16th
Annual

# Connecticut STEM Fair

Saturday, February 6, 2016

Sponsored by:

CONNECTICUT STEM FOUNDATION, INC.

Inspiring and Educating Students

CTSTEMfoundation.org

# Fair Schedule

## 7:30 am:

Judge Check-In (Main Lobby)
Breakfast (Cafeteria) followed by
Orientation (Auditorium)

## 8:30 am:

Exhibitor Check-In (Athletic Entrance)
Breakfast (Cafeteria) and
Set-Up (North and South Gymnasiums)

## 9:30 am – 12:30 pm:

Judging of Exhibits (North and South Gymnasiums)

## 12 pm – 1:30 pm:

Fair Exhibits Open to Public (North and South Gymnasiums)
Lunch for Exhibitors & Judges (Cafeteria)

## 1:30 pm:

Keynote Presentation by
**Peter Shankman** (Auditorium)

Followed by Awards Ceremony

# Keynote Speaker

## 16th Annual
## Connecticut STEM Fair

### We are honored to welcome
## Peter Shankman
### *Author and Entrepreneur*

*The New York Times* has called him "a public relations all-star who knows everything about news media, and then some." Peter Shankman is a spectacular example of what happens when you merge the power of pure creativity with Attention Deficit Hyperactivity Disorder (ADHD) and a dose of adventure, and make it work to your advantage.

Peter is best known for founding Help A Reporter Out (HARO) which, in under a year, became the de-facto standard for thousands of journalists looking for sources on deadline. He is the founder and CEO of The Geek Factory, a boutique Social Media, Marketing and PR Strategy firm in NYC.

He is the author of 4 books including bestseller, *Zombie Loyalists - Using Great Service to Create Rabid Fans*.

Peter serves on several advisory boards including Natural Machines, a 3D food printing company and NASA Education and Outreach Committee. Some of his clients include American Express, The US Department of Defense, and Walt Disney World.

Peter is frequently featured on Fox News, CNN and MSNC. In 2011, a tweet of his was voted as one of the Top Ten Tweets of the year by ABC News and Twitter.

In his spare time, he is a sub–4 marathon runner, Ironman, and B–licensed skydiver.

**shankman.com**

# Special Thanks

The Connecticut STEM Foundation, Inc.
Gratefully Acknowledge the Generous Support of

## The Sexauer Foundation

Grants from the Sexauer Foundation have provided crucial support for the work of the Connecticut STEM Foundation as it expands its mission.

Sexauer's donations have underwritten major expenses associated with producing a fair at which the number of exhibitors has grown each year, and have allowed the Foundation to fund the enrollment of teachers from a variety of schools and districts in a program enhancing their ability to teach science research effectively.

Sexauer's support this year has allowed us to triple the monetary awards given to deserving students, plus support two college scholarships towards freshmen year expenses.

Our thanks go out to this visionary benefactor.

# Acknowledgements

**The Connecticut STEM Foundation, Inc.,** gratefully acknowledges these generous contributors:

**Major Sponsor of Foundation and Scholarship Program:**

Sexauer Foundation, Inc.

**Sponsors and Donors:**

Laticrete International, Inc.

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Dorothy & Joop deGroot

Estelle Fanucci

Dr. Matt Miller

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Fran & Dale Lichtenberg

Robert Susalka, CPA

The Connecticut STEM Fair could not exist were it not for the contributions of dozens of volunteers who devote their considerable talents and thousands of hours to fair activities.

Volunteers include approximately 200 judges, 40 individuals who prepare materials for the fair; 25 who assist with fair day activities, and the members of the Connecticut STEM Foundation Board of Directors who manage the fair.

**We acknowledge in a special way the Faculty and Staff of Darien High School, which hosted the fair.**

## For Their Valuable Services:

Paul & Karin Cook
(medals & banners)
Elizabeth Helling (program design)
Barbara Garelick (program printing)
Infinite Web Designs (web site)

## For Their Endless Hours of Service:

Ziaul Mannan: Fair Coordination
Fran Walker-Lichtenberg: Judging Coordination
Dale Lichtenberg: Logistical Coordination
Dave Lewis: Darien High School Science Teacher
Joop deGroot: Software Development
Dr. A.J. Scheetz: Registration Coordination
Rita Smircich: Program Booklet Coordination

## For Their Dedicated Service on the Day of the Fair:

The Board of Directors of the Connecticut STEM Foundation

## Tabulation Room Volunteers:

Sydney Brown
Robin and Bill Fox
Joop deGoop
Rita Smircich
Bob Susalka

## For Their Dedicated Service:

Our Talented and Hard-Working Judges (as of 1.24.2016)
Chirag Adhia
Larry Adzima
Lamar Ager
Benjamin Alper
George M. Anderson
Herbert Auslander
Sundararajan Balaraman
Richard Banfield
Dianna Bartel
Steven Baumann
Rick Benson
William Berson
Claudia Bertuccio
Ralph Binder
Carl Binner
Russ Blair
Larry Bowman
Naoise Boyle
Randall P. Bright
David Caianiello
Rachel Cain
Christopher Calitri
Dave Callan
Kenneth Camplese
Alina Carballo
Jose Carballo
Joe Carraway
Prakash Chakravarti
Paula Chapla
Ty Chatchaidech
Robert Cordery
Mark Costello
Richard Crouse
Craig Cuttner
Cheryl Damiani
Greg D'Andrea
Joseph I. D'Anna
J. Nathan Davis
Frank DiCristina
Michael Doery
Anna Duran
Sophie Dutheil
Ryan Earl
Avery Erwin-McGuire
Linda Farber
Kathleen Fearon
John Feder
Paul Ferencz
Anthony Fiumidinisi
John Fleming
Glenn Gardner
Francesca Gaspari
Paul Gerardi
Frances W. Ginsburg
Ken Goldman
Nicolas Greco
Kevin Green
Marshall Greenspan
Joe Grills
Rob Grosso
Michael Gugger
Akshar Gupta
Sanjeev Handa
Amy Handmaker
Roseanne Haughton
Carissa Iannone Hernandez
Aaron Herold
Steve Heyman
Robert Higgins
Dave Hill
Don Holtz
John Honey
Michael Honsberger
Wayne Howell
Rene Hymel
Haya Jamali
Tommy John
Andy Judge
Eduardo Kamenetzky
Andy Karatjas
Josh Karges
Mat Kastner
A. Corey Kiasset
Betty Klein
Craig Knebel
Rajeswari Kompalli
Lillian Labowsky
Mike Labowsky
Danielle LaChance
Jean Larson
Tom Larson
Marc Lash
Jon Lawrence
Judith Leahy
Tom Liaskas
Samantha Lin
Wilson Lin
Ann Lindo
Bob Logano
Michael LoTurco
Tony Lucas
Carolyn Macica
Jim Magid
Joanne Malia
Malik Miller
Sylvia Malinski
Steve Marlin
Kent Marshall
Ray Martinelli
Robert McDougal
Sharon McNeal
Shari Meyers
James Molina

Ruth Montgomery
Hector Morera
Nina Morrisson
Thomas H. Morrisson
F. Carl Mueller
Bikshandarkoil (BA) Narayanan
Xiomara Nunes
Paul Oestreicher
Thompson Okumodi
Lenore Snowden Opalak
Michael L. Oristaglio
Kate Otley
Chaitanya (CK) Pai
Neil Pathak
Prabir Patra
John Pelegano
Jeff Pierce
Karen Pierce
Christopher Pittenger
Bill Poirier
Albert Powers
Atif Rakin
Nomita Ramchandani
Hannah Reed
Tom Reitz
Marshal Root
David Ross
Harry Rosvally
Stephen Roux
Karin Russo
Marie Sabo
James Saulnier
Joshua Schwartz
Michelle Schwenger
Steve Sciallo
Gad Selig
Harlie Shaul
Taku Shimura
Kanwar Sidhu
Beth Siegelbaum
Deirdre Silberstein
Ray Skorupa
David Smith
Joanne Smith
Penny Snetsinger
Tarek Sobh
Ken Spelke
Alan Stolz
Eugene Swisher
Brian Thompson
Carol A. Tomczyk
Nancy Touba
Pattie Tsikos
Tom Tyler
David Valovich
Karen Varco
Thomas Venturino
Ivan Volchkov
Robert Wagman
Lee Warren
Andrea Waterman
Jim West
Christina Whiteus
Kimberly Wolcott
Simon Wong
Robert Wood
Paul Yonkers
Linfeng Zhang
Geza Ziegler Jr.

We would like to thank
**Estelle Fanucci**
for her foresight and generous support in spearheading our scholarship programs.

CONNECTICUT **STEM** FOUNDATION, INC.

**Inspiring and Educating Students**

**CTSTEMfoundation.org**

The **Connecticut STEM Foundation, Inc.** is a non-profit organization. Your financial contribution, of any amount, is greatly appreciated. Our goal is to expand our Fair to include students from other areas of Connecticut, create educational programs, and lecture series, and increase our annual awards and scholarships.

We also welcome volunteers to assist with fundraising, web development and development.

If you'd like to make a tax-deductible donation, or volunteer to help us reach our future goals, please contact us at CTSTEMfoundation.org, or send us an email to info@CTSTEMfoundation.org

Thank you for your support!

**How to Contact Us:**
The Connecticut STEM Foundation, Inc.
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info@CTSTEMfoundation.org
You can find us on Facebook and LinkedIn

The Connecticut STEM Foundation, Inc., an IRS Sec. 501 (c)(3) non-profit organization, seeks to inspire and educate students by encouraging inquiry and exploration in science and engineering, and by exposing them to exciting and practical advances in science.

This year, the Connecticut STEM Foundation will provide over $10,000 in Awards and Scholarships. If you would like to make a donation towards our efforts in promotion and education of STEM, please send us an email at info@ctstemfoundation.org.

If you shop on **Amazon.com**, please consider registering Connecticut STEM Foundation, Inc. to receive 0.5% of your purchase on AmazonSmile.com. Thank you.

For more information, sponsorship opportunities, or how to make an individual financial or in-kind donation, please visit us at our web site at CTSTEMfoundation.org.

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your donations to a non-profit?

Please consider a donation to
**Connecticut STEM Foundation, Inc.**
and ask your employer to
match your donation.

For further information, please send
an email to: info@CTSTEMfoundation.org.

Connecticut STEM Foundation, Inc.

Inspiring and Educating Students

CTSTEMfoundation.org


The Connecticut STEM Foundation, Inc.
would like to thank the

**Office of Naval Research**

for their generous support of our
Connecticut STEM Fair by providing
five Awards to deserving students.

The Board of Directors, and the Advisory Board would like to extend our deepest heart-felt appreciation to

## The Sexauer Foundation, Inc.

for their continuous support of our Foundation. This year, the Sexauer Foundation are proud sponsors of the Health, Environmental and Behavioral Science Awards. Plus the two college scholarship awards to graduating seniors are given on behalf of the Sexauer Foundation.


The Board of Directors of

Connecticut STEM Foundation, Inc.

would like to congratulate

**Dr. A.J. Scheetz &**

**Mr. Robert J. Susalka**

recipients of this year's

## Paul Heilman Award

Their extraordinary hard work,

A.J. as Chair of Registration, and

Bob as Treasurer

make our Fair run smoothly

and professionally.

Congratulations on a

very well deserved Award.

The Connecticut STEM Foundation, Inc.

would like to thank

**Dr. Anna Duran**

of Avatar Research Institute

for her contribution to

our Foundation

in securing grants

towards this year's

CT STEM Fair 2016.

# About the Connecticut STEM Fair

The Connecticut STEM Fair (formerly known as the Southern Connecticut Science & Engineering Fair), was started in Westport in 2001 as an eight-student local event. Over the past 15 years it has grown substantially and is now a major regional event. The 2015 fair was held at Newtown High School in Newtown, CT and showcased the original research of more than 250 students and the participation of a similar number of judges, science and technology professionals drawn from our communities. A key element of the Fair is comprehensive interactive judging of all entrants.

The Fair promotes critical thinking skills and motivates students to pursue science and engineering after high school. Students receive individual awards in four scientific categories: health, physical, environmental, and behavioral. Within each category, awards are given for both completed projects and research proposals. There are also two team categories: research proposals and completed projects. This year we expect to present more than 30 cash prizes and scholarships, representing over $10,000 in awards. The Fair is supported in part by the Sexauer Foundation.

Please visit us at CTSTEMfoundation.org for more information.

# About The Connecticut STEM Foundation, Inc.

The Connecticut STEM Foundation, Inc. (formerly known as the Southern Connecticut Science & Engineering Foundation), is an all-volunteer, IRS 501(c)(3) non-profit organization.

Our mission is to foster interest among all Connecticut high school students in science, technology, engineering, and math (STEM) by providing experiences for them to present their original research and interact with like-minded students and professionals.

We advocate for STEM and we seek to inspire and educate students, academics, parents and other members of our communities. In addition to sponsoring the Connecticut STEM Fair each year, the Connecticut STEM Foundation has supported advanced teacher training, and held some extraordinary events for students to see the practical application of science via field trips and lectures.

Please visit us at our website: CTSTEMfoundation.org for more information.

# Scholarship Program for Graduating Seniors and Summer Science Program

The Connecticut STEM Foundation, Inc. is pleased to announce a scholarship program open to all graduating seniors.

Seniors who have participated in this year's Connecticut STEM Fair are eligible to apply for financial support to help pay for their freshman year college expenses. **This year's scholarships will consist of two (2) scholarships in the amount of $1,000 each. Deadline for submission of completed college scholarship application is April 30, 2016.**

Scholarships will be awarded to graduating seniors, majoring in one of the four science categories: Science, Environmental, Health Field or Medicine, and Physical or Engineering.

Students in grades 9, 10, and 11, who have participated in this year's Connecticut STEM Fair are eligible to apply for financial support towards a summer science program expenses. **This year there will be one (1) scholarship in the amount of $500. Deadline for submission of completed summer scholarship application is June 1, 2016.**

For more information about applying for these scholarships, go to our website: CTSTEMfoundation.org and click on the tab, Scholarships.

To make a donation to the scholarship fund, please send an email to info@CTSTEMfoundation.org.

# Welcome & Thanks to the Science Teachers

**Amity Regional High School**
Deborah Day
Catherine Piscitelli
Scott DeMeo

**Convent of the Sacred Heart**
Mary Musolino

**Darien High School**
William Heher
Christine Leventhal
David Lewis

**Glastonbury High School**
Diane Pintavalle

**Joel Barlow High School**
Katherine Nuzzo

**Newtown High School**
Tim DeJulio

**Ridgefield High School**
Ryan Gleason
Patrick Hughes
Michael Yagid

**Sacred Heart Academy**
Elizabeth Christophy

**Staples High School**
Karen Thompson

# The Connecticut STEM Foundation, Inc.

## Board of Directors:

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Mr. Mike Opuszynski, *Vice-President*
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Ms. Deborah Day
Dr. Paul Oestreicher
Ms. Deirdre Silberstein
Ms. Nancy Yates

# Directory of Student Participants

| Student | School | Category | Project # |
|---|---|---|---|
| Ahmad, Yusuf | ARHS | Completed Project, Behavioral | 1 |
| Albanese, Libby | JBHS | Research Proposal, Environmental | 2 |
| Alindogan, Nicole | RHS | Research Proposal, Health and Medical | 3 |
| Alptekin, Susie | DHS | Research Proposal, Physical Science | 198 |
| Antaya, Joseph | ARHS | Completed Project, Environmental | 4 |
| Anumolu, Mounisha | ARHS | Completed Project, Environmental | 5 |
| Arellano, Nicole | SHS | Research Proposal, Health and Medical | 6 |
| Arevalo, Kellie | DHS | Research Proposal, Environmental | 7 |
| Augenbraun, Nathan | NHS | Completed Project, Physical Science | 8 |
| Balaji, Suvasini | ARHS | Completed Project, Behavioral | 9 |
| Banks, Colin | DHS | Research Proposal, Health and Medical | 10 |
| Beckford, Chelsea | CSH | Research Proposal, Health and Medical | 11 |
| Benedetti, Joseph | ARHS | Completed Project, Environmental | 12 |
| Benz, Andrew | DHS | Research Proposal, Physical Science | 13 |
| Berrigan, Brendan | DHS | Research Proposal, Physical Science | 14 |
| Bevill , Corinne | DHS | Research Proposal, Health and Medical | 15 |
| Bhattarai, Nitya | ARHS | Completed Project, Environmental | 16 |
| Bi, Jimmy | ARHS | Completed Project, Behavioral | 17 |
| Bonat, Alexandra | ARHS | Completed Project, Health and Medical | 18 |
| Borecki, Claire | DHS | Research Proposal, Health and Medical | 20 |
| Borecki, Elizabeth | DHS | Research Proposal, Physical Science | 19 |
| Boutros, Tom | ARHS | Completed Project, Behavioral | 164 |
| Bradley, Lizzy | DHS | Research Proposal, Physical Science | 21 |
| Brandon, William | DHS | Research Proposal, Health and Medical | 22 |
| Bredahl, Jane | DHS | Completed Project, Environmental | 23 |
| Britto, Aneeka | RHS | Research Proposal, Health and Medical | 24 |
| Brown , Onora | DHS | Research Proposal, Environmental | 25 |
| Buggy, Kaela | DHS | Research Proposal, Health and Medical | 26 |
| Burke, Quinn | ARHS | Completed Project, Behavioral | 27 |
| Campanella, Escher | DHS | Research Proposal, Physical Science | 28 |
| Carlo, Mary Cate | DHS | Research Proposal, Health and Medical | 29 |
| Carotenuto, Sabrina | CSH | Research Proposal, Behavioral | 30 |
| Cashman, Jackson | RHS | Research Proposal, Health and Medical | 31 |
| Chen, Alicia | ARHS | Completed Project, Health and Medical | 32 |
| Chinitz, Samuel | SHS | Completed Project, Environmental | 33 |
| Chuma, Harrison | RHS | Research Proposal, Environmental | 34 |
| Clark, Charlie | CSH | Research Proposal, Behavioral | 30 |
| Clarkin, Maia | RHS | Research Proposal, Physical Science | 35 |
| Colao, Annie | RHS | Research Proposal, Environmental | 36 |
| Comer, Stephanie | CSH | Completed Project, Health and Medical | 37 |

**AHS:** Amity Regional High School, Woodbridge
**CSH:** Convent of the Sacred Heart, Greenwich
**DHS:** Darien High School, Darien
**GHS:** Glastonbury High School, Glastonbury
**JBHS:** Joel Barlow High School, Redding/Easton
**NHS:** Newtown High School, Newtown
**RHS:** Ridgefield High School, Ridgefield
**SHA**: Sacred Heart Academy, Hamden
**SHS:** Staples High School, Westport

| Student | School | Category | Project # |
|---|---|---|---|
| Conway, Kaleigh | DHS | Completed Project, Environmental | 38 |
| Crafford, Leanna | RHS | Research Proposal, Health and Medical | 39 |
| Criscuolo, Emily | ARHS | Completed Project, Health and Medical | 40 |
| Criscuolo, Teddy | ARHS | Completed Project, Environmental | 41 |
| Crow, Joshua | ARHS | Completed Project, Physical Science | 46 |
| Dardik, Kevin | ARHS | Completed Project, Health and Medical | 175 |
| Davidi, Barak | ARHS | Completed Project, Environmental | 98 |
| Davis, Adrianna | RHS | Research Proposal, Environmental | 42 |
| Davis, Ben | SHS | Completed Project, Physical Science | 43 |
| DeNunzio, Emily | DHS | Research Proposal, Health and Medical | 44 |
| Desai, Sarishka | DHS | Completed Project, Health and Medical | 45 |
| Dharani, Himay | ARHS | Completed Project, Physical Science | 46 |
| Dimm, Katie | RHS | Research Proposal, Environmental | 47 |
| Ding, Howard | ARHS | Completed Project, Environmental | 48 |
| Diorio, John | RHS | Completed Project, Health and Medical | 49 |
| Dixit, Agrani | ARHS | Completed Project, Health and Medical | 50 |
| Documet, JP | DHS | Research Proposal, Environmental | 51 |
| Dolberry, Mahoghany | DHS | Completed Project, Behavioral | 52 |
| Driscoll, Julia | RHS | Research Proposal, Health and Medical | 53 |
| Du, Rosie | ARHS | Completed Project, Behavioral | 54 |
| Du, Weixin | ARHS | Research Proposal, Behavioral | 55 |
| Dubovik, Ulada | ARHS | Completed Project, Health and Medical | 56 |
| Dusenbury, Gregory | SHS | Research Proposal, Health and Medical | 57 |
| Dushyanth, Deah | CSH | Research Proposal, Health and Medical | 114 |
| Dym, Caroline | CSH | Research Proposal, Environmental | 91 |
| Eason, Rick | SHS | Research Proposal, Physical Science | 58 |
| Estra, Dana | ARHS | Completed Project, Behavioral | 59 |
| Feuerstein, Jacob | ARHS | Completed Project, Health and Medical | 60 |
| Findlan, Emily | DHS | Research Proposal, Health and Medical | 61 |
| Foley, Annie | ARHS | Completed Project, Behavioral | 62 |
| Friedman, Alexander | ARHS | Completed Project, Health and Medical | 63 |
| Gazula, Yogasai | SHA | Completed Project, Health and Medical | 64 |
| Ghoshal, Dahlia | GHS | Research Proposal, Health and Medical | 65 |
| Gianukakis, Ariel | DHS | Research Proposal, Health and Medical | 66 |
| Gilbride, Austin | ARHS | Completed Project, Health and Medical | 67 |
| Gillis, Sarah | RHS | Research Proposal, Physical Science | 68 |
| Goll, John | DHS | Research Proposal, Behavioral | 69 |
| Gorey, Catherine | DHS | Research Proposal, Behavioral | 70 |
| Gowda, Jethin | ARHS | Completed Project, Physical Science | 205 |
| Gowda, Shiva | ARHS | Completed Project, Behavioral | 71 |
| Granath, Will | DHS | Research Proposal, Environmental | 72 |
| Greene, Nicole | RHS | Research Proposal, Physical Science | 73 |
| Gross, Jacob | ARHS | Completed Project, Health and Medical | 74 |
| Grosso, Danielle | ARHS | Completed Project, Behavioral | 75 |
| Gunawardana, Dileka | JBHS | Research Proposal, Health and Medical | 76 |
| Gunya, Katherine | DHS | Research Proposal, Environmental | 77 |
| Hager, Paul | DHS | Research Proposal, Health and Medical | 78 |
| Halabi, Carson | DHS | Research Proposal, Environmental | 79 |

| Student | School | Category | Project # |
|---|---|---|---|
| Han, Paul | GHS | Completed Project, Physical Science | 80 |
| Handler, Katherine | ARHS | Completed Project, Environmental | 81 |
| Harman, William | DHS | Research Proposal, Environmental | 82 |
| He, James | ARHS | Completed Project, Behavioral | 83 |
| Heinzerling, Kelly | CSH | Completed Project, Behavioral | 148 |
| Henrie, Madeline | CSH | Research Proposal, Health and Medical | 84 |
| Higgins, Tim | DHS | Research Proposal, Physical Science | 85 |
| Hopper, Juliana | SHS | Research Proposal, Environmental | 86 |
| Jain, Anisha | ARHS | Completed Project, Health and Medical | 87 |
| Jarad, Haya | ARHS | Completed Project, Health and Medical | 88 |
| Jarad, Khaled | ARHS | Completed Project, Health and Medical | 89 |
| Johns-Woodby, Yahnah | CSH | Research Proposal, Health and Medical | 84 |
| Jones, Phoebe | RHS | Research Proposal, Health and Medical | 90 |
| Jordan , Stephanie | CSH | Research Proposal, Environmental | 91 |
| Juan, Avery | CSH | Completed Project, Environmental | 92 |
| Kachru , Ananya | ARHS | Completed Project, Behavioral | 93 |
| Kasak, Chloe | NHS | Research Proposal, Health and Medical | 94 |
| Keena, Henry | DHS | Research Proposal, Physical Science | 95 |
| Keenan, Colleen | RHS | Research Proposal, Health and Medical | 96 |
| Khan, Adam | ARHS | Completed Project, Behavioral | 97 |
| Khan, Haseeb | ARHS | Completed Project, Environmental | 98 |
| Khire, Priti | ARHS | Research Proposal, Physical Science | 99 |
| Kiefer, Rahul | JBHS | Research Proposal, Physical Science | 100 |
| Kline, Camilla | DHS | Research Proposal, Health and Medical | 101 |
| Kupcho, Lindsey | ARHS | Completed Project, Behavioral | 102 |
| Landler, Anna | RHS | Research Proposal, Environmental | 103 |
| Lang, Karen | RHS | Research Proposal, Health and Medical | 104 |
| Lang, Patrick | RHS | Research Proposal, Behavioral | 105 |
| Lee, Christina | ARHS | Completed Project, Behavioral | 106 |
| LeMay, William | NHS | Research Proposal, Physical Science | 107 |
| Lensky, Yevgeny | SHS | Research Proposal, Environmental | 108 |
| Li , Cheyenne | DHS | Research Proposal, Health and Medical | 112 |
| Li, Catherine | RHS | Research Proposal, Health and Medical | 111 |
| Li, Victoria | ARHS | Research Proposal, Health and Medical | 110 |
| Li, Vince | ARHS | Completed Project, Physical Science | 109 |
| Liang, Kimberly | ARHS | Completed Project, Physical Science | 113 |
| Lingareddy, Harika | ARHS | Completed Project, Physical Science | 113 |
| Lippolis, Francesca | CSH | Research Proposal, Health and Medical | 114 |
| Liu, Felix | ARHS | Completed Project, Physical Science | 115 |
| Liu, Helen | ARHS | Completed Project, Health and Medical | 116 |
| Livesay, Thomas | ARHS | Completed Project, Behavioral | 117 |
| Lowe, Courtney | DHS | Research Proposal, Environmental | 118 |
| MacKay, Madison | ARHS | Completed Project, Behavioral | 119 |
| Maerean, Nora | RHS | Research Proposal, Health and Medical | 120 |
| Mahler, Samuel | ARHS | Completed Project, Behavioral | 121 |
| Marini, Christian | JBHS | Completed Project, Environmental | 122 |
| Maro, Elise | DHS | Research Proposal, Health and Medical | 123 |
| Martin, Casey | DHS | Research Proposal, Environmental | 124 |

| Student | School | Category | Project # |
|---|---|---|---|
| Mathissen, Annemieke | SHS | Research Proposal, Health and Medical | 125 |
| McCormack, Erin | ARHS | Completed Project, Behavioral | 126 |
| McCormack, Kelsey | ARHS | Completed Project, Physical Science | 127 |
| McKenna, Matt | ARHS | Completed Project, Physical Science | 203 |
| McManus, Ryan | ARHS | Completed Project, Physical Science | 203 |
| McQuilkin, Callie | RHS | Research Proposal, Environmental | 128 |
| Meehan, Katherine | ARHS | Research Proposal, Health and Medical | 129 |
| Mehta, Tanmay | DHS | Research Proposal, Health and Medical | 130 |
| Miller, Emily | CSH | Completed Project, Environmental | 92 |
| Miller, Nicole | RHS | Research Proposal, Behavioral | 131 |
| Minsky-Fenick, Eitan | ARHS | Completed Project, Behavioral | 132 |
| Mohseni, Aria | ARHS | Completed Project, Environmental | 4 |
| Molot, Henry | ARHS | Completed Project, Physical Science | 133 |
| Mongillo, Leah | ARHS | Completed Project, Behavioral | 134 |
| Moon, Jasmine | ARHS | Completed Project, Health and Medical | 135 |
| Moran, Kristen | DHS | Research Proposal, Behavioral | 136 |
| Morosky, Mikayla | GHS | Research Proposal, Behavioral | 137 |
| Morr, Caleigh | DHS | Research Proposal, Health and Medical | 138 |
| Murphy, Eva | RHS | Completed Project, Health and Medical | 139 |
| Nadelmann, Julia | ARHS | Completed Project, Physical Science | 140 |
| Narang, Nic | SHS | Completed Project, Environmental | 141 |
| Nelson, J | DHS | Research Proposal, Environmental | 51 |
| Nikzad, Khani | ARHS | Completed Project, Physical Science | 205 |
| O'Connor , Kelsey | NHS | Research Proposal, Environmental | 142 |
| Oleynik, Ryan | ARHS | Completed Project, Physical Science | 143 |
| Panageas, Krista | RHS | Research Proposal, Health and Medical | 144 |
| Park, Sebin | ARHS | Completed Project, Behavioral | 204 |
| Pasa, Alin | SHS | Research Proposal, Behavioral | 145 |
| Pashankar, Neha | ARHS | Completed Project, Health and Medical | 146 |
| Pashankar, Sana | ARHS | Completed Project, Behavioral | 147 |
| Passannante, Grace | CSH | Completed Project, Behavioral | 148 |
| Patel, Rohan | ARHS | Completed Project, Health and Medical | 149 |
| Percarpio, Connor | DHS | Research Proposal, Environmental | 150 |
| Pfrommer, Daniel | DHS | Research Proposal, Physical Science | 152 |
| Pfrommer, Samuel | DHS | Completed Project, Physical Science | 151 |
| Pickett, Maddie | ARHS | Completed Project, Physical Science | 153 |
| Pratt, Charles | RHS | Research Proposal, Environmental | 154 |
| Price, Alex | RHS | Research Proposal, Environmental | 155 |
| Puchall , Daniela | RHS | Research Proposal, Behavioral | 156 |
| Racanelli , Brielle | DHS | Research Proposal, Environmental | 157 |
| Raigosa, Douglas | SHS | Completed Project, Physical Science | 158 |
| Rappaport, Hannah | ARHS | Completed Project, Behavioral | 159 |
| Rivero, Emilio | DHS | Research Proposal, Behavioral | 160 |
| Rutledge, Lauren | DHS | Research Proposal, Environmental | 161 |
| Ryack, Anna | ARHS | Completed Project, Behavioral | 162 |
| Santoro, Kevin | RHS | Research Proposal, Health and Medical | 163 |
| Santos, Levi | ARHS | Completed Project, Behavioral | 164 |
| Saunders, Jillian | JBHS | Research Proposal, Health and Medical | 165 |

| Student | School | Category | Project # |
|---|---|---|---|
| Savino, Oliver | RHS | Research Proposal, Physical Science | 166 |
| Saxe, Sarah | ARHS | Completed Project, Physical Science | 140 |
| Schaaf, Summer | ARHS | Completed Project, Environmental | 167 |
| Scheck, Alexander | RHS | Research Proposal, Physical Science | 168 |
| Schwartz, Jennifer | RHS | Completed Project, Health and Medical | 169 |
| Selmon, Nevia | ARHS | Completed Project, Environmental | 170 |
| Seward, Isabelle | RHS | Research Proposal, Health and Medical | 171 |
| Side, Veronica | RHS | Research Proposal, Environmental | 172 |
| Silliman, Jacob | ARHS | Completed Project, Physical Science | 173 |
| Silver, Natalie | RHS | Research Proposal, Health and Medical | 174 |
| Silverman, Vincent | ARHS | Completed Project, Health and Medical | 175 |
| Silvert, Eli | ARHS | Completed Project, Behavioral | 176 |
| Singer-Freeman, Ari | DHS | Research Proposal, Environmental | 177 |
| Stark, Jake | JBHS | Research Proposal, Physical Science | 100 |
| Stergue, Clint | NHS | Research Proposal, Physical Science | 178 |
| Stimpson, Johnathan | DHS | Completed Project, Health and Medical | 179 |
| Sucre, Francisco | DHS | Research Proposal, Environmental | 180 |
| Sudhir, Neha | ARHS | Completed Project, Behavioral | 181 |
| Sugarmann, Joseph | ARHS | Completed Project, Behavioral | 182 |
| Swift , Alexandra | DHS | Research Proposal, Behavioral | 183 |
| Tamallanca, Tim | JBHS | Research Proposal, Environmental | 184 |
| Tenerowicz, Keri | ARHS | Completed Project, Behavioral | 185 |
| Thomas, Alfston | RHS | Research Proposal, Health and Medical | 186 |
| Thombre, Aman | ARHS | Completed Project, Environmental | 187 |
| Todeasa, Julia | ARHS | Completed Project, Environmental | 188 |
| Tsui, Katie | DHS | Completed Project, Health and Medical | 189 |
| Van de Graaf, Justin | DHS | Research Proposal, Health and Medical | 190 |
| Vanech, Ava | CSH | Research Proposal, Health and Medical | 191 |
| Verdejo, Joshua | RHS | Research Proposal, Physical Science | 192 |
| Vernal, Chris | DHS | Research Proposal, Health and Medical | 193 |
| Vora, Ninad | GHS | Research Proposal, Environmental | 194 |
| Wang, David | ARHS | Completed Project, Physical Science | 109 |
| Wegener, Kate | JBHS | Research Proposal, Behavioral | 195 |
| Weinstein, Ryan | JBHS | Research Proposal, Environmental | 196 |
| Wilson, Will | DHS | Research Proposal, Health and Medical | 197 |
| Wind, Walker | DHS | Research Proposal, Physical Science | 198 |
| Wright, Katherine | JBHS | Research Proposal, Behavioral | 195 |
| Xu, Steven | SHS | Completed Project, Environmental | 199 |
| Yanagisawa, Kevin | ARHS | Completed Project, Health and Medical | 200 |
| Yuan, Kate | ARHS | Completed Project, Physical Science | 201 |
| Zhang, George | ARHS | Completed Project, Behavioral | 176 |
| Zhang, Lillian | ARHS | Completed Project, Health and Medical | 202 |
| Zhao, Kevin | ARHS | Completed Project, Physical Science | 203 |
| Zhou, Yuqi | ARHS | Completed Project, Behavioral | 204 |

## Ahmad, Yusuf — Project #1

Completed Project, Science, Behavioral

### Comparing the Beliefs and Attitudes of Medical Professionals and Medical Students towards Mental Illnesses

Stigma has proven to be a challenge in providing mental health service by negatively shaping perceptions of people with mental illnesses. It interferes with treatment participation by diminishing self-esteem and by robbing people of social opportunities. The focus of this study is to see how the beliefs and attitudes towards people with psychiatric disorders differ between health professionals and college students. Medical students at Yale Medical School were given surveys that included 43 questions, designed to best determine how a person feels towards mental illnesses. Factors in this study will include socializing (if one were to talk to a person with a mental illness), normalizing (if one would treat someone with a mental illness normally), non-supernatural (if one recognizes that mental illnesses are not caused by something supernatural), and bio-social causes (if one understands that mental illnesses are caused by biological/social factors). The students' results will be compared to the results of medical professionals from another study which used the same survey. The prediction for this study is that current medical students will have less stigma associated with their responses than current health professionals due to the marked increase in public awareness and sensitivity to mental illness in recent years, which may be part of their current training. However, preliminary data does not support this.This study will help increase awareness and acceptance of mental illnesses by becoming better acquainted with people's beliefs towards mental illnesses. And understanding these beliefs will lead to improved treatment plans for those suffering from mental illnesses in the future.

## Albanese, Libby — Project #2

Research Proposal, Science, Environmental

### Chemo-responsive prey location behavior of Procambarus crustaceans when exposed to carbon dioxide induced ocean acidification

This experiment observes the effects of CO2 levels in freshwater on chemoreceptors in Procambarus crustaceans, specifically their ability to locate prey, green algae. Recently, research has been collected regarding the effects of ocean and freshwater acidification on the neural functions in marine life. This research will add to the information on how CO2 is affecting freshwater crustaceans neurologically, and what impact this has on the species and marine animals overall. I will be keeping two Procambarus crayfish in each of three different raised CO2 concentrations, maintained at pH 6.80, 7.20, and 7.80 for 4 days, then testing their ability to locate a petri dish containing green algae. I will be measuring time taken to locate the algae, time spent in contact with the algae, duration of locomotion, area usage, and the number of antennae and antennule twitches. I am currently running my procedure. I predict that if CO2 levels in freshwater are elevated, then the crayfish exposed will show a weaker ability to locate the algae. I expect crayfish exposed to the unchanged freshwater pH to display average prey location behavior. I expect the crayfish in the lowest pH to display a weaker prey location ability, showing less antennae movement and requiring longer to locate the prey.If my hypothesis is proven correct, then increased CO2 is damaging to chemo-receptors in crayfish, a primary food source for many marine animals, as well as humans. This damage puts the crayfish, and most likely other crustaceans with the same chemo-receptor function, at risk for extinction due to slower ability to find food. This may also suggest that damage is being done to other creatures, possibly even humans.

## Alindogan, Nicole — Project #3

Research Proposal, Science, Health and Medical

### Notch Inhibitors on Breast Cancer Cell Lines

Cancer is a disease caused by uncontrollable division of abnormal cells in the body. The development of cancer can be attributed to the Notch signaling system, and a new type of therapy is being developed with Gamma-secretase inhibitors. I propose to use the GSIs in combination with the drugs quercetin and cyclopamine on breast cancer cell lines MCF-7 and SKBR-3.There has been research conducted using Gamma-secretase inhibitors in combination with other drugs, called quercetin and cyclopamine to treat leukemia cell lines. I would use the combinations on the MCF-7 and SKBR-3 cell lines and measure the cell viability to determine the cancers' reaction to the drugs.The results of this experiment would find if the Gamma-secretase inhibitors were able to be effectively used on two subtypes of breast cancer, one with high levels of proliferation proteins, and one with low amounts. Knowing the types of cancer and how they react to the GSI could give insight to what kind of genes are being expressed and what other mechanisms lead to cancerous tumors.These inhibitors have the potential to prevent this system from generating cancerous cells, and also minimize side effects to the patient. The proposed experiment would identify the types of cancers that the Gamma-secretase inhibitor would be effective on.

