

73rd Annual Fair



**Connecticut  
Science &  
Engineering  
Fair**

March 8 - 20, 2021

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# **Student Abstracts**

Technical High School Projects

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## Fair Categories

	Life Sciences	Physical Sciences
<b>7<sup>th</sup> &amp; 8<sup>th</sup> Grade Team</b>	<b>LT (1001 – 1999)</b>	<b>PT (4001 – 4999)</b>
<b>7<sup>th</sup> Grade</b>	<b>L7 (2001 – 2499)</b>	<b>P7 (5001 – 5499)</b>
<b>8<sup>th</sup> Grade</b>	<b>L8 (2501 – 2999)</b>	<b>P8 (5501 – 5999)</b>
<b>High School</b>	<b>LS (3001 – 3499)</b>	<b>PS (6001 – 6499)</b>
<b>High School Team</b>	<b>LST (3501 – 3999)</b>	<b>PST (6501 – 6999)</b>

## Special Categories

<b>AT = Applied Technology</b>	<b>EE = Engineering: Electrical &amp; Mechanical</b>
<b>AS = Animal Science</b>	<b>ET = Energy &amp; Transportation</b>
<b>BE = Behavioral &amp; Social Sciences</b>	<b>EV = Environmental Analysis</b>
<b>BI = Biochemistry</b>	<b>EM = Environmental Management</b>
<b>CB = Cellular &amp; Molecular Biology</b>	<b>MA = Mathematical Sciences</b>
<b>CH = Chemistry</b>	<b>ME = Medicine &amp; Health Sciences</b>
<b>CS = Computer Science</b>	<b>MI = Microbiology</b>
<b>EA = Earth Science</b>	<b>PH = Physics &amp; Astronomy</b>
<b>EN = Engineering: Materials &amp; Bioengineering</b>	<b>PS = Plant Science</b>

## Special Category Composites

<b>Biotechnology</b>	<b>AS, BI, CB, EN, ME, MI, PS</b>
<b>Environmental</b>	<b>EV, EM</b>
<b>Engineering</b>	<b>EN, EE</b>
<b>Sustainability</b>	<b>EA, EN, EE, ET, EV, EM</b>

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

LST

Project  
Number

3505

Title: Effects of Sugar Diets on Drosophila Melanogaster

Student Name(s): A. Johnson, E. Garcia

## Abstract:

Drosophila Melanogaster can be used as research models that help us make many significant discoveries that can be applied to the learning of human physiology. In our experiment, we are using flies as models in place of people. The purpose of this experiment is to show the effects of Drosophila Melanogaster when exposed to a high sugar diet that will potentially cause diabetes. This idea came to us because of the potential future advancements, further insight into high concentrated sugar diets that can show how humans could potentially be affected, prevention, etc. The experiment will be set up in the following manner, flies will be separated into three groups, group one having the normal fly food recipe, group two will have a 15% increase of dextrose, and group three will have a 30% increase of dextrose. We will measure the number of deceased flies, and determine whether they died from their insulin receptors being ruined (resulting in diabetes). This experiment will follow death rates because when exposed to a diet high in dextrose we hypothesized we'd see changes in death rates, this is because the flies won't be able to metabolize all of the sugar they consume which will cause their insulin receptors to malfunction and many of them will die off. This experiment will show how diabetes in Drosophila Melanogaster affects their day-to-day actions, while also demonstrating the fluctuations in death rates.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME AS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LST

Project Number

3508

**Title:** The Antimicrobial Effects of Copper on Antibiotic Resistant Strains of Bacteria

**Student Name(s):** N. Smith, G. Fowler

**Abstract:**

The project we've been conducting experiments on, targets the antimicrobial effects of copper from the antibiotic resistance found in strains of bacteria. Copper has the potential to kill other types of deadly diseases and viruses in places like hospitals and public areas where bacteria spreads rapidly. Our project has been completed by physically contacting copper to the substitute ESKAPE pathogen relatives throughout three trials. The petri dishes contain 10% TSA along with 4 groups of the bacteria used for the streaking. The eskape pathogen relatives we're using are: Pseudomonas putida, Staphylococcus epidermidis, Bacillus subtilis and Escherichia coli. Our results have shown copper's ability to fight off pathogens from the streaked bacteria. Four categories organized as control, present, after and under represent different techniques performed to find different results varying from the data recorded in each trial. The petri dishes from each group shows different reactions found due to copper encountering the different types of bacteria in certain instances. The "control" only has bacteria streaked onto the media, the "present" has copper immediately placed on the streaked media opposed to "after" representing copper placed onto streaked media afterwards and the "under" group has copper embedded into the streaked media. Over the course of several weeks, the results observed have been undeniable seeing that the absence of bacteria from the copper has been drastic. Altogether, copper has a natural ability to fight off eskape pathogen relatives because of its antimicrobial properties, and it has a lot of potential if used properly.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV CB MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LST

Project Number

3509

Title: Converting Natural Byproducts Into Soil Compost For Crops Using the Bokashi Method

