REGENERON

ISEF

A PROGRAM OF

SOCIETY FOR SCIENCE & THE PUBLIC

VIRTUAL | 2020

FINALIST DIRECTORY
VIRTUAL REGENERON ISEF 2020

Animal Sciences

ANIM001 Dispersal and Behavior Patterns between Dispersing Wolves and Pack Wolves in Northern Minnesota
Marcy Ferriere, 18, Senior, Cloquet, Senior High School, Cloquet, MN

ANIM002 Antsel and Gretal
Avneesh Saravanapavan, 14, Freshman, West Port High School, Ocala, FL

ANIM003 Year Three: Evaluating the Effects of *Bifidobacterium infantis* Compared with Fumagillin on the Honeybee Gut Parasite *Nosema ceranae* and Overall Gut Microbiota
\# Varun Madan, 15, Sophomore, Lake Highland Preparatory School, Orlando, FL

ANIM004T Using Protease-activated Receptors (PARs) in *Caenorhabditis* elegans as a Potential Therapeutic Agent for Inflammatory Diseases
Swetha Velayutham, 15, Sophomore,
Vyshnavi Poruri, 15, Sophomore,
Plano East, Senior High School, Plano, TX

ANIM005 Utilization of Mechanically Simulated Kangaroo Care as a Novel Homeostatic Method to Promote Healthy Development in *Mus musculus* as a Model for Human Pre-term Neonates
\# Nathan Foo, 16, Junior, West Shore, Junior/Senior High School, Melbourne, FL

ANIM006 A Cost-Effective, Sensitive, and Specific Assay for the Detection of Avian Rotavirus and Picornavirus and Development of Predictive Models of Virus Prevalence via a Retrospective Analysis of Avian Enteric Disease in the United States
\# Arman Sharma, 17, Senior, College Park High School, The Woodlands, TX

ANIM007 An Exploration of the Effects of Magnets and Electromagnetic Radiation on European Honey Bee (*Apis mellifera*) Navigation
Alex Shaffer, 16, Junior, Bend Science Station, Bend, OR

ANIM008 Microplastic: A Possible Rising Tide of Plastic Affecting an Oyster's Filtration
Tsz Yee Pang, 18, Senior, Menai High School, Illawong, New South Wales, Australia

ANIM009 Pigeon Training: Number and Gender Ratio Comparison Affecting Innovation and Ability to Adapt and Learn
Nariah Smith, 18, Senior, La Junta High School, La Junta, CO

ANIM010 The Study of Anasa tristis Elimination Using Household Products
Carter McGaha, 15, Freshman, Vici Public Schools, Vici, OK

ANIM011 The Ketogenic Diet Ameliorates the Effects of Caffeine in Seizure Susceptible *Drosophila melanogaster*
Katherine St George, 17, Senior, John F. Kennedy High School, Bellmore, NY

ANIM012 Development and Application of Attractants and Controlled-release Microcapsules for the Control of an Important Economic Pest: Flower Thrips, *Frankliniella intonsa*
Chunyi Wei, 16, Sophomore, The Affiliated High School of Fujian Normal University, Fuzhou, Fujian, China

ANIM013 The Impacts of Brandt's Voles (*Lasiopodomys brandtii*) on the Growth of Plantations Surrounding their Patched Burrow Units
Meiqi Sun, 18, Senior, The Experimental High School Attached to Beijing Normal University, Beijing, Beijing, China

ANIM014T Analyzing Cortisol Levels of *Ochotona princeps* and Temperature Trends in the Great Basin Alpine Microclimate Habitats
Olivia Slaughter, 17, Senior,
Molly Chien, 17, Junior,
Salt Lake Center for Science Education, Salt Lake City, UT

ANIM015 Effectiveness of Lavandula Scents in Deterring *Odocoileus virginianus* and *Cervus canadensis* from Harming Agricultural Crops
\# Cecily Puckett, 17, Junior, Kamiah High School, Kamiah, ID

ANIM016T Artificial Nest for Earwigs as an Ecological Strategy for Eliminating Fall Armyworms
Thanawan Chomsri, 16, Junior,
Pornrat Kanmanee, 17, Junior,
Sunisa Koton, 18, Senior,
Phanomsarakham "Phanom Adun Witthaya" School, Chachuengsao, Thailand

ANIM017T Introducing Solitary Wasps (*Delta esuriens*) as a Predator for Pest Control in Cultivation Area Using Pseudo Brood Cells Produced from Its Habitat Imprinting Behavior
Kittayod Chaiwong, 17, Junior,
Kamonchanok Khidkhangbon, 17, Junior,
Teerawat Chaisima, 18, Junior,
Damrongratsongkroh School, Muangchiangrai, Chiangrai, Thailand

ANIM018 Gustatory Responses of Honeybees (*Apis mellifera*) to Artificial Sweeteners - Behavioral and Electrophysiological Analyses
Kazuki Iida, 18, Senior, Yasuda Gakuen, Junior and, Senior High School, Sumida-ku, Tokyo, Japan

ANIM019 Screening, Identification and Biodegradability of White Pollution-Degrading Bacteria from Cockroach
Ziteng Zhang, 18, Senior, Middle School Affiliated to Southwest University, Chongqing, Beibei District, China

ANIM020T Decreasing Pest Activities of Rice Field Crab in the Paddy Field Ecosystem
Sirapop Tangvorakasem, 15, Freshman,
Payramin Lerdpong, 15, Freshman,
Bangkok Christian College, Bangkok, Thailand

ANIM021 Analyzing Long-Term Behavioral Patterns in *D. melanogaster* Larvae
\# Hemanth Asirvatham, 18, Senior, Century High School, Rochester, MN

ANIM022 *Gallus gallus Domesticus* Flock Performance with Dietary Herb Supplementation
Lincoln Hollingshead, 17, Junior, Success Academy DSU, St. George, UT

ANIM024T The Lethal Weapon of Marine Flatworm-Breaking Findings of Autonomic Pharynges
Ching-Jung Teng, 18, Senior,
Ying-Jung Su, 18, Senior,
Chih-Yu Yeh, 18, Senior,
National Experimental High School At Hsinchu Science Park, Hsinchu, Taiwan

ANIM025 Combating Malnutrition: The Effect of Eggs on the Development, Learning, and Memory of *Drosophila melanogaster*
Gwyneth MacDonough, 16, Junior, Wachusett Regional High School, Holden, MA

ANIM026 Lipid Droplets in the Aging Brain
William Sun, 17, Senior, Ward Melville High School, East Setauket, NY

ANIM027 Analyzing the Gut Microbiota of SwHi and SwLo Rats
Amaya Martin, 18, Senior, North Central High School, Spokane, WA

ANIM028T The Effects of Cosmic Radiation on Gene Expression in *Caenorhabditis elegans*
Anna Marko, 16, Junior,
Quin Lawrence, 16, Junior,
North Central High School, Spokane, WA

ANIM029T Staying Ahead of the Hit: Using Drosophila melanogaster as an Integrated Model to Elucidate the Neuropathology, Physiology, and Genetic Mechanisms Underlying Traumatic Brain Injury
Shan Lateef, 16, Junior,
Delaney Walts, 17, Junior,
Thomas Jefferson High School for Science and Technology, Alexandria, VA
Charles J. Colgan Sr. High School, Manassas, VA

ANIM030 Phytogenic Alternatives to Antibiotics for Organic Broiler Chicken Production
Sivaranjani Ramanathan, 17, Senior, Kendriya Vidyalaya, Dindigul, Tamil Nadu, India

ANIM031 A Non-invasive Phenol Based Estrus Detection Kit for Dairy Animals
\# Naisargik Lenka, 17, Junior, Dav Public School, Bhubaneswar, India

ANIM032 Fossil-Augmented Species Distribution Models Reveal the Shifted Baselines of California Avifauna under Climate Change
\# Ashwin Sivakumar, 15, Sophomore, Flintridge Preparatory School, La Cañada Flintridge, CA

ANIM033 The Antibiotic Activity and Honey Preservation by *Enterococcus avium* within the Social Stomach of *Apis mellifera* and Its Potential as a Cure for CCD
Jaejun Noh, 17, Senior, Hankuk Academy of Foreign Studies, Yongin, Gyeonggido, South Korea

ANIM034T Relating Major Depressive Disorder (MDD) to Circadian Signaling in Drosophila melanogaster
Taylor Fox, 17, Junior,
Mir Zayid Alam, 17, Junior,
Manhasset High School, Manhasset, NY

ANIM035 Precision and Relative Accuracy of Striped Bass Age, Proportional Growth, and Origin Estimates from Both Scales and Sagittal Otoliths of Maine Striped Bass (*Morone saxatilis*)
Patrick Wahlig, 14, Freshman, Falmouth High School, Falmouth, ME

ANIM036T Hydrocotyle Verticillata
Reduces Ethanol Tolerance and Neurotoxic Effects on Cognitive and Motor Function of *Drosophila melanogaster*
Arabelle Santos, 15, Sophomore,
Jesscel Mae Libiran, 16, Sophomore,
Giuliana Anupol, 16, Sophomore,
Juan R. Liwag Memorial High School, Gapan City, Nueva Ecija, Philippines

ANIM037 Biological Fight between Cordyceps militaris and the Asiatic Wasp Vespa velutina
Nuno Sinde Fernandez de Ana, 18, Senior, SEK Atlántico Pontevedra International, Boa Vista, Pontevedra, Spain

ANIM038   Exposure of Rosmarinic Acid Prior to
           Thiamethoxam and Its Effect on the Survival
           and Circadian Rhythm of Honeybees (Apis
           mellifera) in Puerto Rico
Alejandra Gruber, 18, Senior, University Gardens
           High School, San Juan, Puerto Rico

ANIM039   An Assessment of Cognitive Disorder of
           Drosophila melanogaster by Chemical
           Substances in Food
           Yerim Han, 17, Senior, Gangil High School, Seoul,
           South Korea

ANIM040   Assessing the Effect of Blue Light upon the
           Courtship Behavior of *Drosophila melanogaster*
           in Accordance with Varying Eye Color
Haidyn Washburn, 18, Senior, Sanger High School,
           Sanger, CA

ANIM041   Loss of Reactive Oxygen Species (ROS) Inhibits
           Planarian Regeneration
           Saad Qureshi, 18, Senior, Kalamazoo Area
           Mathematics and Science Center, Kalamazoo, MI

ANIM042   Improving Captive Management Strategies for
           Conservation of *Dendrobates auratus*
           Gavin Peters, 17, Junior, Palos Verdes High School,
           Palos Verdes Estates, CA

ANIM043   Sexual Dimorphism in Red Eared Sliders
           Keysha Kindle, 17, Junior, Westville High School,
           Westville, OK

ANIM044   A Comparative Analysis of Various Means of
           Enzyme Linked Immunosorbent Assay Tests for
           Avian Paramyxovirus-Newcastle Disease Virus
           Jesse Shepherd, 16 Sophomore, Spanish Fork
           High School, Spanish Fork, UT

Behavioral and Social Sciences

BEHA001   Train a Happy Brain!: A Human Behavioral Study on the Emotional Perception of Happiness
Joshua Benzon, 18, Senior, Canterbury School, Fort Myers, FL

BEHA002   Identification of Auditory Biomarkers for Neurological Disorders

Shreya Ramesh, 17, Senior, Milton High School, Milton, GA

BEHA003   Fighting Executive Function Disorders via Artificial Intelligence with Facial Movement Data
#
Ronald Xu, 18, Senior, Winter Springs High School, Winter Springs, FL

BEHA004   Gardners Eight Intelligences
Omarion Hill, 14, Freshman, Lovejoy High School, Hampton, GA

BEHA005   The Effect of Social Media on Mental Health and Academic Performance
Lucy Richardson, 15, Sophomore, St. Joseph's Academy, Baton Rouge, LA

BEHA006   The Effect of Increasing Sensory Modalities on Retention Rates
Dante Martinez, 16, Sophomore, Westminster Christian School, Palmetto Bay, FL

BEHA007   Gender and Sexuality at School: Pedagogical Practices Reported by Teachers against Prejudice and Dropout of Young LGBT
Fabricio Antunes, 16, Senior, Colegio Novaescola, Campo Grande, Mato Grosso do Sul, Brazil

BEHA008T   Getting Crossed: Does Hand/Eye Dominance Affect Basketball Free Throw Shooting Percent?
John Singer, 15, Freshman,
Kaylee George, 15, Freshman,
McGregor High School, McGregor, TX

BEHA009   What Is the Best Auditory Atmosphere for Taking a Math Test?
Ezra Stegemoller, 15, Freshman, Stegemoller Academy Homeschool, Valley Mills, TX

BEHA010   The Dangers of Viewing the News: How News Event Priming Affects Subject Bias and Memory of Witnessed Events
#
Kaitlynn Weiss, 17, Junior, Kalaheo High School, Kailua, HI

BEHA011   Parent Perceptions of Social Skill Development of Adolescent Cochlear Implant Recipients: A Comparative Study across Various Populations
Megan Cantwell, 18, Senior, Veritas Academy, Austin, TX

BEHA012   Prediction of Chronic Stress through a Computational Linguistic Machine Learning Model
Siddhanth Pachipala, 15, Freshman, College Park High School, The Woodlands, TX

BEHA013   Effect of Chronic Treatment with Metformin on Adult Male Mouse Autism Relevant Behavior
Connie Zhang, 17, Junior, Health Careers High School, San Antonio, TX

BEHA014T   A Hope for All: Reducing PTSD Symptoms in Refugees through a Physiologically-Driven Adaptive Home-Based Virtual Reality Exposure Therapy Treatment
Omar Dababneh, 16, Junior,
Aseel Alrazem, 16, Junior,
Jubilee School, Amman, Jordan

BEHA015   Computational Analysis of Music Evolution and Melodic Expectancy
#
Eric Lian, 18, Junior, Oregon Episcopal School, Portland, OR

BEHA016   Iconographic Interpretation of the Rock Paintings of the Quilcay de Singa Complex
Jhocelyn Coaquira, 17, Sophomore, Miguel De La Mata Beraun, Singa, Huanuco / Huamalies, Peru

BEHA017   Connections in Chromesthesia: Analyzing Note Vibrations and Colors Perceived from Sound
Camille Blake, 17, Senior, West Salem High School, Salem, OR

BEHA018   Developing an Application to Measure Stroop Interference in Bilinguals
#
Cameron Neidhard, 17, Junior, Carroll High School, Dayton, OH

BEHA019   A Machine Learning Approach to Identify Socio-economic Factors Responsible for Patients Dropping Out of Substance Abuse Treatment
Prateek Gautam, 17, Junior, Marquette High School, Chesterfield, MO

BEHA020T   A Machine Learning Approach to Help Autistic Individuals Recognize Emotions in Vocal Conversation
Arjun Barrett, 14, Freshman,
Alexander Lan, 15, Freshman,
The Harker School, San Jose, CA

BEHA021T   Brave the Crave
Aria Lakhmani, 17, Junior,
Suyash Lakhmani, 15, Freshman,
Mission San Jose High School, Fremont, CA
Irvington High School, Fremont, CA

BEHA022 Analyzing the Foundation of Rhetorical Gender Inequality through Competitive High School Debating during Adolescence and the Connection to the Workplace
Megan Gole, 17, Senior, Half Hollow Hills High School East, Dix Hills, NY

BEHA023 The Effects of Blue Light and AREDS 2 on the Vision and Cognitive Function of *Drosophila melanogaster*
Ava Ewing, 17, Senior, Greens Farms Academy, Westport, CT

BEHA024T Multidisciplinary Study of Texao (*Tropaeolum majus*) as a Source for the Construction of the Historical Knowledge and Cultural Perspective of Arequipa
Ruben Huillca Loaiza, 17, Junior,
Estefany Manrique Calle, 17, Sophomore,
40222 Diego Thomson, Arequipa, Peru

BEHA025 ABC: The Interactive Lego Game- A Great Investor in Children's Brains and Futures
Raneem AlDalaeen, 16, Junior, Al-Hasaad Al-Tarbawi School, Amman, Amman, Jordan

BEHA026 Comparing the Effectiveness of Two Types of Equine-Assisted Therapy in Reducing Anxiety in Teens
Mya Barger, 17, Junior, Kamiah High School, Kamiah, ID

BEHA027 Social Media *vs.* Streaming Services and Their Effect on GPA
Lauren Lund, 15, Sophomore, Farmington High School, Farmington, UT

BEHA028 "Vinnie": A Solar-powered Talking Clothing Donation Bank
Molly Dixon, 19, Senior, Wenona School, North Sydney, NSW, Australia

BEHA029 Increasing Sales and Customer Satisfactions in Rakuten Market by Understanding Customers Desire and Shops Marketing Strategies
Kanade Shiono, 18, Senior, Tokyo Metropolitan Hibiya High School, Chiyoda-ku, Tokyo, Japan

BEHA030 Subliminal Messaging in Audio: A Study of the Subconscious
Marlea Martens, 15, Sophomore, Elko High School, Elko, NV

BEHA031 Implementation of Novel Sector Weight and Google Trends Data Objectives Using MOEA-D Curtails Systematic Risk for Quintessential Investors
Abishek Ravindran, 17, Senior, W. Tresper Clarke High School, Westbury, NY

BEHA033 Physical Activity Task Modifications through Socially Assistive Robots and Participatory Design Methodologies for Children on the Autism Spectrum
Rishin Kesarla, 16, Junior, Texas Academy of Mathematics and Science, Denton, TX

BEHA034 Novel Perspectives in Academic Practice Strategy: Designing and Exploring Gamification Classroom Practice Approaches that Strategically Target Cognition, Student Motivation, and Engagement to Improve the Academic Performance of Underperforming Elementary School Students
Junwei Tan, 16, Sophomore, Lee Virtual Instruction Program, Fort Myers, FL

BEHA035 Going Up in Vapor; The Effects of Vaping on Mental Capacity
Liam Wisner, 16, Sophomore, Bartlesville High School, Bartlesville, OK

BEHA036 Investigating Problem-Solving Behavior in Different Ethnic Students
Bing-Hong Chen, 18, Senior, Concordia Middle School, Chiayi County, Taiwan

BEHA037 Unlocking Your Genius: Increasing Alpha Waves in the Brain with Forgiveness Meditation
Samuel Wood-Soloff, 16, Sophomore, The Head Royce School, Oakland, CA

BEHA038 The Effect of Sexual Frustration on *Drosophila* Ethanol Consumption
Danielle Hardeman, 18, Senior, Palm Beach Central High School, Wellington, FL

BEHA039 Projectile Points: Our Key to the Past
Madalyn Johnson, 17, Junior, Carbon High School, Price, UT

BEHA040 Solving the Problem of Overweight People by Choosing Dishes for Serving the Food
Anastasiia Kyslova, 16, Sophomore, Higher Grade School #33, Kyiv, Ukraine

BEHA041 A Novel Predictive Paradigm for Pediatric ADHD Behavior through Thalamocortical White Matter Analysis
Kreena Totala, 17, Senior, Plainview-Old Bethpage John F. Kennedy High School, Plainview, NY

BEHA042T A Mobile App for Resolving Conflicts between Students
Niveditha Iyer, 18, Senior,
Anantharaman Iyer#, 15, Freshman,
National Public School - Koramangala, Bangalore, Karnataka, India

BEHA043T A Comparison of the Benefits of Meditation and Nature Using Electroencephalography (EEG) and Blood Pressure (BP) Analysis
Max Green, 17, Junior,
Reed Karman, 16, Junior,
Rhiannon Smith, 16, Junior,
Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

BEHA044 Double Track: An Analysis of the New Public School Enrollment Policy in Ghana
Veenaa Agrawal, 16, Junior, Lincoln Community School, Accra, Greater Accra, Ghana

BEHA045 The Education of Haitian Immigrants in Brazil: Mapping the Conditions of Schooling of Haitians in Brazilian Basic Education through Educational Indicators: Phase II
Ana Meletti, 18, Senior, Colegio Interativa, Londrina, Parana, Brazil

BEHA046 A 360° Video-Based Virtual Reality Aid for Social-Emotional Skills for Individuals with Developmental Disabilities
Anika Mistry, 17, Junior, Scotts Valley High School, Scotts Valley, CA

BEHA047 Using Natural Language Processing and Linguistic Insights to Combat Cyberbullying and Toxicity in Social Media
Arjun Neervannan, 17, Senior, University High School, Irvine, CA

BEHA048 Conflict Prevention in Middle School and High School Group of Students as a Tool of Bullying Prevention: Using Example of Netishyn Secondary Schools
Yeva Maliarchuk, 17, Junior, Netishyn Secondary School No. 2, Netyshin, Kiev, Ukraine

Biochemistry

BCHM001 The Effect of Different Concentrations of Tannic Acid (St. Louis River Water) and Motor Oil on Non-Resistant Staphylococcus aureus and Lemna minor Growth and Biofilm Development
Emily Sapyta, 15, Freshman, Cloquet, Senior High School, Cloquet, MN

BCHM002 Zebra Longwing Caterpillar Response to Three Potential Semiochemicals Supplemented in Grass
Kylah Blough, 15, Freshman, Lakeland Christian School, Lakeland, FL

BCHM003 Analyzing the Effect of Neuropilin 1 Knockdown on Conventional Chemotherapy in GBM
Yash Gulani, 18, Senior, The Bolles School, Jacksonville, FL

BCHM004 Synthesis and Characterization of the Binding of a 5-aminobenzo[c] [2,6] naphthyridine-8-Carboxylic Acid and Peptoid Conjugate to Protein Kinase CK2
Andreas Simson, 17, Senior, Tallinn Secondary School of Science, Tallinn, Harjumaa, Estonia

BCHM005 Microbially Induced Calcite Precipitation by *Bacillus subtilis* 168 for Underground Gas Stagnation, Soil Compaction, and Ion Sequestration
Noah Mathai, 17, Junior, Plano West, Senior High School, Plano, TX

BCHM006 Laccase Power
\#
Memory Bvungo, 16, Junior, Irene Christian College, Harare, Zimbabwe

BCHM007 Machine Learning and Pharmacophore-Based Drug Discovery for Treating Duchenne Muscular Dystrophy
Kate Wang, 16, Junior, Canyon Crest Academy, San Diego, CA

BCHM008 Exploring a Novel Electrochemical Method for Detecting Glutamate Concentration in Body Cerebrospinal Fluid in a Model of Cerebral Ischemia
Yuqing Li, 17, Junior, Beijing No. 35 High School, Beijing, China **BCHM009** Caffeine and Heart Rate: Using *Daphnia magna*
Princess Ortiz, 15, Sophomore, Academy of the Americas High School, Detroit, MI

BCHM010T Is It Protected?:A Study on the Decrease of Deoxyribonucleic Acid Extracted from Microwaved Strawberry Samples
Riley Miner, 16, Junior,
Ryan Miner, 15, Freshman,
El Dorado High School, El Paso, TX

BCHM011 Phase V: The Determination of the Active Protein Binding Moiety of EGCG Utilizing Multidimensional NMR Spectroscopy
\#
Stephen Litt, 15, Kennesaw Mountain High School, Kennesaw, GA

BCHM012 Re-engineering a Centrifuge Force Microscope (CFM) to Enable the Study of Induced Crystal Nucleation in Hypergravity
Bingsheng Guo, 17, Junior, Mounds View High School, Arden Hills, MN

BCHM013T Cardiomyopathic Chagas Disease: An Exploration of Diagnostic Ability via Nanoparticle Biomarker Capture GluOx Pathway, Mass Spectrometry, and Perseus-Based Machine Learning
Raymond Del Vecchio, 18, Senior,
Harini Somanchi, 17, Junior,
Centreville High School, Clifton, VA
Thomas Jefferson High School for Science and Technology, Alexandria, VA

BCHM014 Analyzing the Protein Content of Selected Flours
Victoria Garden, 18, Senior, Grants High School, Grants, NM

BCHM016 The Effect of Caloric Restriction on Longevity
London Blackwell, 18, Senior, Alma High School, Alma, AR

BCHM017 Investigation of Adhesion Peptide Interactions with Hydroxyapatite through Computational Molecular Dynamics
Jaya Hamkins, 17, Junior, Crescenta Valley High School, La Crescenta, CA

BCHM018 Vitamin Enhanced Agglutination
Victoria Leeder, 18, Senior, Eastern High School, Greentown, IN

BCHM019 Investigating Neurofibromin - Fbxo3 Interactions in Live Cells Using NanoBiT Technology
Jinhee Won, 16, Sophomore, Carmel High School, Carmel, IN

BCHM020 Investigation on Biofuel Production Efficiency of Clostridium Pasteurianum BC1 and Yeast in Cellulosic Biomasses of Varying Latex Content
Sahilkrishna Vazhathodiyil, 15, Sophomore, BVM Global Bollineni Hillside, Chennai, Tamilnadu, India

BCHM021 Evolving Resistance to Hydroxyurea: A Common Chemotherapeutic
Eleanor Courcelle, 16, Sophomore, Franklin High School, Portland, OR

BCHM022 Communications of Acquired Knowledge among *C. elegans*
Kaiyue Feng, 14, Sophomore, Shanghai Experimental School, Shanghai, China

BCHM023T Utilizing Protein Crystallography and X-Ray Diffraction to Determine the Structure of TrmD (Crystallized with S-adenosylhomocysteine) from *Mycobacterium abscessus*
Anna Suske, 17, Senior,
Biproprosad Das, 17, Senior,
Melissa Oz, 17, Senior,
Eastport-South Manor, Junior-Senior High School, Manorville, NY
Connetquot High School, Bohemia, NY

BCHM024 A Sensor to Monitor ER Turnover in *C. elegans*
Dhriti Shastri, 16, Junior, St. Joseph's Academy, Baton Rouge, LA

BCHM025T How Do Different Stimulants and Depressants Affect *Daphnia magna*?
Jacquelyn Sullivan, 15, Freshman,
Jared Reuben, 16, Sophomore,
Hilton Head Preparatory School,
 Hilton Head Island, SC

BCHM026T The Extraction and Evaluation of the Bromelain and Phenolic Compounds from Pineapple Peel through Ultrasound Radiation
Daniela Jiménez Cantor, 17, Sophomore,
Gisell Rosas Ortiz, 15, Sophomore,
Institución Educativa Jorge Eliécer Gaitán,
Palmira, Valle del Cauca, Colombia

Biomedical and Health Sciences

BMED001 The Effect of the Canonical Wnt Signalling Pathway on the Differentiation Potential of NG2 Glia after Ischemic Injury
Hana Bernhardova, 19, Junior, Gymnazium Frantiska Palackeho Valasske Mezirici, Valasske Mezirici, Zlinsky Kraj, Czech Republic

BMED002 Analyzing the Effects of Hyaluronic Acid through Enzymatic Digestion in Cancer Cell-Derived Extracellular Vesicles
Grace Littler, 18, Senior, Ponte Vedra High School, Ponte Vedra, FL

BMED003 Deceleration of Trimethylamine Nitric-Oxide (TMAO) by Preventing Oxidation of Trimethylamine (TMA) through Hepatic Flavin-Containing Monooxygenase (Hepatic (FMO)'s) via Omega-3 Fatty Acid Polyphenol Induced Experimental Substance
Axel Ramirez, 17, Junior, United High School, Laredo, TX

BMED004 A Novel, Tumor-Suppressive Role for Adhesion Molecule PLEKHA7 in Pancreatic Cancer
Misra Rishi, 18, Senior, The Bolles School, Jacksonville, FL

BMED05T Utilizing a Systemic Design of an Artificial Cell to Evaluate the Efficacy of Multiple Factors that Influence Catalase Activity
Jackson Pool#, 18, Senior,
Zachary Uhren#, 18, Senior,
Jaxon Henderson#, 18, Senior,
Cascia Hall Preparatory School, Tulsa, OK

BMED006 A Genomic-Based Investigation of Repetitive Behaviors across Four Neurodevelopmental Disorders Using a Machine Learning Approach
Tali Finger, 17, Junior, Dr. Michael M. Krop, Senior High School, Miami, FL

BMED007 Testing the Activity of Epigallocatechine-3-gallate on Cells of Colorectal Carcinoma *in vitro*
Viliam Glezl, 18, Senior, Gymnazium Ludovíta Stura, Zvolen, Banskobystrický, Slovakia

BMED008T Application of pH-Responsive Nanogels for Targeted Drug Delivery
Tommy Nguyen, 18, Senior,
Ashanah Gayden, 17, Senior,
Rockdale Magnet School for Science and Technology, Conyers, GA

BMED009 Investigating Sterol Carrier Protein-2 Inhibition to Prevent Endocannabinoid Uptake: A Novel Treatment of Anxiety
Neil Dogra, 17, Junior, University School of Milwaukee, Milwaukee, WI

BMED010 Human Genetic Variant OtpQ153R/+ Causes Excessive Weight Gain and Glucose Intolerance in Mice
Khyathi Thallapureddy, 18, Senior, Texas Academy of Mathematics and Science, Denton, TX

BMED011T The Deleterious Effect of Vaping Additives on the Motility of *Chlamydomonas reinhardtii*
Marie (Mimi) Papathanasopoulos, 16, Sophomore, Cecilia Hua, 17, Junior,
Oregon Episcopal School, Portland, OR

BMED012 Arsenic Concentration in Drinking Water and Risk for Prostate Cancer in the Swiss Canton of Grisons: An Ecological Study
Elin Cathomas, 19, Senior, Bundner Kantonsschule, Chur, Grisons, Switzerland

BMED013 The Time Course of Murine Cardiomyocyte Maturation
Eric Feng, 16, Junior, Mounds View High School, Arden Hills, MN

