. I also performed and quantified fermentation experiments to demonstrate that efficient conversion of cellulose into ethanol. With these data I developed a comprehensive mathematical model in MATLAB to predict the assembly efficiency of anchor scaffold protein (aScaf) to primary scaffold proteins (pScafs), the overall assembly efficiency of multi-scaffolded enzyme assemblies (mSEAs) on the yeast cell surfaces, and the performance in direct conversion of cellulose to ethanol of different mSEAs. In the future, these yeast cells can be engineered to achieve the optimum surface enzyme display in the consolidated bioprocessing (CBP) to achieve the biomass degradation and ethanol production in a single step, which is critical for developing sustainable biomass-based refinery.

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