85th Annual

Minnesota State Science & Engineering Fair

March 20-31, 2022

Minnesota Academy of Science | mnmas.org

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Welcome from the Minnesota Academy of Science Board President

On behalf of the Minnesota Academy of Science Board of Directors, I welcome you to the 2022 Hybrid Minnesota State Science and Engineering Fair!

By competing in the MSSEF you are showing the world that you are a top student scientist. You took your curiosity and drive and chose to complete a project and to compete in Science Fair alongside your peers. No matter what you become in life or what you do, you are now part of the Minnesota Academy of Science family. Whether you win an award or not, being at the State Science Fair and the journey you took to get here are the true awards. You are all winners—you all earned your spot in this competition and we are very proud of you!

Thank you to the parents, teachers, advisors, and volunteers for your support. Thank you for putting up with the late hours, paperwork, and projects (sometimes with very interesting smells) taking over the lab, coffee table, or workbench. We know that the State Science Fair wouldn't happen without you.

To our student scientists, congratulations! We hope that you will be always curious, always learning, and always growing. The world is out there waiting for you.

Sincerely,

Dr. Cindy Ward-Thompson
President, Minnesota Academy of Science

About the Minnesota State Science & Engineering Fair

The mission of the Minnesota State Science & Engineering Fair (MSSEF) is to help Minnesota students become informed citizens who are well versed in the methods and ideas of science and to encourage them to pursue careers in science, technology, engineering, and math (STEM). MSSEF introduces students to new concepts, inspires them to research topics of personal interest, and encourages them to network with professional scientists and their peers.

An annual competition since 1938, MSSEF showcases the research of Minnesota's most engaged STEM students. It is the culmination of our state's Regional Science Fairs. From approximately 2,500 regional participants, hundreds of middle school and high school students qualify to advance and present their research at the state level. Students compete for prizes and awards worth more than $15,000 sponsored by dozens of corporations, nonprofits, government agencies, and professional scientific societies.

About the Minnesota Academy of Science

Originally founded in 1873, the Minnesota Academy of Science (MAS) is a statewide 501(c)(3) organization committed to advancing science, technology, engineering, and math (STEM) in Minnesota by connecting Minnesotans of all backgrounds with resources and opportunities to engage in STEM learning, research, and communication—and to recognize excellence in these areas. To learn more about our programs, connect with us, volunteer, or make a donation to support our work, please visit **mnmas.org**.

2022 MSSEF Schedule

Links to these opportunities will be sent daily emails each morning and are also available in zfairs.

See the Workshop, Listening Sessions and Movie section for more information.

Monday, March 21

6:00 pm | Workshop: *You are What You Eat and Where You Live Matters: How to Determine What a Fish Needs to Survive in a River Changed by Humans*

Tuesday, March 22

5:00 pm | Listening Session for Middle School Students

6:00 pm | Listening Session for High School Students

Wednesday, March 23

5:00 pm | Workshop: *Rebuilding 35W in South Minneapolis*

Thursday, March 24

5:00 pm | Workshop: *Global Soundscapes*

Friday, March 25

All day | *Particle Fever* film streaming access

Saturday, March 26

11:00 am | Workshop: *Renewable Energy*

2:00 pm | Workshop: *What's in your Watershed?*

3:00 PM | Workshop: *Imaging the "Invisible" World*

All day | *Particle Fever* film streaming access

Sunday, March 27

12:30 - 2:00 pm | High School projects: judge and participant question and answer sessions

2:30 - 4:00 pm | Middle School projects: judge and participant question and answer sessions

Monday, March 28

In-person event registration deadline: Watch your email for details and registration information

(Science Museum of Minnesota on March 31 from 11:00-4:30)

Tuesday, March 29

Deadline for extra activities (STEM poetry contest, project showcase scavenger hunt, and social media contest)

Wednesday, March 30

7:00 pm | Virtual Awards Ceremony

Click here to join via zoom

Thursday, March 31

In-person event at the Science Museum of Minnesota, St. Paul

Lunch vouchers for Seventh Street Truck Park provided.

11:00 am - 4:00 pm | Award pick up, photos, and giveaways in Xenon Room; explore Science Museum exhibits

1:00 - 2:00 pm | IMAX movie for ***high school students*** in Omnitheather

1:00 - 2:30 pm | Networking event featuring Now. Make. Art. for ***middle school students*** in Discovery Hall

3:00 - 4:00 pm | IMAX movie for ***middle school students*** in Omnitheater

3:00 - 4:30 pm | Networking event featuring Now. Make. Art. for ***high school students*** in Discovery Hall

Workshops, Listening Sessions & Movie

The 2022 workshops and listening sessions offer opportunities to engage with your peers while learning from STEM professionals. Workshops will occur over zoom. *Watch your inbox in the mornings for daily schedule reminders containing zoom links from MAS communications specialist Emily Shepard. Links will also be posted in Zfairs.* You will have the opportunity to record your attendance on a certificate of participation to serve as a lasting record of your engagement in this year's MSSEF.

Monday, March 21

6:00 pm | **You are What You Eat and Where You Live Matters: How to Determine what a Fish Needs to Survive in a River Changed by Humans**

Presenter: Shaley Valentine | Center for Fisheries, Aquaculture, and Aquatic Sciences, Southern Illinois University

Workshop description: Humans have greatly changed the Mississippi River, leading to decreases in fish populations and a struggle to survive for some species. For species to survive, they require different foods and habitats depending on their age and where they currently live in the river, and we will explore some of the needs these fish currently have and how the needs change based on where a fish lives.

Tuesday, March 22

5:00 pm | **Listening Session for Middle School Students**
6:00 pm | **Listening Session for High School Students**

Facilitator: Sara Gomez, Minnesota Academy of Science Director of Community Outreach

Description: Students, what would you like us to know about your Science Fair experience? What ideas do you have for the annual competition? Do you have experiences you'd like to share? Come chat with Minnesota Academy of Science staff and learn what your peers have to say. We're all ears!

Wednesday, March 23

5:00 pm | **Rebuilding 35W in South Minneapolis**

Presenter: Aaron Tag | West Area Engineer in MnDOT's Metro District

Workshop description: Learn about what it takes to rebuild a major interstate through a dense urban area. From transit stations, to bridges, to underground stormwater storage tanks – see what it took to design and construct this important project.

Thursday, March 24

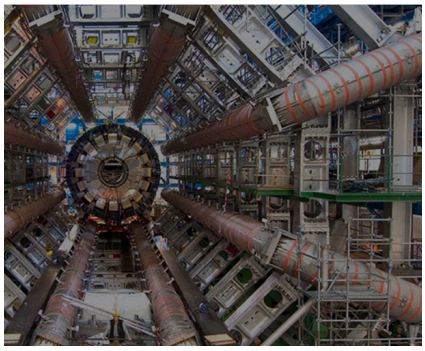
5:00 pm | **Global Soundscapes**

Presenter: Pacific Science Center

Workshop description: Immerse yourself in the amazing sounds of our planet! Through high quality images, audio files, and live presentation, Global Soundscapes takes you on an ear-opening journey into the science of sound and the emerging field of soundscape ecology. Learn about the tools that scientists use to record and analyze sounds. Explore basic acoustics through interactive activities and incredible slow-motion footage of pulsating musical instruments, vibrating vocal chords, snapping shrimp, and slobbering "raspberries." Discover what soundscapes tell us about the health of our planet.

