

**NMSEF ENTRY FORM**  
 Please place all forms in numerical order with this form as the top sheet for each student project.

Student Name: Claire Sample Grade: 8

Teacher/Sponsor: SUE DODGE School Year: 2019-2020

Student School: New School of Lancaster School District: N/A

Project Title: Can an invasive species be repurposed as a bio-absorbent?

**Junior Division Category**

- Consumer Science
- Earth Science
- Engineering
- Life Science
- Physical Science
- Plant Science

**Senior Division Category**

- Animal Science
- Behavioral and Social Sciences
- Biochemistry, Cellular and Molecular Biology
- Biomedical, Health, Translational Medical Sciences
- Chemistry
- Computational Biology, Bioinformatics, and Biomedical Engineering
- Earth and Environmental Sciences
- Energy: Chemical
- Energy: Physical
- Environmental and Mechanical Engineering
- Materials Sciences
- Mathematics
- Microbiology
- Physics and Astronomy
- Plant Sciences
- Robotics, Systems Software, and Embedded System

*Please select only ONE category*

**NMSEF SRC Approval Form**

- Required for ALL/MOST Projects
- Signed Checklist for Adult Sponsor (1)
  - Student Checklist (1A)
  - A Research Plan
  - 5 Sources in Bibliography
  - Signed Approval Form (1B)
  - Risk Assessment Form (3)

- Regulated Research Institution Project (Form 1C)
- Continuation Project (Form 7)
- Human Consent Project (Form 4)

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
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( indicates a problem form – see comments for details)

ANY Project with the following forms MUST be reviewed by a Governing SRC member

- Signed Qualified Scientist Form (2)
- Human Subjects Form (4)
- Vertebrate Animal Form (5A)
- Vertebrate Animal Form (5B)
- Potentially Hazardous Biological Agents Form (6A)
- Human and Vertebrate Animal Tissue Form (6B)
- Continuation Projects Form (7)

( indicates a problem form – see comments for details)

**Project Proposal APPROVED**

Research may begin immediately; no further conditions are required by the SRC.

**Project Proposal CONDITIONALLY APPROVED**

Research may begin immediately; the above conditions must be rectified in the final application. Make corrections and re-submit between November and January for final SRC approval.

**Project Proposal DENIED**

See above for details of denial, please make contact with fair officials for assistance on how to rectify any issues.

  
 SRC Member Signature

  
 Governing SRC Member Signature (if required)

00/00/00  
 SRC Review Date

# Student Checklist (1A)

This form is required for ALL projects.

1. a. Student/Team Leader: \_\_\_\_\_ Grade: \_\_\_\_\_  
Email: \_\_\_\_\_ Phone: \_\_\_\_\_  
b. Team Member: \_\_\_\_\_ c. Team Member: \_\_\_\_\_

2. Title of Project:  
\_\_\_\_\_

3. School: \_\_\_\_\_ School Phone: \_\_\_\_\_  
School Address: \_\_\_\_\_  
\_\_\_\_\_

4. Adult Sponsor: \_\_\_\_\_ Phone/Email: \_\_\_\_\_

5. Does this project need SRC/IRB/IACUC or other pre-approval?  Yes  No Tentative start date: \_\_\_\_\_

6. Is this a continuation/progression from a previous year?  Yes  No  
If Yes:

**Question 5 is confusing. All projects need to be approved by the NMSEF SRC, so check yes.**

a. Attach the previous year's  Abstract **and**  Research Plan/Project Summary

b. Explain how this project is new and different from previous years on  
 Continuation/Research Progression Form (7)

7. This year's laboratory experiment/data collection:

\_\_\_\_\_ Actual Start Date: (mm/dd/yy)

\_\_\_\_\_ End Date: (mm/dd/yy)

8. Where will you conduct your experimentation? (check all that apply)

Research Institution  School  Field  Home  Other: \_\_\_\_\_

9. List name and address of all non-home and non-school work site(s):

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone/  
email \_\_\_\_\_

10. Complete a Research Plan/Project Summary following the Research Plan/Project Summary instructions and attach to this form.

11. An abstract is required for all projects after experimentation.

# Checklist for Adult Sponsor (1)

This completed form is required for ALL projects.

