



# International Student Science Fair 2018

*To significantly influence life on our planet  
through cooperation and collaboration*

**June 27 - July 1, 2018**

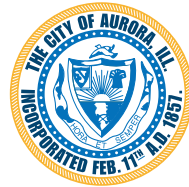
UNITED STATES OF AMERICA

Illinois Mathematics and Science Academy, Aurora, IL

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#ISSF2018 #GLOBALGOALS [issf2018.com](http://issf2018.com)

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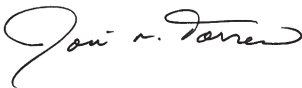
## WELCOME TO ISSF 2018 IN THE USA!

It is my great pleasure to welcome you to the Illinois Mathematics and Science Academy (IMSAS) and the 14th Annual International Student Science Fair. We have an exciting five days planned for you with a little something for everyone. You can connect with others around the world to create knowledge and innovations that support the world. You can also visit Chicago's world-class museums, meet our friendly people, enjoy barbecues and baseball. No matter what you do, we want you to feel right at home here at IMSAS.

I am excited both about the opportunity for IMSAS to host ISSF 2018 and for what will follow as a result of the collaboration and work we will do together on three of the United Nations Sustainable Development Goals: Zero Hunger, Clean Water and Sanitation, and Affordable and Clean Energy. I look forward to seeing the ISSF 2018 theme of "significantly influencing life on our planet through cooperation and collaboration" lived out this week. Our collective ideas for addressing the world's most pressing issues that surpass national boundaries and that cannot be solved by any one country acting alone will change the world. Together, we will be world-changers!

We are delighted you have joined us for what promises to be a most extraordinary event. I urge you to be open and ready to share your ideas. Be ready to learn and be ready to network and develop lifelong friendships. I wish you a wonderful ISSF 2018 experience!

Best Regards,



Dr. José M. Torres, President  
Illinois Mathematics & Science Academy

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### IMSAS BOARD OF TRUSTEES

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*Executive Director, Professional Field Services*

# ABOUT IMSA

Illinois Mathematics and Science Academy (IMSA) is the world's leading teaching and learning laboratory for imagination and inquiry and an esteemed three-year residential high school. Students hail from across Illinois and are enrolled in tuition-free, rigorous college preparatory classes. Graduates are leaders in the business, education, scientific, and civic sectors.

Notable technology alumni include YouTube Co-Founder Steve Chen, PayPal Co-Creator Yu Pan, Yelp Co-Founder Russell Simmons, SparkNotes and OkCupid Co-Founder Sam Yagan, and Hearsay Social Founder, Clara Shih. IMSA is proud to have been named among the top 40 public and private college preparatory institutions in the world by The Wall Street Journal. IMSA has been profiled by NBC-TV's *Dateline*, CNN's *Science and Technology News*, *USA Today*, *New York Times*, and *The Wall Street Journal*.

## IMSA Mission & Vision

IMSA's mission is to ignite and nurture creative, ethical, scientific minds that advance the human condition. IMSA's vision for 2022 is to be a recognized global leader and catalyst in equity and excellence in STEM teaching and learning, innovation and entrepreneurship guided by the United Nations 17 Sustainable Development Goals.

## IMSA Academics

IMSA's academic program prepares students to become bold inquirers, problem solvers and integrative thinkers. It challenges them to question, creatively probe, take risks and test and support their ideas. Talented faculty members, who are among the nation's best, provide challenging opportunities for students to think critically and creatively, engage in exploration and discovery, and apply their knowledge to solve significant, real-world problems.

Student Inquiry and Research (SIR), an integral part of the academic program, enables students to work independently and collaboratively with peers and world-renowned scholars and scientists. Through SIR, students have the opportunity to conduct investigations of their own design with guidance from professionals on-campus at IMSA or off-campus at facilities throughout the Chicago metropolitan area and beyond.

With a focus on STEM and innovation, IN2 Steve and Jaime Chen Center for Innovation and Inquiry, creates authentic learning experiences for teen entrepreneurs, while serving as an ever-evolving model for applied teaching and learning in the 21st century. IN2 prepares students for emerging STEM fields, entrepreneurship ventures and new models of business and collaboration, and collaboration with innovation hubs in Illinois and across the country. Programs offered through IN2 include entrepreneurship and makerspace education. In 2017, IN2 received the People's Choice Award from Chicago Innovation.

## IMSA Outreach

IMSA Outreach is a suite of innovate and experiential programs designed to provide transformative STEM experiences for teachers and students by leading educators at IMSA. IMSA Outreach programs are designed to take the advancements made in teaching and learning on campus, out to teachers and students around the state of Illinois and beyond.

Our Educator and Student programs are rooted in Inquiry, focused on Design-Thinking and promote the development of critical thinking skills to create new knowledge. Through collaborations with leading institutions and universities, IMSA Outreach is changing how teachers and students experience STEM education.

# THANK YOU

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## ORGANIZING COMMITTEES

### **STEERING COMMITTEE**

*Mary Collins, ISSF 2018 Project Manager*

Dr. José Torres, IMSA President

Katherine Berger, Program Chair

Julie Dowling, Logistics Chair

Tami Armstrong, Marketing and Public Relations Chair

Dr. Kelly Page, Digital Media Chair

### **PROGRAM COMMITTEE**

Jean Bigger

Carolyn Harvey

Diane Hinterlong

Julia Husen

Connie James-Jenkin

Dr. Sanza Kazadi

Dr. Crystal Randall

Angela Rowley

### **LOGISTICS COMMITTEE**

Dale Arentsen

Jennifer Banham

Rich Busby

Sarah O'Leary Driscoll

Ralph Flickinger

Chris Kornsey

Dottie Krett

### **STUDENT LEADERS**

*Sonya Gupta, Co-chair*

*Claudia Zhu, Co-chair*

Ellyonna Glenn

Briella Henderson

Eva Liu

Jodie Meng

Daniel Mwangi

Harsha Nalam

Shruti Shakthivel

Katie Si

Mikki Rajvanshi

*A special thank you to Sodexo for providing food service during the event and alumna-owned Spinning Wheel Brands for providing snacks during the week.*

United States Senate  
Washington, DC 20510-1304

Dear Friends,

It gives me great pleasure to welcome all of you to the Illinois Mathematics and Science Academy's 14th International Student Science Fair. This gathering is a special opportunity to recognize the great work of the Illinois Mathematics and Science Academy as well as the many bright young minds participating in the International Student Science Fair.