Friday, March 25

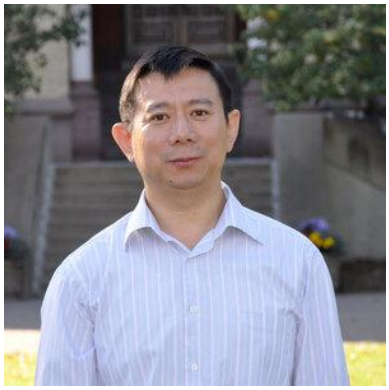
All day | **Streaming access to Particle Fever film**
Access details will be sent in daily email for March 25 and will also be on zFairs



Imagine being able to watch as Edison turned on the first light bulb, or as Franklin received his first jolt of electricity. 10,000 scientists from over 100 countries join forces in pursuit of a single goal: to recreate conditions that existed just moments after the Big Bang and find the Higgs boson, potentially explaining the origin of all matter. *Particle Fever* gives audiences a front row seat to one of our generation's most significant scientific breakthroughs, the launch of the Large Hadron Collider - one of the biggest and most expensive experiments in the history of the planet. See the *Particle Fever* preview here.

Saturday, March 26

11:00 am | **Renewable Energy**



Presenter: Lifeng Dong | Department Chair in Physics at Hamline University and the Director of the Hamline University Renewable Energy and Environmental Research Laboratory. Dr. Dong also serves on the MAS Board of Directors and has judged for the MSSEF.

Workshop description: Learn about current primary energy production and consumption in the United States and Minnesota as well as the development of renewable energy conversion and storage devices, such as solar cells, fuel cells, batteries, and supercapacitors.

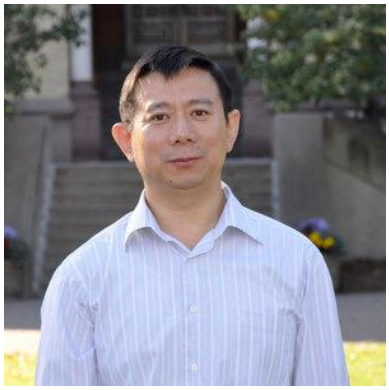
2:00 pm | **What's in your watershed?**

Presenter: Claire Adams | Environmental Education Fellow at Osprey Wilds Environmental Learning Center

Workshop description: Every living thing is part of a watershed. Learn about what makes up a watershed and how to keep it healthy in this presentation from Osprey Wilds Environmental Learning Center.

- See page 13 for more Saturday, March 26 workshops -

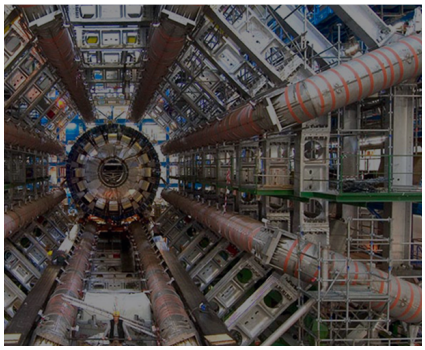
3:00 pm | **Imaging the "Invisible" World**



Presenter: Lifeng Dong | Department Chair in Physics at Hamline University and the Director of the Hamline University Renewable Energy and Environmental Research Laboratory. Dr. Dong also serves on the MAS Board of Directors and has judged for the MSSEF.

Workshop description: How do scientists observe and understand an "invisible" microscopic world? This workshop will give brief introductions to light microscopes and electron microscopes as well as talk about their applications in fields like forensics, manufacturing and assembly industries, semiconductors and electronics, and life sciences.

All day | **Streaming access to *Particle Fever* film**
Access details will be sent in daily email for March 26 and will also be on zFairs



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2022 Keynote Speaker

Dr. Nisha Botchwey will address participants in a keynote speech at the 85th Annual Minnesota State Science and Engineering Fair virtual awards ceremony on March 30, 2022 at 7:00 pm.

Dr. Botchwey began serving as the dean of the University of Minnesota Humphrey School of Public Affairs in January 2022. Her research and teaching have been at the nexus of environmental and health policy and the built environment, with a special focus on youth engagement and health equity. The impact of Botchwey's public health and social justice work was recognized in 2021 with the prestigious Dale Prize for Excellence in Urban and Regional Planning, and in 2016 by the White House Council on Women and Girls.

Previously, Dr. Botchwey served as associate dean at Georgia Tech Professional Education, where she played a key role in leading the school's response to the COVID-19 pandemic. Dr. Botchwey was also a tenured associate professor in Georgia Tech's School of City and Regional Planning and director of the School's Healthy Places Lab.

MSSEF Surveys

Student Survey | Judge Survey | Parent/Coach Survey

2022 MSSEF Awards

Minnesota Academy of Science Grand Awards

The Grand Awards recognize excellence in scientific research at the middle school and high school level.

The top 5% of projects presented at MSSEF receive the Gold Award

The next 10% of projects receive the Silver Award

The next 15% of projects receive the Bronze Award

Projects are ranked according to judge scores and the competitiveness of the category in which students present.

Minnesota Junior Academy of Science (MJAS)

Top-scoring high school presenters from the MN State Science & Engineering Fair and the Junior Science & Humanities Symposium will be invited to join the MJAS, an honorary society and leadership group of high school and college students from Minnesota who have demonstrated excellence in scientific research. As members of the MJAS, students will have opportunities to network and become leaders and ambassadors for STEM and STEM education at the local, state, and national levels.

Regeneron International Science and Engineering Fair (ISEF) Award

The Regeneron ISEF Award recognizes up to five of the top high school projects. Winners typically receive an all-expense-paid trip to compete in ISEF. In 2022, the Regeneron ISEF is scheduled to take place in Atlanta, Georgia, between May 7 and 13. Regeneron ISEF will be held as a hybrid event with a judged competition and distribution of Grand and Special awards for in-person and virtual finalists.

Seagate Awards

MAS thanks Seagate Technology, Premier Sponsor of the State Science & Engineering Fair, for their continued support of STEM education in Minnesota. Seagate is the global leader in data storage solutions, developing amazing products that enable people and businesses around the world to create, share and preserve their most critical memories and business data.

Seagate Excellence in Science Mentoring Award

The Seagate Excellence in Science Mentoring Award recognizes outstanding science teachers from around the state who find creative ways to nurture students' interest in scientific research and discovery. The award acknowledges teachers who go above and beyond the classroom to promote science education in their schools and who encourage students to engage in hands-on projects and experiences outside the classroom.

Seagate Technology gives two awards – one for a teacher with less than 10 years of experience and another for teachers with 10 or more years of experience. Award recipients receive a $1,000 award and a Seagate portable hard drive. The teachers' schools or science programs also receive a $1,000 award.

Seagate Rising Star Award

The Seagate Rising Star Award recognizes two emerging student scientists whose projects not only exemplify excellence in their category but also demonstrate high degrees of difficulty, thoroughness, complexity, creativity, innovation, and effective communication. One high school student receives a $2,000 award, trophy, and a Seagate portable hard drive; one middle school student receives a $1,500 award, trophy, and a Seagate portable hard drive.

Seagate Emerging Scientist Award

The Seagate Emerging Scientist Award recognizes excellent scientific research conducted by students competing for the first time. The top 10% of first-year students receive trophies.

Special Awards

The Minnesota Academy of Science thanks the following organizations for sponsoring awards for the State Science & Engineering Fair. Awards are listed alphabetically by organization. Award winners will be listed on mnmas.org after the March 30th award ceremony.