BMED014 A Novel Approach to Early Directional Diagnosis of Prescription Opioid Addiction
Gitanjali Rao, 14, Freshman, STEM School Highlands Ranch, Highlands Ranch, CO

BMED015 Nrf2 Pathway Is Critical to Right Heart Failure by Sulforaphane in a Pulmonary Arterial Hypertension Mouse Model
Emma Huang, 17, Junior, duPont Manual High School, Louisville, KY

BMED016 Utilizing C. elegans to Study Effects of Natural and Pharmaceutical Anti-Obesity Medications
Louie Martinez, 18, Senior, Grants High School, Grants, NM

BMED017 The Use of Curcumin to Mitigate the Inclusion of α-synuclein in Transgenic *Caenorhabditis elegans*
Jacqueline Albert, 18, Senior, Syosset High School, Syosset, NY

BMED018 Forecasting Influenza Outbreaks Using Machine Learning Models
Aaron Wan, 16, Junior, The Mississippi School for Mathematics and Science, Columbus, MS

BMED019 An In-Depth Look into Identifying the Differentiation Pathway and Cell Type of Dual-Receptor Expressing Lymphocytes in Type 1 Diabetes
Hannah Davis, 18, Senior, Hayti, Senior High School, Hayti, MO

BMED020 Characterization of Learning and Memory Dysfunction in Mouse Models of Genetic and Acquired Epilepsy
Keegan Gilbert, 17, Junior, Juan Diego Catholic High School, Draper, UT

BMED021 Stranger Danger: A Novel Approach to Cancer Research Using Morphing -- The Correlation between Intercellular Transfer from Cancer-Associated Fibroblasts and Metastatic Capacity, Proliferation Rate and Phenotype of Osteosarcoma Cells
Angelina Arora, 17, Senior, Sydney Girls High School, Sydney, NSW, Australia

BMED022 NailCAD (Nail Computer Aided Diagnosis) Non-Invasive Screening of Coronary Artery Disease Using a Mobile Application
Suhaib BaniHani, 16, Junior, Jubilee School, Amman, Jordan

BMED023 Sodium Benzoate, a Common Preservative, Inhibits Growth, Shortens Lifespan, Induces Premature Aging, and Accelerates Neurodegeneration
Jason Cui, 15, Sophomore, Fairview High School, Boulder, CO

BMED024 Effects of GSH and VEGF on Angiogenesis
Sharon Li, 18, Senior, Caddo Parish Magnet High School, Shreveport, LA

BMED025 What Factors Increase the Risk of Contracting the Common Cold?: An Epidemiologic Study Identifying Risk and Protective Factors for the Common Cold
Elizabeth Lesher, 16, Sophomore, Newton Country Day School of the Sacred Heart, Newton, MA

BMED026 Exploring the Effects of E-Cigarettes Using *Drosphila melanogaster*
Aditi Dosi, 15, Freshman, Shrewsbury High School, Shrewsbury, MA

BMED027 Applying RNAi Screening to Identify Novel Genes that Control Intestinal Stem Cell Proliferation and Gut Regeneration
Christopher Li, 17, Junior, West High School, Salt Lake City, UT

BMED028 Identifying Functional Disease Drivers in Lupus Nephritis Associated with Glomerular Remodeling
Nabiha Subzwari, 18, Senior, Valley Stream South High School, Valley Stream, NY

BMED029 The Impact of Horizontal Velocity on the Effectiveness of Parkour Landings
David Hayes, 18, Senior, Farmington High School, Farmington, UT

BMED030 The Role of Semantic Monitoring in Speech for Parkinson's Patients
Abigael Parrish, 17, Junior, Niles North High School, Skokie, IL

BMED031 PIF1 Gene Integration: A Novel Chemosensitizing Approach in Cancer
Maximilian Zhang, 17, Senior, Bergen County Academies, Hackensack, NJ

BMED032 How Do Pesticides Affect the Rate of Regeneration of Planarians; Possible Connection to Mutations within Embryonic Stem Cells
Ollaya Krikib, 14, Freshman, Boston Latin Academy, Boston, MA

BMED033 The Effect of Antioxidants on Crown Gall Disease in Plants
Mia Blennau, 15, Freshman, Taunton High School, Taunton, MA

BMED034 Dysbiosis of the Oral Microbiome due to Radiation Therapy in Patients with Squamous Cell
Quincy Koons, 16, Sophomore, DaVinci Academy of the Science and the Arts, Ogden, UT

BMED035 Vascular Normalizing Agents Differentially Modulate Tumor Cells, T Cells and Dendritic Cells *in vitro*
Maxim Yaskolko, 17, Junior, Pittsburgh Allderdice High School, Pittsburgh, PA

BMED036 Ear Canal Shape and Its Impact on Sound Transmission to the Ear Drum at Various Frequencies
Andrew Qi, 17, Junior, Central Virginia Governor's School for Science and Technology, Lynchburg, VA

BMED037 *Holothuria cinerascnes* and *Holothuria impatiens'* Cuvierian Tubules Extracts Decrease HCT-116 Colon Cancer Cells' Viability
Kaeo Kekumano, 17, Senior, Kamehameha Schools Kapalama Campus, Honolulu, HI

BMED038 The Effects of Sulforaphane on Bacterial Growth
Aubrey Evilsizer, 15, Freshman, Northwestern High School, Kokomo, IN

BMED039 Impact of Klotho Gene Variability and DNA Methylation on Traumatic Brain Injury Outcomes
Daniela Naumov, 18, Senior, Pittsburgh Allderdice High School, Pittsburgh, PA

BMED040 Whole Body Periodic Acceleration (WBPA) Improves Muscle Function in Diabetic Mice
Jordan Umlas, 17, Junior, Miami Beach, Senior High, Miami Beach, FL

BMED041 Investigating the Effects of Propofol on Reduced Cell Proliferation and Invasion of Human Rheumatoid Arthritis Fibroblast-like Synoviocytes (RA-FLSs)
Maryam Imran, 17, Junior, American Heritage School of Boca Delray, Delray Beach, FL

BMED042 Bloodborne Thrombin Promotes the Death of Murine Lymph Node Fibroblastic Reticular Cells
Mary Sotiryadis, 18, Senior, North Shore High School, Glen Head, NY

BMED043 Taking ABiTE out of Cancer: A Novel Aptamer-based BiTE for Cancer Immunotherapy
Bhavya Mohan, 17, Junior, Colonel By Secondary School, Ottawa, Ontario, Canada

BMED044 Expression of c-MYC in Human Endothelial Cells Results in Abnormal Vascular Morphogenesis and Metabolic Reprogramming
Hannah Shell, 17, Senior, Burnt Hills-Ballston Lake High School, Burnt Hills, NY

BMED045 Combating Familial Alzheimer's Disease: A Study of Resveratrol's Effects on a Presenilin Model of *Drosophila melanogaster*
Elizabeth Chun, 16, Junior, Ardsley High School, Ardsley, NY

BMED046 Metformin and Mannose Inhibit Human Hepatic Stellate Cell Activation and Proliferation: Implications for Anti-Fibrotic Therapies in Patients with MPI Deficiency and Chronic Liver Disease
Manav Bansal, 17, Junior, The Wheatley School, Old Westbury, NY

BMED047 Evaluating the Dispersal of Gram-Negative Bacteria from Sink Drains in a Hospital Setting
Jeremy Gries, 19, Senior, Bellarmine Preparatory School, Tacoma, WA

BMED048 Psyllium Husk as a Plant-Based Stabilizer to Produce High Fiber Low Syneresis Yoghurt
Boon Yee Oh, 16, Junior, Heng Ee High School, George Town, Penang, Malaysia

BMED049 Modeling Childhood Brain Tumor Mutations in Fruit Flies: Testing Therapeutics for H3.3 K27M Mutant Glioblastoma in *Drosophila melanogaster*
Nirmay Bhanderi, 15, Sophomore, Maclay School, Tallahassee, FL

BMED050 Analysis of Epithelial-Mesenchymal Transition Biomarkers, E-Cadherin and Vimentin, in Colorectal Cancer
\# Rohin Patel, 17, Senior, Sebring High School, Sebring, FL

BMED051 Effects of Nickel Chelator, Urease and Carbonic Anhydrase Inhibitor on Helicobacter *pylori* Eradication in Artificial Gastric Environment
\# Meena Ramadugu, 16, Sophomore, John F. Kennedy High School, Cedar Rapids, IA

BMED052 Evaluation of Exosomal Influence on Proliferation, Migration, and Invasion in MDA-MB-231 TNBC Cells
Kaitlyn Perkins, 18, Senior, New Orleans Charter Science and Mathematics High School, New Orleans, LA

BMED053 Solubility of Different Brands of Aspirin
Andreea Merzianu, 15, Freshman, City Honors School, Buffalo, NY

BMED054 Humidity and Enriched Oxygen on the Flammability of Non-woven Disposable Surgical Drapes
Danielle Miller, 15, Sophomore, East Pennsboro Area, Senior High School, Enola, PA

BMED055 Investigating the Effect of Fibulin-2 on NF-kB Pathway Activity and Proliferation of Pediatric Gliomas
Samarjit Kaushik, 17, Junior, Nikola Tesla STEM High School, Redmond, WA

BMED056 Development of a Novel Exosomal miRNA Biomarker Panel for Treatment and Rapid Identification of Lung Cancer by Blood Tests Utilizing Next-Generation Sequencing, Computational, and *in vitro* Analyses
\#\# Perisa Ashar, 17, Junior, Maggie L. Walker Governor's School for Government and International Studies, Richmond, VA

BMED057T You and the Flu: Your Nasal Microbiome Protects You from the Flu
Sophia McLain, 17, Senior,
Alexx Weaver, 17, Senior,
Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

BMED058 Reverse-Engineering Brain Structures in MRI with Deep Learning
\# Benjamin Yan, 17, Senior, Century High School, Rochester, MN

BMED059 The Effect of Neuroglobin and Aldehyde Dehydrogenase on TBI-Induced *C. elegans*
Aryanna Wolfe-Herman, 18, Senior, Sarasota High School, Sarasota, FL

BMED060 Biological Mechanisms of Stress Response and the Risk of Alzheimer's Disease
Elliot Park, 16, Junior, Tenafly High School, Tenafly, NJ

BMED061T Creating Cellulose as a Potential Xenographic Substitutes for Skin Grafting
Jane Damstedt, 17, Junior,
Siena Allen, 16, Junior,
Williamsville South High School, Buffalo, NY

BMED062 Targeted Breast Cancer Therapy Using Nanoparticles Modified by Tumor-Homing Peptides
Angelina Mao, 16, Junior, Norman North High School, Norman, OK

BMED063 Analysis of Diabetes Mellitus and Obese BMI as Risk Factors for Alzheimer's Disease and Vascular Dementia
Bridgette Bromell, 16, Junior, Columbia River High School, Vancouver, WA

BMED064 Compounds that Facilitate the Reactivation of Mutant P53 into Wildtype
Ananya Raghavan, 17, Junior, Morris Hills High School, Rockaway, NJ

BMED065 Development of Artificial Epidermis for Personalized Allergy Tester through Cultivation of Collagen Film and Keratinocyte Cell Line
Junwoo Lee, 18, Junior, Episcopal High School, Alexandria, VA

BMED066 Cure of Breast Cancer Stage III: Discovering Inflammation Inhibitors as a Novel Approach to Treatment of Triple Negative Breast Cancer Using 3-D Organoid Culture
Christine Song, 15, Freshman, Mayo High School, Rochester, MN

BMED067T Can Cardiac Risk Factors and Age Predict the Progression of Aortic Stenosis?
Logan Kusher, 19, Sophomore,
Cam Srivastava, 15, Freshman,
Spartanburg Day School, Spartanburg, SC

BMED068 A Novel Multi-omic Approach to Identifying Cancer Recurrence-Associated Gene Signatures
\# Kevin Sheng, 17, Senior, Roanoke Valley Governor's School for Science and Technology, Roanoke, VA

BMED069T "White" to a New Height: Effect of 4-Dicaffeoylquinic Acid on Whitening Antibacterial and Micronuclear Rate of Garlic Root
Kun Nam Ip, 19, Senior,
Chon Hei Kuok, 16, Sophomore,
Weng Man Lam, 17, Senior,
Escola Kao Yip, Macao, China

BMED070 The Functionality of Memory T Cells in Preventing AML Relapse in Patients Treated with a Fusion Vaccine
Skylar Kronrad, 18, Junior, Pine Crest School, Fort Lauderdale, FL

BMED071 Effects of Allergies on Salivary IgE
Bracken Pratt, 17 Junior, American Fork High School, American Fork, UT

Biomedical Engineering

ENBM001 Horsensor: Quantitative Analysis of Movements Using Different Types of Riding Equipment in Hippotherapy
Daniel Verdi do Amarante, 19, Senior, Instituto Federal de Educação Ciência e Tecnologia Catarinense - Campus Rio do Sul, Rio do Sul, Santa Catarina, Brazil

ENBM002 Muscle Activity and Energetic Adaptation to Step Frequency
Wendy Nevarez-Sanchez, 17, Junior, South Atlanta High School, Atlanta, GA

ENBM003 Phototherapy: A Life Saving Technique for the Treatment of Hyperbilirubinemia of the Newborn -- Development of a System to Provide Treatment in Remote Regions of the World
Haylee Darling, 16, Junior, Forest High School, Ocala, FL

ENBM004 Developing a Lateral Flow Immunoassay for Cortisol Detection, Year Two
Sarah Burkey, 17, Senior, Rockdale Magnet School for Science and Technology, Conyers, GA

ENBM005T Au and Ag Nanoparticles from Invasive/Ornamental Plant Extract for Cancer Diagnosis
Jaley Adkins, 18, Senior,
Madison Slone, 16, Sophomore,
Belfry High School, Belfry, KY

ENBM006T Theoretical and Experimental Aspects on the Hyperthermia with Magneto-Caloric Effect
Ioana Vancea, 17, Junior,
Ioana Seteanu, 16, Junior,
International Computer High School of Bucharest, Bucharest, Romania

ENBM007 Efficacy of a Porcine Epiglottis *versus* a 3D Printed Epiglottis in Mimicking the Natural Closure Process during Swallowing Preventing Aspiration of Liquid Utilizing Different Closure Processes
Hannah Kennedy, 15, Freshman, The Villages Charter High School, The Villages, FL

ENBM008 Tissue Engineering and Bioprinting a Synthetic Epidermal Scaffold to Accelerate Epithelialization
Hudson Hale, 17, Junior, Oregon Episcopal School, Portland, OR

ENBM009 The iSpy Platform: A Multi-Faceted Suite of Affordable Smartphone Imaging and Sensor-Based Utilities for the Non-Invasive Detection of Parkinsonian Tremor and Skin Cancer via Machine Learning
Kabir Jolly, 18, Senior, College Park High School, The Woodlands, TX

ENBM010 The Intelligent Medical Stapler: Ending the Emergency Room Crisis
Arnav Jain, 18, Senior, Gwinnett School of Mathematics, Science, and Technology, Lawrenceville, GA

ENBM011T The Synthesis of the Silver Nano in the Medicinal Plant Baikal Skullcap and Their Antioxidant Activity
Maryam Hajiyeva, 17, Junior,
Nigar Alshanova, 15, Freshman,
Lyceum Named after Academician Zarifa Aliyeva, Baku, Azerbaijan
School 175, Baku, Yasamal, Azerbaijan

ENBM012 De Nevo HIV-1 PPT Primer Repressor: Possibility for Molecular Immunity
Chase Tarrillo, 18, Senior, Viera High School, Viera, FL

ENBM013 Privacy-Preserving Ubiquitous Activity Recognition with Wearable Sensors
Anindita Rajamani, 17, Junior, Highland Park, Senior High School, Saint Paul, MN

ENBM014 Community-Wide Rapid Detection of Pathogenic Microbes Using Low-Cost Digital in-line Holographic Microscopy in Microbial Fuel Cells
Pranathi Pilla, 17, Junior, Texas Academy of Mathematics and Science, Denton, TX

ENBM015T A Device to Digitally Enhance and Assist Perception
Gryphon Patlin, 16, Sophomore,
Zakery Snider, 15, Sophomore,
The Classical Academy, Colorado Springs, CO

ENBM016 Detecting Impaired and Intact Cerebral Autoregulation to Monitor Intracranial Pressure for Noninvasive Sensing
Neeti Prasad, 17, Junior, Dayton Regional STEM School, Kettering, OH

ENBM017 An Exploration into the Effects of Incorporating Biomimicry into Position Specific Helmet Technology and the Potential to Reduce, or Possibly Eliminate, Chronic Traumatic Encephalopathy (CTE)
Rachel Pizzolato, 16, Sophomore, John Curtis Christian School, River Ridge, LA

ENBM018 Thrombus-Responsive Drug Delivery Systems for Targeted Fibrynolisis

\# Tejal Pendekanti, 17, Senior, Hathaway Brown School, Shaker Heights, OH

ENBM019 Variance in Segmentation of Lung Tumors: Creating Robust Radiomics Models in Lung Cancer

Jessica Chang, 15, Junior, Hathaway Brown School, Shaker Heights, OH

ENBM020 Development of a Machine Learning Algorithm to Predict the Path of Joints for Gait Rehabilitation

Sejal Gupta, 18, Senior, Hicksville, Senior High School, Hicksville, NY

ENBM021 Multi-functional Pneumatic Wearable Soft Rehabilitation Glove: A Novel Rehabilitation Device to Integrate Fingers and Wrist Function Utilizing Double-layer Soft Actuators

Keyu Wan, 15, Sophomore, Shanghai Pinghe Bilingual School, Shanghai, China

ENBM022 Design and Development of Smartphone-based Fundus Camera

Sitong Liu, 16, Junior, The High School Affiliated to Renmin University of China, Beijing, Beijing, China

ENBM024 Development of Bioartificial Bone Tissue through 3D-Bioprinting with Sepiolite, Eggshell, Gelatin Biocomposite and Mesenchymal Stem Cells

Tan Elcin, 18, Senior, Ted Ankara College Foundation Private High School, Ankara, Golbasi, Turkey

ENBM025 Save Your Health by Your Kinetic Energy

Roaa Fnaish, 17, Junior, Islamic Educational College, Amman, Jordan

ENBM026 Rehabilitation and Utilizing Impaired Hand Using a Motor Controlled Prosthetic Arm Using by the Non-Paralyzed Hand

Mohammad Alzoubi, 16, Sophomore, Alramtha Secondery School, Irbid, Jordan

ENBM027T A Novel Method of Screening for Foot Ailments Using Machine Learning

Abhitha Vegi, 17, Junior,
Priyanka Jakka, 16, Sophomore,
Mission San Jose High School, Fremont, CA

ENBM028 Do You Need A Hand?: A Robotic Device Designed to Assist Physically Disabled People with Eating

Urianna Acosta, 15, Freshman, Monte Vista High School, Monte Vista, CO

ENBM029T A Novel Obstructive Sleep Apnea Management System

Anjan Sesetty, 15, Freshman,
Ishaan Jain, 14, Freshman,
Poolesville High School, Poolesville, MD
Richard Montgomery High School, Rockville, MD

ENBM030 A Novel Approach to Improving Blood Circulation Using Complex Ultrasonic Wave-Forms

\#\# Isabela Perdomo, 17, Junior, MAST at FIU Biscayne Bay Campus, North Miami, FL

ENBM031 Electronic Height Meter

Aleksandr Slugin, 16, Sophomore, Station of Young Technicians, Khanty-Mansiysk, Tyumen Region, Russian Federation

ENBM033T Real-Time Object Search and Detection for the Visually Impaired

Irfan Nafi, 15, Sophomore,
Eugene Choi, 15, Sophomore,
Raffu Khondaker, 16, Sophomore,
Thomas Jefferson High School for Science and Technology, Alexandria, VA

ENBM034T USDL: Ultrasound Noise Reduction Using Machine Learning Techniques

Kathryn Chung, 18, Senior,
Manish Balamurugan, 18, Senior,
Venkat Kuppoor, 18, Senior,
Fairfax High School, Fairfax, VA

ENBM035 Developing an Automated Effective Device Using Turbidity-based Technique for Identifying Sickle Cell Anemia

Nuran Alim, 16, Senior, 19th Secondary School in Makkah, Mekkah, Western Region, Saudi Arabia

ENBM036 Edge- Intelligence Biosensor Based Point-of-Care Diagnostic Device for Chronic Kidney Disease

\# Eeshani Behara, 17, Senior, American Heritage School of Boca Delray, Delray Beach, FL

ENBM037 A Novel Suture Additive: Use of Beet Extract to Assess for Surgical Wound Infection

Dasia Taylor, 19, Junior, West High School, Iowa City, IA

ENBM038 Designing and Building an Intelligent Device for Eye Disorder Treatment

Victor Yang, 17, Junior, Fox Chapel Area High School, Pittsburgh, PA

ENBM039T Medical Car

Deyaa Alhaq Alshbatat, 14, Freshman, King Abdullah II School for Excellence, At-Tafilah, At-Tafilah, Jordan

ENBM040 Dynamic Stability

\# Mackenzie Hunt, 18, Senior, New Tech Institute, Evansville, IN

ENBM041   Sanjeevani: A Novel Automated System for Hospital Acquired Infection Monitoring and Prevention
Samyak Shrimali, 15, Freshman, Jesuit High School, Portland, OR

ENBM042   Real-Time Seizure Forecasting for Epileptics on a Consumer Product
Matthew Anderson, 15, Sophomore, Cherry Creek High School, Greenwood Village, CO

ENBM043   Insucool: An Affordable Insulin Cooling Device for Transportation and Storage
Mitchell Sampson, 17, Junior, Northview High School, Brazil, IN

ENBM044   Converting a 3D Printer to a 3D Bioprinter for Modeling of a Lumbar Vertebral Body
Katie Collins, 17, Junior, Terre Haute North Vigo High School, Terre Haute, IN

ENBM045   DyslexAI: A Novel Approach for Dyslexia Diagnosis and Treatment Using a Computer Webcam via Machine Learning
Vivek Kogilathota, 15, Sophomore, Rick Reedy High School, Frisco, TX

ENBM046   A Fully Integrated Microfluidic Device for Blood Plasma Separation and Biomarker Detection
Stanley Liu, 16, Junior, Arcadia High School, Arcadia, CA

ENBM047T Raman Spectroscopy as a Novel Autonomous Machine Learning and Chemical Imaging System Used to Distinguish Quantitative Abnormalities in MCF-7, MDA-MB-231, and MCF10-A Cells for the Early Detection of Basal and Epithelial Breast Cancer through Inelastic Scattering and Spectroscopic Analysis in an in vitro Model
Saja Mahdi, 17, Senior,
Rafee Mirza, 17, Junior,
Chesapeake Science Point Public Charter School, Hanover, MD

ENBM048   3D Printing an Intrauterine Device Specifically for Nulliparous Women, by Adjusting Size and Exterior Design
Taylor Rice, 16, Junior, Nikola Tesla STEM High School, Redmond, WA

ENBM049   Therapeutic Lantibiotic Delivery and Functionalized Antimicrobial Surfaces via Thermostable, Degradation-Resistant Nisin-Adsorbed Endospores: Engineering an Alternative to Antibiotics and Pesticides
Neil Kadian, 17, Junior, Dr. Ronald E. McNair Academic High School, Jersey City, NJ

ENBM050   Design and Implementation of a Novel Thermographic Device for Rapid Diagnosis of Partial Thickness Burns
Gabriella Taylor, 18, Senior, Alabama School of Mathematics and Science, Mobile, AL

ENBM051T Production of Biomembranes and Pharmaceutical Formulations from Mangaba Latex (*Hancornia speciosa*) to Aid in the Healing of Leg Ulcers in Patients with Diabetes Mellitus
Joao Lima, 18, Senior,
Itila Maykely Santos Conceicao, 19, Senior,
Instituto Federal de Educacao, Ciencia e Tecnologia Baiano - Campus Catu, Catu, Bahia, Brazil

ENBM052   Smart and Biocompatible Ostomy Bag Hydrogel Adhesive
William Pan, 16, Junior, Northwood High School, Irvine, CA

ENBM053   Engineering Macroporous Hydrogels to Recapitulate Aspects of the Tumor Microenvironment
Diya Jayram, 17 Senior, American Heritage School, Plantation, FL

Cellular and Molecular Biology

CELL001 Live Cell Analysis of Collagen Deposition and Cell Proliferation: Indicator of a Promising Osteoarthritis Treatment
\# Elisha Johnston, 16, Junior, Palos Verdes Peninsula High School, Rolling Hills Estates, CA

CELL002 Genetic Modification of *Escherichia coli* with the Gene alkB2 to Replicate *Alcanivorax borkumensis* Oil Degradation
Camille Campbell, 18, Senior, North Carolina School of Science and Mathematics, Durham, NC

CELL003 Identification, Artificial Evolution, and Modification of Polystyrene Degrading Bacterial Enzymes
Samuel Tukua, 19, Senior, Paulding County High School, Dallas, GA

CELL004 The Potential Pathophysiological Role of STING in the Development of Hypertensive and Diabetic Nephropathy
\# Rohan Anne, 16, Junior, University School of Milwaukee, Milwaukee, WI

CELL005 A Study of the Relationship between Aging, Maturity, and Oxidative Stress on Huntington Disease Neurons
\#\# Ritika Jeloka, 18, Senior, Melbourne High School, Melbourne, FL

CELL006 Characterization of Astrocyte Polarity with Regards to the Primary Cilium
Geoffrey Zhang, 17, Junior, Texas Academy of Mathematics and Science, Denton, TX

CELL007 Dismantling Malignant Brain Tumor Protections: Novel Role of POLK in Protecting GBM-derived Cells from Replication Catastrophe
Victoria Hwang, 18, Senior, Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

CELL008 Utilization of a Novel Method of RNA Interference in *Caenorhabditis elegans* to Conduct a Phenotypic Analysis of the daf-2 and daf-16 Longevity Genes
Rincon Jagarlamudi, 16, Junior, Marquette High School, Chesterfield, MO

CELL009 Spatiotemporal Pattern of Neuropathology in the Olfactory System as a Biomarker for Onset of Alzheimer's Disease in a Rat Model
\# Akshay Padala, 15, Sophomore, Little Rock Central High School, Little Rock, AR

CELL010 Examining Mechanisms of Resistance in Palbociclib-Resistant Estrogen Receptor-Positive Breast Cancer Cells
Aditi Kona, 16, Sophomore, North Oldham High School, Goshen, KY

CELL011 Evaluation of the Yes-associated Protein as a Target for Breast Cancer Therapy
Vivian Yee, 16, Junior, International Academy, Bloomfield Hills, MI

CELL012 A Potential Pancreatic Cancer Treatment in Pre-mRNA Splicing Inhibition: An Innovative Approach by Identifying Vulnerabilities in Pancreatic Cancer Cells Using Biflavonoid Isoginkgetin and Pladienolide B
Prabuddha Ghosh Dastidar, 16, Sophomore, Marvin Ridge High School, Waxhaw, NC

CELL013 Analysis of Upf Protein Over-Expression on the Efficiency of Targeting Aberrant mRNAs to NMD
Ella Kazazic, 16, Senior, Hathaway Brown School, Shaker Heights, OH

CELL014 Linking Diet and Cancer: Arachidonic Acid Augments Canonical Wnt Signaling to Enhance Stemness
Vyom Shah, 16, Junior, Jericho High School, Jericho, NY

CELL015 Blocking the Binding of Bacterial Lipid Droplets to Phage DNA
Zhilei Bei, 17, Junior, The High School Affiliated to Renmin University of China, Beijing, Beijing, China

CELL016 Adeno-associated Virus 5 Vound to Its Cellular Ceceptor AAVR
Zhengjia Yuan, 16, Sophomore, Capital Normal University High School, Beijing, Beijing, China

CELL017 UG-Rich RNA Is Key to Alleviating Neurodegeneration in a Drosophila Model of Amyotrophic Lateral Sclerosis (ALS)
Karah Mayer, 16, Sophomore, Tanque Verde High School, Tucson, AZ

CELL018 The Role of Apoptosis Signal-Regulating Kinase 1 in Hyperoxia-Induced Lung Injury
Saisha Dhar, 16, Junior, Paul Laurence Dunbar High School, Lexington, KY

CELL019 Exploring the Effects of GRN on Chemotherapy Response in Small Cell Lung Cancer
Sarah Karam, 17, Junior, Bergen County Academies, Hackensack, NJ

CELL020 A Novel Role for Fis1-mediated Mitochondrial Fission as a Senolytic Target
Seton Liu, 15, Sophomore, Bergen County Academies, Hackensack, NJ

CELL021 The Division Decision: The Cdc13 Protein and Cell Size Control
Claire Morton, 17, Senior, Blacksburg High School, Blacksburg, VA

CELL022 Sex and Genotype Driven Disparities in Vascular Integrity, Metabolic Profile, Gut Microbiome, and Behavior in Alzheimer's Disease
Ashley Su, 19, Senior, Paul Laurence Dunbar High School, Lexington, KY

CELL023 Decoding the Molecular Dynamics of ASH1L in Cancer Using NMR for Novel KMTase Inhibitor
Modhi AlMarzooqi, 17, Senior, Riyadh School for Boys and Girls, Riyadh, Saudi Arabia

CELL024 A Prioritized Screen to Identify Downstream Targets of the Forkhead/Fox Transcription Factor Jumeau that Mediate Cardiac Progenitor Cell Divisions
Ishreet Lehal, 17, Junior, Terre Haute South Vigo High School, Terre Haute, IN