Since 2005, the International Student Science Fair has brought international students together to showcase their advanced scientific research, exchange ideas and network with fellow STEM students and academics. This year, the Illinois Mathematics and Science Academy has the privilege of hosting the International Student Science Fair, an honor they can be proud of. I applaud your commitment to academic excellence and the Illinois Mathematics and Science Academy.

Again, I would like to extend my warmest wishes to today's attendees for your dedication to the Illinois Mathematics and Science Academy, as well as your participation in the International Student Science Fair. Congratulations on all your work and achievements, and I wish you the best of luck in your future endeavors.

Very truly yours,



Richard J. Durbin  
United States Senator

# United States Senate

Washington, DC 20510-1304

Greetings Friends,

I am honored to welcome you to the Illinois Mathematics and Science Academy's International Student Science Fair. I would like to extend a special welcome to all the students, teachers and principals in attendance today.

I would like to extend a special thank you to the Illinois Mathematics and Science Academy for organizing this wonderful event. Your efforts to educate your students on the importance of critical thinking and understanding the world around us is vital to the education of all young Americans.

To the students, I was thrilled to learn that at such a young age it seems you have mastered the characteristics that will prepare you for the road to achieving all of your dreams. With hard work and perserverance, you will accomplish great things. I wish you much success in your future endeavors.

Sincerely,



Tammy Duckworth  
United States Senator





# Congressional Record

PROCEEDINGS AND DEBATES OF THE 115<sup>th</sup> CONGRESS, SECOND SESSION

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## *House of Representatives*

### Honoring the 14th Annual International Student Science Fair

*HON. BILL FOSTER OF ILLINOIS  
IN THE HOUSE OF REPRESENTATIVES*

**MR. FOSTER.** Mr. Speaker, I rise today to recognize the 14th Annual International Student Science Fair.

The International Student Science Fair is a unique opportunity for young scientists to demonstrate their scientific abilities and achievements on an international stage. It fosters a cross-cultural, collaborative environment that brings together a diverse group of people in the service of a great cause. I am very proud to say that this is the first time the ISSF has been held in the United States and is being held at our own Illinois Math and Science Academy.


The young scientists participating in this esteemed event are part of a new generation that will face some of the most important and fascinating scientific questions of our age. It is truly exciting to see so many young people committed to scientific inquiry and international cooperation.

Mr. Speaker, I ask my colleagues to join me today in recognizing the International Student Science Fair and the great achievements that so many young scientists have made across this country and its communities.

# ROCLAMATION

*Presented by*  
**Senator Linda Holmes**  
*to the*  
**Illinois Mathematics and Science Academy**  
*Presented this 27<sup>th</sup> day of June, 2018*

- WHEREAS:** The members of the Illinois Senate are pleased to recognize The Illinois Mathematics & Science Academy (IMSA) for hosting the 14th Annual International Student Science Fair (ISSF) for the first time in the U.S. in Aurora; and
- WHEREAS:** The Illinois Mathematics and Science Academy develops creative, ethical leaders in science, technology, mathematics and engineering; and
- WHEREAS:** The International Student Science Fair is an annual worldwide event where students from approximately 40 STEM schools across the globe participate in workshops, lab experiments and independent research projects; and
- WHEREAS:** The International Student Science Fair will highlight three global challenges: water, hunger and energy; therefore be it
- PROCLAIMED:** BY THE SENATE OF THE ONE-HUNDREDTH GENERAL ASSEMBLY OF THE STATE OF ILLINOIS, that we celebrate the Illinois Mathematics and Science Academy for its service to thousands of educators and students in Illinois and beyond; and be it further
- PROCLAIMED:** That a suitable copy of this resolution be presented to The Illinois Mathematics & Science Academy at the 14th Annual International Student Science Fair as a symbol of our esteem and respect.



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**Senator Linda Holmes**  
*42<sup>nd</sup> Senate District*

**STATE OF ILLINOIS**  
**HOUSE OF REPRESENTATIVES**  
**100TH GENERAL ASSEMBLY**



HOUSE RESOLUTION NO. 1074  
OFFERED BY REPRESENTATIVE LINDA CHAPA LA VIA

**WHEREAS**, The members of the Illinois House of Representatives wish to recognize The Illinois Mathematics & Science Academy (IMSA) for hosting the 14th Annual International Student Science Fair (ISSF) in Aurora on June 27, through July 1, 2018, this is the first International Student Science Fair hosted in the United States; and

**WHEREAS**, The five-day event will highlight three global challenges that transcend national boundaries; water, hunger, and energy; through the theme, “to significantly influence life on our planet through cooperation and collaboration,” IMSA strives to deepen its mission as the world’s leading teaching and learning laboratory for the prosperity and security of present and future generations; and

**WHEREAS**, The International Student Science Fair provides a festive opportunity for young scientists to showcase their research and compete on an international stage; the fair is organized by the International Science Schools Network (ISSN), which provides a forum for promoting leading-edge science education on a global scale; and

**WHEREAS**, The International Student Science Fair is an annual international event that was officially launched in 2005; visiting students are able to visit local universities and corporate research facilities; approximately 250 students and educators will meet to build professional capacity, share experiences, conduct experiments, engage in workshops, and research independent projects; invitations will be extended to 40 international STEM schools in addition to other United States and western hemisphere STEM schools; IMSA has been participating since 2007; and

**WHEREAS**, IMSA’s mission is “to ignite and nurture creative, ethical, scientific minds that advance the human condition”; as a teaching and learning laboratory created by the State of Illinois, the Academy enrolls academically talented Illinois students, grades 10-12, in its advanced residential college preparatory program; additionally, IMSA serves thousands of educators and students in Illinois and beyond through innovative instructional programs that foster imagination and inquiry; the Academy advances education through research, groundbreaking ventures, and strategic partnerships; and

**WHEREAS**, 2018 marks the Illinois Bicentennial; the International Student Science Fair at IMSA has been designated as a key event of the Bicentennial celebration; therefore, be it

**RESOLVED, BY THE HOUSE OF REPRESENTATIVES OF THE ONE HUNDRETH GENERAL ASSEMBLY OF THE STATE OF ILLINOIS**, we recognize the Illinois Mathematics & Science Academy for hosting the 14th Annual International Student Science Fair and for their commitment to promoting diverse perspectives and lifelong learning; and be it further

**RESOLVED**, That a suitable copy of this resolution be presented to The Illinois Mathematics & Science Academy as an expression of our esteem and respect.

