



# MSEF

Massachusetts Science  
+ Engineering Fair

HIGH SCHOOL FAIR 2024

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## High School Award Winners

For Category Excellence and Special Awards go to page 9

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Scholarship, Summer Program, and Society for Science Sponsored Awards will be posted at

<https://scifair.com/news-opportunities/>

### Sanofi Grand Award

**Jia Anand**

St. Mark's School

*Ginsenoside Ck and RK1 Effects on High Intensity Behavioral  
Patterns of Agression in a Tauopathy Model of Alzheimers  
Disease in Drosophila Melongaster*

### MathWorks First Place Award

**Vishnu Angiras**

**Misha Mishechkin**

Tahanto Regional High

*Impact of Surface Conditions on the Magnus Effect*

### First Place Awards

**Avery Leonard**

St. Mark's School

*The Influence of Ginger Root Extract on Female  
Reproductivity in Caenorhabditis elegans*

**Yanchen Lu**

Groton School

*Design of a Multi-legged Robot with Extraterrestrial Terrain  
Exploration and Sample Retrieval Functions*

**Ananya Mathur**  
**Gianna Nalumansi**  
**Mariyam Patel**

Billerica Memorial High  
School

*Study Smarter not Harder: The Neuropsychology Behind  
Studying Techniques in Correlation to Academic Performance  
of Adolescents*

<b>Timucin Erbas</b>	Acton-Boxborough Regional High	<i>Higher Efficiency Dynamic Rocket Engine Nozzle</i>
<b>Shuhan Luo</b>	Worcester Academy	<i>A Novel Hadronization Model for Charm-Quark</i>
<b>Arnav Chetty</b>	Acton-Boxborough Regional High	<i>Using Clustering Algorithms to Predict Whether Phytochemicals are Cancerous or Anti-Cancerous.</i>
<b>Sophia Caramanica</b>	Massachusetts Academy of Math & Science at WPI	<i>Orthotic Hand Brace to Improve Range of Motion in Patients with Cerebral Palsy</i>
<b>Aaron Hong Aakarsh Tathachar Andrew Wu</b>	Acton-Boxborough Regional High	<i>Filtering Methane from Septic Tanks</i>
<b>Yuze Cai</b>	Concord Academy	<i>SpinTOL: Research and Development of a Highly Efficient UAV</i>
<b>Samhitha Bodangi</b>	Massachusetts Academy of Math & Science at WPI	<i>Analyzing HLA sequences to Predict Organ Rejection and Find Targets for Precise Immunosuppression</i>
<b>Yvangi Jacques</b>	Brockton Public Library	<i>A Sound Approach to Attracting or Repelling Pollinator Insects</i>
<b>Andrea Tang</b>	Newton South High	<i>An Innovative Assessment of the Transgenerational Effects of Extreme Temperatures on Children's Health</i>
<b>Ansh Hiranadani Yujiang Zhu</b>	Westborough High	<i>Using an AI Equipped Drone for Early Detection of Fires</i>

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## Second Place Awards

<b>Allison Liu</b>	Lexington High	<i>Next-Generation Synthetic Receptor Circuits for T-Cell Therapy</i>
<b>Devan Agrawal Simon Farruqui Ching Hei Andre Leung</b>	Milton Academy	<i>Words That Shape the World: A Novel Sentiment Analysis Approach to Quantifying Polarization from U.S. President Rhetoric on Immigration</i>