## Antaya, Joseph
## Mohseni, Aria — Project #4

Completed Project, Engineering, Environmental

### Exploring Sustainable Alternatives for Interior Light Fixtures

In this project, an energy evaluation will be conducted at Amity Regional High School. The evaluation is intended to supply information regarding energy consumption, cost, and efficiency. This project will explore alternatives, such as LEDs, to Amity's current CFL lighting fixtures. Although LED lighting presents higher capital costs, the operating costs associated with energy consumption may in fact offer long-term cost savings, as well as environmental, health, and safety benefits. It is hypothesized that if the Amity High School makes the switch to LED bulbs, then the school will benefit through cost savings and enhanced environmental health and safety. In the incipient stages of our project, meticulous "data mining" will be pursued. A 2010 energy benchmark conducted by ECSU's Institute for Sustainable Energy will serve as the cornerstone of our background research, which was provided by Jim Saisa, Amity High School's current Director of Facilities. Then, to determine the best alternative lighting source for Amity, we will construct a down-selection matrix that numerically scores potential lighting systems, with the highest score determining the best alternative. Anticipated results for our energy evaluation will be significant financial savings and reduced electricity consumption, which accounts for nearly 74% of the school's annual energy bill. The primary alternative to the current fluorescent bulbs at Amity is a more suitable LED lighting system. The scores will be based around numerous factors, specifically kilowatt hours (kWh), purchasing expenses, bulb life span, available bulb sizes for Amity's light fixtures, and health/safety concerns. After all the point values have been factored into the down selection matrix, the calculations will support a decision to change Amity's fluorescent lighting to LEDs.

## Anumolu, Mounisha Project #5

Completed Project, Science, Environmental

### The Impact of Agricultural Fertilizers on Dead Zone Creation as Determined by Algal Growth in Water Samples

Ecosystems have been detrimentally affected by fertilizer-runoff from nearby farms. Fertilizer fosters growth of harmful algal blooms (HABs). HABs use oxygen in marine ecosystems in decomposition, creating oxygen dead zones and causing organisms to suffocate. The larger the HAB, the less dissolved oxygen(DO) there is following decomposition. Varying fertilizer type may affect growth of HABs, thus affecting DO levels of water when algae decomposes. This experiment examined effects of popular fertilizers on future DO levels of water as algae grows in simulated ecosystems. It was hypothesized that nitrogen fertilizer will cause the largest growth in algae. Independent variable was type of fertilizer- urea 44-46% nitrogen, superphosphate (44-46% phosphate), sulfate of ammonia, and potassium chloride (60%). Dependent variable was the growth of the algae samples. The control group was waters without fertilizer.Water and algae samples were collected from Woodbridge, Connecticut pond. Samples were tested with four separate fertilizers using 12 containers. Collected samples were equally put into each container. Equal amounts of fertilizer were added to each of these containers. The control received no fertilizer. Over 72-hour intervals, pictures of the growth were taken. Using density-grid methods, percentage of algae in the pan and rate of growth were determined. Data was graphed and analyzed to determine relationships between algal growth and various fertilizers. The results showed nitrogen causes the most algal growth, followed by sulfate of ammonia, then potassium chloride, and lastly the super phosphate fertilizer. This information demonstrates how run-off from nitrogen fertilizer will result in the biggest dead zone after the algae decomposes. Nitrogen fertilizer will cause the highest number of marine wildlife to suffocate and the most deterioration of an ecosystem as a result of the dead zone. This information motivate farmers to especially control the use of nitrogen fertilizers.

## Arellano, Nicole Project #6

Research Proposal, Science, Health and Medical

### The effects of environmental factors on overexpressed tau genes in Drosophila Melanogaster in regards to neurodegeneration

The number of deaths due to neurodegenerative diseases has been increasing. Alzheimer's disease is currently the fifth leading cause of death and the root of sixty to seventy percent of dementia cases in the United States. This study sets out to minimize the expression and accumulation of toxic tau. This has prompted research in suppressing these diseases. Research by Rossi showed that a common trait between neurodegenerative diseases includes protein aggregation (2004). Studies in 2001 revealed that expressing mutant forms tau, a human protein which plays a role in neurodegeneration, in Drosophila Melanogaster displayed features including adult onset, progressive neurodegeneration, early death, toxicity of tau, and buildup of abnormal tau (Feany). Results from administering a heat shock to Drosophila who have been crossed with UAS-Tau Drosophila will be compared to that of a fly with no heat shock given in terms of larval crawling.

## Arevalo, Kellie — Project #7

Research Proposal, Science, Environmental

### The Effect of Low Frequency Sounds on Loggerhead Sea Turtles' Avoidance Behavior

The sea turtle population has decreased rapidly worldwide. Sea turtles have been on our planet for around 100 million years, revealing a direct ancestry with dinosaurs. Sea turtles are responsible for controlling the shellfish and algae populations, and play a crucial part in our ocean's food webs. As their population decreases, it is affecting humans and the world we live in. It is our duty to pursue research in this topic to save the sea turtles. A major threat to the sea turtle population is the commercial fish industry. Sea turtles, as bycatch, tend to get tangled in fishing nets, where they usually die. Scientists are researching various deterrents to prevent these sea turtles from getting caught in fishing nets. Although scientists have examined the effect of visual and odor deterrents on avoidance behavior, there is little research onhow sound might affect sea turtles. A large tank would be used to test the effect of low frequency sounds on juvenile loggerhead sea turtles. On one end of the tank, a machine would create low frequency sounds and the turtle would have to respond to these noises. It is expected that the turtles will be affected by the sounds, but I'm not sure how it will affect the avoidancebehavior. If the low frequency noises work, it could potentially benefit other marine life as well.

## Augenbraun, Nathan — Project #8

Completed Project, Engineering, Physical Science

### The Power of Microbial Fuel Cells

How does a Microbial Fuel Cell (MFC) compare to other popular methods of electricity generation in terms of cost per voltage. 6 mud samples were taken from various locations. Each sample was incorporated in an MFC, and tested for voltage production and reactants consumed over the course of a week. The 3 best preforming mud samples would then be used in an experiment that tested the effectiveness of a carbon brush anode. The most favorable mud- anode combination would be used in a MFC that was constructed using a ion exchange membrane. The MFC would then be tested for voltage production, reactant consumption, and substrate consumption. The data collected will aid in selecting the best mud sample for future MFC construction. The reactants consumed will help predict how long an MFC can run for a certain volume of reactants. Substrate consumption will be tested to predict how often the substrate will have to be replenished during long term use. The data collected for the MFC will be used to compare its cost effectiveness with that of other electrical generation methods.

## Balaji, Suvasini — Project #9

Completed Project, Science, Behavioral

### The Role of Feedback in the Identification of Flavor Stimuli

Flavor perception not only involves multisensory interactions and integration, but is also influenced by the context of the food stimuli and by people's knowledge/expectations. The effects of context and cognitive processes have potential to impair identification of flavor mixtures, particularly those involving lemon and citric acid flavorants, which are often confused "Ò most likely, from our experience with lemon-flavored substances, in which both lemon and citric acid are correlated.Thus, it is possible that the flavor system is capable of discriminating these two components, but experience has not created adequate conditions for learning to distinguish them. Therefore, the purpose of the investigation was to assess the role of post-response information (feedback) in identifying flavor-stimuli involving lemon and citric acid, and to test the hypothesis that trial-by-trial feedback can benefit subsequent performance. Within the study, there were two groups ofparticipants "Ò one that received feedback, and another that did not. Each participant was asked to identify 48 given solutions among the options of citric acid, lemon, and an acid/lemon mixture. For the second set of 16 solutions, the participants in the group receiving feedback were told the correct answer after submitting their response. Results thus far show improvement in responses post-feedback for the experimental group, suggesting that lemonand citric acid are distinguishable by the flavor system, but while performance typically fails to reveal this capacity due to inadequate conditions created by experience, feedback can benefit subsequent performance in identification of these components. Understanding the role of feedback in the identification of flavors supplements overall understanding of the flavor system, which could prove valuable in developing better treatments of disorders involving swallowing, eating, nutrition, and body weight.

## Banks, Colin — Project #10

Research Proposal, Science, Health and Medical

### Enhancing the Diagnosis of Multiple Sclerosis Through Measurements of Microparticles in Blood and Cerebrospinal Fluid

Multiple sclerosis (MS) is a neurodegenerative disease that affects the fatty myelin sheath of the neuron. Currently, the diagnosing procedures are expensive and invasive. The exploitation of two procedures (see below) would measure certain levels of biomarkers with the goal of allowing diagnosing capabilities to be enhanced. In order to limit the types of MS the patients would be identified as having relapsing-remitting multiple sclerosis (RRMS) or primary progressive multiple sclerosis (PPMS). The two procedures would depend upon variances in the expanded disability status score scale (EDSS) and upon predetermined iron levels in the blood, which would be references in which to facilitate the creation of a measurement scale for diagnosis. The first procedure would involve a sampling of blood to measure the level of certain microparticles in prediagnosed multiple sclerosis patients in order to find a pattern. The microparticles to be measured would be CD31, CD51, CD61, and CD54, as they are the most prominent and easily measured. The second procedure would involve measuring microparticles in the cerebrospinal fluid (CSF) using the same patients in order to find a pattern. The microparticles from the CSF would be NFL, YKL-40, and GFAP. Furthermore, the goal would be to find a "blueprint" of the patterns involved within the patients' microparticle levels, if present. The expected results should create a pattern referencing EDSS and iron levels, with the main focus upon microparticle types and levels. The implications of these discoveries would greatly enhance the diagnostic capabilities of physicians. Further experiments involving the measurement of microparticles could produce therapies involving changes in the microparticle levels.

## Beckford, Chelsea — Project #11

Research Proposal, Science, Health and Medical

### The Effects of the Anesthetic Disruption of Axon Guidance on Behavior

It has been shown that exposure to general anesthesia during early brain development can result in deficits in learning and memory. More specifically, anesthesia is known to disrupt axon guidance mechanisms.The effect of anesthesia on behavior, however, has not been the focus of extensive study. The purpose of this study is therefore to determine the effect of anesthetic disruption of axon guidance on the behavior of mice. Multiple exposures of pediatric anesthesia will be administered to mice and the effect on social and emotional behavior will be studied. A control group of mice with no anesthesia administered will be included.This study can possibly lead to a new treatment that will counteract the detrimental effects of anesthesia on children.

## Benedetti, Joseph — Project #12

Completed Project, Science, Environmental

### Effects of Potassium Sulfate on Plant Growth

Due to the current growth rate of the world's population, an adequate food supply is of paramount importance. Fertilizers can speed up the growth of plants. A main ingredient of fertilizers is Potassium Sulfate. The purpose of investigating the effects of Potassium Sulfate on plants is to know what exactly Potassium Sulfate does for plants and how it can be added to achieve maximum growth. It was hypothesized that by adding more of the chemical Potassium Sulfate to the soil, radish plants will grow and mature at a faster rate. Four containers were filled with soil, and forty-five seeds were placed in each container. For the control group, zero grams of Potassium Sulfate was added to the soil. An amount of two, four, and six grams of Potassium Sulfate was added to the soil of each of the other containers, respectively. The containers were placed under grow lights and the soil was watered daily. The independent variable was the amount of Potassium Sulfate administered, and the dependent variable was the mass of the radish plants.The data of the experiment has suggested that the plants with more Potassium Sulfate grew faster, and more radishes actually sprouted. With less Potassium Sulfate in the soil, the data suggests that the plants grew slower and fewer radishes sprouted. Using this information, farmers can be helped to produce more crops quicker than before. The findings could help fertilizer producers establish the proper amount of Potassium Sulfate to add to their product. Whether they are adding too much Potassium Sulfate or too little, fertilizer producers can better control the amounts of Potassium Sulfate in their products. This could also lead to experiments with other chemicals, in the correct amounts, that could maximize crop production and growth.

## Benz, Andrew — Project #13

Research Proposal, Science, Physical Science

### Using Threshold Cryptography to Make PolyPasswordHasher Resource-Intensive

PolyPasswordHasher is a mechanism for storing passwords that was developed at New York University in order to improve upon the current methods of password storage. PolyPasswordHasher is designed to exponentially increase the computational effort expended by the attacker by allowing passwords to only be verified in batches. This is achieved through the use of Shamir Secret Sharing, a mathematical procedure that effectively splits a secret value intomultiple shares such that the secret value can only be retrieved given a certain number of shares. The process of recovering the secret value from a set of given shares is known as recombination, and the number of shares required to perform recombination is known as the threshold. The goal of this experiment is to improve on the design of PolyPasswordHasher by changing the verification process to performing threshold decryption.The purpose of changing PolyPasswordHasher's design is this way is to make the attacker expend more effort for each password he or she guesses, as it is expected that performing threshold decryption will require more CPU cycles to perform than just performing Shamir Secret Sharing. The threshold decryption procedure will be implemented in the C programming language. Victor Shoup's NTLlibrary will be used both to improve the performance of the threshold decryption procedure and as a reference to design the secret sharing procedure. The getrusage() function from the C standard library header sys/resource.h will used to calculate the number of total CPU cycles executed by both the threshold decryption procedure and the regular secret sharing procedure.

## Berrigan, Brendan — Project #14

Research Proposal, Science, Physical Science

### The Effects of Physiological Data Awareness in Video-Based CMC

Computer-mediated communication (CMC) is a field exploring how individuals communicate over computers, how such communication differs from face-to-face communication, and how communication over computers can be improved. åÊWith the rapid expansion of video communication in recent years, the creation of higher-fidelity communication channels has largely stagnated. This research explores if higher-fidelity communication can be created, and if it will be effective.It is hypothesized that if data from galvanic skin response, electrocardiogram, electromyogram, and temperature sensors are used during communication, this higher-fidelity communication will improve the quality of communication as measured by scores given by interlocutors, as well as changes in physiological indicators. A prototype of the device has already been created, and it is planned that the device will be used alongside a video conversation in CMC conversations.One of the interlocutors in these conversations will have been exposed to an artificial stressor, such an unexpectedly difficult task, which they will do before an audience of other members of the study. The other interlocutor will be advised to attempt to help the other interlocutor feel better about their performance. The same will be done with interlocutors who use only a video chat as well as those having face-to-face conversations.Physiological indicators will be measured in all interlocutors. Additionally, all interlocutors will take a survey rating their experience. This research will provide information about the quality of the device and give better information on video chat as a whole. This research will lead to better CMC systems for use in cases such as remote therapy for those suffering from a wide range of mental illnesses, including but not limited to PTSD.

## Bevill, Corinne — Project #15

Research Proposal, Science, Health and Medical

### The Effect of Induced Neural Stem Cell Treatment on Parkinson's Patients

Parkinson's disease is a disorder of the nervous system that affects millions each year. The disease destroys the motor neurons of the central nervous system, leading to immobility and muscle failure. Although today's treatments prolong the lives of patients, there is no known cure. Studies have shown that induced neural stem cells (iNSCs) injected with the Sox2 gene can prosper in-vivo, but it has not been determined which growth supplements can culture iNSCs efficiently. The application of modernized patient-specific induced neural stem cells in Parkinson's patients presents a possible answer. To create these stem cells, human fibroblasts will be extracted and undergo transduction, introducing the Sox2 gene to the cell. These fibroblasts will then be cultured in various growth enhancement proteins of various immunogenicity (FGF8, FGF21, FGF3, FGF11) to identify which would be most efficient for treatment. Next, patch clamp testing will be done to ensure proper neuronal response. Later, cell cultures will be mixed in-vitro with sample cells extracted from a Parkinson's patient, testing which group of neural stem cells can regenerate viable iNSCs for treatment. The expected outcome of this research should identify a growth supplement that can eliminate cell death and formation of teratomas in iNSCs. Data should support that using the FGF8 growth supplement, with 100% immunogenicity to humans, will produce the most efficient group of iNSCs with the ability to restore the cells in Parkinson's patients. If success is found with a certain growth supplement, researchers should move to in-vivo trials with mice in order to identify potential problem before proceeding with a clinical trial which may open doors in finding a cure to Parkinson's disease.

## Bhattarai, Nitya — Project #16

Completed Project, Science, Environmental

### Spatial Distribution Analysis of Damages Caused by Recent Earthquakes in Nepal

In April 2015, Nepal suffered a 7.8 magnitude earthquake which caused over 10,000 deaths. Much of the damage occurred around mountains and hills where destruction was not uniform throughout. This led to the possibility that seismic shaking is impacted by topographic attributes such as slope, gradient, and aspect. The purpose of this research is to evaluate if relationships exist between these topographic attributes and damage the earthquake caused.The independent variable is slope aspect and the slope of the hill. The dependent variable is the damage in the area around the hill. First, topographic data will be acquired from USGS database. Next, damage data would be collected from multiple reports. Lastly, apply ArcGIS to analyze relationship between slopes, aspect and damage which occurred. Data is still being proceeded. However, initial findings have shown that the percentage of slope has the greatest effect on the damage. The steeper the slope is, the greater the damage. Also, most damage occurs when the hill is facing the south. This research will help Nepalese engineers plan and build buildings in safe zones in and around mountains to avoid the devastation caused by the earthquake in April of 2015.

## Bi, Jimmy — Project #17

Completed Project, Science, Behavioral

### Probing Cognitive Abnormalities in Causal Reasoning in OCD

In Obsessive Compulsive Disorder, the individual suffers from anxiety-causing obsessions that lead to relieving compulsions. Causal learning is the ability to make predictions based off of prior knowledge of cause and effect. The certainty levels and prediction error were examined in OCD patients. Certainty is the length of time in milliseconds in which a participant holds down a key for yes or no while prediction error is a true or false value based on whether or not the participant answered correctly. It was hypothesized that the OCD patients show lower confidence values. The Java program was created with Eclipse to convert data of separate participants taken from the program to a readable format in Excel. The program also was able to combine the Excel spreadsheets from multiple participants into a single spreadsheet. For the second phase of the project, OCD and control participants were gathered through the Yale institution. They took the electronic DMDX assessment, which consists of hypothetical allergy related situations, to test for cognitive abnormalities within causal learning. The data collection phase has begun. Participants have been gathered and are being tested individually during organized sessions. Analysis will be conducted upon its completion. The application will help automate the data analysis process as it is currently done manually. The larger study could help early detection of the mental disorders and development of treatment methods. Also, by doing the study in accordance with fMRI (Functional magnetic resonance imaging) it is possible to learn more about the regions of the brain that correspond to causal learning.

## Bonat, Alexandra — Project #18

Completed Project, Science, Health and Medical

### The Effect of Tommy John Surgery in MLB Pitchers on Post-Surgery Performance

In the past several years, an increasing number of pitchers have been undergoing a repair of the ulnar collateral ligament of their throwing arm. The surgery, a procedure in which a damaged ulnar collateral ligament is replaced with a tendon from elsewhere in the body, is named after Tommy John, who was the first to have it in 1974. This experiment sought to determine how having Tommy John surgery affects a pitcher's performance for the remainder of his career. It was hypothesized that having Tommy John surgery negatively affects pitcher performance after the surgery.The independent variable in this experiment was whether a pitcher had undergone Tommy John surgery, and the dependent variable was the pitcher's performance for the remainder of his career. Performance was assessed using metrics such as ERA-, FIP-, walks per nine innings, strikeouts per nine innings, and innings pitched. To test the hypothesis, the statistics of pitchers who underwent their first or only Tommy John surgery between the third and eighth year of their MLB career from 1995-2009 were taken from Fangraphs and analyzed using Microsoft Excel. The pitchers' statistics before and after undergoing Tommy John surgery were compared to determine the effect of the surgery.Preliminary results showed a slight negative relationship between Tommy John surgery and future pitcher performance. These results could be used to determine whether Tommy John surgery is worthwhile for pitchers and could lead to research of rehabilitation methods after the surgery in order to determine the method of recovery from Tommy John surgery that corresponds to the best future performance.

## Borecki, Elizabeth — Project #19

Research Proposal, Engineering, Physical Science

### Reinventing the Quadcopter: Developing the most user-friendly, cheapest, and smallest drone

Our airspace one day soon may be filled with "unmanned aerial vehicles" (UAVs) or "remotely piloted aircrafts" (RPAs). However, many people have limited knowledge of drones and therefore do not trust them. The investigation seeks to construct the most user-friendly, cheapest, and smallest drone -with educational and commercial applications. The focus will be on the quadcopter, a type of RPA, which is the most suited for the requirements. A 3D printer will be utilized to construct the quadcopter as it provides a way to keep costs low and to continue to remake parts when troubleshooting. The more complex parts will be obtained from an already made quadcopter, as buying parts individually is more expensive, and will be broken down and adjusted as needed. The end result will be a prototype or finished product that could be sold mass market and be used as an educational tool. The practicality of anyone building his or her own will also be determined. The findings could be applied to other types of RPAs and UVAs to extend the educational and commercial applications. In addition, the utilization of 3D printing could be expanded to the rest of the aerospace field as well. The transportation of objects by any person to any place could be revolutionized.

## Borecki, Claire — Project #20

Research Proposal, Science, Health and Medical

### Parvalbumin and the Gamma Band: Applying New Biological Understanding to Measuring Risk and Diagnosing Autism

Alteration in the inhibitory and excitatory synaptic transmission (I/E) balance underlies dysfunction in autism spectrum disorders, as well as other complex neurological disorders like schizophrenia. In autism specifically, recent research has implicated dysfunction in Parvalbumin (PV) interneurons, which regulate inhibitory GABAergic neurons. PV cell function is strongly linked to critical periods (important developmental periods of learning and adaptation) that allow the brain to be in a more plastic state. Recent research also finds the gamma band, a type of brain activity that may reflect how the brain integrates information, is decreased in infants at high risk for autism. This experiment seeks to associate parvalbumin-deficient mice with irregular gamma band activity, and to find whether the severity of the dysfunction reflects the severity of autistic-like symptoms. Control mice will be used along with PGC-1a and PV-deficient heterozygous and homozygous knockout mouse models. All mice will be tested for social skills and repetitive behaviors, including use of a 3-chamber social assay. Surgery will allow for nodes to interpret gamma activity during visual stimuli. Autism is a disorder made difficult to research and understand because of its genetic and phenotypic variability. This research would support PV interneuron dysregulation as a point of convergence in autism, an important advancement. Results would also support continued work into using gamma band activity as a measurement of autism risk, useful for screening very young children in a way that does not rely only on the current diagnosis system of behavioral symptoms.

## Bradley, Lizzy — Project #21

Research Proposal, Science, Physical Science

### Yellowstone Caldera

The study of seismology and volcanology are important fields of science, critical to knowing how to prevent or prepare for the next catastrophic disaster. By comparing the most threatening supervolcanos to the eruption of Toba as well as the 1980 Mt. St. Helens eruption, the severity of such an event can be predicted. The problem at hand is: If supervolcanos were to erupt today, then what would the effects be?For example, and what this research will focus on, what if the Yellowstone Caldera were to erupt? This question is based on a future, hypothetical event, so it is necessary to reflect on similar situations. The largest volcanic eruption that science has been able to identify is the Toba Supervolcano eruption, about 74000 years ago. This event triggered volcanic winter, thus causing mass extinction. Geological evidence has shown how much lava poured from the volcano, how much ash was expelled/how high the ash column was, as well as how long the eruption lasted. It has been predicted that the next Yellowstone eruption will be approximately 1000 times that of Toba and 2000 times that of the 1980 Mt. St. Helens eruption. If a seismometer was placed as near to the magma chamber as possible, could it help us to predict when this catastrophic event will occur. Assuming that the seismometer remained unharmed, it is predicted that the movement of the crust will be recorded. With this data, more accurate estimates can be made.

## Brandon, William — Project #22

Research Proposal, Science, Health and Medical

### In Vitro Treatment of Human Gastric Carcinoma with Clostridium perfingens Enterotoxin

In past studies, Clostridium perfingens enterotoxin (a common cause of food poisoning) has exhibited an impressive ability to selectively lyse cancerous ovarian epithelial cells in both in vivo and in vitro models. This phenomenon is the result of upregulated claudin 3 and claudin 4 expression in ovarian epithelial cancer (claudins are surface proteins which the enterotoxin binds to instigating cell death). Recent testing has shown that colon carcinoma may have claudin expression that is similarly upregulated to ovarian epithelial cancer. When chemically treating cancer, tumor resistance and recurrence is a commonly faced problem for healthcare providers and as a result it is of great importance that a variety of treatments are made available for a given type of cancer. This experiment will measure the efficacy of Clostridium perfingens enterotoxin treatment in gastric carcinoma. First, the copies of claudin coding RNA will be quantified with reverse transcription PCR in each cell strain. Then the colon carcinoma cells will be plated and treated with the enterotoxin in varying dosages alongside healthy gastric cells. Via cell staining, the percentage of cells that have lysed will be measured over time. It is expected that the enterotoxin treatment will be more effective in strains expressing higher levels of claudins 3 and 4, that gastric carcinoma cells will express higher levels of claudins than healthy cells, and that the cell lysis rate will correlate with dosage concentration. If Clostridium perfingens enterotoxin lyses cancerous cells while sparing healthy epithelial cells, it will have the potential to treat cancer with minimal side effects, improving both quality of life and survival rates for those diagnosed with gastric carcinoma.

## Bredahl, Jane — Project #23

Completed Project, Science, Environmental

### The Creation of Growth Curves for Lionfish Utilizing Information from Otoliths

Lionfish, Pterois volitans and Pterois miles, are a venomous marine species native to the Indo-Pacific that are invading the Atlantic Ocean. The effects of the lionfish on these foreign waters have been decisively negative, including the destruction of coral reefs and reductions in recruitment of native species. The ecological impacts of the invasion are massive and will continue to harm the ecosystem if the problem is not addressed. In this experiment, growth curves were created utilizing information from lionfish otoliths to determine the average growth rates of both male and female lionfish. This information can point to more efficient removals and provide more background on the species. In a laboratory in Bermuda over the summer of 2015, male and female lionfish were dissected in order to retrieve otoliths from the cranial cavities. The otoliths were then processed and put onto microscope slides so that their rings could be counted and the data recorded. The number of rings on each otolith corresponds to the age of the lionfish, which allows for the mass and total length of each individual fish to be compared to years alive. Once this information was organized, the data was plotted onto graphs and the points took the shape of a curve. Complete eradication of lionfish from the Atlantic is improbable if not impossible, so the best hope for the future of the ecosystem is to use the results of experiments such as this one to create a specific plan, including local removal efforts to keep the population in check, and attempts to assimilate the species into the ecosystem to reduce the detrimental damage.

## Britto, Aneeka — Project #24

Research Proposal, Science, Health and Medical

### Examining the Hereditary Prevalence of Atopic Symptoms of Adults and Children

Food allergy reactions have an array of responses ranging from mild (redness of skin) to severe anaphylactic reactions. Researchers estimate that approximately 50% of children of atopic families inherit an allergic disease, contrasted with children without a family allergic history who have roughly a 20% hereditary allergy rate. The experiment objective is to measure the correlation between the allergic reaction severity in adults and atopic inheritance of children. A survey will be administered to families across the region with both dichomotous as well as closed format questions regarding the severity of allergic reactions. Participants will be asked to indicate the types of food allergies they have, length of their allergic disease, and prevalence of allergies in their children. Severity of reactions will be classified as mild, moderate, or severe anaphylactic reaction.Using a statistic analysis software, a mulitvariate examination will be made of all variables for quantity,severity, and hereditary inheritance of allergic reactions. A correlation coefficient will be established to show the relationship between parent and child allergic symptoms and the prevalence of allergies for children from atopic and non-atopic families.Results from this study will quantify the measurement of correlation between adult and child allergic reaction symptoms. Future implication include conclusions regarding allergy treatment and predictions for the type of allergies children will inherit from their parents. Although the population sample does not represent the total range of Americans with allergic diseases, it will draw conclusions about inheritance and prevalence of allergies.

## Brown, Onora — Project #25

Research Proposal, Science, Environmental

### Increased Water Temperatures Increase Bleaching in Highly Susceptible Corals

Will highly susceptible corals bleach at a faster rate if water temperature was increased ? The motivation for this experiment is the increased climate temperatures that are affecting corals and therefore, the fish that inhabit susceptible corals. The goal of this experiment is to raise awareness of this issue in order provide more reason for creating environmental reform to combat rising global temperatures. The experiment will include four trials. The corals will be in individual tanks of 50 cm in diameter with a depth of one meter. A heat lamp will be used over each tank to distribute light and a water heater will be inserted into each tank to regulate temperature. The experiment will last six weeks and every week the temperature in the tanks will rise 2 ‰ãÄ, ranging from 30 ‰ãÄ to 40 ‰ãÄ. If the highly susceptible Stylophora madagascariensis, Acropora digitifera, and Acropora selago are inserted into tanks with increasing water temperatures then, the Acropora selago coral will bleach at the fastest rate because of its widespread branches that can absorb more light and heat due to its larger surface area. It is also expected that the smaller, more compact coral species, Stylophora madagascariensis will take the most time to bleach due to its smaller more compact form. Rising global temperatures are having a profound negative impact on marine species, making it important to conduct experiments to encourage environmental reform. Without the protection of healthy coral, predation increases and creates unbalance in the food chain. Increased predation also leaves fisherman nothing to catch, therefore also affecting local economies that rely on the fishing industry.

## Buggy, Kaela — Project #26

Research Proposal, Science, Health and Medical

### The Correlation Between Cranial Cervical Syndrome and Chronic Traumatic Encephalopathy

Chronic Traumatic Encephalopathy (CTE) is a neurodegenerative disease, not unlike Multiple Sclerosis or Alzheimer's disease, that has received national recognition for inhibiting countless individuals with a history of head trauma from living a full life. Until recently, the only official diagnosis of CTE could be done through post mortem analysis of the brain.Now, through great efforts towards being able to diagnose patients prior to death, the development of therapies to manage the progression of the syndrome has advanced greatly. This experiment will examine the correlation between Cranial Cervical Syndrome and Chronic Traumatic Encephalopathy, and the possible correspondence of treatments. Through the use of the chiropractic Atlas Orthogonal treatment, this investigation will observe the change in patient's symptoms pre and post therapeutic intervention. Subjects will receive an upright MRI prior to, and then at two week intervals during and after the chiropractic treatment, while subsequently recording any changes in his or her symptoms (including, but not limited to: memory loss, confusion, impaired judgment, impulse control problems, aggression, depression, suicidal thoughts or actions, the development of Parkinson's disease, and eventually progressive dementia) and/ or ability to function.It is expected that after receiving Atlas Orthogonal chiropractic treatment, subjects who have a history of traumatic brain injury and experience symptoms commonly associated with CTE will show greatest improvement in the severity of their symptoms. These results will lead to a greater understanding of CTE, its treatment(s), and ultimately possible treatments for other neurodegenerative diseases such as Multiple Sclerosis and Alzheimer's disease.

## Burke, Quinn — Project #27

Completed Project, Engineering, Behavioral

### The Effect of Protective Material Type on Concussion

Today, football players face increasing danger from hits to the head while on the field. Concussions are on the rise, and new safety measures need to be taken. A recent study of deceased NFL players found that 96% had CTE (Chronic Traumatic Encephalopathy). CTE is a degenerative brain disorder, becoming increasingly more common in football players. Understanding the vulnerable area of the brain, skull and the types of impacts to these areas is key to protecting the players. Will replacing current helmet padding technology with new protection such as a shredded memory foam layer improve protection and therefore helmet safety? The hypothesis is that a helmet equipped with a shredded memory foam layer will be more effective at protecting the brain from concussions than current padding technology, foam or air inflated padding. Foam and air padding, or the current helmet model, is the control group. The independent variable is the type of padding material used. The dependent variable is the effectiveness of the materials protective properties. To test the hypothesis, all helmets were tested using the helmet crash test machine at the CT Science Center. The machine swings a hammer from a predetermined height, and impacts the side of the helmet. The machine uses sensors inside a manikin head to report the amount of g's or g force felt by the head. A g is an acceleration of Earth's gravity that causes weight. In testing the helmets, it was discovered that the helmet with shredded memory foam was a better option for protecting the head. Although only a prototype, the memory foam proved to be a better option for consistently protecting the head, holding up under multiple trials. With an improved design, memory foam could be a viable option for future football helmets. The absorption properties of memory foam as well as the rigidity it causes in helmets is ideal for protecting the head. The shredded memory foam helmet shows a noticeably better ability to protect the brain than the two control helmets. In the future a padding method like shredded memory foam could be a viable option on its own for improving helmet protection. It would even work coupled with current helmet technology. Although a concussion can not be entirely prevented, the shredded memory foam shows that it does a better job of protecting the head than current helmet technologies, and could be implemented in helmets in the future across all platforms, not just football helmets.

## Campanella, Escher — Project #28

Research Proposal, Engineering, Physical Science

### Pulse Sensor Wearable that Warns User of Dangerous Heart Rates

Wearable health monitors are entering the internet-of-things(IoT): the network of sensors and electronics. IoT devices are expanding the possibilities in fields like healthcare and tracking of everyday health. One major risk to many people that IoT devices can help reduce, is the risk of a heart attack or heart failure. The slowing of the heart could lead to a heart attack, and if a person's heart rate suddenly becomes too low or too high, it can cause dangerous symptoms. Even those who seem to have a healthy heart and lifestyle are vulnerable to these scenarios. The goal of this project is to develop a wearable health monitor that is long lasting, easy to wear, and user friendly. This device will consist of two components. The first component will contain a pulse sensor and will be attached to the user's shirt on the skin near the heart (This also will contain code that processes the readings from the sensor). The second component will be a åÊbracelet with a LED light that will signal when the user's heart rate is at a dangerous level.When the pulse sensor records the pulse rate, the rate will be transmitted through a transceiver to the bracelet which will process that information and will determine if the user is in a dangerous situation. A product like this could not only be interesting to learn to use, but it could help save someone from an immediate heart attack or a sudden change in the heart rate when not expected.

## Carlo, Mary Cate — Project #29

Research Proposal, Science, Health and Medical

### Using Stem Cells to Treat Chronic Traumatic Encephalopathy

Late-onset behavioral problems have been correlated to contact sports. Recent studies show that repetitive blows to the head cause cellular death in the brain over time. Eventually, this begins to trigger a behavioral disorder - even several years after retirement from the sport. These behavioral problems lead many NHL/NFL players to commit suicide or harm themselves, making it important to find a treatment. Current techniques include taking biopsies and obtaining a fibroblasts from the extracted sample. In the proposed experiment, these fibroblasts would be obtained from the patient's brain cells, which would then be cultured in a well plate. Then, using stem cells created by the patient's blood, the brain cells would be treated with the regenerative properties of the stem cell to help regrow the tau protein in the affected neural cells. The results are expected to be positive. Using stem cells to treat neural cells has shown a promising future in other studies because the stem cell has the ability to act just like another cell and take over the target cell's job seamlessly. Stem cells could show promising results in treating these behavioral disorders as it has with similar disorders like Parkinson's Disease, another late onset tauopathy, and schizophrenia. In Chronic Traumatic Encephalopathy (CTE), this disease is classified as tauopathy which with the tau protein of the human brain, causing tangles in the neurons from brain death. Stem cells could be used to regenerate the affected brain cells, therefore relieving the brain and preventing further damage. Much work needs to be done to discover a way to diagnose CTE before irreversible brain damage is done, so that they can bratel successfully with the stem cells.

## Carotenuto, Sabrina
## Clark, Charlie — Project #30

Research Proposal, Science, Behavioral

### The Effect of Omega-3 On The Behavior of C.elegans- Improving ADD and ADHD Symstoms

Studies have suggested that Omega-3 may have a positive impact on the behavior of children with ADD and ADHD. Considering that C.elegans have advanced nervous systems, this hypothesis will be tested on them. This experiment will allow researchers to observe and record the phenomenon by which normal and mutant strains of C. elegans can direct their movement in response to Omega-3 in their environment.The experiment will begin by preparing nutrient agar plates with E.coli in which the C. elegans will grow. The worms will be collected and transferred to 4 sets of petri dishes. In one set, the C. elegans will be exposed to Omega-3. In another, they will be exposed to both buffer and Omega-3. In the last set, they will be exposed to just buffer. This will be the control group. We will leave them alone for several days to fully absorb the substances in each dish before testing begins. Testing will include the determination of the number of back and forth movements in a set timeframe, as well as memory and learning tests. Initial testing shows a difference in the number of movements between the C. elegans exposed to Omega-3 versus the buffer. The reduced number of movement with the Omega-3 could imply a positive outcome for individuals with ADD/ADHD. Testing will continue focusing on learning and memory. The results of this study could have potential implications in the treatment of children with ADD and ADHD.

## Cashman, Jackson — Project #31

Research Proposal, Science, Health and Medical

### An Analysis of Playground Related Injuries in the United States, 2005-2015

Playground related injuries are one of the main causes of injury in children in the United States. Previous studies have also suggested that the number of these injuries has increased in recent years. These results are concerning because they question the effectiveness of the safety precautions put on playgrounds. My research will see if the the number of these injuries has gone up or down in recent years. I will be using the NEISS database, a free injury database provided by the CSPC, to collect my data over multiple variables. These variables are method of injury, location of injury, patient age, body region of injury, injury type, disposition from ER. I plan to organize this data and analyze it with Epi Info software. I plan to see that the number of playground injuries has risen, as this has been suggested by similar research. I plan to see that the most common method of injury is caused by a fall to the surface, that the most common location is a school, that the most common age is 6 to 12, that the most common body region is an upper extremity, that the most common injury type is a fracture, and that the most common disposition from ER is being discharged. The implications of this study could either condemn or support the safety restrictions placed on playgrounds. This research can be used by government officials and other researchers to alert them on whether or not they need to develop better playground safety precautions. Hopefully, with the help of these people, a safer play environment can be built for the developing minds of tomorrow.

## Chen, Alicia — Project #32

Completed Project, Science, Health and Medical

### Levels of Intermedin and Renalase In Hepatocellular Carcinoma as a Potential Biomarker

Hepatocellular carcinoma is the 3rd leading cause of cancer death, largely in part to late diagnosis and consequently few treatment options available at time of diagnosis. Intermedin (IMD) has demonstrated elevated levels in early-stage HCC. IMD and renalase (RNLS) are involved in angiogenesis, which is required for tumors to grow. This study investigates the levels of IMD and RNLS in HCC patients to assess their potential as a diagnostic biomarker.IMD levels from 74 cancer samples and 20 healthy controls were measured using an indirect ELISA. RNLS levels from 60 cancer samples and 19 control samples were analysed using a sandwich ELISA. Concentration levels were measured using a spectrophotometer. åÊData for IMD and RNLS were collected. RNLS has shown to be significantly elevated in HCC patients. The IMD data will be analysed. A student's t-test will be used for significance. The data suggests RNLS to be a diagnostic HCC biomarker. If there are significantly different levels of IMD, IMD will also be a biomarker candidate. If IMD or RNLS turns out to be an effective biomarker, they will be instrumental in detecting HCC in patients.