Adopted by the House of Representatives on May 16, 2018.

TIMOTHY D. MAPES  
CLERK OF THE HOUSE

MICHAEL J. MADIGAN  
SPEAKER OF THE HOUSE



**CAMPUS SECURITY**

Emergency: 630.907.5042  
Non Emergency: 630.907.5002

**OFF-CAMPUS EMERGENCY: 911**

**RESIDENTIAL HALLS**

1504: 630.907.5401  
1505: 630.907.5501  
1506: 630.907.5601  
1507: 630.907.5701



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IMSAPublic

**PASSWORD:**

issf2018  
(all lowercase)

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**guidebook**

For the most current program  
information, download the  
ISSF 2018 Guidebook.



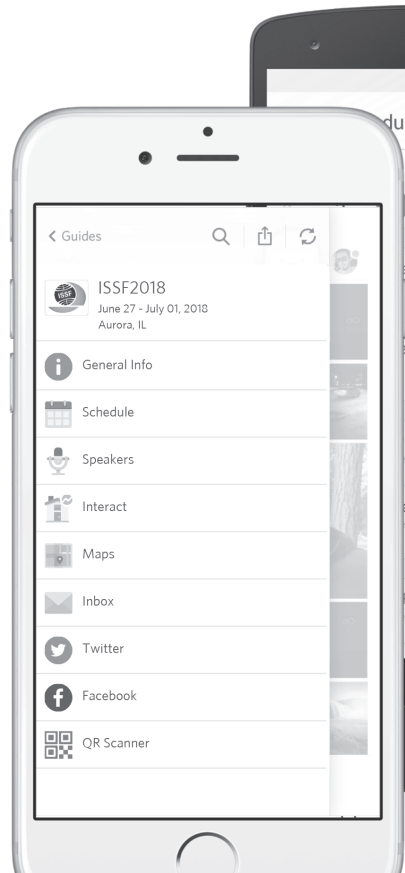
guidebook

# ISSF2018 has gone mobile!

For the most current program information, download the ISSF 2018 Guidebook.  
Get the app on your mobile device now, for free.

<https://guidebook.com/g/issf2018/>

- 1 Visit the above URL on your device
- 2 Tap the "download" button to get the free Guidebook app
- 3 Open Guidebook and look for the guide:  
ISSF2018



The image features a central white hexagon with the word "participants" written in a bold, black, sans-serif font. This central hexagon is surrounded by a grid of dark gray hexagons, all separated by thick black outlines. The overall composition is a repeating pattern of hexagons, with the central one being the only white one.

**participants**

AUSTRALIAN SCIENCE AND MATHEMATICS SCHOOL, AUSTRALIA	
PARTICIPANT	POSITION
Ms. Jayne Heath	Principal
Kay Gillett	Coordinator of Partnerships and Learning
Julia Erceg	Student
Constance Gladwin	Student
Ngan Lai	Student

BEIHANG EXPERIMENTAL SCHOOL, CHINA	
PARTICIPANT	POSITION
Mr. Du Wei	Principal

BROOKHOUSE SCHOOL, KENYA	
PARTICIPANT	POSITION
Mr. Abraham Irudhayaraj	STEM Coordinator
Catherine Achieng Olang	Student
Dwaha Ali Daud	Student
Gouri Rajagopal	Student

BUDI MULIA DUA INTERNATIONAL HIGH SCHOOL, INDONESIA	
PARTICIPANT	POSITION
Mrs. Tasniem Fauzia	Principal
Sukses Risdiyanto	English Teacher
Muhammad Dzulfikar Farkhan	Student
Nabila Fikria Santoso	Student
Naila Aliyahandra Anzani	Student

## PARTICIPANTS

CAMBORNE SCIENCE & INTERNATIONAL ACADEMY, UNITED KINGDOM	
PARTICIPANT	POSITION
Mr. Ian Kenworthy	Principal
Emma Haase	Deputy Principal
Naomi Dower	Science Teacher
Ross Winter	Student
Jamie Burnell	Student

CENTER FOR YOUNG SCIENTISTS, INDONESIA	
PARTICIPANT	POSITION
Mrs. Monika Raharti	Principal
Helita Gusran Imat	Biology Teacher
Chynara Leticia Harisinta	Student
Leo Mahendra	Student
Rosa Nathalia	Student

CHULALONGKORN UNIVERSITY DEMONSTRATION SECONDARY SCHOOL, THAILAND	
PARTICIPANT	POSITION
Mrs. Pornprom Chaichatpornasuk	Principal
Komed Nachaeng	Science Teacher
Sarasit Sirawattanakul	Student
Thipok Bovornratanaraks	Student
Norakamon Ariyakanon	Student

DOREGOS PRIVATE ACADEMY, NIGERIA	
PARTICIPANT	POSITION
Mr. Adebisi Adegbulugbe	Principal
Olaide Oluseyi Lawal	Science Teacher
David Odusanya	Student
Faith Odusanya	Student
Michael Omotoye	Student



**FORT RICHMOND COLLEGIATE, CANADA**

PARTICIPANT	POSITION
Mrs. Janet Gray	Principal
Bob Adamson	STEM Program Director
Cheryl Boguski	Science Teacher
Dylan Walker	Student
Josephine Zhao	Student
Kathleen Bradie	Student

**ILLINOIS MATHEMATICS AND SCIENCE ACADEMY, UNITED STATES OF AMERICA**

PARTICIPANT	POSITION
Dr. José M. Torres	President
Dr. Robert Hernandez	Principal
Alice Liu	Student
Hanson Hao	Student
Mia Ye	Student

**JOHN MONASH SCIENCE SCHOOL, AUSTRALIA**

PARTICIPANT	POSITION
Mr. Peter Corkill	Principal
Sarah Adolph	Science & Physical Education Teacher
Angelin Tomlin	Student
Parker Stroh	Student
Xavier Pellow	Student