Sponsoring Organization	Award
3M	**3M Science Applied to Life Award** $500 + certificate + plaque - First Place high school project $300 + certificate + plaque - Second Place high school project $200 + certificate + plaque - Third Place high school project $500 + certificate + plaque - First Place middle school project $300 + certificate + plaque - Second Place middle school project $200 + certificate + plaque - Third Place middle school project Plaque - Honorable mentions (4) **3M Consumer Innovation Award** $120 + plaque - 6 high school projects & 6 middle school projects
American Chemical Society, Minnesota Section	**Outstanding Experimental Project in Chemistry** $100 + Certificate – First Place high school project $50 + Certificate – First Place middle school project Certificate + 1 year subscription to *Chem Matters* - Honorable Mentions (3 High School & 3 Middle School Students)
American Fisheries Society, Minnesota Chapter	**Aquatic Sciences Excellence Award** Book + Fishing Pole - First Place high school student Book + Fishing Pole - First Place middle school student
American Heart Association	**American Heart Association Community Impact Award** Certificate - First Place middle school project

American Institute of Professional Geologists & Minnesota Geological Society	**Geology, Earth Science, Environmental Science & Sustainability Excellence Award** Geoscience handbook + fossil specimen kit - 3 projects
American Meteorological Society	**Outstanding Achievement for Excellence in Atmospheric or Related Science** Certificate + weather radio – First Place high school project
American Psychological Association	**Outstanding Research in Psychological Science** Certificate - First Place high school project
American Society of Plumbing Engineers	**Best Display of Mechanical Engineering** $500 + certificate - First Place high school project
ASM Material Education Foundation	**Outstanding Exhibit in Materials Science** Certificate + medallion - First Place high school project
Association for Women Geoscientists	**Student Awards for Geoscience Excellence** Certificate - First Place project from a female student
Beckman Coulter Foundation	**Beckman Coulter Awards** $350 - First Place high school science project $200 - Second Place high school science project $75 - Third Place high school science project $350 - First Place high school engineering project $200 - Second Place high school engineering project $75 - Third Place high school engineering project $350 - First Place middle school science project $200 - Second Place middle school science project $75 - Third Place middle school science project $350 - First Place middle school engineering project

	Beckman Coulter Awards continued $200 -Second Place middle school engineering project $75 - Third Place middle school engineering project
Bolton & Menk Inc.	**Bolton & Menk Young Inventor Award** $500 + t-shirt + certificate + job shadow at a Bolton & Menk location - 3 projects
Broadcom Foundation	**Broadcom Coding with Commitment Award** $250 + Raspberry Pi Personal Computer Kit - First Place Middle School Project
Broadcom Masters	**Broadcom Masters Award** Certificate + tee shirt + $10 gift card + invite to apply to National Competition - Top 10% of middle school projects, winners must place 1st to 4th in overall judging.
David Braslau Associates, Inc.	**Excellence in Acoustics** $100 - First Place high school project $50 - Second Place high school project $25 - Honorable Mention high school project $100 - First Place middle school project $50 - Second Place middle school project $25 - Honorable Mention middle school project
DiaSorin, Inc.	**DiaSorin Inc. Merit Award** Best independent work demonstrating the scientific method $100 - 5 middle school projects **Relativity Award** Best project that involves the use of a family pet $30 + Certificate – First Place project

Ecolab	**Water Vision Award** $700 + certificate – First Place high school project $700 + certificate – First Place middle school project **Ecolab Food Safety Award** $700 + certificate – First Place high school project $700 + certificate – First Place middle school project
Emerson Women's Impact Network	**Female in STEM Excellence Award** $200 - First Place high school project $200 - First Place middle school project
Good Chemistry	**Good Chemistry Prize for Creativity** Perfume kit + framed certificate - First Place middle school project
Googol Bike Project	**STEM the Stigmas Award** $500 – Up to 6 projects
Institute of Food Technologists, Minnesota Section	**Institute of Technologists Food Scientists Award** $200 - First Place high school $150 - Second Place high school $200 - First Place middle school $150 - Second Place middle school
Land O' Lakes	**Land O'Lakes Award for Food Innovation** $500 – 2 high school projects $500 – 2 middle school projects
Lemelson Foundation	**Lemelson Early Inventor Award** $100 – First Place middle school project

Minnesota Environmental Health Association (MEHA)	**MEHA Award for Excellence in Environmental Health Science** $200 – First Place high school $100 – Second Place high school $50 – Third Place high school $100 – First Place middle school $50 – Second Place middle school
Minnesota Women in STEM chapter at Abbott	**The Female in STEM Excellence Award** $100 - First Place project from a female high school student $100 - First Place project from a female middle school student
Mortenson Environmental	**Mortenson Environmental Excellence Award** Certificate + fossil or geological specimen - 3 projects
Mu Alpha Theta	**Mu Alpha Theta Award** Certificate - First place project
NASA	**Earth Systems Science Award** Certificate – First place high school project
NOAA	**Taking the Pulse of the Planet Award** Certificate + medal – First place high school project
Regeneron	**Regeneron Biomedical Science Award** $500 + certificate – First place high school project
Ricoh	**Ricoh Sustainable Development Award** Certificate - First place project
Science Museum of Minnesota	**Science Museum of Minnesota Science Communication Award** 1-year Museum Membership – 3 high school projects 1-year Museum Membership – 3 middle school projects

Seagate Technology	**Seagate Excellence in Science Mentoring Award** $1,000 + Trophy + Hard drive + $1,000 for research program – 1 Teacher w/ 1-10 yrs experience promoting science education $1,000 + Trophy + Hard drive + $1,000 for research program – 1 Teacher w/ 11+ yrs experience promoting science education **Seagate Rising Star Award** $2,000 + Trophy + Hard drive – First Place high school project $1,500 + Trophy + Hard drive – First Place middle school project **Seagate Emerging Scientist Award** Trophy – Top 10% of First-Year Students
Society for In Vitro Biology	**Outstanding Achievement for Ability and Creativity in In Vitro Biology** Certificate - First Place high school project
Society for Science & National Geographic Society	**That's Geography! – Cultivating Empathy for the Earth Award** $100 + certificate - First Place high school project
U.S. Air Force	**Air Force Achievement Award** Framed certificate - First Place high school project
U.S. Metric Association	**Best Use of the International System of Units** Certificate – First place project
U.S. Navy	**Naval Science Award** $75 + medal + certificate – 3 high school students Certificate + medal – 3 middle school students
Water Environment Federation	**Stockholm Junior Water Prize** Certificate + state competition entry - 3 Projects
Yale Science & Engineering Association, Inc.	**Most Outstanding Exhibit in Computer Science, Engineering, Physics, or Chemistry** Certificate + medallion – First place high school project

Middle School Projects by Category

Animal Sciences

MS-ANIM-040	Aidan Moeller	The amount of Calcium in Poultry Eggs
MS-ANIM-058	Mary Watson and Kate Anderson	Sunscreen vs. aquatic life
MS-ANIM-094	Aubrie Bothma	Taste Test for Fido
MS-ANIM-130	Henry Lenz	Dogs-Does Color Matter
MS-ANIM-131	Aiden Korby	Busy Beaver: What effect does a homemade beaver poplar tree repellent have on if there is beaver evidence on the side of the tree?
MS-ANIM-132	Kayla Covington	Dogs home alone behavior
MS-ANIM-203	Shreya Sekar	Turtle Tracks: Characterizing and quantifying the relationship between habitat, environmental, temporal, and climate data with turtle sightings
MS-ANIM-204	Isabella Blanco-Abundez	A Reply From Your Dog
MS-ANIM-205	Gabriel Zhina	What Are Cat's Favorite Food?
MS-ANIM-291	Ronny Hustvedt	How Long a leech will survive with different water additives
MS-ANIM-292	Ainsley Mick	Saddle Pad Science