CELL025 Use of Cardioprotective Paracrine Factors Secreted by hgPSC-derived Cardiomyocytes to Prevent Fibroblast Activation and Scar Formation following Myocardial Infarction
Breanna Brownson, 16, Junior, Rye High School, Rye, NY

CELL026 The Relationship between Tumor Suppressor Genes LZTR1 and SMARCB1 in Schwannomatosis Pain
Natalie Wang, 17, Senior, Lincoln High School, Portland, OR

CELL027 Solving the Structure of Collagen IV in *Drosophila*
\#   Madison Yarbrough, 18, Senior, Poyen High School, Poyen, AR

CELL028 Allorecognition in *Hydractinia symbiolongicarpus*: Determining the Loci of Genes Controlling Allorecognition in Addition to Alr1 and Alr2 Using Machine Learning
Nicole Shigiltchoff, 18, Senior, Winchester Thurston School, Pittsburgh, PA

CELL029 Superior Antitumor Fusion Proteins Genetically Engineered in Cell-Based Cancer Therapy
\#   Danish Mahmood, 16, Junior, London Central Secondary School, London, Ontario, Canada

CELL030 The Role of the Degron, a Protein-Degradation Motif Essential for Capsid Assembly in Adeno-Associated Virus
Sophia Chang, 17, Senior, Phillips Exeter Academy, Exeter, NH

CELL031 The Thawing Temperature of Cryopreserved Equine Semen and Its Effects on Spermatozoal Motility
John Holz, 16, Junior, Kildare Catholic College, Wagga Wagga, New South Wales, Australia

CELL032 Intronic RNA as a Therapeutic Target in Neurodegeneration: A Multipronged Study of RNA Lariat Debranching Enzyme DBR1
Anushka Sanyal, 16, Junior, Homestead High School, Cupertino, CA

CELL033 Developing Molecular Genetic Tools for the Detection of Varroa Mites (*Varroa destructor*) from Honey
\#   Mia Foster, 18, Senior, Hellgate High School, Missoula, MT

CELL034 DNA Damage Induced by Cell Phone RF Radiation
Benjamin Schall, 18, Senior, Saginaw Arts and Sciences Academy, Saginaw, MI

CELL035 Designing a Tumor-Specific Oncolytic Virus to Induce Suicide Gene Expression
\#   Sowmya Chundi, 16, Sophomore, Carmel High School, Carmel, IN

CELL036 Effects of Therapeutics on Cell Migration
Lia Barrow, 16, Junior, Broadneck High School, Annapolis, MD

CELL037T Illuminating the Cell's Secrets
Yongbin Ko, 17, Senior,
Jiwoo Chun, 18, Senior,
Cheongshim International Academy, Seoul, South Korea

CELL038 PLEKHA7: Assessing Locational Responses to Induced Cellular Stress to Uncover Junctional Mechanisms in Colorectal Cancer
Valentina Ortega, 18, Senior, American Heritage School, Plantation, FL

CELL039 Investigating Neuromesodermal Progenitor Development and Differentiation Using Danio rerio Single Cell Sequencing Data
Eddie Dai, 17 Senior, Olathe North High School, Olathe, KS

Chemistry

CHEM001 Novel Fabrication and Implementation of Copper and Silver Plasmonic Nanostructure-Coated Foil as a Spectrally Selective Absorber in Highly Efficient Solar Steam Generation Under One Sun Illumination
\# Andy Shar, 14, Junior, Vanguard High School, Ocala, FL

CHEM002 Lanthanum-Barium Iron-Based Perovskite Oxides for Low Temperature Carbon Dioxide Conversion
Anya Patidar, 16, Sophomore, C. Leon King High School, Tampa, FL

CHEM003 Development of a Pyrolysis Reactor to Determine the Efficiency of Polystyrene-based Biofuel
\# Stephanie Nguyen, 16, Sophomore, The Villages Charter High School, The Villages, FL

CHEM004T Super Tree Glue: An Investigation and Characterization of an Innovative 4-in-1 Combo Material for the Treatment of Tree Infection
Pui Lam Queenie Choi#, 17, Junior,
Lok Yi Ng, 16, Junior,
Shun Tak Fraternal Association Yung Yau College, Hong Kong, China, Hong Kong Special Administrative Region

CHEM005T ASA Treatment for Oil Spills
Paul Kunisch, 18, Junior,
Thomas Derra, 17, Junior,
Friedrich-Dessauer-Gymnasium, Aschaffenburg, Bayern, Germany

CHEM006T Synthesis, Characterization and Application of New 4-Hydroxy-1,3-thiazole Derivatives in Fluorescence Microscopy
Milena Wiegand, 19, Senior,
Max Asenow, 19, Senior,
Tina Munkewitz, 19, Senior,
Albert-Schweitzer-Gymnasium, Erfurt, Thuringen, Germany

CHEM007T Replacement of Standardized Primary Polyethylene Microbeads with Sustainable Biodegradable Alternatives
Cleo Gallen, 17, Junior,
Zainab Shahid, 17, Junior,
Loreto Balbriggan, Dublin, Ireland

CHEM008 Characterization of Novel Reconfigurable Mid-IR Metalenses Enabled by Phase Change Materials
\# Helena Jiang, 17, Senior, F. W. Buchholz High School, Gainesville, FL

CHEM009 Sleep De-Lighted: An Environmentally Friendly, Plant-Derived Flame-Retardant Solution Targeted Towards Usage in Open-Cell, Flexible Polyurethane Foam
Sohi Patel, 14, Freshman, College Park High School, The Woodlands, TX

CHEM010 Sustainable Management and Economic Potential of *Mauritania flexuosa* Extraction
Ana Beatriz Silva, 15, Sophomore, Centro Educacional ArteCeb, Imperatriz, Maranhão, Brazil

CHEM011 Synthesis of Alloy Nanowire Array Electrode for Wearable Direct Urea Fuel Cell
Long Hei Ziv Leung, 17, Junior, The Chinese Foundation Secondary School, Hong Kong, China, Hong Kong Special Administrative Region

CHEM012 Making Energy from Vibrations or Mechanical Force
Lisa Pham, 15, Freshman, Orlando Science Schools, Orlando, FL

CHEM013 Designing UiO-67 Metal-Organic Frameworks (MOFs) Loaded with Cadmium Sulfide Quantum Dots: Developing a pH-Responsive Drug Delivery System for Melanoma Treatment
\# Lasya Damaraju, 18, Senior, West Shore, Junior/Senior High School, Melbourne, FL

CHEM014 Computational Affinity between Anthraquinone Derivatives and DNA
Chelsea Campbell, 17, Junior, Gwinnett School of Mathematics, Science, and Technology, Lawrenceville, GA

CHEM015 Creating Crosslinking Compounds to Cure Cancer
\# Kylie Guiles, 16, Junior, Mancos High School, Mancos, CO

CHEM016 Color of Metals and Transition Heavy Metal Analysis in Water
Andrew Wang, 17, Junior, Saint Louis Catholic High School, Lake Charles, LA

CHEM017 Coated Phase Change Materials (PCM) Particles for Light-to-Heat Conversion and Heat Storage
Zhi-Wei Zeng, 17, Junior, Zeng Homeschool, Katy, TX

CHEM018 Synthesis of a Novel Flame-retardant Hydrogel for Skin Protection Using Xanthan Gum and Resorcinol Bis(diphenyl phosphate)-coated Starch
Bole Pan, 17, Senior, Guangzhou Tianhe Foreign Language School, Guangzhou, Guangdong, China

CHEM019 Primordial Soup: Testing the Catalytic Properties of Clays on the Production of Different Biomolecules
Sky Harper, 18, Senior, Navajo Preparatory School, Farmington, NM

CHEM020 Direct Conversion of Biomass Carbohydrates to Platform Molecules
Nyaradzo Mutiti, 16, Sophomore, Queen Elizabeth Girls' High School, Harare, Zimbabwe

CHEM021 Designing a Smarter Smart Hydrogel: Optimization of Poly(vinyl alcohol)-Sodium Borate Hydrogels by Physical Crosslinking with Sodium Alginate for pH-Responsive Controlled Drug Delivery
Parker Hoang, 16, Sophomore, Langley High School, Mclean, VA

CHEM022 Investigations into the Significance of Epidermal Fatty Acid Binding Protein (FABP5) in Breast Cancer Survival and Design of Novel FABP5 Inhibitors
Tong Ye, 18, Senior, Half Hollow Hills High School East, Dix Hills, NY

CHEM023 Post-Synthetic Modification (PSM): En route to Novel Functional Macrocyclic Compound Construction
Zihui Xu, 17, Junior, Beijing Guangqumen Middle School, Beijing, China

CHEM024 Components of Thermal Sensors: Synthesis and Properties of Thermochromic Crystals
Kirill Romanov, 16, Sophomore, Andrey Melnichenko Foundation Center for the Development of Children's Creativity in Science and Engineering (Nevinnomyssk), Nevinnomyssk, Stavropol Krai, Russian Federation

CHEM025 Elucidation of the Relationship between the Chemical Structures of Saccharides and Caramelization
Mai Takatsu, 18, Senior, Takarazukakita High School, Takarazuka, Hyogo, Japan

CHEM026 Defatted Soy as a High-Performance Energy Storage Material for Supercapacitor
Amna Khan, 16, Sophomore, Little Rock Central High School, Little Rock, AR

CHEM027 Towards the Total Synthesis of the Leishmanicidal Lindbergin E for the Development of a Novel Phloroglucinol-Derived Asymmetric Cyclic Polyketide Synthesis
Elijah Jones, 17, Junior, Jackson, Senior High School, Jackson, MO

CHEM028T Development of Convenient Optical Instruments for Chemical Analysis
Yuki Nitta, 18, Senior,
Hiroto Tamano, 19, Senior,
Tokushima Prefectural Jonan High School, Tokushima-City, Tokushima, Japan

CHEM029 Functionalized Polylactide Filament for Additive Manufacturing
Suvin Sundararajan, 16, Junior, Westfield High School, Westfield, MA

CHEM030T The Synthesis of Magnetic Hydrochar from Oil Palm for Adsorption of Heavy Metals in Industrial Water
Thitirat Chantorn, 18, Senior,
Pongphak Kanwinphruet, 18, Senior,
Yutthapichai Aiadthum#, 18, Senior,
Princess Chulabhorn's College Nakhon Si Thammarat, Nakhon Si Thammarat, Thailand

CHEM031 Effectiveness of *Musa acuminata, Solanum tuberosum*, and *Ipomoea batatas* as Sources of Starch to Create Bioplastics
Brenlie Shirts, 16, Junior, Success Academy DSU, St. George, UT

CHEM032 Comparing and Analyzing Six Metal Ion Nitrates' Ability to Behave as Lewis Acids and What Causes this Behavior
Alexa Sayles, 17, Junior, Bluefield High School, Bluefield, WV

CHEM033 Green Synthesis of Boron Doped 3D Printable Microcomposites from Plastic Wastes for Solar and Nuclear Absorption Applications
Mehmet Cekuc, 18, Junior, Kartal Anadolu Imam Hatip High School, Istanbul, Turkey

CHEM034T Thiol Ligand-Assisted BSA-Capped Gold Nanoclusters for Hypochlorite Detection
Jen-Chen Yeh, 17, Junior,
Chia-Yu Hu, 17, Junior,
Taipei First Girls High School, Taipei, Taiwan

CHEM035 The Iodization of Table Salt: The Use of Potassium Iodide *vs.* Potassium Iodate
Sarah Austbo, 19, Senior, Blindern VGS, Oslo, Norway

CHEM036 Applying Solvent-Free Green Chemical Recycling of Plastic Waste for Corrosion Inhibitors for Steel Alloy
Layan AlHamashi, 17, Junior, The First Secondary School in Hail, Hail, Central Province, Saudi Arabia

CHEM037 Next Generation Ultrafiltration for Wastewater Treatment: Characterization and Performance of Fouling-Resistant Polymeric and Lyocell Cellulose Nanofiber Membranes
Riya Patel, 17, Senior, Jericho High School, Jericho, NY

CHEM038T Synthesis of Luminescent Complexes of Lanthanides with New O,N-Tetradentate Ligands
Anna Gradova, 17, Junior,
Ilya Okladnikov, 17, Senior,
Moscow South-Eastern School Named After V. I. Chuikov, Moscow, Russian Federation

CHEM039T MICROPA: A Novel Approach and a Device for the Detection, Quantification, and Filtration of Microplastics in Drinking Water
Aditya Chauhan, 14, Sophomore,
Tejas Sharma, 15, Sophomore,
Bharatiya Vidya Bhavan's R.K. Sarda Vidya Mandir, Raipur, Chhattisgarh, India

CHEM040T Development of Biodegradable Paper Bags Using Alginate-chitosan Gel and Its Potential as Eco-friendly Flame Retardant
Hyunjeong Lee, 18, Senior,
Hyun Seung Lee, 17, Senior,
Korean Minjok Leadership Academy, Hoengseong, Gangwon, South Korea
Sejong Academy of Science and Arts, Sejong, Chungcheong, South Korea

CHEM041 Characteristics of Iron Oxide Rust Prepared by Peracetic Acid and Its Removal of Heavy Metals in Water
Sunyu Jung, 18, Junior, Korean Minjok Leadership Academy, Hoengseong, Gangwon, South Korea

CHEM042 The Low-Cost, Simple "Green Chemistry" Method of Carotenoids Obtained via Formation of Zn-Al LDH's Carotenoid Nanocomposite *in vitro* in Vegetable or Fresh Fruit
Yuliia Viktosenko, 15, Freshman, Chemical Ecological Lyceum, Dnipro, Dnipropetrovsk Region, Ukraine

CHEM043T To Investigate the Fire-Resistant Property of Rice Husk
Fiha Khan, 17, Junior,
Ayesha Aamir, 17, Junior,
Pak Turk Maarif International Schools and Colleges, Karachi, Sindh, Pakistan

CHEM044 Detecting and Imaging Triple Negative Breast Cancer Using Water-Soluble Perovskite Quantum Dots
Vinod Ruppa-Kasani, 15, Freshman, Chattahoochee High School, Johns Creek, GA

CHEM045T N-doped Carbon Quantum Dots-Based Selective and Sensitive Fluorescent Probes: Portable in situ Water Monitoring Prototype Kit for Hg2+ and Pb2+
Marvince John Araneta, 18, Senior,
Lorraine Joy Bales, 18, Senior,
Iloilo National High School, Iloilo City, Philippines

CHEM046 Acetaminophen Phenylbutyrate Conjugate Is an Alternate to Acetaminophen
Shreya Kavuru, 17, Junior, St. Paul's School, Concord, NH

CHEM047T A Study on the Removal Method of Microplastic Using *Ambrosia trifida*
Seojune Kang, 17, Senior,
Junah Kang, 17, Senior,
Sejong Academy of Science and Arts, Sejong, Chungcheong, South Korea

CHEM048 Innovative Photocatalytic Materials to Enable Global Accessibility to Clean Water
Aoife Morris, 17, Junior, St. Aloysius' College, Carrigtwohill, Cork, Munster, Ireland

CHEM049T Methyl Formate as a Reducing Agent for Reductive Amination: New Approach for C-N bond Formation
Anton Kuznetsov, 17, Junior,
Fedor Kliuev, 17, Junior,
Moscow South-Eastern School Named After V. I. Chuikov, Moscow, Russian Federation

CHEM050T Facile Synthesis of Cr-doped NiSx Nanoflowers as Ultra-Highly Efficient Electrocatalyst for Hydrogen Evolution Reaction
Man Teng Leung, 16, Junior,
Fei Fei Cheong, 17, Junior,
Weng Chio Ye, 17, Junior,
Macau Pooito Middle School, Macao, China, Macao Special Administrative Region

CHEM051T Carbon (IV) Oxide Electro-Reduction Process to Curb Effects of Global Warming
Jennipher Kitsao, 19, Junior,
Joan Otieno, 19, Junior,
Njoro Girls High School, Nakuru, Kenya

CHEM052 A Novel Approach for Heavy Metal Removal from Aqueous Solutions using Ferrofluids
Sachitaa Senthilkumar, 16 Sophomore, Cypress Bay High School, Weston, FL

Computational Biology and Bioinformatics

CBIO001 Cancer Survival Rate Analysis: Cytoskeletal Protein Stop and Frame Shift (fs) Codons *vs.* Missense Codons
Jessie Strickland, 16, Sophomore, Wildwood High School, Wildwood, FL

CBIO002T Utilization of Artificial Intelligence Assisted Brain-Computer Interface to Allow Patients with Motor Impairments or Paralysis to Regain a Range of Mobility
Cindy Mo, 14, Freshman,
Freddie Liang, 14, Freshman,
President Theodore Roosevelt High School, Honolulu, HI

CBIO003 Correlation between Protein Type and Fatality Rates in Zaire Ebolavirus
Ellen Jones, 15, Freshman, Haines City IB East, Lake Wales, FL

CBIO004 MedBrain: A Novel Deep Learning Tool for Holistic Patient Data Interpretation and Clinical Event Prediction
Suraj Anand, 17, Senior, Palos Verdes Peninsula High School, Rolling Hills Estates, CA

CBIO005 Analyzing the Mechanics of Pollutant Degradation
Melannie Nimocks, 18, Senior, College Park High School, The Woodlands, TX

CBIO006T Persistent Homology and Analysis of Histological Data
Georgii Kadantsev, 17, Junior,
Aleksandr Sinitsyn, 17, Junior,
School 564, St. Petersburg, Russian Federation

CBIO007 Exploring the Mechanisms of Major Depression and Antidepressant Response Using Gene and miRNA Expression
Ethan Dunsworth, 17, Junior, Wentzville Holt High School, Wentzville, MO

CBIO008 Predicting Epileptic Seizures Using Discrete Wavelet Transform and Machine Learning
Daye Kwon, 17, Junior, Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

CBIO009 A Biologically-inspired, Biomarker-driven, Rapid Early Warning System for Epileptic Onset Prediction and Seizure Detection Using Machine Learning
Pratik Vangal, 16, Sophomore, Sunset High School, Portland, OR

CBIO010 Identifying Tablets Using Neural Networks
Isha Narang, 15, Freshman, Ardrey Kell High School, Charlotte, NC

CBIO011T Understanding Schizophrenia: Changing the Game with the Oral Microbiome
Madeline Hace, 17, Junior,
Eliana Zubert, 17, Junior,
Chanhassen High School, Chanhassen, MN

CBIO012T Auditory Attention Decoding Approach to Cocktail Party Problem Using Deep Learning
Govardhan Poondi, 17, Junior,
John Rho, 17, Junior,
Plano West, Senior High School, Plano, TX

CBIO013 Determining Gene Interactions in Congenital Heart Disease for Development of a Comprehensive Fetal Cardiac Diagnostics Platform
Krithik Ramesh, 17, Senior, Cherry Creek High School, Greenwood Village, CO

CBIO014 Finding the Most Influential Factors in the Healing Process of Diabetic Foot Ulcers Using Parameter Space Geometry
Gloria Huang, 16, Junior, The Carol Martin Gatton Academy of Mathematics and Science in Kentucky, Bowling Green, KY

CBIO015 Identification of Novel LEAD Compounds for Solute Transporter Protein Member 5 in Sensorineural Hearing Loss
Saaim Khan, 16, Junior, Cranbrook Kingswood School, Bloomfield Hills, MI

CBIO016 An Enhanced Early Detection Model of Dengue Fever Outbreaks Using SEIR Infectious Disease Epidemiological Compartments, Generalized Linear Regression, and Statistical Computing
Tarun Kumar Martheswaran, 16, Junior, The Waterford School, Sandy, UT

CBIO017 Abstract Text Mining to Create an Exhaustive Disease-disease Correlation Database
Suchir Misra, 17, Senior, Jericho High School, Jericho, NY

CBIO018 A Smart Heart Monitoring System with ECG Analysis Based on Deep Transfer Learning
Jason Park, 17, Junior, Baton Rouge Magnet High School, Baton Rouge, LA

CBIO019 The Development of Neural Network Inversions on Synthetic MRI Data Masks to Accurately Estimate Brain Tissue Stiffness Indicative of Alzheimer's Dementia
Andrew Cao, 16, Junior, Century High School, Rochester, MN

CBIO020 Multiparameter Optimization of the Extracellular Matrix: A Novel Approach to Controlling Cancer
Antara Pal, 18, Senior, Acton Boxborough Regional High School, Acton, MA

CBIO021 Improving Hazard Characterization in Bacterial Pathogens: Predicting Efficiency of Antibiotics Using Machine Learning
Munira AlBerahim, 16, Junior, AlTarbyah AlIslamiya Schools, Riyadh, Riyadh, Saudi Arabia

CBIO022T A Pilot Benchmarking Study of Deep Neural Network Performance on Low Magnification Pathology ROIs
Christopher Pondoc, 18, Senior,
Alexander Plisov, 18, Senior,
Frederick High School, Frederick, MD

CBIO023T Activity-by-Contact Model to Predict Enhancer-Gene Connections: A Tool to Increase Our Understanding of Cancer
Lillian Petersen###, 17, Senior,
Maximilian Corliss, 17, Junior,
Los Alamos High School, Los Alamos, NM

CBIO024T Functional Genetic Biomarkers of Alzheimer's Disease and Gene Expression from Peripheral Blood
Amish Sethi, 16, Sophomore,
Andrew Ni, 16, Sophomore,
Pine-Richland High School, Gibsonia, PA

CBIO025 Genes that Make You Go HMM: Errors in Protein Sequences Propagated by Heuristic Conveniences Fixed with Probabilistic Models
Qijia Liu, 17, Senior, Westview High School, Portland, OR

CBIO026 PANCREAS.AI: Novel Deep Learning-based Screening Towards Precision Applications for Pancreatic Cancer
Rishab Jain, 15, Freshman, Westview High School, Portland, OR

CBIO027 A Real-Time miRNA-based Machine Learning Approach for Precision Cancer Therapeutics
Darsh Mandera, 15, Freshman, Jesuit High School, Portland, OR

CBIO028 Mining Common Structural Features of Aggregating Proteins in Neurodegenerative Diseases
Shuwen Zhang, 17, Junior, Vivian Webb School, Claremont, CA

CBIO029T DeepChem: Using Generative Adversarial Networks to Develop Novel Inhibitors of Carcinomas
Harsh Deep, 16, Sophomore,
Krishay Mukhija, 17, Junior,
The Harker School, San Jose, CA

CBIO030 Modeling Distant Metastasis-Free Survival: Applications to Hazard Prediction and Pairwise Gene Interaction Discovery
Russell Yang, 16, Junior, The Harker School, San Jose, CA

CBIO031 Gene Embedding: A Novel Computational Hybrid Approach to Somatic Mutation-Based Primary Cancer Type Identification and Biomarker Discovery
Sidra Xu, 16, Junior, The Harker School, San Jose, CA

CBIO032 Real-time Correlation of Electrode Stimuli onto a Movement Model
Adriel Torresola Merced, 16, Senior, Centro Residencial de Oportunidades Educativas de Mayagüez, Mayagüez, Puerto Rico, Puerto Rico

CBIO033T Implementing a Machine Learning Model in an Effective and Low-Cost Parkinson's Disease Diagnosis Algorithm
Sanjita Pamidimukkala#, 16, Junior,
Dennis Chan, 17, Junior,
Dougherty Valley High School, San Ramon, CA

CBIO034 Survival Analysis of Pediatric Neuroblastoma Patients Using Gene Expression Data: Identification of Novel Neural Differentiation Related Biomarkers
Ankita Menon, 17, Junior, Nikola Tesla STEM High School, Redmond, WA

CBIO035 Identification of Novel Antimicrobial Peptides with Designed Activity through a QSAR Based Machine Learning Model
Fiona Luo, 16, Junior, Monta Vista High School, Cupertino, CA

CBIO036 Getting Cryptic with Bioinformatics!
Katheryne Lochart, 18, Senior, Broadneck High School, Annapolis, MD

CBIO037 GADDNET: A Platform for Connecting Researchers via the Genes and Diseases They Studied and Will Study
Emma Yang, 16, Junior, Brearley School, New York, NY

CBIO038 Determining the Most Cost-Efficient Indicators of Alzheimer's Disease Using Neural Networking
Brea Swartwood, 17, Senior, Mililani High School, Mililani, HI

CBIO039 An Optimized Molecular Docking Protocol Targeting Musashi RNA-Binding Proteins for Cancer Drug Design
Khushi Kohli, 16, Junior, Olathe North High School, Olathe, KS

CBIO040 Predicting Recurrence in Triple-Negative Breast Cancer Patients through Analysis of the Tumor-Immune Microenvironment
Aalok Patwa, 17, Junior, Archbishop Mitty High School, San Jose, CA

Earth and Environmental Sciences

EAEV001 Engineering a Filter through 3-D Printing Capabilities in order to Remove Microplastics from Drinking Water
Ashna Sai, 16, Junior, Spruce Creek High School, Port Orange, FL

EAEV002 A Novel Machine Learning Process for Proactive Management of Cyanobacteria Blooms and Microcystin Toxins
Griffin Wagner, 18, Senior, Vero Beach High School, Vero Beach, FL

EAEV003T A Natural Solution to Sinkholes
Mia Johnson, 18, Senior,
Kaitlyn Taylor#, 17, Senior,
The Villages Charter High School,
The Villages, FL

EAEV004 A Dual Sensor Machine Learning Approach to Sulfur Quantification in Lignite Coal
Julia Kagiliery, 17, Junior, Episcopal School of Jacksonville, Jacksonville, FL

EAEV005 Programming an Analysis of the Effects of the El Niño-Southern Oscillation Cycle on the Development of Hurricanes and Their Translation Speed
Aidan Gregerson, 16, Sophomore, Kauai High School, Lihue, HI

EAEV006 Phosphate Loading Prevention Qualities of Biodegradable Filters for Septic Use
Beatrice Youd, 17, Senior, F J Turner High School, Beloit, WI

EAEV007 Evaluating the Effects of Heavy Metals on the Germination and Development of Seeds and Employing the Bioremediation Properties of Wood Mulch in Extracting Heavy Metals from Tar Creek
Peyton Carter, 17, Junior, Cascia Hall Preparatory School, Tulsa, OK

EAEV008 Clean Clothes, Contaminated Conditions: Fabric as a Source of Plastic Microfiber Pollution
Savannah Scriven, 18, Senior, Palos Verdes High School, Palos Verdes Estates, CA

EAEV009 To Tree or Not to Tree: Tracking Survival and Growth of *Pocillopora acuta* Spat on Coral Restoration Trees *vs.* Direct Reef Placement
Mariko Quinn, 17, Senior, James B. Castle High School, Kaneohe, HI

EAEV010T Processing and Testing of the Invasive Species, *Ipomoea aquatica*, as a Low-Cost and Environmentally Sustainable Soil Amendment Agent
Ashlynn Carney, 15, Sophomore,
Caleb Beeler, 16, Sophomore,
Mililani High School, Mililani, HI

EAEV011 Don't Be So Salty, Phase III: The Phytoremediation of Brine Contaminated Soils through the Use of Cover Crops, Halophytes, and Foxtail Barley
Evan Knoll, 15, Freshman, Park Christian School, Moorhead, MN

EAEV012 A Quantum Leap: Application of CNTs/GOs/GQDs to Desalination Using MDCs
Ashar Khazi-Syed, 16, Sophomore, Harmony School of Innovation - Fort Worth, Fort Worth, TX

EAEV013 Predicting Harmful Algal Blooms to Mitigate Neurotoxin Exposure Using 20 Years of Shellfish and MODIS Satellite Data
Lila Schweinfurth, 17, Junior, Oregon Episcopal School, Portland, OR

EAEV014T The Effects of Cobalt on *Daphnia magna*
Sarah Boyer, 17, Junior,
Elizabeth Bennett, 17, Junior,
Mary Persons High School, Forsyth, GA

EAEV015 Remote Controlled Solar Powered Micro and Macro Plastic Water Cleaning System (Year 2)
Joseph Enguidanos, 18, Senior, Niceville High School, Niceville, FL

EAEV016T A Simplified Method to Measure Ground-Level Ozone in the Atmosphere
Mattie Singley, 18, Senior,
Emily Stratman, 18, Senior,
Brush High School, Brush, CO

EAEV017 Environmentally Friendly Alternatives to Standard Road Salts
Jack Gootzeit, 15, Freshman, Waconia High School, Waconia, MN

EAEV018 Investigating Urban Heat Islands Using Mathematical Models, Satellite Data, and On-Site Measurements
Kathryn Kummel, 16, Junior, William J. Palmer High School, Colorado Springs, CO

EAEV019T Searching the Shadows: Using s Shadows in Aerial Imagery to Classify Trees by Genus for Urban Tree Management, Year II
Abigail Roh, 18, Senior,
Samantha Detor, 18, Senior,
Breck School, Golden Valley, MN

EAEV020 The Long-Term Monitoring of Macroinvertebrate Community Structure in an Intermittent Ozark Headwater Stream
Echo Mitchell, 14, Freshman, Rural Special High School, Fox, AR

EAEV021 Stayin' Alive: Effects of Disturbances on the Biodiversity of an Aquatic Ecosystem
Madison Perkins, 14, Freshman, Gilmer High School, Gilmer, TX

EAEV022 Determining the Toxicological Effects of Polyurethane Foam and Complex Leachate on *Artemia nauplii*
Virginia Worrell, 18, Senior, Southwest Virginia Governor's School, Pulaski, VA

EAEV023 Coral Grief: Machine Learning on Crowd-sourced Data to Highlight an Ecological Crisis
Rithika Narayan, 17, Junior, Elwood John Glenn High School, Elwood, NY