## Chinitz, Samuel — Project #33

Completed Project, Science, Environmental

### Finding the Optimal Conditions for Energy Recovery in an Electric Car

Improving the efficiency of vehicles has become a priority for many automakers and countries due to environmental issues with inefficient vehicles, the economic repercussions that come with inefficient cars and the limited amount of oil available. As the demand for increased fuel efficiency of cars rises, automakers have advanced in the field through electric cars but further research is necessary for companies to reach standards that countries have set.This project obtained data from a 2011 Ford Focus electric car which was placed on a dynamometer and simulated with an urban driving experience. Measuring equipment was attached to the car and gave the data necessary. This data will be analyzed to determine the main factors that affect the energy recovery and what the optimal conditions may be for an electric car to recover the most energy possible.Of all the variables tested, the initial braking velocities and deceleration rates had an impact on the effectiveness of the energy recovery in the electric car. It was found that an initial braking velocity of 46.73 mph was most effective for energy recovery and that the higher the deceleration rate, the more energy was recovered.If the average commuting American is driving an electric car with regenerative braking and follows the UDDS - making the adjustment to have an initial braking velocity of 46.73 mph at three designed places - they will be able to drive an additional 0.981 miles on a single charge. Perhaps the most practical use of this type of system, though, would be a taxi driver in a city.

## Chuma, Harrison — Project #34

Research Proposal, Science, Environmental

### A search for Robustness in Microalgae species

In a commercial production facility, a microalgae species ability to resist predation could have a drastic impact on the overall financial cost. The two different species Nannochloropsis oceanica and Chlorella Vulgaris are vastly different in this regard and this has been noted in previous experiments. While N. Oceanica does not grow as fast, C. vulgaris displayed a 33% lower overall productivity as a result of its lack of robustness. Three different microalgae species will be grown in a non-sterilized medium. The species will range in pigmentation, so they will be easily distinguishable. The contamination process will be sped up by exposing the mediums to soil and rainwater, to best simulate a possible commercial production facility. It will be recorded how often they crash. It is hypothesized that Chlorella vulgaris will crash much more frequently than the Nannochloropsis oculata strain. In addition, it is believed that the robustness will change in varying salinity environments. This research will have a prominent impact on the industry. A realization of the effect of the robustness of a species will allow commercial production to catapult forward as they will now be able to identify a strain that can survive predation and pests that may harm valuable products.

## Clarkin, Maia — Project #35

Research Proposal, Science, Physical Science

### The Effect of Royalactin on Social Insects

Royalactin, found in major royal jelly protein 1, increases the body size of honeybees, decreases developmental time, and leads to more successful ovary development. Overall, royalactin is responsible for queen morphology. Royalactin has similar results in the fruit flies Drosophila. I would like to test how Royalactin affects other social insects, such as ants, which also experience caste differentiation because I find epigenetics very interesting.To conduct this experiment I would rear ants with royal jelly stored at 40 degrees Celsius for 30 days, by which time all of the royalactin within the royal jelly is degraded. I would also rear ants with royal jelly containing royalactin, and observe the effect each diet has on ant size and development time. It would be expected that ants given royalatcin would display similar results to honeybees consuming a diet containing royalactin. Thus, one might expect increased body size, decreased developmental time, and more successful ovary development.The effect that royalactin has on ants and other social insects is relevant because it helps demonstrate the processes underlying epigenetics. Observing how royalactin influences caste development can help researchers learn more about signaling pathways, which are also relevant in humans.

## Colao, Annie — Project #36

Research Proposal, Science, Environmental

### Testing Effectiveness of Different Shading Materials on Sand Plots

The species Dermochelys Coriacea (Leatherback sea turtle) may face complete feminization amongst hatchlings in approximately a decade due to climate change, which increases sand temperatures during the incubation period of the eggs. This species is vital in maintaing order in open ocean ecosystems because they balance jellyfish populations. It is necessary to shade the beach regions where Dermochelys Coriacea lay eggs, as cooler temperatures yield more hatchlings.To test effects of shading on beaches, holes 45cm deep will be dug in sand. A control temperature of the nest will be taken. Wooden poles will prop up different types of shading materials. The nest temperatures will be measured every hour for 5 hours, recording which material kept the nest the coolest. Water will be poured onto the materials to determine the permeability of the material. I hypothesize that SunBlocker Premium PolyMax Bulk Polyethylene Knitted Shade-30% material will provide the most shade while still allowing rainfall to pass through. It is a lightweight material with thin holes, providing optimal shade used in agriculture, so it is capable of letting in water. Materials that are darker and denser will probably not yield cooler temperatures for the nests. Shading in hatcheries currently is effective but the structures let in little to no water. If I prove the SunBlocker material provides optimal shade and allows water to pass through, this material could be proposed to conservation groups to see if it could be used at turtle hatcheries or nests in the future. It could also be combined with current shading materials.

## Comer, Stephanie — Project #37

Completed Project, Science, Health and Medical

### Evaluation of the Platelet Aggregation Inhibitor RUC-4 in Preventing Carotid Artery Stent Thrombosis

Heart attacks are the most common cause of death worldwide and comprise 17% of overall national health expenses (WHO. World Health Statistics 2010). Trap-6, a platelet aggregation inhibitor, has been used in people who are in a cardiac arrest to prevent the aggregation of red blood cells in veins. This study was conducted to test a new and possibly improved aggregation inhibitor, Ruc-4, in comparison to Trap-6, in order to allow for proper platelet function. It was hypothesized that Ruc-4 would significantly be better in preventing aggregation than Trap-6. To test this, mice blood was combined with human platelets and tested in different concentrations of Ruc-4 verses the same concentrations of Trap-6. Then the blood was tested in a light aggregometry machine to determine light transmittance .It was found that Ruc-4 promoted normal platelet function in the aggregometry machine in comparison to Trap-6, which clotted more. These results demonstrate that Ruc-4 can be effectively administered to people with a heart attack in order to prevent platelet aggregation.

## Conway, Kaleigh — Project #38

Completed Project, Science, Environmental

### Assessing the Purity of the Horseshoe Crab, Limulus polyphemus, DNA Samples

The horseshoe crab, Limulus polyphemus, is essential to economical and biological systems, e.g., as a primary food source, commercial fishing bait, and in the biomedical field. That being said, the genetic lineage, and possible divergences, of this useful animal is widely unknown. Tissue samples will be harvested from the North and South shores of Long Island and 8 tissue samples will undergo DNA isolation to find the optimal mass and tissue type that will yield the greatest purity. There is currently a void in knowledge of horseshoe crab DNA, thus a method needs to be established to obtain data. If these tissue samples undergo DNA isolation then samples with smaller masses and larger surface areas will yield the purest samples, thus allowing further research and data on this genome to be more reliable. This purification technique will allow researchers in this field to gather reliable data on the genetic diversity, or lack thereof, of the horseshoe crab, which will assist in species management. As stated before, the importance of this animal goes unnoticed. Their copper-based blood contains a special compound that clots when exposed to bacteria, indicating that bacteria are present, which could be possibly deleterious to humans. This compound is unable to be synthetically produced, meaning horseshoe crabs are essential to the biomedical field and the health of humans.

## Crafford, Leanna — Project #39

Research Proposal, Science, Health and Medical

### Differential effects of 24-hydroxycholesterol on alpha-synuclein expression in astrocytes

With my plan to become a doctor, I have a deep interest in diseases that have no cure. An estimated 6.3 million people with Parkinsons can only rely on therapies that progressively become inefficient. My goal is to contribute to finding a cure in the future by determining the impact of 24-OHC on alpha-synuclein in astrocytes.The expression of alpha-synuclein after 24-OHC treatment will be compared in cultured astrocytes from wild-type and alpha-synuclein knockout mice. Alpha-synuclein protein and mRNA levels will be quantified using an antibody and qtRT-PCR. LXR agonist GSK2033 will be used to reverse the effects of the antibody. LPS stimulation will be used to test if the expression of alpha-synuclein and 24-OHC levels increase. 24-OHC will be measured using mass spec. The predicted result is to find that the presence of 24-OHC will produce unphysiological levels of alpha-synuclein in the astrocytes taken from the wild-type mice.If alpha-synuclein levels increase with the presence of 24-OHC, this may lead to alpha-synuclein aggregation to take place. These aggregations, or Lewy bodies, can block communication and nutrient transportation in the brain, killing off important cells.This leads to neurodegeneration and possibly Parkinsons. This would prove that there is a correlation between alpha-synuclein expression and 24-OHC.

## Criscuolo, Emily — Project #40

Completed Project, Science, Health and Medical

### Murine Antibody Responses to the Relapsing Fever Spirochete Borrelia Miyamoitoi

The newly discovered relapsing fever spirochete, Borrelia miyamotoi, was not known to cause disease in humans until 2011. Strains of Borellia have an innate ability to resist complement mediated killing. Therefore, to understand the nature of this pathogen, it is crucial to gain knowledge concerning the way in which its host combats the infection. Specifically, I am investigating murine antibody activity in response to specific proteins expressed by the spirochete. An Immunoblot Assay, specifically an SDS-PAGE, was performed to look for signs of antibody activity. The assay tests for antibodies generated to the proteins: GlpQ, FHBPA, and HH-1. The control used as a comparison was Borrelia burgdorferi lysate of which there is ample information about. Using this assay, blood samples from the mice were tested for the presence of antibodies specific to each recombinant protein individually. Surprisingly, there was practically no reactivity between the FHBA protein and the blood samples, indicating that the mice did not produce the required antibodies in response to this protein. Another interesting finding was the lack of reactivity to GlpQ, for it is highly immunogenic in other relapsing fever infections. There was some noticeable reactivity with the protein HH-1 which prompts further investigation for more conclusive results. With our nascent knowledge of how hosts combat this pathogen, these findings are of value in our understanding of how Borrelia miyamotoi operates. For example, considering the ability of FHBA to combat compliment mediated killing, it's clear that the host has difficulty recovering from the presence of this protein. The more we learn about the host's response to individual proteins, the easier we can develop methods to impede persisting infections.

## Criscuolo, Teddy — Project #41

Completed Project, Science, Environmental

### The Effect of Different Artificial Substrates on the Settlement of Aurelia aurita polyps

Jellyfish blooms are aggregations of a single species of jellyfish. These blooms have increased in size and number over the past few decades, and can be detrimental to fishing, recreation, and can clog coastal power plants. One hypothesis for this increase is that proliferation of anthropogenic ocean construction is providing artificial habitat for polyps. The problem statement is; How do different artificial substrates affect the settlement of Aurelia aurita polyps? A pseudokreisel will be constructed to house medusae of Aurelia aurita. Two mature medusae will be introduced to the tank and fed Artemia nauplii three times a week, to increase breeding. Artificial substrates and one natural substrate will be arranged on a floating base on top of the tank. Over one month, the settlement of polyps on the substrates will be monitored to determine which substrate is the most preferred. Data at this early stage of experimentation is inconclusive. It is expected however that the sample of concrete, which provides ideal darkness and protection that polyps prefer, as well as mimicking the polyp's natural habitat the most, will have the highest number of settled polyps the end of the experiment. Jellyfish blooms can be detrimental to many aspects of human life. It is essential to understand how all stages of the complex jellyfish life cycle contribute to the size and distribution of jellyfish blooms. It could then determined how to minimize the effects that blooms can have on human industry and oceanic activity while protecting the jellyfish and the biodiversity of the areas in which blooms occur.

## Davis, Adrianna — Project #42

Research Proposal, Science, Environmental

### The Impacts of Overfishing on Coral Reef Ecosystems

Coral reefs are greatly affected by human activity. The three main threats that coral reefs face are ocean acidification, nutrient pollution, and overfishing. The focus of this study is to determine how coral reef ecosystems are impacted by sharks due to overfishing. Coral-reef shark populations have been declining rapidly, however, little is known on how the depletion of this apex predator affects coral reef ecosystems. Populative data will be found at areas of coral reefs that are not protected and at marine reserves including no-take and no-entry zones. Populations of coral-reef sharks, including whitetip reef sharks and gray reef sharks will be determined, as well as, herbivorous fish and destructive species. Coral cover and richness will also be measured in order to represent the effects of the food web imbalance.It is expected that the decrease in coral-reef shark populations will cause an imbalanced food web that includes low populations of herbivorous fish. The decrease of sharks will also cause an increase in destructive species such as sea urchins, thus affecting coral reef health. Coral reef health is likely to decline due to the deprivation of algae that is needed for coral reefs to prosper.By comparing the results of areas that are and are not protected by no-take and no-entry zones, no-entry zones will likely have the most positive results, stressing the importance of these reserves. Because no-entry zones cover a very limited amount of coral reefs, coral populations will continue to decline due partially to overfishing. These zones have the potential to dramatically boost coral reef populations, as well as species populations.

## Davis, Ben — Project #43

Completed Project, Science, Physical Science

### The Effects of Interlopers of Binary Systems

In binary star systems, stability is based on the amount of change in eccentricity. A star with high stability might have an orbit which seldom changes shape, whereas an unstable orbit could be becoming more eccentric or circular. Orbits can be destabilized, or perturbed, because of interactions with stellar interlopers.In this project, the effect of outside forces on individual binary systems stability was simulated to learn about how such interactions can affect a system over its lifetime. N-body simulation software was used to model the effects of outside forces, such as passing stars or planets. The change in eccentricity of a system's orbit, depending of the size, speed, and position of an anomaly was measured. Through these methods, a greater understanding of what it takes to significantly alter a binary system's orbit has been obtained.

## DeNunzio, Emily — Project #44

Research Proposal, Science, Health and Medical

### Stem Cell Meniscus Regeneration

The motivation to research meniscus regeneration came from finding out that once you have one surgery of taking out the torn part of a meniscus then it is highly likely that the person will have to have another surgery. The meniscus will not be able to get back to where it was before surgery because the meniscus does not regenerate. This means that once you cut out one part of your meniscus then that one part will not grow back, so you are stuck with a meniscus that cannot function fully. If the amount of stem cells in a scaffold that is placed in the meniscus is tested (0.2, 0.4, 0.6, 0.8, and 1.0 mL) than the 1.0 mL of stem cells will have the greatest effect on regenerating the meniscus. This is becausewith more regenerable cells than the meniscus will have an easier time regenerating back to its normal amount. Each scaffold will have constant size, pore size and shape, and and void space. The scaffold will be implanted into humans with little meniscus onto the lateral menisci. As the amount of stem cells increase then the amount of cell regeneration will also increase. It will be important to find the balance with the number of stem cells and how big the meniscus will regenerate to. This research will lead to finding the perfect amount of stem cells to use while regenerating a meniscus. Being able to regenerate a meniscus can allow athletes to be back to their normal physicality and perform at top levels. People can perform their normal activities and not feel pain. The prolonging meniscus problems can be fixed.

## Desai, Sarishka — Project #45

Completed Project, Science, Health and Medical

### Identification of Novel Small Molecules that Bind to K-Ras and PI3K RBDs, Two Major Protein Components Involved in the Deregulation of the Cell Cycle in Hematological Cancers

The PI3K Pathway has been an attractive target for cancer research and drug development since its discovery in the 1980's, as every major node of the pathway (RAS, PI3K, PTEN, and AKT) is found to be frequently mutated or amplified in a wide variety of malignant tumors of hematological cancers, most notably leukemia and lymphoma. PI3K inhibitors synthesized to date have been directed towards the enzyme's active site, serving as competitive inhibitors for ATP (also known as ATP-mimetics), indicating the need to find new molecules directed towards domains of the protein other than the kinase region. In the case of K-Ras G12D, a protein present in the PI3K pathway, discovering a small molecule that can successfully bind to it has proven difficult due to the lack of a distinct pocket on the enzyme's surface for drug attachment. Regardless, a library of allosteric compounds (non ATP-mimetics) were tested in this experiment, allowing for the identification of a completely different class of inhibitors (noncompetitive inhibitors) directed towards the pathway.In addition, a separate group of inhibitors were tested for their ability to bind to the RBD (Ras-binding domain) region of the PI3K protein, another key protein in the PI3K Pathway. Ultimately, several small molecules were identified and selected on their outstanding ability to allosterically bind to either K-Ras or PI3K, thus inhibiting the PI3K Pathway. The extensive research and clinical testing of specific compounds that inhibit key proteins involved in deregulated cellular proliferation may hopefully translate to new chemotherapies directed towards treating curing and reversing the development patients with hematological cancers in the near future.

## Dharani, Himay
## Crow, Joshua — Project #46

Completed Project, Engineering, Physical Science

### The Effects of Wing Configuration on Aircraft Performance at Variable Speeds

The wing configuration of an aircraft plays a vital role in how the plane maneuvers and having certain designs at certain speeds can result in the aircraft being inefficient. Planes with wings for subsonic and transonic flight cannot operate at higher speeds efficiently. Similarly, planes that have wings for higher speeds cannot operate at slower speeds efficiently. Therefore, this study researched which wing configuration will operate efficiently at all speeds. First, we'll find the most efficient wing at the 4 main speeds, using both information from previous studies and mentor. Efficiency will be determined through lift coefficients produced by wing configurations. We'll put that data in figures. Then, specifics for each wing will be researched through studies and mentor. Then, we'll use simulations to further evaluate by applying forces. Air density, composition, and altitude, and aircraft specifics will be constant. It was hypothesized that a combination of an ogival delta wing and a compound delta tail wing with incidence angle of 15å¡ would yield the most efficient aircraft. The data trends suggest this hypothesis is correct. In finality, the results of this project will yield a wing configuration that will be efficient at all speeds. A design such as this would prove beneficial for air transportation, as it would decrease takeoff and landing speed, as well as increase the ability to fly at all speeds safely.

## Dimm, Katie — Project #47

Research Proposal, Science, Environmental

### Methylmercury Concentrations in Sharks

Over 100 million sharks are killed yearly in a demand for shark meat, fins, and cartilage. This heavy overfishing practice is having detrimental effects upon shark populations worldwide, and the very consumption of shark has become an increasing concern for physicians. Sharks contain heavy concentrations of the organic neurotoxin methylmercury, which when consumed in even small concentrations, can cause irreversible health effects. Preventing Methylmercury exposure requires evaluating and understanding methylmercury concentrations.I am working with my mentor Dr. Zofia Baumann, the assistant director of marine sciences at Avery Point, who has all the necessary cold vapor atomic absorption spectrometry equipment required for methylmercury and mercury analysis. We will be conducting a minimally invasive live study, by working with Ocearch or other shark research teams, to obtain muscle tissue samples and place tags on multiple larger species of shark. Based on the results of previous experiments, it is expected that all sharks sampled will yield methylmercury concentrations that far surpass the 1.00 mg/kg action level for mercury in fish put in place by the USEPA and FDA. Additionally, by conducting a live study, correlations between increasing methylmercury concentrations and physical aspects of the sharks can also be examined. For the future implications of this experiment, as with those of a similar purpose in previous years. The goal is to find evidence that certain species of shark has methylmercury concentrations above the safe consumption rate for humans. Additionally this study would help to provide estimates and evidence for how methylmercury accumulates in sharks and other fish species.

## Ding, Howard — Project #48

Completed Project, Science, Environmental

### How Has the Safety of Fuel Tanks Increased? The Billion Dollar Question

Fuel tank leaks are an environmental and economical issue. Each leak has dangerous consequences that come along. The study is data analysis that assessed how rules and regulations have reduced the amount of tank leaks in New York. This study looked into New York's DEC's database, to gather fuel tank spill data. Various rules and regulations were assessed to check how they have helped in deterring the leaks of fuel tanks. Historical data was collected from NY DEC's information on past leaks, both residential and commercial. The data will be chronologically ordered and related with rules and regulations put into place to analyze if there is a relation between the occurrence of spills after new rules and regulations are put into effect. Data has been collected with a self-written program to gather the needed data points from the DEC database. The data has been separated into residential and commercial, along with what type of fuel has leaked. The residential and oil spills have been geocoded (taking address and converting it into latitude and longitude). The data will be analyzed through heat maps and graphs showing yearly trends.With fuel tanks all over the country, finding a better way to clean up and regulate spills is crucial to preserve the health and safety of the public and the environment. This can ensure that there is an efficient use of fossil fuels and minimal environmental damages to help leave a pollution-free world for the future generations.

## Diorio, John — Project #49

Completed Project, Science, Health and Medical

### Using Genetic Programming to Analyze the Relationship Between Vitiligo's Predisposing Factors

Because numerous factors contribute to vitiligo, it's challenging to predict its course of development. This knowledge would allow dermatologists to give more effective, personalized prognoses. This study identifies which of vitilgo's predisposing factors are the strongest indicators of vitiligo severity and course of development. Investigating the contributions of numerous predisposing factors because elucidating the interplay between those variables and vitiligo could help dermatologists better classify and treat the disease.The Vitiligo Cloud Bank, a database of a few thousand anonymous medical records from vitiligo patients, provided the data. In total, there are 99 variables and 490 patient records. The GMAX, a genetic programming software, was used for the analysis. The GMAX outputs a mean frequencies measure to indicate each variable's contribution to the disease model. The GMAX also calculates more widely recognized statistical measures, including p-values and t values. "The presence of allergy" held a significant correlation to "melanoma/skin cancer" (9.5616 GMAX mean frequency, p-value: <0.00001, 7.71% marginal contribution to the model's strength). With "emotional stress" as the trigger of vitiligo, patients are more likely to be susceptible to severe sunburn (8.0839 GMAX mean frequency, p-value: 0.00610, 6.39% marginal contribution to the model's strength). The results support the concept that vitiligo is multifactorial with different variations of progression. Because this study includes twenty trials, each with a different dependent variable, a complete analysis was performed. The numerous variables allowed this study to investigate relationships that can't otherwise be researched. The path GMAX takes in developing models allows for multiple variables to be simultaneously compared, increasing the likelihood of identifying a novel relationship. The correlation of allergy and skin cancer, one of the strongest associations, has not been researched.

## Dixit, Agrani — Project #50

Completed Project, Science, Health and Medical

### Polymorphism in Mertk Associated to Multiple Sclerosis

Multiple Sclerosis (MS) is a debilitating and incurable disease that inflicts 2.5 million people around the world. A polymorphism in a gene called Mertk, also known as MER proto-oncogene receptor tyrosine kinase, has been studied and is associated with MS due to its role in the inhibition of inflammation. People with the inactivating polymorphic Mertk gene rs55792453 may have a higher risk of developing MS. It is known that MS incidence varies among various ethnicities. The hypothesis of this research project is that different ethnicities may have a higher frequency of Mertk gene mutations, and thus enhance the risk for developing severe MS. If there is a higher prevalence of the specific variant in Mertk in a certain ethnicity or individuals, they may have a higher risk for developing MS than an ethnicity with a lower incidence rate of the polymorphism. This is a bioinformatics project. The 'Thousand Genomes Project' provides information on the incidence of the inactivating mutation of Mertk in 5 major ethnicities.The global database to see the epidemiology of MS cases is found in the Atlas of MS by the MS International Foundation. Data analysis is underway. Proposed analysis may show that since there is a lower frequency of the polymorphic variant of Mertk in South Asia, people of South Asian descent might have a lower risk for developing MS than other ethnicities, which may have higher frequency of Mertk.Identifying high-risk individuals for developing MS is therefore of importance. Genetics are not the only factor playing into the pathology of MS; environmental factors also play a significant role. By knowing whether certain individuals tend to have a higher chance of developing MS due to the inactivating polymorphism in Mertk, people can start taking a proactive role to avoid the development of MS such as regular screenings and a lifestyle change.

## Documet, JP
## Nelson, J — Project #51

Research Proposal, Engineering, Environmental

### Renewable Energy in Aquaponics System

The problem we are trying to solve is the amount of electricity involved in running an aquaponics system. Aquaponics system already solve many of the problems that come from traditional farming, such as pesticide use, soil quality, irrigation, and others, but they require a lot of energy to run. By finding ways to incorporate renewable energy use into the aquaponics system, we can make aquaponics even more sustainable.We are building a relatively small aquaponics system and incorporating wind and solar energy into the pumps and aerators. A large part of the engineering process will involve the building and design of the actual aquaponics, and after the set up is complete and we find out how much electricity is used in regular aquaponics, we will apply the wind and solar energy sources into the system and record differences. The results will tell us how much of a reduction renewable energy can make in the use of electricity in the system by recording the difference between electricity use prior to the addition of wind and solar energy and after. These results would show the overall impact and benefits of applying renewable energy to an aquaponics system and the process will help determine optimal ways to involve alternate energy sources.Aquaponics systems present a strong possibility of sustainable food growth in the future and could potentially revolutionize agriculture and food production. We think finding ways to make aquaponics systems more sustainable by requiring lower inputs of energy and searching for even more ways to enhance the system could contribute to aquaponics' overall impact on the way the world views sustainable food production.

## Dolberry, Mahoghany — Project #52

Completed Project, Science, Behavioral

### Examination of Mere Proximity and Race in Adults Focusing on Intelligence and Wealth/ Social Standings

Childrens social evaluations can be impacted by many factors, but most research studies the influence of race and proximity. Children between the ages of 5 and 10 years old associate traits and judge an individual based on the persons they have been seen in close contact with. This experiment was designed to determine if race and mere proximity effect the traits associated with any one individual. In this experiment agroup of a random sample of college students were selected to take a survey displaying a series of three pictures and instructed to focus on the subject in the middle of the three pictures. For each set, three questions were asked that could be answered on a likert scale. The two variables in the experiment were the occupation and race of the subject pictured in the survey. One set usedpictures of doctors and focused questions on perceived intelligence and capability, and the other used pictures of businessmen/women with questions that focused on perceived wealth and respect. Because this experiment looked at race and mere proximity, the order in which the subjects were presented varied between four sequences of race: 1)Black,Black,Black 2) White, White, White 3)Black, White, Black and 4) White, Black, White. It waspredicted that the results would show a general white bias and support the idea of mere proximity.These results are significant because they contribute to the knowledge the psychology community about the legitimacy of mere proximity as well as contributes to the field of Developmental Psychology. Future research should expand this study so that it can be compared with other age groups in order to determine whether there's a trend.

## Driscoll, JuliaProject #53

Research Proposal, Science, Health and Medical

### Effect of red LED lights on skin grafts for EB

The disease epidermolysis bullosa (EB) is a genetic disease that causes increased blistering and infections in patients. Induced pluripotent stem cells (iPSCs) are used to create skin grafts to treat EB, however they do not have long term graftability. The purpose of my experiment is to determine the effects of infrared light therapy on collagen levels and its overall effectiveness on skin grafts used for the treatment of EB. To do this, I will use previously outlined methods to derive corrected fibroblast iPSCs. Using fibroblasts and collagen I solution, a dermal equivalent lattice will be produced. One of the cultures will be left under normal conditions. The other will be put under red LED lights. After 2 weeks, collagen lattices will be collected and immunofluorescence staining will be performed to show the amount of collagen VII in each culture.After the immunofluorescence staining is done, the collagen levels in the culture that was under red LED lights should be higher than those in the control culture. The red LED lights should stimulate the cellular processes going on in the keratinocytes and fibroblasts resulting in a higher production of collagen VII. In turn, this should lead to a more effective skin graft because increased collagen provides increased strength.If the red LED lights work and help create stronger skin grafts, this research could be applied to current research being done on EB patients. Studies are testing the application of iPSCs on human subjects. Red LED light therapy could be combined with this treatment in an effort to increase the efficiency of the iPSC treatment. Future studies could also assess the effect of different LED frequencies on EB treatment.

## Du, RosieProject #54

Completed Project, Science, Behavioral

### The Effect of Workspace Color on Task Accuracy

Hatta, Yoshida, Kawakami, and Okamoto (2002) conducted a study that tested the effect of computer display color on work performance and showed that red monitor display reduced visual task performance when compared to blue. The study took into account the color of a single light source in the room. The purpose of the current study is to test how the color of an entire workspace impacts task performance. It is hypothesized that if the color of the workspace, defined by colored poster boards, is changed, then participants in the green colored workspace will have the highest task performance because green is a soothing color that is associated with nature and safety.Participants were seated at a desk and given five minutes to fill out as much of a crossword puzzle, the task, as they could. Monday crossword puzzles were used because they are the easiest crossword puzzles published by the New York Times newspaper. Puzzles from the same day of the week are known to be of equal difficulty. Then, the treatment (color: red, yellow, green, blue, or black) was changed. Monday puzzles were used and served as a constant-- one was the control and the other was the experimental group. The order in which the crossword puzzles were given was changed to decrease errors. Six of each color setting were tested.Results are tending to show that the participants answered more questions correctly on the second crossword puzzle than the first, which may not be because of the color setting, but rather an error of the order in which the puzzles were given. Data is still being analyzed, but the green colored workspace is tending to show a higher average of correctly answered questions than other color settings.It is predicted that the green colored workspace setting will have the highest crossword puzzle accuracy. Results from this study can help people perform better on tasks, such as tests or class work, which is essential for success in high school. Having this information may lead to having schools and workplaces consider using colored settings for task completion.

## Du, Weixin — Project #55

Research Proposal, Science, Behavioral

### The Effect of Language Sentence Structure On Holistic and Analytic Perception

Studies show that Asians, particularly Japanese, tend to focus attention holistically (on whole context/background), while Americans focus analytically (foreground). Culture is one explanation, but some studies suggest language to be influential. The Japanese place prepositional phrases first, possibly leading speakers to focus on background. English often places subject first, so speakers focus more on focal objects. This experiment will test that possibility. In this study, Chinese speakers are used in place of Japanese speakers, as Chinese also usually places prepositional phrases first. Participants view flicker paradigms, and are asked to note changes. How long it takes for them to notice and whether changes are in foreground or background are recorded. Participants are then given a 10 minute training session to learn to use a switched sentence structure and retake the flicker paradigm.Data will be collected and analyzed by statistical methods over the next few weeks. The time it takes for participants to notice changes before the training session and after are compared to one another. T-tests with the alpha value of 0.01 will be used to find differences in detection rates.Once data is collected and analyzed, the results may show the effect of language, specifically the sentence structure, on a person's perception of the world and what they tend to focus on more, and as a corollary, what they remember more about what they see.

## Dubovik, Ulada — Project #56

Completed Project, Science, Health and Medical

### Protein Markers on Peripheral Blood Mononuclear Cells

Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death worldwide, but specific therapies are limited. In addition to aging, cigarette smoke exposure (CSE) is the most common risk factor for COPD. This study was done to determine the properties of the cells, the cell surface, and intracellular protein markers on peripheral blood mononuclear cells (PBMC) isolated from never smokers, current smokers, and former smokers with COPD. To accomplish this, a CyTOF machine was used, which utilizes a mass spectrometry technique based on inductively coupled plasma mass spectrometry. The blood samples of smokers, non-smokers, and former smokers with COPD were run through the CyTOF machine which marked the PBMCs. This was performed by qualified research scientists due to an age restriction. The data analysis was completed by Ulada Dubovik.Currently there is insufficient data to formulate a conclusive statement. However, the present data points towards the fact that MIF-CD74 is critical in protecting against COPD and that its augmentation to those with COPD will be therapeutic. To further support the validity of this conclusion, additional data is being gathered and analyzed. This research is a valuable addition to the quest for the cure of COPD. This disease impacts an immense section of the world's population and yet has no definite cure. Therefore, by supporting the hypothesis that MIF-CD76 augmentation will be therapeutic, it opens up another possibility towards aiding the afflicted. Thus, this research may help find a cure, or at least a more effective treatment.

## Dusenbury, Gregory — Project #57

Research Proposal, Science, Health and Medical

### A study of the effect of blue light on mice's quality of sleep

This experiment will be testing the effect that blue light has on mice's quality of sleep. This will be tested by having a control group in which the mice are allowed to sleep normally and another group will be exposed to an ipad screen for some time before falling asleep and then another group will be exposed to an ipad for an even longer amount of time. In addition, the mice's brain waves will be analyzed during sleep to determine which mice had a more productive sleep. As the use of technology increases globally, we need to obtain more information on what this blue light means to us and our sleep. The prediction is that the more blue light the mice are exposed to, the poorer their sleep quality will be which can have implications on humans sleep. By testing the impact of blue light on mice, we can gain crucial knowledge on whether blue light has a measureable impact on sleep or not. In addition, if the hypothesis is proved correct, we can raise awareness for technology use before bed due to its high concentration in blue light and conduct futher research in this area.

## Eason, Rick — Project #58

Research Proposal, Science, Physical Science

### A study of facial recognition error rates relative to non-biological changes in facial features.

In this experiment, we will be testing the effects of changing light direction on the error rate of facial recognition systems while using support vector machines.A large number of people will be photographed based on their age, these photographs will then be used to teach and test the support vector machines. The resulting rate of error for the facial recognition system will be calculated and compared to other tests and to the control.

## Estra, Dana — Project #59

Completed Project, Science, Behavioral

### The Effect of Voice Frequency on Memory Recall

The best way to teach children has been debated for decades. Many researchers believe that the manner in which material is presented affects a child's ability to learn. It was hypothesized that if a speaker's voice frequency is increased, then the listener will have a greater memory recall of the information. To test this hypothesis, subjects listened to a one-minute fictional narrative. In order to activate their short-term memory, participants were asked to wait ten minutes and then answered a questionnaire based on how much they remembered from the story. This procedure was repeated within three different groups, each one with a story at a different voice frequency. The average number of correct answers per group were then compared. The data collected did not support the hypothesis. It was expected that there would be more questions answered correctly in the high frequency group, however the average number of correct answers per group did not have any visible variability. This can be confirmed once statistical tests are performed on the data. Although the findings did not learn towards the expected results, data possibly supporting the hypothesis can be obtained if the experiment is redone with slight alterations. New results can be found using subjects with similar memories, and then it could be observed how their results differ with different voice frequencies. If this experiment has definitive results, the new information found could help educators teach children in the most effective way possible.

## Feuerstein, Jacob — Project #60

Completed Project, Science, Health and Medical

### The Impacts of Non-Sugar Sweetener Usage on Gut Bacteria In Vitro

Imbalances caused by growth rate abnormalities of gut bacteria can be linked to health problems such as obesity and psychiatric illnesses. The effects of non-sugar-sweeteners on human health are currently in question. This study investigates how the non-sugar-sweeteners Stevia, Sucralose, and Saccharin affect the growth rate of the bacteria Lactococcus, Staphylococcus, and Escherichia coli. The hypothesis is that if sweetener type has an effect on bacterial growth, Stevia will decrease bacterial growth the most, followed by Sucralose, and then by Saccharin. Normal sugar will have almost no effect on average growth rate. Five cultures of each bacteria were created. Then, one was set aside, sugar broth was added to one, and non-sugar-sweetener broths were added to the remaining, with one culture for each sweetener. Four trials were conducted. Data was collected using a grid that was placed on top of the dish, and using this grid to track the surface area of bacteria in the dish.The data appears to suggest that Stevia reduced bacterial growth considerably, while Sugar produced far more growth than in the control alone. This is also true with Saccharin, and to a lesser extent in Sucralose. These results may suggest that sweeteners, such as Stevia, can reduce gut-flora populations, while other sweeteners such as Sucralose, Saccharin, and Sugar may lead to increased growth rates among flora. Data collected suggests that flora in the gut possibly react negatively to non-sugar-sweetener usage. These results appear to point towards potential health impacts caused by changes in floral growth. This means that artificial sweeteners may have impacts on bodily functions influenced by gut bacteria, such as metabolism and psychiatric health. Further research should be done to determine the effect these specific growth abnormalities have on human health.

## Findlan, Emily — Project #61

Research Proposal, Science, Health and Medical

### Cadriovascular disease and a Vegan Diet

More than 7% of Americans have some type of cardiovascular disease, which can cause heart attacks, strokes or death. This study is designed to see if a vegan diet can prevent cardiovascular disease. It is hypothesized that if a vegan diet and control diet are tested and their impacts on the rate of cardiovascular disease analyzed, then the vegan diet will reduce the incidence of major cardiovascular disease more than the control diet.This experiment will have a 14-item dietary screener during group studies which will lead to the development of an individual diet plan for each participant, designed to reduce cardiovascular disease. Participants will include different ethnicities and genders, and each will have either type 2 diabetes, or one of the following risk factors: smoking, hypertension, elevated LDL levels, low HDL levels, obesity, and family history of premature coronary heart disease. It is predicted that cardiovascular disease lowers rate for the participants following the vegan diet compared to the low-fat diet because the vegan diet has many overlaps with the Mediterranean diet that has been proven to work in the past. The participants' chances of having cardiovascular disease when they first started the trial will be lower than their chances of cardiovascular disease after the implementation of the vegan diet.Ultimately, this experiment will shed light on an easier easier way to prevent cardiovascular disease just by a small change in lifestyle effectively reducing the amount of people affected by these illnesses.

## Foley, Annie — Project #62

Completed Project, Science, Behavioral

### The Effect of Music on Older People's Quality of Life

Regularly listening to music has been shown to relax individuals and help to control their mental state(Guzzetta 1989). However, this could greatly affect those living in assisted living facilities and increase their quality of life. As a community, it is important to maintain a high level of quality of life throughout generations. It's been shown that those in assisted living facilities have a lower quality of life than others, so it's important to change this. In this study, it is hypothesized that someone in an assisted living facility who listens to 30 minutes of live music for one day each week will have an improved quality of life.This study will be carried out using the OPQOL-brief, a survey which measure the quality of life of an Older Person. The were three concerts, and each lasted 30 minutes each. Before the first concert, the participants took a baseline OPQOL-brief test and answered demographic questions. During each session, qualitative data was taken during every song, and the participants were monitored for changes in emotion over the span of the concert. Finally, after the third concert, each participant took a post-test, which was in turn compared to their baseline test. Although most of the data has not yet been analyzed. It's predicted that the quality of life will have increased throughout the weeks. The participants did show an increased liking of going to the concerts each week, however, most participants had feelings of focus or calmness rather than overall happiness. The results of this study will implicate whether or not these concerts are benefiting those living in assisted living facilities. If this is true, then an increase of programs geared towards the elderly in assisted living facilities could be explored by assisted living facilities to make those living there have a greater experience living in the home.