## PARTICIPANTS

KAMNOETVIDYA SCIENCE ACADEMY, THAILAND	
PARTICIPANT	POSITION
Dr. Thongchai Chewprecha	Principal Emeritus
Arjaree Thirach	Biology Teacher
Damrongrat Siriwan	Student
Laphon Premcharoen	Student
Ruj Dansriboon	Student

KEANG PENG SCHOOL (SECONDARY SECTION), CHINA	
PARTICIPANT	POSITION
Ms. Wong Ho Ieng	Principal Assistant
Ng Lok Tan	Chemistry Teacher
Chan Chi Hou	Student
Si Tu Ying Ting	Student

KOREA SCIENCE ACADEMY OF KAIST, REPUBLIC OF KOREA	
PARTICIPANT	POSITION
Dr. Yoon Chung	Principal
Eun Young Choi	Chemistry Teacher
Sungkwan Lee	Director of Planning
Juhwan Kim	Director of International Relations
Hangyeol Kim	Student
Junseok Ahn	Student
Sukwoo Jung	Student

LEWISTON-PORTER HIGH SCHOOL, UNITED STATES OF AMERICA	
PARTICIPANT	POSITION
Mr. Jared Taft	Principal
David T.R. Stewart	Administrator
Deborah T. Curtis	Administrator
John Mango	Science Teacher
Bailey Hoplight	Student
Ciaran Edwards	Student
Justin Pavan	Student

LYCÉE CHARLIE CHAPLIN, FRANCE	
PARTICIPANT	POSITION
Philippe Jeanjacquot	Physics and Chemistry Teacher, Head of Physics Department
Elora Abdelghafour	Student
Louis Aknin	Student
Oceane Kleber	Student

MACAU ASSOCIATION FOR PROMOTION OF SCIENCE AND TECHNOLOGY, CHINA	
PARTICIPANT	POSITION
Ashley Huanxian Chen	Coordinator of STEM Education Program

MAHIDOL WITAYANUSORN SCHOOL, THAILAND	
PARTICIPANT	POSITION
Dr. Wiwat Ruenglertpanyakul	Principal
Rattachat Mongkolnavin	Board Member
Pantaree Sodkhoksoong	Student
Papidchaya Chanpong	Student
Thunyarus Rodsawatchuchoke	Student

PARTICIPANTS

MOSCOW SOUTH-EASTERN SCHOOL NAMED AFTER V.I. CHUIKOV, RUSSIAN FEDERATION	
PARTICIPANT	POSITION
Zinaida Osipova	ISSN Coordinator
Alexander Sharipov	Student
Igor Mezentsev	Student
Vera Zaborova	Student

NATIONAL JUNIOR COLLEGE, SINGAPORE	
PARTICIPANT	POSITION
Mr. Harman Johll	Principal
Allan Goh	Head of Department Junior High Science
Sheryl Ang	Head of Department Senior High Science
Ashley Chng	Student
Chelsea Wong	Student
Yu Jing Siong	Student

NEW BEGINNING INTERNATIONAL SCHOOL OF MONGOLIA, MONGOLIA	
PARTICIPANT	POSITION
Mr. Erdene Lkhagvasuren	Principal
Solongo Dashbaldan	Chemistry
Khongorzul Turkhuu	Student
Tuguldur Battulga	Student
Tuguldur Turbaatar	Student

NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE, SINGAPORE	
PARTICIPANT	POSITION
Ann Neo Siao Wei	Teacher (Office of Research, Innovation & Enterprise)
Dejoy Shastikk Kumaran	Student
Maxine Minxin Hong	Student
Ragavi Vijayakumar	Student

## PHILIPPINE SCIENCE HIGH SCHOOL MAIN CAMPUS, PHILIPPINES

PARTICIPANT	POSITION
Rose Mary B. Butaran	Special Science Teacher III
Julliane Jeanne M. Negre	Student
Lorenzo Gabriel P. Joquiño	Student
Patricia Joy G. Sabido	Student

## QUEENSLAND ACADEMY FOR SCIENCE, MATHEMATICS AND TECHNOLOGY, AUSTRALIA

PARTICIPANT	POSITION
Ms. Kath Kayrooz	Principal
Tanya Haggarty	Deputy Principal
Kirsten Hogg	ISSN Coordinator
Aryaman Sud	Student
Kalem Akhtar	Student
Utkarsh Sharma	Student

## RITSUMEIKAN HIGH SCHOOL, JAPAN

PARTICIPANT	POSITION
Dr. Miki Horie	Principal
Hiroshi Tanakda	Former Principal
Natsuki Kasamaki	Math Teacher
Azusa Hashimoto	Student
Haruka Kishi	Student
Yu Tsuchisaka	Student

## ROCKDALE MAGNET SCHOOL FOR SCIENCE AND TECHNOLOGY, UNITED STATES OF AMERICA

PARTICIPANT	POSITION
Shelley Seagraves	Research Teacher
Jacqueline Gomez	Student
Jada Grant	Student
Shivam Vohra	Student

PARTICIPANTS

ROCKY HILL SCHOOL, UNITED STATES OF AMERICA	
PARTICIPANT	POSITION
Pamela Matson	Science Department Chair
Andy Hoffman-Patalona	Physics Teacher
Gregory Tatevian	Student
Jacob Pogacar	Student
Lily Kutcher	Student

SAINT PETERSBURG LYCEUM PHYSICAL TECHNICAL HIGH SCHOOL, RUSSIAN FEDERATION	
PARTICIPANT	POSITION
Mr. Konstantin Stolbov	Vice Principal
Vera Lifshits	English Teacher
Mikhail Dvorkin	Information & Computer Science Teacher
Demid Osipov	Student
Daniil Moshnikov	Student
Evgenii Levдик	Student

SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE	
PARTICIPANT	POSITION
Praveena Sandra Mohan	Science Teacher
Alya Sufiyah binte Mohamed Subhan	Student
Matthew Liang	Student
Valerie Tan	Student

SINT-ODULPHUSLYCEUM, THE NETHERLANDS	
PARTICIPANT	POSITION
Mr. Frans Claassens	Principal
Niels Hesselberth	Director of International Activities
Kinah Deekman	Student
Lora Vogels	Student

