The Roanoke Valley Governor’s School for Science and Technology

2023 Student Project Forum

The Roanoke Valley Governor’s School for Science and Technology is supported by the Virginia Department of Education and the public school divisions of the Roanoke Valley. The RVGS Community is grateful for the support and financial commitment from our participating school districts:

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The faculty and staff of the Roanoke Valley Governor's School wish to thank those who have supported the student research effort during this academic year. In particular, we wish to acknowledge the generous support and assistance provided by:

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<td>Salem City</td>
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Laila Alam, MI-B 5
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Emma Seidel, AS-A 8
Gene Seo, SS-B 5
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Evan Shifflett, EM-D 4
Yasmin Shumway, AS-C 7
Amira Shumway, AS-C 7
Zoe Silva, EE 2
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Parker Sisk, SS-A 4
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Penelope Smith, BB 4
Cameron Snyder, BB 4
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Cole Stelter, EM-A 7
Durbin Stevens, CEM 3
Jacob Stewart, EM-C 1
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Brayden Wical, PS-B 5
Elliott Wiegard, AS-A 7
Timothy Wilson, CB 3
Darryl Wilson, III, MI-B 7
Kyla Wooldridge, PS-B 8
Shaykalia Wright, EE 6
William Xiao, AS-A 1
Griffin Yakob, CB 6
Ethan Yeary, MI-A 4
Zachary Young, AS-C 2
Yufei (Sophia) Zeng, MI-C 6
ANIMAL SCIENCES A

**AS-A 1** The Effect of Benadryl on the Heart Rate of *Daphnia magna*
Benjamin King, Northside High School
William Xiao, Northside High School
Teacher sponsor: Mr. Don Wages

**AS-A 2** The Effect of Creatine on the Heart Rate of *Daphnia magna*
Holden Bryant, Franklin County High School
John (Will) Jones, Franklin County High School
Teacher sponsor: Mr. Don Wages

**AS-A 3** Effects of the Heavy Metal Lead on *C. elegans* Movement
Cole Price, Staunton River High School
Teacher sponsor: Mrs. Joanne Villers

**AS-A 4** The Effect of *Lavandula stoechas* on the Heart Rate of *Daphnia magna*
Anna Favor, Patrick Henry High School
Evelyn (Eve) Foster, Patrick Henry High School
Teacher sponsor: Mr. Don Wages

**AS-A 5** The Effect of NAP Peptide on the Learning Ability of Different Strains of *C. elegans*
Leo Halsdorf, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

**AS-A 6** The Effect of *Camellia sinensis* on the Heart Rate of *Daphnia magna*
Savannah Johnson, Lord Botetourt High School
Rhiannon Stowe, Lord Botetourt High School
Teacher sponsor: Mr. Don Wages

**AS-A 7** The Effects of *Zingiber officinale* on the Heart Rate of *Daphnia magna*
Elliott Wiegard, Patrick Henry High School
Teacher sponsor: Mr. Don Wages

**AS-A 8** The Long-term Effect of Beta-Carotene on Eye Color and Light Sensitivity of *Drosophila*
Emma Seidel, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers
ANIMAL SCIENCES B

AS-B 1 The Effect of Anti-Inflammatory Drugs on Motility and Development in Mutant Drosophila Models for Sanfilippo Syndrome
Barbara (Ayla) Lampros, Salem High School
Reese Redford, Salem High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

AS-B 2 The Effect of Citrus x aurantium on the Heart Rate of Daphnia magna
Charlotte Anstey, Patrick Henry High School
Stella Gillenwater, Patrick Henry High School
Teacher sponsor: Mr. Don Wages

AS-B 3 The Effect of Lavandula dentata on the Heart Rate of Daphnia magna
Parneet Gill, Salem High School
Aleigha Weeks, Salem High School
Teacher sponsor: Mr. Don Wages

AS-B 4 The Effect of Pyropia yezoensis on the Heart Rate of Daphnia magna
Benjamin Ogle, Glenvar High School
Teacher sponsor: Mr. Don Wages