<b>Husang Lee</b>	Newton South High	<i>Inhibition of Melanin Synthesis and Anti-Inflammatory Effects of a Novel <i>Leuconostoc mesenteroides</i> subsp. Derived Exosomes Separated from <i>Camellia japonica</i> Flower</i>
<b>Nicholas Giza</b>	Massachusetts Academy of Math & Science at WPI	<i>A Novel Water-based Cooling Approach to Increase Solar Panel Efficiency</i>
<b>Srilakshmi Venkatesan</b>	Hopkinton High	<i>An Examination of the Neuromuscular Impact Induced By Hypermagnesemia Hypercalcemia in <i>Caenorhabditis Elegan</i> Mutants: A Translational Genomic Model for Paralytic Drug Testing</i>
<b>Yiming Ding</b>	Berkshire School	<i>Three-Pronged Approach to Investigating the Development of Novel Inhibitors Targeting KRAS G12C in Lung Cancer.</i>
<b>Yuxian Liu</b>	Phillips Academy	<i>A Tensegrity-Based Inchworm-Like Robot for Crawling in Pipes of Varying Diameters and Angles</i>
<b>Alexander Teymurazyan</b>	Wachusett Regional High	<i>The Effects of Storage Conditions on Conductivity and Oxidation of Ti3C2Tx MXene films</i>
<b>Palak Yadav</b>	Massachusetts Academy of Math & Science at WPI	<i>A Novel Deep Learning Pipeline to Noninvasively Detect and Treat Gynecologic Diseases Using MiRNA Expression and In Silico Modeling</i>
<b>Anoushka Nair Dylan Striek</b>	Hopkinton High	<i>A Novel Spectrophotometric Method of Non-Invasive Blood Glucose Monitoring for Type II Diabetes Using Correlated Electrolyte Concentrations</i>
<b>Marko Mano</b>	North Quincy High	<i>Synthesizing and Optimizing Biodegradable Pectin-Manuka Honey Hydrogels for Transcutaneous Electrical Nerve Stimulation (TENS) Therapy and its Applications in Tissue Engineering</i>
<b>Huiyi Wen</b>	Tabor Academy	<i>Sustainable and Cost-Effective Cactus-Inspired Fog Collecting Kirigami</i>
<b>Pranamyia Keshkamat Kaizar Rangwala</b>	Hopkinton High	<i>Autonomous Algal Bloom Control via AI-Regulated Photodynamic Therapy</i>

<b>Anushri Pal</b>	Acton-Boxborough Regional High	<i>Computationally Derived Average Sum of Binding Affinities of Small Molecules Identifies A Potent Inhibitor of SARS-CoV-2, MERS-CoV, and SARS Viral Proteases Validated by in Vitro Assays</i>
<b>Kruthi Gundu</b>	Massachusetts Academy of Math & Science at WPI	<i>Investigating Genetic Variability in Amyotrophic Lateral Sclerosis to Identify Patient-Specific Treatment with Antioxidants</i>
<b>Angad Pannu</b>	Shrewsbury Sr High	<i>Multi-Step Meta-Analysis of Multiple Human Genome-Wide-Association-Studies to Uncover Highest Risk SNPs Associated with Coronary Artery Disease, Type II Diabetes, and Alzheimer's Disease</i>
<b>Haoxuan Liu</b>	Middlesex School	<i>Assessing the Ability of Composite Molecular Sieve and Glass Fiber Material in Adsorbing Volatile Organic Compounds</i>
<b>Aishwaryalakshmi Saravanan</b>	Sharon High	<i>Using Machine Learning to Develop a Novel Method of Drug Discovery for Estrogen Receptor Alpha Targeted Breast Cancer Treatment, Leading to Potential Drug Alternatives</i>
<b>Pranay Kocheta</b>	Lexington High	<i>A Generative Multimodal Approach to Improve Detection of Lung Cancer</i>
<b>Charuvi Singh</b>	Massachusetts Academy of Math & Science at WPI	<i>Determining the effects of TGF-<math>\beta</math>1 on COL1A1 Expression in Hepatocellular Carcinoma</i>
<b>Ragav Iyer</b>	Ashland High	<i>Astro-Seismic Prognostication using Planetary Position, Historical Earthquakes and MATLAB-based Machine Learning</i>
<b>Sarah Mattson</b>	St. Mark's School	<i>Ashwagandha's Effect on Locomotion in a C. elegans Model of Huntington's Disease</i>
<b>Jessica Liu</b>	Lexington High	<i>Detecting Debris Disks Around White Dwarfs through Infrared Excesses</i>