TOKYO TECH HIGH SCHOOL OF SCIENCE AND TECHNOLOGY, JAPAN	
PARTICIPANT	POSITION
Dr. Motoshi Saeki	Principal
Hayato Higashi	Electricity and Electronics Teacher
Natsuki Morimoto	Student
Norie Kato	Student
Ruka Ozaki	Student

UNIVERSITY HIGH SCHOOL, PUERTO RICO	
PARTICIPANT	POSITION
Keyla Soto Hidalgo	Biology Teacher
Mirna Gandia Ferrer	English Teacher
Araceli Francisco Berdasco	Student
Jorge Rosa Vidal	Student
Juan Padilla La Llave	Student

WEST AURORA HIGH SCHOOL, UNITED STATES OF AMERICA	
PARTICIPANT	POSITION
Dr. Charles Hiscock	Principal
Anna Gonzales	Science Curriculum Coordinator
Alec Wahl	Student
Nathan Hermann	Student
Rhea Kumar	Student

# global goals focus



## **#GLOBALGOALS**

Follow this hashtag to discover what the world is sharing about the UN Sustainable Development Goals (SDGs).



## UN SUSTAINABLE DEVELOPMENT GOALS (SDGS)

*ISSF 2018 and 3 Global Goals: Hunger. Water. Energy.*

One of IMSA's founding principles is to "significantly influence life on our planet." The International Student Science Fair (ISSF) 2018 program, hosted at the Illinois Mathematics and Science Academy in June 2018, will address three of the world's issues that surpass national boundaries and cannot be solved by any one country acting alone. This trailblazing event will encourage and foster cooperation and collaboration among participating students and educators while addressing the global goals of zero hunger, clean water and sanitation and affordable and clean energy to improve people's lives around the world.

To learn more about the global goals watch the videos below and visit [globalgoals.org](http://globalgoals.org).

- UN Sustainable Development Goals <https://youtu.be/5G0ndS3uRdo>
- Michael Green on SDGs (TED) <https://youtu.be/o08ykAqLOxk>

### Achieving the Sustainable Development Goals

UNESCO, as the United Nations' specialized agency for education, is entrusted to lead and coordinate the Education 2030 Agenda, which is part of a global movement to eradicate poverty through 17 Sustainable Development Goals by 2030. Education, essential to achieve all of these goals, has its own dedicated Goal 4, which aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." The Education 2030 Framework for Action provides guidance for the implementation of this ambitious goal and commitments.

### UN SDG 2: ZERO HUNGER

*"End hunger, achieve food security and improved nutrition and promote sustainable agriculture."*

"It is time to rethink how we grow, share and consume our food" is the central message of UN SDG 2: Zero Hunger. According to the United Nations, 795 million people in the world, or one in nine people are undernourished and not healthy enough to lead an active life. Hunger and malnutrition are the number one risks to health worldwide.

### UN SDG 6: CLEAN WATER AND SANITATION

*"Ensure access to water and sanitation for all."*

Clean, accessible water for all is an essential part of the world we want to live in and is the central message of UN SDG 6: Clean Water and Sanitation. Fresh water sustains human life and is vital for human health. However, due to reduced economics or poor infrastructure, 40 percent of the global population is affected by water scarcity (most of them children).

### UN SDG 7: AFFORDABLE AND CLEAN ENERGY

*"Ensure access to affordable, reliable, sustainable and modern energy for all."*

Affordable and clean energy is central to nearly every major challenge and opportunity the world faces today and is the focus of UN SDG 7: Affordable and Clean Energy. One in five people globally lacks electricity to light their homes or conduct business. Clean and affordable energy is central to nearly every major challenge and opportunity the world faces today — jobs, security, climate change and food production.

Information from <https://www.globalgoals.org>

# ISSF overview

DATE	DAY 1: JUNE 27			DAY 2: JUNE 28	
0700	BREAKFAST				
0800					
0900	OPENING CEREMONY		POSTER SESSIONS	ZSPACE VIRTUAL REALITY DEMO	
1000	RETHINK FOOD				
1100			LUNCH		
1200	LUNCH			CHICAGO EXCURSIONS	
1300	STUDENT ZERO HUNGER DESIGN SPRINT	TEACHER PROJECT IDEATION	PRINCIPAL SHARING SESSION		
1400			EXECUTIVE WORKING GROUP MEETING		
1500					
1600	DESIGN SPRINT SHAREBACK		PRINCIPAL NETWORK- ING	AN EVENING AT THE UNIVERSITY OF CHICAGO	
1700	STUDENT NETWORK- ING	TEACHER NETWORK- ING			
1800					
1900					
2000					
2100					
2200					

DAY 3: JUNE 29		DAY 4: JUNE 30		DAY 5: JULY 1	
BREAKFAST					
AFFORDABLE AND CLEAN ENERGY PANEL		RESEARCH PRESENTATIONS		CLEAN WATER AND SANITATION PANEL	
STUDENT ENERGY WORKSHOPS	TEACHER PROJECT DESIGN AND PLANNING	ISSN STEERING COMMITTEE	LUNCH	STUDENT WATER WORKSHOPS	TEACHER PRESENTATION OF PROJECT IDEAS
ISSF GROUP PHOTO		LUNCH		LUNCH	
FIELD TRIPS		RESEARCH PRESENTATIONS		STUDENT REFLECT AND CONNECT	PRINCIPAL AND TEACHER PROFESSIONAL DEVELOPMENT
		BREAK			PRINCIPALS MEETING
BBQ DINNER		DINNER		CLOSING CEREMONY	
INTERNATIONAL CELEBRATION		EVENING SOCIAL ACTIVITIES			
ICE CREAM SOCIAL					