Biochemistry

MS-BCHM-096	Clara Sherwood & Hannah Quinn	The Eggcellent Experiment
MS-BCHM-206	Rebecca Cronin	Candy Chromatography: Skittles vs MMs
MS-BCHM-207	Mery Gomez	What Would the Bacteria Rhizobium Leguminosarum do to a Plant?
MS-BCHM-293	MaKenzie Hochhalter	Drug solubility

Behavioral and Social Sciences

MS-BEHA-059	Karthik Anand	COVID-Apathy: How has lifestyle affected mental health during the pandemic?
MS-BEHA-062	Izzy Fohrman, Maysen Pettengill & Hannah Benetti	BEHA: sight vs taste

MS-BEHA-063	Tej Bhagra	Money Matters: Knowledge, Attitudes Practices among middle and high school students
MS-BEHA-064	Sarah Dingli	Happiness in middle school students in the time of the COVID-19 pandemic
MS-BEHA-065	Jack Wagner	How does color and color intensity affect the way we interpret taste in our drinks
MS-BEHA-097	Aaron McMullen	Prospect Theory and Its Application to Students
MS-BEHA-133	Ethan Lavan	Effects of the Pandemic/Food Supply Chain, City Populations, and time on Minnesota Urban Chicken Keeping
MS-BEHA-134	Amaija Halli	Mental Health: What effect has Covid 19 had on middle school students mental health
MS-BEHA-135	Jordan Linder	What effect does age have on a person's sexual orientation decisions?
MS-BEHA-136	Amaya Bazan	Covid Effect: What effect does the pandemic and a person's ethnicity have on their Mental Health
MS-BEHA-174	Mary Jensen	How Does Music With Different Tempos Affect Our Ability To Recall Information?
MS-BEHA-175	Amelia Seuntjens	The Effect of Screen Time on Overall Academic Performance
MS-BEHA-176	Margaret Bergeron	Can people tell the difference between gluten-free and non-gluten-free foods?
MS-BEHA-177	Jane Laurey	How Accurate are Eyewitnesses at Identifying a Suspect?
MS-BEHA-208	Mason Leonard-Gorrill	Placebo Effect: Does It Work In Food
MS-BEHA-209	Ellie Braun	Follow the Leader!
MS-BEHA-210	Lalaine Acosta-Sanchez	Can You Guess Handedness Based on Handwriting?
MS-BEHA-294	Adelaide Stern	How Does Art Effect/Lower Levels of Stress in People Ages 10-16?
MS-BEHA-295	Sanjana Kollipara	Malleable Memory: Studying the role of false memory, demographics, and suggestion in witness testimony
MS-BEHA-297	Gabriella Sofia Olson	The Nonexistent Word
MS-BEHA-354	Emma-Jane Kirk	Positive or Negative Reinforcement
MS-BEHA-367	Emmie Dammen	How Does Color Affect Memory?

Biomedical and Health Sciences

MS-BMED-072	Zachary Moos	Sports Drinks and electrolytes
MS-BMED-073	Dylan A. Murphy	The brain and motion aftereffect
MS-BMED-074	Ella Brinkman	Lung Capacity and Aging
MS-BMED-098	Ella Orstad	Lung Capacity
MS-BMED-152	Nancy Perrin	What effect does sugar intake have on adolescent mental health?
MS-BMED-211	Riddhi P Singhvi	Development of Artificial Pancreas Model to Optimize Insulin Dosage
MS-BMED-298	Zakaria Salaymeh	Which Beverage Causes The Most Tooth Decay To Tooth Enamel?

Computational Biology and Bioinformatics

MS-CBIO-075	Rathan Duggirala	Determining the Precision and Accuracy of Various Colony Counting Apps

Cellular and Molecular Biology

MS-CELL-067	Srinidhi Babu	Hand Sanitizer Everywhere, Do They Work The Same?; How Much Hand Sanitizer You Need To Kill The Germs
MS-CELL-069	Samuel Razildo & Carson Herr	Alcohol's Effect on Cells
MS-CELL-070	Namik Babayev	DNA extracted from orange juice sold in stores as compared to at-home freshly squeezed juice
MS-CELL-071	Zoe Zhang	The Effect of Activated Sirt-1in Zebrafish Embryos Using Resveratrol

Chemistry

MS-CHEM-025	Asher O’Brien	Which common deicer melts snow the fastest?
MS-CHEM-099	Dawson Colden	Jello-tastic
MS-CHEM-140	Josephine Nephew & Emma Morton	How Fast Do Lion Mints Dissolve In Different Liquids
MS-CHEM-141	William Watson	Colorful Candy Chromatography
MS-CHEM-142	Peyton Werner	Baking powder vs. baking soda
MS-CHEM-178	Cece Hennis	Which Vegetable Has the Highest Level of Chlorophyll
MS-CHEM-212	Olivia Hamann	How Clean is Clean?
MS-CHEM-213	Christopher Martinez	Water Temperature vs Dirty Wool
MS-CHEM-214	Crystal Salgado	Frozen In Time!

	Quiroz	
MS-CHEM-296	Tom Marsalek	Brownie Bonanza
MS-CHEM-299	Edwin Lam	Corrosion Explosion
MS-CHEM-300	Makena Mbuba	Bubble Trouble: How potassium iodide affects the height, strength, and speed it takes foam to rise
MS-CHEM-301	Milkahlyne Muriithi	Dessert Density
MS-CHEM-302	Zabida Ahmed	Rose's are Red different colors too, but how do you find the Rf value? (Color of roses vs Rf value)
MS-CHEM-303	Indira Sivaraj	Sneaky Solutes: Can we trap them?
MS-CHEM-305	Hannah Arika & Katelyn Gregory	Flaming Hot Fuels
MS-CHEM-306	Shiaflyn Cooper	Balloons Go Kaboom; How Vinegar Impacts a Ballons Inflation Time
MS-CHEM-307	Mardhav Shriram	Radical Rockets
MS-CHEM-308	Emilyn Bosch	Fat Swap; The Effects Of Different Fats On The Temperature And Spread Of A Cookie
MS-CHEM-309	Cristian Andres Olson	The Secret to Creamy, Tasty Ice Cream: Stabilizers
MS-CHEM-310	Mya Nelson	Ice, Ice, Baby
MS-CHEM-311	Julia Klein	Baking to a new height
MS-CHEM-312	Sema Asan	A CHANGE In Water
MS-CHEM-313	Hailey Flynn	Skittles VS H.2.O
MS-CHEM-314	Ava Kallunki	The Sweet Reward of Baking: How Flour Type Impacts the Density of a Cupcake
MS-CHEM-315	Kaitlyn	The Impact of Gluten Free Flours on Vanilla Cupcakes
MS-CHEM-316	Cohen Emmick	Picking the Pepper: The Effects of Ripeness on Vitamin C in Bell Peppers
MS-CHEM-317	Carsten Bruin	When Will It Melt
MS-CHEM-366	Erica Beckman	Super Suds!
MS-CHEM-370	Payten Aehlert	Safe Solutions for Cleaning Coins
MS-CHEM-373	Annabelle Simoneau	Which Soap Cuts Grease the Best
MS-CHEM-382	Abby Fisher	Flour Power