AS-B 5 The Effect of Melatonin on the Heart Rate of Daphnia magna
Graham Dietrich, Lord Botetourt High School
Miya Morton, Hidden Valley High School
Teacher sponsor: Mr. Don Wages

AS-B 6 Mortality Rate of Amphipods in Varying Water Temperatures
Irene (Ren) Combs-Cannaday, Patrick Henry High School
Phoenix O’Dell, Patrick Henry High School
Teacher sponsor: Mrs. Joanne Villers and Mr. Steve Villers

AS-B 7 The Effect of L-Arginine on the Heart Rate of Daphnia magna
Jupiter Chapman, Patrick Henry High School
Christian Chicas-Nolasco, William Fleming High School
Teacher sponsor: Mr. Don Wages
ANIMAL SCIENCES C

AS-C 1 The Effect of Malathion on the Heart Rate of Daphnia magna
John (Jack) Janiga, Hidden Valley High School
Caleb Wang, Hidden Valley High School
Teacher sponsor: Mr. Don Wages

AS-C 2 The Effect of Citric Acid on the Heart Rate of Daphnia magna
Jackson Hall, Patrick Henry High School
Zachary Young, Patrick Henry High School
Teacher sponsor: Mr. Don Wages

AS-C 3 The Effects of Prednisone on Planaria Fission and Growth
Emma Pope, Glenvar High School
Teacher sponsor: Mr. Steve Smith

AS-C 4 The Effect of Matricaria chamomilla on the Heart Rate of Daphnia magna
Sarah O'brien, Patrick Henry High School
Brinna Seidel, Patrick Henry High School
Teacher sponsor: Mr. Don Wages

AS-C 5 The Effect of Blue Light on D. melanogaster
Emma Batty, Patrick Henry High School
Annika Plunkett, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland

AS-C 6 The Effect of Withania somnifera on the Heart Rate of Daphnia magna
Kathryn Ha, Salem High School
Mirabel Makked, Salem High School
Teacher sponsor: Mr. Don Wages

AS-C 7 The Effect of Paullinia cupana on the Heart Rate of Daphnia magna
Yasmin Shumway, Patrick Henry High School
Amira Shumway, Patrick Henry High School
Teacher sponsor: Mr. Don Wages
BEHAVIORAL AND BIOMEDICAL SCIENCES

BB 1 Collagen XIX Point Mutant Leads to Schizophrenia Related Behaviors and Brain Disorder in Mice
Claire Wei, Cave Spring High School
Teacher sponsor: Mr. Brandon Taylor

BB 2 Testing the Cold Tolerance of Transgenic C. elegans as a Model for Organ Preservation
Parker Chapman, Franklin County High School
Nate Faulkner, Cave Spring High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

BB 3 The Perceived Effect of Essential Oils on Various Life-Style Health Aspects
Autumn O'Connor, Patrick Henry High School
Teacher sponsor: Mr. Brandon Taylor

BB 4 Investigating Vascular Abnormalities in the Placenta Due to Preeclampsia
Penelope Smith, Patrick Henry High School
Cameron Snyder, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

BB 5 MRI Flow Mapping of Tissue Engineered Lymph Node Stroma: Applications in Response to Interstitial Fluid Flow and Chemotherapy
Sophia Schumaecker, Cave Spring High School
Teacher sponsor: Mr. Brandon Taylor

BB 6 Application of an ATP-Bioluminescence Assay in Colon Cancer Chemosensitivity Testing of Grape Seed Extract
Josephine (Josie) Fraticelli, Glenvar High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

BB 7 Does Infant Sleep Behavior at Home Predict MRI Success Rate?
Natalie Davis, Franklin County High School
Teacher sponsor: Mr. Brandon Taylor
CM 1 The Effect of Blue Light on Opsin3 Gene Expression in the Colon Cancer Tumor Microenvironment
Grace Harig, Patrick Henry High School
Kira McGinnis, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland

CM 2 Generation of a Recombinant TSG101 Standard for Normalization of Extracellular Vesicle Number
Diya Reddy, Cave Spring High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