EAEV024 Effect of Cities on Normalized Differences of Land
Rina Cao, 16, Junior, University City High School, San Diego, CA

EAEV025 Microfossils and Monsoons: What Is Their Relationship across the Deglaciation?
Mia Franks, 17, Senior, University High School, Tucson, AZ

EAEV026 Global Mean Sea Level Variations on Interannual-to-Decadal Timescales
Ting-Juan Liao, 18, Senior, The Affiliated, Senior High School of National Taiwan Normal University, Taipei City, Chinese Taipei

EAEV027 Climate Change: How Carbon Dioxide Affects the Earth's Atmosphere and Oceans
Caleb Morgan, 15, Freshman, West Point, Junior High School, West Point, UT

EAEV028 Modeling *in vitro* Environmental Impacts on Nutrient Remediation in Immobilized *Chlorella vulgaris* (A Novel Second Year Study)
Morgan Barnes, 15, Freshman, Canterbury School, Fort Myers, FL

EAEV029 Optimizing *S. cerevisiae* Population Networks for Ecological Resilience
William Park, 16, Junior, Northfield Mount Hermon School, Gill, MA

EAEV030 Incorporating P.M. 2.5 to Improve Harvested Rainwater Quality
Seung-a Baek, 16, Junior, McIntosh High School, Peachtree City, GA

EAEV031 Carbon Capture Using Solid Sorbents. CO_2 Adsorption Using Amine-Tethered Polystyrene and Polyacrylic Polymers in Humid Conditions
Glenn Grimmett, 18, Senior, American Heritage School of Boca Delray, Delray Beach, FL

EAEV032 Antibiotic Effects on *Tenebrio molitor* Ingestion of Styrofoam
Kieran Dunn, 16, Sophomore, Boston College High School, Boston, MA

EAEV033 Impact of Grain Size and Inclination on Liquefaction Induced Lateral Ground Displacement for Sands Subjected to Simulated Seismic Shock
Rosemary Yahne, 16, Sophomore, Northern Utah Acadamy for Math, Engineering and Science, Layton, UT

EAEV034 Coastal Wave Attenuation Effect of *Rhizophora sp.* & *Avicennia sp. vs.* Vertical Seawalls & Other Man-made Coastal Protections
Parker Smith, 16, Junior, Dunwoody High School, Dunwoody, GA

EAEV035 Plastic Debris as a Vector for Heavy Metal Transport and Contamination in the Marine Environment
Melanie Quan, 17, Junior, Las Lomas High School, Walnut Creek, CA

EAEV036 Effect of Sanco Crystal Blue Ultra Concentrate Pond Dye on Swimming Behavior of *Daphnia magna*
Madeline Phuong, 15, Freshman, Homestead, Senior High School, Fort Wayne, IN

EAEV037T Investigating the Use of *Ceratopteris richardii* as a Model Plant for Phytoremediation of Cadmium
Blake Lippman, 16, Junior,
Tyler Bissoondial, 14, Freshman,
George W. Hewlett High School, Hewlett, NY
John F. Kennedy High School, Bellmore, NY

EAEV038 Evaluating Possible Effects of Polystyrene Sphere Ingestion on Brine Shrimp Hatchability, Longevity, and Length
Anastazja Krostenko, 17, Junior, John Adams High School, South Bend, IN

EAEV039 Using eDNA to Estimate *L. terrestris* Populations
Elliot Wald, 18, Senior, Joel E. Ferris High School, Spokane, WA

EAEV040 The Relationship between Residential and Commercial Zoning and the Concentration of Toxic Heavy Metals
Samuel Peterson, 18, Senior, Joplin High School, Joplin, MO

Embedded Systems

EBED001 Instrumental Platform for the Development of Specialized Computing Systems
Vladimir Egorov, 16, Sophomore, Moscow State School No. 1537, Moscow, Russian Federation

EBED002 Collision Alert Device for Sensing Potentially Harmful Foot Impacts
\#
Rebekah Dorminy, 16, Junior, Sola Fide Home School, McDonough, GA

EBED003 Novel Method of Monitoring Chronic Kidney and Other Renal Diseases Using Colorimetric Test Strip Sensor and IoT Enhancement
Brady White, 14, Freshman, Fleming Island High School, Fleming Island, FL

EBED004 Machine Learning Coupled Trajectory and Communication Design for UAV Facilitated Wireless Networks
Aksh Garg, 16, Junior, Palos Verdes Peninsula High School, Rolling Hills Estates, CA

EBED005T #include Brain.h
Diego Ornelas, 16, Junior,
Jordan Cancino, 17, Junior,
Weslaco High School, Weslaco, TX

EBED006 Smart Car Steering Wheel
\#\#
Aziz Hanafi, 16, Sophomore, International School of Carthage, Tunis, Carthage, Tunisia

EBED007 Implementing an Alert System for Trains at Level Crossings
Joaquin Haces-Garcia, 17, Junior, Academy High School, Kingsville, TX

EBED008T See through the Rubble: A Multimodal Bioradar Life Detection System for Search and Rescue Applications
Rajiv Swamy, 18, Senior,
Rekha Swamy, 18, Senior,
Plano East, Senior High School, Plano, TX

EBED009 Engineering a Cost-Effective and Intelligent Kinematic Tracking System Utilizing Machine Learning
Ian Pedroza, 17, Junior, College Park High School, The Woodlands, TX

EBED010 A Multi-Mode and Auto-Adjustable Visual-Cue-Assisted Gait Rehabilitation System
Ya-Chun Yu, 16, Junior, Taipei First Girls High School, Taipei, Taiwan

EBED011 FireWatch: A Low-cost Wildfire Monitoring System for High-resolution Fire Localization Using Data Sparsity and Feature Matching
Neil Suri, 16, Junior, Oakton High School, Vienna, VA

EBED012 Miniature Telemetry Transmitter for Long Duration Super Pressure Balloon Flight
\#\#
Natalie White, 17, Senior, University High School, Fresno, CA

EBED013 Stay Tuned: An Automatic Tuning Device for Violins
Yizhe Sun, 17, Junior, Shanghai Foreign Language School Affiliated to SISU, Shanghai, China

EBED014 Tomorrow's Crosswalk with Safe Stroll
Jeewan Kaur, 15, Sophomore, Eleanor Roosevelt High School, Eastvale, CA

EBED015 A Low-Cost Hyper-Spectral Image-Processing System to Identify Stressed Crops for Improved Harvest Yields
Neel Jain, 16, Junior, West Linn High School, West Linn, OR

EBED016 AgX
Callum Taylor, 18, Senior, The King's School, North Parramatta, New South Wales, Australia

EBED017 Digital Logic Gates
Zachary McCoy, 16, Junior, Alma High School, Alma, AR

EBED018 IRRIGATEX
Mohammed Kilani, 17, Junior, Modern Systems School, Amman, Amman, Jordan

EBED019 ARAMBH: An Adaptive, Data-Driven, ML-Based Signal Control System
Om Shelat, 18, Senior, Shiv Nadar School, Gurugram, Haryana, India

EBED020 Real-time Fall Detection System for the Elderly Using Deep Learning and Thermal Imaging
Vetri Vel, 15, Junior, Bangor High School, Bangor, ME

EBED021T ABANTE: Arduino-Based Anti-Theft Engine Control by Alcohol-Sensing and Accident Preventive Helmet
Chloe Heather Ellano, 18, Senior,
Thea Marie Lumabi, 18, Senior,
Adoniram Balagtas, 18, Senior,
Caloocan National Science and Technology High School, Caloocan City, National Capital Region, Philippines

EBED022 Reinventing the Wheel: Development of a Novel Magnetic Motion Device for Omnidirectional Movement
Alice Shaughnessy, 17, Senior, Calasanctius College, Oranmore, Co. Galway, Ireland

EBED023   Life READER: REmote Airborne DEtection of Respiration
Lana Lubecke, 17, Junior, Kalani High School, Honolulu, HI

EBED024   The Amazing MYO
Yashua Evans, 17, Junior, The Academy for Advanced Studies, McDonough, GA

EBED025   Accessible Assistive Technology for People with Quadriplegia
Alvaro Vasques, 18, Senior, Instituto Federal de Educacao, Ciencia e Tecnologia Baiano Campus Valenca, Valenca, Bahia, Brazil

EBED026   MindTalk
Mir Muqsit Ali, 16, Junior, Aga Khan Higher Secondary School, Karachi, Sindh, Pakistan

EBED027   A Novel Approach of Slope Failure Analysis via Noise Injected Data for Representation Learning K-means Clustering and Convolutional Neural Networks
Jerome Ariola, 18, Senior, John F. Kennedy High School, Tamuning, Guam

EBED028T Intelligent Disabled Parking Lot Detector
Irdina Mohd Eusof, 16, Sophomore,
Muhammad Irfan Mazlan, 17, Senior,
Sekolah Menengah Kebangsaan Bandar Uda Utama, Johor Bahru, Johor, Malaysia

EBED029   A Low-Cost Approach to Handheld Laser Diode Communication
\#   Cary Xiao, 16, Junior, Alabama School of Mathematics and Science, Mobile, AL

EBED030T Assessing the Structural Strength of Concrete Members Using a Low-Cost, Non-Invasive Monitoring System
Nimish Mathur, 17, Junior,
Demos Negash, 17, Junior,
duPont Manual High School, Louisville, KY

EBED031   Developing a Power-Assisted Voice-Controlled Manual Wheelchair
Kaylin Naidoo, 16, Junior, Star College Boys' High School, Durban, KwaZulu-Natal, South Africa

Energy: Sustainable Materials and Design

EGSD001 Enzymatically Treated Cellulosic Packaging Waste Utilized to Release Fermentable Sugars for the Production of Bioethanol
Serenity Derousie, 16, Sophomore, Ridgeview High School, Orange Park, FL

EGSD002 S.E.R: Supply System of Electric Energy in Rural Environment
Vitor Andrade, 18, Senior, Colegio Franciscano Santo Inacio, Baependi, Minas Gerais, Brazil

EGSD003 Cow Manure and Kitchen Scraps: Year Two, Comparison of Cow and Pig Manure for Methane Production
Eres David, 14, Freshman, Eagle's Landing High School, McDonough, GA

EGSD004 Hybrid Triboelectric-Electromagnetic Nanogenerator for Energy Scavenging
Elaijah Islam, 18, Senior, UTRGV Mathematics and Science Academy, Edinburg, TX

EGSD005 Polydimethylsiloxane Microlens-Enhanced Flexible Gallium Arsenide Solar Cells to Increase Driving Range of Electric Automobiles
Kumaran Selva, 18, Senior, Clear Lake High School, Houston, TX

EGSD006T UltraSolar: Increasing Photovoltaic Efficiency via a Novel Low-Cost Add-on of Fluorescent and Phosphorescent Solutions
Rohan Chhaya, 17, Senior,
Walter Stark, 17, Senior,
Plano, Senior High School, Plano, TX

EGSD007 Developing a Practical Microbial Fuel Cell for Industrial Setting
Janet Arvizu-Garcia, 17, Junior, Wilkinson County High School, McIntyre, GA

EGSD008 Assessment on the Effect of Microbial Fuel Cells to Produce Electricity, C.P. "La Yarada" 2019
Leidy Tairo Chambilla, 16, Junior, Jose de San Martin, Bongara, Amazonas, Peru

EGSD009T Comparative Assessment on Biofuel Based on Nostoc Commune (Cushuro) and Chicken Fat
Yamileth Rincon Tejeda, 16, Junior,
Janirey Raymundo Cangalaya, 16, Junior,
San Mateo de Huanchor, San Mateo, Huarochiri - Lima Provincias, Peru

EGSD010 Transformation of Household and Agricultural Waste into Stable and Energy Dense Biomass Briquettes
Nathaniel Dietz, 17, Junior, Chatfield High School, Chatfield, MN

EGSD011 The Effect of a Heat Sink on a Solar Panel's Efficiency on a Large Scale
Markie Whitney, 18, Senior, Newcastle High School, Newcastle, WY

EGSD012 All-Carbon Supercapacitor Optimization in Electric Vehicles: Fabrication and Empirical Analysis of Graphene Dispersion/Activated Carbon on Conductive Networks in Porous Felt Supercapacitor for Acceleration and Regenerative Braking Assistance
Brayden Noh, 18, Junior, Auburn High School, Auburn, AL

EGSD013 An Economic Approach to Ionic Liquid Pretreatment and Kudzu (*Pueraria montana*) Feedstock for Lignocellulosic Biofuel Production
Michelle Gong, 15, Freshman, Little Rock Central High School, Little Rock, AR

EGSD014 The Effect of V2O5 + TiO2 Composite Cathodes on the Cyclability and Specific Capacity of Iron-Ion Batteries
Daniel Cudzich, 18, Senior, Niles Township West High School, Skokie, IL

EGSD015T The Creation and Optimization of a Plant Microbial Fuel Cell for Energy Generation Using *Brassica rapa*
Samantha Chen#, 16, Junior,
Emma Wang, 16, Junior,
Manhasset High School, Manhasset, NY

EGSD016 The Use of Supercapacitors as an Emergency Power Source
Maya Tovar, 15, Sophomore, Sierra High School, Tollhouse, CA

EGSD017 Assemble Supramolecular Enzyme Complexes on Yeast Cell Surface for Direct Conversion of Biomass to Ethanol
Margaret Yang, 15, Sophomore, Cranbrook Kingswood School, Bloomfield Hills, MI

EGSD018T Preparation of Perovskite Films Using Large Organic Cations to Increase Stability to Degradation
Svetlana Lundina, 17, Junior,
Anzhelika Vanina, 17, Junior,
University High School Moscow State University Named after M. V. Lomonosov, Moscow, Moscow, Russian Federation

EGSD019 All Solid-state Flexible Battery with Fast-Charging
Yan Lin, 17, Junior, Tsinghua University High School, Beijing, China

EGSD020T Development of All-in-one,
Green Supercapacitor from Cassava
Pattrapon Wisidmontien, 18, Senior,
Vanee Prikboonchan, 18, Senior,
Ravisara Suetrong, 17, Senior,
Suankularbwittayalai Rangsit School, Khlong
Luang District, Pathum Thani, Thailand

EGSD021 Improving Energy Efficiency of Electric Vehicles
via Piezoelectric Incorporated Materials
Damian Galasso, 17, Junior, Galasso Homeschool,
Tucson, AZ

EGSD022 Increasing the Stability of Cost-Effective
Perovskite Solar Cells Using a Novel Design with
BAPbI 3 and Carbon
Aseel Bukhari, 17, Senior, KFUPM Schools,
Dhahran, Eastern Province, Saudi Arabia

EGSD023 A Comparative Study of Electrochemical Solar
Supercapacitor Using Cadmium Sulfide
Nanospheres and Self Synthesized Quantum
Dots by Applying Advanced PLAL Method
Woud AlSadoun, 18, Senior, KFUPM Schools,
Dhahran, Eastern Province, Saudi Arabia

EGSD024 Enhancing M-doped Bi2Te2.7Se0.3 for
Thermoelectric Power Generation Using
Advanced Pulsed Laser Deposition Technique
Shouq Madani, 17, Senior, KFUPM Schools,
Dhahran, Eastern Province, Saudi Arabia

EGSD025 Efficient Solar Hydrogen Production Using
Hematite Photoanode Modified with CoFe
Prussian Blue Catalyst via a Novel Surface
Modification Approach
Lama Jarad, 17, Senior, KFUPM Schools, Dhahran,
Eastern Province, Saudi Arabia

EGSD026 Analysis of the Degradation and Biogas Yield of
Anaerobic Digestion of PHBV, PLA, Cellulose,
and PBT Bioplastics with Wastewater Sludge
Inoculum and Food Waste
Benjamin Nachod, 16, Sophomore, Poolesville
High School, Poolesville, MD

EGSD027 Building an Efficient Reversible Fuel Cell Stack
for Use as a Backup Power Source
Anna Grondolsky, 18, Senior, Kamehameha
Schools Kapalama Campus, Honolulu, HI

EGSD028 Catch the Wave
Lauren Jeffries, 15, Freshman, Boone Grove High
School, Valparaiso, IN

EGSD029T Development of a Small Wind
Turbine with Airflow Control Technique Using a
Plasma Actuator
Yu Ishikawa, 17, Junior,
Yoshimi Yokoyama, 17, Junior,
Fukushima Prefectural Fukushima High School,
Fukushima-shi, Fukushima-ken, Japan

EGSD030 Zeolitic Imidazolate Framework Derived-cobalt
Phosphosulfide Nanoparticles Encapsulated into
P, S, N Tri-doped Carbon as Highly Active
Bifunctional Oxygen Electrocatalyst for Zn-Air
Battery
Jeremy Hu, 17, Junior, Pui Ching Middle School,
Macao, Macao, China, Macao Special
Administrative Region

EGSD031 Postharvest Canola Stalks for Cellulosic Ethanol
Production
Chloe Winkler, 15, Sophomore, Odessa High
School, Odessa, WA

EGSD032 Alternate Vehicular Traffic Direction System
Utilizing Solar Energy, Phase II
Sebastian Medina, 16, Junior, Brigida Alvarez
Rodriguez Mathematics and Science High School,
Vega Baja, Puerto Rico

EGSD033 YVDY(Your Voice Distinguishes You)
Rama Alomari, 16, Junior, Dair Yusouf
Comprehensive High School, Irbid, Jordan

EGSD034 Zeolite Heat Exchanger
Yusra Ahmed, 15, Sophomore, Pak Turk Maarif
International Schools and Colleges, Karachi,
Sindh, Pakistan

EGSD035T Homemade Biodigester with Greater Production
of Natural Gas from Decomposed Food
Adrian Lugo Santiago, 16, Junior,
Julián Figueroa Miranda, 16, Junior,
Specialized in Baseball Manuel Cruz Maceira,
Comerío, Puerto Rico

EGSD036T Biogas
Jehovhands Thelus, 18, Senior,
Yud-Haendel Hilaire, 17, Sophomore,
College Saint-Jeseph Du Cap-Haitien, Cap-Haïtien,
Nord, Cap-Haïtien, Haiti

EGSD037T Solar Energy Based on Multiple End
Products System
Aylin Sadixova, 15, Freshman,
Sila Sunan, 14, Freshman,
XXI Century International School, Baku, Azerbaijan

EGSD038 Creation of Marketable Cost
Efficient Transparent Solar Cells with Design
and Testing via Virtual Computer Simulations
and Engineered Model Prototypes for the
Product's Development through the Fabrication
of Nanotechnology
Tashu Gupta, 16, Junior, Bayonne High School,
Bayonne, NJ

EGSD039 Optimal Design of a Reflector to Increase
Photovoltaic Cell Output
Ella Madsen, 15, Sophomore, Madsen
Homeschool, Provo, UT

EGSD040   A Novel Process to Fabricate Whole-Pore
Bipolar Membranes for Fuel Cell: Method
Improvements and Fuel Cell Performance
Results

\#   Nikhita Bontha, 15, Sophomore, Hanford High
School, Richland, WA

EGSD041T The Real Green Energy Enable of the Big Four
Agenda in Kenya
Catherine Mutua, 17, Sophomore,
Cindy Felix, 17, Junior,
Machakos Girls High School, Machakos, Kenya

EGSD042   Testing Different Anthocyanin Sources and
Analyzing the Adsorptions on TiO2 (Titanium
oxide) Nanoparticles with an Electron
Microscope in DSSC
Oluwanifemi Makanjuola, 15 Freshman, Indiana
Math and Science Academy-North, Indianapolis,
IN

Engineering Mechanics

ENMC001 Theoretical and Experimental Aspects Regarding the Development of Morphing Wing Structures for Aerodynamic Efficiency Improvement
\#   Stefan Ursu, 18, Junior, Colegiul Nicolae Titulescu, Brasov, Brasov, Romania

ENMC002 Investigating the Viability of a Deployable Parachute System with Aerial Detachment of the Cabin for Impending Commercial Airplane Crashes via a Novel Computer Simulation
         Vivek Sandrapaty, 15, Freshman, West Port High School, Ocala, FL

ENMC003 Wing Ding
         Charles Sherwin III, 16, Sophomore, Niceville High School, Niceville, FL

ENMC004 Civil Engineering III: A Study of Concrete Mix Designs
         Riley Stokes, 18, Senior, New Home ISD, New Home, TX

ENMC005 Safe Flight: Innovative Modification of a Wing
         Bartosz Piechocki, 19, Senior, 4th Secondary Grammar School, Pozna, Wielkopolska, Poland

ENMC006 A Novel Seawall Design to Reduce Wave Reflections and Overtopping
\#\#   Michael Chen, 17, Senior, Ridgeview High School, Orange Park, FL

ENMC007 Acoustic Levitation: Which Phase Offset Pattern Maximizes Range of Movement?
         Nolan Haisler III, 15, Freshman, President William McKinley High School, Honolulu, HI

ENMC008 Visualization of Three-Dimensional Rocket Motor Flow Using Schlieren Photography
         Melanie Deville, 16, Sophomore, Westminster Christian School, Palmetto Bay, FL

ENMC009T Developing a Multi-Use UAV Capable of Long-Range Flight
         Alexander Bell#, 17, Junior,
         Nicholas White#, 16, Junior,
         Evan Curry#, 17, Junior,
         Kealakehe High School, Kailua-Kona, HI

ENMC010T Creating an Electromagnetic Suit to Simulate Gravity and Electromagnetism Effects on *Dugesia* tigrina
         Izabelle Young, 15, Sophomore,
         MaryAlice Young##, 18, Senior,
         Bishop Kenny High School, Jacksonville, FL

ENMC011T EasyPool: Equipment to Help People with Motor Difficulties to Access the Pool
         Maria Pohren, 19, Senior,
         Tais Enzweiler, 19, Senior,
         Fundacao Escola Tecnica Liberato Salzano Vieira da Cunha, Novo Hamburgo, Rio Grande do Sul, Brazil

ENMC012 Hydroloop
         Ken Yaguchi, 16, Sophomore, Hector J. Garcia Early College High School, Laredo, TX

ENMC013T Deburring on a Next Level! Using Ultrasound to Deburr Tensile Materials
         Jakob Rehberger, 18, Senior,
         Jonas Munz, 17, Senior,
         Kilian-von-Steiner Schule, Laupheim, Baden-Württemberg, Germany

ENMC014 Custom Power Solutions: Exploring the Efficiencies of a Stackable 3-Phase Brushless Motor Design
         Kyle Ledermann, 17, Junior, Grand Rapids High School, Grand Rapids, MN

ENMC015 Pinned in Fire: The Effects that Thermal Processing Has on the Working Properties of a Steel Bobby Pin
         Kate Boudreaux, 14, Freshman, Bartlesville High School, Bartlesville, OK

ENMC016T Hoverboard: A Magnetically Levitated Vehicle
         Felix Sewing, 19, Senior,
         Alex Korocencev, 19, Senior,
         Hochrhein-Gymnasium Waldshut, Waldshut, Baden-Württemberg, Germany

ENMC017T Increasing the Angle of Attack of an Airfoil Using Bernoulli's Principle
         James Prendiville, 17, Junior,
         Sriram Ravulapati, 17, Junior,
         Anay Naik, 17, Junior,
         Fort Myers High School, Fort Myers, FL

ENMC018 Development of a Fully Reusable and Autonomously Landing Suborbital Rocket: Year Two
\#\#\#   Ryan Westcott, 18, Senior, Oregon Episcopal School, Portland, OR

ENMC019 Exoskeleton: Built to Last, Built to Serve, and Built to Protect
\#   Grayson Barron, 16, Sophomore, John Curtis Christian School, River Ridge, LA

ENMC020 Autonomous Glider for Radiosonde Recovery
Tate Schrock, 16, Sophomore, Arickaree School, Anton, CO

ENMC021 Clean Machining: A Comparative Analysis of Cooling Systems in Subtractive Manufacturing Using Biphasic CO_2 as a Safe and Environmentally Sustainable Alternative
Brendan Crotty, 18, Senior, Hickory Hill Academy Homeschool, Muskogee, OK

ENMC022 Ezylift: The Design and Engineering of a Mechanical IRB/Boat Engine Transportation Device
Emma Leggett-Budden, 18, Senior, Barker College, Sydney, New South Wales, Australia

ENMC023 Croc around the Block: Can Crocodilian Adaptations Reduce the Wind Loads on High-Rise Buildings?
Angela Rofail, 16, Junior, Presbyterian Ladies' College, Sydney, Sydney, NSW, Australia

ENMC024 A Novel Coupled and Self-adaptive Anthropomorphic Robot Finger with a Dual-oblique-Belt Mechanism
Yinkai Dong, 17, Senior, Zhengzhou Middle School, Zhengzhou, Henan, China

ENMC025 CAD Modeling, Simulation and Prototyping of a Wave Energy Generation System for USVs
Ian Bailey, 17, Junior, Garden City High School, Garden City, NY

ENMC026 Leaf-Shaped Bionic Micro Flying Vehicle
Jiaqing Guan, 17, Junior, Beijing No. 35 High School, Beijing, China

ENMC027 Full-Color 3D Printer
Jieming Deng, 16, Junior, Nanjing Foreign Language School, Nanjing, Jiangsu, China

ENMC028 Building Bridge Designs
Bryce Despain, 17, Junior, Riverside High School, Lake City, AR

ENMC029 Design of a Novel Supersonic Nozzle Using a Multi-Objective Differential Evolution Framework
Jason Chen, 17, Junior, Thomas Jefferson High School for Science and Technology, Alexandria, VA

ENMC030 A Robotics Assistive Device Application in Minimizing Manibus Tremors and Persons Afflicted with Bradykinesia: Phase IV
Shaylee Stanger, 16, Sophomore, Clearfield High School, Clearfield, UT

ENMC031 Design and Research of Iron Removal Device for Road Sweeper
Peier Ding, 17, Junior, Hangzhou No.2 High School of Zhejiang, Hangzhou, Zhejiang, China

ENMC032T Senior Struggles
Anna Engelman, 15, Freshman,
Abigail Wilbers, 14, Freshman,
Ignite Institute, Erlanger, KY

ENMC033 Simulation of Quadrupedal Mechanical Motion with Regards to the Center of Gravity
Akane Shirota, 18, Senior, Liberty High School, Hillsboro, OR

ENMC034 Cockpit Innovation: In Stealth Fighter Jets
Victoria Whitehead, 15, Sophomore, Holy Spirit Catholic High School, Tuscaloosa, AL

ENMC035 Bionic Hexapod Robot and Study of Improving Walking Efficiency
Kangqi Ni, 17, Junior, Central Catholic High School, Lawrence, MA

ENMC036 Yaw Characteristics of a Powered Flying Wing of a Novel Design and Manufacture
Ethan Wong, 16, Sophomore, Arcadia High School, Arcadia, CA

ENMC037 Control of a Pneumatic Actuator Using Pulse Width Modulation
Rebecca Ashmore, 16, Junior, Blackstone Valley Regional Vocational-Technical High School, Upton, MA

ENMC038 SAGE: Space Astrofarm Greenhouse Enclosure
Charlotte Hively, 17, Junior, Urbana High School, Ijamsville, MD

ENMC039 Enhancing the Combustion of Ammonia as an Alternative Fuel by Adding Ozone
Ibrahim AlDulaijan, 17, Senior, Manarat Al Khobar National & International Schools, Al Khobar, Eastern Province, Saudi Arabia

ENMC040 Constructing Asphalt Solar Collectors into Waipahu Roads
Jeyan Francis Cornelio, 17, Junior, Waipahu High School, Waipahu, HI

ENMC041T Super Battery-Free "HYDRAULIMB" for Hand Amputees
Yuet Tung Cheung, 16, Junior,
Bingyi Cai, 17, Sophomore,
Ka Man NG#, 17, Junior,
Skh Li Ping Secondary School, NT, China, Hong Kong Special Administrative Region

ENMC042 Ash for Insulation
Dia'a Aldweikat, 17, Junior, Modern Systems School, Amman, Amman, Jordan

ENMC044 Biomimetic Wings for Enhanced Aircraft Performance
Sophie Hoye Pacholek, 16, Junior, Henry Wise Wood High School, Calgary, Alberta, Canada

ENMC045 Matrix-Based Systematic Approach for Self-
         Adjusting CNC Manufacturing Processes
         Jeremie Gaudreault, 16, Junior, College des
         Compagnons, Quebec, Quebec, Canada

ENMC046 Efficient Water Generation Using Zeolite Based
         Heating Technology
         Ana Da Silva Carvalho, 17, Junior, Herschel Jenkins
         High School, Savannah, GA

ENMC047 MobiPark, the Mobility Parking

         Management System
         Jordan Salmon, 17, Senior, Clancy Catholic
         College, Sydney, New South Wales (NSW),
         Australia

ENMC048 Polibrick - Rigid Polyurethane Foam Aggregate
         into Concrete Blocks
         Eduarda Lazzeri Goldani, 18, Senior, Fundacao
         Escola Tecnica Liberato Salzano Vieira da Cunha,
         Novo Hamburgo, Rio Grande do Sul, Brazil

ENMC049 Beauty and the Beast: A Novel Approach to the
         Reasons of Plasma Instabilities in Hall Thrusters
         Selin Ertan, 19, Senior, Ankara Fen Lisesi,
         Ankara, Turkey

ENMC050 The Wingtip's Influence on the Efficiency of
         Airplane Wings, and Design and Test of the New
         Swift Wingtip
         Magnus Oddershede, 19, Senior, Gladsaxe
         Gymnasium, Soeborg, Hovedstaden, Denmark