Earth and Environmental Sciences

MS-EAEV-013	Liam Beyer	Hydroponic V.S. Soil Growth
MS-EAEV-024	Rohan Sharma	Magnifying Ultra Violet Radiation- The invisible frontier
MS-EAEV-076	Lauren Arnold	Measuring humidity with a hair hygrometer
MS-EAEV-077	Gavin Buhrow	How do the conditions of an environment effect how many fish you catch?
MS-EAEV-100	Izabel Isaacson	How Do Oil Spills affect birds?
MS-EAEV-144	Makenzie Little & Emilia Swenson	How Does Soil Change the pH of H20?
MS-EAEV-147	Emilia Nephew	What Materials Best Filter Dirty Water?
MS-EAEV-151	Justine Anderson & Kieriahna Goodin	Let It Snow
MS-EAEV-179	Ellen Kovats	How Does the Building Material Affect Urban Heating
MS-EAEV-180	Maggie Hughes	How does Ocean Acidification Affect Coral Bleaching?
MS-EAEV-318	Amelia Leither	What's Poppin'? How Temperature Affects Popping Mass
MS-EAEV-319	Avery Lucille Mros	Fertilizer Frenzy: How Fertilizer Amounts Effects Water Quality
MS-EAEV-320	Sadie Hoekstra	Tenebrio Moliter's Metamorphosis: The Effect of Temperature on Mealworms Metamorphosis
MS-EAEV-321	Adeenah Fahim	Effect of different water types on plant growth at different stages
MS-EAEV-357	Jake Pellowski	Saving The Ocean
MS-EAEV-375	Jaxson Greshik	How safe is your drinking water?

Energy: Sustainable Materials Design

MS-EGSD-101	Adam Jacobson	HYDROGEN is #1 Periodically Leaves no Carbon Behind
MS-EGSD-106	Jacob Brunn & Drew Skorczowski	Which Saves More Money? LED, Fluorescent, or Incandescent
MS-EGSD-145	Matthew Mangan	Geodesic Domes
MS-EGSD-181	Kayden Greeley	What Beverage Will Conduct The Most Amount of Electricity?
MS-EGSD-322	Ayeza Moheet	Manufacturing and Testing Environmentally Friendly Packaging Materials

MS-EGSD-371	Logan Ballard	Battle of the Batteries

Biomedical Engineering

MS-ENBM-324	Alex Ebert	Getting a Grip! How Weight and Shape Affect the Time a D.I.Y. Prosthetic Hand can Hold it

Environmental Engineering

MS-ENEV-215	John Liu	The Use of Controlled-releasing Technology in Winter Deicing to Reduce Salt Contamination in Minnesota Water
MS-ENEV-325	Shagun Shrivastava	100% Biodegradable Plastics!!! Is it true? (Year 2)
MS-ENEV-326	Liiban Abdi	Solar-Powered Water Desalination
MS-ENEV-327	Sadie Vietzen	Making Paper New: The Impact of Different Ratios of Paper to Plastic on Recycled Paper

Engineering Technology: Statics and Dynamics

MS-ETSD-012	Coby Guenther, Carson Mensink, & Noah Pieper	Self Stirring Mug
MS-ETSD-017	Brianna Foley & Peyton Demuth	Skate sharpener
MS-ETSD-078	Ivianna Duquaine	Is it Ripe Yet? Designing a Smart Circuit to Sort Produce
MS-ETSD-080	Benjamin Espy & Dylan Rudzik	What wing produces the most lift and least drag
MS-ETSD-104	Clarabelle Haddix	Lighten Your Load
MS-ETSD-146	Niklas Lehto	What effect does the design of a robot have on how long it takes to travel 100 centimeters?
MS-ETSD-161	Alex Swenson	Magnetic Levitation Train Science Project (Alex Swenson)
MS-ETSD-182	Tetsu Matsumoto	What Type of Winglet Creates the Most Lift?
MS-ETSD-183	Josie Lee	Which Formula 1 Rear Wing Has the Lowest Level of Downforce.
MS-ETSD-184	Lynne Hu	What Effect Does Anti-Slip Material Have On Preventing Tools From Falling?
MS-ETSD-328	Molly Wesolowski	Pennies on a boat: Boat Wreck- Different Structured Tinfoil Boats and Maximum Pennies Supported
MS-ETSD-329	Blake Curti	I Can't Hold It!

MS-ETSD-331	Jack Bauer & Beck Cleaveland	Aerial Ace

Mathematics

MS-MATH-216	Daniel Song	Stock Price Movement Prediction Based on Multi-stage Financial Models and Cross-period Comparison

Materials Science

MS-MATS-103	Reagan Lattimore & Austin Pellinen	Racquet Ball Air Cannon
MS-MATS-107	Tyler Miller	Glass Melting 101
MS-MATS-148	Eva Morgan	Handy Hand Warmers
MS-MATS-149	Tobias Schunk	Wood Burn
MS-MATS-185	Kathleen Dobie	How Hand Warmer Fillings Affect How Long They Retain Heat
MS-MATS-332	Katherine Zylstra	Humpty Dumpty had a Great Fall: The Effects of Packing Material on Shipping Products
MS-MATS-347	Alexander Batham	How Does Temperature Affect Quality?
MS-MATS-358	Adam Biebighauser	Plane Paper: The Effects of Paper Weight on Paper Airplane Flight Distance
MS-MATS-381	Kellen Groth	What Insulation Retains Heat The Best

Microbiology

MS-MCRO-019	Julia Fahl & Chika Nwakama	Science Behind Bacteria in our Cleaning Products
MS-MCRO-109	Elsa Schiller & Maryn Bergstrand	Fruit Decomposition
MS-MCRO-153	McKenna Gandhi	How does using scented/colored soap or hand sanitizer effect hygiene?
MS-MCRO-186	Bryn McSherry	What Time are the Desks and Chairs at School at their Dirtiest

Physics and Astronomy

MS-PHYS-008	Sara Reza	Energy of Emissions From Celestial Objects
MS-PHYS-081	Reva Patel	The Effect of Temperature on Tennis Ball Bounce Height
MS-PHYS-082	Bergen Jacob	Tennis at Temperature: but this time, there's tension so adjust your altitude

MS-PHYS-154	Emmi Seafolk	Across the sea of space the stars are other suns: What effect does age and gender have on knowledge about space?
MS-PHYS-155	Isaiah Langer	"A bad day skiing beats a good day at work" What effect does the type of ski wax have on how fast a ski goes down a hill?
MS-PHYS-156	Trevor Zaitz	How Much Height to Loop the Loop?
MS-PHYS-157	Avery Buschman	Does spinning with your arms extended out or pulled in affect the number of revolutions in your spin?
MS-PHYS-218	Logan Kretz	How does temperature affect the strength of a magnet and its magnetic field
MS-PHYS-333	Shayan Rahman	Cleats Beats: How Different Shoes Impact the Distance of a Ball
MS-PHYS-334	Amina Zahid	Hyperloop 2.0
MS-PHYS-335	Colton Hoffman	Grinding Gears
MS-PHYS-337	Scarlett Hough & Kiaya Mirkut	Tea Bag Rockets