**schedules**

<b>WEDNESDAY, JUNE 27</b>		
<b>TIME</b>	<b>PROGRAM</b>	<b>DRESS CODE</b>
<b>0730 - 0845</b> Student, Teacher	<b>BREAKFAST</b> Location: Cafeteria	<b>BUSINESS/ SCHOOL UNIFORM</b>
<b>0730 - 0845</b> Principal	<b>BREAKFAST</b> Location: Hampton Inn	
<b>0900 - 1030</b> All	<b>OPENING CEREMONY</b> Location: Auditorium	
<b>1030 - 1045</b> All	<b>BREAK</b>	
<b>1045 - 1130</b> All	<b>RETHINK FOOD: A CONVERSATION</b> Location: Auditorium	
<b>1130 - 1200</b> Student	<b>DESIGN SPRINT ICE BREAKERS AND INSTRUCTIONS</b> Location: IN2, Academic (AC) Pit	
<b>1200 - 1300</b> Teacher, Principal Student	<b>LUNCH</b> Location: Staff Lounge Location: Cafeteria	<b>CASUAL</b>
<b>1300 - 1500</b> Student	<b>ZERO HUNGER DESIGN SPRINT</b> Location: IN2, Academic (AC) Pit	
<b>1330 - 1530</b> Teacher	<b>TEACHER PROJECT IDEATION: ZERO HUNGER (UN SDG 2)</b> Location: A117	
	<b>CLEAN WATER AND SANITATION (UN SDG 6)</b> Location: A121	
	<b>AFFORDABLE AND CLEAN ENERGY (UN SDG 7)</b> Location: A129	
<b>1300 - 1400</b> Principal	<b>PRINCIPAL SHARING SESSION</b> Location: IRC	
<b>1400 - 1600</b> EWG Members	<b>EXECUTIVE WORKING GROUP MEETING</b> Location: Horwitz	
<b>1600 - 1630</b> Student, Teacher	<b>DESIGN SPRINT SHAREBACK</b> Location: Auditorium	
<b>1600 - 2200</b> Principal	<b>PRINCIPAL NETWORKING</b> Location: Chicago	<b>BUSINESS</b>
<b>1730 - 2030</b> Teacher	<b>TEACHER NETWORKING</b> Location: Aurora	<b>CASUAL</b>
<b>1700 - 1830</b> Student	<b>STUDENT NETWORKING: STUDENT DINNER</b> Location: Cafeteria	
<b>1830 - 2030</b> Student	<b>STUDENT NETWORKING: STUDENT SOCIAL ACTIVITIES</b>	
<b>2030 - 2200</b> Student	<b>STUDENT NETWORKING: OUTDOOR ACTIVITIES</b>	

THURSDAY, JUNE 28		
TIME	PROGRAM	DRESS CODE
<b>0730 - 0845</b> Student, Teacher	<b>BREAKFAST</b> Location: Cafeteria	<b>BUSINESS/ SCHOOL UNIFORM</b>
<b>0730 - 0845</b> Principal	<b>BREAKFAST DISCUSSION: DIVERSIFYING STEM EDUCATION TO CAREER PIPELINE</b> Location: Hampton Inn, St. Andrews Conference Room (1st Floor)	
<b>0800 - 1200</b> All	<b>ZSPACE VIRTUAL REALITY DEMONSTRATION</b> Location: IN2	
<b>0900 - 1130</b> All	<b>POSTER SESSIONS</b> Location: Old Café, Science Atrium, Pillow Wall Commons	
<b>1100 - 1200</b> Teacher, Principal Student	<b>LUNCH</b> Location: Staff Lounge Location: Cafeteria	<b>CASUAL</b>
<b>1200 - 1630</b> All	<b>CHICAGO EXCURSIONS</b> Location: Various, Meet in the Old Cafe for departures	
<b>1630 - 2100</b> All	<b>AN EVENING AT THE UNIVERSITY OF CHICAGO</b> Location: University of Chicago	

## FRIDAY, JUNE 29

TIME	PROGRAM	DRESS CODE
<b>0730 - 0845</b> Student, Teacher	<b>BREAKFAST</b> Location: Cafeteria	<b>CASUAL/ ISSF T-SHIRT DAY</b>
<b>0730 - 0845</b> Principal	<b>BREAKFAST</b> Location: Hampton Inn	
<b>900 - 1000</b> All	<b>AFFORDABLE AND CLEAN ENERGY PANEL</b> Location: Auditorium	
<b>1000 - 1015</b> All	<b>BREAK</b>	
<b>1015 - 1215</b> Student	<b>AFFORDABLE AND CLEAN ENERGY WORKSHOP #1: NUCLEAR ENERGY ~ THEN, NOW, AND THE FUTURE</b> Location: B116, B108	
<b>1015 - 1215</b> Student	<b>AFFORDABLE AND CLEAN ENERGY WORKSHOP #2: BUILDING A MICROBIAL FUEL CELL (MFC)</b> Location: A200, A202	
<b>1015 - 1215</b> Student	<b>AFFORDABLE AND CLEAN ENERGY WORKSHOP #3: ENERGY EXPLORATIONS IN THE WINDY CITY</b> Location: A207, A209	
<b>1015 - 1215</b> Teacher	<b>TEACHER PROJECT DESIGN AND PLANNING - WORKING GROUP ~ ZERO HUNGER (UN SDG 2)</b> Location: A117	
<b>1015 - 1215</b> Teacher	<b>TEACHER PROJECT DESIGN AND PLANNING: CLEAN WATER AND SANITATION (UN SDG 6)</b> Location: A121	
<b>1015 - 1215</b> Teacher	<b>TEACHER PROJECT DESIGN AND PLANNING: AFFORDABLE AND CLEAN ENERGY (UN SDG 7)</b> Location: A129	
<b>1015 - 1115</b> Principal	<b>ISSN STEERING COMMITTEE MEETING</b> Location: Horwitz	
<b>1130 - 1215</b> Principal	<b>LUNCH</b> Location: IN2	
<b>1220</b> All	<b>ISSF GROUP PHOTO AND BOX LUNCH PICK UP FOR STUDENTS AND TEACHERS</b> Location: Old Cafe	
<b>1230 - 1700</b> All	<b>FIELD TRIPS</b> Location: Various	
<b>1700 - 1830</b> All	<b>BBQ DINNER</b> Location: Main Gym Patio	
<b>1830 - 2030</b> All	<b>INTERNATIONAL CELEBRATION</b> Location: Auditorium	
<b>2030 - 2130</b> All	<b>ICE CREAM SOCIAL</b> Location: Main Gym Hallway	