ENMC051 Countering Aerodynamic Flow Separation:
         Tangentially Blowing across Wing Surfaces by
         Nozzle-Jet Activations to Delay Flow Separation
         and Improve Airflow Laminarity
         Harsh Mathur, 18, Senior, Bishop Cotton Boys'
         School, Bengaluru, Karnataka, India

ENMC052 A New Faster Bike
         Husam Alas'ad, 16, Junior, Irbid Model School,
         Irbid, Jordan

ENMC053T Hydrauto: A Novel Self-Monitoring Homes and
         Commercials Water Reusable System
         Purification
         Thuthukani Florestal, 18, Junior,
         Nazario Glen Jennings Jean, 17, Junior,
         Christ Beaubrun, 18, Junior,
         College Dominique Savio, Petion-Ville,
         Port-au -prince, Haiti

ENMC054T The Idiosyncratic Monitor: A Child Safety Device
         Myrah Hussain, 15, Freshman,
         Aaminah Mohammad, 14, Freshman,
         Generation's School, Karachi, Sindh, Pakistan

ENMC055 Engineering a Superior Bumper
         Reinforcement System with a Piezoelectric
         Force Sensor in High Energy Collisions
         Andrew Wagner, 15, Freshman, Saginaw Arts and
         Sciences Academy, Saginaw, MI

ENMC056 A Gear System to Make Life Easier: Reinventing
         the Wheel
         Marthinus Dreeckmeier, 17, Junior, Hoerskool
         Waterkloof, Pretoria, Gauteng, South Africa

ENMC057T Rapid Flood Emergency Response Underwater
         Vehicle
         Chio Long Lao, 17, Senior,
         Sebastien Sin, 15, Sophomore,
         Pui Ching Middle School, Macao, Macao, China,
         Macao Special Administrative Region

ENMC058 Development and Iterative Design of Multistable
         Multi-Material Compliant Mechanisms
Avery Clowes, 18, Senior, Phillips Exeter Academy,
         Exeter, NH

ENMC059 Engineering a Low Cost Bioprinter
Christian Knuth, 18, Senior, Sarasota High School,
         Sarasota, FL

ENMC060T Integrating the Magnus Effect onto a Streamline
         Airfoil to Increase the Lift to Drag Ratio
         Quintan Ajluni, 17, Junior,
         Robert Ajluni, 17, Junior,
         Caddo Parish Magnet High School, Shreveport, LA

ENMC061T Measure p: Optimize Heat Transfer
         Imaad Syed, 17, Junior,
         Aaban Syed#, 16, Sophomore,
         North County High School, Glen Burnie, MD

ENMC062 The Alteration of Wing and Winglet Designs on
         Commercial Passenger Aircrafts for the
         Reduction of Carbon Dioxide (CO2) Emissions
         and the Increase of Aerodynamic Efficiency
         Karen Shrieves, 16, Junior, Lake Braddock
         Secondary School, Burke, VA

ENMC063T Developing a Bluetooth Enabled Pill Dispenser
         David Arner, 17, Senior,
         Grady Brydges, 18, Senior,
         Roanoke Valley Governor's School for Science
         and Technology, Roanoke, VA

ENMC064T Quake - Alert: Eyes for the Deaf, Ears for
         the Blind
         Fabian Lopez, 16, Junior,
         Kiarelis Perez, 16, Junior,
         Domingo Aponte Collazo, Lares, Puerto Rico

ENMC065T Handwriting to Braille: Creating a Device to
         Facilitate the Computation of Handwritten Data
         Marcus Curran, 17, Junior,
         Cooper Crowther#, 17, Junior,
         Good Hope Country Day School, Kingshill, United
         States Virgin Islands

ENMC066 Design Frequency *vs.* Overclocked CPU
         Amarion Gittens, 19, Freshman, Good Hope
         Country Day School, Kingshill, United States
         Virgin Islands

ENMC067 Stroll to Tinian
         Iris Lee, 18, Senior, Saipan Southern High School,
         Saipan, MP, Northern Mariana Islands

Environmental Engineering

ENEV001 Single-Step Pyrolysis of Phosphoric Acid-Activated Bagasse as a Sustainable Method of Adsorption of the Antibiotic Ciprofloxacin
Liz Diaz, 16, Junior, H.L. Bourgeois High School, Gray, LA

ENEV002 Power and Water Backup for Natural Disasters: Tracking Concentrated Solar Collection with a Simultaneous Cooling and Water Distillation System
Camry Gach, 16, Sophomore, Seabury Hall Upper School, Makawao, HI

ENEV003 Increasing the Buoyancy of Potato-Based Bioplastics
Alex Nakasato, 18, Senior, Mililani High School, Mililani, HI

ENEV004 Precycling: Novel Strategies for Dealing with Household Plastic Recycling
Lene Mortimer, 15, Freshman, Trinity Preparatory School, Winter Park, FL

ENEV005 Moth.NET
Miklos Zsigo, 18, Senior, Krudy Gyula High school, Nyíregyháza, Szabolcs-Szatmár-Bereg, Hungary

ENEV006 Assessment on the Degradation of Expanded Polystyrene by the Action of Orange Peel and Recovery of Polystyrene Using D-limonene
Ariana Ponce Bohorquez, 17, Junior, Santa Ana, Tacna, Peru

ENEV007T Methane on Wheels
Gokulraj Kuppusamy, 16, Junior,
Ethan Tjhin, 16, Junior,
Redeemer Baptist School, North Parramatta, NSW, Australia

ENEV008 Designing an Improved Method of Shellfish Restoration: Increasing Shell Growth by Constructing an Artificial Structure to Increase Surface Area for Oyster (*Crassostrea virginica*) Spat Settlement Using Calcite Media to Improve Water Quality Parameters
Kyle Bramblett, 18, Senior, Titusville High School, Titusville, FL

ENEV009T Biodegradable Polymer *Larva cerambycidae* (Expanded Polystyrene)
Edin Fernandez Tocto, 17, Junior,
Elder Saldana Diaz, 17, Junior,
Alfredo Tejada Diaz, Soritor, Moyobamba, San Martín, Peru

ENEV010T Decomposition of Polystyrene Using Citrus D-Limonene
Darlene Panduro Guerrero, 14, Freshman,
Carmen Ruiz Horna, 14, Freshman,
0005 Antonio Raymondi, Saposoa, Moyobamba, Peru

ENEV011 Plastic Problem or Solution: Screening for Polyethlyene Terephtalate Degrading Bacteria in Arkansas
Jason Hoang, 18, Senior, Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

ENEV012 Using an Arduino-Controlled Tide Simulator to Selectively Breed *Ulva lactuca* for Increased Lignin Content
Veronica Cooke, 17, Senior, West Salem High School, Salem, OR

ENEV013 Auto-Irrigator: A Self-Conservation Method
Surabhee Eswaran, 17, Junior, Little Rock Central High School, Little Rock, AR

ENEV014 A Fail-Safe Cooling System; A Novel Passive Nuclear Safety Design for Nuclear Power Plants
Zoe Diederich, 15, Sophomore, Maritime and Science Technology Academy, Miami, FL

ENEV015 Hydroelectropurification: A Green Approach to Waste Water Treatment
Vivian Chinoda, 18, Senior, Queen Elizabeth Girls' High School, Harare, Zimbabwe

ENEV016T Soil Moisture Sensing Robot: A Novel Agricultural Device
Maya Maciel-Seidman, 16, Junior,
Suchitha Channapatna, 15, Sophomore,
Ruchitha Channapatna, 15, Sophomore,
Bethpage High School, Bethpage, NY

ENEV017 The Use of Eggshell Waste as a Bio-Adsorbant of Phosphates for Water and Soil Quality
Emma Serisier, 18, Senior, Bishop Druitt College, North Boambee Valley, New South Wales, Australia

ENEV018 A Smart "Coat" for Metal Materials Against Acid Rain: Improvements on Traditional Metal Coatings
Tianhao Liang, 17, Junior, The High School Affiliated to Renmin University of China, Beijing, Beijing, China

ENEV019 Investigating the Efficacy of the Gut Biome of *Tenebrio molitor* and *Zophobas morio* in the Biodegradation of Polystyrene
Sadie Smith, 17, Senior, Tucson High Magnet School, Tucson, AZ

ENEV020 Using Pyrolysis to Recycle Polymers into Synthetic Fuels
Nikita Korzienko, 16, Sophomore, Andrey Melnichenko Foundation Center for the Development of Children's Creativity in Science and Engineering (Novomoskovsk), Novomoskovsk, Tula, Russian Federation

ENEV021T Development of an Eutrophication Prevention System that Generates H2 Gas by Low-voltage H_2O Electrolysis
Fukushi Ogawa, 17, Junior,
Yuki Mimuro, 18, Junior,
Serena Aihara, 17, Junior,
Shizuoka Kita High School, Shizuoka-City, Shizuoka-Pref., Japan

ENEV022T Engineering a Solar Heated Temperature Preservation Tank for Low Cost Citrus Protection
Blair Hecker, 17, Senior,
Manjot Dhanda, 18, Senior,
Fowler High School, Fowler, CA

ENEV023 SAMMI: Smart Autonomous Mercury Monitoring Instrument
\#\# Rohan Jakhete, 17, Senior, South Fork High School, Stuart, FL

ENEV024 Engineering GENTOO (Green Emulsion Nullification through Oleophilic Objects) - A Device for Efficient Oil Spill Emulsion Remediation
\# Zoe Gotthold, 17, Senior, Richland High School, Richland, WA

ENEV025 A Multi-Species Air Monitoring Laser Sensor Based on Absorption Spectroscopy and Machine Learning
Basheer AlDajani, 17, Senior, Dhahran Ahliyya School, Dammam, Eastern Province, Saudi Arabia

ENEV026 Efficient Removal of Organic Pollutants in Wastewater Using Pulsed Laser Synthesized $TiO_2/WO_3/g\text{-}C_3N_4$ Nanocomposite
Deemah AlMulhim, 17, Senior, KFUPM Schools, Dhahran, Eastern Province, Saudi Arabia

ENEV027 Biogas Production from Crop Residue, Fruit and Vegetable Waste via Anaerobic Digestion
Thara Aldabagh, 16, Junior, Jeddah Gifted School, Jeddah, Makkah Almukkarmah, Saudi Arabia

ENEV028 Smoke Particulates: An Analysis of Reduction Methods Using GC-MS and Laser Particle Counting
\#\# Abigail Post, 16, Junior, Hankinson Public School, Hankinson, ND

ENEV029 Metal-doped Zinc Oxide Nanochip for Surface-Enhanced Raman Spectroscopic Sensing of Opioid in Water
Michael Zhang, 16, Junior, The Lawrenceville School, Lawrenceville, NJ

ENEV030 The Adsorption of Safranin O and Crystal Violet Dyes onto *Pyracantha coccinea* Biosorbent
Idil Buyukgolcigezli, 15, Sophomore, Bilkent Erzurum Laboratory School, Erzurum, Turkey

ENEV031T Constructing a Novel Multi-rotor Compatible Water Sampling Apparatus, Associated Water Quality Analysis System and Specialized Hexacopter
Jimin Ryu, 16, Sophomore,
Nicolas Medapalli, 19, Sophomore,
Timberline High School, Boise, ID

ENEV032 Determining Vegetation Effects on Sulfide Production
Lia Hancock, 16, Junior, South Aiken High School, Aiken, SC

ENEV033 Optimizing Carbon Dioxide Sequestration Using Olivine and Sodium Hydroxide in a Flow Through System
Teaghan Knox, 16, Sophomore, Bend Science Station, Bend, OR

ENEV034 Exploring Sustainable Methods of Ocean Surface Agriculture
Natalie McGee, 15, Sophomore, Mt. Lebanon High School, Pittsburgh, PA

ENEV035 Utilizing Desktop Fabricated Sensors to Measure Transpiration Rates in *Glycine max*
\# Cooper Bassham, 18, Senior, Salem High School, Salem, AR

ENEV036 Engineering a Desiccant-Driven ($CaCl_2$) Self-Contained Solar Distillation System to Collect Drinking Water from the Atmosphere
\# Ryan Helmer, 16, Junior, Jefferson Montessori Academy, Carlsbad, NM

ENEV037 Solar-Powered Water Purifier
Sabrina Hu, 16, Junior, James Rickards High School, Tallahassee, FL

ENEV038T A Study on the Utilization of Fiber-Type Biosorbiotics Using Waste Matter
Shinhoo Lee, 16, Junior,
Sunhyung Son, 17, Junior,
Taewoo Lee, 16, Junior,
Chungnam Science High School, Gongju Si, Chungcheongnamdo, South Korea

ENEV039 The Effect of Weather Conditions on the Efficiency of Solar Panels
Lilly Heilshorn, 17, Junior, Hempfield High School, Landisville, PA

ENEV040 Developing and Analyzing Hydropower Generators in Fishpond Makaha
Joshua Parker, 17, Junior, Kamehameha Schools Kapalama Campus, Honolulu, HI

ENEV041 Smart Green Farm
Saja Obeidat, 16, Junior, Um-Alsummaq Southern Secondary School, Amman, Jordan

ENEV042T Static Electricity Sea Microplastic Extractor
Muhammad Izz Aniq Mohammad Fariz, 17, Junior,
Haris Hazwan Eddynor, 16, Junior,
The Malay College of Kuala Kangsar, Kuala Kangsar, Pera, Malaysia

ENEV043T Conserving Water through the Filtration and Recyclation of Greywater in a Domestic System
Caleb Cochran, 17, Junior,
Bryce Goodin#, 16, Junior,
Colton McCullough#, 17, Junior,
Bartlesville High School, Bartlesville, OK

ENEV044 The Effect of the Decay of Organic Matter on the Energy Output of a Renewable, Solar Energy Storage System
Logan Dunston, 17, Junior, Sherando High School, Stephens City, VA

ENEV045 An R&D Study on Using a Nutrient Treatment Bio-Filter to Combat Oceanic and Freshwater Deadzones which Harnesses the Intrinsic Potential of Halophyte Species
Timothy McGrath, 18, Senior, Killorglin Community College, Killorglin, Munster, Ireland

ENEV046 Assessment of Coconut Graphene Oxide Manganese Catalyst on Microplastics Degradation
Sreelakshmi Raghav, 17, Junior, Little Rock Central High School, Little Rock, AR

ENEV047 The Effect of Titanium Dioxide on the Photodegradation of Plastic
Celine Bousquet, 17, Junior, Mountain Vista Governors School, Middletown, VA

ENEV048T Portable Aerosol Sampler with Liquid Phase Set on a Drone for Biohazard Monitoring
Veronika Kirillova, 18, Junior,
Anastasia Kadyrova, 17, Junior,
Lyceum â– 1511 Affiliated with MEPHI University Lyceum No. 1511, Moscow, Russian Federation

ENEV049T Methanotrophic Bioremediation for the Degradation of Chlorinated Hydrocarbons
Mason Lee, 18, Senior,
Forest Pineo-Cavanaugh, 18, Senior,
Jasper Cerone, 20, Senior,
The Buckley School, Sherman Oaks, CA

ENEV050 An Autonomous Drone for Water Conservation and Irrigation Location Optimization
Noam Yakar, 16, Junior, Tenafly High School, Tenafly, NJ

ENEV051 Particulates and Toxic Gases: The Hidden Harm in Wood Fires Used in Traditional Hogans and Their Correlation with Asthma and Lung Cancer
Keona Hosteen, 18, Senior, Navajo Preparatory School, Farmington, NM

ENEV052 Removal of Pb Heavy Metal from Water Using Edible Marine Algae (*Undaria pinnatifida*)
Hannah Namkoong, 16, Junior, Tabb High School, Yorktown, VA

ENEV053T Testing the Waters: Engineering an Innovative Method of Water Health Analysis
Byron Jia, 18, Senior,
John Cardwell, 18, Junior,
Breck School, Golden Valley, MN

ENEV054 Application of Various Hydroxide Treatments to Increase Plastic Waste Ratio as a Substitute for Sand in Concrete Solutions
Abhay Dharanikota, 16, Junior, Mills E. Godwin High School, Henrico, VA

ENEV055 The Future of Plastic
Lauren Sotingeanu, 15, Sophomore, North Laurel High School, London, KY

ENEV056T High Density Polyethylene as an Aggregate Additive in Concrete
Brady Decker, 19, Junior,
Dominick D'Emilio, 16, Junior,
Columbia River High School, Vancouver, WA

Materials Science

MATS001 Nitriding in Bath of Non-toxic Salts: A Solution to Industrial Pollution
Natalia Fenner, 19, Senior, Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Sul - Campus Feliz, Feliz, Rio Grande do Sul, Brazil

MATS002 Applications of Microwires and Nanowires in Engineering and Biomedical Regenerative Treatments
Ioana Iordan, 18, Senior, Colegiul National "Spiru Haret", Bucharest, Romania

MATS003 Analyzing the Effect of Micro-Perforated Acoustical Tape *vs.* Acoustical Tiles on the Sound Intensity in an Art Room Using Spectral Analysis and Two- and Three-Dimensional Acoustical Modeling Software
\#\#\# Abigail Smith, 17, Senior, Cloquet, Senior High School, Cloquet, MN

MATS004 Preparation of Lithium-ion Batteries Coupled with Lithium-iron-phosphate Cathodes
Joshua Clemons, 17, Senior, Charles R. Drew Charter School, Atlanta, GA

MATS005 Usage of Conductive Materials to Reduce Pressure Sensor Cost
Vincent Batts, 18, Senior, Westlake High School, Atlanta, GA

MATS006T The Strength Analysis of Altered Magnetorheological Fluids Compared to Industrial Types in Silicone Oil Based Carrier Fluids Induced via a Magnetic Flux
Michael Neibauer, 17, Junior,
Mohammed Oza, 17, Junior,
Vista Ridge High School, Cedar Park, TX

MATS007 CO_2 Capture and Reduction Utilizing Metal Oxide, Electrolyte and Liquid Metal Electrocatalyst
Christopher Huh, 15, Sophomore, Westwood High School, Austin, TX

MATS008 Give Me a Hand: The Comparison and Application of Lightweight Methods of Actuation in Prosthetics
Alan Fletcher, 18, Senior, John Jay Science and Engineering Academy, San Antonio, TX

MATS009 The Sound of a Solution: An Affordable, Self-Calibrating Hearing Aid Via Semi-Porous Nitinol Compression and Optimization of a Novel Concave Amplification Technique
Arshia Elahi, 18, Senior, Plano, Senior High School, Plano, TX

MATS010 Micelle Templating of Calcium Precipitation: A Route to Artificial Bone
Eleanor Clifton-Bligh, 18, Senior, PLC Sydney, Sydney, NSW, Australia

MATS011 The Gram-scale Preparation Process of Pt-Fe-Cu Ternary Ordered Catalyst for Application of PEMFC
Zhongyue Liu, 17, Junior, Beijing No. 35 High School, Beijing, China

MATS012 Preparation of Silk Fibroin-based Tissue-adhesive Hydrogel and Its Application in Treatment of Oral Ulcer
Chenghao Jiang, 17, Junior, Shanghai Datong High School, Shanghai, China

MATS013 Characterizing and Reducing Cytotoxicity of 3D-Printed Polymers
Caimin Xi, 17, Senior, Adlai E. Stevenson High School, Lincolnshire, IL

MATS014 3D Printing Scaffold for Bone Regeneration
Emma Dong, 16, Junior, Caddo Parish Magnet High School, Shreveport, LA

MATS015 Targeted Delivery of Immune Agonists for Antitumoral Response of the Tumor Microenvironment
\# Shruthi Ravichandran, 16, Junior, Hathaway Brown School, Shaker Heights, OH

MATS016 Novel Logic and Global Positioning Capabilities with Germanene-Based Topological Insulators through the Quantum Spin Hall Effect
Lawrence Shi, 17, Junior, Thomas Jefferson High School for Science and Technology, Alexandria, VA

MATS017T Magnatite Nanoparticles Coated with Oleic Acid for Removal of Toxic Elements from Water
Nagham AlHourani, 16, Sophomore,
Farah AlZa'atreh, 16, Sophomore,
King Abdullah II School for Excellence - Maddaba, Maddaba, Jordan

MATS018 Developing a 3D Printable Magnetic Liquid Crystal Elastomer Actuator
Kyle Gregory, 17, Junior, Benjamin E. Mays High School, Atlanta, GA

MATS019 Exploring the Conversion of Plastics to Porous Carbon
Elizabeth Gallagher, 17, Junior, duPont Manual High School, Louisville, KY

MATS020 Improvement and Characterization of Novel Energy-Efficient and Adaptable Bioplastic
Katarina Pejcinovic, 18, Senior, West Linn High School, West Linn, OR

MATSO21T Identifying which Natural Materials Can Be Used to Create an Environmentally Friendly Sanitary Pad
Christina Jayne Bayani, 16, Junior,
Antoinette Consolascion Pinera, 16, Junior,
Waipahu High School, Waipahu, HI

MATSO22 Bioplastic and Its Impact on Aquatic Ecosystems
Aleksander Stec, 17, Junior, Sandy Creek High School, Tyrone, GA

MATSO23 Plasmonic Nanoparticle-Filled Elastic Nanopillar Arrays for Sensing Application
Alice Cai, 17, Junior, Fayetteville High School, Fayetteville, AR

MATSO24 Power of Pykrete
Kyle Sommer, 16, Sophomore, Woods Cross High School, Woods Cross, UT

MATSO25 Engineered Polymer Coated Polyetherimide Composite Hollow Fiber Membrane for Dehumidification of Air
Rneem AlMansoury, 17, Senior, Alhussan Private School, Dammam, Eastern Province, Saudi Arabia

MATSO26 Applying Molecular Dynamics Simulations in the Context of Enhanced Oil Recovery
Yousef AlRabiah, 17, Senior, Manarat Al-Riyadh, Riyadh, Saudi Arabia

MATSO27 Small Scaffolds, Giant Possibilities: Studying the Electrochemical Properties of PEDOT: PSS Scaffolds
Yousuf AlTuwaijry, 17, Senior, Riyadh School for Boys and Girls, Riyadh, Saudi Arabia

MATSO28 The Controlled Production of Graphene Using Automated Mechanical Exfoliation
Spencer Schutz, 18, Senior, Yorktown High School, Yorktown Heights, NY

MATSO29 Electrochemical Synthesis of ZIF-8 Membranes for Propane-propylene Separation
Rakan AlRomayan, 17, Senior, King Faisal School, Riyadh, Riyadh, Saudi Arabia

MATSO3O Engineering a New Internet of Things (IoT) Device with Sustainably Produced Smart Materials
Daniel Kang, 18, Senior, John F. Kennedy High School, Tamuning, Guam

MATSO31 Biosuture: Recombinant Spider Silk Engineering with Anticancer Agent L-asparaginase
Mingya Wang, 17, Sophomore, Oregon Episcopal School, Portland, OR

MATSO32T Bag Safe: Natural Edible Soluble Material
Sut Ian Cheong, 18, Senior,
Lok I Lei, 17, Senior,
The Affiliated School of the University of Macao, Macao, China, Macao Special Administrative Region

MATSO33 Development of Calcium Alginate Bioplastic for Bale Wrap
Jolyn Rost, 18, Senior, Baker High School, Baker, MT

MATSO34 Designing Impact Resistant STF Composites for Various Weather Conditions
Aaditya Saha, 16, Sophomore, Chamblee Charter High School, Chamblee, GA

MATSO35 3D Printing of Hierarchical Porous Glassy Carbon
Howard Hua, 17, Junior, Wheeler High School, Marietta, GA

MATSO36 Hemolytic Effects Induced by Certain Types of Nanoparticles (Fe_2O_3, $ZnFe_2O_4$, ZnO, GaN, GaN/Fe) on Erythrocytes
Alina Pisarenco, 18, Senior, Ion Creanga Theoretical Lyceum, Chisinau, Republic of Moldova

MATSO37T A Nano Solution to a Giga Problem: Novel Hydrophobic Coating
Eshan Bajaj, 17, Senior,
Adithya Balanand, 18, Senior,
DAV International School, Kharghar, Kharghar, Navi Mumbai, Maharashtra State, Raigad District, India

MATSO38 3D Tumor Spheroid Generation Using a Droplet Microfluidic Device
Emily Marionneaux, 17, Junior, St. Joseph's Academy, Baton Rouge, LA

MATSO39 TaipaEstock: Grain Storage Using Taipa of Hand
Gustavo Neideck, 18, Senior, Instituto Federal de Educação Ciência e Tecnologia Catarinense - Campus Rio do Sul, Rio do Sul, Santa Catarina, Brazil

MATSO40 Reusable EDTA Modified Magnetic Graphene Oxide Nanoadsorbents: Its Adsorption Behavior on Organic Pollutants and Bacterial Pathogens in Aqueous Solutions
Marian Ledesma, 18, Senior, Negros Occidental National Science High School, Victorias City, Philippines

MATSO41 Which Packages Leach the Most Microplastics While Brewing Hot Coffee and Tea?
Taylor Koda, 16, Junior, Hershey High School, Hershey, PA

MATSO42 A Facile Method of Producing TiO_2 Nanoparticles through a Dusty Plasma Process
Akanksha Rawat, 18, Senior, Alabama School of Mathematics and Science, Mobile, AL

MATSO43 The Optimization of Photo-Actuated Liquid Crystalline Elastomers through the Engineering and Design Cycle
John "Jack" Griffin, 18, Senior, Saint Mark's School, Southborough, MA

MATS044 Non-linear Optical Properties of
Bi1-xCaxFeO$_3$ Nanostructured Powder in
Chitosan Matrix with a Predicted Tunability in
Their Band Gaps
\#   Natalia Arroyo-Gonzalez, 17, Senior, CROEM HS,
Mayaguez, Puerto Rico, Puerto Rico

MATS045 Micro-morphological Analysis Towards an
Enhanced Diagnosis of Osteomyelitic Bone
Aviral Misra, 17, Senior, Blue Valley High School,
Stilwell, KS

MATS046T Innovation of a Semipermeable Membrane with
Cellulose Acetate and Keratin from Chicken
Feathers (*Gallus gallus Domesticus*) as Its Base
for Initial Testing of a Dialyzer Membrane
Alldrich Soetyono, 17, Junior,
Delia Tjokroardi, 17, Junior,
Santa Laurensia, Senior High School, Tangerang
Selatan, Banten, Indonesia

MATS047 A Comparative Analysis of Underactuated 3D
Printed Hands
Elizabeth Cotter, 17, Senior, Allendale Columbia
School, Rochester, NY

MATS048T Deadly Deterioration: What's Really in
Your Drink?
Emilee Webb, 20, Senior,
Taylor Melton, 18, Senior,
Poyen High School, Poyen, AR

MATS049 Optimizing the Process of Protein Encapsulation
for Potential Applications in Intranasal and Oral
Drug Delivery
Ashni Zaverchand, 17, Junior, American Heritage
School, Plantation, FL

MATS050 Biodegradable Plastic: Seaweed Alternative
\#   Hailey Kintz, 17, Senior, Guthrie Center High
School, Guthrie Center, IA

Mathematics

MATH001 On a Generalization of Artin's Conjecture for Primitive Roots in Gaussian Integers
\#   Dimitar Chakarov, 18, Senior, Model High School of Mathematics "Akademik Kiril Popov", Plovdiv, Bulgaria

MATH002 Optiming Length of Planar Curves
Vojtech Kloud, 18, Sophomore, Prvni Soukrome JazykovE Gymnazium Hradec Kralove, Hradec Králové, Královéhradecký kraj, Czech Republic

MATH003 On the Properties of Knots and Links Constructed from Plane Graphs
\#   Oleg Kashurin, 17, Junior, Moscow South-Eastern School Named After V. I. Chuikov, Moscow, Russian Federation

MATH004 3/4-approximation Algorithm for the Maximum Three Salesman Problem
Semen Savin, 17, Junior, The Orthodox Gymnasium in the name St. Sergius of Radonezh, Novosibirsk Region, Russian Federation

MATH005T Analysis of Fractal Properties of the Iteration of Vieta's Theorem
Cederik Hofs, 16, Junior,
Jonathan Hahne, 17, Junior,
Stiftung Louisenlund, Güby, Schleswig-Holstein, Germany

MATH006 The Rubik's Cube Reshapes Our Notion of Networks
Selim Makni, 18, Senior, Lycee Prive lâ€™Ideale, Nabeul, Tunisia

MATH007 The Geometry of Free Nilpotent Groups
Artem Semidetnov, 16, Sophomore, School 564, St. Petersburg, Russian Federation

MATH008 Embeddable Group Actions on Surfaces
Anatolii Kocheniuk, 17, Junior, School 564, St. Petersburg, Russian Federation

MATH009 Which Monopoly Space Is Most Profitable Based on Probability?
Collin Guggenheim, 19, Senior, John Curtis Christian School, River Ridge, LA

MATH010 Application of Mathematical Modeling to Herd Immunity
Katharina Ravichandran, 16, Sophomore, Albemarle High School, Charlottesville, VA

MATH011 Quantifying Intersection Dynamics for the Purpose of Developing a Quicker, Less Variated and Safer Trip Algorithm
Edward Garth, 16, Junior, Redeemer Baptist School, North Parramatta, NSW, Australia

MATH012 Consideration of Non-Constant Viscosity in the Analysis of the Navier-Stokes Equations
Benjamin Faktor, 16, Junior, Canyon Crest Academy, San Diego, CA

MATH013 Dynamic Pricing of Movie Tickets Based on Consumer Choice Behavior
Jiaying Zhao, 17, Junior, The Experimental High School Attached to Beijing Normal University, Beijing, Beijing, China

MATH014 Research on 3-Periodic Points for the Generalized Tent Maps
Yi Shuai, 17, Junior, Huayang High School, Chengdu, Sichuan, China

