56th Annual Junior Science & Humanities Symposium

Tennessee Regional

March • 4-5 • 2021
Virtual Event
# Program and Agenda

**Thursday, March 4 • 2021**  
**All Times EST**

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| 10:00 - 10:30 AM | **Opening Remarks**  
PRESENTATION OF COLORS & NATIONAL ANTHEM  
WELCOME FROM DR. PAUL JAFFE |
| 10:30 - 11:30 AM | **Poster Session** |
| 11:30 AM - 1:00 PM | **Break for Lunch**  
GO OUTSIDE! GET FRESH AIR!  
GET AWAY FROM SCREENS! |
| 1:00 - 1:20 PM | **Tickle College of Engineering**  
INDUSTRIAL & SYSTEMS ENGINEERING |
| 1:20 - 1:40 PM | **Tickle College of Engineering**  
MECHANICAL, AEROSPACE AND BIOMEDICAL ENGINEERING |
| 1:40 - 2:00 PM | **Tickle College of Engineering**  
NUCLEAR ENGINEERING |
| 2:00 - 3:00 PM | **Oak Ridge National Laboratory**  
OAK RIDGE LEADERSHIP COMPUTING FACILITY TOUR |
| 3:00 - 4:00 PM | **Fun Activity**  
ACTIVITY FOR STUDENTS! |
## PROGRAM AND AGENDA

**FRIDAY, MARCH • 5 • 2021**  
**ALL TIMES EST**

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<th>Event Description</th>
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<td>OPENING REMARKS</td>
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<td>ORAL PRESENTATIONS</td>
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<td>BREAK FOR LUNCH</td>
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<td>ORAL PRESENTATIONS</td>
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<td>UNIVERSITY OF TENNESSEE PRESENTATIONS</td>
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<td>DEPARTMENT OF MATHEMATICS</td>
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<td>DEPARTMENT OF CHEMISTRY</td>
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<td>PRE-HEALTH TRACK AT UTK</td>
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<td>TJSHS AWARDS CEREMONY</td>
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<td>KEYNOTE SPEAKER: CHRISTEN CARADINE</td>
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Poster Session 10:30-11:30 am

**Daniel Joy, Oak Ridge High School**
Using Data Science to Explore Historical Trends and Predict Future Rates of COVID-19

**Kurt Schelzig, Hillsboro High School**
The Development of an Improved Wireless Energy Transmission System and Adapter

**Akhilsai Ujjina, East Hamilton High School**
Data Informatics Approach for Managing Water Crisis During Pandemic Situations
Student Presentations Oral
Friday, March • 5 • 2021
All Times EST

Session 1
9:10 am - 12:00 pm

9:10 am
Skyler Stone, Cleveland High School
The Classification of Crayfish in Mouse Creek, Cleveland, TN in Oct. 2020

9:30 am
Rishi Soni, Cleveland High School
Developing a Fish Image Classification System for Mouse Creek, Cleveland, TN using Machine Learning

9:50 am
Vivian Song, Hamilton County Collegiate High School
The Potential of Different Rice Varieties as a Natural Water-Resistant Adhesive

10:10 am
Asthak Sinha, Girls Preparatory School
Experimenting with Nanotechnology

10:30 - 10:45 am
BREAK

10:45 am
Ridhima Singh, Farragut High School
Understanding the Impact of Landscape Patterns on the Urban Heat Island (UHI) Intensity

11:05 am
Saksham Saksena, Houston High School
Omnidetector: Universal Screening Test for Cancer, Stroke from Atrial Fibrillation, and COVID-19 Thrombophilia

11:25 am
Cheryl Quarter, Hume-Fogg Academic High School
Bioinformatic Analysis Predicts Novel Tissue-Specific Enrichment of Nucleoporin Gene Regulators

12:00 - 1:00 pm
BREAK FOR LUNCH

Session 2
1:00 - 3:45 pm

1:10 pm
Grace Maddox, Cleveland High School
Assessing Stream Health as it Pertains to Plethodontid Salamanders at Several Sites within the Cherokee National Forest

1:30 pm
Junyi Li, McCallie School
Automatic Music Generation Based on Deep Learning Algorithm

