Brown Summit Middle School Team Scientia Young Innovators Grant Application

I. General Information

a. **Team Name: Team Scientia**
b. **School: Brown Summit Middle School for Advanced Academics**
c. **Designated Teachers: Jessica Runtz, Michael Cacaci**
d. **Teacher Contacts Emails: dayj2@gcsnc.com; cacacim@gcsnc.com**
e. **Team Contact Email: teamscientia@0b00000000.me**
f. **Team Website: http://teamscientia.0b00000000.me**
g. **School Phone: 336-656-0432**

II. Project Information

a. **Project Title: The Effectiveness and Practicality of Systemic versus End-user Applications of Biosorbents in the Removal of Aqueous Nickel, Copper, and Zinc.**
b. **Project Timeframe: A final report will be presented to the judges at the Young Innovators Competition in May 11, 2016.** We hope to have all necessary supplies ordered within one week of grant approval. Any unused funds will be returned to the Old North State BSA Council within two weeks of the project's completion.
c. **Total Project Cost: $249.06 (See Attachment A – Team Budget for details).**

III. Project Description

What if you could turn waste products from staple crops like bananas, oranges, and apples into a safe, efficient way to filter heavy metals from water? Brown Summit Middle School's Team Scientia is looking for a grant to develop a real-world implementation of this promising idea.

Water insecurity is a global problem, but it's not that far away. Just look to Flint, Michigan, where an underprivileged community is being piped water contaminated with lead, which can cause brain damage, especially in young children. Look to industrialized nations around the world where residents live in poverty and have access only to water laced with heavy metals like zinc, copper, nickel, lead, and cadmium, caused by pollution from nearby industries and corroded plumbing. As it turns out, scientific research shows that the peels of many common fruits, such as bananas, oranges, grapes, tomatoes, can be used to remove these toxic contaminants from water. We are requesting a grant to conduct scientific research, building on existing research in peer-reviewed academic journals, to determine the most effective way to implement this exciting technology. Specifically, we will attempt to determine the most effective methods to: (1) dehydrate and prepare the peels, (2) agitate the peels to induce the reaction; and (3) filter out the peels and metal precipitates from the water. We plan to purchase laboratory solutions of copper (Cu), nickel (Ni), and zinc (Z), which we will dilute in deionized water to the concentrations normally found in polluted drinking water. Then, we will clean, dehydrate, and pulverize the fruit peels for use as a biosorbent to precipitate the heavy metals out of the aqueous solution. After agitating the solution and allowing time for the reaction to occur, a mechanical filter will then be used to remove the peel and metal precipitates from the water. We will then

use calibrated test equipment to measure the remaining levels of the metals in the water, and compare the levels to the maximums set by United States federal law and by the World Health Organization.

We will then evaluate how the procedure could be preformed in a non-laboratory environment, such as by using a solar oven to dehydrate the peels, using a household blender to pulverize the peels, and shaking the solution by hand instead of using a laboratory agitator or centrifuge. We will use these findings to determine the most effective way to implement this technology and the costs, benefits, and drawbacks of each implementation model.

IV. Project Expenditures

For a detailed budget for this project, please see Attachment A – Team Budget.

V. Additional Funding

Should additional funding be required for this project, Team Scientia has identified multiple potential sources, including: remaining funds from Brown Summit Middle School's STEM curriculum accounts; fundraising from parents and from the PTSA; inter-grade fundraising competitions; and the use of materials already owned by the school.

VI. Results and Outcomes

While previous research has focused mostly on industrial and large-scale filtration, this project will shed light on the potential for small-scale, consumer water filtration that could be used to combat water insecurity around the world. We will evaluate the efficacy and practicality of the following approaches to utilize this technology: (1) onsite generation of the powder using inexpensive, locally-available equipment; (2) laboratory preparation of powder and distribution for on-site filtering; and (3) large-scale systemic preparation and filtering of main water or wastewater supply. We will also recommend which fruits would be best suited to these usage models and deliver a detailed report featuring the data collected and our reasoning for the above claims. We will present our findings and conclusions at the Young Innovators Science Fair on May 11, 2016.

VII. **Authorization**

a. **Team Approval: As noted in the Team General Meeting Minutes, in a unanimous voice vote on 3/3/2016, Team Scientia delegated to the Project Leader (Anna Croitoru), the Chief Research Officer (Aidan Hunt), and the Lab Manager (Sydney Berry) executive authority to finalize and submit the team's Young Innovators Grant Application prior to the team's next General Meeting and to use and dispense the funds received in accordance with this Application. Acting on the advice and counsel of the team, the Officers listed above duly prepared, executed, and submitted this Young Innovators Grant Proposal Application to the Old North State Council of the Boy Scouts of America. Their signatures and the signatures of the Designated Teachers appear below.**

b. **The Officers and Designated Teachers listed above and in Part I warrant that this Application, including all parts and attached or linked documents, is accurate, correct, and truthful to the best of their knowledge.**

c. **Signatures of Team Officers:**

   i. **Team Leader – Anna Croitoru:** Anna Croitoru

   ii. **Chief Research Officer – Aidan Hunt:** Aidan Hunt

   iii. **Lab Manager – Sydney Berry:** Sydney Berry

d. **Signatures of Designated Teachers:**

   i. **Jessica Runtz:** _____

   ii. **Michael Cacaci:** Michael Cacaci

e. **Date of above Signatures:** 3/7/2016

BSMS Team Scientia Young Innovators Grant Application – Attachment A – Team Budget				
Item	**List Price**	**Item Source**	**Tax on Item**	**Total Cost**
Ni, Cu, and Z Reagents	$60.00	Fisher Science	$4.59	$64.59
40 Fresh Organic Bananas	$8.00	Harris Teeter	$0.16	$8.16
20 Fresh Organic Gala Apples	$25.00	Harris Teeter	$0.50	$25.50
20 Fresh Organic Roma Tomatoes	$11.20	Harris Teeter	$0.22	$11.42
40 Fresh Organic Oranges	$32.00	Harris Teeter	$0.64	$32.64
Contaminant Testing Supplies	$100.00	TBD	$6.75	$106.75
GRAND TOTAL				**$249.06**