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**Third Place Awards**

<b>Aanya Gupta</b>	Shrewsbury Sr High	<i>A Novel In vitro Co-culture System of Primary Human Adipocytes and Primary Murine Cortical Neurons</i>
<b>Evan Xie</b>	Deerfield Academy	<i>Computational and AI-Assisted Design of Dual-Metal Single-Atom Catalyst for Oxygen Reduction Reaction</i>
<b>Pranav Addanki</b>	Canton High	<i>Identifying a Novel, Inexpensive, and Noninvasive Biomarker for Fibromyalgia: Using Metabolomics, Genomics, and a Drosophila melanogaster Model</i>
<b>Juliet Findlen</b>	Hopkinton High	<i>Algae Fertilizer: Efficiency and Biosorption of Copper by Chlorella Vulgaris</i>
<b>Ayanna Rohil</b>	Acton-Boxborough Regional High	<i>Fight the Fibrosis: Investigating the role of a Epigenetic Regulator Protein X in Human Embryonic Kidney (HEK293) Cells in the Development of Kidney Fibrosis</i>
<b>Yifan Evan Ding</b>	Boston Latin	<i>Engineering a Termination Readthrough-Based Gene Switch Enables Controllable CRISPR Gene Editing</i>
<b>Shrila Maity Jacob Wu</b>	Hopkinton High	<i>BiliSpectro: Building and Testing a Noninvasive Optical Sensor to Detect Bilirubin Content in Blood for Diagnosis and Monitoring of Jaundice</i>
<b>Kais Guessab, Rishit Shekhar, David Priefer</b>	Hopkinton High	<i>First Animal Study On Novel Drug Candidates Targeting Alzheimer's</i>
<b>Jiachi Wang</b>	Brooks School	<i>Emissions-Aware Energy Storage Decision Based on Deep Reinforcement Learning</i>
<b>Hayim Sims</b>	Maimonides School	<i>Nanoparticle Guided Synthesis of Size-Tunable Photonic Crystals</i>
<b>Suri Hoang</b>	Worcester Academy	<i>Social Space Assay Reveals- F1 and F2 Drosophila Exhibited Sign of Autism Caused by Daily Excessive Consumption of Copper</i>

<b>Yuyao Wu</b>	Thayer Academy	<i>Bionic Insect Jumping Device</i>
<b>Nicholas Ramos</b>	Barnstable High	<i>Investigating the Effect of Varying Pigment to Binder Ratios on Paint Performance</i>
<b>Ethan Yan</b>	Groton School	<i>ALlocate: A Low-Cost Automatic Artificial Intelligence System for the Real-Time Localization and Classification of Acute Myeloid Leukemia in Bone Marrow Smears</i>
<b>Thomas Li</b>	Weston High	<i>Analysis and Machine Learning Modeling of Spatial Data to Identify Asthma Hotspots in Massachusetts</i>
<b>Lucas DeFilippo, Kyle Wu, Feichen Li</b>	Weston High	<i>Modular OLED Infrared Digital Night Vision Goggles for Critical Search and Detection in Underdeveloped Countries</i>
<b>Varun Nerella</b>	Acton-Boxborough Regional High	<i>Tick-Tock, Let's Reverse The Clock: A Systems Biology Approach to Unravel Neurodegeneration and Aging</i>
<b>Yuxuan Zhang</b>	Boston Latin	<i>Heavy Metal Analysis of Lichen Samples at Lower Neponset River Reveals Previously Overlooked Contamination</i>
<b>Jessica Tao</b>	Acton-Boxborough Regional High	<i>Data Driven Optimization of Pt-Based Ternary Alloy Catalysts for Hydrogen Fuel Cells</i>
<b>Kyle Denny</b>	Brockton Public Library	<i>Biochar's Potential for Mitigating Climate Change</i>
<b>Anna Li</b>	North Quincy High	<i>How Does the Species of Microalgae Reduce the Effects of Carbon Dioxide in Seawater on Calcium Carbonate</i>
<b>Agastya Sarmah</b>	Sharon High	<i>Identification of Potential Biomarker and Survival Analysis for Hepatocellular Carcinoma Utilizing Bioinformatics Approach: An Investigation Utilizing Cancer Datasets</i>
<b>Sasha Litvak</b>	Wachusett Regional High	<i>The Effects of Dead Sea Mud Minerals and Herbal Additives on the Regeneration of <i>Dugesia tigrina</i>.</i>
<b>Molly Gedutis</b>	Dennis-Yarmouth Regional High	<i>Testing Pesticide Resistance, Avoidance, and Efficacy in Mosquito Populations on Cape Cod</i>