1:50 pm
Holden Korbey, Hillsboro High School
Density-Dependent Effects of Lonciera maackii Allelopathy

2:10 - 2:25 pm
BREAK

2:25 pm
Eyrin Kim, Farragut High School
Analyzing Disparities of Eviction During the COVID-19 Pandemic Through Spatial Statistical Analysis

2:45 pm
Raymond Jin, Farragut High School
The Relationship Between Tropical Cyclone Translation Speeds and Aerosol Concentration

3:05 pm
Noah Graybeal, McMinn County High School
Masking The Problem: Examination and Analysis of Currently Available Facial Masks and Re-Designed Improvement to Help Prevent Respiratory Exacerbations

3:25 pm
Charles Eichman, Hillsboro High School
Effects of diammonium phosphate on Saccharomyces cerevisiae Growth and Metabolism

3:45 - 4:00 pm
BREAK
PARTICIPATING SCHOOLS

Brentwood Academy, Brentwood, TN - Williamson County

Chattanooga School for the Arts & Sciences - Chattanooga, TN - Hamilton County
Teacher: Ty Campbell

Cleveland High School, Cleveland, TN - Bradley County
Teacher: Jeannie Long

East Hamilton High School, Ooltewah, TN - Hamilton County

Farragut High School, Knoxville, TN - Knox County
Teacher: William Reynolds

Girls Preparatory School, Chattanooga, TN - Hamilton County
Teacher: Keith Sanders

Hamilton County Collegiate High School at Chattanooga State, Chattanooga, TN - Hamilton County
Teacher: Kelly Davis

Hillsboro High School, Nashville, TN - Davidson County
Teacher: Joshua Swartz

Houston High School, Germantown, TN - Shelby County
Teacher: Abigail Simone

Hume-Fogg Academic High School, Nashville, TN - Davidson County
Teacher: John Lee

McCallie School, Chattanooga, TN - Hamilton County
Teacher: Caleb Bagby

McMinn County High School, Athens, TN - McMinn County
Teacher: Cynthia Moses

North Greene High School - Greeneville, TN - Greene County
Teacher: Olivia Kuper

Oak Ridge High School, Oak Ridge, TN - Anderson County
Teacher: Deanna Pickel

Ravenwood High School - Brentwood, TN - Williamson County
Dr. Paul Jaffe is an electronics engineer and researcher with over 25 years of experience at the U.S. Naval Research Laboratory (NRL). He has led or held major roles on dozens of space missions and on breakthrough technology development projects for civilian, defense, and intelligence community sponsors, including SSULI, STEREO, TacSat-1, TacSat-4, ORS, MIS, PRAM, CARINA, RSGS, PTROL, S2FOBs, and LEctenna.

He was responsible for electrical system and spacecraft computer hardware development. He served as coordinator and editor of two solar power satellite study reports and was the principal investigator for a ground-breaking space solar research effort.

His current roles include program management and systems engineering of a portfolio of projects. He serves as a lecturer for the Aerospace Engineering Department at the University of Maryland. He has over 50 journal, conference, and patent publications and is the recipient of numerous awards. Dr. Jaffe has made many international speaking and media appearances, including as a TEDx speaker, on MSNBC, and the Science Channel’s “Through the Wormhole with Morgan Freeman.” He is also active in educational and STEM outreach.
Christen Caradine is an Infection Preventionist and Registered Nurse with the Tennessee Department of Health in the Healthcare Acquired Infection Program. Christen completed her undergraduate studies in nursing at the University of Tennessee Knoxville where she is currently completing her Doctorate of Nursing Practice (DNP) and will graduate in May 2021.

In the field of research, Christen served on an epidemiology research study in collaboration with the Tennessee Department of Health, Emory University, and the University of Utah entitled “Extensively Drug Resistant Organisms: Improving Understanding Of Care Patterns In Long Term Care Facilities”. As a part of her DNP research, she implemented an antimicrobial stewardship program in an enhanced respiratory care unit to combat the increase of drug resistant organisms in healthcare settings. Additionally, she served as a facility site coordinator in the production of an “Extensively Drug Resistant Acinetobacter Baumannii” manuscript in September 2019.