To be completed by the Adult Sponsor in collaboration with the student researcher(s):

Student's Name(s): \_\_\_\_\_

Project Title: \_\_\_\_\_

1.  I have reviewed the ISEF Rules and Guidelines.
2.  I have reviewed the student's completed Student Checklist (1A) and Research Plan/Project Summary.
3.  I have worked with the student and we have discussed the possible risks involved in the project.
4.  The project involves one or more of the following and requires prior approval by an SRC, IRB, IACUC or IBC:
  - Humans  Potentially Hazardous Biological Agents
  - Vertebrate Animals  Microorganisms  rDNA  Tissues
5.  Items to be completed for **ALL PROJECTS**
  - Adult Sponsor Checklist (1)  Research Plan/Project Summary
  - Student Checklist (1A)  Approval Form (1B)
  - Regulated Research Institutional/Industrial Setting Form (1C) (when applicable; after completed experiment)
  - Continuation/Research Progression Form (7) (when applicable)

**Additional forms required if the project includes the use of one or more of the following** (check all that apply):

- Humans**, including student designed inventions/prototypes. (Requires prior approval by an Institutional Review Board (IRB); see full text of the rules.)
  - Human Participants Form (4) or appropriate Institutional IRB documentation
  - Sample of Informed Consent Form (when applicable and/or required by the IRB)
  - Qualified Scientist Form (2) (when applicable and/or required by the IRB)
- Vertebrate Animals** (Requires prior approval, see full text of the rules.)
  - Vertebrate Animal Form (5A) - for projects conducted in a school/home/field research site (SRC prior approval required.)
  - Vertebrate Animal Form (5B) - for projects conducted at a Regulated Research Institution. (Institutional Animal Care and Use Committee (IACUC) approval required prior experimentation.)
  - Qualified Scientist Form (2) (Required for all vertebrate animal projects at a regulated research site or when applicable)
- Potentially Hazardous Biological Agents** (Requires prior approval by SRC, IACUC or IBC, see full text of the rules.)
  - Potentially Hazardous Biological Agents Risk Assessment Form (6A)
  - Human and Vertebrate Animal Tissue Form (6B) - to be completed in addition to Form 6A when project involves the use of fresh or frozen tissue, primary cell cultures, blood, blood products and body fluids.
  - Qualified Scientist Form (2) (when applicable)
  - The following are exempt from prior review but require a Risk Assessment Form 3: projects involving protists, archae and similar microorganisms, for projects using manure for composting, fuel production or other non-culturing experiments, projects using color change coliform water test kits, microbial fuel cells, and projects involving decomposing vertebrate organisms.
- Hazardous Chemicals, Activities and Devices** (No SRC prior approval required, see full text of the rules.)
  - Risk Assessment Form (3)
  - Qualified Scientist Form (2) (required for projects involving DEA-controlled substances or when applicable)
- Other**
  - Risk Assessment Form (3)

\_\_\_\_\_  
Adult Sponsor's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date of Review (mm/dd/yy)

\_\_\_\_\_  
Phone

\_\_\_\_\_  
Email

# Approval Form (1B)

A completed form is required for each student, including all team members.

## 1. To Be Completed by Student and Parent

### a. Student Acknowledgment:

- I understand the risks and possible dangers to me of the proposed research plan.
- I have read the ISEF Rules and Guidelines and will adhere to all International Rules when conducting this research.
- I have read and will abide by the following Ethics statement

Student researchers are expected to maintain the highest standards of honesty and integrity. Scientific fraud and misconduct are not condoned at any level of research or competition. Such practices include but are not limited to plagiarism, forgery, use or presentation of other researcher's work as one's own, and fabrication of data. Fraudulent projects will fail to qualify for competition in affiliated fairs and ISEF.

\_\_\_\_\_  
Student's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date Acknowledged (mm/dd/yy)  
(Must be prior to experimentation.)

### b. Parent/Guardian Approval: I have read and understand the risks and possible dangers involved in the Research Plan/Project Summary. I consent to my child participating in this research.

\_\_\_\_\_  
Parent/Guardian's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date Acknowledged (mm/dd/yy)  
(Must be prior to experimentation.)

## 2. To be completed by the local or affiliated Fair SRC

(Required for projects requiring prior SRC/IRB APPROVAL. Sign 2a or 2b as appropriate.)

a. Required for projects that need prior SRC/IRB approval BEFORE experimentation (humans, vertebrates or potentially hazardous biological agents).