CM 3 The Effect of Various Nanoparticles on Fibroblast Cell Proliferation
Oliver Luci, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland

CM 4 Cell Cycle and Circadian Synchronization in Colon Cancer HCT116 Cells
Eleanor Little, Patrick Henry High School
Teacher sponsor: Mr. Brandon Taylor

CM 5 The Effect of Oxidative Stress on Fibroblast Cells Containing the Dsup Gene
Courtney Monard, Hidden Valley High School
Krischal Sutar, William Fleming High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

CM 6 The Effect of Different Melatonin Amounts on Colon Cancer Cells
Andrew Michie, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland

CM 7 Analyzing the Differences in Structure of Preeclamptic and Normotensive Placental Blood Vessels
Benjamin Blevins, Staunton River High School
Emily Kiser, Staunton River High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers
CHEMISTRY/ENERGY/MATERIALS SCIENCE

**CEM 1** Removing Pollutants from Water Using Sodium Alginate–Bentonite Beads  
Evelyn Anderson, Cave Spring High School  
Heidi Thompson, Cave Spring High School  
Teacher sponsor: Mr. Steve Smith

**CEM 2** The Effect of pH on Copper Pipes  
Robert Berry, Patrick Henry High School  
Teacher sponsor: Mr. Steve Smith

**CEM 3** Viability of Different Plant Waste as an Alternative Fuel Source  
John Paul (JP) Prusakowski, Patrick Henry High School  
Christopher (Durbin) Stevens, Patrick Henry High School  
Teacher sponsor: Mrs. Joanne Villers

**CEM 4** The Effect of Container Material on the Removal of *E. coli* from Water by UV Light  
Cameron McPhee, William Fleming High School  
Teacher sponsor: Mr. Steve Smith

**CEM 5** The Effect of Various Natural Dyes on Dye-Sensitized Solar Cells  
Divya Bharati, William Fleming High School  
Autumn Patterson, William Fleming High School  
Teacher sponsor: Mr. Steve Smith

**CEM 6** The Effect of Various Metal Anodes on Battery Voltage  
Conlan McNulty, William Fleming High School  
Teacher sponsor: Mr. Steve Smith
CB 1 Retrospective Analysis of ADHD-Associated Genes via Anthropological DNA Sources
Aaron Henion, Cave Spring High School
Teacher sponsor: Mr. Mark Levy

CB 2 A Machine Learning Diagnostic Tool to Predict Alzheimer's Disease using Blood-Based Biomarkers
Maggie Parkhurst, William Byrd High School
Teacher sponsor: Mr. Mark Levy

CB 3 Py-CRIT: Python Cancer RNA Interference Tool
Brayden Whitlow, Franklin County High School
Timothy Wilson, James River High School
Teacher sponsor: Mr. Mark Levy

CB 4 The Phylogenetic Relationship of Ctenophores with Respect to Other Basal Metazoan Clades
Brett Smith, Lord Botetourt High School
Teacher sponsor: Mr. Mark Levy

CB 5 Shared Genetic Variations Associated with ADHD and ASD
Mariam Abdelmalak, Salem High School
Carter Baka-Collins, James River High School
Teacher sponsor: Mr. Mark Levy

CB 6 Determining the Applicability of Peripheral Blood Biomarkers for Lung Adenocarcinoma Diagnosis
Griffin Yakob, William Byrd High School
Teacher sponsor: Mr. Mark Levy
EARTH AND ENVIRONMENTAL SCIENCES

ES 1 The Effect of Inorganic and Organic Fertilizers on the Growth of Raphanus sativus and Eutrophication
Sydney Anderson, Patrick Henry High School
Margaret (Maggie) Jarrett, Patrick Henry High School
Teacher sponsor: Mrs. Joanne Villers and Mr. Steve Villers

ES 2 Cover Crop Effect on Soil Microbial Diversity
Luke Sumner, Franklin County High School
Teacher sponsor: Mrs. Joanne Villers

