

Name(s) of ISEFers: Danielle Grenier

Date: September 16, 2020

ISEF PROJECT PRÉCIS

Working title of the project:

The effect of electromagnetic (EM) fields on fruit fly navigation

I/we plan to (check the choice that best fits your project at this time):

- | | |
|---|---|
| <input checked="" type="checkbox"/> Do an experiment to test a hypothesis | <input type="checkbox"/> Develop a new way of doing something |
| <input type="checkbox"/> Conduct an observational experiment | <input type="checkbox"/> Develop something new with math |
| <input type="checkbox"/> Create something new to address a need | <input type="checkbox"/> Develop something new with computers |

Problem Statement: Provide context for this project with one or two sentences that briefly describes a currently existing issue. Explain the value of your project with EVIDENCE from your background research.

EM fields are a growing public health concern (see Ref. #1). Cell phones are a huge part of people's everyday lives, and in fact, people spend a lot of time each day in close contact with their phones and other devices emitting electromagnetic fields (see Ref. #4). EM fields can be measured with a gauss/Tesla meter (see Ref. #3). EM fields continue to be a health concern though the research is inconclusive (Ref. #3 and #4). Fruit flies can be a good model for human health effects because they share many genes with humans (need reference). Fruit flies are influenced by static electric fields (Ref. #5), suggesting that EM fields may have a negative effect on flight, and a biochemical pathway has been suggested (Ref. #4) for EM field disruption in flies. Previous studies have not used for food intake as a variable in a well-controlled experiment (Ref. #4, #5). This study will conclusively demonstrate effects, if any, of EM fields on neurological processes (orientation, navigation and flight) necessary for survival in fruit flies.

Research question OR the Engineering Goal:

A good research question refers to an independent variable to one or more dependent variables.

A good engineering goal is a focused declarative sentence or two that summarizes the specific goal(s) of your project stated using goal-oriented terms of desired outcomes.

How do EM fields from a cell phone impact the fruit fly's ability to fly and find food?

IV: EM fields present or not

DV: Time it takes for the fruit fly to find food

Background Research Citations and their Value – write out on a separate page and attach to this worksheet: these citations should be written in APA format and you should have a minimum of 5

- ✓ One reference that presents basic background knowledge related to your topic (often a textbook or manual).
- ✓ One article on why this topic is important
- ✓ One reference on what is known about the *focused area* you plan to examine within that topic area
- ✓ One reference for the methods used in projects of this type – maybe shows a procedure you can use, or explains what equipment was used, or shows appropriate statistical analysis
- ✓ One that describes findings of a related experiment or engineering design.

Fill out the following in for each of the five articles (you may choose to recreate this table on a separate page):

<p>Citation (APA Format) #1 What are electromagnetic fields? (2017). Retrieved September 21, 2017, from https://www.who.int/peh-emf/about/whatisEMF/en/ (World Health Organization International)</p>	<p>This article supports the:</p> <table border="0"> <tr> <td><input type="checkbox"/> Background research</td> <td><input type="checkbox"/> Methods</td> </tr> <tr> <td><input checked="" type="checkbox"/> Importance of the topic</td> <td><input type="checkbox"/> Related experiment or engineering design</td> </tr> <tr> <td><input type="checkbox"/> Focus area in my topic</td> <td></td> </tr> </table>	<input type="checkbox"/> Background research	<input type="checkbox"/> Methods	<input checked="" type="checkbox"/> Importance of the topic	<input type="checkbox"/> Related experiment or engineering design	<input type="checkbox"/> Focus area in my topic	
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<p>Thesis Statement (main argument): There are many types of EM fields; some are natural and some are man-made, but they are are created by differences in voltage.</p>							
<p>3 facts that you think will be important later: You don't need one of each, but consider: ethos (establishing credibility), logos (facts, statistics, examples, quotes), and pathos (emotional appeal) This citation is mostly an overview of the science involved with EM fields – it is presenting a summary of information collected by researchers around the world so they don't necessarily have an argument.</p> <ol style="list-style-type: none"> 1. This is the World Health Organization, many world experts contribute to this research 2. They use principles from physics to describe electrical and magnetic fields 3. These EM fields have an impact on the human body but the way that looks varies greatly. 							
<p>A quote that inspires your project: "Electromagnetic fields are present everywhere in our environment but are invisible to the human eye. Electric fields are produced by the local build-up of electric charges in the atmosphere associated with thunderstorms."</p>	<p>Your thoughts (reactions, connections, agree, disagree, ideas to build on/support or refute) This paper is a good way to get started learning about EM fields and it shows that they know there are impacts on organisms</p>						