## Friedman, Alexander Project #63

Completed Project, Science, Health and Medical

### The Effect of Chitinase Digestion of Mycobacteria Peptidoglycan on Neutrophils

The question that is being studied this year's is to find out if chitinase can digest peptidoglycan in bacteria. Past research by Colorado State University about the cell wall of tuberculosis and the University of Freiburg about asthma led to an inquiry about the similarities between the two molecules. This is because asthmatics have increased chitinase expression, and some believe that asthma is becoming an evolutionary adaptation for innate immunity.We will compare peptidoglycan, which is the independent variable, with peptidoglycans digested by chitinase, which is the dependent variable. Treatment of undigested peptidoglycans on neutrophils are known to stimulate release of pro-inflammatory cytokines such as interleukin-1, interleukin-6 and tumor necrosis factors. These will be incubated and the cytokines will be measured by ELISA. We hypothesize that chitinase digest mycobacteria peptidoglycan and that this results in decreased cytokines release.Preliminary data has been taken with promising results of the cytokine TNF-a. The combination of the digested product yielded less cytokine release than the undigested products including the controls.. So far, our hypothesis has been proven correctly, but more trials will need to be conducted in order to solidify the results. Furthermore, we will test different cytokine and the effect of the digested product of them.If the research is successful, then there will be a decrease in cytokine release when the undigested product is present. It would also explain the evolutionary adaptation towards asthma. Further research into this field can result in new developments in science such as a field of study in antibiotics using chitinase. This would revolutionize the field of antibiotics and medicine.

## Gazula, Yogasai Project #64

Completed Project, Science, Health and Medical

### Herbs and Spices as Alternatives to Antibiotics

Due to the growing problem of antibiotic resistance, there needs to be an alternative to antibiotics in livestock feed. Herbs/spices are known to have used for medicinal purposes, and this project aims at investigating their antibacterial properties. If the extracts of cilantro, mint, basil, thyme, coriander, turmeric, ginger, cumin, cloves, black pepper, and cinnamon are added to E.coli cultures, they will inhibit its growth due to their antibacterial properties. Each agar plate had two extracts from the same herb, one extracted in water, the second in DMSO. Both were applied to the culture on a different area, and the plates were placed in an incubator for 12 hours. Afterwards, the area of inhibition was measured. In the second experiment, tubes contained a chicken "broth" (chicken and E.coli culture), and each extract was added to a different tube. Tubes were placed in a shaker and the contents were applied to different agar plates. The plates were placed in an incubator for 12 hours and the number of bacterial colonies was recorded. The results showed that the extracts which most effectively inhibited bacterial growth to the equivalent of the antibiotics were cilantro, basil (water extracts), thyme, cumin, cloves, and cinnamon (DMSO extracts). The area of inhibition of the DMSO extracts of cloves and cinnamon was greater than that of the antibiotics (control). When the same DMSO extracts (cloves and cinnamon) were added to the chicken broths, the least number of bacterial colonies were present. The antibacterial properties and the results of this experiment suggest that further research could be done to investigate whether herbs/spices could be effective alternatives to antibiotics in livestock feed. The herbs/spices would be used for the same purpose as antibiotics, but would not result in the growth of drug-resistant bacteria.

## Ghoshal, Dahlia — Project #65

Research Proposal, Science, Health and Medical

### How Cisplatin, An Anti-Cancer Drug, Affects Hearing Loss

Cisplatin, a chemical often used in treatment of some cancers, unfortunately also results in cell death of outer hair cells (OHCs) in the cochlea of the ear. The aim of my study is to develop a histological method for quantifying cisplatin-induced OHC damage in a mouse model. This method can then be utilized to measure the time course of cisplatin-induced hearing loss, and assess the efficacy of protective drugs. Cisplatin is first injected into the mice, and the mice are sacrificed after varying time intervals. The heads are placed in paraformaldehyde for fixation, and afterwards, the cochleas are extracted and placed in a decalcifying solution to soften the bone encasing them. The cochleas are then dissected and examined under phase-contrast microscopes, to perform outer hair cell counts to quantify the cisplatin-induced OHC damage.The research has not been completed yet.Unfortunately, histological analysis can only be performed once per organism. It would be very useful to also have methods that assess the health of OHCs without resorting to a terminal procedure. Therefore, a long-term objective of the study is to correlate the results of this study with the results of a novel blood test that permits early detection of inner ear damage. Finding this correlation will be very important in clinical situations, providing more than one axis to quantify cisplatin-induced ototoxicity.

## Gianukakis, Ariel — Project #66

Research Proposal, Science, Health and Medical

### The Effect of Dietary Balance of Omega 3 and Omega 6 Fatty Acids on the Frequency and Severity of Asthma Symptoms in Asthmatic Children

Asthma affects 1 in 12 people in the United States and causes about 250,000 deaths each year worldwide. This experiment will investigate if a dietary balance of omega 3 and omega 6 fatty acids will reduce asthma symptoms in children ages 5 to 12. If children's asthma symptoms are monitored before, during, and after a nutritional shift to balanced intake of omega 3 and omega 6, then the symptoms will decrease with the balance. This is because omega 6 causes immune response and inflammation and omega 3 reduces inflammation. In the United States the average ratio of omega 6 to omega 3 intake is 8.4 to 1. In this experiment, 400 asthmatic children from ages 5 to 12 will be given a dietary plan to balance of omega 3 and omega 6. Asthma symptoms including frequency and severity of cough,chest pain, shortness of breath, and difficulty breathing will be recorded for each child before the start of the experiment, and every month for the following year. Statistical analysis will then be used to determine if the dietary balance reduced asthma symptoms. Balancing the ratio will still allow immune response to occur, but it will limit excess inflammation in the body, including the bronchial tubes. Because asthma symptoms result frominflammation of the bronchial tubes, the dietary balance will reduce asthma symptoms. This experiment is important because asthma affects millions of people in the world, and the risk is becoming more severe, therefore using a non-invasive nutritional therapy should prevent onset and progress of this condition, and fewer lives will be lost.

## Gilbride, Austin — Project #67

Completed Project, Science, Health and Medical

### The Effect of Fatigue on the Order of Cardiovascular

The purpose of this project is to discover if doing a cardiovascular workout before a strength based workout will affect the amount of fatigue present during the total workout. Opposed to a person doing a strength based workout first. Studying this field and conducting authentic research will help myself and others learn about the human body so that humans can extend knowledge about health and physical fitness. Subjects were first asked to fill out a consent form and participate in the experiment at their local high school campus. The experiment was then completed in the gymnasium. First participants completed a 5-minute static stretch to prevent injury. The subjects were then split up into two groups, with half of them into the strength workout first, and half in the cardiovascular workout first. The cardiovascular workout required participants to jog for 4 minutes, while the strength workout required subjects to do push-ups, sit-ups, and leg raises. Participants completed the experiment four times, and then were given a minimum of a weeks rest to compensate for the fatigue from the experiment. Data is tending to show that the hypothesis is correct due to the average calculation in data for participants in group B is higher than the average calculation of data for participants in group A. From the data collected so far, the experiment is currently showing that there is less fatigue present in a strength based workout, and then a cardiovascular workout, opposed to a cardiovascular workout, and then a strength based workout. The implications of this project are that people can benefit during a workout by becoming less fatigued and performing better, rather than tiring themselves out in the beginning of the workout and performing under than the goal they have set for themselves.

## Gillis, Sarah — Project #68

Research Proposal, Engineering, Physical Science

### Robotic Foot Modified for Better Tracktion

Many robots have a metal rod leg and a rubber “foot” to use as a grip. And although it works, it runs into problems on different terrains with grip. When a robot goes to save a person from disaster, it has to be able to move on all different terrains or else it may not get there in time.I am planning on studying the anatomy of a cougar paw and learn the ways that it reacts on different terrains, such as ice, sand, and dirt by video taping it as the cougar walks. I would then try to replicate the paw and its actions, so that it would be most efficient in all scenarios. Theoretically, the cougar paw should be more efficient because it has multiple textures from the fur and the sand-papery skin and it has retractable claws that can help when it is slipping or when extra grip in necessary. The robotic paw would be more complex and thus work better than the metal rods with the rubber on the bottom. With the completed paw, it would be attached to a leg that resembled one of a huge cat and be programed to react depending on the environment that it is in. With would then solve the problem of the robot failing to make it to a certain location because of its lack of traction or ability to making it across the ground.

## Goll, John — Project #69

Research Proposal, Science, Behavioral

### Cognitive Development of Foraging Skills in Corvids

How are the foraging techniques in corvids affected by their being either wild or captively raised? Better understanding the acquisition of foraging skills could lead to further developments in how these skills are obtained through either natural genetic instinct or learning from natural parents. Multiple experiments have tested the cognitive capacities of birds in comparison to primate species by testing the manipulation ability through various level of difficulty tasks and cognitive tests. Basing these tests around foraging techniques and the subjects' motivation to manipulate food based tests to mimic foraging in the wild to show how they acquire foraging skills. Recording time and success rate of manipulating the tests would provide insight on the development of foraging behaviors in corvids.A link between how wild versus captive raised corvids interact with various foraging tests will show how learning and developing skills occurs in corvids. Testing the time the corvid subjects are in contact with the test object and the success rate of completing the task will backup the findings of the experiment. By testing cognitive development in early corvids, information on development in other birds or mammalian brains could be better understood. Further testing into genetics role in early cognitive development in corvids, can show how corvids develop foraging abilities used in later life.

## Gorey, Catherine — Project #70

Research Proposal, Science, Behavioral

### SL651498 as a Treatment for Autism Spectrum Disorder (ASD) in Mouse Model

Autism is a spectrum disorder that affects one's ability to understand emotions, social interactions, and human connection. The prevalence of autism is rising, making it increasingly important to find treatments targeted at the core social deficits of this condition. Autism's neurochemical basis has recently been attributed to a dysfunction of the GABA system. GABA is the main inhibitory neurotransmitter in the adult brain, and an impaired system creates an excitatory inhibitory imbalance in the nervous system. Agonists of the GABAa receptor increase GABA reuptake, and therefore increase the inhibitory effects of GABA. By administering SL651498, a subset GABA 2/3 agonist to BTBR mice, a mouse model of autism, then autism-like symptoms previously observed in the mice will be reduced as determined by established behavioral tests. These tests are designed to test sociability, cognitive function, and repetitive behaviors of the mice. These tests are comparable to the symptoms of the disability in humans. If successful, this experiment would provide additional potential options to test in human subjects. Having multiple options for treatments of autism is important to pharmaceutical developers because since autism is a spectrum disorder there is no single treatment that is beneficial to all levels of severity of the disorder. Autism is not a disorder that only affects the individual,only affects the individual, the families of children with autism also have their lives altered by this disability. Often the loved ones of those with autism are devastated that the child is unable to understand and reciprocate their love for them. The development of pharmaceutical treatment of autism is extremely valuable to allow those living with the disability and their loved ones to live fuller and more complete lives.

## Gowda, Shiva — Project #71

Completed Project, Science, Behavioral

### The Effect of Food Consumption Before Sleep on Dream Memory

There have been several studies on what effects dreams based on what one does before sleeping from exercising to drinking certain beverages. This particular experiment tested the relationship between consumption of food within a given time frame before sleep and dream memory as well as the clarity of the dream. Research has shown that remembering dreams have improved the quality of the one's sleep period, and that it reduces stress among most people. The hypothesis of this experiment is that if one consumes food right before he or she goes to bed, then the person will have a higher chance of remembering their dream and have a clearer dream.The test subjects in this experiment ate a food directed by the experimenter thirty minutes prior to their sleeping time. The subject then filled out a questionnaire the next morning containing questions about their night. This process repeated for five days. Next, as a control, the same subjects did not eat food prior going to bed, and answered the same survey for another five days. Independent variables are what the subject ate prior going to bed, and the time between eating the food and sleeping. Dependent variables are if the participants remembered their dreams and the clarity of the dream.Preliminary data show that eating foods prior going to sleep did increase the amount of days the participant experienced dreams compared to the days where they did not eat anything before sleeping. In addition, many of the dreams that the participant's experienced on the days that they ate food prior going to sleep were reported to be more clear compared to the days where they did not eat anything before sleeping.This experiment may lead to further research on the effect of food's chemical components on memory.

## Granath, Will — Project #72

Research Proposal, Science, Environmental

### The Effects of Pesticides, Hypoxia, and Water Temperature on the Susceptibility of Lobsters to Epizootic Shell Disease

Since 1998, the lobster population in Long Island Sound has decreased by 90%. There are many theories about the cause of this sharp and sudden decline, but there is no conclusive evidence to support any one. Researchers have discovered support for the theory that an epizootic shell disease (ESD) is causing the deaths, but there is no consensus on how the disease is able to penetrate these crustaceans' formidable shells.This proposal will test the role that pesticides, hypoxia, and climate change play in weakening lobsters' shells. Shell disease will be identified and recorded as an initial "spot" or as a progressed "lesion." If lobsters are observed in contained environments that mirror Long Island Sound's pesticide content, hypoxiation, recent temperature, and all three factors combined, then the combined effects will show the greatest melanization and erosion of the shell. To test this hypothesis, eighty juvenile lobsters will be collected from the Atlantic Ocean off the coast of Maine (where ESD prevalence is very low). Four tanks, mirroring the various factors, will each receive 20 lobsters and be infected with the shell-eating disease strain found in Long Island Sound.It is expected that the lobsters will be more susceptible to ESD when they are in the tank affected by all three factors. This experiment aims to support the hypothesis that the decline in lobster population in Long Island Sound is multifactorial, rather than the result of a single cause.

## Greene, Nicole — Project #73

Research Proposal, Science, Physical Science

### Measuring The Efficiency of a Solar-Electrolysis Proton Exchange Membrane Hydrogen Fuel Cell System for use in a Household

The purpose of this experiment is to test the efficiency of a solar-electrolysis fuel cell system. This experiment could help to increase the use of hydrogen fuel cells in a household environment in order to benefit the environment.In this experiment, the electricity for the electrolysis of water is produced by a solar panel. The hydrogen produced by the electrolysis is then used to fuel a Proton Exchange Membrane Hydrogen Fuel Cell (PEMFC) to produce electricity. The exhaust and energy output of the solar-electrolysis fuel cell system is then compared to the exhaust and energy output of a solar panel alone, and then a gasoline-powered generator.It is expected that the fuel cell will have a similar electricity output to that of the generator, but the exhaust will be much less that the exhaust from the generator because fuel cells have very clean exhaust. Compared to the solar panel, the fuel cell system is expected to have a greater efficiency, but a greater amount of exhaust. This research will add to the current knowledge of fuel cells and help to make it easier for people to use energy-efficient, environmentally friendly means of electricity for their homes in order to help the environment.

## Gross, Jacob — Project #74

Completed Project, Science, Health and Medical

### The Effect of Baseline Severity of Depression on Magnitude of Response to Ketamine Treatment

Today, depression is a problem that affects 350 million people around the world. Antidepressants commonly prescribed such as Selective Serotonin Reuptake Inhibitors (SSRIs) and Serotonin-Norepinephrine Reuptake Inhibitors (SNRIs) can help, but they take weeks to work and have a relatively low response rate. The anesthetic ketamine, an NMDA receptor antagonist, shows a promising future as a new type of rapid-acting antidepressant. This could save thousands of people in coming years. This project uses pre-existing data from past studies. I analyzed results from studies where patients received treatments of ketamine. They were evaluated on the Beck Depression Inventory (BDI) and the Hamilton Depression Rating Scale (HDRS). The participants were evaluated at certain times before and after the treatment. I graphed and analyzed the data to draw conclusions. While analysis is still ongoing, early trends indicate the a patient who is more depressed (having a higher BDI or HDRS score) will be more responsive to treatment. Also, a medium dose of ketamine, which is 0.5mg/kg administered intravenously seems to be the most effective route of administration for antidepressant qualities.These findings show that ketamine's antidepressant effects are most present in patients who have higher depression levels pre-treatment. In the future, a patient who is more depressed may choose to seek ketamine as a treatment, while a patient with mild to moderate levels of depression may instead pick a more conventional antidepressant.

## Grosso, Danielle — Project #75

Completed Project, Science, Behavioral

### The Effect of Birth Order on Personality Type

Studies have shown that people with different birth orders have certain personality tendencies. This experiment will be testing if birth order has an effect on personality tendencies (e.g. extrovert versus introvert). Birth order was the independent variable and personality type the dependent variable. It was hypothesized that birth order affects personality type. A group of subjects were gathered and administered the 16 Personalities Personality Test in order to match them to the correct personality type. After the subjects obtained their results, they took a survey used to determine their birth order, age difference between the siblings, sibling gender, and how many siblings they have. The materials used for this experiment were the 16 Personalities personality test, the Birth Order and Personality Type Survey, consent forms, Google Sheets, and participants. The data was transferred into Google Sheets and was analyzed in order to determine possible relationships between birth order and personality type.Data trends so far show that oldest children displayed the most extroversion, while middle children showed the most intuition, feeling, and judging. This information may be of value to employers hiring that are interested in finding employees with specific characteristics.

## Gunawardana, Dileka — Project #76

Research Proposal, Science, Health and Medical

### A Novel Approach for Detection of Early Onset of Chronic Kidney Disease (CKD) in the Rural Communities of Sri Lanka

According to the WHO, 15% of Sri Lankans are at risk of getting CKD, and those who get it suffer a miserable, painful and unproductive life. Renal failure takes years to develop, so if the disease is caught before it progresses to a later, more fatal stage, then it can be treated. In order to lower rates of CKD, an accessible, affordable, simple urine dipstick test needs to be developed. In order to make this urine test, there needs to be several reagents on the dipstick that will visibly react with a molecular marker (protein like albumin or creatinine) that is only in the urine of those with CKD. In my experiment, I'll be observing the various reactions that occur when chemical reagents like bromothymol blue or citric acid are reacted with both normal (control) and abnormal levels of protein. During my experiments, I expect that there will be at least one chemical reagent that reacts with all the proteins, and produces a specific color change. All the chemicals in this experiment are the basic ingredients of most procedural urinalyses administered by hospitals. Also, I expect that the reaction will change depending on the concentration of protein that is present in the urine. Based on my expected results, the conclusion can be made that the chemical reagent producing the most accurate results can be used as an accurate indicator on an inexpensive, accessible, simple dipstick urinalysis to test for CKD. Like a home pregnancy test, people who suspect they have the disease can take a test and analyze the color change to figure out whether they have CKD, how serious it is, and get necessary treatment.

## Gunya, Katherine — Project #77

Research Proposal, Science, Environmental

### Frogs exposed to bispenol A display larger numbers of physical abnormality

Bisphenol A (BPA), an endocrine disrupting chemical, is an estrogen mimic used as a plasticiser. Measurable quantities of the substance have been found in water bodies all over the world, and aquatic animals have shown developmental abnormalities in water more contaminated with BPA. If frog eggs and tadploes are exposed to bisphenol A, then there will be a higher number or frogs born with physical defects than in populations not exposed to bisphenol A. Frog eggs would be placed in water environments with different levels of bisphenol A. Upon maturing, all frogs would be examined for any physical defect.It is projected that frogs exposed to the largest dose of bisphenol A in egg and tadpole stages will show the highest amount of physical defects within the population while the control group will show few to no defects due to the absence of an endocrine disrupting chemical in the water.If bisphenol A dissolved in water affects frogs to the point of deformity or sterility, then the earth may see a drastic decline in frog populations near contaminated bodies of water. Amphibians are also known as indicator species, meaning that they are the first to show signs of environmental contamination, and what happens to amphibians could eventually happen to other animals and humans.

## Hager, Paul — Project #78

Research Proposal, Science, Health and Medical

### p120 Catenin Site Mutation at pY228 to Prevent Anchorage-Independent Growth

7.6 million people die, per year, at the hands of various cancers. While treatment has become increasingly effective in recent years, reliable diagnostic and interventional practices remain elusive. The proposed research aims to either confirm or reject the hypothesis that, if SRC phosphorylation at the pY228 site of the p120 catenin junctional protein in MDA-MB-231 (adenocarcinoma positive) cancerous breast cells is eliminated through the use of phenylalanine site mutation, anchorage-independent growth (AIG) will still be increased. This will occur because the effects of phosphorylated p120ctn stem from phosphorylation at multiple sites. Current methods and materials for p120 catenin tests are well-established by previous p120 research. The salient techniques involved in the testing would be tissue microarray, immunohistochemical (IHC) staining, immunoprecipitation, and western blot. The predicted result would show that AIG can indeed occur without phosphorylation at pY228, due to the expectation that it is the synergism between multiple phosphorylated sites, not the effects of one alone, that encourages cancerous growth in breast cells. The data would be analyzed by viewing and charting the western blot results. If the hypothesis is confirmed, further testing would be required to better grasp the effects of phosphorylation on p120 action while, if rejected, an important and specific aspect of cancer pathogenesis would be recognized. This research would have meaningful implications both in guiding future breast cancer research and providing a possible marker or mediation site for treatment. Microbiological research like that which has been proposed offers hope to the millions on the front lines, who know the battle against cancer all too well.

## Halabi, Carson — Project #79

Research Proposal, Science, Environmental

### Comparing European Bat Species to Eptesicus fuscus to Gain Insight into Resistance to White-nose Syndrome

More than five million bats in North America have been killed by white-nose syndrome (WNS) since emergence of the disease in North America in 2006. The associated fungus, Pseudogymnoascus destructans, does not have fatal effects on the North American bat Eptesicus fuscus, nor bats in Europe, where WNS originated. As E. fuscus is the only hibernating American bat resistant to WNS, it would be beneficial to compare it to species in Europe, many of which are resistant. Discerning similar characteristics between the bats could aid scientists discover why certain bats are WNS-resistant. The comparison will focus on four main characteristics: hibernation, diet, population, and appearance. The hibernation test will study torpor patterns in the winter months by using a temperature sensor. Bat guano will be examined carefully to compare diets. Population fluctuations will be measured with annual censuses. To look at physical similarities, the bats will be X-rayed. The bats' hibernation patterns are expected to be similar. Diet and physical appearances between the two species could vary. As for population, it will be interesting to see how many bats of each species live together in a cave, and whether the European bat populations are fluctuating like those in America.It is predicted that despite differences in diet and appearance, the bats will have steady populations in both regions. As thousands of bats die each year in Northeastern states, we grow closer to the possibility that bats will disappear. This is consequential, as bats are vital to ecological balance because of their role in pollination and limiting the insect population. Investigating the similarities between WNS-resistant bats would be a step forward in combating WNS.

## Han, Paul — Project #80

Completed Project, Engineering, Physical Science

### Evaluation of H-Bridge and Half-Bridge Resonant Converters in Capacitive-Coupled Wireless Charging

As of 2014, over 90 high-end mobile devices implement inductively-coupled wireless charging, which requires magnetic shielding that increases bulk and cost. Recently, there has been interest in an alternative method: capacitive coupling, which eliminates the large and expensive shielding of the inductively-coupled method and thus decreasing cost, manufacturing complexity, and bulk. In order to facilitate development, suitable transmitter topologies for a standard consumer wireless charging system were investigated.General specifications for the transmission system were chosen based on theoretical and practical considerations. A simplified model of the system was then simulated in MATLAB and LTSPICE to confirm the validity of the theoretical calculations. After validation of the designs, both systems were constructed and their input/output efficiencies were measured using a power analyzer. The material costs of both systems were recorded and compared with a commercial wireless charging system. The experimental results indicate that the h-bridge, which cost $60, was almost 15% more efficient than the half bridge, which cost $65. A measured PF of 0.9991 for the H-bridge and 0.9900 for the half bridge confirm in-phase operation for both systems. The h-bridge is more efficient and cost effective in capacitively-coupled charging applications, setting a clear precedent for future designs. Experimental results indicate lower efficiency than predicted by theoretical calculations and simulation, indicating that both models have unaccounted losses. Future work will focus on PCB construction in order to eliminate parasitic losses, closed loop control via FPGA controlled PLL, and implementation of GaN for lower conduction and switching losses.

## Handler, Katherine Project #81

Completed Project, Science, Environmental

### Succession Variations in Kenyan Scavenger Communities and the Importance of Wildebeest Carcasses

A delicate relationship exists between the aquatic and terrestrial ecosystems in the Kenyan Serengeti Mara Ecosystem. Approximately 7,000 wildebeest annually drown during migration patterns, resulting in a build up of carcasses rich in nutrients. Research is limited regarding the decomposition of carcasses and the subsequent turnover of nutrients within them. This project is designed to broaden our understanding of scavengers present at carcasses and to determine where the nutrients go.I have analyzed 1,802 photos taken by an automated game camera in October 2013 at a carcass site along the Mara River in Kenya. Field research documented the data of the drowning event. I collected data on number of carcasses, number and species of scavengers, and the temperature. Data collection is complete; analysis has started.Trends thus far show a significant turning point in the composition of scavenger communities at which the smaller scavengers (Sacred Ibis, Hooded Vulture, etc.) become more abundant than the larger scavengers (Marabou Storks, various vultures, etc.). Terrestrial scavengers become more abundant as the days since drowning event increases. Further analysis is required for more conclusions regarding the importance of the carcasses.Calculating the metabolic rates and energy requirements will help determine the nutrient partitioning of the carcasses. Results will help determine the course of succession in a scavenger community and the energy dependence percentages of the scavengers. These data will add to the knowledge of carcasses as well as survival requirements of endangered animals.

## Harman, William Project #82

Research Proposal, Science, Environmental

### Threadfin butterflyfish and Climate Change

I have been around the world, and places that I go to, my parents tell me stories of how when they were kids, everything looked a little different. The oceans cover 70% of the world, and are not currently fully explored, so we need to protect them, before they change completely. I want to see how the changing climate and other human factors are going to change the adaptations ofmarine organism in the future. This experiment will be done in a lab, wit a group of 30 Threadfin butterflyfish fry. There would three different tanks, with 10 fish in each one. The tanks, would have a ecosystem similar to what the Threadfin butterflyfish live in, same pH, salinity, etc., but the temperature would be raised by a degree Celsius, and 3 degrees Celsius. The fish would be observed andevery other day all would be taken out, and observed, for physical changes and photographed. As well the whole group of fish will be observed to see if any psychological changes occur into the community. The results will show that with the increase of temperature will have a lower survival rate. As well a decrease in the size of the fish will occur with the increased temperature of the water. This data will be used to see what will happen to warm water fish, when they are placed in even warmer water, and what adaptation will occur with global warming. It will give researchers a base model to compare other future data too. Also, to see in the future what is most likely going to happen to marine ecosystems in the warmer predicted climate.

## He, James — Project #83

Completed Project, Science, Behavioral

### The Correlation of the Development of Children's Phonological Processing, Intelligence Quotient, and Reading Cognition

Reading, a fundamental skill, is cognitively complex as it incorporates different brain regions. Individuals with high IQ's may develop reading disabilities. Phonology, potentially linked to reading development, involves comprehending, storing, and repeating sounds orally, inducing the question, "As children increase reading cognition, how does the relation of phonological processing and IQ to reading change?" It is hypothesized that phonology and IQ become more related to reading as reading proficiency increases. Approximately 200 randomly selected participants ages 3-7 from New Haven will be tested three times over two years using standardized assessments to determine their IQ, phonological ability, and reading cognition. As participants are assessed, their raw scores are converted into standard scores via scoring manuals accompanying the assessments, and are inputted into Filemaker Database available at the Haskins Laboratories of Yale University. Once completed, a spreadsheet is generated and analyzed. From data gathered thus far, phonological ability and IQ both increased as reading proficiency increases. Additionally, the correlation of IQ and phonological ability with reading cognition increased in degree as reading proficiency increases. Lastly, the correlation between IQ and phonological ability increased in degree as well. Evidently, the hypothesis was proven, indicating they more directly influence each other as reading development progresses.Phonological ability and IQ more accurately determine reading cognition as children's reading proficiency increases. Throughout reading development, an increase in phonological skills, such as phonological awareness, phonological memory, and rapid naming as well as in IQ components such as word knowledge, verbal reasoning, visual perception, organization, and processing may enhance reading cognition, allowing for reading instruction to be targeted at specific skills to develop more proficient reading cognition.

## Henrie, Madeline
## Johns-Woodby, Yahnah — Project #84

Research Proposal, Science, Health and Medical

### Research Taking Flight: Using DNA Barcoding to Detect the Type of Bacteria on Common Surfaces Inside an Airplane

Public transportation is a common vehicle for the spread of infectious pathogens. Being able to determine the variety of different bacteria that live on airplanes will allow scientists to figure the most effective way to fight these bacteria. This study will determine the bacteria on surfaces on airplanes for both domestic and international flights. A variety of surfaces will be tested by swabbing the surfaces to detect the bacteria present on both domestic and international flights. Samples will be DNA barcoded to determine the species. Much like the patho-mapping done on the New York City Subway, it is hypothesized that an amalgam of different species of bacteria will be found.In preliminary testing thus far, common skin bacteria has been detected on surfaces, but testing will continue. Through identifying any harmful bacteria, a calculated plan to remediate the situation can be identified. In future research, the same procedures will be conducted on domestic and international airports, and a similar study will be conducted in taxi cabs and cars used for car services.

## Higgins, Tim — Project #85

Research Proposal, Engineering, Physical Science

### Heatpack

The purpose of the project is to create an electric heated backpack that can help students stay warm in the winter. It is especially intended for those who need to walk home from school. Create an electric heated pad that is battery powered and install it inside of the back of the backpack. The heated backpack poses a slight fire hazard, but the backpack can be heated. The backpack can provide a significant amount of warmth to the user without adding too much weight. I will create a backpack that helps students stay warm when they need to go outside in cold areas of the country during the winter.

## Hopper, Juliana — Project #86

Research Proposal, Science, Environmental

### The Effects of the Cowpea Gene, CPRD22, on Transformed Alfalfa Related to Drought Resistance

Due to the growing drought problem in California it would be advantageous to transform water monopolizing crops, such as alfalfa, to be more drought resistant. This would aid in maintaining enough water to support all of California's agricultural community. Alfalfa can be transformed with the cowpea gene CPRD 22 that will allow it to go through more ABA synthesis, which closes the stomata to keep water that would be transpired through the leaves, inside the plant, thus conserving water for future use. Transforming the alfalfa can be achieved through a simplified agrobacterium transfer process(Weeks et. al. 2008). When the alfalfa plants, transformed and wild type, reach 1/10 bloom the water use efficiency (WUE) will be quantified by measuring the rate of photosynthesis compared to the amount of water the plant received in the past 48 hrs. over the rate of photosynthesis per unit of time. Since alfalfa is a major part of California's agricultural economy, it would be beneficial for growers to have crops that use water more efficiently, which also benefits water conservation efforts during the current drought crisis.

## Jain, Anisha — Project #87

Completed Project, Science, Health and Medical

### Level Of Awareness Regarding Hepatitis B Current Treatment Guidelines Amongst Physicians At Different Levels

In this study, the awareness amongst gastroenterologists/hepatologists at various levels of experience (faculty, fellow and resident) regarding AASLD guidelines for the management of Hepatitis B (HVB) will be compared. It is speculated that the practicing gastroenterologist/hepatologists will know the most about HVB treatment guidelines compared to the trainees (fellows and residents). A questionnaire will be given to all members of the division of Gastroenterology at Yale New Haven Hospital through survey monkey. The independent variable is rank of the physician in the department (i. e. trainees vs. faculty). The dependent variable is the number of questions the participant answer correctly. This data will be statistically analyzed using 2-variable test to compare the trainees and faculty against each other. This study is important since Hepatitis B is widely spread disease which when treated incorrectly may lead to cirrhosis and liver failure. Implications of this study could be more rigorous training of the residents and fellows, and having faculty take classes more frequently to be updated on the newest, most effective treatments.

## Jarad, Haya — Project #88

Completed Project, Science, Health and Medical

### Identifying quasi periodic patterns in functional MRI data

A functional MRI (fMRI) is a form of Magnetic Resonance Imaging (MRI) that tracks the metabolism of neuron cells in order to measure brain activity. This is done by detecting levels of deoxyhemoglobin, a paramagnetic substance in brain tissue. As neurons become active, they require more oxygen. This oxygen is carried to the brain through blood by a transport protein known as hemoglobin. While carrying oxygen, hemoglobin is called oxy-hemoglobin.Oxyhemoglobin is non-detectable through fMRI. However, after metabolizing, it becomes deoxyhemoglobin, a paramagnetic substance; which registers as a contrast in fMRI image. These images can be analyzed to better understand brain function. Images can be compiled to make movies, depicting periodic patterns of energy-flow through the brain. Sometimes patterns were not periodic, but Quasi-Periodic Patterns (QPPs). An algorithm exists that identifies the instances of periodic patterns in neuroimaging data.Results thus far indicate that the algorithm will only identify the QPP accurately when the start time and length inputted to in the algorithm strongly correlates with one instance of the pattern. These two values are manually chosen by the researcher.While the algorithm is very good at identifying the periodic patterns, this project will be of the first to attempt using it to identify QPPs The significance of QPPs is that they are thought to depict the state of brain waves as energy moves in the brain. A diseased brain will not be able to transfer energy properly, so being able to identify irregularity in QPPs using the algorithm will allow for detection of brain diseases.

## Jarad, Khaled — Project #89

Completed Project, Science, Health and Medical

### The effect of Powerade vs Water on Heart rate during a cardiovascular workout

Recently, athletes and gym goers have either used or relied on energy drinks over traditional water as a pre workout drink. It is important to study this field because learning which drink will aid a workout better will make gym goers and athletes more productive. The purpose of this experiment is to investigate whether PowerAde or water are more effective in raising a person's heart rate during a workout. It is hypothesized that if the gym goer drinks PowerAde over water then they will have an increase in heart rate. To begin the project participants were gathered throughout Amity Regional High School. Participants then took a survey assessing their athletic ability to determine the pace they would run at. Next the participant would drink one cup of PowerAde. Then run for 4 min on a treadmill. Their heart rate would be determined using a fit bit watch that they would be wearing during the run. After 3 days they would repeat the test except for this run they would drink one cup of water. The findings suggest that Using PowerAde as a pre workout energy is less effective than water. PowerAde is more effective than water in raising heart rate during a workout. The data shows that participants who drink PowerAde have an exponentially higher heart rate than when the participants drink water. This means the heart is doing more work. The data is expected to follow this trend. Using this information athletes and gym goers can now know that water is a better choice than PowerAde. Because the PowerAde raises the heart rate thus causing more fatigue at a faster pace. If an athlete is looking to last in a workout as long as possible water is optimal pre workout drink.

## Jones, Phoebe — Project #90

Research Proposal, Science, Health and Medical

### How Environmental Toxicants Affect Epigenetics

Environmental Toxicants are affecting the world for the worst. By ingesting or inhaling certain pollutants and metals from the environment, people are changing how their genes are being expressed which can change overall how a body functions. For this experiment, DNA methylation and histone acetylation of leukocytes is being studied to see how toxicants affect the immune system. To find out the frequency of DNA methylation and histone acetylation, one must test a gene to see its expression frequency and the frequency of methylation and acetylation. The chosen gene is HRAS because it is a gene that is used for regulating cell division. Testing of this will be done by obtaining and comparing the blood of people with cancer to blood of people without cancer through methylation analysis. This gene has been over expressed in a large portion of the population. Since it is a proto-oncogene is has the high potential to become cancerous. The results will show that the toxicants in the environment are causing hypomethylation and hypermethylation are causing an increase in cancer and cancer risks by overexpressing and not expressing genes enough. Since the experiment will show how the environment affects human health for the worst the government will take action. Once these findings are understood and heard, law will be implicated regulating pollution after seeing how the environment affects human health.

## Jordan, Stephanie
## Dym, Caroline — Project #91

Research Proposal, Science, Environmental

### Determining the Water Quality Index in Areas Adjacent to Wastewater Treatment Plants

Discharge from a wastewater treatment plant can negatively affect a body of water adjacent to the plant. In this study we will test water samples collected from the Hudson River near the North River Wastewater Treatment Plant and from the East River near the Wards Island Wastewater Treatment Plant. We will assess them on several characteristics used to rate the Water Quality Index. This experiment will expose the quality of local bodies of water through testing the pH levels, the nitrate levels, the phosphorus levels, and the turbidity of the water. It is expected that the two bodies of water that are adjacent to the wastewater treatment plants will be negatively impacted and have lower water quality index values compared to a controlled body of water. The results of this experiment will give us the ability to determine how much waste is being dumped into the water as well as where and why the polluted water is entering into the clean water.

## Juan, Avery
## Miller, Emily — Project #92

Completed Project, Science, Environmental

### Discovering Differences in the Biodiversity of Beetles in the Nicrophorus Genus in Urban, Rural, and Suburban Locations to Determine the Effect of Urban Fragmentation

Studying beetle population biodiversity is important because beetles are decomposers that break down nutrients for the ecosystem. It is therefore important to understand the effects of human activity on beetles. The purpose of this study was to determine how urban fragmentation affects the biodiversity of beetles in the Nicrophorus genus. Beetles were collected and the abundance and richness of the different species were determined at urban, suburban and rural locations. The hypothesis was that the biodiversity of the Nicrophorus genus beetle will be lowest in fragmented urban areas and highest in rural areas. At each of the different urban, suburban, and rural locations, three traps were set. The traps contained raw chicken as bait and a rain cover to protect it from the elements. The traps were left out for a week and then the beetles in the traps were counted and identified. It was found that, despite being fragmented, urban locations had a higher species richness and diversity of beetles than the suburban and rural locations. These results did not support the original hypothesis and suggest that beetles could be synanthropic species that benefit from human activity. Future research includes comparing the beetles found in this study to the beetles stored in Fordham University's Calder Center, to see how the beetles in the Nicrophorus genus population have changed over the last forty years. Further studies would also include experiments to discover what aspects of urban environments make it conducive to a high biodiversity of beetles in the Nicrophorus genus.