MATH015 Best Fit, Most Beautiful: Explore the Relationship between Glasses and Facial Features
Weiduo Zhu, 16, Junior, The Experimental High School Attached to Beijing Normal University, Beijing, Beijing, China

MATH016 An Algorithm to Solve Non-Perfect Square Roots
Elayan Krabshah, 17, Junior, Al Joud Schools for Creativity and Excellence, Al-Mafraq, Jordan

MATH017 Counting the Number of K-Derangements with Applications to Web Crawler Problem
Pin-Shao Chen, 17, Senior, Taipei Municipal Dazhi High School, Taipei, Taiwan

MATH018 Fractal Theory in Computer Graphics: How to Create a Program for Telescope in Order to Find a Planet to Replace Earth?
Emil Rustamli, 16, Junior, School #7, Baku, Sabail, Azerbaijan

MATH019 Generalizing the Formulae for the Wiener Indices of the Double Vertex Graphs of Certain Families of Graphs
Olcay Oransoy, 15, Sophomore, Izmir Bahcesehir College 50. Year Science and Technology High School, Izmir, Izmir, Turkey

MATH020T Luck *vs.* Probability
Cammie Thompson, 15, Sophomore,
Karly White, 16, Sophomore,
Spring Creek High School, Spring Creek, NV

MATH021 Unit Groups, Quotients, and New Perspectives on tau-I-factorizations
\#\#\#   Daniel Santiago, 18, Senior, Centro Residencial de Oportunidades Educativas de Mayagüez, Mayagüez, Puerto Rico, Puerto Rico

MATH022 Analyzing Collatz-type Fractals Using Minkowski Dimensions
\#   Hector Lugaro, 16, Sophomore, CROEM HS, Mayaguez, Puerto Rico, Puerto Rico

MATH023 Pythagorean Triples in the Pascal Triangle: A Computational and Algebraic Approach
Jan-Paul Ramos, 17, Junior, University Gardens High School, San Juan, Puerto Rico

MATH024 A Generalization of Stars and Bars for Placing Identical Items into Identical Bins
Annie Wang, 13, Freshman, Aquinas Academy of Pittsburgh, Gibsonia, PA

MATH025T Generating Gray Code with Double Chinese Rings Algorithm
Tsz Tung Tsei#, 18, Junior,
Ho Yin Tsui, 16, Junior,
Maryknoll Fathers' School, Hong Kong, China, Hong Kong Special Administrative Region

MATH026 Compatible Recurrent Identities of the Sandpile Group and Maximal Stable Configurations
Rupert Li, 17, Senior, Jesuit High School, Portland, OR

MATH028 A Five Phase Interpretation of a Continuum Traffic Flow Model
Jeein Hong, 17, Junior, Iolani School, Honolulu, HI

MATH029 K Numbers: A Novel Approach in the Study of Composite Numbers
Adarsh Kumar, 18, Senior, Delhi Public School, Hapur, Uttar Pradesh, India

MATH030 Using R to Analyze Election Results and Accurately Predict the Results in Correlation with Social Media Use and Presence
Casey Crary, 15, Sophomore, Greencastle High School, Greencastle, IN

MATH031 Analogues of the Robin-Lagarias Criteria for the Riemann Hypothesis
Ambrose Yang, 17, Senior, Montgomery Blair High School, Silver Spring, MD

MATH032T Strophoid Research
Nikita Pyatkov, 18, Junior,
Daniil Sidorov, 17, Junior,
High School for Gifted Students in Physics and Math, Ust-Kamenogorsk, East Kazakhstan, Kazakhstan

MATH033 Bleichenbacher-type Attacks on Generalized El-Gamal Schemes
Valentyna Zinkova, 15, Sophomore, Technical lyceum of NTUU "KPI", Kyiv, Ukraine

MATH034 An Application of Group Theory to Number Theory
Shambo Saha, 15, Sophomore, DAV Model School, Durgapur, West Bengal, India

MATH035 Genetic Algorithm and Geometric Constructions
Zarema Sirazitdinova, 15, Sophomore, Specialized High School #165, Almaty, Kazakhstan

MATH036T The Smallest Lattice Cube Containing Nontrivial Band Knots
Junhyun An, 17, Senior,
Jinwook Kim, 17, Senior,
Jaeik Park, 18, Senior,
Korea Science Academy of KAIST, Busan, Busan, South Korea

MATH037 Dynamical Systems in Soccer: Analyzing Possession Outcomes and Player Movement
Stephen Andrews, 15, Sophomore, Chatham High School, Chatham, NJ

MATH038 On a Variation of the Witsenhausen Problem Concerning Maximal pi/2-Avoiding Spherical Sets
AnaMaria Perez, 18, Senior, Albuquerque Academy, Albuquerque, NM

Microbiology

MCRO001 Molecular Mechanisms of Interaction of Bacteriocins with Bacterial Cells Based on an Example of Acidocin M
Piotr Walczak, 19, Senior, XL Liceum Ogolnoksztatcace z Oddziatami Dwujezycznymi im. Stefana Zeromskiego w Warszawie, Warsaw, Mazowieckie, Poland

MCRO002 Characterizing Bacteriophage with Restriction Enzymes and Observing the Effects of Exposing Bacteriophage to Ultraviolet Irradiation
\#
Nichapa Dancharnjitt, 17, Junior, Lincoln Park Academy, Fort Pierce, FL

MCRO003 Directed Radioresistance via Genetic Engineering (Year V)
\#
Maximus Schieman, 18, Senior, Satellite High School, Satellite Beach, FL

MCRO004 Differentiating the Effect of Aqueous-based Synthetic and Natural Antibiotic Hybrids in a Model of an Infected Terminal Ileum of the GI Tract, Year Four
Om Patel, 16, Sophomore, Eau Gallie High School, Melbourne, FL

MCRO005 Compound and Antiproliferative Analysis of FM1005: A Marine Source Derived Endophytic Fungal Strain
Lela DeVine, 16, Junior, Waiakea High School, Hilo, HI

MCRO006 *In vitro* Study of the Antibacterial Properties of *Azadirachta indica* of Oral *Lactobacillus acidophilus* to Prevent Dental Caries
Shruti Patel, 18, Senior, James W. Mitchell High School, New Port Richey, FL

MCRO007T Novel Compound for Cystic Fibrosis: Antibiofilm Effects of Pentagalloyl Glucose on *P. aeruginosa*
Hoi Wan Lee, 17, Junior,
Yue Yan Jade Tong, 17, Senior,
Chinese International School, Hong Kong, China, Hong Kong Special Administrative Region

MCRO008 Repurposing the Antihelminthic Drug Niclosamide to Inhibit *E. coli*
Alyssa Sepulveda, 18, Senior, UTRGV Mathematics and Science Academy, Edinburg, TX

MCRO009 Treatment of *Staphylococcus epidermidis* Utilizing Iontophoresis of Quorum Factor-Targeted siRNA through Catfish Skin
Alexandria Flynn, 14, Freshman, Keystone School, San Antonio, TX

MCRO010 Bioleaching of Rare Earth Elements from Phosphogypsum Using *Aspergillus niger*
\#
Bridget Li, 17, Senior, Vandegrift High School, Austin, TX

MCRO011 Comparative Study of the Effects of a Non-Nutritive Sucralose Sweetener and Ordinary Cane Sugar on *Lactobacillus*
Lincoln Estes, 16, Freshman, Latta High School, Ada, OK

MCRO012 Effect of Berberine on Gregarine Infections of *Tenebrio molitor*: An Organic Alternative to Antibiotics for Protozoan Gut Infections
\#
Ryan Ballou, 17, Junior, Carroll High School, Dayton, OH

MCRO013 Examining Antibacterial Properties of Native American Medicinal Plant Extracts against *Streptococcus pyogenes* ATCC 19615
Saffeyya-Grace Ibrahim, 16, Sophomore, Sonoran Science Academy - Tucson, Tucson, AZ

MCRO014 A Novel Approach to Improve Bacteriophage Phi X174 Lysis of *E. coli* K-12 through Addition of Methylcellulose
Richie Woo, 15, Sophomore, Dublin High School, Dublin, CA

MCRO015 How Well Do Household Disinfectants Kill *E. coli* Bacteria?
Rhea Kalivas, 17, Junior, Pocatello High School, Pocatello, ID

MCRO016 Discovery and Analysis of Microbacteriophage Squeegee
Diksha Satish, 15, Junior, The Carol Martin Gatton Academy of Mathematics and Science in Kentucky, Bowling Green, KY

MCRO017T CCDC11 Acts as a Scaffold to Assemble the ESCRT Membrane-Scission Machinery at Viral Budding Sites for HIV-1 Release: Identifying a Novel Therapeutic Strategy for Antiviral Therapy
Poojan Pandya\#, 17, Senior,
Leo Takemaru\#, 17, Senior,
Half Hollow Hills High School West, Dix Hills, NY
Ward Melville High School, East Setauket, NY

MCRO018 Interrupting Cell-to-Cell Communication in Pathogenic Bacteria
Mallorie Coffee, 17, Junior, Jackson, Senior High School, Jackson, MO

MCRO019 Novel Application of a Quorum-Sensing Based Genetic Circuit within an Antimicrobial Bioengineered Probiotic

\# Jakar Dhillon, 17, Junior, Bloomfield Hills High School, Bloomfield Hills, MI

MCRO020 Analysis of the Volatile Compounds Produced by Microbial Communities Associated with *Drosophila suzukii*

Ziyin Xiong, 18, Senior, Tianjin Xinhua High School, Tianjin, Tianjin, China

MCRO021T Analysis of the Effectiveness and Antimicrobial Capabilities Against Bacterial Pathogens of *Lactobacillus sp.* and Other Strains Found in Probiotics

Violet Jira, 18, Senior,
Gina Nguyen, 18, Senior,
The Mississippi School for Mathematics and Science, Columbus, MS

MCRO022T A Novel Strategy for Definitive Antibiotic Therapy via Initiation of Targeted Programmed Cell Death

Sarah Syed\#\#, 19, Senior,
Saijai Supanklang\#\#, 17, Senior,
Miamar Burgos-Rosario\#\#, 18, Senior,
Hayfield Secondary School, Alexandria, VA

MCRO023 Identifying Novel Cis-Regulatory Elements in the Viral Genome of Adeno-Associated Virus (AAV) for Increased Genetic Modification Efficiency

\# Jared Wieland, 18, Senior, Wilsonville High School, Wilsonville, OR

MCRO024 Analysis of Drought Tolerance Conferred by Plant Growth Promoting Rhizobacteria from *Symphoricarpos*

Justin Lusarreta, 18, Senior, North Central High School, Spokane, WA

MCRO025 Discovery of the Antifungal Volatile-producing Bacterium *Brevibacterium sp.* H4 Isolated from the Feces of Pill Bugs

Masahito Kataoka, 17, Junior, Izumo High School, Izumo, Shimane, Japan

MCRO026 Role of Protective Species in Inhibiting Virulence Factor in *S. mutans*

\# John Lin, 17, Junior, Boston Latin School, Boston, MA

MCRO027 Solar Powering Day and Night with Boxed Micro-Biosphere

Chien-Wei Li, 17, Junior, Taipei First Girls High School, Taipei, Taiwan

MCRO028 A Novel Synthetic Biology Approach to Enabling Soil Bacteria to Produce Powerful Chlorinated Auxins

\# Gary Zhan, 15, Sophomore, Logan High School, Logan, UT

MCRO029 Comparison of Two Tick Populations in Domat/Ems (GR, Switzerland) on a Hiking-Trail and on a Golf Course According to the Amount of Ticks, Hosts and Infections with the Pathogens of Tick-borne *Encephalitis*, Lyme *Borreliosis* and *Tularemia*

Saskia Durisch, 19, Senior, Bundner Kantonsschule, Chur, Grisons, Switzerland

MCRO030 The Effects of Population Density on Endospore Formation in *Bacillus* megaterium

Kyle Kristoff, 18, Senior, Valparaiso High School, Valparaiso, IN

MCRO031 Lipid-conjugated HIV-1 Fusion Inhibitor Exhibits Enhanced Potency and Increased Serum Half-life

Giselle Rasquinha, 16, Junior, Syosset High School, Syosset, NY

MCRO032 Identification of Antimicrobials of *Annona muricata* to Prevent Wound Infection

\# Dheiksha Jayasankar, 15, Sophomore, Sir Winston Churchill Secondary School, St. Catharines, Ontario, Canada

MCRO033 Effects of Declining pH Levels of Seawater Caused by Ocean Acidification on *Zooxanthellae* and Coral Bleaching

Van Nguyen, 17, Junior, Oregon Episcopal School, Portland, OR

MCRO034 Don't Drink the Water: The Risk of Viable but Non-Culturable *Escherichia coli* in Long-Term Water Storage

Sierra Lutz, 17, Junior, Farmington High School, Farmington, UT

MCRO035 Bacterial Food Poisoning Detector

Dania Seder, 16, Junior, Bunat Alghad Academy, Amman, Jordan

MCRO036T Antibacterial Activity of the Essential Oil of *Xenophyllum poposum* and of the Hydroalcoholic Extract of *Xenophyllum poposum* and *Moringa oleifera versus Escherichia coli* and *Salmonella typhi* in Tacna Sewage Water

Maria Jaico Roman\#, 17, Junior,
Fernanda Marceliano, 17, Junior,
Santa Ana, Tacna, Peru

MCRO037 Synergistic Effect of Combined Heavy Metal Exposure on Dopaminergic Neurodegeneration and Associated Behaviors in *C. elegans* as a Model for Parkinson's Disease

Marvia Pressoir, 17, Senior, Elmont Memorial, Junior-Senior High School, Elmont, NY

MCRO038 Fungitoxic Effect of Vegetal Extracts on the Development *in vitro* of the Phytopathogen *Colletotrichum gloeosporioides* (Penz.) Cause of Anthracnose on Papaya Tree

Augusto Catuzzo, 16, Senior, Colegio Estadual Jardim Porto Alegre, Toledo, Brazil

MCRO039 CRISPR/Cas-Mediated Pathogenesis Disruption to Sustainably Combat Multidrug-Resistant Pathogens
Albert Nitu, 17, Junior, Lisgar Collegiate Institute, Ottawa, Ontario, Canada

MCRO040 Comparison of the Antimicrobial Effects of Eugenol, Indol-3-Carbinol and Carvone with Triclosan
Ana Brence, 18, Senior, II.gimnazija Maribor, Maribor, NULL, Slovenia

MCRO041 The Effects of Antioxidants on Mouse Osteoblastic Cancer Cells: Comparative Analysis of Effectiveness of Apoptosis
Saad Shabbir, 17, Junior, Little Rock Central High School, Little Rock, AR

MCRO042T ECIG: *E. coli* Inhibitor Garlic
Diego Rodríguez Velez, 15, Sophomore,
Adriam Santana Cartagena, 16, Sophomore,
Specialized in Baseball Manuel Cruz Maceira, Comerío, Puerto Rico

MCRO043 Lifestyle Determination qPCR Assays for *S. aureus* Bacteriophage
George Santarpia, 18, Senior, Albuquerque Institute for Math and Science, Albuquerque, NM

MCRO044 Optimization of Microbial Fuel Cell Technology to Maximize Power and Nitrate Removal
Alexandra McDonald, 17, Junior, Yorktown High School, Arlington, VA

MCRO045 Tools for Combating Algal Blooms: Developing Resistance to Cecropin A in *E. coli*
Ethan Talley, 18, Senior, Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

MCRO046T Antibiotics Crises: Bacteriocins from Whey of Cow's Milk Fermented by Kefir Grains: A Possible Solution?
Samara Rossi, 17, Senior,
Sophia Rossi, 17, Senior,
Instituto Federal de Educacao, Ciencia e Tecnologia - Campus Suzano, Suzano, Sao Paulo, Brazil

MCRO047 Isolation and Characterization of Endophytes from *Cordyline fruticosa*
Cade Kane, 16, Junior, Kamehameha Schools Kapalama Campus, Honolulu, HI

MCRO048 The Role of Mitochondrial tRNA Fragments (tRFs) in Cancer Metastasis
Jonas Rowland, 18, Senior, Shawnee Mission Northwest High School, Overland Park, KS

MCRO049 Enhancing Biodegradation Capabilities of the *Ideonella sakaiensis* Plasmid Using mutD *Escherichia coli*: A Case Study in the Use of Directed Microbial Evolution and Bioengineering
Nicholas Faiferlick, 16, Sophomore, Camdenton High School, Camdenton, MO

MCRO050 The Effects of a Simulated Mars Environment Carbon Dioxide Chamber on the Primary Productivity of Select Cyanobacteria
Olivia Nalley, 18, Senior, Cascia Hall Preparatory School, Tulsa, OK

MCRO051 30% NaCl Solution as a Disinfecting Alternative for Surgery Equipment and Wound Care
Signe Hogh, 19, Senior, Egaa Gymnasium, Aarhus, Midtjylland, Denmark

MCRO052 Identifying and Quantifying Synergistic Effects of Antibiotics from *C. leucodermis* Formulated with Nanoparticles Using a Simulation-Aided Method
Daniel Feng, 16, Junior, University High School, Irvine, CA

Physics and Astronomy

PHYS001   Revealing Broken Gates in Quantum Circuits by Exploiting Hybrid Machine Learning
Allee Rogers, 18, Senior, St. Joseph's Academy, Baton Rouge, LA

PHYS002   Optimisation of a Neural Network for Dark Matter Research
Carolin Kohl, 18, Senior, Paul-Klee-Gymnasium Overath, Overath, Nordrhein-Westfalen, Germany

PHYS003   Development of a Scalable Algorithm to Solve the Schrödinger Equation for Applications in Quantum Chemistry
Caspian Chaharom, 18, Senior, Edgewood, Junior, Senior High School, Merritt Island, FL

PHYS004   A Sound Analysis: An Acoustic and Statistical Investigation of Frequency Patterns in Breaking Waves for Use in Autonomous Vehicle Guidance Applications
\#   Michael Odzer, 17, Junior, Dr. Michael M. Krop, Senior High School, Miami, FL

PHYS005   The Orbital Period of Moons Based on Kepler's Laws Related to Eccentricity
Madison Burt, 17, Junior, Manatee High School, Bradenton, FL

PHYS006   Mapping the Habitability of the Milky Way with Gaia and Stellar Kinematics
\#   Camille Chiu, 17, Junior, College Station High School, College Station, TX

PHYS007   Facilitating Next-Generation Electronics: Novel, Efficient, and Cost-Effective Methods to Protect Next-Generation MoS2 Transistors from Degradation in Air
Kevin Yao, 18, Senior, Texas Academy of Mathematics and Science, Denton, TX

PHYS008   Quantum Machine Learning Frameworks for Improved SiD Calorimetry and Higgs Boson Analysis
\#   Lucas Braun, 17, Junior, School of Science & Technology, Beaverton, OR

PHYS009T   Using Doppler Effect and Collimation to Study Atomic Behavior
KeShaun Kelly, 18, Senior,
Srirakshaa Sundararaj, 17, Senior,
Martha Ellen Stilwell School of the Arts, Jonesboro, GA

PHYS010   Atmospheric Oxocarbons: Implications on New Planets for Human Life
Jaeyoung Lee, 17, Junior, Auburn High School, Auburn, AL

PHYS011   Calculation of Dark Matter in S0 g Galaxy NGC3115 - Galaxy Mass Discrepancy and Escape Velocity Analysis
Judd Katz, 18, Senior, Moriah College, Sydney, NSW, Australia

PHYS012   The Spatial Correlation of Binary Black Hole Mergers Calculated from Localization of LIGO/Virgo Detections of Gravitational Waves
\#   Ashini Modi, 16, Sophomore, Caddo Parish Magnet High School, Shreveport, LA

PHYS013   Classification of the Milky Way's Dwarf Spheroidal Satellite Galaxy Candidates through Machine Learning
Seung Jean Yoo, 17, Junior, West High School, Salt Lake City, UT

PHYS014   An Efficient Approach to Minor Planet Recovery, Detection, and Characterization Using N-body Integration and the Probabilistic Hough Line Transform
Anirudh Cowlagi, 18, Senior, Huron High School, Ann Arbor, MI

PHYS015   Resonance Phenomenon of Metronome Synchronization
Xiaoyang Liu, 17, Junior, No. 2 High School of East China Normal University, Shanghai, Shanghai, China

PHYS016   Temperature Distribution Measurement of Transparent Fluids Using Twyman-Green Interferometer
Yiwei Chen, 16, Junior, The Affiliated High School of South China Normal University, Guangzhou, Guangdong, China

PHYS017   Order Restoration in Perturbed Electrorheological Fluids
Yi-Hsin Chang, 17, Junior, Taipei First Girls High School, Taipei, Taiwan

PHYS018   Automatic Classification and Cataloging of Eclipsing Binary Star Systems with Amateur Telescopes
David Hernando Diaz, 18, Senior, Collegi Santo Angel, Gavà, Barcelona, Spain

PHYS019   Changing the Wettability of Titanium Using the Method of Laser Surface Modification in Liquid
Mariia Marshunina, 17, Junior, Samara Regional Centre for Intellectually Gifted Children, Samara, Samara, Russian Federation

PHYS020T GW150914/GW170817: Gravitational Wave Data Analysis Using ROOT and Fast Fourier Transform
Joao Dinis Alvares, 18, Senior,
Ana Moreira, 19, Senior,
Escola Secundaria Dona Maria II, Braga, Portugal

PHYS021 Is the Crater Diameter Ruled by Gravity? Experimental Verification of Gravitational Scaling Law of Craters
Kohshi Hashimoto, 18, Senior, Otemae, Senior High Scool The Evening Course, Osaka City, Osaka Prefecture, Japan

PHYS022 Computer Simulation of Chladni's Figure and Research of Its Characteristics
Wenji Zou, 17, Junior, Shanghai Jianping High School, Shanghai, Shanghai, China

PHYS023 Properties of Interfering Hydraulic Jumps on an Incline
Izequiel Freitas, 17, Senior, Evanston Township High School, Evanston, IL

PHYS024 Precise Stellar Ages: Calibrating Theoretical Isochrones Using Non-Local Thermodynamic Equilibrium Conditions
\# Subhash Kantamneni, 18, Senior, Suncoast Community High School, Riviera Beach, FL

PHYS025 Study of the Factors Influencing the Speed of Sound in Low-Pressure Air Based on the Doppler Effect
Guanyu Lu, 17, Senior, Suzhou High School of Jiangsu Province, Suzhou, Jiangsu, China

PHYS026 Engineering One Layer of a Two-Dimensional Acoustic Band Gap Material and Reconstructing the Sound Pressure Field Using Acoustic Holography
Ella Wesson, 18, Senior, Manhasset High School, Manhasset, NY

PHYS027 SWIFT: A Novel Machine-Learning Platform for Space Weather Forecasting from HMI Vector Magnetograms
Yash Kadadi, 17, Junior, The Westminster Schools, Atlanta, GA

PHYS028 Feasibility of a System Using Cell Phone Signals to Locate Trapped Survivors after a Building Collapse
\# Meredith Hillier, 15, Sophomore, Newport, Senior High School, Bellevue, WA

PHYS029T Active Heaping: New Clustering and Heaping Phenomenon Discovered in Strongly Shaken Granular Matter
Qingyi Wang#, 18, Senior,
Jiehong Yin, 18, Senior,
Xinwei Ke, 18, Junior,
No. 2 High School of East China Normal University,
Shanghai No.60 High School, Shanghai, China
Chongqing Yucai Secondary School, Chongqing, China

PHYS030 Determination of the Number of Eigenstates between the State of Proton and Planck State Using 1-D Quantum Harmonic Oscillator
Lana AlAbbasi, 15, Junior, 18th Secondary School, Jeddah, Western Region, Saudi Arabia

PHYS031 Determining Plastics through the Use of a Grating Spectrometer
Francisco Catanzaro, 15, Junior, Cathedral Catholic High School, San Diego, CA

PHYS032 Orbit Determination and Projection of Potentially Hazardous Asteroid 12538 (1998 OH)
\#\# Sarah Tang, 17, Senior, Fairview High School, Boulder, CO

PHYS033 Biomimicry of Woodpecker Anatomy to Improve Helmet Design in Prevention of Chronic Traumatic Encephalopathy
John Oei, 17, Junior, East Catholic High School, Manchester, CT

PHYS034 Novel Surveys of Substructure in Pulsar Glitch Morphology and Glitching Pulsar Populations
\# Christine Ye, 15, Sophomore, Eastlake High School, Sammamish, WA

PHYS035 Modelling Space Weather: A New Deep Learning-Based Approach
\# Aditya Radhakrishnan, 17, Junior, Suguna PIP School, Coimbatore, Tamil Nadu, India

PHYS036 Centrifugally Tensioned Metastable Fluid Detector (CTMFD) *vs.* Ludlum Neutron Detector Performance Comparisons for Neutron Monitoring with a Plutonium-Beryllium Source
Eli Vanderkolk, 18, Senior, Lafayette Jefferson High School, Lafayette, IN

PHYS037 Astronomy Will Not Trail Off: Novel Methods for Removing Satellite Trails from Celestial Images
Owen Dugan, 16, Junior, Dugan Homeschool, Sleepy Hollow, NY

PHYS038 Quantum Gravimeter Based Internal Structure Prediction Algorithm
Jaewon Dong, 17, Senior, Korean Minjok Leadership Academy, Hoengseong, Gangwon, South Korea

PHYS039 A Study on the Foot Structure of the Robot for Improvement of Harsh Driving Capacity through the Analysis of Foot Structure in Alpine Ibex
Young Min Jung, 18, Senior, Incheon Jinsan Science High School, Incheon, South Korea

PHYS040 Can You Hear the Empty Spaces? - Improving Spacecraft Efficiency and Capability through a Novel Microgravity Slosh Mitigation Technique
Eleanor Sigrest, 17, Junior, Governor's School at Innovation Park, Manassas, VA

PHYS041 The Effect of Meteor Impact Location on the Energy Transmitted
\# Cameron Sharma, 16, Sophomore, Mills E. Godwin High School, Henrico, VA

PHYS042T An Energy Scavenging Thermoelectric Microprocessor Implementation for the Conversion of Waste Heat into Electrical Power
Jay Upadhyaya, 16, Junior,
Ashwin Katta, 16, Junior,
Colleyville Heritage High School, Colleyville, TX

PHYS043 Exploring the Wonders of the Early Universe: Green Pea Galaxies and Light Flux
Mina Mandic, 17, Junior, Saint Paul Academy and Summit School, Saint Paul, MN

PHYS044T Analyzing Matter and Color by a Self-Made Micro Spectrometer Which Works with Visible and Near-Infrared Light
Ayce Altin, 17, Junior,
Bartu Aygul, 15, Sophomore,
Ozel Izmir Bilfen Fen Lisesi, Izmir, Turkey

PHYS045 Ensuring Target Wireless Power Transfer (WPT) Efficiency Using Coupling Coefficient and Circuit Parameter Normalization
Seojun Lee, 16, Junior, Gyeonggi Science High School for the Gifted, Suwonsi, Gyeonggido, South Korea

PHYS046 Generation of Musical Progressions Using Bayesian Networks
Evan Flores, 17, Junior, University Gardens High School, San Juan, Puerto Rico

PHYS047T Measuring and Modeling the Energy Spectrum of Cosmic Ray Muons
Phillip Ionkov, 16, Sophomore,
Anthony Lestone, 16, Junior,
Los Alamos High School, Los Alamos, NM

PHYS048T A Study on the Fabrication and Application of AL (Acoustic Levitation) Devices
Geon Kang, 18, Senior,
Haewon Yang, 17, Senior,
Seung won Lee, 16, Junior,
Yeosu High School, Yeosu-si, Jeollanam-do, South Korea

PHYS049 An Analysis of the Superconducting Transition of Copper (II) Sulfide
Jack Langejans, 17, Senior, Kalamazoo Area Mathematics and Science Center, Kalamazoo, MI

PHYS050 Using Oil Drops as a Model for Quantum Mechanics
Garrick English, 17, Junior, Elizabethtown Area High School, Elizabethtown, PA

PHYS051 Extending Frontiers: A Statistical Analysis of Characteristics Influencing Pulsar Classification for Optimized Search by Applying Ensemble Machine Learning Techniques
Lucas Lima, 16, Sophomore, Lee Virtual Instruction Program, Fort Myers, FL

PHYS052 Post-Quantum Cryptography: Development and Use of Encoding Protocols
Henrique Guerra, 15, Junior, Colegio Dante Alighieri, Sao Paulo, São Paulo, Brazil

PHYS053T DSLR Photometry of the Eclipsing Binary u. Her
Jaewoo Park, 17, Senior,
Cheol Hyeon Kim, 18, Senior,
Geon Yeong Koh, 17, Senior,
Bundang Jungang High School, Seongnam-si, South Korea

PHYS054 Bassoon - Dinosaur or Innovation?
Zoe Williams, 18, Senior, Athens High School, The Plains, OH

PHYS055T Flow Field 3D Waverider Optimization of a Variable Hypersonic Scramjet
Aakash Sunkari, 17, Junior, North Attleboro High School, North Attleboro, MA

PHYS056T Using the Double Slit Quantum Phenomena to Prove the Accuracy of Schrodinger's Equation
Dominic Adamson, 13, Freshman,
Andrew Christensen, 15, Freshman,
Hawthorn Academy, West Jordan, UT

Plant Sciences

PLNT001 Cultivation of *Mikania laevigata in vitro*: Searching for Higher Levels of Coumarin for the Treatment of Asthma
Lara Stefani, 15, Junior, Colegio Dante Alighieri, Sao Paulo, São Paulo, Brazil