Plant Sciences

MS-PLNT-083	Quinn M. Williams	Which Type of Pesticide Affects Vegetation the Most
MS-PLNT-084	Elise Weingarten	Tapping into Sweet Sap Success
MS-PLNT-086	Ava Hart & Sylvia Thompson-Jewell	How music affects the growth of plants?
MS-PLNT-158	Tuuli Koivisto	How Does Java Moss Effect Water Quality
MS-PLNT-159	Parker Sickmann	More sustainable than soil? Comparing deep water hydroponics to traditional soil for food production
MS-PLNT-219	Ethan Finch	How Do Daily Temperatures Affect Sap Production in Maple Trees?
MS-PLNT-338	Sophie Ertel	Food For Fertilizer: You Can Use Composted Fertilizer To Enhance Plant Growth
MS-PLNT-340	Aidan Kavanaugh & Bradan Kavanaugh	Phosphorescence of the Sea
MS-PLNT-341	Veda Rao	Organic or Not?
MS-PLNT-342	Josie Lee Dederichs	Its Grow Time: The effect ribosomal bacteria has on plant growth rates
MS-PLNT-343	Daniel Beekman	The Relationship Between Beans and Gas: The Effects of CO_2 on Plant Growth

MS-PLNT-359	Alexis Scheid	Rock n’ Grow
MS-PLNT-364	Jack Willman	Enlighten Me (The Effects of Different LED Colors on the Growth Rate of Lettuce)
MS-PLNT-369	Jacob Moore	Which Color of Corn Germinates the Best?

Robotics and Intelligent Machines

MS-ROBO-088	Michael McCright & Timothy Schroeder	Detecting potential cyberbullying using keywords
MS-ROBO-344	Saif Elkhateeb	Building an Edge and Light Detecting Robot

Translational Medical Science

MS-TMED-345	Milan Darji	There’s Not An App For That! A Novel Clinical Assessment Tool To Predict Heart Failure Patient Outcomes
MS-TMED-346	Hadley Gott	Best Mask

High School Projects by Category

Animal Sciences

HS-ANIM-028	Caleb Smith	Harms and benefits of oral sucrose provided to reduce domestic rabbit’s distress during needle prick procedures: Random Controlled Trial
HS-ANIM-039	Julia Carlson	Healthy Herefords: Study of Ideal Cow Age for Birth Weight
HS-ANIM-113	Harmony Tracy	Tough Turkeys Year 2: What habitat types do turkeys now associate with in Northeast Minnesota?
HS-ANIM-163	Nina Chafee	The Effect of Adolescent Temperature Variation on Development and Adult Performance in V. cardui

Biochemistry

HS-BCHM-009	Josiah Butler	Synthesizing Ethanol from Recycled Cardboard Sludge using a Cellulase Enzyme Blend and Yeast
HS-BCHM-042	Katelin Flack	The Importance of Disposing Yard Waste Properly
HS-BCHM-089	Hannah Johnshoy	A Study on Hide Preservation
HS-BCHM-120	Emily Sapyta	The use of different concentrations of tannic acid and Micrococcus luteus on the bioremediation of motor oil contaminated aquatic systems
HS-BCHM-220	Romy Peterson	Don’t Forget About Caspase-2: Analyzing the Binding Site Specificity of a Protein Linked to Alzheimer’s Disease

Behavioral and Social Sciences

HS-BEHA-007	Seungmin Han	Investigating the Psychological Determinants of Efficient Behavioral Changes by Community Members to Pursue a Common Interest Using the Drosophila Model
HS-BEHA-045	Nandini Iyer	Stressed Out! How does COVID news affect stress levels?
HS-BEHA-114	Stella Harbson	Does Awareness of Misleading Questions Reduce Memory Inaccuracy?
HS-BEHA-116	John McEachran	How does music affect your solve times on a Rubik's Cube

HS-BEHA-119	Lucia Nelson	Study Notes: How Music Affects Learning
HS-BEHA-164	Per Johnson	The Effects of Temperature on Learning Complex Tasks in Red Harvester Ants
HS-BEHA-165	Kishori Patel	The Effect of the Amount of Beef Food Source and Exposure Time on Calliphora vomitoria Pupation
HS-BEHA-166	Spencer Burris-Brown	Assessing the Influence of Personality on Active and Passive Procrastination among Adolescents
HS-BEHA-187	Emma Boys	Gender Differences and the Stroop Effect
HS-BEHA-222	Sarah Feng & Sydney McDaniel	Finding Functionality: A Rasch Analysis of a Body Functionality Appreciation Scale
HS-BEHA-223	Chloe Chu	Learning Lizards Assessing the Impact of Human Socialization on Behaviors of Varanus Acanthurus
HS-BEHA-225	Ziyi (Rick) Qian	Defeating Dyslexia: A robust meta-analysis of the relationship between hearing and Dyslexia to achieve early diagnosis and treatment
HS-BEHA-362	Ben Bjerke	Reading Between The Lines

Biomedical and Health Sciences

HS-BMED-043	Megan Lawver	Does gender affect reaction time
HS-BMED-044	Bobbie Krause	What Brand of Toothpaste Cleans Staining Best?
HS-BMED-048	Christine Song	Cure of Breast Cancer - Year 5: A Novel Approach to Treating Hormonal Breast Cancer using Diabetes Medication through Clinical Database and 3D ex vivo Model
HS-BMED-050	Albert Hu & Felix Lu	Investigating the Effect of Human Perspiration on the Deterioration of Single Use Masks
HS-BMED-051	Jeffrey Wang	Automatic Classification of Peripheral Neutrophils on Digital Images Analyzed by Artificial Intelligence
HS-BMED-128	Johanna Bernu	Disinfectant Properties of Nuphar advena: An Ethno-pharmaceutical Approach
HS-BMED-189	Eithne Onsinyo & Abdi Ekal	Measuring Calories in Snack Foods

HS-BMED-190	Nawal Warfa	Comparison of Fat Between Non-Organic and Organic Foods
HS-BMED-191	Rahul Balaji	Breaking News: There is more than one way to break the back! Characterizing and quantifying the effects of two models of the intervertebral disc for the purpose of successfully treating lower back pain
HS-BMED-192	Karen Nakamura	The Electromyographic Evaluation of the Bilateral Muscle Asymmetry of the Latissimus Dorsi in Martial Arts and the Effect of Real-Time Biofeedback on Technique Improvement
HS-BMED-193	Coolsjes Singhvi	Modeling of Blood Glucose to Optimize Diet and Exercise for Type 2 Diabetes Management
HS-BMED-229	Ayres Warren & Mina Adabag	Piecing the Heart Together: Optimizing Procedures to Identify Cell Types in Murine Cardiac Tissue
HS-BMED-230	Isabelle Stroh	Using Artificial Intelligence to Detect and Localize Brain Tumors
HS-BMED-231	Julia Terrell	Efficacy of bacteriophage therapy on E. coli caused urinary tract infections during the perinatal period
HS-BMED-232	Ava Chen	A new potential antidepressant? The effects of L-tryptophan on serotonin levels, behavior, and alcohol aversion in Faxonius virilis model organisms
HS-BMED-234	Zahraa Mansoor	The Link Between Hearing Loss and Alzheimer's Disease in Elderly Patients
HS-BMED-236	Muminah Mohammed & Noor Omar	Hidden Hunger
HS-BMED-238	Aayush Goud & Ella Alexander	DBS Discovery: A multifaceted approach to Deep Brain Stimulation with new advances in neurosurgical testing equipment and synchronization of alpha and beta bands for postural instability in Parkinsonian patients
HS-BMED-239	Adhvaith Sridhar	Immune System Innovation: Ushering in a new era of immunology research by characterizing cell populations most impacted by normal microbial exposure for preclinical research and healthcare treatment development success
HS-BMED-240	Srijani Datta	Sepsis Survivor: Characterizing muscle stem cells using RNA sequencing from a murine surgical model of sepsis for the purpose of preventing sepsis-associated muscle wasting
HS-BMED-350	Eric Yang	Does “The Fluoride Treatment” Prevent Sugar Decay