Christen was honored to serve as a keynote speaker during the 2019 Smoky Mountain Fall Conference of American Professionals in Epidemiology and Infection Control, presenting a talk entitled: “Non-Traditional Infection Control: Thinking Outside the Acute Care Box”. Christen holds a certification in Infection Control and Epidemiology by the Certification Board of Infection Control (CBIC). She is a member of both the local and national chapters of the Association for Professionals in Infection Control & Epidemiology, as well as both the local and national chapters of Sigma Theta Tau. Christen is an active participate in the Knoxville East Tennessee Healthcare coalition and is a member of the Graduate Student Nursing Association.
JUDGING PANEL
POSTER PRESENTATION SESSION
THURSDAY, MARCH 4

Betsy Chesnutt, PhD
Lecturer, Department of Engineering Fundamentals
The University of Tennessee, Knoxville

Dr. Betsy Chesnutt holds a PhD in Biomedical Engineering and is a Lecturer in Engineering Fundamentals at the University of Tennessee, Knoxville, where she teaches first-year engineering students and is involved with several engineering outreach programs. She currently researches engineering education, with a particular focus on K-12 engineering education and teacher training, and she also has experience conducting research in the area of biomaterials and tissue engineering.

Doris D’Souza, PhD
Associate Professor of Food Microbiology and Food Virology
Sections, Food Science and Technology
University of Tennessee, Knoxville

Dr. Doris H. D’Souza, is an Associate Professor of Food Microbiology and Food Virology Sections in the Department of Food Science and Technology at the University of Tennessee, Institute of Agriculture. Her research program includes rapid and sensitive molecular detection of foodborne bacterial and viral pathogens; their transmission, tracking and persistence; novel and natural control and intervention strategies and genomic approaches to understand and determine modulation of the gut microbiota by bioactives. Dr. D’Souza earned her B.S. in Microbiology/Biochemistry, St. Xavier’s College, University of Mumbai, India and her Ph.D. in Food Science & Technology (Microbiology), from The University of Georgia, Athens, Georgia. Before joining the University of Tennessee in 2006, Dr. D’Souza was a Postdoctoral Research Associate in the Department of Food Science, North Carolina State University, Raleigh, North Carolina.

Wilfred Post, PhD
Retired Research Scientist

Dr. Wilfred M. Post retired in 2013 as a senior scientist in the ORNL Environmental Sciences Division, a staff member of ORNL’s Climate Change Science Institute (CCSI), and an adjunct professor of Ecology and Evolutionary Biology at the University of Tennessee, Knoxville. He is a recognized expert on soil carbon dynamics nutrient relationships between soil and vegetation, and the impact of species recomposition on ecosystem processes. He has developed approaches to representing the impact of land-use change and climate change in terrestrial biogeochemistry models. He has more than 100 peer reviewed open literature publications and co-authored two books. Post has a Ph.D. in Ecology from the University of Tennessee, Knoxville, and an M.S. in Botany and a B.S. in Mathematics from the University of Wisconsin, Madison.

Sudip Seal, PhD
Senior Scientist, Oak Ridge National Laboratory
Associate Professor, Tickle College of Engineering
University of Tennessee, Knoxville

Dr. Seal is a Senior Scientist in the Computer Science and Mathematics Division, Oak Ridge National Laboratory and an ORNL-UT Associate Professor of Electrical Engineering and Computer Science at the University of Tennessee, Knoxville. He holds Ph.Ds in Computer Engineering and Theoretical High Energy Physics. Dr. Seal researches in scalable parallel algorithms for large-scale applications of traditional and AI-driven methods in science and engineering and is currently involved in projects related to fusion, neutron and materials sciences.
JUDGING PANEL
ORAL PRESENTATION SESSION
FRIDAY, MARCH 5

**Betsy Chesnutt, PhD**
Lecturer, Department of Engineering Fundamentals  
The University of Tennessee, Knoxville

Dr. Betsy Chesnutt holds a PhD in Biomedical Engineering and is a Lecturer in Engineering Fundamentals at the University of Tennessee, Knoxville, where she teaches first-year engineering students and is involved with several engineering outreach programs. She currently researches engineering education, with a particular focus on K-12 engineering education and teacher training, and she also has experience conducting research in the area of biomaterials and tissue engineering.