ES 3 Degradation of Polyethylene and Thermoset Amino Formaldehyde Polymers using Pleurotus ostreatus and Mucor hiemalis
Erica Gergely, Lord Botetourt High School
Elliott (Ellie) McClung, Lord Botetourt High School
Teacher sponsor: Mrs. Joanne Villers

ES 4 The Effect of Gold Particles Attached to Eggshells on the Removal of Dyes and Heavy Metals
Cara Wardell, Patrick Henry High School
Teacher sponsor: Mr. Steve Smith

ES 5 The Effect of Various Amounts of Olivine on Carbon Dioxide Concentrations in Solution
Caroline Reichardt, Patrick Henry High School
Teacher sponsor: Mrs. Joanne Villers and Mr. Steve Villers

ES 6 The Effect of Iron Oxide in Marine Sediment on the Adsorption of Arsenic
Meribel Pan, Hidden Valley High School
Teacher sponsor: Mrs. Joanne Villers

ES 7 A Comparison of Benthic Macroinvertebrates Upstream and Downstream a Groundwater Source in the Roanoke River
Thomas (Trey) Joyce, III, Salem High School
Teacher sponsor: Mrs. Joanne Villers

ES 8 The Effect of Redlining on Soil Microbial Diversity
Jefferson (Aidan) Callis, Patrick Henry High School
Teacher sponsor: Mrs. Joanne Villers and Mr. Steve Villers
ENGINEERING MECHANICS A

EM-A 1 Ultrasonic Sensing Belt for the Blind
Caroline O’Keeffe, Patrick Henry High School
Elisabeth Tershak, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-A 2 Self Leveling Car
Frances Reddan, Patrick Henry High School
Jordan Wattie-Shear, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

EM-A 3 The Effect of Different Eddy Current Braking Designs on the Efficiency of Bike Braking
Nicholas Louvet, Glenvar High School
Nathan Sprouse, Cave Spring High School
Teacher sponsor: Mr. Drew Hurst

EM-A 4 Ball Launcher
Sallie Boxley, Patrick Henry High School
Nathalie Moreno, William Fleming High School
Teacher sponsor: Mr. Connor Wade

EM-A 5 Automatic Color Based Sorter
Samuel Crawford, Patrick Henry High School
Seth Perry, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-A 6 Improving the Road System in Franklin County Virginia
Benjamin Dye, Franklin County High School
Teacher sponsor: Mr. Brandon Taylor

EM-A 7 Egg Whisking Machine
Kensington Reynolds, Cave Spring High School
Cole Stelter, Lord Botetourt High School
Teacher sponsor: Mr. Connor Wade

EM-A 8 Controlling the Direction of a Remote Controlled Car Via Bluetooth
Charles (Bass) Beasley, Jr., Patrick Henry High School
Maximilian Roberson, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-A 9 Robotic Pipette
John Aziz, Patrick Henry High School
Margaret Kauffman, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade
ENGINEERING MECHANICS B

EM-B 1 Robotic Dish Cleaner
Isaac Olson, Patrick Henry High School
Ryan Prusakowski, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

EM-B 2 Fingerprint Scan Door Lock Mechanism
Diol Glele, Patrick Henry High School
Dominic LaConte, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

EM-B 3 Demonstrating American Sign Language through the Use of a Mechanical Hand
Tristen (Jack) David, Franklin County High School
Falan Peters, Lord Botetourt High School
Teacher sponsor: Mr. Drew Hurst

EM-B 4 Automated Dog Door Utilizing Facial Recognition Technology
Lucas Mann, Franklin County High School
Forrest Moorman, Franklin County High School
Teacher sponsor: Mr. Drew Hurst and Mr. Doug Divers

EM-B 5 Water Serving Aid
Guillaume Preud'homme, Patrick Henry High School
James (Ben) Schweitzer, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

EM-B 6 Mechanical Jar Opener
Keely Garri, Franklin County High School
Adison Mayhue, Lord Botetourt High School
Nicole Scarlatescu, Hidden Valley High School
Teacher sponsor: Mr. Connor Wade