## Kachru, Ananya — Project #93

Completed Project, Science, Behavioral

### Mapping the Relationship Between Reading Ability and Successfully Learning an Artificial Lexicon

Learning is an essential part of life. Recently, identifying predictors of learning has become an important phenomenon. This study will look into the correlation between reading ability- specifically comprehension, vocabulary, and fluency-compared to an individual's learning rate which is acquired through testing an Artificial Lexicon. Artificial Lexicon is a controlled method that is used to measure learning. By learning essentially a fake language, artificial lexicon measures an individual's ability to comprehend as well as to accurately define and pronounce terms. This study uses an artificial lexicon called VAL- Visual Artificial Lexicon. After a learning phase, VAL will show a word and a pair definitions on screen. Each participant pronounces the word and chooses one of the two definitions. By doing so, VAL tests if the participants can accurately pronounce and define the word- indicating that the participant has acquired and successfully learned that word. Each participant will go through a phase of 5 blocks of testing, and their experimental test results will be compared to their reading ability- obtained through multiple standardized tests.The experiment's overall goal is to try to show a correlation between reading ability and learning an Artificial Lexicon- if there is a one existent.Correlations will be considered through several different approaches of statistical analysis. Preliminary data, derived from multiple regressions, demonstrates a positive correlation among all parameters- both the independent and dependent variables. Currently, it has been determined that the Peabody Picture Vocabulary Test seems to be the best predictor for both efficacy of learning definitions and pronunciations. Further statistical analysis will be done. This study delves into the process of learning as well as its crucial, corresponding factors- learning definitions and learning pronunciations. It essentially evaluates predictors regarding two influential aspects of the learning process. Through this research study, it can be determined whether standardized tests are an effective way of assessing one's learning. In addition, whether or not an individual may be better at accurately learning either definitions or pronunciations for a given lexicon, depending on certain standardized score results, can also be determined.

## Kasak, Chloe — Project #94

Research Proposal, Engineering, Health and Medical

### Exoskeleton Apparatus for Osteogenesis Imperfecta

Osteogenesis Imperfecta is a genetic distorter were bones break easily. By creating an exoskeleton for this genetic disease it will prevent the bones from breaking as easily. The first step in creating this exoskeleton is to learn the dynamics of the leg. After that create a rough sketch of how the exoskeleton will be composed. Using shape up, a 3D printer program to create the exoskeleton. Individually printing different parts and then constructing it after using different methods like hinges so the exoskeleton is able to move with the body.I hope to find that the exoskeleton prevents bone fractures for a patient with Oseogenesis Imperfecta.This exoskeleton will be used to prevent fractures for a patient with Osteogenesis Imperfecta.

## Keena, Henry Project #95

Research Proposal, Engineering, Physical Science

### SQL Injection Prevention and Detection through Arbitrary Variable Values and Tracking Cookies

With the growing threat of hackers and scammers, the need to secure websites has become a priority among those in the field of Information Security, to protect consumers and private corporations that may be at risk. Th most common form of website exploitation, SQL Injection takes advantage of values or functions in a website's SQL database, allowing an attacker privileged access to confidential information such as usernames, passwords, etc. By removing and changing undefined variables inside SQL command functions to have random arbitrary values, it will be harder for an attack to be confused as SQL commands. Also, by implementing tracking cookies into SQL code, when a possible attack occurs, the attacker can have a flag that will identify their browser, as well as other information that can provide security analysts with what they need to prevent future attacks. It is expected that by implementing this method, that security analysts will be able to not only detect attempted SQL Injections, but also to detect the source of attacks as well as macking it harder for attacks to take place.Implementing this method to protect and defend against SQL Injections may help to defend websites of not only consumers and private institutions, but also defend national and international cyber security interests.

## Keenan, Colleen Project #96

Research Proposal, Science, Health and Medical

### Expression and Regulation of Gluconeogenic Enzyme Genes in Epithelial vs. Mesenchymal Breast Cancer Cells

Metastasis is the number one cause of cancer lethality. Epithelial-mesenchymal transition is a biological process in which epithelial cells assume a mesenchymal phenotype, conferring the ability to metastasize to distant sites. Several studies have found a negative correlation between post-EMT mesenchymal cancer cells and several gluconeogenic enzymes. This study will test expression and regulation of the gluconeogenic enzymes PECK2, FBP1, and G6PD by the transcription factors GATA3, ER__Y_, and FOXO1. Levels of PECK2, FBP1, and G6PD will be assessed in two epithelial and two mesenchymal breast cancer cells using 3-dimensional cultures. The protein levels of the enzymes will be assayed by immunoblot. The mRNA levels of the enzymes will be assayed by quantitative PCR from MCF7 and BT474 epithelial cell lines treated with siRNAs and inhibitors for GATA3, ER__Y_, and FOXO1. Oxidative stress levels will be tested. It is hypothesized that FOXO1, GATA3 and/or ER__Y_ knockdown/inhibition will suppress one or more gluconeogenic enzyme, thereby phenocopying post-EMT mesenchymal cells. Gluconeogenic enzymes will be downregulated in mesenchymal cells vs. epithelial cells to support their highly glycolytic phenotype. The genes that display regulation will be further analyzed, and an increase in oxidative stress is predicted if FOXO1 expression is decreased in mesenchymal cells. The findings of this study could reveal the means by which metabolic changes in EMT are regulated by transcription factors in breast cancer. EMT-induced metabolic changes promote aerobic glycolysis, a process which increases cancer resilience and proliferation. Elucidating the mechanisms that drive these metabolic shifts could lead to new cancer therapies that act on the regulators of processes that exacerbate cancer invasiveness and metastasis.

## Khan, Adam — Project #97

Completed Project, Science, Behavioral

### The Implications of Preferred Learning Style on GPA and Hobby Choices

In an article by Professor Rita Dunn regarding learning styles, her findings shed lights on how to improve our educational system. She discusses the correlation between using learning style teaching in comparison to traditional teaching methods. A study conducted in New York schools found that when learning style teaching was implemented, student performances on standardized tests increased dramatically, after just six weeks in some instances. The same teaching was implemented into to several schools in North Carolina with very similar results. By finding more trends between learning style and other attributes such as GPA and Hobbies, we may be able to increase the efficiency of learning in a classroom environment. A multitude of high school students were asked to take a survey. The first section of the survey asked personal questions to determine the student's preferred learning style. The second part asked questions hoping to obtain information about the student's GPA and hobbies. These hobbies were then ranked into different categories such as academic or physical to finalize the trend in preferred learning style versus GPA and Hobbies. Data is still being collected at the moment. However, initial research may be showing that Visual and Auditory learners tend to perform better academically and participate in more hobbies. Should the data collected help to show interesting trends, this information could be implemented into educational systems as to benefit students. By targeting students individually and identifying their strengths and weaknesses, steps can be taken to ensure that the teaching style is oriented towards the student.

## Khan, Haseeb
## Davidi, Barak — Project #98

Completed Project, Science, Environmental

### Comparing the Effects of Oniscus asellus and Trachelipus rathkii Activity and Associated Decomposition on Soil Composition and Plant Growth

Detritivores have a significant impact on the composition of soil through their process of decomposition. The specific effects isopods have on soil quality are not well understood. This project aims to determine singular-species and multi-species effects of isopods. First, 40 mesocosms with 7 cm of soil were prepared. Then 240 mesh litter bags were created- 120 were filled with 0.5 grams of goldenrod litter and 120 were filled with 0.5 grams of grass litter. Six bags of goldenrod were placed in 20 mesocosms each and six bags of grass litter were placed in the remaining 20 mesocosms. Two anion/cation membranes were then placed in each mesocosm to measure nitrogen content in the soil. The two groups of mesocosms were divided into 4 groups of different population densities- either a total of 0, 2, 4, or 6 isopods in each. Two replications for each species by themselves and mixed together for every population density were prepared. Over the course of 6 weeks, the litter bags were collected and massed to measure decomposition rate, and the anion/cation membranes were replaced biweekly. Data thus far shows that, compared to the control, the isopods have had an effect on the decomposition of litter. Additionally, it was observed that as population density increased, the decomposition rates increased also. In the multi-species mesocosms, the decompositon rate was significantly larger, pointing towards a possible mutualistic relationship of isopods. The anion/cation strips will all be analyzed at the end of the study, at the same time, to determine how the composition of soil changed. Then, Poa pratensis grass will be planted in each mesocosm and harvested after 4-6 weeks to determine the effect the isopods had on plant growth.

## Khire, Priti — Project #99

Research Proposal, Science, Health and Medical

### Expression of Protein in Bacteria (E. coli) System and Test for Activity

Proteins are known to be difficult to obtain because of the large size and high cost of synthesis. Recombinant proteins are man-made proteins that can be expressed in a bacterial strain such as E. coli., yeast, and eukaryotic cell lines. By using E. coli, which usually provides high yields of protein, to produce proteins the efficiency of synthesis should improve. Vascular endothelial growth factor (VEGF), which helps cells with proliferation, was the protein used in this project. Is VEGF functionally active when expressed in E. coli?The first step was the polymerase chain reaction which enlarged the VEGF DNA fragment in order to identify and experiment on it. Next was expression of VEGF in E. coli. and the check for growth of the protein. Then the protein was isolated from the bacteria and expressed it in endothelial cells to test operability. If it was not functional VEGF needed to be expressed in cells from higher organisms for activity. Materials included E. coli., VEGF, restriction enzymes, gel boxes, water bath, incubator, and a spectrophotometer.The anticipated results are that VEGF will be successful in helping endothelial cells proliferate after being expressed in E. coli. A 2010 study High-yield expression of human vascular endothelial growth factor VEGF in Escherichia coli and purification for therapeutic applications was able to produce 9 grams of the protein using E. coli. and it was tested for functional activity in human umbilical vein derived endothelial cells. Proteins are very useful in the medical field and VEGF specifically had the potential for accelerated wound healing. For that reason the efficiency of its production is very important. This method can be used by scientists who use proteins in the creation of their medical drugs. For example, the company Alexion was recently very successful in the production of a drug, Soliris, using the recombinant protein method.

## Kiefer, Rahul
## Stark, Jake — Project #100

Research Proposal, Engineering, Physical Science

### Corsair Transportation

The objective of this project is to design a mechanism that would enable a Sikorsky helicopter to rescue a downed Corsair off Beaumont, TX in the Gulf of Mexico. Thus, the objective is to find the most efficient way to engineer a harness attached to a Sikorsky helicopter in order to rescue the downed Corsair. Our plan is to design a harness that can carry the weight of a Corsair while attached to a Sikorsky HH-3E Jolly Green Giant Helicopter. To do this, we will design a harness that can be attached the the plane in four places. The harness will consist of 4 sets of chains each with securing bands on the end. The points at which we plan to fit these bands around are: The empennage of the aircraft as well as the front in order to make sure the plane does not pitch during transportation. We will also attach one band to each of the wings to ensure that there is no chance of the aircraft rolling during the flight. The cables used for the harness will be 1/4 in galvanized metal wire ropes that each have a maximum carrying capacity of 1300 lbs. By doubling the ropes up, as well as placing them among the 6 mounting points designed for this lifting unit, the theoretical max carrying capacity is 15,600 lbs, which is within the necessary requirements, considering the maximum weight of the Corsair F4-U is 14,533 lbs and the assumed drag force will only be 500 lbs. We will attach all of these cables together and then mount them to two 2 inch nylon straps that can support 10,000 pounds each. The cables will be attached together via a set of 1 inch groove clamps that can withstand the weight being put on them. The nylon will also be attached via a grooved clamp, and the whole system will remain sturdy due to the clamp's overbuilt design. The nylon straps would then be mounted to the structural hardpoint on the Sikorsky Jolly Green Giant helicopter, which is more than capable of lifting the weight of the F4U Corsair. This is important because we would be able to use our engineering to design and implement other equipment for rescue missions in real-life situations, and even other situations that require high-precision measurements and data to be able to function properly.

## Kline, Camilla — Project #101

Research Proposal, Science, Health and Medical

### Evaluating Expression of VEGF and CCl-2 in V600E B-Raf Melanoma as Targets for Immunotherapy

Melanoma accounts for 50-75% of all estimated 13,000 and rising skin-cancer related deaths per year. Treatments such as radiotherapy and chemotherapy can damage normal somatic cells; immunotherapy is a new form of treatment that utilizes antibodies to manipulate immunoregulatory processes to treat cancer. Growth factor VEGF and chemokine ligand protein CCL-2 have been indicated in cell growth and division, evoking the question, do melanoma cells excrete higher levels of CCL-2 and VEGF than CRL-7523 ™ cells? If both regular skin cells and melanoma cells are assessed for their expression of growth factor VEGF and chemokine ligand protein CCL-2, then the melanoma cells will have a greater expression of both as measured by the width of the band on a Western Blot for both CCL-2 and VEGF, indicating that those are suitable candidates for immunotherapy. This will occur because both CCL-2 and VEGF have been indicated in the cells growth and division within normal cells and often abnormal cells exploit mitotic pathways in the process of tumorigenesis. Two cell lines, CRL-7523 and B-Rafv600E will both undergo the Western blotting method to determine the amount secreted by the cells, as indicated by the thickness of its band after gel electrophoresis. To indicate the presence of CCL-2, the cells will be stained with primary antibody MCP-1 and secondary IgA, while primary and secondary antibodies 16F1 and IgA will indicate the presence of VEGF. Antibodies altering these possibly overexpressed proteins would likely be able to treat B-RafV600E melanomas by slowing down or inhibiting mitotic processes and enhancing apoptotic responses without damaging other normal somatic cells. This is the most promising way to reverse cancer development, while eliminating the negative side effects of current therapies.

## Kupcho, Lindsey — Project #102

Completed Project, Science, Behavioral

### Impact of Personality Type on Reaction to Images

Assessing how people's emotions are configured upon their face has become its own branch of forensics. There's also research based evidence that personality types influence facial expressions. This experiment focuses to determine whether personality types, as defined by Meyer Friedman, have an impact on facial reactions. There are two types of personalities represented in this experiment: Type A and Type B. If a person is a Type A personality, then they will relay their emotions more intensely than a target with a Type 2 personality. Participants took a survey to determine their personality type. After test results were analyzed, participants were placed in a room to be exposed to a variety of images that are designed to evoke severe emotion. One's reactions were monitored based on the presence of certain indicators, such as the presence of tears, furrowed eyebrows, an open or closed mouthed smile, a laugh, deep stares and a frown. The data and number of indicators present were compared with personality type to discover if there is a trend or inclination of one personality over the other. Based on trends, type A personalities typically expressed more dramatic and visible reactions compared to type B, whose reactions were less severe. Type A normally searched for deeper meaning, so indicators such as wrinkled eyebrows and deep stares lasted anywhere from 2-15 seconds, when one looked at the images. Type A clearly showed at least 2 indicators on each image, while some type B personalities showed no visible indicators and made little to no comments about how the picture made them feel or what they saw. This experiment addresses the impact of personality type on reaction to images. This has potential implication for forensic investigations.

## Landler, Anna — Project #103

Research Proposal, Science, Environmental

### The Affects of Fertilizer on Daphnia Populations

Currently, key species are going extinct at a rapid rate due to human activity. My research on this upcoming mass extinction led to my research in regards to Daphnia, a species of zooplankton that is essential to the maintenance of lake ecosystems; it's extinction would be devastating. I plan to research the effects of the introduction of common lawn fertilizers to their environment on their recovery time over generations. The experiment will use two controlled settings, set up using samples from actual lake ecosystems. In one, no environmental shock will be applied and in one a specific nitrogen-based fertilizer will be applied. Then, comparisons of population sizes periodically by collecting consistently sized samples and assessing the number of daphnia. Over time, the population change will be visible, should there be any.Due to the short generation span of Daphnia, changes resulting from the introduction of the chemical fertilizers would likely be seen within their usual 21-day life span. It is likely that there will be a decline after the initial introduction of fertilizer. However, Daphnia, being particularly adaptable, will probably be able to evolve to suit themselves better to their environment and then repopulate. There are more variables in real ecosystems, which is likely to skew the results, because it is likely that Daphnia would adapt differently to such extra variables. Hence, this is not a definite recreation of the Daphnia population changes resulting from to human activities, but it will outline their adaptability as well as isolate possible consequences of specific fertilizers. This could lead to more effective preservation in the future.

## Lang, Karen — Project #104

Research Proposal, Science, Health and Medical

### Synergistic Effect of Manuka Honey and Antibiotics on Staphylococcus aureus

Antibiotic resistant bacteria such as methicillin resistant staphylococcus aureus are becoming a growing concern in the medical field. This has led scientists to look for alternative methods for killing bacteria. It has been discovered that Manuka honey has antibacterial properties. Honey is able to kill bacteria through its low pH and high osmolarity. It has also been discovered that there is a synergistic effect when honey is combined with an antibiotic to kill bacteria.In the proposed research I plan on testing different concentrations of Manuka honey, antibiotics, and a combination of Manuka honey and antibiotics against Staphylococcus aureus. I will use an agar diffusion assay to test the antibacterial activity of each solution. The agar plates will then be incubated for 24 hours at 37 degrees Celsius. The zones of inhibition will be measured and the solution that produces the largest zone of inhibition is the most effective at killing bacteria.It is expected that the Manuka honey in combination with the antibiotic will have the largest zone of inhibition compared to the zone of inhibition of the Manuka honey alone or the antibiotic alone.If this synergistic effect is found to be effective at killing Staphylococcus aureus then it can be tested against MRSA in other experiments in the future. This research will also add to the information regarding Manuka honey's antibacterial activity and help with the acceptance of Manuka honey as a treatment for bacteria.

## Lang, Patrick — Project #105

Research Proposal, Science, Behavioral

### Lucid Dreaming as Related to Hypnotic Susceptibility Through Linkages Between Frequency Measurement and Overall Ability

The relation between lucid dreaming and hypnotic susceptibility has yet to be explored. My hypothesis is as follows: lucid dreaming and autosuggestion are directly varied with hypnotic susceptibility as shown through the comparable scores received by the subjects on two scales. The eight-point lucid dream frequency scale tests the frequency of lucid dreaming and the Harvard Group Scale of Hypnotic Susceptibility or HGSHS tests the degree of hypnotizability. I will be administering the two scales listed above in order to measure the frequency lucid dreaming versus one's hypnotic susceptibility. The greatest number of subjects possible will be found, and they will first answer the one-question lucid dreaming frequency scale. Then, under the supervision of a hypnotizability researcher, I will administer the HGSHS. From there, I will analyze the results.I expect that there will be a positive correlation between the frequency of lucid dreaming and one's hypnotic susceptibility. Lucid dreaming has been found to be linked to a high level of creative thinking, as has hypnotic susceptibility. Transitively, the two should show a strong relationship. Upon finding and analyzing the results, they will be shared throughout the fields of both lucid dreaming and hypnotic susceptibility. The results of this study can help other researchers increase their knowledge and take steps to further apply lucid dreaming to the real world. I believe that discovering a connection between these two phenomena can serve as a catalyst to further exploration into lucid dream therapy through the utilization of different means. For example, if scientists can use different ways to heal patients with PTSD, still yielding the desired end product, treatment styles could grow exponentially.

## Lee, Christina — Project #106

Completed Project, Science, Behavioral

### The Effect of Sitting Versus Standing on Concentration

Many companies such as Google and Facebook are starting to incorporate standing desks into workspaces due to the vast benefits of increasing productivity. By placing this into a classroom setting for high school students, a student's performance may be impacted from sitting versus standing at their work space. It is hypothesized that students who stand at their workspace will have better concentration and lead to higher productivity compared to them while sitting. The purpose of this study is to examine if standing desks or sitting desks increase concentration of high school students.High school students were given a vocabulary test containing 45 words in Swahili along with the definitions in English. Students had to memorize as many words and definitions as they could within 10 minute either sitting or standing. Afterwards, the tests were collected and they were given a blank paper to write as many words along with their definitions down. The same group of students came in a week later to take the exact same test, but were either sitting or standing based on their previous position. Data is still being collected, however past researches that were conducted show that many workers believed that they felt more concentrated while they stood at their workspace. Results from this study can create an optimal environment for learning. Furthermore it can lead to a higher productivity rate for students and encourage them to complete work in a timely manner. Further research can focus on different age groups or genders and even acknowledge potential health benefits when standing at their workspace.

## LeMay, William Project #107

Research Proposal, Science, Physical Science

### The Synthesis of Silica X-Aerogel through the Sub-Critical Process

The goal of this project is to create a silica X-aerogel that doesn't increase the density of the X-aerogel by the significant amount that most X-aerogels increase. My motivation for this project is to help and cheapen the cost of things sent into space by making a material with high strength that is also lightweight that can be used for structure and insulation.The first step to creating a silica X-Aerogel is to create a sol gel, a type of gel with a strong 3D framework. To create a sol gel, a silica solution and catalyst solution must be combined to aid polymerization. The solution must then be washed in methanol to remove impurities. Then, polystyrene would be added to strengthen it. Finally, it is dried through the sub critical process. The X-aerogels that have been created have shown improved strength, but have had greater densities and worse insulating abilities. This change in density and insulation are drawbacks to X-aerogels, as those properties are coveted in their applications. Other research has been done, showing ways to change pore size, which has opened the door to fixing the density problem through the amount of solvent present. The main applications of X-aerogels is as a structural component in anything sent out to space because they have high strength and maintain their density and insulating abilities. To send a pound of material into space, it costs ~$10,000. Since X-Aerogels have such low density, they cut down on costs. They are also used in residential housing as structural and insulating material, as they are very effective at both.

## Lensky, Yevgeny Project #108

Research Proposal, Science, Environmental

### Selecting for Glyphosate Resistance in Fast Plants

The goal of this project is to demonstrate that resistant strains of plant life can come about within three generations of exposure to the popular herbicide Roundup. Over the years as synthetic pesticides have become more and more prevalent over the years, farmers and normal gardeners have been required to use them in order to remain competitive and profitable. However, increasing numbers of herbicide resistant populations of weeds are becoming more common as time goes on. This experiment will require the growth of two separate populations of Wisconsin Fast Plants. One will act as a control and be grown without any herbicide while the others will be grown with the presence of the Roundup herbicide. Both will be cross-pollinated within their populations and after three generations of each group, seeds will be taken from both groups and will be placed in containers including roundup in order to demonstrate that a genetic resistance is in effect should offspring from the experimental group survive. It is expected that the majority of the plants will die but any that survive will have heritable resistance genes.The results from this study can be used to help people schedule more organized uses of herbicides so that such resistant populations will not come about.

## Li, Vince
## Wang, David — Project #109

Completed Project, Engineering, Physical Science

### Creating a Mobile School Navigation App

Each year, incoming freshmen have trouble finding paths to their next class, and even students who are familiar with the school may use inefficient ones. The purpose of this project is to create a program to determine the best path for a student to reach his or her next class. Other uses may also include providing directions for visiting guests and parents or emergency responders in the school.This program was designed as an Android application that can be used for directions in our district high school. This app utilized the A* pathfinding algorithm to find the quickest path from one classroom to another. Because this is an Android application, Java was used as the programming language. Once the shortest path is found, a map of the school containing the path is displayed to the user.Currently, our pathfinding algorithm works and can successfully find the shortest path between two locations. Furthermore, the school has been mapped into nodes, and once it has been implemented into our program, we will be able to find paths between rooms and display them on the Android smartphone screen. Once completed, we will test the application in our school for validity and efficiency.Overall, this application will be able to supply efficient directions for new students, parents, and even emergency responders who are unfamiliar with the school layout. This application also shows the feasibility of indoor navigation systems that utilize the A* algorithm. For the future, this application could be expanded to function at other locations such as museums, college campuses, or shopping centers.

## Li, Victoria — Project #110

Research Proposal, Science, Health and Medical

### Improving Cancer Immunity By Blocking a Tumor's Sugar Addiction Through Enolase Suppression

Currently, we don't have a basic understanding of what controls T cell metabolism within tumors, nor do we know how the metabolic states of tumor cells affects those of infiltrating T cells. This project will use microRNAs, which are short RNA strands that suppress protein synthesis in cells (known as knockdown) to manipulate the glycolytic pathway of tumor cells to determine its effects on infiltrating immune cells.Enolase, a key enzyme in the production of glucose for the tumor cell, will be knocked down in malignant melanoma tumor cells using inducible microRNA sequences. To confirm that the inducible knockdown of these genes affects aerobic glycolysis in tumor cells, we will measure extracellular acidification rate and oxygen consumption rate in vitro using the Seahorse flux analyzer and other commercially available kits. These tumors as well as a control tumor from malignant melanoma cell lines will be engrafted onto different flanks of wild type B6 mice. After 14 days the tumors will be isolated, weighed, and phenotypes and functions of infiltrating immune cells will be analyzed using flow cytometry. All animal experiments will be performed according to the approved protocols of Institutional Animal Care and Use Committee.It is anticipated that results will show the knockdown of enolase will increase cytokine production of T cells. If effects on immune cells that map to particular types of metabolic pathways are discovered, this would reveal a new manner by which tumor cells influence their microenvironment and could open up several new lines of investigation.

## Li, Catherine — Project #111

Research Proposal, Science, Health and Medical

### Induction of Apoptosis in Breast Cancer Cells through Modulation of the PI3K/Akt Pathway and Subsequent Cell Cycle Arrest due to Co-Administration of Phytosomes and Phytochemicals with a Quinazoline Derivative

Breast cancer is the most common cancer in women worldwide. Current modes of treatment display high toxicity, leading to many adverse side effects on the human body. Therefore, the primary objective of this experiment is to examine whether co-administration of phytosomes and phytochemicals with WYK431 on MCF-7 and MDA-MB-231 cell lines will work synergistically to induce apoptosis through G2/M cell cycle arrest, caspase expression, and down-regulation of the PI3K/Akt pathway. Cell lines will be cultured and incubated in various concentrations of each solution. A cell viability assay will determine toxicity. Flow cytometry and western blot will assess the cell cycle as well as related cyclinB1 and cdk1, caspase expression, Bcl-2 family protein expression and regulation of the PI3K/Akt pathway. Gel electrophoresis and immunoblot will be used to detect cytochrome c release. DMSO will be used as a control. It is hypothesized that co-administration will induce apoptosis in the cells and increase bioavailability. The strongest results will be observed when a combination of substances is used. Cell cycle arrest will occur at G2/M phase, parallel to decreased expression of cdk1, CDC25C. Apoptosis will be induced, reflected by expression of caspase-3/-9, release of cytochrome c. Increased Bax expression and decreased p110alpha, p85, p-Akt expression will suggest a disrupted PI3K/Akt pathway. These results have incredibly significant future clinical applications by aiding the search towards a novel therapeutic approach for cancer treatment. High mortality rates due to metastasis may be better resolved by further investigating the anti-cancer activities of these substances. If the co-administration method of these substances can successfully induce apoptosis, they will also display great potential to be incorporated with current treatment methods for more effectiveness.

## Li, Cheyenne — Project #112

Research Proposal, Science, Health and Medical

### Obesity with Obstructive Sleep Apnea and the link to Hypertension

Obstructive sleep apnea (OSA) is a sleep disorder caused by the collapse of the muscles in the back of the throat, resulting in a decreased level of oxygen in the blood. One leading cause of OSA is obesity, and patients with OSA have an increased risk of developing hypertension. The problem this experiment will test is to determine the relationship between obese OSA patients and hypertension.It is hypothesized that because obesity is linked to the prevalence of OSA, then losing weight will help reduce the risk of developing incident hypertension. All participants who are chosen did not have a link to hypertension, are obese, and are categorized by the severity of OSA. In order to define obesity, body mass index (BMI), a height-to-weight ratio measured in kilograms and meters are used. Hypertension would be measured in mmHg. The controls will receive no weight training, while the experimental patients do. In the ending result, the percentage of the people who developed incident hypertension would be compared with the controls and experimented patients. Weight loss treatment is expected to lower the risk of developing incident hypertension for all severities of OSA. This experiment will lead to a better understanding of the cause of OSA, and continuation of future research on other risks from OSA.

## Lingareddy, Harika
## Liang, Kimberly — Project #113

Completed Project, Engineering, Physical Science

### FY16 RWDC State Unmanned System Challenge: Moisture Detection

Precision agriculture (PA) is a method of farming whose purpose is to optimize crop yield, protect the environment, improve agricultural profitability, sustainability, and augment product quality. In a world with a rapidly growing population, it is important to have a steady, reliable food supply. With technology quickly advancing, it seems practical to design and implement an Unmanned Aircraft System (UAS) to support precision agriculture.The team used a 6-step process which was provided by the mentors from Pratt and Whitney. The process involved analyzing needs and requirements, brainstorming, down selecting options, creating a detailed design, testing the system, and providing life cycle support to discover the optimal solution to efficiently detect the moisture levels in the crop and the soil in order to increase the crop yield for the farmer.The main aspects of the challenge included down-selecting the airframe and sensors, creating a viable flight plan, and composing a strong business case. The team chose to use the Albatross SP, a battery-powered fixed wing pusher propeller design. The final design also includes one hyperspectral and one electro-optical sensor.The final UAS design has the potential to change farming for the better. By detecting moisture in a cornfield, the UAS would help farmers treat their crops more effectively. Overall, crop production would then increase and the agricultural industry would be able to expand to feed the growing population.

## Lippolis, Francesca
## Dushyanth, Deah — Project #114

Research Proposal, Science, Health and Medical

### Comparing the Level of the Protein HE4 in Patients with Malignant Adnexal Masses to Patients with Benign Adnexal Masses

The purpose of this study is to compare the level of human epididymis protein, HE4, in women with benign adnexal masses versus women with malignant adnexal masses. This information may assist in the early detection of malignant adnexal masses. It was hypothesized that women with malignant adnexal masses would show significantly elevated levels of HE4. Uterine wall tissue and blood samples will be collected from women with adnexal masses, both malignant and benign. They will be processed using an ELISA protocol to determine the concentration levels of the protein. It is expected that individuals with a malignant adnexal mass will have significantly higher levels of HE4 than an individual with a benign adnexal mass. The results of this study may lead to a marker for women to determine if they are prone to developing malignant adnexal masses. Further research will need to be conducted to determine whether elevated levels of HE4 cause the malignant mass, or if the malignant mass produces higher levels of HE4.

## Liu, Felix — Project #115

Completed Project, Science, Physical Science

### The Effect of Various Conductor Materials on the Seebeck Coefficient

Thermoelectricity has potential as a clean energy source. The Seebeck effect, a part of the thermoelectric effect, is the production of voltage from the temperature difference of two dissimilar conductors. However, the voltage created is usually measured in microvolts. The objective of this project was to further research the effect of different combinations of conductors on the Seebeck coefficient. The hypothesis was that the combination containing nickel-chromium and nickel-aluminum wires will have the highest Seebeck coefficient. This was tested by creating different combinations of conductors from using two wires of different conductor materials. The two junctions that were created on the thermocouple were each put in different temperature water and tested to five different temperature differences, which were no temperature difference (0 degrees Celsius), 25 degrees Celsius, 50 degrees Celsius, 75 degrees Celsius, and 100 degrees Celsius. Voltage was created and read from a multimeter connected to the thermocouples and recorded. Wires of various conductor materials and a multimeter were necessary and two Styrofoam cups of different temperature water were used as heating and cooling devices. Physical properties of each conductor material were researched and included in graphs to find correlations between specific properties and the Seebeck coefficient. The graphed data currently shows no trends between the conductor materials and the Seebeck coefficient. Results from this experiment could be used to further the potential for thermoelectric energy as a more efficient way to produce green energy. Correlations found in the data could help find combinations of conductors with the best properties to generate the most energy through the Seebeck effect.

## Liu, Helen — Project #116

Completed Project, Science, Health and Medical

### Developing a Novel Progranulin-Derived Biologic for Gaucher Disease

Gaucher disease (GD), the most common lysosomal storage disease, is caused by a deficiency of the lysosomal enzyme glucocerebrosidase (GBA). This mutation results in the accumulation of its substrate glucosylceramide, leading to swelled lysosomes resulting in enlarged spleens, livers, and lymph nodes in patients. The current treatment for this condition is enzyme replacement therapy (ERT); however, ERT has been unsuccessful for some patients. In some cases, adverse effects have been reported. Furthermore, the cost for treatment is approximately $350,000/year. We found that the loss of progranulin (PGRN), a growth factor with multiple functions also causes lysosome storage dysfunction. Therefore, this study prompted us to test whether PGRN could have therapeutic effects in treating GD. Recombinant PGRN prevents glucosylceramide accumulation and ameliorates GD symptoms in various cell cultures and animal models. Binding assays demonstrated that PGRN binds directly to GBA and is required for the delivery of GBA from the nucleus to the lysosome. Unbiased mass spectrometry approaches identify HSP70 as a GBA-associated protein that mediates trafficking of GBA through PGRN. More importantly, we determined the essential fragment needed for this binding, Pcgin, a PGRN derivative composed of 98 c-terminal amino acids that retains the binding activity to GBA and HSP70.Pcgin appears to be the crucial part of PGRN that ameliorates diseases in GD patient fibroblasts and animal models. Collectively, these findings not only demonstrate that PGRN is a novel co-chaperone of HSP70-mediated trafficking pathway and plays an essential role in the GBA lysosomal delivery, but also provide new therapeutic interventions for various HSP70-mediated pathologies and offer a novel drug candidate for Gaucher Disease.

## Livesay, Thomas — Project #117

Completed Project, Science, Behavioral

### Impact of Handedness on Pictorial Memory

It has been hypothesized in various studies that handedness impacts memory. Studies have been conducted testing linguistic memory. The motivation is to explain the unbalanced percentage of US presidents being left handed as compared to the general population. The hypothesis is that if the varying degrees of handedness impacts the memory of a test subject, then the neutral-handers will have stronger memory because they have better use of both hemispheres which is needed in accessing memories. First a video, a handedness questionnaire, and a test on the video were designed. Consent forms and questionnaires were given to freshmen English classes as well as other volunteers. The questionnaires were completed and analyzed. After receiving consent, individuals were gathered and shown the video. Thirty seconds later, each participant completed the test. The independent variable is the varying degrees of handedness. The dependent variable is pictorial memory as represented by a participant's score on video test. Results thus far indicate that the hypothesis has been disproved. Neutral-handers have the lowest mean score. Furthermore, the highest groups were the mixed right-handers and mixed left-handers. This leads to the belief that being neutrally handed may have a negative impact on memory, and being slightly mixed leads to strongest memory. If the hypothesis was proven to be true, it could begin to broaden our understanding of the importance of handedness. There would be yet another way differences in handedness impact our ability to use both hemispheres in the brain, and therefore tasks such as memory. Future research could prove this to be true and help understand the full effect handedness has in all aspects of life.

## Lowe, Courtney — Project #118

Research Proposal, Science, Environmental

### Impact of the density of Anabaena azollae on the Azolla fern's bioremediation capabilities

Illegal dumping of wastewaters, from milling, mining, or oil refining sites around the world, pollutes the Earth's waterways and damages ecosystems. Many heavy metal ions, toxic to living creatures in very small concentrations, are found in these waters. Bioremediation may provide a cost-effective and environmentally friendly way to remove these harmful pollutants. The Azolla fern and Anabaena azollae cyanobacteria within its fronds, has been proven to have the ability to significantly absorb harmful aqueous contaminants. Research continues to determine the capacity and cause of Azolla's ability tosignificantly absorb harmful aqueous contaminants. Research continues to determine the capacity and cause of Azolla's ability to absorb heavy metal ions; cadmium, fluorine, and iron among others. By increasing the density of Anabaena azollae in Azolla, the cyanobacteria will assist in the greater absorption of pollutants. The fern's ability to attract heavy metal ions will be evaluated through elemental analysis of wastewaters before and after exposure to Azolla and Anabaena azollae. The fern with an increased density of cyanobacteria will have the greatest absorption capacity. This is due to the nitrogen fixing capabilities of the Anabaena azollae. The external source of nitrogen is used by Azolla to increase its biomass. Increased cyanobacteria will lead to the increase in growth rate of Azolla. As a result of increased plant tissue, there will be a greater absorption of pollutants. This experiment willdetermine the mechanism of phytoremediation in Azolla, and help in further research of the fern and of bioremediation. A deeper understanding of bioremediation and Azolla is an essential step in the development of greater advancements in the eco-friendly removal of hazardous waste from fresh water around the world.

## MacKay, Madison — Project #119

Completed Project, Science, Behavioral

### Students' Traits and the Stroop Effect Test

This experiment tests students who have different physical traits and different hobbies. In the experiment, subjects are tested by being timed while they complete the Stroop Effect. The Stroop Effect tests concentration and word/color processing. If students with faster times have traits in common, those certain traits supposedly improve concentration and processing skills. The traits are physical, like eye color and age, and personal, like students' reading minutes per day and how many art classes they take. The hypothesis is that if students take art classes, then they will have a faster time when doing the Stroop Test. Subjects are first asked to fill out a consent form, then answer a six question survey about their traits. After the survey, each individual is asked to identify six different colors, to make sure they can clearly identify each color that would be used in the Stroop Effect. The Stroop Effect test is explained, and then the subjects complete it while being timed. If they mess up by saying the incorrect color and don't correct themselves, a method is used to calculate the amount of seconds added to their overall time. Their time is divided by the amount of words, then multiplied by the amount of mistakes, and that number is added to the time.The data that has been collected so far suggests that those who took art classes had faster times than those who took less than 2 classes. I asked the subjects who took art classes what art subject they took. People who took forms of art that included physically painting and sketching with coloring material, had an overall quicker time than those who took more hand and shaping art like sculpting. Since the data suggests that taking painting and sketching art classes improve Stroop Effect times, and the Stroop Effect focuses on testing color and word processing, an implication is that students should take art classes based on colors t improve their processing skills.