**Scott Emrich, PhD**
Associate Professor, Electrical Engineering & Computer Science  
The University of Tennessee, Knoxville

Dr. Emrich is an Associate Professor of Electrical Engineering and Computer Science at the University of Tennessee, Knoxville. He holds a PhD in Bioinformatics split evenly between theoretical biology and high performance algorithms in computer science. Dr. Emrich researches in computational genomics and DNA sequence analysis and related informatics with an emphasis on global health and ecological applications. He is currently involved in projects related to protein folding, malaria parasite genetics, biofuel stock improvement, and data science/machine learning applied to genomic applications.

**Marcin Nowicki, PhD**
Research Assistant Professor, Entomology & Plant Pathology  
The University of Tennessee Institute of Agriculture

Dr. Marcin Nowicki is a Research Assistant Professor in Entomology & Plant Pathology. His professional interests include invasive species, speciation, plant biochemistry, environmental inferences, comparative genomics, and crop resistance breeding. His areas of expertise are plant biochemistry & molecular biology, population genetics analyses & programs, pest management, controlled environmental agriculture, and pest management. He holds a B.S. in Biology from the University of Oregon and a Ph.D. in Evolutionary Biology from the University of Wisconsin-Madison. He currently teaches at the University of Tennessee-Knoxville and is involved in several research projects related to plant pathology and biochemistry.

**Wilfred Post, PhD**
Retired Research Scientist

Dr. Wilfred M. Post retired in 2013 as a senior scientist in the ORNL Environmental Sciences Division, a staff member of ORNL’s Climate Change Science Institute (CCSI), and an adjunct professor of Ecology and Evolutionary Biology at the University of Tennessee, Knoxville. He is a recognized expert on soil carbon dynamics, nutrient relationships between soil and vegetation, and the impact of species composition on ecosystem processes. He has developed approaches to representing the impact of land-use change and climate change in terrestrial biogeochemistry models. He has more than 100 peer-reviewed open literature publications and co-authored two books. Post has a Ph.D. in Ecology from the University of Tennessee, Knoxville, and an M.S. in Botany and a B.S. in Mathematics from the University of Wisconsin, Madison.
ADDITIONAL SESSIONS
THURSDAY, MARCH 4

1:00 - 1:20 pm EST
Laura O'Shaughnessy
Assistant Professor of Practice, Industrial & Systems Engineering
University of Tennessee, Knoxville

Rachel Ware
Senior and Outreach Ambassador
University of Tennessee, Knoxville

Session Description:
Information and Discussion about the exciting intersection of engineering and business - Industrial Engineering!

1:20 - 1:40 pm EST
Doug Aaron, Ph.D
Assistant Department Head, Undergraduate Programs, Mechanical Aerospace and Biomedical Engineering
University of Tennessee, Knoxville

Session Description:
An introduction to the people, activities, and organizations that make MABE a vibrant department.

1:40 - 2:00 pm EST
Jamie Coble, Ph.D
Associate Professor, Nuclear Engineering

Emily Hutchins
Ph.D Student
University of Tennessee, Knoxville

Session Description:
Nuclear engineering is a diverse field that touches on many aspects of our lives, often without us even knowing! Students at the University of Tennessee study the fundamental elements of nuclear engineering to positively impact global challenges, from clean energy production to medical imaging and treatment to safe deep space exploration. Learn more about how you can make a difference with nuclear engineering.

2:00 - 3:00 pm EST
Subil Abraham
High Performance Computing Engineer, Operations-Productions Group
Oak Ridge National Laboratory

Session Description:
A virtual tour of the Oak Ridge Leadership Computing Facility
ADDITIONAL SESSIONS
FRIDAY, MARCH 5

4:00 - 4:20 pm EST  
Joan Lind, PhD  
Associate Professor, Director of Math Majors & Minors  
Department of Mathematics  
University of Tennessee, Knoxville

Session Description:  
Since research in math generally does not involve labwork, the idea of math research can be more mysterious. Come and find out what it means to do research in math and glimpse the variety within mathematical research.