PLNT002 Selection of Drought-Resistant Genotypes of Common Wheat (*Triticum aestivum L.*) by Examining the Root System
Natalie Rudolfova, 19, Junior, Slovanske Gymnazium Olomouc, Olomouc, Czech Republic

PLNT003 Using Phytoaccumulation to End Mineral Deficiencies: Increasing the Iron Content in *Brassica juncea*
Emelyn Beaster, 15, Freshman, East High School, Duluth, MN

PLNT004 Can Hydroponics Save the Native Hawaiian 'Ohi'a lehua?
Zahra Bhattacharya, 15, Sophomore, Henry Perrine Baldwin High School, Wailuku, HI

PLNT005 Bermudgrass Playing Surface Conditions Altered with Fertility and Surfactants under Different ET Replacements
\# Michael (Mac) Chaloupka, 15, Sophomore, Christ the King Cathedral School, Lubbock, TX

PLNT006 A Flexible DLP 3D-printed Coated Microneedle Patch for the Delivery of New Therapeutics to Citrus Stem Tissue
\#\# Laboni Santra, 16, Junior, Oviedo High School, Oviedo, FL

PLNT007 The Effect of Thiamine on *Hedera helix* to Inhibit *Rhizopus stolonifer* Fungus
Katrina Kuo, 17, Junior, Kalani High School, Honolulu, HI

PLNT008 GMO Corn Pollen Drift
Amara Livingston, 17, Junior, Cochrane-Fountain City High School, Fountain City, WI

PLNT009 Acclimating Plants Grown Using the Process of Micropropagation into Natural Growing Environments to Create Disease-Resistant Plants
Makenzi Lloyd, 17, Senior, Wiregrass Ranch High School, Wesley Chapel, FL

PLNT010 The Presence and Efficiency of Endophytic Nitrogen-Fixing Bacteria in *Populus deltoides*
\# Ryan Hardin, 18, Senior, Union County High School, Lake Butler, FL

PLNT011 The Effect of Nano Pro on Varying Concentrations of Glyphosate Efficiency
Noah Anuez, 17, Senior, Fort White High School, Fort White, FL

PLNT012 Effect of Vegetable Extracts Based on Elder Tree, Willow Tree, Shamrock and Purple Nutsedge in Natura and Dehydrated in the *in vitro* Development of Orchids, 2nd Phase
Rafaela Liberali, 15, Sophomore, Colegio Estadual Jardim Porto Alegre, Toledo, Brazil

PLNT013 Microgreen Biofortification for Human Health
Lily Crawford, 16, Sophomore, Lincoln Park Academy, Fort Pierce, FL

PLNT014 Assessing Fern Biodiversity through DNA Barcoding and Measuring Abiotic Conditions
Taneesh Makkena, 17, Junior, Lake Highland Preparatory School, Orlando, FL

PLNT015 Shedding Light on Mobile tRNA in Plant Biotic Stress
Sebastian Russo, 17, Junior, San Marcos High School, San Marcos, TX

PLNT016 A Pulsating Magnetic Field Stimulates Growth in Cress Seedlings
Malin Mueller, 18, Senior, British International School of Stavanger, Stavanger, Rogaland, Norway

PLNT017 Putting Pectin in Its Place: The Effect of Extracted Pectin Placement on a Shallow-rooted Seed in a Sand Growth Medium in Relation to Soil Moisture Retention and Plant Growth
\# Rachel Mammen, 16, Sophomore, T.C. Jasper High School, Plano, TX

PLNT018 A Study of the Effectiveness of Hydroponic Growing Variables on *Lactuca sativa* var. *capitata*
Jacob Zajkowski, 17, Junior, Anthony Wayne High School, Whitehouse, OH

PLNT019 Pattern of Inheritance and Dihybrid Genetics of *Brassica rapa*
Ashlyn Farris, 17, Junior, Home School, Sierra Vista, AZ

PLNT020 Investigating OsSxr Nutrient Transporters to Increase Rice Submergence and Drought Resilience via CRISPR-Cas9 Technology
Isabelle Do, 16, Senior, Martin Luther King High School, Riverside, CA

PLNT021 The Rate of Pollen Tube Reallocation and Its Effect on the Location of Developmental Hybrid Seeds in *Cucurbita pepo*
Joseph Reamsnyder, 17, Junior, Hilltop High School, West Unity, OH

PLNT022 Cultivation of Plant in Nutrient Solutions
Nalani Barbadillo, 17, Senior, Eastlake High School, El Paso, TX

PLNT023 Comparison of Phototropic Inhibition of Natural and Synthetic Auxin
Ana Navarro, 15, Sophomore, Harvest Preparatory Academy, Yuma, AZ

PLNT024 Bending of the Saguaro Cactus
Celeste Browne, 18, Senior, University High School, Tucson, AZ

PLNT025 Microalgae as an Environmentally-Friendly Bio-feedstock: Microbial Characterization to Augment Photosynthesis
Emily Gan, 18, Senior, Jericho High School, Jericho, NY

PLNT026T The Effects of Philippine Cypermethrin on Earthworm Cardiovascular Health: Continued Evaluation of Environmental Damage and Proposed Solutions for Sustainable Pest Management Systems
Aaron Ullman, 18, Senior,
Jessica Wu, 16, Junior,
West Career and Technical Academy,
Las Vegas, NV

PLNT027 Research of Probable Hybridization of Violets in Natural Populations of Belgorod Area
Dmitry Ryabov, 17, Junior, Moscow State Secondary School named after N. M. Karamzin, Moscow, Russian Federation

PLNT028 Root Response to Abiotic Stress during Germination and Trifoliate Stages of Purple Corn
Yuxiao Liu, 17, Junior, Beijing No. 8 High School, Beijing, Beijing, China

PLNT029 Diurnal Fluctuations in Water Absorption Efficiency of Rice (*Oryza sativa*) Based on Aquaporin Expression and Stomatal Opening and Closing Rhythms
Ayaka Maeda, 17, Junior, Notre Dame Seishin Gakuen Seishin Girls' High School, Kurashiki, Okayama, Japan

PLNT030T Increasing Crop Yields and Lowering GHG Emissions by Dynamically Changing Fertilizer Input Using Cutting-edge "Smart Neural Network" Technology
Darya Tikhonova, 15, Freshman,
Kseniya Romanenko, 15, Freshman,
Anton Shargorodskiy, 17, Sophomore,
Andrey Melnichenko Foundation Center for the Development of Children's Creativity in Science and Engineering (Nevinnomyssk), Nevinnomyssk, Stavropol Krai, Russian Federation

PLNT031 How Does Ambient Humidity Affect the Ability of *Pisum sativum var. Marcrocarpons* (Sugar Peas) to Perform Photosynthesis?
Doan Goolsby, 16, Sophomore, Empire High School, Tucson, AZ

PLNT032 Extreme Learning Machine with Particle Swarm Optimization for Agricultural Tillage Practices Mapping
\#   Dennis Lee, 17, Senior, The Mississippi School for Mathematics and Science, Columbus, MS

PLNT033T Pollen Tube Attraction in Lilies: Is there More than One Attractant in the Upper Pistil?
Koyo Iwata, 18, Senior,
Futo Kubo, 18, Senior,
Nagoya Koyo, Senior Highschool, Showa-ku, Nagoya, Aichi, Japan

PLNT034 The Mechanism of Endosymbiosis of the *Chlorella* Species within the Cell of a Ciliate *Paramecium bursaria* by Adjusting the Surrounding pH and Overcoming Digestion
Mimu Motoi, 18, Junior, Urawa Girls' Upper Secondary School, Saitama-City, Japan

PLNT035 Analysis of Gambel's Oak Growth and Influence within Gunnison's Sage-grouse Habitat, Poncha Pass, Colorado
Andres Villa, 17, Junior, Monte Vista High School, Monte Vista, CO

PLNT036 Utilizing Real-Time qPCR and Scanning Electron Microscopy to Gauge Proliferation of Citrus Greening Disease in Persian Lime Trees in South Florida
Nicholas Pizzo, 18, Senior, Florida Atlantic University High School, Boca Raton, FL

PLNT037T Role of Lipids in Pollen Germination and Tube Growth
Pei-Cin Chang, 18, Senior,
Shih-Min Chang, 18, Senior,
The Affiliated, Senior High School of National Taiwan Normal University,
Taipei City, Chinese Taipei

PLNT038 The Effect of Available Phosphate in a Hydroponic System on the Production of *L*-Ascorbic Acid in *Brassica oleracea var. Acephala*
Kathryn Parks, 18, Senior, Chattanooga School for the Arts and Sciences, Chattanooga, TN

PLNT039 A Novel Synthesis of Manganese Nanoparticles Using Microfluidic Devices to Study Stress Tolerance in *Raphanus sativus*
Taytum Stratton, 15, Freshman, Canyon View High School, Cedar City, UT

PLNT040T Horn Structure Related to Sinking Pattern of Water Caltrop Rhizome
Pachara Oranriksupuk, 17, Junior,
Prynn Jittiphalangsri, 16, Sophomore,
Bangkok Christian College, Bangkok, Thailand

PLNT041 Identifying Responsible Salt Tolerant Genes in Chenopodium Quinoa through Genomic Sequencing Analysis
\#   Abduallah AlSinan, 17, Senior, Dhahran Ahliyya School, Dammam, Eastern Province, Saudi Arabia

PLNT042 Enhancing Wheat (*Triticum aestivum L.*) Growth through Uptake and Translocation of Iron (III) Oxide (Fe_2O_3) Nanomaterials

\# Norah AlAmri, 18, Senior, Alfaisaliah Islamic Schools, AlKhobar, Saudi Arabia

PLNT043 The Promotion of Secondary Succession of Guam's Southern Badlands by Evaluating the Allochory Seed Dissemination of *Barringtonia asiatica, Bikkia mariannensis, Terminalia catappa*, and *Hibiscus tiliaceus*

Anica Camacho, 15, Sophomore, Academy of Our Lady of Guam, Hagatna, Guam

PLNT044 Revitalizing Soil by Managing Soil Microorganism Populations to Sustainably Increase Crop Production

\# Emma Kratcha, 16, Sophomore, Hankinson Public School, Hankinson, ND

PLNT045 Novel and Effective *Tridax procumbens* Extract for Protection Against Yellow Mosaic Virus in *Abelmoschus esculentus* (Okra)

Shreenabh Agrawal, 16, Junior, The Chanda Devi Saraf School &, Junior College, Nagpur, Maharashtra, India

PLNT046 Mediated RNA Virus Interference in *N. benthamiana* Using Novel CRISPR-CasRx

Rund AlDossary, 17, Senior, The Second Secondary School for Girls, Dhahran, Eastern, Saudi Arabia

PLNT047 Using Novel Soil Microbes as a Neonicotinoid Alternative on *Popillia japonica* Newman Infestations as a Method of Pollinator Protection

Safiya Sankari, 15, Sophomore, Eman Schools, Fishers, IN

PLNT048 Comparative Analysis of the Mitigation and Emission Rates of Volatile Organic Compounds (VOCs) of Various Ornamental Plants Using a Monitored Environment

Patricia Joseph, 16, Sophomore, Engineering and Science University Magnet School, West Haven, CT

PLNT049 Innovation of Nursing *Afzelia* for Mixed Forest in Arid Areas

Jiraporn Khumdinpitak, 19, Senior, Kanlayanawat School, Khon Kaen, Thailand

PLNT050 Farming on Mars: Potential Bioremediation Strategies Using Natural Resources for Sustainable Agriculture (Phase III)

\# Pooja Kasiviswanathan, 17, Senior, Ames High School, Ames, IA

PLNT051 Using Differential Calculus to Optimize the Urea and Potassium Sulfate Fertilizer Concentrations to Maximize Plant Growth

Mohammad Shihab, 17, Junior, Genesis Global School, New Delhi, Delhi, India

PLNT052T Low-Cost Sugarcane Bagasse Waste to Improve Soil Moisture Retention in Agriculture

Xu Lin Yeng, 20, Junior,
Song Lin Yeng, 16, Sophomore,
Heng Ee High School, Georgetown, Penang, Malaysia

PLNT053T Isolation and Characterization of Lactic Acid Bacteria Isolated from *Nypa fruticans Wurmb.* Sap (Tuba): A Potential Antimicrobial and Antioxidant

Ray Vincent Pelayo, 20, Senior,
Gerardo Rafael Tallador, 17, Senior,
Iloilo National High School, Iloilo City, Philippines

PLNT054 Determining the Effects of Natural Mulching Components on Bok-Choy (*Brassica rapa Chinensis*) Plant Growth

Vincent Maverick Jagon, 17, Senior, Fa'asao Marist High School, Pago Pago, American Samoa

PLNT055 No Ifs, Ands, or Butts: The Effect of Cigarette Butt Litter on Root Length of Germinating *Centaurea cyanus*

Uyen-Vy Le, 16, Senior, Oak Grove High School, San Jose, CA

PLNT056 A Comprehensive Pharmacological *in vitro* Study of Ayurvedic Phytocompound Mangiferin Using Spectral and Cell Line Studies

Divya Somashekhar, 16, Sophomore, James Madison High School, Vienna, VA

PLNT057 The Effect of Pseudomonas, *Piriformospora indica* and *Laccaria bicolor* on the Growth of *Gossypium hirsutum*

Eric Armstrong, 18, Senior, Oak Ridge High School, Oak Ridge, TN

PLNT058 The Effects of Short-Term Radiofrequency Electromagnetic Radiation on Diatom Photosynthetic Productivity

Anthony Chen, 17, Junior, Saint Paul Academy and Summit School, Saint Paul, MN

PLNT059 Reduction of Cadmium Concentration in the Leaves of Arabidopsis thaliana Mutants Containing Over-Expressed AVP1 - A Genetic Model for Developing Edible Crops in Contaminated Areas

Ryan Dodds, 18, Senior, Eldon High School, Eldon, MO

PLNT060T The Effects of Carbon Dioxide and Environmental Factors on Stomatal Density, Size, and Potential Conductance Index

Sonia Balani, 16, Sophomore,
Lina Kim, 16, Sophomore,
Pascack Hills High School, Montvale, NJ

PLNT061 Plants and Magnets

\# Shouyu Du, 16, Senior, Agape Christian School, Saipan, Northern Mariana Islands

PLNT062T Nitrogen Fixation Efficacy of *Trifolium repens* with Rhizobia inoculant Treatments
Derek Fearon, 18, Senior,
Hope James, 17, Senior,
Sage Wheeler, 18, Senior,
Rock Canyon High School, Littleton, CO

PLNT063T A Biochemical Analysis of *Agastache rugosa* to Improve the Availability of Health-Functional Foods and Explore How to Use Medicines
Minseo Chae, 16, Junior,
Suyeon Ryu, 16, Junior,
Incheon Posco Academy, Incheon, South Korea

Robotics and Intelligent Machines

ROBO001 Memory-Augmented Neural Agents for Deep Model-free Reinforcement Learning
Victor Kolev, 17, Junior, Sofia High School of Mathematics, Sofia, Bulgaria

ROBO002T A Bionic Study on the Legs of Insects with Applications in MEMs
Mihai Mitrea, 18, Junior,
Eric Drutu-Danciu, 18, Junior,
International Computer High School of Bucharest, Bucharest, Romania

ROBO003 Autonomous Atmospheric Water Generating Robot for Developing Ecosystems in Drought Areas
\# Alan Michael, 17, Junior, Allen D. Nease High School, Ponte Vedra, FL

ROBO004 To What Degree? Combating the Greenhouse Effect in Vehicles
\# Evan Crispino, 18, Junior, Terrebonne High School, Houma, LA

ROBO005 Novel Method to Efficiently Analyze Videos Using Spatio-temporal Analysis, Advanced Deep Learning in the Cloud
Laya Yalamanchili, 16, Sophomore, L C Anderson High School, Austin, TX

ROBO006 Implementing Supervised Deep Learning with Feedforward Neural Network Using Genetic Algorithms
Buwei Chen, 16, Sophomore, University School of Milwaukee, Milwaukee, WI

ROBO007 Security Agent
Malek Bouzidi, 17, Junior, Menzah 9 High School, Tunis, Tunisia

ROBO008 A Novel Approach to Facial Emotion Recognition Using a CNN and Frame-by-Frame Analysis with Pipe Framework to Aid Students with Autism
\# Anwesha Mukherjee, 16, Senior, Westview High School, Portland, OR

ROBO009 Game of Controllers: The Future of Robotic Surgery Is Here
\#\# Ibrahim Al-Akash, 17, Junior, Veterans Memorial High School, Corpus Christi, TX

ROBO010 DeltaBionics: Open Source Bionic Hand
Anton Khrustalev, 17, Junior, 529 School, Petergof, Saint-Petersburg, Russian Federation

ROBO011 AI Based Autonomous Garbage Sorting Bin for Public Places
Vladimir Kirilenko, 16, Sophomore, Vorobyovy Gory School, Moscow, Russian Federation

ROBO012 PaanDiDe: A Deep Learning-based Robot for Plant Disease Detection
\# Ruslan Bayramov, 17, Junior, Lyceum Named after Academician Zarifa Aliyeva, Baku, Azerbaijan

ROBO013T Supervised Machine Learning Algorithm to Predict the Outcome of Shelter Animals
Zhoucai Ni, 18, Senior,
Fahnmusa Edwards, 18, Senior,
Cape Coral High School, Cape Coral, FL

ROBO014 Purifying Water with Artificial Intelligence: An Innovative Solution for Efficient, Cost-Effective Filtration
Michael Brockman, 17, Junior, Bartlesville High School, Bartlesville, OK

ROBO015 Testing a Variety of Methods for Training a Neural Network to Determine Which One Achieves the Lowest Error Rate Fastest?
Elias Sanders, 15, Sophomore, Idaho Falls High School, Idaho Falls, ID

ROBO016 A Machine Learning Approach to Pokemon Battling
William Sepesi, 18, Senior, Minnetonka High School, Minnetonka, MN

ROBO017 Project SHELI
Wendy Sandoval, 18, Senior, Montwood High School, El Paso, TX

ROBO018 Machine Learning Applications in Cancer Detection
Joshua Arulsamy, 17, Senior, Laramie High School, Laramie, WY

ROBO019 Comparison of K-Nearest-Neighbor and Neural Networks for Human Detection with Thermal Imaging
\# Benjamin Davis, 16, Junior, Auburn High School, Auburn, AL

ROBO020 Predicting the Onset of Alzheimer's Disease Using Graph Neural Networks and Diffusion Tensor Imaging
\# Siddarth Ijju, 17, Senior, Cherry Creek High School, Greenwood Village, CO

ROBO021 A Novel Lip-Reading Method Based on Transfer Learning from MobileNet and LSTM Architecture
Xingyu(Carl) Ji, 17, Junior, Portsmouth Abbey School, Portsmouth, RI

ROBO022 Using Environmental Context in Pedestrian Trajectory Prediction
\# Alexander Wan, 17, Junior, Novi High School, Novi, MI

ROBO023 A Mobile Robot Self-Localization System Based on Multi-Perspective Vision
Tongzhou Liao, 18, Senior, Shenzhen Experimental School, Senior High School, Shenzhen, Guangdong, China

ROBO024 Diagnosis of Malaria with a Lightweight Deep Convolutional Neural Network on a Raspberry Pi
Adam Sun, 17, Junior, Detroit Country Day School, Beverly Hills, MI

ROBO025 Beetlebot: A Stable, Energy-efficient Hexapod Inspired by the Discovery of a Unique Bump and Gait in the Japanese Rhinoceros Beetle
Tyler Nagashima, 17, Junior, Makuhari, Senior High School, Chiba, Chiba, Japan

ROBO026 Speech Emotion Recognition-Based on Multi-Feature and Multi-Language Fusion and Its Application in Facial Expression Editing
Chunyi Wang, 17, Junior, The Experimental High School Attached to Beijing Normal University, Beijing, Beijing, China

ROBO028 Edge-Guided Automatic Image Completion: A Novel AI Illustrator Finishing Your Incomplete Sketches
Koichi Namekata, 18, Senior, Senior High School at Komaba, University of Tsukuba, Setagaya-ku, Tokyo, Japan

ROBO029 Near-Perfect Melanoma Diagnosis with Optimized Feature Learning and Classification
Gwyneth Liu, 15, Freshman, Mills E. Godwin High School, Henrico, VA

ROBO030T AGV²: Automated Guided Vehicle by Vision
Fernando Augusto Barros, 18, Senior,
Ana Schneider, 18, Senior,
Fundacao Escola Tecnica Liberato Salzano Vieira da Cunha, Novo Hamburgo, Rio Grande do Sul, Brazil

ROBO031 Mean Green Recycling Machine: A Machine Learning Solution to Misrecycling with Mechanical Design
\# Jacob Zhao, 17, Junior, Bend Science Station, Bend, OR

ROBO032T Firebot
Nelson Salgado, 18, Senior,
Maria de Fátima Guimarães, 19, Senior,
Carla Filipa Ferreira da Cunha, 19, Senior,
Escola Profissional de Felgueiras, Felgueiras, Portugal

ROBO033T Assistive Glasses for the Vision Impaired
Okan Baykal, 16, Junior,
Tankut Çekic, 17, Junior,
Izmir Ozel Ege Lisesi, Izmir, Bornova, Turkey

ROBO034 Automated User Request Operator and Responsive Application (AURORA): A Novel Approach Implementing a Deep Learning Convolutional Neural Network Framework to Detect Choroidal Neovascularization, Diabetic Macular Edema, and Macular Degeneration
Anu Iyer, 15, Freshman, Little Rock Central High School, Little Rock, AR

ROBO035 Developing a Deep Learning Neural Network with Image Analysis for the Early Diagnosis of Kawasaki Disease
Ellen Xu, 14, Freshman, Del Norte High School, San Diego, CA

ROBO036 A Fourier Series-Based Neural Network Model to Predict Especially Fluctuating Data
Julien Grijalva, 15, Sophomore, Northern Utah Acadamy for Math, Engineering and Science, Layton, UT

ROBO037 EZ-Sign: A Nonintrusive Aid for Communication with ASL Using Machine Learning
Amrita Thirumalai, 16, Junior, Massachusetts Academy of Math and Science at WPI, Worcester, MA

ROBO038 Autonomous Drones for Search and Rescue Operations
An Doan, 17, Junior, Nikola Tesla STEM High School, Redmond, WA

ROBO039 ALV+IN: An Intelligent Stereoscopic Olfactory System for Autonomous Localization of Volatile Organic Compounds
Audrey Gruian, 16, Sophomore, Eastlake High School, Sammamish, WA

ROBO040 Computationally Combatting Fake News Using Deep Learning and Natural Language Processing
Arnav Das, 17, Senior, Hiranandani Foundation School - Powai, Mumbai, Maharashtra, India

ROBO041   SoundCare: Alerting Emergency Situations to
          People with Hearing Impairment Using
          Deep Learning
          Taeuk Kang, 16, Sophomore, Korea International
          School, Jeju Campus, Seogwipo-si, Jeju-do,
          South Korea

ROBO042   Weakly Supervised LSTM RNNs
          for Longitudinal Breast Cancer Recurrence
          Prediction via Unstructured Clinical Narratives
          Josh Sanyal, 16, Junior, Homestead High School,
          Cupertino, CA

ROBO043   Delivery Cannon
          Egor Belashov, 17, Junior, Advanced Educational
          Scientific Centre, A.N. Kolmogorov Boarding
          School, Moscow, Moscow, Russian Federation

ROBO044   Mission-Critical Communications Planning Over
          Contested RF Spectrum with Deep
          Reinforcement Learning Aided Artificial
          Intelligence
Milidu Jayaweera, 15, Sophomore, La Cueva High
          School, Albuquerque, NM

ROBO045   Feasibility of Using Auditory Stimulus Counter
          Human Drowsiness
          Sanurak Natnithikarat, 17, Senior, Ruamrudee
          International School Bangkok, Bangkok, Thailand

ROBO046   Development of an Artificial Neural Network for
          Semantic Segmentation of Nuclei and
          Mitochondria in Transmission Electron
          Microscopy and Serial Block Face Scanning
          Electron Microscopy Images
          Sinan Lal, 15, Sophomore, Port Huron Northern
          High School, Port Huron, MI

ROBO047   Detecting Common Retinal Diseases through
          Use of Convolutional Neural Networks
          Yuvanshu Agarwal, 17, Junior, The Academy for
          Mathematics, Science & Engineering, Rockaway,
          NJ

ROBO048   Friday: A Micro-controlled Prosthesis
          Thiago Moreira, 19, Senior, Escola Estadual de
          Educacao Profissional Avelino Magalhaes,
          Tabuleiro do Norte, Ceara, Brazil

ROBO049   Logographic Language Detection and
          Recognition Using a Deep Learning Approach
          Nicholas Yi, 17, Junior, The Harker School, San
          Jose, CA

ROBO050   Design and Application of Automated Robots
          Powered by Inductive Smart Tiles
          Andrew Balch, 17, Junior, New Horizons
          Governor's School for Science and Technology,
          Hampton, VA

ROBO051   Using Machine Learning for *Pneumonia*
          Diagnosis
          Storm Rhoda, 18, Senior, Camps Bay High School,
          Cape Town, Western Cape, South Africa

ROBO052T Universal Robot Designed for Movement on Any
          Cableways
          Roman Grachev, 16, Sophomore,
          Ilya Zarubin, 18, Junior,
          School 91, Toylatti,
          School Number 74, Togliatti, Samara Region,
          Russian Federation

Systems Software

SOFT001 "Screen Puzzle": Big Screen, that Fits in Your Pocket
Sofia Tkachenko, 15, Freshman, Municipal gymnasium #36, Rostov-on-Don, Rostov-on-Don, Russian Federation

SOFT002 Heimdall: USB Mass Storage Devices Threat Evaluation Using an Embedded System
Ivan Zlatanov, 17, Junior, National Trade and Banking High School, Sofia, Sofia, Bulgaria

SOFT003 SmartCal: A Machine Learning Approach to Enhancing Student Performance by Optimizing School Processes
Srikar Parsi, 16, Junior, Strawberry Crest High School, Dover, FL

SOFT004 Can Artificial Intelligence Create Original and Convincing Art?
Ana Orona Castro, 16, Sophomore, Griffin High School, Griffin, GA

SOFT005 A Novel Study of the Potential Applications of Higher Efficiency Extraterrestrial Solar Cells
Joshua Kopp, 17, Junior, Wiregrass Ranch High School, Wesley Chapel, FL

SOFT006 cryptStick: Development of a Portable Cryptographic Device for Online Authentication
Aaron Schlitt, 18, Senior, Albert-Schweitzer-Schule Kassel, Kassel, Hessen, Germany

SOFT007 Improved Value Investing with Machine Learning and an Innovative K-Nearest Neighbor Algorithm Variant: Development, Evaluation, and Deployment
Jun Yi He, 17, Junior, College Park High School, The Woodlands, TX

SOFT008 PhotoFolio: A Smartphone Application for the Efficient Detection of Various Plant Diseases Using Machine Learning
Michael Gerhard, 17, Senior, College Park High School, The Woodlands, TX

SOFT009 ElectroAssist: A Cost-Efficient, Wearable Body Sensor System for the Prediction of Cardiac and Neural Episodes through Machine Learning Models and a Proactive Mobile Application
Prerit Choudhary, 17, Senior, College Park High School, The Woodlands, TX

SOFT010T Development of WALTER: A Route Planning System that Analyzes Accident Data to Determine Fast, Simple, and Safe Driving Routes
Mani Chadaga, 17, Junior,
Akshay Nambudiripad, 17, Junior,
St. Paul Central High School, St. Paul, MN

SOFT011T Applying Dijkstra's Algorithm to Simulate Obstacles in Delivery Routes
Guillermo Hoffmann Meyer, 17, Senior,
David Barber, 18, Senior,
Mississippi School for Mathematics and Science, Columbus, MS

SOFT012 Cybersecurity Defense of Aircraft Automatic Dependent Surveillance-Broadcasts (ADS-B) Using the ADS-B Cybersecurity Environment (ACE) for Public Safety
Steven Lewis, 15, Sophomore, Pine Creek High School, Colorado Springs, CO

SOFT013 Developing FourS 2.0: A Web Hosting Software that Uses Encrypted Quick Response Code to Reduce Violence in School
Milan Jostes, 16, Junior, Stillwater Area High School, Stillwater, MN

SOFT014 Quarkz Encryption
Tavian Larson-Robertson, 17, Senior, Nampa Christian High School, Nampa, ID

SOFT015T ForeSight: A Computer-vision Approach to Providing Depth-based Spatial Information to the Visually Impaired
Elijah Cirioli, 18, Senior,
Casey Culbertson, 18, Senior,
West Linn High School, West Linn, OR

SOFT016 Diagnosing and Monitoring Pathological Tremors: Neural Network and Mobile Technologies
Davesh Valagolam, 16, Junior, Jericho High School, Jericho, NY

SOFT017 Library Book Counting Based on the Image Recognition of Book Spines and Color Labels
Yunhan Luo, 16, Junior, Beijing National Day School, Beijing, China

SOFT018 Social Companionship for Children with Autism: A VR System with Force-thermal Feedback and Immersive Visual Display
Jiachi Zhang, 17, Junior, The High School Affiliated to Renmin University of China, Beijing, Beijing, China

SOFT019T Multilingual and Mixed Input Method with Automated Identification and Correction
Jung-Cheng Lin, 18, Senior,
Yi-Xin Lan, 17, Senior,
Yu-Po Wang, 18, Senior,
National Lo-Tung, Senior High School, Luodong Township, Yilan County, Chinese Taipei