1 DAY SCHEDULES

SATURDAY, JUNE 30		
TIME	PROGRAM	DRESS CODE
<b>0730 - 0845</b> Student, Teacher	<b>BREAKFAST</b> Location: Cafeteria	<b>BUSINESS/ SCHOOL UNIFORM</b>
<b>0730 - 0845</b> Principal	<b>BREAKFAST</b> Location: Hampton Inn	
<b>0900 - 1200</b> All	<b>RESEARCH PRESENTATIONS</b> Location: Academic (AC) Pit, Math Study Area, IRC	
<b>1200 - 1300</b> Teacher, Principal Student	<b>LUNCH</b> Location: Staff Lounge Location: Cafeteria	
<b>1300 - 1500</b> All	<b>RESEARCH PRESENTATIONS</b> Location: Academic (AC) Pit, Math Study Area, IRC	
<b>1500 - 1600</b> All	<b>BREAK</b>	
<b>1600 - 1715</b> Teacher, Principal Student	<b>DINNER</b> Location: Staff Lounge Location: Cafeteria	<b>CASUAL</b>
<b>1700 - 2200</b> All	<b>EVENING SOCIAL ACTIVITY: KANE COUNTY COUGARS BASEBALL GAME</b> Location: Northwestern Medicine Field	
<b>1730 - 2100</b> All	<b>EVENING SOCIAL ACTIVITY: CHICAGO PREMIUM OUTLETS</b> Location: 1650 Premium Outlet Blvd., Aurora	



SUNDAY, JULY 1		
TIME	PROGRAM	DRESS CODE
<b>0730 - 0845</b> Student, Teacher	<b>BREAKFAST</b> Location: Cafeteria	<b>CASUAL</b>
<b>0730 - 0845</b> Principal	<b>BREAKFAST</b> Location: Hampton Inn	
<b>900 - 1000</b> All	<b>CLEAN WATER AND SANITATION PANEL</b> Location: Auditorium	
<b>1000 - 1015</b> All	<b>BREAK</b>	
<b>1015 - 1215</b> Student	<b>CLEAN WATER AND SANITATION WORKSHOP #1: BE THE SOLUTION TO WATER POLLUTION - EVERY DROP COUNTS</b> Location: B108/B109, B110/B111	
<b>1015 - 1215</b> Student	<b>CLEAN WATER AND SANITATION WORKSHOP #2: SURVIVOR DAPHNIA ISLAND</b> Location: A207, A209	
<b>1015 - 1215</b> Student	<b>CLEAN WATER AND SANITATION WORKSHOP #3: DON'T ACID RAIN IN MY WATER</b> Location: A200, A202	
<b>1015 - 1215</b> Teacher, Principal	<b>TEACHER PRESENTATION OF PROJECT IDEAS</b> Location: IN2	
<b>1215 - 1315</b> Teacher, Principal Student	<b>LUNCH</b> Location: Staff Lounge Location: Cafeteria	
<b>1315 - 1530</b> Student	<b>REFLECT AND CONNECT</b> Location: Cafeteria	
<b>1315 - 1445</b> Principal, Teacher	<b>PROFESSIONAL DEVELOPMENT: MINDFULNESS</b> Location: Academic (AC) Pit	
<b>1500 - 1600</b> Principal	<b>PRINCIPALS MEETING</b> Location: Academic (AC) Pit	
<b>1615 - 2200</b> All	<b>CLOSING CEREMONY</b> Location: Museum of Science and Industry	

The image features a dark gray background with a pattern of hexagons. A single hexagon in the upper-middle section is white and contains the word "tracks" in a bold, black, sans-serif font. The other hexagons are dark gray and form a grid around the central white one.

**tracks**

**WEDNESDAY, JUNE 27**

TIME	PROGRAM
<p><b>0900-1030</b> Auditorium</p>	<p><b>OPENING CEREMONY</b> During the Opening Ceremony the visiting schools will be introduced, IMSA students will provide entertainment and an overview of the week's activities will be provided. Keynote speaker is Dr. Wil Burns, Co-Executive Director, Forum for Climate Engineering Assessment, School of International Service, American University.</p>
<p><b>ZERO HUNGER</b> Hashtags: #ISSF2018 #GlobalGoals #EndHunger</p> <p>It is time to rethink how we grow, share and consume our food. If done right, agriculture, forestry, and fisheries can provide nutritious foods for all and generate decent incomes while supporting people-centered rural development and protecting the environment. Right now, our soils, freshwater, oceans, forests, and biodiversity are being rapidly degraded.</p> <p>Climate change is putting even more pressure on the resources we depend on, increasing risks associated with disasters such as droughts and floods. Many rural women and men can no longer make ends meet on their land, forcing them to migrate to cities in search of opportunities.</p> <p>A profound change of the global food and agricultural system is needed if we are to nourish today's 795 million hungry and the additional 2 billion people expected by 2050. The food and agricultural sector offers key solutions for development and is central for hunger and poverty eradication.</p>	
<p><b>1045 - 1130</b> Auditorium</p>	<p><b>RETHINK FOOD: A CONVERSATION</b> A panel of subject matter experts will provide their insights on how to begin to end global hunger. The panel will include:</p> <ul style="list-style-type: none"> <li>• David Louridas, WE Schools Program Manager, WE.org</li> <li>• Ali Kleiche, GenUN Fellow Midwest Region, United Nations Association</li> <li>• Tiffany King, Director of Corporate Engagement, Northern Illinois Food Bank</li> <li>• Bill Davison, Extension Educator, Local Food Systems and Small Farms, University of Illinois Extension</li> </ul>
<p><b>1600 - 1630</b> Auditorium</p>	<p><b>DESIGN SPRINT SHAREBACK</b> The winning student ideas will be "pitched" to the entire community.</p>

THURSDAY, JUNE 28	
TIME	PROGRAM
<b>0900-1130</b> Old Café, Science Atrium, Pillow Wall Commons	<b>POSTER SESSIONS</b> Students will present posters of projects from their home schools across a variety of subjects.
<b>1200 - 1630</b> Various	<b>CHICAGO EXCURSIONS</b> Participants will visit one of five of Chicago's world class museums: Adler Planetarium, Art Institute of Chicago, Field Museum, Museum of Science and Industry and Shedd Aquarium.
<b>1630-2200</b> University of Chicago	<b>AN EVENING AT THE UNIVERSITY OF CHICAGO</b> Participants will have the opportunity to take a tour of the campus, experience a faculty taught model class, and engage with a panel of admissions counselors representing several Chicago-area universities and colleges. A box dinner will be provided.