**Richard Chen  
Megan Zhang**

Andover High

*Global Navigation Satellite Systems Observations of the Ionosphere During Strong Thermal Emission Velocity Enhancement*

**Shaurya Patni**

Massachusetts Academy of Math Science at WPI

*Utilizing Methotrexate and Dimethyl fumarate on the STING Pathway Modulation to alleviate symptoms of Crohn's disease.*

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## Honorable Mention

**Zachary Chen**

Boston Latin

*Finding Early Dementia Predictors: Survival Analysis Utilizing Sleep Electroencephalogram and Blood-Based Biomarkers*

**Jahnavi Bolleddula**

Lexington High

*Protecting Our Moms: An Early and Effective Detection of Preeclampsia*

**Alyssa Kruger**

Wachusett Regional High

*Fungi versus Fast Fashion (The Effect of Oyster Mushrooms on the Decomposition of Different Clothing Materials)*

**Caroline Song**

Boston Latin

*Field Deployable Real Time Natural Gas Leak Detection*

**Elizabeth Hanechak**

Pope Francis Preparatory School (Springfield)

*Solving Our Planet's Plastic Problem: Developing a Biological System That Turns Toxic Waste Into Drinkable Water and Fertilizer*

**Kayla Vallecillo**

Massachusetts Academy of Math & Science at WPI

*Minimizing Fuel-Oxidizer Mixture Inhomogeneities in Rotating Detonation Engines*

**Eric Nie**

Phillips Academy

*Optimized Autonomous Caregiving Robot with Facial and Speech Recognition*

**Megan Ashun**

Massachusetts Academy of Math & Science at WPI

*Solar Powered UV-C LED Water Sterilizer*

**Aaryan Arora,  
Madhav Girish**

Acton-Boxborough Regional High

*Predictive Analysis of Sjögren's Syndrome: A Machine Learning Approach*

<b>Jack Li, Jayson Wang</b>	Wellesley Sr High	<i>Selection of Green and Sustainable Bio-Based Solvent by Artificial Intelligence for Pharmaceutical Research and Process Development</i>
<b>Anika Karre</b>	Massachusetts Academy of Math & Science at WPI	<i>Examining Enhanced Komagataeibacter hansenii Production via Unconventional Food Waste</i>
<b>Camilla Royal</b>	Foxborough Regional Charter School	<i>Natures Guide to Organ Preservation: How the Study of Hibernating Animals Can Lead to New Techniques of Organ Preservation</i>
<b>Alex Kuai</b>	Newton North High	<i>Advanced 3D Deep Transfer Learning for Multistage Alzheimer's Disease Diagnosis</i>
<b>Sam Lizotte</b>	Brockton High	<i>Using Machine Learning to Detect Alzheimer's Disease in MRI Scans</i>
<b>Qinghe Zhao</b>	Boston Latin	<i>The Effect of Fire on the Amount of Chlorophyll in Pine Tree Needles</i>
<b>Yaniv Taussky</b>	Wellesley Sr High	<i>Preventing Abortive Spinal Surgery using a Novel Machine Learning Classification of Posterior Thoracolumbar Instrumentation Systems</i>
<b>Ishana Saroha</b>	Shrewsbury Sr High	<i>Early Detection of Drug Toxicity</i>
<b>Lola Keeney, Diya Patlolla</b>	Winchester High School	<i>The Effects of Nature on Stress</i>
<b>Steven Xiang</b>	Bancroft School	<i>Comparison of Pest Resistance in Crops with Natural and Artificial Priming</i>
<b>Tim Nguyen</b>	Boston Latin	<i>SplattingTAPIR: Utilizing TAPIR and 3D Gaussian Splatting for Efficient Robust Reconstruction</i>
<b>Juliette Clausen, Niyathi Srinivasan, Siya Setty</b>	Lexington High	<i>Machine Learning Classification Using Neural Networks and Transfer Learning on CT Scans of 4 Lung Cancer Subtypes</i>
<b>Sierra Kelch</b>	Wachusett Regional High	<i>Comparing the Effects of BPA and BPS on the Heart Rate and Reproduction of Daphnia Magna</i>