HS-BMED-368	Audrey Tumberg	Study of Biofilm Prevention with Antibiotic and Organic Substances
HS-BMED-374	Courtney Frohling	Study of Aerobic Bacteria Growth on Bed Sheets
HS-BMED-376	Madilyn Johnson	Nice to MEAT you! A Study on Bacterial Survival Inside and Outside of Meat at Different Temperatures
HS-BMED-377	Angelina Nicholas & Katrina Roberts	An Analysis on the Impacts of Antibiotics on Synbiotics

Computational Biology and Bioinformatics

HS-CBIO-052	Margaret Hu	Identifying Breast Cancer Cell Surfaceome Mutations as Potential B-cell Targets
HS-CBIO-194	Srinath Hariharan	Tumor targeting: Utilizing spatial data science techniques to decode the enigmatic immune response with the goal of informing further efforts to develop immunotherapies for tumor treatment
HS-CBIO-242	Aedin Yu & Mohit Agarwal	A two-part approach and implementation of early-stage skin cancer diagnosis using a novel dense convolutional neural network (CNN) architecture and affordable computing hardware
HS-CBIO-272	Scott Sorensen	Manipulating Dissolved Gas Content in Computer Simulations of Acoustic Cavitation

Cellular and Molecular Biology

HS-CELL-046	Isha Kapoor	Overcoming melphalan resistance in the treatment of multiple myeloma
HS-CELL-243	William Anderson	Using decellularized grapes to grow yeast
HS-CELL-244	Jack Wherry	Prediction of anterior/posterior polarity in planaria through bioelectrical signals
HS-CELL-245	Claire Huang	Creating induced pluripotent stem cells by reprogramming CD34+ cells through episomal gene insertion
HS-CELL-246	Sana Ikramuddin	Inhibition of Senescent Associated Phenotype Secretion using Lithocholic Acid in 3T3-L1 Preadipocyte cells
HS-CELL-247	Abby Hoekstra	Effects of sea cucumber glucocerebrosidase on amyloid-beta gene

HS-CELL-248	Alexandra Wagner	INS-1 Rattus norvegicus cells and gene expression in response to Cinnamomum zeylancium
HS-CELL-352	Willa Krase	The Effect of Iron on Carbon Dioxide Consumption in Algae: Could Iron be the solution to global warming?

Chemistry

HS-CHEM-032	Katelynn Marquardt	It's Salty: A Comparison of Sodium Chloride and Potassium Chloride
HS-CHEM-041	Chloe Sargent	Effect of Baking Soda on Cookies
HS-CHEM-121	Morgan Houle	What chemicals burn different colors and how long do they burn
HS-CHEM-123	Daniel Dutcher	What Is The Most Effective Salt Mixture In A Salt Water Battery
HS-CHEM-195	Cady Pagel	Gluten-Free or Gluten Debris: Prolamin and Glutelin Levels in Oat Flours
HS-CHEM-351	Elizabeth Grace Smith	You Freeze, I Freeze, We all Freeze for Ice Cream
HS-CHEM-360	Ellie Rogness	Energy Burnout
HS-CHEM-365	Jaxon Bain	Sn2 vs. E2: The Effects of Temperature

Earth and Environmental Sciences

HS-EAEV-021	Jack Gootzeit	Organic Acids with Standard Road Salts: An Eco-friendly Solution
HS-EAEV-029	Grace Moeller	The Effects of Natural and Artificial Dyes on Water Quality
HS-EAEV-033	Charlotte Slama	Filtrating 101
HS-EAEV-053	Nick Baker	The effects of CuSO4 5H2O contamination on freshwater copepods
HS-EAEV-054	Annika Bartucz	Reducing Freshwater Acidification
HS-EAEV-092	Paige Jacobson	The More we work together, the GREENER our world will be!
HS-EAEV-124	Emelyn Beaster	Quantitative analysis of the effects of climate change on wildfire occurrence and severity in NEMN
HS-EAEV-125	Emaleigh Olesiak	Air Air Everywhere

HS-EAEV-126	Rowan Rock	The Use of Mealworm Microbes to Isolate and Identify Bacteria that can Biodegrade Polystyrene
HS-EAEV-127	Grace Lavan	Effects of the Line 3 Pipeline on Gray Wolves (Canis lupus) on the Fond du Lac Reservation
HS-EAEV-167	Cooper Danielson	The Effect of Varying Concentrations of Miracle-gro fertilizer on Composting Earthworm Ecosystems
HS-EAEV-168	Linnea Cooley	Effect of Ethanol and Octocrylene on the Cell Growth and Chlorophyll-a Levels of Cyclotella meneghiniana
HS-EAEV-197	Sneha Sureshkumar & Sriram Sureshkumar	The Detrimental Impacts of a Tilling Based Agricultural System.
HS-EAEV-249	Grace Kaung	Creating chitosan hydrogels to promote phytoplankton growth and accelerate carbon sequestration
HS-EAEV-250	Nicole Haraway	The impacts of chemicals found in plastics having Estrogenic Activity on the synthesization of vitellogenin protein in mussels
HS-EAEV-251	Roxy Neset	Agriculture in the Big City: Studying the effectiveness of soil treatments on weed growth
HS-EAEV-348	Evan Knoll	The Phytoremediation of Brine Contaminated Soil: Phase IV: An In-Depth Analysis of the Effects of Phytoremediation Using Hordeum vulgare and Secale cereale
HS-EAEV-353	Isabella Wimmer	The Study of Coliform and Biological Oxygen Demand Levels in Rivers Comparing Urban and Agricultural Land Use
HS-EAEV-361	Mari Pulver	Study of the Affects of a Ring Billed Gull Colony on the Aquatic Ecosystem
HS-EAEV-363	Nicholas Swanson	An Investigation of the Effect of Crude Oil on Freshwater Organisms.
HS-EAEV-379	Onalee Shogren	Can't Handle the Heat

Embedded Systems

HS-EBED-198	Nickolas Zander	Automated Sorting Device Using Sensors and Motor Control

HS-EBED-252	Alia Peterson	Designing and building a technologically enhanced toy
HS-EBED-253	Shreshth Shrivastava	Wi-C.A.R.E: Wifi Computer-Assisted Remote Eldercare (Year 3)

Energy: Sustainable Materials Design

HS-EGSD-034	Madison Anderson & Oliva Noble	Ice, Ice, Baby. A Study of Insulated Waterers
HS-EGSD-037	Max Magnus	Finding the Best V.A.W.T.
HS-EGSD-169	Maggie Banks	A Plant With Promise: Using Engineering Principles to Create an Eco-Friendly Manufacturing Process for a Biodegradable Piezoelectric Transducer

Environmental Engineering

HS-ENEV-199	Gabriel Cordova Gonzalez	Keeping Your Cool
HS-ENEV-200	Ellen Guo	Novel Cellulose Carbon Fiber Based Biofilm for Airborne VOC Filtration
HS-ENEV-254	Kyla Fung	Sustainable Bioplastics: Seaweed and Hemp-based Alternatives to Fossil Fuel-based Plastics
HS-ENEV-255	Ivars Emerson	A collapsible reusable cooler for eco-friendly shipping of cold medications