✓ **I checked on the ISEF project database to see if my project has already been done/investigate and if it has, I have an idea about how I can modify/improve. Link to ISEF Project Database:**
<https://student.societyforscience.org/projects-database>

Experimental Considerations & Risks: (Check all that apply)

- Use of vertebrate animals** (such as changing diet, behavior study, taking tissue or other samples from the animal)
- Use of human subjects** (such as asking people to eat and/or drink anything, exercise, do a quiz or answer survey questions)
- Growth and study of bacteria, fungi, molds, and/or viruses; use of animal or human tissues**
- Potentially hazardous chemicals** (even common household chemicals that might harm health or the environment)
- Hazardous activities** (NOTE: most projects involving weapons are NOT allowed)

All projects must have an Adult Sponsor. See your ISEF Guidebook for more information about this person's role in your project. Please have your Adult Sponsor* sign this form before you turn it in.

To the Adult Sponsor: *I have reviewed this brief project proposal and am willing to serve as Adult Sponsor on this ISEF project for the school year. As Adult Sponsor, I will offer suggestions on the research plan when it is shared with me, and periodically check in with the student to affirm progress.*

Name: Mr. Schauer Signature: Mr. Schauer Date: _____

<p>Citation (APA Format) #2 Kanda, M. (1993). Standard probes for electromagnetic field measurements. <i>IEEE Transactions on Antennas and Propagation</i>, 41(10), 1349-1364. doi:10.1109/8.247775</p>	<p>This article supports the:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Background research <input type="checkbox"/> Importance of the topic <input type="checkbox"/> Focus area in my topic <input type="checkbox"/> Methods <input type="checkbox"/> Related experiment or engineering design
<p>Thesis Statement (main argument): There are different antennas for measuring radio frequency – some of these are better for some applications and others work better for others.</p>	
<p>3 facts that you think will be important later: You don't need one of each, but consider: ethos (establishing credibility), logos (facts, statistics, examples, quotes), and pathos (emotional appeal)</p> <ol style="list-style-type: none"> 1. They evaluate several different types of dipoles 2. Each type of antenna demonstrates a different compromise between broadband frequency response and sensitivity 3. They also look at how the microenvironment can impact the receiving characteristics of each antenna 	
<p>A quote that inspires your project: "Each type of antenna demonstrates a different compromise between broadband frequency response and sensitivity"</p>	<p>Your thoughts (reactions, connections, agree, disagree, ideas to build on/support or refute) This article starts to give me an introduction to how EM signals are measured and evaluated.</p>

<p>Citation (APA Format) #3 Mccallum, L. C., Aslund, M. L., Knopper, L. D., Ferguson, G. M., & Ollson, C. A. (2014). Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern? <i>Environmental Health</i>, 13(1). doi:10.1186/1476-069x-13-9</p>	<p>This article supports the:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Background research <input type="checkbox"/> Importance of the topic <input type="checkbox"/> Focus area in my topic <input checked="" type="checkbox"/> Methods <input type="checkbox"/> Related experiment or engineering design
<p>Thesis Statement (main argument): The results suggest that there is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices</p>	
<p>3 facts that you think will be important later: You don't need one of each, but consider: ethos (establishing credibility), logos (facts, statistics, examples, quotes), and pathos (emotional appeal)</p> <ol style="list-style-type: none"> 1. They used 15 wind turbines as examples but they measured many parts: substations, buried and overhead collector and transmission lines etc. 2. Data were collected during three operational scenarios to characterize potential EMF exposure: 'high wind' (generating power), 'low wind' (drawing power from the grid, but not generating power) and 'shut off' (neither drawing, nor generating power). 3. Most recently worries about exposure to EMF has been raised at public meetings and legal proceedings These fears have not been based on any actual measurements of EMF exposure surrounding existing projects but appear to follow from worries from internet sources and misunderstanding of the science 	
<p>A quote that inspires your project: Magnetic field levels detected at the base of the turbines were low and rapidly diminished with distance, becoming indistinguishable from background within 2 m of the base</p>	<p>Your thoughts (reactions, connections, agree, disagree, ideas to build on/support or refute) This seems like a very well done paper, it's in a peer-reviewed journal and they found that you have to be very close to be exposed to any EMF</p>