SOFT020T The Estimation of the Weight of Coconut Meat
from the Exterior Properties with Inscribed
Circle Theory
Kodchakorn Bangbuangam, 17, Senior,
Sirikhwan Wisetchat, 19, Senior,
Princess Chulabhorn Science High School
Phetchaburi, Cha-Am, Phetchaburi, Thailand

SOFT021 Visualization of Instructional Object-based

on Artificial Intelligence Recognition and
Human Interactions includes EEG, Voice and
Hand Action
\# Hyogi Kim, 16, Sophomore, Ewha Womans
University High School, Seoul, Seoul, South Korea

SOFT022 Gorani Reader: Data-Driven Guidance of
Electronic Book Reading for Pleasure of
ESL Students
Sunho Kim, 19, Senior, Homeschool, Yongin-si,
Gyeonggi-do, South Korea

SOFT023 Parallel Max-Min Ant System for Solving
Combinatorial Constraint-satisfaction Problems
\# David Vulakh, 17, Senior, Paul Laurence Dunbar
High School, Lexington, KY

SOFT024 Assessing School Lockdown Procedures Using
an Agent-Based Simulation Model
Mahika Parakh, 15, Sophomore, Westfield High
School, Chantilly, VA

SOFT025 Solving Image-Based CAPTCHAs Using Optical
Character Recognition and Machine Learning
Matthew Fogel, 17, Junior, Yucaipa High School,
Yucaipa, CA

SOFT026 New Program for Construction of a Closed
Curve Graph Using a Discrete Fourier Transform
Ivan Dedov, 17, Junior, Municipal Educational
Institution Secondary School No. 9 Named after
V.T. Stepanchenko, Rzhev, Tver Region, Russian
Federation

SOFT027T Cyber Attack Identification in the Electric Power
Grid by Anomaly Detection
Trevor Brunette, 18, Senior,
Christopher Reed, 18, Senior,
CREC Academy of Aerospace and Engineering,
Windsor, CT

SOFT028 Under What Circumstance Can
the Enigma Cipher Machine Be Decrypted?
Diem-Mi Ribler, 17, Junior, Central Virginia
Governor's School for Science and Technology,
Lynchburg, VA

SOFT029 American Sign Language Classifier
Thomas Yim, 17, Junior, Lakeside School,
Seattle, WA

SOFT030 PrediGen: A Tool for Tracing the Genealogy of
Medical Devices
Dhruv Pai, 16, Sophomore, Montgomery Blair High
School, Silver Spring, MD

SOFT031T GraFX Cipher: A Cipher Based on
Transformations in the Cartesian Plane
Prem Jagadeesh, 17, Junior,
Ege Karaahmet, 17, Junior,
International School Michel Lucius, Limpertsberg,
Luxembourg

SOFT032 Cyber Smart Security: Artificial Intelligence for
Network Intrusion Detection Systems
Lian Fouse, 15, Freshman, President William
McKinley High School, Honolulu, HI

SOFT033 Enhanced Lossless Data Compression Using
Logistic Context Mixing and Predictive Analysis
Subhigya Priyansh, 14, Freshman, D.B.M.S English
School, Jamshedpur, Jharkhand, India

SOFT034 Bottleneck Trees and Its Applications in Solving
Path Queries Involving Bottleneck Edges
Rajarshi Basu, 18, Senior, Bodhicariya, Senior
Secondary School, Kolkata, West Bengal, India

SOFT035 Investigating the Application of Computer
Vision to Assess and Regulate Human Posture
Kyuseung Shin, 17, Junior, Chadwick International
School, Incheon, South Korea

SOFT036 Human Activity Recognition Using Wi-Fi
Channel State Information (CSI)
Jordan Walsh, 17, Junior, Commack High School,
Commack, NY

SOFT037T A Study on Real-Time Feedback System for
Forward Head Posture Using Markerless Skeletal
Tracking
Sunjin Kim, 18, Senior,
Yejun Jang, 17, Senior,
Sejong Academy of Science and Arts, Sejong,
Chungcheong, South Korea

SOFT038 Step by Step: Predicting Alzheimer's Disease
with Wearable Technology
Shristi Sharma, 16, Junior, Maharishi School of the
Age of Enlightenment, Fairfield, IA

SOFT039T Autism Emotion Recognition Web-Application
Zainab Shahid, 15, Freshman,
Aliha Chaudhry, 14, Freshman,
PakTurk International Schools and Colleges-
Lahore, Lahore, Punjab, Pakistan

SOFT040 Robust Watermarking in
Stereolithography File Formats
Devin Patel, 17, Senior, Arkansas School for
Mathematics, Sciences and the Arts,
Hot Springs, AR

SOFT041T BabyCatch: Infant Monitoring System for
Visually Impaired Parents
Deokhaeng Lee, 18, Senior,
Seong-Jun Yea, 17, Senior,
Hyunseok Hong, 17, Junior,
Korean Minjok Leadership Academy, Hoengseong,
Gangwon, South Korea

SOFT042 Sangja: PC OS Virtual Machine App for Android
Devices
HyeokJae Oh, 17, Senior, Hansung Science High
School, Seoul, South Korea

SOFT043 Traffic Signal Color Detection Using the Pixy2
Camera
Nicholas Shepich, 16, Sophomore, Saginaw Arts
and Sciences Academy, Saginaw, MI

SOFT044 The Jurisdictional Clarity Project: A Webtool for
On-Demand, District-Specific Data Estimates
Ryan Beam, 18, Senior, Scotts Valley High School,
Scotts Valley, CA

SOFT046T NRDAA: A Machine Learning Algorithm for
Fitting Neutron Reflectometry Data
Veda Seay, 18, Senior,
Andrew Brady, 17, Senior,
Oak Ridge High School, Oak Ridge, TN

Translational Medical Science

TMED001 Porphyrazine: A Killer of Tumor Cells and an Indicator of the Therapy Effectiveness
Nikita Zagorodnikov, 18, Junior, Municipal Lyceum #28, Nizhniy Novgorod, Nizhegorodskiy Region, Russian Federation

TMED002 Hero: Automated Detection System for Prescription Stimulant Overdose via Synthesized GNP-Based Metabolite Detection, AI-Based Emotion Inference, and Novel Biometric Measurement
\# Divya Nori, 16, Junior, Milton High School, Milton, GA

TMED003 A Machine Learning-Based Approach for Characterization of Neurological Proteomic Biomarkers in a Mouse TBI Preclinical Model
Kashyap Sreeram, 17, Senior, Seminole High School, Sanford, FL

TMED004 Improving Tumor Detection Accuracy in Mammograms of Dense Tissue Breast Cancer Patients with Machine Learning Methods and Image Processing Techniques
\# Akshra Paimagam, 17, Junior, North Carolina School of Science and Mathematics, Durham, NC

TMED005 Synthesis and Characterization of a Novel PROTAC Containing a Beta Hairpin Sequence Motif
\# Jay Iyer, 17, Junior, Baton Rouge Magnet High School, Baton Rouge, LA

TMED006 CELLnet: Automated White Blood Cell Differential Counting as a Diagnostic Method for Leukemia Using Artificial Intelligence
Tara Moghiseh, 18, Senior, Staatliches Heinrich-Heine-Gymnasium, Kaiserslautern, Rheinland-Pfalz, Germany

TMED007 Investigating the Anticancer and Antioxidant Properties of *Zingiber zerumbet* and *Piper methysticum*
Rachel Tao, 14, Freshman, Waiakea High School, Hilo, HI

TMED008 Hey Computer, Am I Sick? Finding Disease Patterns Using Computer Vision
Diego Pensado, 17, Senior, John Jay Science and Engineering Academy, San Antonio, TX

TMED009T Determining the Cumulative Effects of Artificial Sweeteners and Ethanol on the Developing Embryo of *Danio rerio*
Rianna Trevino, 16, Sophomore,
Gaddiel Garcia, 16, Sophomore,
Homer Hanna High School, Brownsville, TX

TMED010T Using Motor Function and Caspase-3 Activation in *Drosophila melanogaster* to Determine the Effectiveness of Warfarin, Aspirin, and Methylene Blue in Preventing Induced Ischemic Stroke
Abigail Parker#, 18, Senior,
Sarah Gonzales, 17, Junior,
Keystone School, San Antonio, TX

TMED011 Supplementation of Retinoic Acid on the Regeneration Rate of *Dugesia tigrina*
Chloe Soriano, 17, Junior, Okeechobee High School, Okeechobee, FL

TMED012T PanOculus: A Novel, Multifaceted Diagnostic Tool for Ocular Disease Powered by a Variable Focus Liquid Lens, Deep Learning, and Telemedicine Technology
Naail Lakhani#, 17, Junior,
Jayanth Pratap#, 17, Junior,
Abhinav Sinha#, 17, Junior,
Dulles High School, Sugar Land, TX

TMED013 A Pathological Voice Analysis to Detect Parkinson's Disease with MFCC and SVM
Asha Gopu, 15, Sophomore, Eagle's Landing High School, McDonough, GA

TMED014 Direct Oral Anticoagulants for Treatment of *Thrombophilia*
Shamel Basaria, 18, Senior, Gwinnett School of Mathematics, Science, and Technology, Lawrenceville, GA

TMED015 Computational Eye-Tracking Biomarker for Improved Neuropsychological Evaluation via Deep Learning
Alay Shah, 16, Junior, Plano West, Senior High School, Plano, TX

TMED016 Feeling the Heat: Impact of Chemicals on the Temperature of Vape
Shelby Blach, 16, Junior, Yuma High School, Yuma, CO

TMED017 An Active Role for Machine Learning in the Diagnosis of Atrial Fibrillation
Quentin Hughes, 16, Sophomore, Minnetonka High School, Minnetonka, MN

TMED018 Triangulating Fluoxetine into a Novel Macular Degeneration Therapy via Biochemical, *in vivo* and Big Data Approaches
Meenakshi Ambati, 15, Sophomore, Albemarle High School, Charlottesville, VA

TMED019 Cepha: An End-to-End Self-Diagnostic Platform for Parkinson's Disease Utilizing Smartphone Sensor Data and Ensemble Machine Learning Methods
Nitya Ayyagari, 16, Sophomore, Amador Valley High School, Pleasanton, CA

TMED020 The Effect of Neighborhood Resources on Cardiovascular Risk
William Wiley, 17, Senior, Valley High School, Louisville, KY

TMED021 Therapeutic Potency of Physioxia Cultured Cardiac Mesenchymal Cells for Myocardial Repair in Mice with a 30-day-old Myocardial Infarction
\# Robi Bolli, 16, Sophomore, duPont Manual High School, Louisville, KY

TMED022 Instrumentation & Investigation of Phage-Antibiotic Synergy on *K. pneumoniae*, *H. alvei*, and Transductant *H. alvei*
Ibnat Meah, 17, Junior, Dallastown Area High School, Dallastown, PA

TMED023 Exploring the Role of Cannabidiol in a *Caenorhabditis elegans* Epilepsy Model
Hailey Edelman, 17, Senior, Syosset High School, Syosset, NY

TMED024 Mammographic Image Processing Application for Detecting and Classifying Breast Cancer Using Deep Learning
Shreeja Kikkisetti, 16, Junior, Chantilly High School, Chantilly, VA

TMED025 An Analysis of the NaV1 VGSC Family to Develop a Treatment for Nociceptive Pain
Audrey Gunawan, 17, Junior, West Bloomfield High School, West Bloomfield, MI

TMED026 How Do Different Concentrations of 2 Deoxy-D-glucose Affect the Proliferation of VM-M3 Brain Cancer Cells *in vitro*?
\# Cheyenne Shirley, 15, Sophomore, South Sumter High School, Bushnell, FL

TMED027 Developing a Pre-Risk Assessment Incorporating Machine-Learning and Biomarkers to Diagnose Alzheimer's Disease
\# Dimple Amitha Garuadapuri, 16, Sophomore, Eleanor Roosevelt High School, Eastvale, CA

TMED028 The Effect of Quercetin, a Plant Polyphenol, on Advanced Bladder Cancer Cell Growth
Aysha Khan, 16, Junior, duPont Manual High School, Louisville, KY

TMED029 Retinal Endothelial Cell Surface Proteins and Oxidative Stress in Hyperglycemia
Ravdeep Warar, 18, Senior, Caddo Parish Magnet High School, Shreveport, LA

TMED030 Investigating Amalgamations of NURF Knockdown and Chemotherapies through Metabolic Deviations in Tumor Cells
Ashish Vaidyanathan, 17, Junior, Science, Math, and Technology Center at Mills E. Godwin High School, Henrico, VA

TMED031 Synergy Screen of NIH Oncological Drug Set VII in Combination with Aurora Kinase B Inhibitor to Enhance Chemotherapeutic Sensitivity
Clara Tandar, 16, Junior, West High School, Salt Lake City, UT

TMED032 Novel PIM Inhibitor PIM447 Produces Significant Anti-Tumor Effects in Human Hepatoblastoma Cells
Hooper Markert, 17, Junior, Indian Springs School, Indian Springs, AL

TMED033 Utilizing Tuberculosis-Recognizing Antibody Serum in order to Identify Specific Tuberculosis Antigens to Fabricate a Novel Vaccine
\# Suhaas Narayanan, 18, Senior, Fort Collins High School, Fort Collins, CO

TMED034 Cross-talk between HER2 and TGF-β-Signaling Pathways in the Development of Trastuzumab Resistance
Sarah Rutledge, 18, Senior, Baylor School, Chattanooga, TN

TMED035 A Matter of Life and Breath: Early Lung Cancer Detection via Deep Learning CT Scan Analysis and DNA Methylation/exRNA Sequencing
Andrew Gao, 16, Sophomore, Canyon Crest Academy, San Diego, CA

TMED036T Applying the Surface Plasmon Resonance of Gold Nanoparticles to Denature Proteins Characteristic of Alzheimer's Disease
Cooper Hanley, 16, Junior,
Cosmo Mitchell, 17, Senior,
Liam Barnes, 18, Senior,
Monarch High School, Louisville, CO

TMED037 Bryostatin-1 and Its Effect on Neutrophil Transmigration through the Endothelial Layer in Liver and Kidney Ischemia-Reperfusion Injury Models
Ashleyn Malik, 18, Senior, Caddo Parish Magnet High School, Shreveport, LA

TMED038 Development of an Aptamer Based Lateral Flow Test: A Novel Approach to Depression Diagnosis
\# Astha Ray, 16, Junior, Dallastown Area High School, Dallastown, PA

TMED039 Tracking Red Blood Cells in Real Time with Deep Learning
Elijah Whang, 16, Sophomore, BASIS San Antonio Shavano Campus, San Antonio, TX

TMED040 Phytochemical Screening and Antimicrobial Activity of Gubinge, Pindan Walnut, and Mamajen Plants
Nyheemah Cox, 18, Senior, Christian Aboriginal Parent Directed School, Coolgardie, Western Australia, Australia

TMED041 Early Diagnosis of Pancreatic Cancer via Urinary Biomarkers with a New, Rapid, and Simple Lateral Flow Assay
Ana-Florina Galic, 15, Sophomore, Greenwich High School, Greenwich, CT

TMED042T A Portable Low-Cost Solution for Early Detection of Valvular Heart Disorders
Sachin Singh, 16, Sophomore,
Kaushik Singh#, 17, Senior,
Inventure Academy, Bengaluru, Karnataka, India

TMED043 Reversal of Chemo-Resistance in 5FU Resistant HeLa Cells Using Herbal Formulation Containing Green Tea and Turmeric (*Camelia sinensis* and *Curcuma longa*)
Maanasi Nair, 16, Junior, The International School of Bangalore (TISB), Bangalore, Karnataka, India

TMED044 PanCan Diagnosed: Developing an Algorithm for the Accurate and Affordable Early Diagnosis of Pancreatic Cancer via Machine Learning and Bioinformatics
Siya Goel, 15, Sophomore, West Lafayette, Junior/Senior High School, West Lafayette, IN

TMED045T Early Detection of Pancreatic Cancer Using a Low-Cost & Non-Invasive Strip-Based Test Aided with a Smart Web-Application Utilizing Retrospective Data for Risk Assessment
Anmol Rathi, 17, Junior,
Harsh Agrawal, 16, Junior,
Bharatiya Vidya Bhavan's R.K. Sarda Vidya Mandir, Raipur, Chhattisgarh, India

TMED046 Ivermectin Induces Apoptosis, Cell Cycle Arrest and Senescence in C4-2 Prostate Cancer Cells
Taylor Moniz, 17, Junior, Kamehameha Schools Kapalama Campus, Honolulu, HI

TMED047 Identifying and Controlling the Spread of Salmonella Pathogens in the Poultry Industry
Mac Dykeman, 14, Freshman, Langley Fine Arts School, Fort Langley, British Columbia, Canada

TMED048 Haem: Deep Learning to Detect Anaemia Using Smartphones
Vrishab Krishna, 17, Junior, National Public School, Indiranagar, Bangalore, Karnataka, India

TMED049 Assessment of Mild Cognitive Impairment (MCI) with a Novel Deep Neural Network-based Brain-Computer Interface (BCI)
Saraswati Sridhar, 16, Senior, Southwestern Educational Society, Mayaguez, Puerto Rico

TMED050 Biolistic Gene Delivery as a Potential Treatment for Skin Cancer
Justin Bromell, 17, Senior, Rockdale Magnet School for Science and Technology, Conyers, GA

TMED051 A Predictive Diagnose for Parkinson's Disease through Machine Learning
Shounak Ray, 17, Senior, Webber Academy, Calgary, Alberta, Canada

TMED052 Hierarchically Engineered Nanotheranostic for Ovarian Cancer
Paulina Naydenkov, 17, Albuquerque Institute for Math and Science, Albuquerque, NM

TMED053 Optical Device for Screening Examination and Dynamic Monitoring of Diseases that Violate Transparency of the Optical Eye-Media
Vitalii Morenko, 19, Freshman, MBGEI OF Murmansk City - Gymnasium #2, Murmansk, Murmansk Region, Russian Federation

TMED054 A Novel Machine Learning Method to Predict Breast Cancer Patient Response to Neoadjuvant Chemotherapy from MRIs
Janice Yang, 17, Senior, Dougherty Valley High School, San Ramon, CA

TMED055T Dual-Stimuli Responsive Nanomedicine for Cancer Therapy
Sap Tou Lao, 15, Sophomore,
Hong U Fong, 15, Sophomore,
I Sam Hui, 17, Junior,
Pui Ching Middle School, Macao, Macao, China, Macao Special Administrative Region

TMED056 RadioWrite: Rapid Radiology Imaging Evaluation and Assessment Using Deep Learning and Natural Language Processing Methods
Krishi Kishore, 17, Junior, Lambert High School, Suwanee, GA

TMED057 Mapping Central Nervous System Mechanisms Underlying Photobiomodulation and Neuromodulation to Treat Injury-Induced Neuropathy
Nadia Ansari, 16, Sophomore, Sage Hill School, Newport Beach, CA

Appendix

The projects in the appendix were selected to represent their regional fair at Rengeron ISEF 2020. Due to a number of extenuating circumstances caused by COVID-19, they were not able to complete their paperwork in time to be given a Booth Number. Nevertheless, the Society for Science & the Public and Regeneron fully recognizes these young scientists and engineers as ISEF finalists and alums of the Society.

Animal Sciences

AnInvestigation of the Effect of Various Yeasts andWater Sources on Aedesalbopictus Oviposition and Egg Hatching
Jadyn Lynne, 17, Junior, Southeastern Junior/ Senior High School, Augusta, IL

Pedal Mechatronic Milking Machine
Shiv Patel, 13, Freshman, No School Listed

The Impacts of Human Habitation on the Health Condition of Variations of Fish Caught in Industrialized vs. Non-Industrialized Watershed Areas
Yasminna Sanchez, 17, Senior, Samoana High School, Pago Pago, American Samoa

Behavioral and Social Sciences

Using Machine Learning and Smart Insoles for Early Detection of Autism Spectrum Disorder
Olivia Takla, 16, Sophmore, Marine Academy of Technology and Environmental Science, Manahawkin, NJ

Biochemistry

Infrared Studies of Sulfide Species with Superoxide Dismutase: Role of Sulhydration in Oxidative Stress
Alana Rodriguez, 17, Senior,
Mealanie Rodriguez, 18, Senior,
Escuela Especializada en Ciencias, Matemáticas y Tecnología, Caguas, Puerto Rico

Biomedical and Health Sciences

APOE Gene and It's Relationship with Alzheimer's: Comparison between APOe2 and APOe4 Allelic Variants and Their Relationship to Alzheimer's Development
Daniella Hernandez, 15, Sophmore, The San Juan Math, Science and Technology Center, San Juan, Puerto Rico

Investigating the Genetic Etiology of a Familial Case of Arrhythmia
Anna Gould, 17, Senior, Nicolet High School, Glendale, WI

Toxicological Effects of E-cigarette Vapors on *Daphnia magna's* Cardiovascular System
Aishwarya Suresh, 14, Freshman, Parkland High School, Allentown, PA

Microbial Bacteria on Cellular Devices
Kodiann Lynn, 15, Freshman,
Cassandra Olson, 15, Freshman,
Simms High School, Simms, MT

Predicting the Development of Postural Orthostatic Tachycardia Syndrome Using Machine Learning and Automated Feature Detection
Iliana Close, 15, Sophmore,
Keira Swei, 15, Sophmore,
Carlmont High School, Belmont, CA

Biomedical Engineering

Wearable Lactate Sensor: Effective Biomarker Monitoring
Emily Wang, 20, Senior, Germantown Academy, Fort Washington, PA

Designing a Prosthesis to Aid in Right Hand Motion of Violin
Susan Deering, 16, Sophmore, Avon Grove High School, West Grove, PA

Smart Electronic Compression Glove for Arthritis Patients
Vrishti Yadav, 15, Freshman, Pennbrook Middle School, North Wales, PA

A Step Towards Solving Foot Pain: A Revolutionary Shoe with Magnetic Leviation to Reduce Ground Reaction Forces, Year Two
Dev Lochan, 17, Junior, Cumberland Valley High School, Mechanicsburg, PA

Cellular and Molecular Biology

Antibody Affinity as a Correlate of Protection: Assessing Shigella Vaccine Potency Using Surface Plasmon Resonance
Melissa Jones, 18, Senior, Eleanor Roosevelt High School, Greenbelt, MD

Nonlinear Categorization by *Caenorhabditis elegans* Using a Hydrochloric Acid Gradient
Parth Desai, 16, Sophmore, Spring Valley High School, Columbia, SC

Mapping Glial Cells within the Mouse Visual Thalamus
Mary Giles, 18, Senior, Roanoke Valley Governor's School for Science and Technology, Roanoke, VA

The Effect of Glyphosate on Gene Expression in *Saccharomyces cerevisiae*
Joshua Grover, 19, Senior, Pine Crest School, Fort Lauderdale, FL

Chemistry

Relative Tensile Strength of Starch Based Bioplastics: Effective and Biodegradable Materials for Applications in Consumable Manufacturing
Benjamin Lin, 17, Junior, Holmdel High School, Holmdel, NJ

Chlorinated Chemiluminescence: A Study of the Light Produced by Luminol and Sodium Hypochlorite
Rena Ouyang, 17, Junior, Rutherford B. Hayes High School, Delaware, OH

The Quantification of the S Stereoisomer and Racemic Mixture of Ibuprofen in Generic and Name Brand Pills Through X-ray Diffractometry
Corbin Hite, 18, Senior, Columbian High School, Tiffin, OH

TColorimetric Pressure Sensor Based on Nanostructured Particle Deformation
Laura Noronha, 17, Senior, Redlands High School, Redlands, CA

Biofuels
Miguel Nieves Ramos, 16, Junior, Academia Interamericana de Arecibo, Arecibo, Puerto Rico

Earth and Environmental Sciences

The Effects of Plastic Leachates on Various Organisms
Lillian Miller, 17, Junior, Perkiomen Valley High School, Collegeville, PA

Styro-Carbon 2.0: Enhancing Its Adsorption Efficiency and Various Applications
Keerthin Karthikeyan, 15, Freshman, Oxford High School, Oxford, MS

Crazy Creek Chemicals
Hannah Fransen, 14, Freshman, Gresham High School, Gresham, OR

Embedded Systems

Trash Residuals Collector "Hydrocleaner Robot"
Juan Puerta Marin, 17, Junior,
Manuela Cardona Acevedo, 17, Junior,
Institucion Educativa Academico, Cartago, Valle del Cauca, Colombia

The Ultrasonic Vision Glasses
Eliezer Ayala, 18, Senior, Oxon Hill High School, Oxon Hill, MD

Energy: Sustainable Materials and Design

Development of a Digitally Regulated Oxyhydrogen Gas Generator and Analysis of Volumetric Flow Rate as a Function of Power Cycle Modulation
Jorge Ruiz Ruiz, 17, Senior, Escuela Secundaria Especializada en Ciencias, Matematicas y Tecnología, Caguas, Puerto Rico

Engineering Mechanics

App-Operated Hospital Bed Blanket Lifter
Holland Henderson-Boyer, 16, Sophmore, Great Mills High School, Great Mills, MD

Low-Profile Haptic Feedback Glove for Use with Virtual Environments
James Speedy, 18, Senior,
Cameron Knapp, 17, Senior,
Mountlake Terrace High School, Mountlake Terrace, WA

Exploring Solutions to Assist Finger Rehabilitation with Flexibility
Jihe He, 16, Senior, No School Listed

Exploring the Use of Carbon Nanotubes to Develop Breath Biomarkers
Shriya Kapoor, 15, Sophmore, Spring Valley High School, Columbia, SC

Environmental Engineering

Using Bone Charcoal and Phytoremediation on Leachate Treatment Plants in Toa Baja, Puerto Rico Landfill
Camila Rodriguez, 18, Senior, The San Juan Math, Science and Technology Center, San Juan, Puerto Rico

Utilizing a Polymeric Adsorbent & GAC to Filter a-Estradiol from Drinking Water
Varshith Yadav, 17, Junior, No School Listed

Development of Closed Recirculating Water Heating System to Reduce Water Waste and Energy Consumption
Nimar Cisneros Figueroa, 17, Senior, Colegio Puertorriqueno de Ninas, Guaynabo, Puerto Rico

Energy Generation Through Modifying a Falling Particle Solar Receiver
Colin Roark, 18, Senior, Saint Xavier High School, Louisville, KY

Materials Science

Semiconducting Material (ZnO) Resistance Change with Exposure to Methane Gas in Low and High Temperatures
Francisco A. Rivera, 17, Senior, The School of San Juan, San Juan, Puerto Rico

Flexible Flash-Welded Responsive Polymeric Photonic Crystal Actuators
William Porayouw, 16, Junior, Redlands High School, Redlands, CA

Leveraging Polymer Immiscibility in Additive Manufacturing: Sequestration of Graphene Nanoplatelets within a Phase-Separated PLA/iPP Polymer Matrix for Optimized Mechanical and Thermal Performance
Addison Liu, 17, Junior, Unionville High School, Kennett Square, PA

Microbiology

Investigating Synthetic Compounds to Enhance SMAC Mimetic Treatment on HBV Producing Cells
Rishi Vaidyanath, 18, Senior, Central Bucks High School East, Doylestown, PA

Physics and Astronomy

Optimal Hair Bun Placement to Reduce Drag for Swimmers
Jen Parsons, 16, Sophmore, Upper Dublin High School, Fort Washington, PA

A Study on the Foot Structure of the Robot for Improvement of Harsh Driving Capacity through the Analysis of Foot Structure in *Alpine Ibex*
Youngmin Jung, 18, Senior, Incheon Jinsan Science High School, Incheon, South Korea

Robotics and Intelligent Machines

Testing the Incongruity Theory: Recognizing Humor with Natural Language Processing
Chantal Greaves, 17, Senior, Eleanor Roosevelt High School, Greenbelt, MD

Autonomous Firefighting Robot
Baraa Al-Jasim, 17, Junior, Blaine High School, Blaine, MN

Systems Software

Educational App with Virtual Manipulatives to Promote Learning of Addition and Subtraction in Children of 6-8 Years with Autism Spectrum Disorder
Santos Despiau Orozco, 17, Senior,
Orlando Rivera Acevedo, 18, Senior,
The San Juan Math, Science and Technology Center, San Juan, Puerto Rico

Translational Medical Science

Early Diagnosis of Pneumonia with Deep Learning
Deniz Urey, 19, Senior, Robert College, Istanbul, Turkey

The Regeneron International Science and Engineering Fair encourages students to tackle challenging scientific questions and develop the skills needed to solve the problems of tomorrow.

SOCIETY FOR SCIENCE & THE PUBLIC

The Society for Science & the Public is a champion for science, dedicated to expanding scientific literacy, effective STEM education and scientific research. Founded in 1921, we are a nonprofit 501(c)(3) membership organization focused on promoting the understanding and appreciation of science and the vital role it plays in human advancement. Through its acclaimed science research competitions, including the Regeneron Science Talent Search, the Regeneron International Science and Engineering Fair and the Broadcom MASTERS, and its award-winning magazine, *Science News* and digital media properties, *Science News for Students*, the Society is committed to inform, educate and inspire.

LEARN MORE AT
www.societyforscience.org

AND FOLLOW US ON
Facebook
https://www.facebook.com/societyforscience

Twitter
@Society4Science

Instagram
@Society4Science

Snapchat
Society4Science

SOCIETY FOR SCIENCE & THE PUBLIC

1719 N Street, NW | Washington, DC 20036-2801 | 202.785.2255
societyforscience.org/ISEF2020