Engineering Technology: Statics and Dynamics

HS-ETSD-055	Tanmay Iyer	Improving the Efficiency of Home Hot Water Circulation
HS-ETSD-170	Will Sedo	Optimizing Waterflow in a Simulated River Environment
HS-ETSD-257	Amira Sinclair & Trisha Samba	Water You Risking? Developing a Novel Maze to Assess the Effects of Thirst. on Risk-Taking Behavior in Mice
HS-ETSD-258	Nathan Walsh	Everything you 'Kneed': Development of an adjustable, above-knee prosthetic capable of performing multiple activities
HS-ETSD-259	Noah Anderson	Development of remotely operated underwater vehicle to aid in exploration and mapping of underwater cave systems
HS-ETSD-260	Billal Saidi	Engineering a Cost-Effective Ventilator

HS-ETSD-261	Valerie Nelson	Effects of Chamber Shape on Movement of Accordion Soft Actuators and Implementation in Artificial Hands

Mathematics

HS-MATH-224	Leon Luo	Does ESG investing affect international capital flows? Evidence from statistical and machine learning methods
HS-MATH-262	April Wang	Predicting COVID-19 cases through high-dimensional data analysis

Materials Science

HS-MATS-023	Tyler Kranz	Shaded Window Blinds: Do They Affect Room Temperature?
HS-MATS-030	Mitchel Masters	How does the design of wind turbine affect its power output
HS-MATS-171	Benjamin Chen	Recycled Plastic for Resilient Infrastructure
HS-MATS-264	Kendall White & Sarah Peterson	Knots or Not? Using electricity to study DNA entanglements in nanochannels
HS-MATS-265	Madison Andrews	Safe Food: Analyzing the function of a portable incubator for E. coli powered by electrothermal films
HS-MATS-266	Nick Carver	The potential application of Nitinol's shape memory properties for use in internal muscle repair
HS-MATS-267	Jared Geppert	3D Printing Layer Angles

Microbiology

HS-MCRO-047	Danielle Wang	The Identification of Long-COVID Prognostic Biomarkers via Upper Respiratory Microbiome Genome
HS-MCRO-201	Sigrid Davidson	Effect of Salinity Instabilities on Halobacterium Versus Escherichia coli
HS-MCRO-202	Caroline Schlehuber	New Research, Old Medicine: Exploring Antibacterial Properties of Plants and Fungi Used in Indigenous Medicine
HS-MCRO-233	Elizabeth Levinshteyn	A Look Into the TINY Earth: Finding Antibiotic Producing Bacteria in Yellowstone Soil
HS-MCRO-268	Calais Michaelsson	Re-sensitization of E. Coli to tetracycline using plant-derived efflux pump inhibitors

HS-MCRO-269	Ethan Chen	Examination of various essential oils on Candida albicans model organism growth as an indicator of anti-dandruff properties on Malassezia
HS-MCRO-270	Jackson Jaffe	Effects of far-UVC radiation (wavelength 222nm) on pathogens and mammalian cells
HS-MCRO-271	Quinn Goergen	Finding Growth of Mycelia and Decomposition of Pesticides in Soil
HS-MCRO-273	Yousef Eldahshoury	Cyanobacteria Aid In Plant Growth In Martian Soil

Physics and Astronomy

HS-PHYS-038	Destiny Alberty	How is Sound Intensity Affected by Distance
HS-PHYS-129	Ethan Perrotti	Do Sweet Potatoes Fly Farther Than Russet Potatoes
HS-PHYS-378	Jonha Bieger	Testing the effect of Various Mixture Ratios on Rocket Impulse

Plant Sciences

HS-PLNT-022	Nathan Klitzke	Scott's fertilizer vs. Miracle grow
HS-PLNT-091	Emily Ericson & Keira Trest	The Dirt-y Truth
HS-PLNT-093	Isaac Mauch	Studying The Practicality of Biofilms Use in Agriculture
HS-PLNT-274	Katriana Trinh	Effects of silica Nanoparticles to mitigate abiotic stress
HS-PLNT-275	Maxwell Maveus	Sporophytic abortion rates under desiccation stress and the potential of sporophytic autonomy in the mosses Leucobryum glaucum and Bryum caespiticium
HS-PLNT-277	Quinn Hughes & Tyler Clair	Using Monte Carlo Simulation to Optimize Vitamin C Production in Brassica oleracea using Abiotic Plant Stress
HS-PLNT-279	Abirami Rajasekaran & Harini Senthilkumar	Secure the Manure: Utilizing sequential fiber methods to assess the effect of manure on forage nutritive value of Medicago Sativa plants
HS-PLNT-349	Grace Finnerty	A Chemical-Free Apple Tree Cultivation Technique

HS-PLNT-355	Benjamin Brand	Impact of Yeast(Saccharomyces cerevisiae) on the Biomass of Wisconsin Fast Plants
HS-PLNT-356	Jordyn Ellis	Respiration and Photosynthesis
HS-PLNT-372	Sophia LeMire	The Capacity of Pea Plants for Associative Learning

Robotics and Intelligent Machines

HS-ROBO-056	Marc Zoghby	Assessing the Impact of Hyperparameter Tuning on the Performance of a Brain Hemorrhage Object Detection Model
HS-ROBO-173	Ruth Mellin & Alexander Moore	Project SERSI: Smartphone Enabled Robotic Sign-Language Interpreter
HS-ROBO-280	Tristan Green	The use of machine learning to identify leukemia cells in patients
HS-ROBO-281	Merlin Morton	Using Machine Learning to Improve the Accuracy of GPS by Reducing the Impact of Multipath and Other Sources of Error
HS-ROBO-282	Ross Volkov	Diagnosing Parkinson's disease with machine learning voice analysis
HS-ROBO-283	Krish Inba Rajashankar	Medical device recall prediction using MAUDE reports
HS-ROBO-284	Stavya Arora	Overcoming Opioids: Analyzing, characterizing, and quantifying the sentiment of Reddit posts' tone and language prior to a relapse to allow for early intervention
HS-ROBO-286	Daniel Wang & Peter Xu	Nimble Navigation: Designing and developing an interactive chatbot with natural language processing to assist visually-impaired users to maneuver in outdoor settings with assurance

Systems Software

HS-SOFT-122	Tanner Risley	How easily can your password be hacked
HS-SOFT-287	Amrita Pal	Pollution and Prejudice: Building a computer-based algorithm to assess pollution exposure levels by Asian American subgroup
HS-SOFT-288	Mahmoud Said	Controlling a computer cursor with basic webcam input
HS-SOFT-289	Saloni Somia	Increasing Access to Epinephrine Injectors during Allergic Reactions through a Location Tracking Mobile Application.
HS-SOFT-290	Kiefer Miskiw	Realtime 3D Collaboration

Translational Medical Science

HS-TMED-227	Ava Jaffe & Amrit Menon	Essential Protection: Using UV-sensitive yeast to evaluate essential oils as an alternative to sunscreen

Minnesota State Science & Engineering Fair
Extra Activities

MAS invites you to participate in a few totally optional activities - perhaps something to keep you occupied between workshops or while waiting for the award ceremony to begin? *The decision to participate or not in this contest will have no impact on how your project or presentation is judged and is completely voluntary.*

Visit mnmas.org/ssef-contests for more info and FAQs

In each activity, two entrants will be drawn to win a $25 gift card to Two Photon Art!

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