<p>Citation (APA Format) #4 Fedele, G., Green, E. W., Rosato, E., & Kyriacou, C. P. (2014). An electromagnetic field disrupts negative geotaxis in <i>Drosophila</i> via a CRY-dependent pathway. <i>Nature Communications</i>, 5. doi:10.1038/ncomms5391</p>	<p>This article supports the:</p> <table border="0"> <tr> <td><input type="checkbox"/> Background research</td> <td><input type="checkbox"/> Methods</td> </tr> <tr> <td><input type="checkbox"/> Importance of the topic</td> <td><input checked="" type="checkbox"/> Related experiment or engineering design</td> </tr> <tr> <td><input type="checkbox"/> Focus area in my topic</td> <td></td> </tr> </table>	<input type="checkbox"/> Background research	<input type="checkbox"/> Methods	<input type="checkbox"/> Importance of the topic	<input checked="" type="checkbox"/> Related experiment or engineering design	<input type="checkbox"/> Focus area in my topic	
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<p>Thesis Statement (main argument): Negative geotaxis in flies, scored as climbing, is disrupted by a static EMF, and this is mediated by cryptochrome (CRY), the blue-light circadian photoreceptor.</p>							
<p>3 facts that you think will be important later: You don't need one of each, but consider: ethos (establishing credibility), logos (facts, statistics, examples, quotes), and pathos (emotional appeal)</p> <ol style="list-style-type: none"> 1. Something about CRY is connected to EMF 2. <i>Drosophila melanogaster</i> also respond to electromagnetic fields (EMFs), although the reported effects are quite modest 3. CRY expression in antennae, is sufficient to mediate negative geotaxis and EMF sensitivity. Climbing therefore provides a robust and reliable phenotype for studying EMF responses in <i>Drosophila</i>. 							
<p>A quote that inspires your project: Many higher animals have evolved the ability to use the Earth's magnetic field, particularly for orientation.</p>	<p>Your thoughts (reactions, connections, agree, disagree, ideas to build on/support or refute) Animals actually USE EMF to navigate the world, so maybe extra EMF from man-made sources is bad because it messes with the naturally occurring fields</p>						

<p>Citation (APA Format) #5 Electric fields signal 'no flies zone'. (2015, July 31). Retrieved September 21, 2017, from https://www.southampton.ac.uk/news/2015/07/electric-fields-signal-no-flies-zone.page</p>	<p>This article supports the:</p> <table border="0"> <tr> <td><input type="checkbox"/> Background research</td> <td><input type="checkbox"/> Methods</td> </tr> <tr> <td><input type="checkbox"/> Importance of the topic</td> <td><input type="checkbox"/> Related experiment or engineering design</td> </tr> <tr> <td><input checked="" type="checkbox"/> Focus area in my topic</td> <td></td> </tr> </table>	<input type="checkbox"/> Background research	<input type="checkbox"/> Methods	<input type="checkbox"/> Importance of the topic	<input type="checkbox"/> Related experiment or engineering design	<input checked="" type="checkbox"/> Focus area in my topic	
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<p>Thesis Statement (main argument): wings of the insects are disturbed by static electric fields</p>							
<p>3 facts that you think will be important later: You don't need one of each, but consider: ethos (establishing credibility), logos (facts, statistics, examples, quotes), and pathos (emotional appeal)</p> <ol style="list-style-type: none"> 1. Fruit flies are often used as model organisms to understand fundamental problems in biology 2. Flies avoid spaces that are charged, unless they have no wings, then they don't seem to care. And smaller wings seem to avoid the charge, but not as much as the fully-winged. 3. It seems as though the scale of the fields relative to the size of the organism matter 							
<p>A quote that inspires your project: "We are particularly interested in how electric fields could be used in pest control"</p>	<p>Your thoughts (reactions, connections, agree, disagree, ideas to build on/support or refute) This opens up a whole bunch of new research questions that could be ISEF projects!</p>						