<b>Anika Jacob</b>	Littleton High School	<i>A Study on the Effect of Caffeine on the Growth and Development of Zebrafish Embryos Using Automated Quantitative Assessment of Morphological Changes</i>
<b>Lixian Zhou</b>	Northfield Mount Hermon School	<i>A Launchable Aerial and Underwater Rotorcraft Robot</i>
<b>Ruichen Zhu</b>	Berkshire School	<i>Secure Code Generation with Large Language Models</i>
<b>Avaneesh Mohan</b>	Sharon High	<i>Filtration Capabilities of Different Chemicals for PFOAs and PFAS Molecules</i>

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## Category Excellence Awards

### AMD Engineering Excellence Award

<b>Yanchen Lu</b>	Groton School	<i>Design of a Multi-legged Robot with Extraterrestrial Terrain Exploration and Sample Retrieval Functions</i>
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### MITRE Computer Science & Technology Excellence Award

<b>Ansh Hiranandani, Yujiang Zhu</b>	Westborough High	<i>Using an AI Equipped Drone for Early Detection of Fires</i>
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### Alnylam Bioscience Excellence Award

<b>Avery Leonard</b>	St. Mark's School	<i>The Influence of Ginger Root Extract on Female Reproductivity in <i>Caenorhabditis elegans</i></i>
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### MCTA Chemistry Excellence Award

<b>Alexander Teymurazyán</b>	Wachusett Regional High	<i>The Effects of Storage Conditions on Conductivity and Oxidation of Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene films</i>
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## Special Awards

### Eversource Sustainability Award

**Nicholas Giza**      Massachusetts Academy of  
Math & Science at WPI      *A Novel Water-based Cooling Approach to  
Increase Solar Panel Efficiency*

### Massachusetts Life Science Center Trailblazer Award

**Megan Ashun**      Massachusetts Academy  
of Math & Science at WPI      *Solar Powered UV-C LED Water Sterilizer*

### ASM Microbiology Award

**Husang Lee**      Newton South High      *Inhibition of Melanin Synthesis and Anti-Inflammatory  
Effects of a Novel *Leuconostoc mesenteroides* subsp.  
Derived Exosomes Separated from *Camellia japonica*  
Flower*

### Regeneron Biomedical Science Award

**Anushri Pal**      Acton-Boxborough  
Regional High      *Computationally Derived Average Sum of  
Binding Affinities of Small Molecules Identifies A  
Potent Inhibitor of SARS-CoV-2, MERS-CoV, and  
SARS Viral Proteases Validated by in Vitro  
Assays*

### Paul Parravano Memorial Award

**Atreya Mallana,  
Vivek Mehta**      Lexington High School      *Your Voice Matters: Using Machine Learning to  
Detect and Classify Dysphonia*

### Pauline J. LaMarche Memorial Award

**Anika Jacob**      Littleton High School      *A Study on the Effect of Caffeine on the Growth and  
Development of Zebrafish Embryos Using Automated  
Quantitative Assessment of Morphological Changes*

## Ben Eisenstadt Memorial Award

Lola Keeney,  
Diya Patlolla

Winchester High School

*The Effects of Nature on Stress*

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### ISEF Delegates

<b>Jia Anand</b>	St. Mark's School
<b>Sophia Caramanica</b>	Massachusetts Academy of Math & Science at WPI
<b>Arnav Chetty</b>	Acton-Boxborough Regional High
<b>Teagan Chisholm-Godshalk</b>	Westfield High School
<b>Timucin Erbas</b>	Acton-Boxborough Regional High
<b>Avery Leonard</b>	St. Mark's School
<b>Anna Li</b>	North Quincy HS
<b>Yanchen Lu</b>	Groton School
<b>Shuhan Luo</b>	Worcester Academy
<b>Ananya Mathur, Gianna Nalumansi, Mariyam Patel</b>	Billerica Memorial High School
<b>Misha Mishechkin, Vishnu Angiras</b>	Tahanto Regional High
<b>Tim Nguyen</b>	Boston Latin
<b>Camilla Royal</b>	Foxborough Regional Charter School
<b>Kayla Vallecillo</b>	Mass Academy of Math & Science
<b>Ethan Yan</b>	Groton School

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### MSEF High School Teacher Award

Sponsored by Sanofi

**Tanya Chiarella** Billerica Memorial High School