EM-B 7 RC Airplane
Roxanne Culley, Patrick Henry High School
Luke Moon, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-B 8 Joystick Controlled Paint Car
Nikolai Morgiewicz, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst
ENGINEERING MECHANICS C

**EM-C 1 Golf Ball Claw Machine**
Seth Caldwell, Franklin County High School
Jacob Stewart, Hidden Valley High School
Teacher sponsor: Mr. Connor Wade

**EM-C 2 Automatic Key Turner**
Russell (McLure) Bailey, Patrick Henry High School
John (J.B.) Clements, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

**EM-C 3 Motor Skates**
Thomas (TJ) Hinson, Salem High School
Teacher sponsor: Mr. Drew Hurst

**EM-C 4 Self Controlled Extinguisher**
Sanchit Baskota, William Fleming High School
Jacob Jackson, Patrick Henry High School
Jeremiah Morgiewicz, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

**EM-C 5 Testing the Strength of a Simple Magnetic Gear**
Canaan (Cane) Fetzer, Cave Spring High School
Coleman Grindstaff, Franklin County High School
Teacher sponsor: Mr. Drew Hurst

**EM-C 6 Mark and Erase Arm**
Charlie Comer, Franklin County High School
Arden Gardner, Franklin County High School
Teacher sponsor: Mr. Connor Wade

**EM-C 7 Claw Machine**
Zane Ellis, Staunton River High School
Cora Reid, Staunton River High School
Teacher sponsor: Mr. Connor Wade

**EM-C 8 Squirt, the Robot**
Trinity Breedlove, Patrick Henry High School
Zoie Mills, William Fleming High School
Teacher sponsor: Mr. Drew Hurst
EM-D 1 Drawing Robot
Katie Coles, Patrick Henry High School
Luke Thompson, Patrick Henry High School
Teacher sponsor: Mr. Connor Wade

EM-D 2 Object Detecting and Avoiding Self-Driving Car
Titus Counihan, Patrick Henry High School
Tristan Kerr, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-D 3 The Application of Robotic Arm Swarm Behaviors for Autonomous Construction Tasks
Carson Ray, Cave Spring High School
Kane Reczek, Lord Botetourt High School
Teacher sponsor: Mr. Connor Wade

EM-D 4 Voice Activated Lamp
Evan Shifflett, Patrick Henry High School
Alexios (Lex) Stratton, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-D 5 Engineering Visualized
Paulo Carey, Franklin County High School
Teacher sponsor: Mr. Brandon Taylor

EM-D 6 Bacteria Plate-Swabbing Arm
Daniel Han, Cave Spring High School
Kiersten Lauer, Northside High School
Teacher sponsor: Mr. Connor Wade

EM-D 7 Roof Painting Robot
Chloe DeKorsey, Patrick Henry High School
Faith Kuehl, Patrick Henry High School
Teacher sponsor: Mr. Drew Hurst

EM-D 8 Trash Removal Crane
Zachary Easter, Salem High School
Austin Frantz, Salem High School
Teacher sponsor: Mr. Connor Wade
ENVIRONMENTAL ENGINEERING

EE 1 The Study of the Bioremediation of Copper by *E. coli* K-12  
Bailey Barker, Patrick Henry High School  
Riley Beasley, Patrick Henry High School  
Teacher sponsor: Mrs. Joanne Villers and Mr. Steve Villers

EE 2 Using Chitosan for Water Purification  
Zoe Silva, Staunton River High School  
Teacher sponsor: Mr. Steve Smith

EE 3 The Bioremediation of Perfluorooctanoic Acid by *Pseudomonas putida*  
Aidan Mayhue, Lord Botetourt High School  
Seth Richards, Lord Botetourt High School  
Teacher sponsor: Mrs. Joanne Villers

EE 4 The Application of Interpolymer Complex Hydrogels in the Removal of Aqueous Heavy Metal Pollutants  
Ainsley Robertson, Cave Spring High School  
Teacher sponsor: Mr. Steve Smith