The SRC/IRB has carefully studied this project's **Research Plan/Project Summary** and all the required forms are included. My signature indicates approval of the **Research Plan/Project Summary** before the student begins experimentation.

\_\_\_\_\_  
SRC/IRB Chair's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date of Approval (mm/dd/yy)  
(Must be prior to experimentation.)

OR

b. Required for research conducted at all Regulated Research Institutions with no prior fair SRC/IRB approval.

This project was conducted at a regulated research institution (not home or high school, etc.), was reviewed and approved by the proper institutional board before experimentation and complies with the ISEF Rules. Attach (1C) and any required institutional approvals (e.g. IACUC, IRB).

\_\_\_\_\_  
SRC Chair's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date of Signature (mm/dd/yy)  
(May be after experimentation)

## 3. Final ISEF Affiliated Fair SRC Approval (Required for ALL Projects)

### SRC Approval After Experimentation and Before Competition at Regional/State/National Fair

I certify that this project adheres to the approved **Research Plan/Project Summary** and complies with all ISEF Rules.

\_\_\_\_\_  
Regional SRC Chair's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date of Approval (mm/dd/yy)

\_\_\_\_\_  
State/National SRC Chair's Printed Name  
(where applicable)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date of Approval (mm/dd/yy)

## Risk Assessment Form (3)

Must be completed before experimentation.

Student's Name(s) \_\_\_\_\_

Title of Project \_\_\_\_\_

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**To be completed by the Student Researcher(s) in collaboration with Designated Supervisor/Qualified Scientist:**  
(All questions must be answered; additional page(s) may be attached.)

1. List all hazardous chemicals, activities, or devices that will be used; identify microorganisms exempt from pre-approval (see Potentially Hazardous Biological Agent rules).
  
  
  
  
  
  
  
  
  
  
2. Identify and assess the risks involved in this project.
  
  
  
  
  
  
  
  
  
  
3. Describe the safety precautions and procedures that will be used to reduce the risks.
  
  
  
  
  
  
  
  
  
  
4. Describe the disposal procedures that will be used (when applicable).
  
  
  
  
  
  
  
  
  
  
5. List the source(s) of safety information.

**To be completed and signed by the Designated Supervisor (or Qualified Scientist, when applicable):**

I agree with the risk assessment and safety precautions and procedures described above. I certify that I have reviewed the Research Plan/Project Summary and will provide direct supervision.

\_\_\_\_\_  
Designated Supervisor's Printed Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date of Review (mm/dd/yy)

\_\_\_\_\_  
Position & Institution

\_\_\_\_\_  
Phone or email contact information

\_\_\_\_\_  
Experience/Training as relates to the student's area of research

Student Name: [REDACTED]

Title of Project: Can an Invasive Species be Repurposed as a Bio-absorbent?

School: The New School of Lancaster

Category: Middle School Earth Science

### **Background**

Excessive presence of nitrogen compounds can lead to pollution of water resources. One way that large amounts of nitrate gets into the water is through the heavy utilization of artificial fertilizers and manure. High levels of nitrate in water can lead to algal blooms, which can harm important ecosystems. This research project proposes to look at the effect of *Carcinus maenas* shells on nitrate levels in water. Chitin, an absorbent polymer, can be found in the shells of crustaceans. In the United States, green crabs threaten many native species by competing for shelter and resources. I am measuring the amount of nitrate left in the water after treatment to discover whether or not *Carcinus maenas* can be repurposed as a bio-absorbent.

### **Research Plan**

**Question:** Will the amount of nitrate in the water change if crushed shells of *Carcinus maenas* are added?

**Independent Variable:** The amount of crushed shells from *Carcinus maenas* added to the water. (milligrams)

**Dependent Variable:** The amount of nitrate in the water (parts per million)

### **Controlled Variables:**

Name	How will it be controlled?
Temperature of the water	The flasks will be in a room that will stay at room temperature.
Amount of water in each flask	The same amount of water will be put in each flask.
Amount of nitrate in the water	Will make an initial large amount of solution with a specific starting nitrate ppm.
The amount of time the aqueous solution is treated before being measured.	Trials will all be started at the same time and allowed to run the same length. Samples will be taken from each flask at the same time.