## Maerean, Nora — Project #120

Research Proposal, Science, Health and Medical

### The Effect of Multiple Pitch Therapy on Speech Recovery in Aphasic Patients

According to the National Institutes of Health, one in 272 Americans suffer from aphasia, or loss of ability to produce and/or understand language. The use of melody and rhythm has been recommended for improving fluency in aphasic patients (Melodic Intonation Therapy). Although MIT is known to improve fluency in these patients, there is nothing documented on which key and pitch variations have a greater impact on its effectiveness. Everyday words and phrases will be translated into melodies of more than two pitches. Half of the patients with aphasia participate in therapy using two-pitch melodies, and the other half would participate in therapy that uses melodies with multiple pitches. At the end of the therapy, evaluations and assessments would be done to find the percent syllables correct and the correct number of syllables each patient can say per minute.It is expected that both the two-pitch therapy and the multiple-pitch protocol are equally effective. Therapies with more complex melodies do not yield better results in achieving fluency. One of the main reason singing helps patients speak is that there is a slower rate of articulation. The number of pitches in the melody does not significantly improve the effectiveness of MIT. Future studies testing different versions of MIT and their effectiveness should determine what the standard therapy protocol should be around the globe. This way, therapists across the country will consistently use similar protocols. Also, my research can provide further insights on music processing in brain and recovery of speech in aphasic patients.

## Mahler, Samuel — Project #121

Completed Project, Science, Behavioral

### The Effect of Different Types of Noise upon Concentration

There have been several studies on the effects of noise on concentration level from ambient sounds to leaf blowers. However, little work has been done on how different types of noise may affect people's concentration levels. This experiment focused on the effects of different types of noise on concentration level. It was hypothesized that while ambient noises would not affect concentration ability, music and leaf blower recordings would negatively affect concentration ability. The independent variable was the type of noise introduced, the dependent variable was the concentration level. In one trial, the control trial, participants took a math test with no outside noises. There were three other trials, all with the same room and lighting and time of day. One of the trials had the song Bohemian Rhapsody playing, another had wave sounds playing, and a third had a leaf blower recording playing. Math tests were timed and recorded. Subjects then filled out a survey on how, if it all, they felt they were affected by the presence of the noises. The data was then analyzed for any trends showing an increase or decrease in concentration level based on type of noise. Current data trends show no significant difference between the control and experimental trials. The experiment shows that in the very short term, background noise does not affect concentration levels in people performing math tests.This experiment may lead to further research on how different types of noise affect concentration during longer trials of concentration.

## Marini, Christian — Project #122

Completed Project, Science, Environmental

### A Novel Application of Biochar to Prevent Potential Evapotranspiration of Cotton Plants

Currently, the Great Plains Region is exposed to severe drought and global climate change. Due to such little rainfall, small farmers, specifically those of cotton, are forced to pay high prices to irrigate their crops. However, because the soil is so dry, water easily percolates through the soil, resulting in the withering and ultimate worthlessness of such crops. During September 2015, I performed a two-week examination to determine if the organic compound of biochar can be applied to soil to reduce potential evapotranspiration crops and yield tremendous plant growth. I did so by constructing two lysimeters, one of which had a white salvia plant with biochar, the other had a salvia plant without biochar. Each day, I measured the initial height of each plant, then I added one gallon of water, and after ten minutes, measured the amount of water that had percolated through the soil. Throughout the two-week examination, the plant of biochar soil grew about 24% (5.25 inches) of its original height (21.5 inches), whereas the plant without biochar soil grew only 18% (4.00 inches) of it original height (22.5 inches).My findings articulate that the organic compound of biochar should be applied to soil of crops in the Great Plains Region due to its ability to retain nutrients and water within the soil, and yield the tremendous plant growth desired by farmers of the cotton crop.

## Maro, Elise — Project #123

Research Proposal, Science, Health and Medical

### The effect of aerobic exercise on the quality of life in patients with Inflammatory Bowel Disease

Inflammatory Bowel Diseases are autoimmune diseases that cause inflammation in the digestive tract. In the field right now, researchers are trying to find a cure for this common disease and have come up short. Researchers are specifically trying to find ways to manage symptoms and foster a greater quality of life for the patient. This research will attempt to show if aerobic exercise will improve symptoms and the quality of life in those with Inflammatory Bowel Disease's. The experiment will need a patient population of about one hundred males and females with moderate-to-severe Crohn's Disease and Ulcerative Colitis and age matched controls. These patients would complete and log different aerobic exercises four times a week and complete a symptom-based survey, blood test, and fecal test at they end of each week. Based on the survey, the researcher would give a score for the patient's quality of life and compare it to that of the patient's age-matched controls. The fecal and blood tests will measure the amount of pro-inflammatory cytokines that are being expressed. The research will show that patients who exercised more would have a higher quality of life score and less pro-inflammatory cytokines compared to those who don't exercise in their age-matched controls. It is hard to manage symptoms of Inflammatory Bowel Disease's because they are not uniform among all patients.With this research, millions of people across the world will be able to manage their symptoms better than they did before and lead to longer, healthier, and happier lives. If the hypothesis is supported, then it would bring up questions about how exercise directly affects inflammation in the gut.

## Martin, Casey — Project #124

Research Proposal, Science, Environmental

### The Correlation Between the Diameter of Microencapsulated Liquid Sodium Carbonate and Carbon Dioxide Sequestration

Industrial pollution through flue gas is largely responsible for the increasing atmospheric concentration of carbon dioxide (CO2) . To mitigate the greenhouse effects of CO2, carbon capture and storage should be considered. Sodium carbonate (Na2CO3) has the ability to bond with CO2, producing sodium bicarbonate (NaHCO3), safely storing the gas. To increase the efficiency of CO2 capture, liquid Na2CO3 will be encapsulated, and the ideal diameter for CO2 absorption determined.A double capillary device will be used to manufacture different size capsules. They will consist of a liquid Na2CO3 core and a selectively permeable silicone membrane. A pH indicator will be added to allow for qualitative measurement of absorption, and will turn yellow when fully saturated. The capsules will be placed in fluidized beds, then exposed to pure CO2 gas, with the time between initial exposure and full saturation recorded.The proposed results are that the smallest manufactured capsules (about 100 μm) will have the highest surface area-to-volume ratio, thereby enabling them to absorb CO2 at an increased rate. This ratio is nearly double that of conventional methods. The small size will also allow for larger quantities of capsules to be contained in fluidized beds for flue gas filtration. In the experiment, varying diameters of capsules will be tested to determine which diameter enables the fastest absorption of CO2 from flue gas. This experiment will provide a relationship between diameter and absorption, revealing which diameter will yield the most efficient capture, and therefore contribute the most to the mitigation of global warming.

## Mathissen, Annemieke Project #125

Research Proposal, Science, Health and Medical

### Decreased Hardiness Due to Recessive Hereditary Traits in Drosophila melanogaster

In the past, crosses between male apterous drosophila, an autosomal mutation, and female drosophila melanogaster with the epistatic white eyed X- Linked trait yielded results where far fewer flies expressed both recessive traits than expected, with special attention focused on all flies with white eyes. When a chi square was done of the data, a value of 127.66 was found; far above what was expected and therefore rejecting the null hypothesis. There are many reasons that could explain this anomaly, including an unlucky mutation, harmful outside factors, transmission ratio distortion of the chromosomes during meiosis, nondisjunction, and recombination all being possibilities. Many of these, however, can be ruled out given the simplicity of the Drosophila chromosomes and its life span. One reason being investigated, however, is decreased hardiness in flies with recessive traits such as white eyes due to pleiotropy. In order to explore this idea of decreased hardiness, I first replicated the original cross. After multiple trials were done and the same results were found, I used cold shock treatment on F2 drosophila in the early stages of development. The vials containing the Drosophila were placed in a -5 degree celsius environment for 15, 30, and 45 minutes in order to kill off the weaker of the flies. The survivors of each phenotypic combination were then counted and analyzed. Sufficient numbers are still being collected.Ultimately, if this theory of decreased hardiness holds true, it is expected that with the cold shock treatment there will be a greater gap between observed number of drosophila with recessive phenotypes and the expected numbers. Any information gathered from this experiment could work towards suggesting decreased hardiness as a pleiotropic effect of recessive traits, or specifically epistatic genes. Given the Drosophila melanogaster's use as a model organism, any discoveries also have the potential to apply to other species such as humans as well.

## McCormack, Erin Project #126

Completed Project, Science, Behavioral

### The Effect of the Amount of Sleep on Efficiency to Solve Math Problems

Sleep deprivation is a serious health issue that affects many workers and students. Sleep can seriously affect a person's ability to perform, increase the risk of getting diseases, and even early death. This research project is designed to test if a person's average amount of sleep affects their efficiency in solving math problems. It was hypothesized that if an individual gets less sleep than their average amount, then their efficiency to do math problems in a certain amount of time will decrease.The independent variable is the amount of sleep a person receives. The dependent variable is the amount of accurate answers in a certain amount of time. Throughout a 2 week period during school and a 2 week period during a vacation, participants recorded their amount of sleep. After each week, participants took a test to see if, and how, the participant's amount of sleep affects their efficiency to solve math problems.The results of this experiment showed that in most cases the hypothesis was true. About 73 percent of the participants improved on their test with more sleep, thus supporting the hypothesis. About 27 percent of the participants improved drastically with increasing only one and a half hours or less.Some businesses, like Google, have used information from studies such as this to help their employees, like having sleeping pods where they can take a nap during their breaks. They are a simple solution to sleep issues for workers.This data can also be used to further develop on this research topic and go more in depth on the connection between sleep and the efficiency.

## McCormack, Kelsey
## Greifenberger, Courtney Project #127

Completed Project, Engineering, Physical Science

### Incorporating Biomimicry into Airfoil Design

This project will be testing the effect of different biologically inspired airfoil designs on normal (lift) and axial (drag) forces. Airfoils are sail, wing, and blade like structures used to study fluid motion with design. Designs have been added to airfoils such as scales, vertical indents, stabilizing fins, and vertical protrusions, to mimic desirable qualities of aerodynamic animals. The airfoils will be designed using 3D CAD modeling and printed using a 3D printer to test in a wind tunnel.They will be attached to a sting in the wind tunnel which will record the axial and normal forces when testing. The independent variable is the type of design and the dependent variable is the reaction of the lift and drag calculations to these deviations in structure. All results will be compared to the Clark y-14 model, which is the standard airfoil design. It is hypothesized that the designs mimicking fish fins with vertically stretching ridges and protrusions will display an increase in aerodynamic efficiency, or a higher lift to drag ratio. The designs with fins are expected to increase drag, but if the increase is not significant, would be an advantage on larger aircrafts to stabilize sharp turns. If these results follow the hypothesis', they could be applied to many real world ideas. Any of these ideas could be incorporated into the design of wind turbine blades, airplane wings, or vehicles which utilize fluid motion. If the stabilizing fin design does not significantly increase drag, it could be applied to planes or submarines which are forced to make sharp banking turns.

## McQuilkin, Callie Project #128

Research Proposal, Science, Environmental

### The Effect of Breeding for Aggressive Behaviors on Brain Size

During the agricultural revolution, animals were domesticated and consequently selected for increased tameness. This selection engendered brain size reductions ( as large as 33%) that can still be seen today. But how far does the trend extend? Does it work the other way around? Does breeding for aggression (rather than reduced wariness) result in a selection for larger brain size? What parts of the brain are affected and to what degree? Data will be obtained on brain sizes (compared to body mass) of animals with more aggressive counterparts (such as the pitbull terrier vs. the normal terrier). Afterwards, sizes of different regions of the brain specific to species studied will be researched. Results will be analyzed to conclude if there exists any noticeable difference in brain size compared to body mass, or the amount various parts of the brain were affected. Expected to see increased brain size in more agressive breeds. Expected to see limbic system (which controls hormone production and therefore reaction to stress) increase by the largest amount.Counterintuitively, intelligence has no correlation to brain size. Often, undomesticated species are thought to be more "primitive" than their tame counterparts. However, if the expected results are obtained, this experiment will demonstrate the dependence of cranial capacity not on IQ, but on environmental selective factors out of the control of the domesticated species.

## Meehan, Katherine Project #129

Research Proposal, Science, Health and Medical

### The Effects of Leg Length Discrepancies on Running Mechanics in Runners

A leg length discrepancy is a difference between the length of each leg. There is a lot of data supporting the idea that severe leg length differences, greater than 6 cm, forces the body to find ways to compensate for the difference in length, can greatly impact running mechanics, and can cause extreme pain. On the contrary, there is little information on how smaller discrepancies, less than 6 cm, affect gait and how the body functions. There are theories that leg length discrepancies may lead to stress fractures, lower back pain, and osteoarthritis, as well as many other pelvic, knee, and lower leg injuries. This project will compare those with leg length discrepancies to those with undistinguishable differences. The participants will fill out a questionnaire about past injuries and any pain they experience. Then height, weight, and leg length will be measured. Participants will warm up for 5 minutes at 4.8 km/hr and then run on the treadmill for 7 minutes at 10.5 km/hr while the sensors record the biomechanical factors and forces and compare each leg to each other. Afterwards, participants will be allowed to cool down for as long as they want at a speed they can control. It is hypothesized that those with distinguishable leg length discrepancies will have experienced a stress fracture, lower back pain and osteoarthritis more often than those who have undistinguishable leg length differences and will have higher impact forces and a shorter time to the active peak on their shorter leg. The results of this project can help determine if leg length discrepancies contribute to differences in running mechanics, which may be the source for specific injuries or chronic pain.

## Mehta, Tanmay Project #130

Research Proposal, Science, Health and Medical

### Electrospinning Proteins to Develop a Replicated Extra-Cellular Matrix to Promote Hemostasis in Trauma Patients

Trauma patients often die because of uncontrolled blood loss due to their inability to clot the blood wound quickly enough. To help them achieve hemostasis, an artificial ECM (extracellular matrix) will be replicated and injected into the site of injury to quicken the process of hemostasis. The ECM is a complex, heterogeneous network of proteins, growth factors, and polysaccharides which helps keep cells in a stable state.Previous studies have implemented the electrospinning technique to develop nano-scale fibers. In this proposed experiment the ECM's proteins –collagen, fibrin, etc– will be electrospun to develop a replicated scaffold for the cells.It is expected that the results of this experiment will show a significant decrease in the time it takes for the fibrin clot to form on the wound. This will be characterized by an Activated Partial Thromboplastin Time which measures the time it takes for a fibrin clot to form.The results of this experiment will determine if electrospun fibers in an ECM can promote hemostasis for trauma patients once the ECM has been incorporated into the site of injury.

## Miller, Nicole — Project #131

Research Proposal, Science, Behavioral

### fMRI as a Lie Detector

To explore the implications and effectiveness of the fMRI and a combination of lie detectors versus other methods of lie detection. As of now there are no accurate lie detectors, and if there were, it could solve problems in court and in the law. The fMRI is the closest and most precise lie detector and it has room for improvement to become even more so. Group of 5 males and 5 females, tested in an fMRI and a combinations of fMRI and other lie detection methods including micro expressions and temperature. The conditions will be truth, lying, and lying with deceit directed at the lie detector. After tests, analyze and find the differences between each, and compare to find which was more accurate.This is based off of journal articles by G. Ganis. et al. Combining multiple forms of lie detection into one test could lower the ability for deception to occur during test, and may result in a more accurate lie detector. This should show differences in brain activity between all three conditions and the combination should be more accurate than the fMRI by itself. In the future this research can be applied in labs to create a new lie detector that branches off of the fMRI and could be used commercially like the polygraph once was.

## Minsky-Fenick, Eitan — Project #132

Completed Project, Science, Behavioral

### The Effect of Payoff Size on the Power of Loss Aversion

This project determined whether the extent of loss aversion scales with the size of the payoffs. I hypothesized that loss aversion will increase with the size of the payoffs. The outcome of this experiment has impact on the way we teach fiscal responsibility to children. Also, this will change our understanding of loss aversion, resulting in potentially better experiments in the future.This project used the scale of the payoffs (both gain and loss) as the independent variable, and the acceptance of certain games of chance as the dependent variable. The tools used are a survey designed to determine loss aversion at certain payoff sizes, as well as to collect demographics. The survey was distributed using Amazon's Mechanical Turk Human Intelligence Task crowd-sourcing system.Data is still being collected, but preliminary data suggests a strong correlation between payoff size and the power of loss aversion. It is clear from the data that high potential for loss, even when accompanied by high potential for gain, is less often accepted than low risk, low reward games. All data will be analyzed using appropriate statistical tests, such as T-tests.This correlation has implications both for future research and for current practices. If future data continues the present correlation, it can be concluded that the size of the payoff affects the power of loss aversion. This implies that financial responsibility at a certain monetary magnitude may not scale to other magnitudes. Also, the outcome of this research will hopefully form the basis for more specialized research in the future.

## Molot, Henry — Project #133

Completed Project, Science, Physical Science

### The Effect of Air Pressure on the Distance of a Soccer Kick

Due to conflicts in the field of sports involving deflation, the air pressure levels of sports balls has been a hot topic among scientists and athletes. Much research has been done, but questions remain unanswered about deflation vs inflation. The problem statement is: when the distance of a soccer kick is concerned, is it best to inflate a soccer ball past its recommended PSI level, or deflate it below that level?Multiple tests are needed for this project. In test one, two virtually identical soccer balls of the same model and material will be kicked, at the PSI of 13.1. Both balls will be kicked at this level of PSI 3 times. The ensuing tests will involve each ball being reduced by 0.5 PSI. This process will be repeated until the PSI level reads 3.6 PSI. The balls will be kicked.....by a kicking machine that is constructed by the experimenter and the mentor. This machine will kick each ball at the same force among all tests. The preliminary data shows that levels of PSI below the recommended level results in a decrease in the distance of a kick. However, this trend only becomes easily noticeable when the PSI level is below 3 PSI.In the future, the experiment will be continued by not only testing soccer balls but also playground balls and basketballs. The data collected with other types of balls will provide useful information about whether the trend of lower PSI leading to lower distance is a common occurrence among other types of balls. This will help to prove that PSI levels do impact distance in many sports, not just soccer as the preliminary data suggests.

## Mongillo, Leah — Project #134

Completed Project, Science, Behavioral

### The Effects of Dance on Young Girls' Communication Skills

The purpose of this study was to see the effects of dance young girls' communication skills. This study was done to learn the possible benefits of dance and find treatments for children with problems communicating. The hypothesis was participants who dance will have better communication skills than non-dancing participants. The independent variable is whether the participants dance and the dependent variable is the participants' communication skills. Participants (ages 5-7) and their parents were asked to anonymously fill out a short survey. There were two different surveys, one for the children and one for the adults. The scores will be totaled and participants with higher scores will have better communication skills. The participants were taken from an elementary school and a dance studio. The data will be collected from January 6 to January 15. The average of both surveys for the dancers and non-dancers will be found. A t-test will be done to find the statistical significance of the results. If the results support the hypothesis it would be beneficial to children who have trouble developing their communication skills. Dance could be a way to increase communication skills in children.

## Moon, Jasmine — Project #135

Completed Project, Science, Health and Medical

### The Effect of Functional Ankyloglossia

Ankyloglossia, commonly known as "tongue-tie," is characterized by a tethered frenulum that decreases tongue mobility. The incidence of ankyloglossia in infancy ranges from 3-16% but its association with later speech dysfunction is highly controversial. The motivation of this study is to find evidence of such association by measuring tongue mobility and recording any history of speech problems within a high school population. The hypothesis is that there is no relationship.A single rater measured tongue protrusion (TP) using a 5-point TP test designed as follows: 5-tongue reaches lip, 4-tongue reaches over lip, 3-tongue reaches halfway up philtrum, 2-tongue reaches the columella, and 1-tongue reaches tip of nose. A TP score of 5 was defined as "functional ankyloglossia." Next, queries about previous knowledge of ankyloglossia and any history of speech problems were assessed through a short survey.Of 121 participants, 13 (10.7%) had a TP test score of 1; 25 (20.7%) a score of 2; 72 (59.5%) a score of 3; 10 (8.3%) a score of 4; and 1 (0.8%) a score of 5. Speech problems affected 11 (9.1%), and the single participant with "functional ankyloglossia" had normal speech. There was no association between TP test score and speech problems (p=0.37, Fisher's exact).The findings in this study suggest that a) "functional ankyloglossia" is uncommon in adolescents; b) ankyloglossia, if present in infancy; is "outgrown" by adolescence; and c) ankyloglossia and speech difficulties are unrelated. These observations support the arguments in the medical literature that interventions to treat ankyloglossia (e.g. lingual frenectomy) in infants are mostly unnecessary. These results may be of interest to pediatricians and speech pathologists.

## Moran, Kristen — Project #136

Research Proposal, Science, Behavioral

### The Origin of Birds: Examining Cranial Development of Embryonic Specimens

The archaeological record shows that, almost as long as there have been humans, there has been a fascination with birds. Cave paintings depict the creatures, wings outspread, taking to the skies. We have conquered the mystery of flight, our modern airplanes soaring through the skies, but there is much left to learn about these animals. John Ostrom of Yale University began the Dinosaur Renaissance with his support for a dinosaur-bird relationship in the late 1960s, and through contributions of many important figures, perhaps most notably Jacques Gauthier solidifying the application of the phylogenetic approach in the field, further investigation is now possible. This project will examine wet embryonic specimens of various reptilian species from the Yale Peabody collection and compare the cranial development of multiple avian species (most notably Dromaius novaehollandiae, Eudromia elegans, and Struthio camelus) to that of a non-avian reptile (Alligator mississippiensis) to find differences in maxillary development and brain case development, with respect to timing, speed of growth, and center of growth. These results will be used to determine more specifically when avian dinosaurs diverged from non-avian reptiles. The microscope photography of these specimens is currently underway, and this analysis will take place once the photography is completed.

## Morosky, Mikayla Project #137

Research Proposal, Science, Behavioral

### Assessing the Effectivity of Instructional Videos in Medical Education: A Meta-Analysis Study

Based on systematic review and meta-analysis of literature in medical educational journals, the purpose of this study is to determine whether videos improve the immediate and long term learning of procedural skills by medical students and residents, medical student and resident confidence of their ability to perform the procedural skills presented and performance on assessments of procedural skills after being granted access to an instructional video.To carry out the systematic review, an electronic search of studies is to be carried out on online databases. Studies, fitting certain inclusion criteria based on the research question, from the search will be included in the meta-analysis process, where data will be extracted from them and entered in to a meta-analysis generator software which will be used to generate a forest plot chart, displaying the overarching outcomes of each of the selected studies combined. The primary outcome for this meta-analysis will be performance of procedural skills presented to the students and/or resident physicians, represented through assessment of performance and reported as follows: percent correct/incorrect, accuracy, precision, time to completion or external reviewer performance rating. The secondary outcomes will be confidence in performing procedural skills by medical students and/or resident physicians, as well as the long term retention of the performance and confidence in learned procedural skills. By completing a systematic review of the published literature and performing a meta-analysis of smaller experiments that have been carried out to assess how well videos instruct medical students, it can be determined whether video instruction has a positive effect over traditional styles of teaching, such as textbooks and lectures, by allowing factors such as students performance of procedural skills, confidence, and knowledge to be more successful with video instruction, outweighing disadvantages, such as the cost and time required for video production

## Morr, Caleigh Project #138

Research Proposal, Science, Health and Medical

### Reversal of Type 1 Diabetes Following Combination Therapy with Antibodies Otelixizumab and Tocilizumab

Type 1 diabetes is an autoimmune disease for which there are treatments but no cure. It progresses as T cells of the immune system attack and destroy insulin-producing beta cells in the pancreas. To discover a method to reverse the disease, extensive research is currently being done with antibodies, proteins in the immune system that regulate health. Otelixizumab is one antibody that has been shown in past studies to stop beta cell destruction, reversing diabetes. However, high doses of otelixizumab cause adverse effects such as cytokine release syndrome (CRS). CRS is a complication in which the immune system releases harmful signals, causing fever-like symptoms such as nausea and headache. As demonstrated in past studies, CRS can be reversed with the antibody tocilizumab. A combination therapy of otelixizumab and tocilizumab will effectively reverse diabetes while treating any adverse effects that arise, such as CRS. The experiment will be done in a humanized diabetic mouse model, or a mouse that responds to a treatment similarly to how a human would. Both antibodies will be infused intravenously: otelixizumab at a dose of 60 mg and tocilizumab at a dose of 8 mg. Treatment efficacy will be measured by levels of C-peptide, a byproduct of insulin biosynthesis found in equal levels as insulin. It is expected that C-peptide levels will increase in mice treated with both antibodies, indicating that beta cell destruction has stopped and diabetes has been reversed. Symptoms of CRS, if they appear, will improve soon after treatment. Researching methods to treat diabetes is important as a cure would improve millions of lives. This research could also lead to the development of other similar treatments involving antibodies.

## Murphy, Eva — Project #139

Completed Project, Science, Health and Medical

### Using chicken forebrain neurons to visualize the localization of L1CAM protein mutations

CRASH syndrome is a disorder associated with a mutation in the L1CAM gene. The L1CAM gene instructs how the L1 protein develops. L1 protein is vital in the organization of neurons, the development of myelin sheath and the formation of synapses. Humans with L1CAM mutations grow up with a significant developmental disability. I believe that L1CAM protein mutations will localize in different areas of a neuron when compared to non-mutated L1CAM proteins. Culture plates and chicken embryo forebrain were prepared. Mutant DNA was added and transfected. Cultures were incubated with the primary antibody, 5G3. Cultures were permeabilized and incubated with secondary and tertiary antibodies. Observations were made on a microscope and digital images acquired. Average pixel intensity was measured along each drawn line segment and pixel values analyzed. Currently, from visual data we have concluded that the P941L mutation has localized along the axon as expected. The D544N mutations localizes in cell soma, which was not expected. This is because the mutation likely causes the protein to change shape and get stuck inside of the endoplasmic reticulum; therefore, causing the mutation to localize in the soma. Discovering where these proteins and mutations are expressed will have a societal impact by providing a launching point for further research. We can then look at what types of proteins lead to the mutations localizing where they do, which in turn provides more insight into CRASH syndrome and how it works.

## Nadelmann, Julia
## Saxe, Sarah — Project #140

Completed Project, Engineering, Physical Science

### Designing a Bench-top Pump Using Ferrofluids and Electromagnets

Heart disease is the leading cause of death worldwide. Patients who progress to end-stage heart disease are limited to heart transplantations, but donor shortages allow only 2000 people annually to receive these. An alternative to transplantations is a Ventricular Assist Device (VAD) which support failing hearts. VADs pump blood using complicated bulky machinery, often resulting in blood clotting. A solution would be to combine the advantages of a positive displacement pump with a continuous flow pump by using ferrofluids and electromagnets. A device similar in structure to a brushless motor was created. The device had an outer ring of electromagnets wrapped together by magnetic wire around a metal stator, a polytetrafluoroethylene tube which blood would travel through, and an inner tube filled with a ferrofluid. The wrapped magnetic wires were connected to a controller enabling electric current to be isolated to individual wires. Using the controller, a mechanism was created to cycle electricity through the electromagnets so that only one magnetic field was present around the stator at any given time. It cycled through this consecutively. When one of the electromagnets was activated the ferrofluid was attracted to it. The flexibility of the tubing permitted the ferrofluid to compress the tube of blood and propel it forward as the magnetic fields, and thus the ferrofluids, cycled. The pump is expected to be successful in clinical testing as the machinery will not come into direct contact with the blood.Thus, the device will reduce the likelihood of post-operative bleeding and increase the time a patient can be placed on a ventricular assist device prior to receiving a heart transplant.

## Narang, Nic — Project #141

Completed Project, Science, Environmental

### The Habitat of the Asian Shore Crab

The invasive Asian Shore Crab has destroyed aquatic habitats along the Long Island Sound since the late 1800's. In order to combat the problem, it is imperative that the crab's primary habitat is discovered in order to take further action.First determine the site that you will be testing at. Next, take the temperature of the air and the water in degrees fahrenheit. Before beginning the experiment, measure the distance between the shoreline and testing site. Next, place a hula hoop over the testing site and count the amount of crabs within the hula hoop. Next, capture as many crabs as possible and measure the size in inches. Lastly, finalize the data and repeat the steps for the next site.There were significantly more Asian Shore Crabs in rocky habitats compared to other tested habitats, thus proving that the species prefer rocky areas. The crabs in the rocky habitats closest to the shoreline were generally the largest. While there were crabs in the marshes and muscle reefs, the crabs struggled to fill up the hula hoop. The estimated ratio of crabs in rocky habitats to those in muscle reefs and marshes is 6:1.Based on the results, action can be taken to combat the Asian Shore Crab population across the Long Island Sound in its primary choice of habitat; rocky shorelines. Since the crab continues to migrate further south, coastal regions can use methods of prevention in rocky shoreline habitats that may be threatened.

## O'Connor, Kelsey — Project #142

Research Proposal, Science, Environmental

### Using Octadecanol to Prevent Freshwater Evaporation

With many places suffering from droughts, the effects of evaporation can be devastating. The shortage of water caused by water evaporation drastically affects many states and nations. This project uses the chemical compound, octadecanol to prevent freshwater evaporation for use in public water supplies including hydropower and drinking reservoirs. If the compound is effective at preventing water from evaporating at a fast rate it can be used on a large scale to conserve water and save millions of dollars lost from evaporation. In order to execute the experiment, there will be several smaller scale experiments which will involve using 150 mL beakers and a UV lamp placed directly over the beaker to mimic the sun. 1 beaker will contain just water to determine if water will evaporate using the UV lamp. The second beaker will contain water and a small amount of octadecanol, around 0.5 grams per 125 mL. The 3rd beaker will contain 1 gram of octadecanol. The 4th beaker will contain 2 grams of octadecanol. Finally 2 tests will be done using sea monkeys to insure that the compound has no harm on any lifeforms. After finding the results there will be a test on soil to see if it is effective in preventing evaporation of water in soil, for agricultural purpose. This experiment should be effective at preventing evaporation at a rate of around 30 to 40 percent. Smaller tests may result in a lower evaporation rate over a larger scale experiment. But the experiment should result in preventing evaporation. This experiment should also be compatible with life, as the compound is safe for human consumption as well. Octadecanol has a waxy texture and is hydrophobic which allows oxygen to still penetrate the water. This should effectively make a biofilm layer in which is effective at preventing evaporation and is safe for animals.There may be trouble when testing this experiment in a large setting as there would have to be larger amount of the compound. It also would be difficult to determine the exact measurements of water evaporation. In addition other factors come into play including freezing,nonconstant sunlight, and animal habitation, which can have an effect on the overall test.

## Oleynik, Ryan — Project #143

Completed Project, Science, Physical Science

### Aggregation of Phospholipid Based Vesicle Using Triblock Polymer

The motivation of this study is to learn more about the effect of lipid to polymer ratios on the biosensing platform in lipid-based vesicles. Nanoparticles are useful because of their ability to detect cancer in the body with the aid of antibodies. This early detection is crucial in avoiding the rapid spread of tumors. In this study, nanoparticles were synthesized for bio-sensing applications. This was accomplished by combining a long chain lipid (dipalmitoyl-sn-glycero-3-phosphocholine, DPPC) and a short chain lipid (diheptanoyl-sn-glycero-3-phosphocholine, DHPC). After this, the nanoparticles underwent a temperature cycling procedure. Next, the nanoparticles went through a 100nm extrusion filter. This transformed the multilamellar vesicles (MLVs) into unilamellar vesicles (ULVs). The polymer (polypropylene oxide - polyethylene oxide - polypropylene oxide) was then added to the samples, which served as a linker to create a cluster of ULVs.The clustering process was monitored using apparent UV absorption and dynamic light scattering. Dynamic light scattering reflects the hydrodynamic radius of the particle and UV absorption records the change in turbidity. If large clusters are formed, then both the UV absorption and the hydrodynamic radius will increase. Three different polymer to lipid ratios were used: 2.5:1, 1:1, and 0.5:1.The results show that with an increase of polymer to lipid ratios, the aggregation process was facilitated.The nanoparticles were fabricated at the Self-Assembled Functional Nanomaterials (SAFN) lab under the mentorship of Professor Mu-Ping Nieh. The results of this study could provide a more effective way to detect malignant cancer cells in susceptible patients.

## Panageas, Krista — Project #144

Research Proposal, Science, Health and Medical

### Using Bioluminescence to Further Malaria Drug Treatment

Malaria is carried by the Plasmodium falciparum parasite which is transferred into the human bloodstream from the saliva of mosquitoes. Then, it goes through a long, five-stage maturation period, making it hard to conduct research. It is important to be able to see each phase of the parasite to find the stage that it is the weakest in, in order to create a drug which will attack it then.Two types of illuminates will be tested for quality, one the bioluminescent Renilla luciferase. The other is a combination of the chemiluminescent Rluc probe and green fluorescent protein, which is brighter yet sometimes unstable in vivo. The parasite will then be tested with an antimalarial drug five times, once at each stage to find out when the drug is the most effective.The green fluorescent protein will be better at illuminating the parasite at each stage because it emits a strong light, yet it is not as sensitive or stable as the Rluc, therefore some problems may occur. Also the parasite will be weakest in its earlier stages due to the fact that it is still developing. This work will help to advance drug technology and effectivity, if it can target the P. falciparum at a specific weak stage. The use of bioluminescence in this experiment will prove which type is more effective on the parasite, so that it can be later used in drug tests on the P. falciparum. Hopefully this research will be able to aid drug production and Malaria research.

## Pasa, Alin — Project #145

Research Proposal, Science, Behavioral

### The Temporary Effect of External Factors on Moral Foundations

This experiment aims to answer the question: Do external factors influence people's moral foundations, at least temporarily? The purpose of this study will be to determine if moral foundations are altered by the circumstances experienced by individuals. It is hypothesized that external factors, especially negativity, will affect one's moral choices temporarily.This experiment will test for morality changes through a tri-test group, test and control format. Group A and B will be subject to treatments, designed to be positive and negative external factors. Group C will be the control group; they will not be given a treatment. Post treatments, the questionnaire, Moral Foundations Theory questionnaire, will be administered to all groups.The difference in results from the treated groups will be contrasted and analyzed against the control group. This experiment will provide a foundation that leads to further research such as possible influence of media on society's morals.

## Pashankar, Neha — Project #146

Completed Project, Science, Health and Medical

### Comparing mGluR5 Availability between Patients with BD-Dep and MDD-Dep and Healthy Controls Using PET

One of the three cycles of Bipolar Disorder is depression. Currently, the lack of a biological marker distinguishing between Bipolar Depression (BD-Dep) and Major Depression Disorder (MDD-Dep) leads to a frequent misdiagnosis. The glutamatergic system of the brain could be a potential marker. [18F]FPEB PET scan uses a mGluR5 (Metabotropic glutamate receptor subtype 5) ligand that can quantify the mGluR5. In this study, the aim is to assess whether the mGluR5 is a mechanism to distinguish between BD-Dep and MDD-Dep, and whether it can be used for advancements for treatment for BD-Dep. The independent variable is the type of illness. The dependent variable is the mGluR5 availability, measured by volume of tissue (VT), the equilibrium ratio of tissue-to-plasma binding. First, the presence of absence of a current depressive episode was confirmed by the structured clinical interview for DSM-IV diagnoses (SCID) for patients, other diagnostic surveys, and information about the subjects' history. Subjects also took cognitive testing before the scans. Next, subjects participated in an [18F]FPEB PET scan and were scanned for 30 minutes while radiotracer steady levels for 90-120 minutes. Before and during that time, blood samples were acquired to determine VT. Data is all collected and is being analyzed to assess regional (ROI) differences, primarily the ventromedial prefrontal cortex and the ventrolateral prefrontal cortex, between groups using analysis of variance (ANOVA). If mGluR5 proves to be a biological marker between BD-Dep and MDD-Dep, there would be a significant decrease in misdiagnosis and improve the treatment for patients with BD-Dep.

## Pashankar, Sana — Project #147

Completed Project, Science, Behavioral

### The Likeliness of Similar Emotional Sensitivity Between Siblings

In this experiment, the question that will be investigated is whether siblings will show similar emotional sensitivity at a higher rate than a pair of unrelated individuals. This experiment will contribute to the greater topic of discovering the likeliness of certain gene groupings and variations between siblings. It is expected that if siblings take a test for emotional sensitivity, then they will have a higher likeliness of similar emotional sensitivity than unrelated individuals, possibly due to the fact that they both contain a specific gene variation. The independent variable is whether or not the subjects are genetically related, and the dependent variable is the degree of emotional sensitivity. To conduct this experiment, a group of fifteen pairs of siblings from grades nine through twelve will be gathered, keeping gender constant for specific pairs. All of the subjects will then take the Highly Sensitive Person Quiz individually and will be given a score based on their answers. The scores will then be compared between the original sibling pair and an unrelated pair of individuals. So far, the data seems to show a negative association between siblings and their emotional sensitivity scores. Based on this information, either most siblings seem to lack the certain gene that affects emotional sensitivity or have been affected by extraneous background experiences that affect their emotional sensitivity. If siblings were to show a greater likeliness of similar emotional sensitivity, this could show that not only physical traits but also psychological tendencies or preferences could be inherited through genetic makeup. With this information, scientists in the future could perhaps base their conclusions about one person through the psychological aspects of their brother or sister. This could be used as a tool in fields such as criminal psychology or law enforcement.

## Passannante, Grace
## Heinzerling, Kelly — Project #148

Completed Project, Science, Behavioral

### The Effect of Zoo Visitors and Noise Levels on the Stereotypies of Gorillas in Captivity

Stereotypic behavior is a repetitive self-destructive behavior in captive primates that can result in physical and mental problems. This behavior includes pacing, scratching, eating dung, and repetitive regurgitation. The purpose of this study is to determine if the number and noise level of zoo visitors affect the number and type of stereotypies exhibited by captive gorillas. The number and type of stereotypies exhibited by the gorillas were recorded at a major zoo during a range of visitor and noise levels. Stereotypies recorded during low visitor and noise levels served as the control and were compared to those exhibited during moderate to high visitor and noise levels. The noise levels were recorded using a phone application, visitor levels were recorded using a scanning approach, and stereotypies were recorded using the all occurrence method. An ethogram was used to define certain stereotypies and ranges of visitor numbers and noise levels. The data suggests a correlation between higher visitor levels and a greater frequency of certain stereotypies, such as eating dung, scratching, and repetitive regurgitation. Noise levels did not significantly affect stereotypies. This is an important study because stereotypy research is lacking for most zoo species. The findings suggest that further research be done to better regulate both the number of visitors and noise levels at exhibits in order to promote captive gorilla welfare.