Student Name(s): L. Salazar, G. Fedus, N. Mendez

## Abstract:

The Bokashi composting method is a method used to break down food and organic matter to provide plants with nutrients. Places like Hawaii and Asia typically use this way of composting because the majority of the plants grown there are anaerobic. It is an efficient way to save space rather than continuously adding waste to landfills. The Bokashi composting method will help minimize several environmental problems that society faces today, including landfills and hazardous waste disposal. Landfills all around the world release huge amounts of methane and carbon emissions. Both of these greenhouse gases contribute to climate change, which is why the global food system makes up for one third of human-caused gas emissions. This composting method reuses natural byproducts in fruit, vegetable, dairy, meat, and bone waste to provide an additional amount of nutrients for plants. The Bokashi method is simple to set up, creating the flakes that contain the EM-1 bacteria, lactobacillus casei strains. EM-1 bacteria is the microbial inoculant that enables the waste to break down. The waste products are then left for ten days, allowing the bacteria to ferment the food. The purpose of this research is to show an alternative method that is better than traditional composting methods. The simplicity of the setup and the usage of the byproducts in the compost could have a significant impact on future gardening. If America can implement Bokashi composting, it can help eliminate thousands of pounds of waste in landfills that add to environmental contaminants and global warming.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM EA MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

206

Fair Category

LST

Project  
Number

3518

Title: Heat Shocking Caenorhabditis Elegans to Show Symptoms of Alzheimer's

Student Name(s): K. Caswell

## Abstract:

Alzheimer's disease (AD) is a progressive disorder that causes brain cells to waste away (degenerate) and die. Currently, over 4 million Americans suffer from this disease and unfortunately, over 22,000 Americans die each year from Alzheimer's disease. In patients suffering from Alzheimer's disease (autosomal dominant hereditary), mutations in the amyloid precursor protein (APP) can be found. Caenorhabditis elegans were used in this experiment because they have the same APP gene that is present in humans. In humans when the APP gene is already mutated/ blocked Alzheimer's symptoms are present. By heat shocking the C. elegans it creates a block/plaque in the APP gene, just like in the human APP gene. That plaque build-up will make the C. elegans show symptoms of early-onset or even an advanced onset of the disease. C. elegans will present with symptoms like; difficulty moving, forgetfulness with eating, shorter life expectancy, change in how they move, and their trails. By exposing the C. elegans to the heat shock method it is going to cause plaque build-up, from there we can find a way to reverse the protein plaque which ultimately reverses the symptoms of "Alzheimer's". This research can lead to possible new treatments for Alzheimer's and Dementia patients.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME MI CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LST

Project  
Number

3519

Title: Using CRISPR To Silence Antibiotic Resistant Genes In Bacteria

Student Name(s): R. Savoie, R. Riley

## Abstract:

Ampicillin resistance or any type of antibiotic resistance is a leading cause for bacterial infections to spread from person to person which can lead to deaths from these infections. Beta-lactamase is a common enzyme produced by bacteria and can cause resistance to many antibiotics like ampicillin. In this project the goal is to use CRISPR to remove or silence this beta-lactamase enzyme. An "Out of the Blue CRISPR Kit" from Bio-Rad was used to show how CRISPR works and how it can silence or take out a gene. The kit was used to show how E. coli HB101-pBRKan can be incubated and produce blue colonies by the lacZ gene. After CRISPER is added the colonies turn white. The reason for this is CRISPR is silencing the gene lacZ. So in theory if CRISPR is used to remove or silence the gene in bacteria that produces the enzyme beta-lactamase that causes antibiotic-resistance then the current antibiotics can be used to fight bacterial infections. Antibiotic-resistance is a major health problem and something that needs to be addressed and highly emphasized right now at least 35,000 people die from antibiotic-resistance every year in the U.S. and there are more than 2.8 million antibiotic-resistant infections in the U.S. every year. These numbers could rise to almost 10 million deaths worldwide by 2050 and by 2030 nearly 24 million people worldwide could experience extreme poverty due to antibiotic-resistance.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB MI PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

PST

Project  
Number

6503

Title: Sucrose vs Drosophila melanogaster

Student Name(s): J. Reels, C. Howard

## Abstract:

Drosophila Melanogaster can be used as research models that help us make many significant discoveries that can be applied to the learning of human physiology. In our experiment, we are using flies as models in place of people. The purpose of this experiment is to show the effects of Drosophila Melanogaster when exposed to a high sugar diet that will potentially cause diabetes. This idea came to us because of the potential future advancements, further insight into high concentrated sugar diets that can show how humans could potentially be affected, prevention, etc. The experiment will be set up in the following manner, flies will be separated into three groups, group one having the normal fly food recipe, group two will have a 15% increase of dextrose, and group three will have a 30% increase of dextrose. We will measure the number of deceased flies, and determine whether they died from their insulin receptors being ruined (resulting in diabetes). This experiment will follow death rates because when exposed to a diet high in dextrose we hypothesized we'd see changes in death rates, this is because the flies won't be able to metabolize all of the sugar they consume which will cause their insulin receptors to malfunction and many of them will die off. This experiment will show how diabetes in Drosophila Melanogaster affects their day-to-day actions, while also demonstrating the fluctuations in death rates.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AS BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No