4:20 - 4:40 pm EST  
Mike Best, PhD  
Professor, Director of Graduate Studies  
Department of Chemistry  
University of Tennessee, Knoxville

Session Description:  
Pre-recorded virtual tour of research labs and facilities followed by a discussion about pursuing a career in chemistry with Q&A

4:40 - 5:00 pm EST  
Shanna Pendergrast  
Associate Director, Arts & Sciences Advising Services  
University of Tennessee, Knoxville

Session Description:  
Are you a student thinking about pursuing a career in the health professions? If so, this session is for you! During the session we will discuss what it means to be a college student on a pre-health path. Our interactive session will conclude with some resources to assist you in exploring your interests in health care.
JUNIOR SCIENCE AND HUMANITIES SYMPOSIUM, TENNESSEE REGIONAL ADMINISTRATIVE STAFF

Thomas Broadhead, PhD
Lead PI
Director of Undergraduate Academic Advancement
Office of Undergraduate Admissions
The University of Tennessee, Knoxville

Susan Troop
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Jason Moody
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The University of Tennessee, Knoxville

Jaime Morales
Graduate Student Assistant, Pre-College Programs
Office of Undergraduate Admissions
The University of Tennessee, Knoxville
TENNESSEE SPONSORS AND SUPPORTERS

The Junior Science and Humanities Symposium, Tennessee Regional, is hosted by the University of Tennessee, Knoxville, and is administered through the Pre-College Research Excellence Programs in the Office of Undergraduate Admissions, Division of Enrollment Management. Judges are provided by the University of Tennessee, Knoxville and the Oak Ridge National Laboratory.

NATIONAL SPONSORS

The Junior Science and Humanities Symposium, Tennessee Regional, (JSHS-TN) is jointly sponsored by the research offices of the United States Departments of the Army, Navy, and Air Force in cooperation with leading research universities throughout the nation. The Department of Defense generously provides funding for the National Symposium and the JSHS-TN scholarships. The JSHS-TN program is administered nationally through the National Science Teaching Association.

FINANCIAL SUPPORT

The Junior Science and Humanities Symposium, Tennessee Regional, is provided by a grant from the National Science Teaching Association. The University of Tennessee Pre-College Research Excellence Programs, Office of Undergraduate Admissions, Division of Enrollment Management provides supplementary support.
The 59th National JSHS will be held April 14-17 2021, as a virtual competition. The National JSHS brings together 245 high school students who qualify by submitting and presenting original scientific research papers in regional symposia held at universities nationwide. Approximately 130 high school teachers, mentors, university faculty, ranking military guests and others also attend and join in encouraging the future generation of scientists and engineers and celebrating student achievement in the sciences.

THE COMPETITION

All regional symposia student finalists are invited to present their research at the National JSHS. The top two regional delegates will present their research in the oral session to compete for military-sponsored undergraduate, tuition scholarships. All other regional delegates will present their research in the poster session to compete for cash awards. Sessions will be organized by categories that are selected by the students during the registration process.

THE SCIENTIFIC AND EDUCATIONAL PROGRAM

All students will participate in interactive activities to enrich their JSHS experience and to engage with DoD researchers, laboratories, and related STEM organizations and professionals. Unique opportunities for JSHS students include:

- The Student Research Presentations, the highlight of the National JSHS, feature the STEM achievements of outstanding students representing the U.S., Puerto Rico, and the DoD Dependents Schools of Europe and the Pacific.
- DoD STEM Experiences allow students and teachers to engage with DoD’s world-class STEM professionals and provide exposure to the Department’s cutting edge research and technologies.
- Banquet and Awards Ceremony recognizes all participants and announces scholarships awarded to students in each competition category of the oral session categories of the National JSHS competition.

The Junior Science and Humanities Symposium, Tennessee Regional, is sponsored by the United States Departments of the Army, Navy, and Air Force, and is administered by the National Science Teaching Association in cooperation with the University of Tennessee, Knoxville.

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