EE 5 The Effect of Manganese and Barium on the Intake of Metals by *Pleurotus ostreatus*  
Georgia Honts, James River High School  
Teacher sponsor: Mrs. Joanne Villers

EE 6 The Effect of Various Chemicals and Evaporation on Impurities in Creek Water  
Shaykalia Wright, William Fleming High School  
Teacher sponsor: Mr. Steve Smith
MICROBIOLOGY A

MI-A 1 The Effect of Transformed *L. acidophilus* on *E. coli*
Jamal Millner, Patrick Henry High School
Daniel Owen-O'quill, Patrick Henry High School
Teacher sponsor: Mr. Matthew Browning

MI-A 2 The Effect of Caffeine on *E. coli*
Nathan Preston, Lord Botetourt High School
Teacher sponsor: Mr. Matthew Browning

MI-A 3 Engineering Stable Carotenoid Producing Yeast for Bread Leavening
Keaton Lucas, Lord Botetourt High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

MI-A 4 Comparison of the Effects of Honey and Manuka Honey on *P. fluorescens*
Matthew Love, Franklin County High School
Ethan Yeary, Franklin County High School
Teacher sponsor: Mr. Matthew Browning

MI-A 5 The Effect of Nanoparticle Size on Protection from Ultraviolet Radiation
Raimee Sykes, Lord Botetourt High School
Teacher sponsor: Mr. Steve Smith

MI-A 6 The Effect of Herbal Essential Oils on *B. subtilis*
Caroline (Gracie) Greer, Patrick Henry High School
Claire McCahill, Patrick Henry High School
Teacher sponsor: Mr. Matthew Browning

MI-A 7 The Effects of Alkaline Water on the Growth of *Bifidobacterium* and *Lactobacillus*
Su Gursoy, William Fleming High School
Teacher sponsor: Mr. Steve Smith

MI-A 8 The Effect of *P. soyauxii* on *S. epidermis*
Teegen Bowen, Patrick Henry High School
Virginia (Ginny) Matthews, Patrick Henry High School
Teacher sponsor: Mr. Matthew Browning
MICROBIOLOGY B

**MI-B 1** The Effect of Allyl Isothiocyanate Seed on *E. coli*
Craig (Isaac) Morris, Craig County High School
Maxwell Vanover, Lord Botetourt High School
Teacher sponsor: Mr. Matthew Browning

**MI-B 2** The Antibacterial Effects of Acetic acid on *E. aerogenes*
Isaiah Butler, Patrick Henry High School
Teacher sponsor: Mrs. Tracy Jenkins

**MI-B 3** The Effect of White Ginger and Chili Pepper on *S. macescens*
Gabrielle (Gabby) Harig, Patrick Henry High School
Nolan Stokes, Patrick Henry High School
Teacher sponsor: Mr. Matthew Browning

**MI-B 4** The Effect of *A. vera* on *P. fluorescens*
Aman Mengistu, Cave Spring High School
Ayush Pinnamaraju, Cave Spring High School
Teacher sponsor: Mr. Matthew Browning

**MI-B 5** The Antibacterial Properties of Metal-Impregnated Fabrics
Laila Alam, Lord Botetourt High School
Emily Duncan, Lord Botetourt High School
Teacher sponsor: Mr. Steve Smith

**MI-B 6** Synergistic Effect of *C. longa* & *O. vulgare* Oil on *E. coli*
Aaron Bhowansingh, Hidden Valley High School
Mann Patel, Glenvar High School
Teacher sponsor: Mr. Matthew Browning

**MI-B 7** The Effect of Cinnamon Oil on *Pseudomonas* Biofilm
Darryl Wilson, III, William Fleming High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

**MI-B 8** The Effect of Cannabidiol Oil & Distillate on *P. fluorescens*
Michael Aziz, Patrick Henry High School
Teacher sponsor: Mr. Matthew Browning
MICROBIOLOGY C