## Patel, Rohan — Project #149

Completed Project, Science, Health and Medical

### GABA Responses in Adult MCH Neurons

Melanin-concentrating hormones (MCH) play a critical role in energy and sleep homeostasis, and losing these neurons can result in a substantial lack of sleep. GABA is an amino acid that promotes sleep by inhibiting a neuron called hypocretin (HCRT), which is essential for maintaining wakefulness. This in turn excites the MCH neurons, which allows for sleep. The purpose was to discover if GABA depolarized MCH cells and increased calcium.An olympus microscope, electrical stimulator, and light stimulation were used to record information of the cells.The responses of the MCH neurons were recorded when white light was shined upon the the neurons which allow the expressing channelrhodopsin in all cells and photostimulating cells to release GABA. The amount of calcium present in the cell will be determined by a fluorescence technique: the more fluorescence, the more calcium. Calcium was more abundant when 100 micromolar glutamate was relased onto the MCH cells, but GABA did not seem to have as plenty. However, the cell quality and location could be factors. Inhibition responses were of neuropeptides. When antagonists were applied to the cell, there was a very similar response, and it could not have been another neurotransmitter because inhibition was gradual. Spontaneous depolarization was inferred to be glutamate.GABA had the ability to excite MCH neurons, but depolarization doesn't generate only excitatory responses. It also led to the ability to lead to spike generation of shunting inhibition, also known as postsynaptic potential inhibition. So, depolarization also could be due to Chlorine efflux that springs from MCH neurons. The data indicated the possibility that different groups of MCH neurons play different roles in the function of the MCH system.

## Percarpio, Connor — Project #150

Research Proposal, Science, Environmental

### The effect of Nitrogen levels on Arginine in Macroalgae

Problem: How will the levels of Nitrogen and the acidity of the Hawaiian waters affect the levels of arginine in the macroalgae and therefore the levels of FP. Fibropapillomatosis or FP is a deadly tumor forming disease that is spread through a herpesvirus that is commonly found in Hawaiian Green Sea Turtles (Chelonia mydas). FP levels in these turtles have varied over the years, peaking in 1990. Studies have been done on FP, linking the disease to the turtle size, Nitrogen levels in water, and most importantly, macroalgae.The Nitrogen levels of three hawaiian islands will be recorded with a nitrogen footprint. Samples of macroalgae will collected in these areas and will be tested for the levels of amino acids. Expected results are increases in the levels of Nitrogen directly link to the increase in levels of arginine in the macroalgae. Levels of Nitrogen will also be expected to lead in the increase of macroalgae itself due Nitrogen helping proteins and enzymes grow. If the hypothesis is correct then the levels of nitrogen will directly link with arginine and therefore, the levels of the deadly disease fibropapillomatosis in Hawaiian Green Sea Turtles.Recently researchers have found that turtles who carry the FP virus also have multiple elevated amino acids. These are glycine, arginine, proline, alanine, and serine. Out of those five amino acids glycine, proline, and alanine are known to be linked to tumors. However, arginine links directly to FP because it is known for spreading herpesviruses, arginine is also found in macroalgae. This experiment will study how the changes in nitrogen levels affects the levels of arginine in the macroalgae.

## Pfrommer, Samuel — Project #151

Completed Project, Science, Physical Science

### Relationships Between Current, Angular Velocity, and Torque in Position-Controlled Servos

In the robotics literature, many balance and stabilization algorithms output a set of joint torques, one for each of the robot's actuators. This raises the barrier of entry for beginning researchers and hobbyists, who have to purchase expensive torque-controlled servos rather than conventional position-controlled servos.The purpose of this experiment is to determine whether it is feasible to accurately control the output torque of hobby servos by measuring in real time easily observed variables such as current draw and servo position. A series of experiments are conducted using a position-controlled HJ S3315D digital servo under various loads. The current and angular position are measured while the servo is working both with and against the load.The results show that once maximum speed has been reached, the shaft torque can be estimated using either current or angular velocity while the servo is rotating against the load. However, the 200 millisecond latency before maximum speed is achieved is prohibitively large for most practical applications.In the case where the servo and load are working in the same direction, there is no meaningful relationship between the torque and the velocity or current.

## Pfrommer, Daniel — Project #152

Research Proposal, Science, Physical Science

### Post-detection AprilTag Motion Blur Correction

In many visual fiducial systems, motion blur is a major source of error in the accurate localization and detection of markers. In particular, it has been noted that the AprilTag algorithm, although relatively robust, is significantly affected by motion blur, which causes it to erroneously localize tags. This problem is especially prevalent indoors and on mobile platforms, where poor lighting conditions and quick movements result in increased motion blur. The existing AprilTag algorithm uses a line detection system to determine the borders of the marker, which, if blurred, causes the detected corners to be offset by several pixels. Although relatively small, these errors are a major hindrance to using fiducials for gathering ground-truth data for camera localization. To reduce this error, a two-part investigation is proposed. First, various types of motion blur will be applied to determine the effects of motion in blur on the localization of both the marker and the camera. Secondly, a post-detection correction algorithm which uses the positions of the internal features of the markers to correct the markersŠ—È locations will be used to better localize the fiducial. It is predicted that these adjustments would determine the extent of error caused by motion blur as well as allow for more accurate tag localization. These improvements would allow for the use of fiducials to determine ground-truth data for the comparison of camera localization algorithms.

## Pickett, Maddie — Project #153

Completed Project, Science, Physical Science

### Surface Type's Affect on Bacterial Growth Rates

In this experiment, different surfaces were tested to see which surface would promote the least bacterial growth. The motivation for this experiment was to distinguish which surface should be used in an environment where bacteria is not wanted, like school desks or bathroom counters. The hypothesis for this test is if bacteria is grown on different surfaces, then there will be the least bacterial growth on metal. The surfaces were sterilized prior to the experiment using UV light. The bacteria (Bacillus brevis) was swabbed onto three different surfaces (wood, metal, and plastic) using sterile swabs and sat for two days in petri dishes. Then the bacteria was swabbed onto agar dishes, sealed with parafilm, and placed in an incubator and left to grow for two weeks. The independent variable in this experiment is the type of surfaces the bacteria is growing on. The dependent variable is the rate at which the bacteria grows. The results showed that there was the most bacterial growth on plastic, then metal, and the least on wood. The findings suggest that in an environment, plastic is not a prefered surface to use if bacterial growth is not wanted. The hypothesis was incorrect because the least bacteria grew on wood. Based off the results, this experiment could lead to another test to find how different plastics can affect bacterial growth. These results could help provide information for environments that strive to be "germ-free", such as schools.

## Pratt, Charles — Project #154

Research Proposal, Science, Environmental

### How Soil Nitrogen-Nitrate Concentration Based Application Affects Soil Nitrate Losses

How much more accurate is using soil nitrate-nitrogen concentrations for predicting nitrogen needs than traditional methods of nitrogen application? My experiment plans to answer this question and more. After reading journals and communicating with my mentor I formed this problem based around areas lacking in research in the field of nitrogen and nitrate sorption. An excess of nitrogen can lead to plant death and eventually harmful blooms in runoff water.This experiment requires a 30x40 foot plot of land, which will be at RHS or my house. The plot will be set up based on UConn plots for testing. In early May, soil samples will be taken and different fertilizers applied to different sections of the plot. Every few weeks the fertilizers will be reapplied, chlorophyll measured, and samples of soil taken and analysed for nitrate composition at UConn.The results of this experiment will be most likely accurate and function to add data to previous experiments along with providing data about the effectiveness of certain fertilizers. The soil samples taken during my experiment will be analysed at UConn's soil labs and will be measured for nitrogen content. Chlorophyll meters will also be tested for accuracy. We expect a direct correlation between application strategy and losses in soil. Using the results I expect to receive from this experiment, I will have determined a way to more accurately predict nitrogen needs vs. excess nitrogen in turf grass. This will enhance farming and reduce nutrient pollution everywhere soil testing is viable. These findings will be shared with scientists in this field of study, as well as, members of the agricultural community.

## Price, Alex — Project #155

Research Proposal, Science, Environmental

### Methane's response to changing climate

The purpose of this research is to study wetland sources of CH4(Methane) and it's responses to the climate. This is important because there is much more research to be done on this specific topic. Pursuing this research can really help the field of climate change. This research can do this by giving projections of amounts of methane emissions, and how this could change the increase in temperature. The first thing I will to do is look at previous research done that involves methane emissions, and their relation to climate change. Then I will collect data and measurements of emissions from the canadian permafrost region by looking at it for a certain period of time. From this I would like to develop a model with a mentor that shows methane and it's responses to the environment.Based on broad studies, and models, it is predicted that there will be a 30-50% decrease in the area of permafrost. The predictive models will look at possible responses of methane to the changing climate. The results of my study would compare the increase in temperature to the increase in methane emissions.The information the models contain could be used as great help for researchers in this field. The different possible scenarios of methane emissions can provide valuable information for slowing down global warming. It would do this by showing how much the methane emissions are increasing by, and what that is doing to the increase in temperature.

## Puchall, Daniela — Project #156

Research Proposal, Science, Behavioral

### The Effects of Energy Drink Consumption on Frequent and Infrequent Caffeine Consumers

Energy drink consumption has been seen to be an indicator of risky behavior among adolescents and young adults. I will be investigating if the behavioral effects of energy drinks would differ between those who consume caffeine daily and those who do not. I will also be assessing if either group is more susceptible to risky behavior after consuming energy drinks. A double-blind test on individuals 18-25 years old, where each participant will answer a series of questionnaires. The first questionnaire would ask how often participants consumed caffeinated beverages and would to indicate the type of caffeinated beverage. This group would split into separate groups, habitual and non-habitual caffeine drinkers. Additional questionnaires such as Withdrawal (WQ), Profile of Mood States questionnaires (POMS), and assessment of risky behavior questionnaires would be used. It is expected that the habitual caffeine consumers would not be as affected as nonhabitual caffeine consumers after consuming energy drinks. Habitual caffeine consumers often need a certain dose of caffeine for it to be effective. They will be more resistant to the full effect of the dosage in energy drinks. Non-habitual caffeine consumers would be more affected by the caffeine and more susceptible to risky behavior as a result. Energy drink consumption has been seen to increase risk taking behavior and is a possible indicator of individuals who are more likely to take risky actions or demonstrate unsafe behaviors. Knowing the possible effects of energy drinks on different types individuals can help people become more aware of the dangers of consuming energy drinks, since the FDA has yet to put any regulations on energy drinks.

## Racanelli, Brielle — Project #157

Research Proposal, Science, Environmental

### Dolphins and Echolocation

Dolphins are intelligent marine mammals. This proposed study is important because it could keep dolphins safe from boats and predators by being able to assess their ability to locate objects in their habitat. It is hypothesized that If two dolphins use echolocation as their primary means for foraging and predator watch, they should be able to obtain vigilance behavior in a 15-by-15 meter pen for a period of 21 days. It has been found that in using pens with the dimensions of 6.1-by-6.1 meters the dolphins were able to correctly detect signals for 5 to 15 days. In this experiment, two dolphins will be placed in separate netted pens measuring 15-by-15 meters inside a 17-by-16 meter pen that will have eight phantom targets placed around it.There will also be a response paddle located in the front of the inner pen. For 21 days in a row, the dolphins will have to detect a randomly generated phantom target and report it by touching the response paddle with in ten minutes. The dolphins should be able to locate objects at least 15 meters away for 21 days in a row about 95% of the time. Possible implications for this research are to determine if dolphins can detect objects from a distance to keep them safe, and to help the U.S. Navy Marine Mammal Program by aiding them with the detection of undersea objects. These anticipated results could point to future research by expanding the dimensions of the pen the dolphin was placed in and see the maximum distance from which they can detect targets.

## Raigosa, Douglas — Project #158

Completed Project, Science, Physical Science

### Critical Parameters for Investigating Orbital Stability for the Kozai Mechanism

This project examines the effects of the Kozai mechanism in a Sun-Earth-Jupiter three body system. Kozai mechanisms are essential to understanding the inclination and eccentricity exchange and the trajectory of artificial and natural satellites in highly inclined orbits. These simulations test a variety of ratios of semi-major axes between the exterior orbiting satellite and the inner satellite system.This project tests a Sun-Earth-Jupiter system with real state vectors provided by NASA's Jet Propulsion Lab's HORIZONS system. This project simulates systems with different ratio values in reference to the central star (by increasing factors of 1/8). The project is computed and mapped out on a program called Gravity Simulator. The program runs theoretical objects and provides both state vectors and orbital elements over time. Each trial begins with the same conditions as the next. The only factor that changes between each trial is the distance of the exterior body (Jupiter) in reference to the central star (the Sun). The control is the actual placement of the Sun, Earth, and Jupiter. The program evolves orbits over 500,000 years with a timestep of 1.517 days. Data is collected every 10 years for the entire 500,000 yearsAs a result of the research, the Kozai Mechanism was stable at all semi-major axes ratios; no satellite collided nor was ejected. All of the trials except for one, were periodic. As the value of the ratio increased, the time the Kozai Mechanism took to return to its lowest value (its period) increased. In the midst of stable periodic motion, stable chaotic inclination fluctuations were found when the semi-major axes ratio decreased by five eighths (1:1.951727109). The inclination of the Kozai Mechanism reached its lowest value at sporadic intervals.The result of this data proves the existence of a stable chaos threshold for the ratio of semi-major axes of the Kozai Mechanism in a ternary system (1:1.951727109). If Jupiter and Earth were to have these parameters, a chaotic Kozai Mechanism would be activated. Beyond these parameters, Jupiter and Earth would maintain a stable and predictable periodic exchange between eccentricity and inclination. Future research could further investigate this chaos threshold. By testing around 1:1.951727109 by small positive and negative factors (factors smaller than one eighth), the range of parameters that generate chaos and periodic motion can be better identified.

## Rappaport, Hannah — Project #159

Completed Project, Science, Behavioral

### The Effect of Lack of Confidence and Illusory Perception on Susceptibility to the Rubber Hand Illusion

An illusion occurs when the brain encounters strange phenomena. Illusions may be particularly prevalent when people feel they have a lack of control. To test if this tendency can be decreased, people were placed in an experimental situation where they were given false confidence. It was hypothesized that when participants are put into a state of low control, they will be more susceptible to the Rubber Hand Illusion (RHI). Sense of control was changed in two thirds of the study participants using a computer quiz that gives false feedback. All subjects' responses to the RHI, in which participants "adopt" a rubber hand as their own, were studied. The independent variable was the amount of the participants' personal control, and the dependent variable was the susceptibility to the illusion.Anticipated results may show that participants in the lack of confidence group had higher susceptibility (more proprioceptive drift) to the rubber hand illusion than participants in the confidence and control groups, based on past studies. Once complete, the data will be analyzed using Bayesian statistics.This study is important because if a simple process such as the false feedback quiz can boost sense of control enough to lessen susceptibility to the rubber hand illusion, there are many possibilities to help patients with alarming feelings, thoughts, or illusions, just by giving them higher confidence.

## Rivero, Emilio — Project #160

Research Proposal, Engineering, Behavioral

### Increasing Efficiency in the Darien High School Cafeteria

The Darien High School Cafeteria is one of the few grumbling points among the student body of the High School. Certain food options are comprised of odious long lines while other options remain untouched by most students. By interviewing many members of the Darien High School student body and cafeteria workers, that is, the people who work for or purchase from this environment every day, I was able to gain perspective into the issue. I also studied the cafeteria's design and blueprints. Workforce is not appropriately distributed in the cafeteria. The distribution is much too even, while the student preferences vary greatly among the students. This leads to certain food options being overstaffed while others are understaffed. By reducing inefficiency in the Darien High School Cafeteria through an industrial engineer's perspective, waiting lines will be reduced and students will be able to spend this time performing other tasks. These could include studying or heading to class earlier, thus benefitting the DHS community.

## Rutledge, Lauren — Project #161

Research Proposal, Science, Environmental

### Future Food: Finding Efficient Alternative Protein Sources within Lower Trophic Levels to Run a Stable Aquaponics System

The future to our food on Earth is going to be what is produced out of an Aquaponic system: a system that combines conventional aquaculture (raising aquatic animals) with hydroponics (cultivating plants in water) in a symbiotic environment. The system itself already results in plant growth and fish growth with minimal inputs. However, the fishmeal/food input is currently not sustainable, as it damages the food web dramatically by knockingout almost a full level (the prey of the fish being used in the system). Taking away a whole level on the food chain questions the future of food production in these systems. Thus, a large system has been designed in order to determine which protein source in the fish feed (besides the traditional fish meal) results in the most efficient feed conversion ratio paired with the lowest ecological impactin an Aquaponics system. The large system will be broken down into three subsystems: one for which the species will be fed with kelp, the second with soy, and the third with traditional fishmeal. To measure the feed conversion ratio, the initial total mass of the fish will be taken and compared to the final mass after feeding the fish with the particular amount of their designated feed, accountingfor any uneaten food. It is expected that similar or more efficient feed conversion ratios will be achieved in kelp and soy with lower ecological impacts. If the results meet or exceed the expectation, the world will have determined a path towards high yield food production with a drastically less ecological impact, combined with less pressure on allowing wild aquatic ecosystems to replenish.

## Ryack, Anna — Project #162

Completed Project, Science, Behavioral

### Creating a Growth Chart following Prenatal Alcohol Exposure and Impulsivity Testing in Rats

This study follows the impact of prenatal alcohol exposure on the growth and impulsivity of rats. Past studies have shown that many animals, people and rats included, who suffer from drug and alcohol addiction or exposure show increased signs of impulsivity. The proposed study will further examine the relationship between impulsivity and exposure to alcohol.Three groups of rats, one control, one prenatally exposed to alcohol, and one exposed to water, will be raised on an unrestricted diet, and have their growth tracked. This information will be used in the next phase of the study, in which another 3 groups will be raised, keeping their weight at 80% of their predetermined optimal weight, so they are kept motivated to complete an impulsivity task.Future generations of rats will also be put through the same tests, to examine the hereditary aspect of impulsivity in alcohol exposure. Data is still being collected, however results thus far have shown differences in the growth rates of rats exposed to alcohol, and the control groups. It is also anticipated that the group of rats that were prenatally exposed to alcohol will demonstrate increased impulsivity, compared to the other groups. Alcoholism is unfortunately a major problem in the United States. Many sufferers even drink while pregnant, and that prenatal exposure to alcohol has numerous negative effects on offspring. This study will help provide further understanding on the impact that prenatal alcohol exposure has on impulsivity, which can be applied to help better the situations of future children effected by prenatal alcohol exposure.

## Santoro, Kevin — Project #163

Research Proposal, Science, Health and Medical

### The Effect of Insulin Growth Factors on Folliculogenesis in vitro

Common cancer cause gonadal toxicity due to their unspecific and widespread effects on the body. In female patients this would inhibit any hopes for reproduction in the future, therefore, practice today is the removal and unsuccessful cryopreservation of a women's eggs in order to avoid exposure to harmful therapeutics. Culture of immature follicles in a 3-D hydrogel microenvironment has shown promise to provide an alternative to cryopreservation for cancer patients.Secondary size ovarian follicles will be isolated from 14-day old mice. The follicles will be encapsulated in a fibrin-alginate hydrogel. The encapsulated follicles will be cultured in a 96-well plate dish with the perimeter wells filled with DPBS. The wells with encapsulated follicles will contain a media with insulin growth factor-I. The follicles will be incubated for a 12-day period and imaged every 2 days.After 12 days, the follicles should have grown to pre-antral stage. Granulosa cell numbers will have increased and a visible antrum will have developed. Current systems foster pre-antral growth and a survival rate of 80%. This addition of insulin growth factor-I will provide increased activity of the AKT pathway facilitating cell proliferation and increasing survival rate compared to current culture systems. Current cancer therapeutics have increased survival rates exponentially over the past decade, so patients can finally look forward to life after cancer. An improved culture system could eventually allow options for fertility preservation for cancer patientsThe effect of insulin growth factor-I on ovarian follicles could reveal the role the AKT pathway has in regulation of cell growth in folliculogenesis.

## Santos, Levi
## Boutros, Tom — Project #164

Completed Project, Science, Behavioral

### Intergenerational Transmission: The Mother/Daughter Effect

To better understand crime one of the origins of crime, the parents, must be examined to understand if there is an intergenerational transmission of illegal behavior from parent to child. Past research regarding the intergenerational transmission of criminal activity from parent to child has mostly been concentrated on the transition from father to son and father to daughter, but very little on mother to daughter. It is hypothesized that if there is a relationship between mother/daughter crime records, then daughters with convicted mothers will be more likely to be convicted themselves.In this study, both the parents and children will be exclusively female. The women will be selected on two constant criteria: to be from a city environment and to be from the same relative socioeconomic background. Next, their public criminal records will be accessed and evaluated with the help of mentor Dr. David Bernstein, a forensic psychologist.The results of this correlation study have yet to be gathered and analyzed. However, once the public crime databases have been examined, the mothers and daughters will both be classified based on their crime committing patterns, either non-offender, sporadic offender, or chronic offender. From there, the records of a mother will be compared to her daughter to see if there is any type of relationship between the two.If there is a positive correlation between mothers and daughters, meaning that a sporadically offending mother has a sporadically offending daughter, then law enforcement can begin to look at the daughters and provide support to struggling families. This, in turn, will help prevent crime from happening in the first place hopefully keeping individuals out of prison. However, if there is a negative correlation then it can be concluded that daughters of crime committing mothers are not more at risk to commit crimes when compared to their peers.

## Saunders, Jillian — Project #165

Research Proposal, Science, Health and Medical

### Somatic Cell Regeneration of Caenorhabditis Elegans when exposed to Diversified Levels of Carbon Dioxide

In what ways, after injury, will the somatic cell growth in the nematode Caenorhabditis Elegans be influenced when exposed to varying levels of carbon dioxide? Will the regeneration of the cells increase or decrease when exposed to slightly or much more carbon dioxide, and how can this research further our understanding of regeneration?First, I'll dye the C. Elegans using Lipophilic Vital Dye DiI, allowing me to visualize the neural structures in the nematodes. I will set up three separate environment tanks. One having the normal amount of carbon dioxide found in air, one having a 10% increase, and one having a 20% increase in carbon dioxide. Next, I'll splice three C. Elegans, taking that measurement. The spliced C. Elegans will remain in their respective tanks for 5 days. At the end of 5 days, I will re-measure the length of the nematodes and record the results. I would like to conclude that after injury, if Caenorhabditis Elegans are exposed to less carbon dioxide than their rates of regeneration of their somatic cells will, in general, increase. Where as when the Caenorhabditis Elegans are exposed to more carbon dioxide, their rates of regeneration of their somatic cells will, in general, decrease.I would like to do further research to see how this knowledge can be used in regenerating certain cells in humans, that normally have trouble regenerating. For example, C. Elegans are a model for axon regeneration studies, so I would like to, after this experiment, look into other areas C. Elegans can be a model for, especially areas frequently around carbon dioxide (i.e. lung tissue/cells).

## Savino, Oliver — Project #166

Research Proposal, Engineering, Physical Science

### Analyzing the effect of different chambers geometry for soft robotic actuation

To investigate the performance of Helical formation air chambers as compared to the more common cylindrical air chambers in soft robotic actuation. Take 2 rulers and place them perpendicular to each other. Place a video camera above this to easily review the results. Place the chamber in the bottom corner of the 2 rules and start actuation. Then turn the pump on and fully actuate the robot. Review the video and time the length of actuation and measure the degree of freedom.The helical chamber should be more precise than the cylindrical chamber, with the drawback of reaching the desired actuation at a slower rate. However, the helical chamber should have a greater degree of freedom than the cylindrical chamber. The time of actuation should be at most 2 seconds for the helical formation and nearly 1.67 seconds for the cylindrical formation.If the helical chamber is more precise than the cylinder charmer, helical chambers would be much better to use with many other soft robots because soft robots struggle with being precise in their tasks. Additionally, this would allow for these robots to be more adaptive to all situations.

## Schaaf, Summer — Project #167

Completed Project, Science, Environmental

### Effects of pH on Ghost Shrimp

In an article, written by Rob Painting, studies show that acidic pH levels affect negatively sea oysters. The pH of the ocean is declining and this process is known as ocean acidification. In this experiment, the effect of different pH levels on ghost shrimp were tested. If pH affects the size of ghost shrimp, then the ghost shrimp will grow better in nonå_-acidic levels of pH. In this study, ninety ghost shrimp were evenly distributed into three buckets; thirty ghost shrimp in each bucket. Each bucket was filled with 3.5 gallons of water and were all at the same temperature. The length and width of the ghost shrimp were taken using a ruler before and after living in the buckets for eight days. To control the pH, a pH control kit was used and a pH meter was used to take the pH. In this experiment, all of the ninety ghost shrimp died. Only thirteen ghost shrimp were found, while the others disintegrated. The average size of all the ghost shrimp decreased in size. In the bucket with a pH of 7.0, there was a 96% decrease in size and in the bucket with a pH of 8.0, there was a 95% decrease in size. In the bucket with a pH of 5.5, there was a 94% decrease in size. The disintegrated ghost shrimp were unable to be found, so they were each represented as 0 inches squared. Results from other studies, for example, the study of pH on oysters, showed that pH negatively affected oysters. However, the results from my study show that the area of ghost shrimp changed the least in a pH of 5.5, which is acidic. Since acidity increased twenty-five percent over the past two centuries, ocean acidification has become a huge issue. By performing this experiment, the effects of pH on ghost shrimp has been studied.

## Scheck, Alexander — Project #168

Research Proposal, Engineering, Physical Science

### Lidar based collision avoidance system on a quadcopter

Currently there is a growing popularity in drones. They are affordable and small; many companies like amazon want to use them to deliver packages. Anybody can get or make one for a reasonable price. The problem is that the more drones that are flying around the higher the risk of somebody getting hurt. To solve this problem I plan on creating a collision avoidance system using 2 lidar sensors. They will be mounted on a 180 degree servo and one will always be facing the opposite direction of the other. Since the sensors are based off the speed of light they can be spun at a high rate to sense the area around it. I do hope that in the end I can have a completed and working project. Since I have not done any kind of testing on my collision avoidance design I am not sure what to expect. I do expect many trails and errors throughout my testing. There will mostly likely be problems in the code that cause the drone to do things that I wouldn't want it to do. If the drone crashes there will most likely be things that have to be fixed or replaced.

## Schwartz, Jennifer — Project #169

Completed Project, Science, Health and Medical

### The Induction of Apoptosis in Leukemia and Lymphoma Cell Lines by Small Molecule Inhibitors through Inhibition of Antiapoptotic Proteins

Cytotoxic chemotherapy and radiation's toxic efficacy comes with a host of side effects. By attacking all rapidly dividing cells in the body, the immune system and the digestive system become damaged. The use of a tumor-specific small-molecule inhibitor is very promising. By targeting resistance (antiapoptotic) proteins, cancer can be treated without attacking every cell in the body, only the ones with mutations, which could potentially kill resistant, previously untreatable cancers. This study tested the efficacy of small-molecule inhibitors like A1210477, Gossypol, ABT-737 and ABT-199. All drugs tested were either in single agent trials or in combination with one of the other drugs in increasing concentrations. The efficacy of these combinations was compared in both a sensitive and a resistant cell model. After incubation, cells were stained and assessed for apoptosis. Percent cell viability measured efficacy of drug combinations. After data analysis, most of the inhibitors worked very well on the sensitive model and not as well on the resistant model, except for one combination. ABT-737 worked extremely well with A1210477 to treat even the most resistant cell line, THP-1. In general, pairing two drugs that target different proteins meant increased efficacy unless the cell was only dependent on one signal, which occurred in the sensitive model. A combination of just two drugs that can specifically target the two main causes of resistance in leukemia proposes a new method for treating the cancer without side effects. This new treatment could mean a safer option than the overly toxic chemotherapy combinations or the carcinogenic radiation.

## Selmon, Nevia — Project #170

Completed Project, Science, Environmental

### Energy Generation of a Hamster Running on a Wheel as a Possible Power Source

Alternative, renewable resources are sought in order to reduce the amount of Earth's natural resources that are being used up daily. If enough energy is generated from a hamster running on a wheel, then this can be used as a renewable power source in daily life. This project will explore the idea that the amount of revolutions generated by a hamster running on a wheel are enough to be used as a possible energy source to provide power for many everyday objects. In order to perform this experiment, a laser tachometer was wired to a data logger, which was then placed across from the hamster wheel. There was a piece of reflective tape placed, horizontally, on the hamster wheel, allowing every revolution of the wheel to be recorded. Based upon the amount of revolutions, the amount of milliamp hours were then calculated. Data trends as of now show that the hamsters run for bursts up to five hours throughout the night and early morning hours. There have been enough milliamp hours produced, throughout a 24 hour period, to charge an iphone multiple times. Based upon the data collected, energy generation from a hamster running on a wheel is a viable solution for charging common household objects, such as cell phones, tablets, and laptops, therefore, reducing the amount of electricity used for everyday charging needs. This experiment is a step in the right direction for using renewable power sources and saving Earth's natural resources.

## Seward, Isabelle — Project #171

Research Proposal, Science, Health and Medical

### Sport Specific Concussion Analysis Utilizing ImPACT Test Results

Each year, over 3 million athletes in the United States suffer from concussions, many of which go unreported because athletes fear loss of play time. This study applies a new approach to analyzing concussion trends on a sport by sport basis utilizing ImPACT test results. The purpose of this study is to discover correlations between test scores, symptoms, and sports that may be implemented to create new safety protocols. ImPACT test results will be obtained and compared by module and by sport. Correlations will be drawn to determine any sort of symptom trends or trends between test modules (Word/Visual Discrimination, etc). After these associations are defined, these trends will then be compared by sport that the patient participates in. This will be done alongside a mentor who specializes in Statistical Analysis in order to assist with findings. Due to the fact that every concussion is different, it is difficult to accurately predict results. These findings should show how athletes of the same sport either tend to experience the same/similar symptoms and which sections of the ImPACT Test they seem to score lower in. These results could then be compared to functions/ parts of the brain most commonly affected by concussions and sport type. Implications of these findings include generating new customized approaches to address concussion prevention and protocol by sport. Knowing which sections of the ImPACT test athletes (who play the same sports) tend to score lower in can provide the field with more extensive baseline knowledge. It is important that common symptoms by sport are addressed in order to create sport-specific recovery and prevention plans to protect these athletes in the future.

## Side, Veronica — Project #172

Research Proposal, Science, Environmental

### Anthropogenic Carbon Dioxide Raising Ocean Acidification and its Effects Calcifying Marine Organisms

The oceans absorb 30% of the CO2 in the atmosphere causing increases in pH levels which have negative effects on marine organisms, specifically calcifying organisms. The CaCo3 they utilize is being dissolved, which can result in death for these organisms. I am researching to find a solution to the problem in which the the acidity levels can decrease and the CaCo3 levels can be restored. There are geoengineered substances that can remove CO2. They are being experimented with by many scientists in my field. My method is to familiarize myself with these substances and note their reactions to CO2. I plan to work to find a solution that can not only get rid of the excess acid in the ocean but can also reverse some of the damage done to the marine organisms. So far I have found that the solution would need to be a natural solution in order to protect ocean life. Geochemical solutions are ideal, but harmful. I have also found the problem is world wide. The entire ocean deals with the same effects. Researchers working in specific small sections of the ocean are not producing beneficial results. A conclusion that can be drawn from this is that we must start big in order to make an impact. Working with substances in one part of the ocean is not beneficial because waves travel at 60 mph and it spreads out very quickly. A global ocean solution is the main focus now. Another conclusion is we need an environmentally safe solution ignorer to protect the already endangered marine life.

## Silliman, Jacob — Project #173

Completed Project, Science, Physical Science

### The Fabrication and Characterization of Carbon Nanotubes Using Different Transition Metal Nanoparticles

Carbon nanotubes (CNTs) potential use as transistors in microchips would preserve Moore's law as silicon technology reaches its physical limits. Moore's Law claims that the number of transistors per square inch on an integrated circuit would double every 18 months. The purpose of this experiment is to grow a forest of vertically aligned CNTs with optimum diameter and wall thickness. The transition metal salt is mixed with the bulk co-polymers and the mixture forms a lattice like structure. The copolymer is then burnt off by an oxygen plasma leaving behind the transition metal nanoparticles. The array of nanoparticles is then put in a chemical vapor deposition furnace where the CNTs will grow. These grown CNTs are then analyzed using Scanning Electron Microscope (SEM) and Transmission Electron Microscopy (TEM). It was hypothesized that transition metal salts and bulk co-polymers can be used in a chemical vapor deposition (CVD) furnace to grow forests of CNTs. From these forests of CNTs we can later determine which transition metal salt (Iron Nitrate, Nickel Nitrate, and Cobalt Nitrate) allowed for growth of single walled nanotubes with optimum diameter and wall thickness. Preliminary data trends support the hypothesis. Understanding how to control CNT growth is very important towards figuring out a way to consistently produce single-walled CNTs of optimum diameter and wall thickness. This experiment will determine what transition metal salt is best for producing forests of CNTs with the desired attributes.

## Silver, Natalie — Project #174

Research Proposal, Science, Health and Medical

### The Impact of Sodium Chloride on the Effectiveness of Multiple Sclerosis Therapies

2.3 million people worldwide have been diagnosed with multiple sclerosis (MS). There is no cure or diagnostic test. What if the cause for multiple sclerosis is in something we can control in our surroundings? New research is showing evidence of environmental factors having an influence on multiple sclerosis, along with genetics. Sodium chloride (NaCl) influences the worsening of autoimmune diseases like MS in cell cultures and in mice. In my experiment, I plan to test the impact of sodium chloride on CD4 T-Cells along with MS treatments. I will compare the effectiveness of these treatments in a high-salt culture compared to a low to no-salt culture. In order to measure the impact sodium chloride can have on the effectiveness of these treatments, I will measure proinflammatory cytokines such as Interleukin 17A. There will likely be fewer proinflammatory cytokines in the low-salt-content cells because that would align with other research findings related to NaCl's impact on autoimmune diseases and could lead to future research on mice and eventually humans. Fewer proinflammatory cytokines will be a sign that there will be reduced inflammation in CD4 T-cells, which represents a less pathogenic disease compared to a culture with more proinflammatory cytokines. Advancing knowledge about the impact of environmental factors on multiple sclerosis could help to find a cure or prevention for MS. I am looking to conclude whether high levels of sodium will have an impact on the effectiveness of MS therapies working to reduce or stabilize inflammation in cells. It would be a significant step in MS research if diets or prescriptions could be modified to help treat the disease.

## Silverman, Vincent
## Dardik, Kevin — Project #175

Completed Project, Science, Health and Medical

### Characterization of Thulium and Ytterbium Contrast Agents

Medications used in treating potentially cancerous tumors vary based on the environment of these tumors. Contrast agents are used to measure important parameters in these tumors. This study was designed to research the effectiveness and sensitivity of two contrast agents, TmDOTA4AmP and YbDOTA4AmP. It was hypothesized that the Tm contrast agent would be more sensitive because its extra free electron should provide additional contrast. Data collection was done by inserting samples containing either contrast agent at varying pH into a 500 Megahertz magnet, which models a practical MRI machine. After the experiments are completed, each of eleven peaks produced by the spectrometer was measured in ppm and intensity. This process was repeated for multiple temperatures and pH values; the data was then graphed to determine the sensitivity of the agent to these parameters. The ppm value, which determines the location of each peak, changes with the changes in pH and temperature, and this change is the determinant for the sensitivity of the contrast agent. The slope of the plots of pH or temperature and signal intensity were compared in order to determine the more sensitive contrast agent. Results thus far support our hypothesis that the Tm contrast agent is more sensitive. Current magnetic resonance or MR methods measure important characteristics like temperature and pH, but are also sensitive to other parameters. The new MR method known as BIRDS (Biosensor Imaging of Redundant Deviation in Shifts) measures chemical shifts and is thus less sensitive than previous methods. The more sensitive contrast agent allows medications given based on these measurements to be more accurately prescribed.

## Silvert, Eli
## Zhang, George — Project #176

Completed Project, Science, Behavioral

### Integration of Auditory and Visual Features of Speech Perception in Schizophrenia: A Neurophysiological Investigation of the McGurk Effect

The McGurk effect occurs when incongruent auditory (e.g. “ba”) and visual (e.g. “fa”) components of speech are presented together so that they are perceived as a single sound (e.g. “va”). Susceptibility to this illusion is highly dependent on the temporal presentation of the stimuli and individual differences. Individuals with schizophrenia have shown abnormalities in audiovisual integration. How does the perception of the McGurk effect in schizophrenia patients differ from that of healthy controls? The independent variable in this experiment is the presence of schizophrenia. The stimuli were also manipulated by timing and phoneme type. The dependent variable is the perception of the McGurk effect in each individual, determined by behavioral response (measured by button-press) and neurophysiological response (measured by EEG). After obtaining consent, healthy and schizophrenic subjects were individually interviewed, and then hooked up to an EEG. They then watched four blocks of the McGurk effect video on a computer while reporting their perception of each stimulus by button press. The video lasted one hour. Data thus far shows that patients with schizophrenia have a distinct pattern in their behavioral responses. Across most timing offsets, schizophrenia patients are significantly less susceptible to the McGurk effect than healthy controls, while there are no significant differences in the congruent and inverse McGurk conditions. EEG data is in the process of being cleaned, averaged, and analyzed. This study aims to determine how schizophrenia affects audiovisual integration processes and to better understand the mechanisms responsible for the McGurk effect. The distinct, and consistent, pattern in behavioral data indicates that a McGurk video could be used to help diagnose schizophrenia and predict the onset of schizophrenia in children at risk.