**Hypothesis:** If crushed shells from *Carcinus maenas* are added to an aqueous solution, the amount of nitrate in the water will decrease because the chitin in the shells will absorb the nitrate in the water.

**Materials:**

- *Carcinus maenas* shells (frozen, from a lobsterman in Maine)
- Ten 200 milliliter glass flasks
- Distilled water
- Miracle-Gro Liquid Plant Food 1-Quart All Purpose Food (from Lowe's)
- Saltwater testing kit (from That Pet Place)
- Blender
- Oven
- Pot
- Lid for the pot
- Shaker
- Balance
- Aluminum foil
- Stirring stick

**Procedures:**

1. Purchase the green crabs from a lobsterman in Maine.
2. With adult supervision, steam the crabs at 120°C.
3. With adult help, remove the meat from each carapace.
4. Dry the carapaces in an oven at 30°C.
5. In a blender, process the crab shells into a powder.
6. Following the instructions on the Miracle-Gro Liquid Plant Food package, dilute it in distilled water.
7. Make an initial stock solution. Mix 1 liter of distilled water with the diluted Miracle-Gro Liquid Plant Food.
8. Place 100 milliliters of the solution into each of the ten 200 milliliter flask.
9. Add 100 milligrams of crushed crab shells to the five experimental flasks.
10. Measure and record the pH and nitrate levels of each flask.
11. Cover each flask with a piece of aluminum foil to prevent external contamination.
12. Place all flasks in the shaker for six hours.
13. Measure and record the pH and nitrate levels of each flask.
14. Repeat the experiment eight times.

**Data Analysis Plan:**

I am going to average the nitrate levels of the experimental and control flasks each trial. I am going to make a bar graph for each trial to show the average nitrate levels of the flasks with crab shells in them and the average nitrate levels of the flasks without crab shells.

<b>Trial Number</b>	<b>Flask Number</b>	<b>pH Before</b>	<b>pH After</b>	<b>Nitrate Before (ppm)</b>	<b>Nitrate After (ppm)</b>
1	Experimental 1				
	Experimental 2				
	Experimental 3				
	Experimental 4				
	Experimental 5				
	Control 1				
	Control 2				
	Control 3				
	Control 4				
	Control 5				



## References / Works Cited:

- Aris, A. Z., Ismail, F. A., Ng, H. Y., & Preveena, S. M. (2014). An Experimental and Modelling Study of Selected Heavy Metals Removal from Aqueous Solution Using *Scylla serrata* as Biosorbent. *Pertinka Journals*. Retrieved October 5, 2018, from [http://www.pertanika.upm.edu.my/Pertanika PAPERS/JST Vol. 22 \(2\) Jul. 2014/13 JST 0448 2012.pdf](http://www.pertanika.upm.edu.my/Pertanika%20PAPERS/JST%20Vol.%2022%20(2)%20Jul.%202014/13%20JST%200448%202012.pdf)
- Banerjee, S. (2015, August 27). Crab shells effective in purifying contaminated water, say Malaysian researchers. Retrieved October 5, 2018, from <https://www.water-technology.net/uncategorised/newscrab-shells-effective-in-purifying-contaminated-water-say-malaysian-researchers-4658258/>
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- European Green Crab. (n.d.). Retrieved October 5, 2018, from <http://www.dfo-mpo.gc.ca/species-especies/profiles-profil/europeangreencrab-crabevert-eng.html>
- Heppe Medical Chitosan GmbH. (n.d.). Retrieved October 5, 2018, from <https://www.gmp-chitosan.com/en/products-services/chitin.html>
- Identifying European Green Crab. (n.d.). Retrieved October 5, 2018, from <https://wsg.washington.edu/crabteam/greencrab/id/>
- Morghì, M., Abidar, F., Soudani, A., Zerbet, M., Chiban, M., Kabli, H., & Sinan, F. (2015). Removal of nitrate ions from aqueous solution using chitin as natural adsorbent. *International Journal of Research in Environmental Studies*, 8-20. Retrieved October 5, 2018, from [http://www.bluepenjournals.org/ijres/pdf/2015/April/Morghì\\_et\\_al.pdf](http://www.bluepenjournals.org/ijres/pdf/2015/April/Morghì_et_al.pdf)
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- Water Treatment Solutions. (n.d.). Retrieved October 5, 2018, from <https://www.lenntech.com/periodic/elements/n.htm>