MI-C 1 The Effect of *A. cepa* on *E. coli*
Archit Arora, Staunton River High School
Joshua Manning, Staunton River High School
Teacher sponsor: Mr. Matthew Browning

MI-C 2 The Effects of Aminoglycoside & Beta-Lactam Antibiotics on *S. marcescens*
Emma Baldwin, Salem High School
Teacher sponsor: Mr. Matthew Browning

MI-C 3 The Effect of Microcargo on Chemotaxis of *D. discoideum* Towards cAMP
Mitchell Deese, Salem High School
Teacher sponsor: Ms. Cindy Bohland and Mr. Steve Villers

MI-C 4 The Effect of Oregano Oil and Vancomycin on *S. epidermidis*
Citlalli (CC) Garcia-Quiroz, Patrick Henry High School
Tammy Phung, William Fleming High School
Teacher sponsor: Mr. Matthew Browning

MI-C 5 Investigating the Use of Various Essential Oils to Create Antimicrobial Starch-Based Bioplastics
Ayden McNulty, William Fleming High School
Teacher sponsor: Mr. Steve Smith

MI-C 6 The Synergistic Effect of Cinnamon Leaf & Bark Oil on *E. coli*
Gabrielle Romeo, William Byrd High School
Yufei (Sophia) Zeng, Hidden Valley High School
Teacher sponsor: Mr. Matthew Browning

MI-C 7 The Effects of Various UV Filters on the Bioluminescence of *Aliivibrio fischeri*
Mieko DeKorsey, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland

MI-C 8 The Effect *Z. officinale* Oil on *B. megaterium*
Jaiden Dann, Lord Botetourt High School
Jonathan Fortune, Franklin County High School
Teacher sponsor: Mr. Matthew Browning
PLANT SCIENCES A

PS-A 1 The Study of the Allelopathic Effect of Lavender Tea on Leek Seed Germination
Kaleb Humerickhouse, Cave Spring High School
Alpinveer (Alpin) Singh, Cave Spring High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-A 2 A Study of the Allelopathic Effect of *T. aestivum* on the Germination and Radicle Growth of *D. sanguinalis* Seeds
Chloe Herold, Hidden Valley High School
Jeanne-Eugenie Picard, Cave Spring High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-A 3 The Effect of Hydrogen Peroxide on the Germination and Growth of Various Plants
Sachita Baskota, Patrick Henry High School
Himangi Tiwari, Patrick Henry High School
Teacher sponsor: Mr. Steve Smith

PS-A 4 The Allelopathic Effect of *B. oleracea* on *S. lycopersicum* Germination
Nathan Bulla, Cave Spring High School
Rishika Sethumadhavan, Cave Spring High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-A 5 A Study of the Allelopathic Effect of *M. officinalis* on *O. basilicum*
Hannah Hertz, Patrick Henry High School
Frances Livingston, Patrick Henry High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-A 6 The Effect of Heat and Water Stress on the Germination of Seeds of *Brassica*
Alexander (Lex) Farmer, Patrick Henry High School
Teacher sponsor: Mrs. Joanne Villers and Mr. Steve Villers

PS-A 7 A Study of the Allelopathic Effect of Broccoli on Radishes
Eyad Al-Aromah, William Fleming High School
Anissa-Rosa Morfa, William Fleming High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-A 8 A Study of the Allelopathic Effect of Habanero and Anaheim Peppers on Dandelion Seeds
Samuel Dandridge, Patrick Henry High School
Anam Neopaney, Patrick Henry High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-A 9 Measuring the Germination and the Chlorophyll Content of Plant Leaves Based on Daily Light Exposure
Esly Cruz-Nolasco, William Fleming High School
Teacher sponsor: Mr. Steve Smith

PS-A 10 A Study of the Allelopathic Effect of *Tagetes patula* on *Trifolium alexandrinum*
Walker (Jackson) Farrar, Patrick Henry High School
Trinity Hopson, Patrick Henry High School
Teacher sponsor: Mrs. Tracy Jenkins
PLANT SCIENCES B