## Singer-Freeman, Ari Project #177

Research Proposal, Science, Environmental

### Returning Plasticity to Arabidopsis thaliana

A phenotype is defined as the observable expression of a variation of a trait, and phenotypic plasticity as the ability of an organism to express different traits when in different environments. Plasticity is rated on a scale from robust (less) to plastic (more). Currently, there are few traits known to be phenotypically plastic in plants, however, plasticity provides a buffer that gives plants more time to adapt to changing environments. In this experiment, Arabidopsis thaliana, ecotype Cape Verde x Landsberg erecta, will be tested to ascertain how long it takes for a plant that has become robust to return to being plastic. It is hypothesized that if plants that are extremely robust in expressing positive phototropism are taken from an environment in which positive phototropism is discouraged, and moved to an environment in which positive phototropism is beneficial, it will be ascertained how quickly a plant can regain plasticity to respond to changing environments.The plants will be split into twogroups. One group will be in an environment in which positive phototropism is encouraged by providing allowing more light to reach the plant once it grows to 25cm in height. The second group will be allowed to grow per normal. Phototropism will be measured by total growth and by production of the HSP90 protein, which promotes robustness. The plants in this experiment will be measured over six generations in these conditions to ascertain whether they regain plasticity or remain robust.This research is significant because as climate change alters environments, plants will need to change to be more plastic, and the results of this experiment will give insight into how quickly this can be done.

## Stergue, Clint Project #178

Research Proposal, Engineering, Physical Science

### Using electrolysis to convert water to fuel

To create an efficient and cost effective water to fuel converter. The converter will use electrolysis to split water into hydrogen and oxygen.This experiment will be performed. First, I will build the converter. After that is built, I will take 1 liter of distilled water and put one catalyst in it so it dissolves completely. I will do this multiple times until I have at least 3 different containers of water, each with a different catalyst. From there I will put one mixture into the generator and turn it on. I will measure the amount of direct current coming from the power source and the amount of gas that is produced. After I finish with the first mixture, I will rinse out the generator and use the second mixture and repeat the same process. Then do the same with every other mixture. This will help me find the most efficient catalyst. Once I find the most efficient catalyst I will see if the amount of power affects the the gas production of the generator to find the optimal power usage that is still efficient but not wasteful.What I hope to find from this experiment is that I could produce a cost effective and efficient water to fuel converter. One that produces enough gas/fuel that the average consumer could use whenever they needed to. But also to find out what catalysts are the best to use while taking into account cost and how efficient it works. And to find the best amount of power to put into the generator to get the most gas out.There are many uses for a hydrogen generator. From backyard experiments to electrical backup power. Or, high purity uses for industrial and automotive applications.

## Stimpson, Johnathan Project #179

Completed Project, Science, Health and Medical

### The Relationship Between Exposure to Proton Pump Inhibitors and Risk for Bacteremia in ICU Patients: A Retrospective Cohort Study

We investigated whether proton pump inhibitors (PPIs), a class of increasingly prescribed acid-suppression medication used ubiquitously as a stomach ulcer prophylaxis in ICU patients, alter the incidence of bacteremia in ICU patients over the age of 18. We initially hypothesized that by inducing gastric hypochloridia, PPIs would increase risk for ICU-onset bacteremia. We performed a retrospective cohort analysis of 15,740 adult patients admitted to Columbia Medical Center and Weill Cornell's ICUs between January 1st, 2009 and December 31st, 2012 using STATA. For all patients, we gathered information on exposure to PPIs, demographic information, and pertinent ICU exposures. We examined the crude relationship between PPIs and bacteremia, and then the relationship between PPIs and bacteremia after adjusting for other variables and duration of follow-up using a Cox proportional hazards model. Initial analysis found that the incidence of bacteremia was 1.8 times greater among individuals treated with PPIs (95% CI=1.48-2.13). However, after adjusting for other variables in our final Cox proportional hazards model, we found that there was no longer a significant association between PPIs and bacteremia (HR=.72; 95% CI = .59-.88). Use of proton pump inhibitors did not associate with an increased risk for bacteremia. However, mechanical ventilation, the presence of a central venous line, and the placement of a feeding tube were independently associated with bacteremia. Therefore, interventions seeking to decrease Bacteremia in the ICU should instead focus on these factors.

## Sucre, Francisco Project #180

Research Proposal, Science, Environmental

### Solar Powered Water Desalinator

Desalination has long been an option for creating greater quantities of clean freshwater for the masses, but is a very difficult and expensive avenue of creating freshwater. By doing a smaller scale solar powered version, it proves to be a simpler and more cost effective alternative that proves that problems can be solved in a non-linear fashion. Specifically in how a single object/machine can serve various purposes, where nothing is wasted, but re-used. In solving the problem in a non-linear way, the desalinator will be built using an open wooden base that houses three tanks. (One larger, two smaller). They will both be out of glass, with the larger one holding the saltwater, and a DC water heating element powered by a large solar panel overhead. One smaller one will hold the the clean water (carried over with a pipe), and the other one will hold cardboard ridges that carry saltwater through a distillation process that is moved by a solar powered fan. The expected result is to have clean water delivered in a hybrid form of two different ways for increased efficiency, and having different ways of solving a single problem. The water should be clean enough for filtering and being usable to drink.There are a variety of different ways in which the clean water created from this desalinator can be used; on top of it's main purpose of just creating clean freshwater. It can obviously be used to drink on an even larger scale, but can also even be used to make a self-sustaining eco system of plants, to name one. With clean water being one of the main roots of life, there are almost endless implications for this desalinator.

## Sudhir, Neha — Project #181

Completed Project, Science, Behavioral

### The Effect of Color on Perception of Saltiness

A recent study performed by Jeff Mulhollem at Penn State University indicated that the color of food affects how bitter and sour flavors are perceived, but shows very minimal effect on perceived sweetness. In this experiment, the question that will be investigated is whether the color of a sugar cookie affects how salty a consumer perceives it to be. The aforementioned study also showed that 'warm ' colored foods, like yellow and red, are perceived to have the strongest flavor. Based on this study, it is hypothesized that if consumers were to taste an orange colored cookie, a warm color, they would perceive it to be more salty than any other cookie. The independent variable of this experiment is the color of the cookie. The dependent variable is how salty the cookie is perceived to be. The control is the cookie that has no added dye, and the experimental groups have green, blue, and orange cookies. In order to conduct this experiment, high school participants tasted cookies of different colors and decide which cookie they perceived to be the saltiest and which one was the least salty using the Likert Scale. Results thus far indicate that color has no consistent influence on taste perception. Data is still being analyzed, but the colored cookies are perceived to be saltier than the control cookies. However, the data so far shows no clear difference between the perception of each experimental group. The motivation for this experiment is to see if consumers have expectations about food based on its color. If an association is discovered, businesses can begin to sell their products in different colors to get better sales based on the predicted perceived taste.

## Sugarmann, Joseph — Project #182

Completed Project, Science, Behavioral

### The Effect of Eating Lunch on the Test Taking Performance of Adolescents

Test taking is a very important skill that one must have in order to succeed. Finding simple ways to improve test taking accuracy would be extremely beneficial to our society. Eating releases glucose slowly into the bloodstream, which then goes to the brain. This promotes healthy brain function and mental alertness throughout the day. Recent studies show a positive correlation between a healthy breakfast and the cognitive performance of elementary school students. However, the benefits of breakfast can only last so long, and its effect on younger children may not be the same as its effect on an older age group. This study attempts to determine how eating lunch affects the test taking performance of adolescents. Students from Amity Regional High School with a class split before and after lunch filled out two brief surveys. One was before lunch and one was after. The surveys asked them what, when, and how much they ate both leading up to and during lunch. Two different samples of five ACT math questions followed. Each survey also asked how much effort each student gave, how hungry they were, and if they had seen any of the questions before. Students with unsatisfactory responses were exempt from the data pool. Although data collection is not yet complete,analysis of data collected thus far shows a significant decrease in test accuracy of adolescent students after they ate lunch. These results go against the trend that several past studies suggest. What this means for our society is that the age-old concept of working on a full stomach may not be the best idea if one wishes to do the best the possibly can on a test or exam.

## Swift, Alexandra — Project #183

Research Proposal, Science, Behavioral

### The Migration Differences Between Carcharodon carcharias in the Pacific and Atlantic Oceans

White Sharks, or Carcharodon carcharias', are found in both the Pacific and Atlantic Oceans, and although they are of the same species, their adaptation to different living environments may result in variations between the groups. The purpose of this research is to determine if differences in migration patterns exist between sharks in the Atlantic to sharks in the Pacific Ocean. These goals would be reached through the use of Pop-up [Satellite] Archival Tags (PAT Tags), which would be attached to the muscular dorsal tissue of white sharks chosen randomly from both oceans. The PAT tags would then track the shark's movement, location, depth, body temperature, and other data that are important for understanding patterns of migration. The data would then be analyzed and compared, in order to determine if there are significant differences in migration patterns of the Atlantic white sharks and the Pacific white sharks. If their migration patterns are in fact different, then future research could explore the causes of those differences.This study is one of the first of its kind, and it is important to decipher the differences between white sharks from opposite coasts of the United States. In order to help conserve the species, it may also help to reduce the number of casualties to sharks each year, due to a better understanding of their seasonal changes of location.

## Tamallanca, Tim — Project #184

Research Proposal, Science, Environmental

### Anomalies Between the Change in Temperature and the Growth of the Bacterium Erwinia Amylovora in the Malus McIntosh

Food is an integral part of America's culture, and it used in many different facets of the American society. The American people grow food for profit and sustenance; therefore, without this necessity the human race would not be able to survive. I am investigating the effect that the increase in temperature is having on the food supply in the Northeast region. This experiment will begin with me accumulating statistics online for my two variables from the years 1975 to 2014. I will be running a statistical analysis for the thirty-nine data points that I will have.I have not done any of the statistical analysis for the project, and I am still in the process of accumulating data. My research can help show and confirm the effects of these climate changes. A shift in temperature could cause more of our vital crops to diminish and die. My data could help prepare people for the changes. People could understand and comprehend the influence of the climate change in my experiment because my variables are relevant in our lives, for many people enjoy eating apples.

## Tenerowicz, Keri — Project #185

Completed Project, Science, Behavioral

### The Effects of Fun Theory on the Disposal of Recyclable Garbage

Fun Theory is a method of persuading people to complete tasks by altering their perspectives. This experiment was conducted to determine if people would walk out of their way to dispose of recyclables if a fun recycling bin was available but not as close. It was hypothesized that most participants would walk to the fun bin.Five fun recycling bins were in five science classrooms. They were farther than the regular recycling bin from the general area of the people in each classroom. Fun was applied to the bins by adding a basketball-themed backboard and net to each bin. Participants with disposables could either walk less to a regular recycling bin or more to a fun bin to dispose of them. After each of ten full school days, the recyclables from each bin were counted and organized based on the bin it was in. The independent variable was the type of bin. The dependent variable was the number of items in each bin. The constants were the materials and location.Data has shown that applying the Fun Theory in this way is not effective enough to attract people to fun bins compared to regular bins. However, after seeing types of garbage like crumpled paper balls, a follow-up theory was formed about how the fun bins motivated people to recycle more often. Data of the amounts of items in the regular bins after the fun bins were removed has supported the follow-up theory.The experimental setup could be used to promote recycling potentially in more locations than just classrooms. The initial data may not have supported the hypothesis, but the fun bins improved the overall amount of items disposed in four out of the five classrooms observed.

## Thomas, Alfston — Project #186

Research Proposal, Science, Health and Medical

### Using a PLGA PVA based hydrogel system in order to prevent inflammatory reactions caused by wireless continuous glucose monitors

Diabetes is a pancreatic disease which occurs when the body is unable to produce enough insulin. It affects 370 million people globally. Diabetes has no definite cure however, it is controllable. Diabetics are currently required to wear external glucose monitors or use test strips in order to get an accurate blood glucose reading. A more convenient approach to this is to use a wireless glucose monitoring system. My goal for this project is to design a hydrogel based drug delivery system that coats a wireless glucose monitor for sustainable use. Once inserted into the body, the monitor faces problems such as inflammation. This is why a system which protects the monitor by fighting inflammatory reactions is critical. The design consists of a PVA based hydrogel combined with PLGA nanoparticles. To create the nanoparticles, PLGA will be dissolved in methylene chloride and then combined with PVA to create the hydrogel. After, 10 mg of dexamethasone, will be dissolved into the nanoparticles.The microspheres will be characterized for its ability to drug load, its particle size and thermal properties. I hypothesize that the nanoparticle based hydrogel will be able to prevent anti inflammatory reactions from occurring and have a 250 day release period. The use of the dexamethasone will allow slow delivery in order for long term treatment. It will also prevent degradation of the monitor.Being able to read blood glucose level immediately is very important for an individual diabetic. Even though there is no cure, having an implantable wireless continuous glucose monitor will revolutionize the way diabetics manage this horrible disease.

## Thombre, Aman — Project #187

Completed Project, Science, Environmental

### The Effect of the Frequency of Light on the Growth of Radishes

Rapid population growth is leading to less space to farm products and more people to feed. Due to these reasons, indoor farming is on the rise. To be effective, indoor farming must be at a maximum efficiency. Hence, this study aims to answer the question, "under which frequency of light will radishes grow best?" It was hypothesized that blue light will yield the most plant growth.To test the aforementioned question, four shelves were made to contain 14 Cherry Belle radishes per shelf, each with a different frequency of light source. Colored lights were used to control the frequency of light to which each group was exposed. The frequencies used were 540-580 THz (green), 510-540 THz (yellow), 610-670 THz (blue) and 430-480 THz (red). To measure the growth of the plants, stem length is measured each day, and at the end of the growing period, leaf area and the diameter of the bulb will be measured. Initial findings (based solely on stem length) tend to indicate that the radishes growing under white/yellow light grow best, followed by blue, green and red. The data gathered from this experiment has many effects on indoor farming. This study aims to find which frequency of light maximizes growth efficiency. Using this research, a higher growth efficiency could be achieved, meaning that more people can be fed. Potential future avenues could test more frequencies of light, including frequency ranges that are outside of visible light. Tests could be made to see whether ultraviolet or infrared light could increase the growth of plants.

## Todeasa, Julia — Project #188

Completed Project, Science, Environmental

### The Relationship Between Night Sky Visibility and Temperature

In folklore, it is said that "cold is the night when the stars shine bright." However, it is unclear whether or not there is some kind of correlation between night sky visibility and temperature. Through this project, it was hoped to find a clear conclusion on this traditional statement. It was believed that if the visibility of the night sky was high, the temperature during the night would be low.In the project, 5 cities across the world were studied: New Haven, CT; Yellowknife, Canada; Cairo, Egypt; Sokol, Russia; and Darwin, Australia. Visibility (miles) and temperature (å¡F), as well as humidity (%) and pressure (inches), were the data being collected. Each day at 10:00 pm for two months, each of the factors were found on Weather Underground's website and recorded in a spreadsheet (one table per city). Once all of the data was collected, graphs were made and analyzed.A few relationships were apparent such as when the visibility rose, the temperature fell, and vice versa. In most cities, the humidity seemed to almost "follow" temperature by rising and falling with it. Pressure maintained about the same value throughout data collection in all cities. Overall, there was not enough support to prove that visibility and temperature have a direct relationship, but there may be one between humidity and temperature.This project has helped to ascertain that this traditional saying may indeed be only a myth. Similar experiments like this one would also help to rule out even more myths or even prove some of them.

## Tsui, Katie — Project #189

Completed Project, Science, Health and Medical

### The Influence of the LGI-1 Gene on Cognition of APP/PS1 Alzheimer's Disease Mouse Models

Alzheimer's disease (AD) is a common and fatal form of dementia that affects over 40 million people worldwide. It inhibits proper functioning of neurons in the hippocampus and cortex, and results in steep cognitive decline and loss of synapses. The leucine-rich, glioma inactivated 1 (LGI-1) gene is associated with increased synaptic pruning and deregulated synaptic plasticity. Preliminary Western Blot studies have shown that there is a substantial increase in LGI-1protein quantity in mouse hippocampi and cortices affected by AD, suggesting that neurodegenerative pathology may be induced by over-pruning of synapses by LGI-1. To analyze the influence of this gene on AD, 15 wild-type, 5 APP/PS1, 13 LGI-1 +/- (hemizygous), and 6 APP/PS1/LGI-1+/- mice were genotyped with polymerase chain reaction and gel electrophoresis. They were tested with the Morris Water Maze at 6 months old to determine cognitive abilities through measurement of path length (cm) and escape latency (sec) taken. It was expected that APP/PS1/LGI-1+/- mice would exhibit stronger cognition than APP/PS1 mice with wild-type expression of LGI-1, because partially suppressing LGI-1 would rescue some brain functioning by decreasing rates of synaptic overpruning. Surprisingly, analyses processed by IBM SPSS Statistics 2.0 have indicated that the hemizygous LGI-1 gene status is not correlated with improved cognition in a statistically significant manner. However, more supportive data are projected to come to light when older mice and fear-conditioning behavioral tests are used in future trials of this experiment. Final results will provide the scientific community with a better understanding of how synaptic pruning affects AD and how certain genes should be targeted for therapy and preventative methods to combat such a debilitating disease.

## Van de Graaf, Justin — Project #190

Research Proposal, Science, Health and Medical

### Age and Ulnar Collateral Ligament Reconstruction

The prevalence of ulnar collateral ligament reconstruction is increasing and it is becoming more important to understand the causes and effects. The experiment will be done in the interest of making the game safer. If professional pitchers that underwent Tommy John surgery were analyzed, then pitchers who had surgery at a younger age would only reach lower levels of professional baseball because the surgery leads to higher risk of impairedplay and loss of pitch effectiveness. To gather data for baseball injury, specifically the causes and results of UCL surgery, prospective studies, biometric analysis, and surveys are used. In this experiment the data would be gathered through an analysis of existing data on professional and minor league players and the distribution of surveys to track player progress. Data will be focused on age, age/level at time of injury, currentlevel, and basic pitching stats. The expected result is to see a significant difference between pitchers who had surgery during younger years than those who had it later on, meaning that they (younger pitchers) would only reach the minor leagues or not return to their current level at all, while the other players reached higher levels of play. Through analyzing the data by comparing age and level at time of surgery and current level, the experiment will show the effects of this surgery and its implications for players. The experiment will illustrate the success of UCL surgery and spread awareness of the injury in youth play. This research could prompt the need for developments in UCL surgery itself and research on what needs to be looked at further, specifically causes of the injury.

## Vanech, Ava — Project #191

Research Proposal, Science, Health and Medical

### Investigating Low Stimulation in the Central Thalamus as a Cause for Impaired Consciousness During Absence Seizures

Absence seizures affect hundreds of thousands of Americans every year and are most common in children. They are characterized by a loss of consciousness for several seconds, and can happen hundreds of times per day. Losing consciousness can disrupt a child's attention skills and performance in school, however it is unknown what causes unconsciousness during the seizure. It is hypothesized that low stimulation in the central thalamus impairs consciousness during an absence seizure. This hypothesis will be tested using four groups of rats that undergo electrically-induced absence seizures. Three groups will be treated during the seizure with various frequencies and durations of optogenetic light stimulation in the central thalamus. The fourth group will be kept as a control with no stimulation. Functional magnetic resonance imaging will be used to detect brain blood-oxygen levels, and thus, levels of brain activity.It is expected that as the frequency and duration of light stimulation increases, so will the blood-oxygen levels in the rat's brain. The rats that have 100 Hz stimulation for 30 seconds will thus have the highest blood-oxygen levels, and therefore the most brain activity. These findings would suggest low brain activity in the central thalamus as a possible mechanism causing impaired consciousness during absence seizures. Determining a cause behind the loss of consciousness can ultimately lead to advancements in treatments, and a better quality of life for absence seizure patients.

## Verdejo, Joshua — Project #192

Research Proposal, Engineering, Physical Science

### Effective Use of Brain Computer Interface Controlled Micro Robotic Swarms

Micro robots are being developed to exhibit swarm like behaviors, working together to achieve a common goal. This experiment will look to test the efficiencies of utilizing a Brain Computer Interface (BCI) versus 2 other methods of control to control the robotic swarm. This experiment will further the relationship between brain computer interface systems and micro robotics. The Emotiv EPOC (a BCI) will be used to control a micro robotic swarm (either the Harvard Kilobot or E-puck System) in order to test for efficiency, distinct trials will be run, in completing various tasks, such as obstacle courses, with time for completion and accuracy being evaluated. Efficiency will be measured by having subjects complete tasks as quickly as possible. I expect to find that the manual controls, such as keyboard input, will be the most efficient, however, I believe that the brain computer interface will be able to perform more effectively than vocal controls. Out of the different types of brain computer interface controls, I believe that the brain computer interface with a robotic leader will be the most efficient. This study will help give researchers in the blossoming field information when developing control techniques for swarms of micro robots. Learning to make electronics function efficiently on such a small scale will allow for more cost efficient, lighter, and faster technology. Micro robotics have tremendous potential (nearly instantaneous construction using billions of robots, micro and nano medicine with the potential to perform internal surgery) and this research brings technology closer to this potential.

## Vernal, Chris — Project #193

Research Proposal, Science, Health and Medical

### The Effect of the Lower Body and Core Activation on UCL Load

The act of throwing a baseball naturally places significant valgus force on the throwing arm and elbow of the pitcher. This force can cause tears in the ulnar collateral ligament (UCL), an injury which often sidelines pitchers for at least one full season. The goal of this proposed research is to evaluate the roles the lower body and core play in the pitching motion and injury prevention.Previous studies have used biomechanical models and dynamic simulations to evaluate the forces involved in the pitching motion. The simulation used in this proposed experiment will reproduce a pitching motion and analyze the muscle forces generated by the lower body and core, as well as their effect on the UCL.The lower body and the core will both have an impact on the forces on the UCL. More force generated by the lower body generally creates more pitch velocity, potentially creating more strain on the UCL. The core will most likely help to relieve some of the stress on the UCL by working to stabilize the entire body throughout the pitching motion. The results of this research will allow a better understanding of the pitching motion and the forces generated by the entire body during this motion. This research will also show how the UCL is affected by these different forces and how to reduce the load on the UCL, thereby reducing the injury risk for pitchers.

## Vora, Ninad — Project #194

Research Proposal, Engineering, Environmental

### Sustainable Elementary School

Today, the majority of our world is powered by fossil fuels1. Carbon emissions are rapidly increasing. The goal of this project is to design a sustainable school. This design will meet certain objectives. These objectives are: –Lower energy consumption –Reduce Operating Costs –Reduce wasteI will need to build a model of the school. This will be a foam core model, which will accurately display the details and sustainable features of the school. Further calculations will also need to be conducted. These calculations include estimating the amount of electricity that will be generated by the concentrated photovoltaic panels. In addition, I will calculate the amount of water collected by the green roof. The space that is occupied by both the solar panels and the green roof will be calculated, taking in to account space that cannot be used, such as fields or air vents/ mechanical equipment. The amount of money that is saved by these enhancements will also be calculated. Once the model is built and the calculations are complete, the data can be submitted to the Glastonbury Board of Education. The data can then be used to improve the existing schools or be incorporated into plans for any future schools. A benefit of this type of research is that this research can easily be applied to existing schools instead of spending much more money on an entirely new school. If this concept can be implemented into our existing schools, then the town of Glastonbury or any other town can cut down on carbon emissions and costs.

## Wegener, Kate
## Wright, Katherine Project #195

Research Proposal, Science, Behavioral

### The Developmental Neuroscience of Rational Decision Making and Risk Taking in Childhood and Adolescence

We are interested in studying the human brain and how it processes risk taking as we mature from children to adolescents, and finally into adulthood. To accompany our research, we will conduct several experiments on an age range which spans from elementary school aged children to mature adults to examine how the age groups of our relatively small samples compare to each other. Our data will be collected by means of a survey and corresponding analysis of the information. The survey will be given to three general age groups that represent childhood, adolescence, and adulthood, and will include questions that deal with intuition-based risky decision making (ex- a monetary gambling situation.) It will be completely anonymous, each participant filling out their age and gender but no other personal information. We want to focus on the brain's development throughout childhood and adolescence as it relates to risky decision making, and to study people our own age. We hope to achieve a broadened understanding of what influences decision making and what particular factors (such as age and gender) influence such decisions. By comparing the results to the science of brain development, we hope to come to a conclusion about common decisions made by young people at particular points in brain development. Our main points of research will be brain development from very early childhood to late adolescence, or high-school aged students. By studying how physical changes of the brain correspond to changes in behavior and decision making skills, we hope to form a greater understanding of how young people approach risk taking, and how this approach changes as they mature. The topic of risky decision making is incredibly relevant to daily life; in fact, there are few aspects of life that are more important, since we make so many decisions both subconsciously and consciously. Real life involves an endless demand for decision making and potentially risky gambles, and our research and experiments could provide us with interpretations of the way children and adolescents think and decide: What risks are we willing to take? Why does risk-taking increase between childhood and adolescence, and why does it decline between adolescence and adulthood?

## Weinstein, Ryan
## Kontogiannis, Cristina Project #196

Research Proposal, Science, Environmental

### A Study of the Effects of an Increased Temperature on Carbon Dioxide Intake of Aquatic Crassulacean Acid Metabolism Plants

The release of carbon dioxide into the atmosphere has contributed to global warming, and scientists have been trying to figure out a way to sequester carbon dioxide in order to keep it out of the atmosphere. Aquatic CAM plants are 100% efficient in their photosynthetic processes, meaning that they never undergo photorespiration, a process that hurts the environment. This makes aquatic CAM plants a good choice to sequester carbon dioxide.We will buy two vallisneria americana plants, which are aquatic CAM plants, and put each one in a separate tank. We will feed a constant amount of carbon dioxide into each tank and the temperature of one tank will remain constant, while the other will gradually rise, and we will measure how much carbon dioxide each plant takes in daily.We have not completed our testing yet, but we are expecting to see a decrease in the amount of carbon dioxide taken in by the plant that is put under increased temperature. This is because we believe that increased temperatures will put increased stress on the plant's photosynthetic processes and therefore decrease its carbon dioxide intake.If we find that the plants under increased temperatures do indeed have greater stress and therefore take in less carbon dioxide, it will have great implications on the future of global warming. This is because if aquatic CAM plants are not as efficient under increased temperatures, then they will not be efficient in sequestering carbon dioxide when temperatures increase. Therefore, they won't be useful in fighting global warming.

## Wilson, Will — Project #197

Research Proposal, Science, Health and Medical

### Reversal of Diabetes through Lentivirus gene therapy

Diabetes is an autoimmune disease characterized by the selective destruction of insulin producing beta cells. The disease affects approximately 1.25 million Americans alone including myself. Treatment for the disease is a 7 billion dollar industry, and many diabetics face financial concerns. Therefore, ever since diagnosis I have tried to find a way to cure this disease and that is what has motivated me to this proposal. The experiment involves inserting a genetically modified retrovirus,which specifically targets and induces apoptosis within autoaggressive CD8 T cells, in non-obese diabetic mice. The modified virus will be administered by a syringe intraperitoneally near the pancreas. A measurement of blood glucose levels of the mice will be made at scheduled daily intervals to monitor the efficacy of the treatment. Also, the T-Regulatory to T-Effector cell balance will be monitored daily. The results of the experiment should show a shift in the balance of Regulatory T cells to Effector T cells favoring an increase in T-Regs. Once this occurs, T-effector cells will stop attacking beta cells, allowing insulin production to continue. Hopefully, beta cell function will be preserved leading to a full recovery and insulin independence. This will lead to less fluctuation in blood glucose levels and lower them dramatically. The results will allow for an increase the current understanding of gene therapies and hopefully will provoke other researchers to pursue this promising field. More importantly the results of this experiment could lift the burden of diabetes off of the shoulders of 1.25 million Americans. Diabetes is growing fast and at a rate of 40,000 Americans a year a breakthrough is needed.

## Wind, Walker
## Alptekin, Susie — Project #198

Research Proposal, Engineering, Physical Science

### Mini Speaker

Electrical Engineering has been helping us understand and work through our problem and goals surrounding the creation of a miniature speaker. Our initial problem was that we did not have our own portable speaker, and we wanted to make it as small as possible.We began our process by researching various methods of accomplishing this goal through working to understand the components of a speaker. Most importantly, we sought to learn about the integrated circuits and components of the circuit board. After online research, the simplest and most pragmatic method of building a small speaker was to insert the necessary components of a speaker into a small altoid tin. After trial and error with testing out various methods of building our own circuit board and other components we found that the easiest and most efficient method with building the speaker was to transfer components from a pre-manufactured speakers into the altoid tin. We are currently attempting to improve our research and understanding of this area of engineering. There are several alternate options regarding the containment of the speaker components. We want to be able easily build a mini speaker that is portable, has a good sound quality, and can be used for listening to all types of music.

## Xu, Steven — Project #199

Completed Project, Science, Environmental

### Quantifying the Effect of Carbon Dioxide on the Growth of Chlorella vulgaris

There is an increasing need for green energy sources, one of which is biofuel derived from algae, in this era of increasing climate change and geopolitical instability. This project will examine the growth behavior of Chlorella vulgaris algae when exposed to heightened levels of aqueous carbon dioxide, CO2, as a selective pressure over multiple generations, to assess both the algae's adaptation to higher levels of CO2 and the viability of CO2 as a selective pressure. An increase in CO2 is expected to cause a general increase in the algal growth rates compared to samples growing concurrently as well as across generations of growth. C.vulgaris was grown in three aquariums, one with a constant CO2 pressure, one that has been exposed to CO2 pressure and restored to ambient conditions, and a control. Throughout the growth period, spectrophotometer data was taken of the algae to determine its growth through absorption of specific wavelengths. It was found that the presence of CO2 had a positive effect on the growth of algae to a statistically significant degree, but its ability to function as a selective pressure appeared inconclusive. For that reason, even though future research is necessary and CO2 tends to increase algae growth in established literature, at this time CO2 as a selective pressure to increase biomass yields does not seem viable.

## Yanagisawa, Kevin — Project #200

Completed Project, Science, Health and Medical

### The Effect of Nicotine Concentration on Endothelial Cell Proliferation

The current generation has come up with countless new inventions. One of these inventions was the electronic cigarette (e-cig). The e-cig emits water vapor instead of toxins and chemical that are seen in conventional cigarettes. Due to the toxicity and the chemical contents of the nicotine drops that can be put into the e-cig, this study will investigate how the concentration of the added nicotine affects endothelial cell proliferation.On day one, endothelial cells were cultivated in a 96 well plate. The next day, the cells within the 96 well plate were counted and recorded using a hemocytometer. On that same day, eight different concentrations of nicotine were added to the cells, then they were cultivated for three more days. On the final, fifth day, the number of cells were counted in a Florometer, then analyzed on the computer.Experimentation thus far has shown that culturing endothelial cells with different nicotine concentrations does not affect the cell proliferation. If the endothelial cell proliferation is affected because of the added nicotine, the data collected could warn users of the possible harmful effects that smoking an electronic cigarette can cause, can assist future nicotine research, and can provide new insight on endothelial cells.

## Yuan, Kate Project #201

Completed Project, Engineering, Physical Science

### Designing an Effective Microbead Filtration System

Microbeads, polyethylene balls smaller than five mm, are not filtered out in treatment plants. They flow through the pipes, absorbing toxic metal particles, and end up in lakes and oceans. The issue is the animals that eat the beads get poisoned, and the poison travels up the food chain. To complete the task, a small filtration system was created using PVC pipe, aluminum netting, and PVC adapters. Then, various materials were tested such as gravel, insulation, and dacron. The weight of beads that flowed through and flow rate was measured. This was to measure effectiveness and efficiency. In the results, it was found that large marble gravel had the highest flow rate at an average of 192.556mL/s, however it also allowed the most microbeads through with an average of 8.37 grams of the 10 grams entered. A very effective filtration material was the foam filter insert. It was both fast and effective in trapping the microbeads with an average flow rate of 148.846mL/s while trapping all of the beads. The idea of cost effectiveness must be thought of in a situation like this. The material must be able to be upscaled to be utilized in the sewage system. These facets are essential because if the material is not sustainable and and cheap, the reward would not be worth the cost. Thinking cost effectively, the foam filter inserts wouldn't be the best material because they are not very cheap. To incorporate effectiveness, efficiency, and cost, the material that best fits these aspects is dacron. Although it is made out of plastic, it is a very cheap material to buy.

## Zhang, Lillian Project #202

Completed Project, Science, Health and Medical

### The Effect of Sub-minimal Inhibitory Concentration of Antibiotics on the Bacterial Swimming Behaviors of Pseudomonas Aeruginosa

The widespread and increased use of antibiotics has resulted in stronger antibiotic resistance. Pseudomonas aeruginosa is a bacterial species that often infects cystic fibrosis patients and can cause other dangerous infections as well. They are able to move around in their environments, but not much is known about how their movements might change in response to sub-minimal inhibitory concentrations of antibiotics. High and low concentrations were first determined for each antibiotic: meropenem, tobramycin, and ciprofloxacin. 3 mL bacteria cultures of P. aeruginosa (strain K) were grown overnight. Each antibiotic was diluted 1:100 and added to the 3 mL of PAK for each condition. The control group had no antibiotic stressed. The stresses were applied for ~30mins and ~60mins. Each condition was spotted on microscope slides and their behaviors filmed.All videos of each condition are analyzed using MATLAB that has a cell tracking program that records the movements the cell traveled and calculates cell velocity and frequencies of cell reversals. Analysis is not complete thus far, however, preliminary analysis has found that the frequencies of reversals are higher in conditions with sub-MIC stressed antibiotics. It was hypothesized that sub-MIC antibiotics will decrease swimming speeds and increase tumbling frequency. Results from this study will further our understanding of the behavioral responses of Pseudomonas aeruginosa to environments with sub-MICs of antibiotics. In future studies, we can adapt results to newer issues faced by researchers on managing resistance with a focus on cell movements and changes in their movement, and find potential solutions to modify bacterial cell movement and to alleviate increasing antibiotic resistance.

## Zhao, Kevin, McManus, Ryan & McKenna, Matt — Project #203

Completed Project, Engineering, Physical Science

### Unmanned Aircraft System Design Challenge: Precision Pesticide Application

Precision agriculture (PA) is method of farming whose purpose is to optimize crop yield, protect the environment, improve agricultural profitability, sustainability, and augment product quality. In a world with a rapidly growing population, it is important to have a steady, reliable food supply. With technology quickly advancing, it seems practical to design and implement an Unmanned Aircraft System (UAS) to support precision agriculture.The team used a 6-step process which was provided by the team's mentors from Pratt and Whitney. The process involved analyzing needs and requirements, brainstorming, down selecting options, creating a detailed design, testing the system, and providing life cycle support, to discover the optimal solution to efficiently apply pesticides to the entire field to increase the crop yield for the farmer.After the state challenge, the team reviewed the design and decided what needed to be change. The team kept the single-rotor aircraft design for the airframe, and implemented a third UAV into the mission for speed and cost effectiveness. Furthermore, the team redesigned the example flight plan to better fit each plot of land and treat infested areas more efficiently.The team's final UAS has the potential to change farming for the better. By detecting pests in a field, the UAS would help farmers treat their crops more effectively. OVerall crop production would then increase, and the agricultural industry would be able to expand to feed the growing population. The UAS would also have several practical applications outside of agriculture, such as performing aerial surveys for rescue missions.

## Zhou, Yuqi Park, Sebin — Project #204

Completed Project, Science, Behavioral

### The Effect of Multilingualism on Attentional Control Measured with Time Perception

Today, speaking two or more languages is becoming more common. Besides communication, what advantages do multilingual individuals have? This study focused on investigating multilinguals' advantage of precise time perception under distractions. It was hypothesized that if multilingual and monolingual individuals are both given distractions, then multilingual individuals will do better on the experimental time perception test. In this study, two distractions were used: a horror movie clip and a fast tempo audio clip. First, a time perception test was given, followed by a random test. Then a distraction was given and the second time perception test which was given 3 minutes in, during the distraction. A second random test was given followed by another distraction and time perception test. 2-sample-t tests were used to analyze the data. Preliminary data do not support the hypothesis. This might be because that participants were given the distractions first, so the multilingual participants might have focused better on the distractions than monolinguals thus performed poorly on the actual task. If this study supports the hypothesis that multilingual individuals are better at time perception under the presence of distractions, then schools could enforce the policy of taking a second language to develop possible advantages of multilingualism. Future plans to extend this study could be adding more types of distractions such as plain visual distractions or making the time perception test into different lengths.

**Gowda, Jethin**
**Khani, Nikzad**

**Project #205**

Completed Project, Science, Physical Science

### The Effect of Variable Temperatures and Bending Radii on the Electrical Resistance of Graphene

A problem with today's computer screens is that their electrical and mechanical properties fail when exposed to a small bending radius. Graphene, however, is able to physically and electrically handle severe bending. This experiment will investigate how different bending radii and temperatures imposed on a graphene sheet mounted on PET will affect the graphene's resistance. Utilizing temperature will show how graphene's electrical properties react to bending in a CPU-heated setting. It is hypothesized that as the bending radius decreases, graphene's resistance increases, and as the temperature increases, the resistance will decreases. Graphene will be bent around cylinders of various radii (2.5mm, 5mm, 10mm, and 20mm). Graphene's resistance will also be measured in differing temperature environments (21C, 35C, 60C and 70C) to better model a flexible electronic application. Finally, this experiment will also run bending tests concurrently with varying temperatures. The data collected will show three types of correlations, each showing a unique electrical property of graphene. The correlations are: bending radii vs. graphene resistance, done by measuring resistance at room temperature, temperature vs. resistance, done by not bending graphene, and bending radii and temperature concurrently vs. resistance. If the graphene is able to electrically withstand both the bending and temperature tests by only having minor variations in resistance, it would greatly promote graphene's candidacy for use in flexible electronic applications. These tests would prove that graphene can overcome many issues that current materials used in screens have with bending. This could then allow for the creation of transparent, flexible screens and touchscreens that use graphene