PS-B 1 A Study of the Allelopathic Effect of *Allium sativum* on *Lactuca sativa*
Caralyn (Carrie) Collins, Lord Botetourt High School
Sophie Tisdale, Franklin County High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 2 A Study of the Allelopathic Effect of *S. oleracea* on *I. purpurea*
Molly Caroline Fitzgerald, Patrick Henry High School
Lydia Goad, Patrick Henry High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 3 The Study of the Mutual Allelopathic Effects of Alfalfa and Tomato Seeds.
Josephine Eaton, Salem High School
Claire Rawlins, Salem High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 4 The Effects of Neodymium Magnets on Plant Growth and Germination
Meera Raichura, William Byrd High School
Teacher sponsor: Mr. Steve Smith

PS-B 5 The Allelopathic Effect of *F. vulgare* on the Germination of *D. ciliaris* Seeds
Dorothy Myers, Salem High School
Brayden Wical, Franklin County High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 6 A Study of the Allelopathic Effect of Leek Leaves on Wheat Seeds
Nafisah Izzat, Cave Spring High School
Anvita Panchumarthy, Cave Spring High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 7 The Effect of Temperature and Light on Photosynthesis in Arabidopsis Plants with a DET1 Gene Mutation
Kathryn (Kate) Feldmann, Patrick Henry High School
Penelope Roberts, Patrick Henry High School
Teacher sponsor: Ms. Cindy Bohland

PS-B 8 A Study of the Allelopathic Effect of *P. vulgaris* on *C. maxima*
Claire Togo, Patrick Henry High School
Kyla Wooldridge, Patrick Henry High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 9 The Allelopathic Effect of Mint Tea on the Growth of Basil Seeds
Aaron Bowlby, Hidden Valley High School
Teacher sponsor: Mrs. Tracy Jenkins

PS-B 10 The Effect of Winter Rye Grass Extract on Haustoria Formation by Dodder on Tomato
Hannah Mizuba, Lord Botetourt High School
Teacher sponsor: Mr. Steve Smith
SS-A 1 Python One-Time-Pad Encryption
Maddox Bary, Glenvar High School
Sean Cady, Craig County High School
Teacher sponsor: Mr. Doug Divers

SS-A 2 Using Java to Collect Client Information from a Private Database with POST Endpoints
Alex Kurtz, Franklin County High School
Teacher sponsor: Mr. Brandon Taylor

SS-A 3 Handwriting Recognition in Python
Sharmila Balaji, Cave Spring High School
Hana Sageer, Hidden Valley High School
Teacher sponsor: Mr. Doug Divers

SS-A 4 Python Study Aid
William (Alex) Burnette, Hidden Valley High School
Parker Sisk, Hidden Valley High School
Teacher sponsor: Mr. Doug Divers

SS-A 5 Using Python to Optimize Overland Logistics
Michael (Brenden) Hartung, Northside High School
Teacher sponsor: Mr. Doug Divers
SYSTEMS SOFTWARE B

SS-B 1 The Significance of COVID-19 Precautionary Measures on Case Numbers and Economic Recovery
Noah Svirsky, Cave Spring High School
Teacher sponsor: Mr. Doug Divers

SS-B 2 Price Comparison Aggregator in Python
William Henderson, Franklin County High School
Jeremiah (Chase) Noel, Franklin County High School
Teacher sponsor: Mr. Doug Divers

SS-B 3 Converting Image to Sound Using Pixel Data
Kaeli Berry, James River High School
Teacher sponsor: Mr. Doug Divers

SS-B 4 Block Attack: The Karate Simulation Experience
Tyler VanDyke, Craig County High School
Teacher sponsor: Mr. Drew Hurst

SS-B 5 Using Artificial Intelligence to Simulate Naval Battles of the Second World War
Gene Seo, Northside High School
Teacher sponsor: Mr. Doug Divers

SS-B 6 Language Translator with Text-To-Speech Generator
Seijin Campbell, Franklin County High School
Kalob Daniels, Lord Botetourt High School
Teacher sponsor: Mr. Doug Divers
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