FRIDAY, JUNE 29	
<b>AFFORDABLE AND CLEAN ENERGY</b>	
<p>Hashtags: #ISSF2018 #GlobalGoals #SustainableEnergy</p> <p>Energy is central to nearly every major challenge and opportunity the world faces today. Access to energy, for all, is essential to supporting jobs, security, climate change, food production, and increasing incomes. Sustainable energy is an opportunity—it transforms lives, economies, and the planet.</p>	
TIME	PROGRAM
<b>900 - 1000</b> Auditorium	<b>AFFORDABLE AND CLEAN ENERGY PANEL</b> A panel of subject matter experts will provide their insights on attaining affordable and clean energy. <ul style="list-style-type: none"> <li>• Michael Wang, Senior Scientist and Manager, System Assessments Group, Argonne National Labs</li> <li>• Clive Christison, Vice President, Supply &amp; Optimization, BP Fuels, North America</li> <li>• Kris Zadlo, SVP, Commercial Analytics, Regulatory Affairs &amp; Transmission, Invenergy</li> <li>• The Honorable Bill Foster, U.S. House of Representatives, Illinois Congressional District 11</li> </ul>
<b>1220</b> All	<b>ISSF GROUP PHOTO AND BOX LUNCH PICK UP FOR STUDENTS AND TEACHERS</b> Location: Old Cafe
<b>1230-1700</b> Various	<b>FIELD TRIPS</b> Participants will have an opportunity to participate in one of seven field trips: Argonne National Lab (Clean Energy), Ball Horticulture (Zero Hunger), Fermi National Accelerator Lab (Clean Energy), Illinois American Water Wastewater Facility (Clean Water and Sanitation), Illinois Institute of Technology (Clean Energy, Zero Hunger, Clean Water), Invenergy Renewable Energy Facility (Clean Energy), The Plant (Zero Hunger).
<b>1700 - 1830</b> Main Gym Patio	<b>BBQ PICNIC DINNER</b> Enjoy a good old-fashioned BBQ picnic.
<b>1830 - 2030</b> Auditorium	<b>INTERNATIONAL CELEBRATION</b> Participants will have the opportunity to share their cultural heritage through music, song and dance.
<b>2030 - 2130</b> Main Gym Hallway	<b>ICE CREAM SOCIAL</b> The perfect conclusion to a BBQ picnic—ice cream sundaes!

## SATURDAY, JUNE 30

TIME	PROGRAM
<b>900 - 1200 &amp; 1300 - 1500</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b>
<b>1700 - 2200</b> Northwestern Medicine Field	<b>EVENING SOCIAL ACTIVITY: KANE COUNTY COUGARS BASEBALL GAME AND FIREWORKS</b> The Kane County Cougars are a Class A baseball team affiliated with the Arizona Diamondbacks. Saturday night the Cougars will be playing against the Quad City River Bandits. Prior to the game, Mr. Myers, a Caribbean rock and Jimmy Buffet tribute band, will perform. After the game, there will be an opportunity to "run the bases" and view a fireworks display.
<b>1730 - 2100</b> 1650 Premium Outlet Blvd., Aurora, IL	<b>EVENING SOCIAL ACTIVITY: CHICAGO PREMIUM OUTLETS</b> <a href="http://www.premiumoutlets.com/outlet/chicago">http://www.premiumoutlets.com/outlet/chicago</a>

## SUNDAY, JULY 1

### **CLEAN WATER AND SANITATION**

Clean, accessible water for all is an essential part of the world we want to live in. There is sufficient freshwater on the planet to achieve this goal. But, due to bad economics or poor infrastructure, every year millions of people, most of them children, die from diseases associated with the inadequate water supply, sanitation, and hygiene. Water scarcity, poor water quality, and inadequate sanitation negatively impact food security, livelihood choices, and educational opportunities for poor families across the world. Drought afflicts some of the world's poorest countries, worsening hunger and malnutrition. By 2050, at least one in four people will be likely to live in a country affected by chronic or recurring shortages of fresh water.

TIME	PROGRAM
<b>900 - 1000</b> Auditorium	<b>CLEAN WATER AND SANITATION PANEL</b> A panel of subject matter experts will provide their insight on clean water and sanitation developments and opportunities. <ul style="list-style-type: none"> <li>• Paul R. Anderson, Ph.D., P.E., Armour College of Engineering, Illinois Institute of Technology</li> <li>• Richard Fisher, P.E., CFM, Senior Civil Engineer, Metropolitan Water Reclamation District of Greater Chicago</li> <li>• Vidya Venkataramanan, Post-Doctoral Fellow, Northwestern University</li> <li>• Joshua Miller, Study Coordinator, Northwestern University</li> <li>• Gouthami Rao '08, Environmental Microbiologist, Center for Disease Control and Prevention</li> </ul>
<b>1615 - 2200</b> Museum of Science and Industry	<b>CLOSING CEREMONY</b> The Closing Ceremony will be held at the Museum of Science and Industry. The ceremony will include the presentation of awards and the hand-off of the ISSF Trophy to the host of ISSF 2019, National Junior College, Singapore.  A dinner of Chicago inspired food will be provided. Once dinner and the ceremony has concluded, participants will be able to explore parts of the museum.

WEDNESDAY, JUNE 27

TIME	PROGRAM
<b>0730 - 0845</b> Hampton Inn	<b>BREAKFAST</b>
<b>0900 - 1030</b> Auditorium	<b>OPENING CEREMONY</b>
<b>1045 - 1130</b> Auditorium	<b>RETHINK FOOD: A CONVERSATION</b>
<b>1200 - 1300</b> Staff Lounge	<b>LUNCH</b>
<b>1300 - 1400</b> IRC	<p><b>PRINCIPAL'S SHARING SESSION</b></p> <p>Principals will have an opportunity to share an overview of their schools and communities in a small group setting. Table leaders will facilitate this introductory session in which participants will share factual information about their school, what makes them most proud of their school along with the greatest challenges they face.</p> <p>Participants should come prepared to share answers to questions such as:</p> <ul style="list-style-type: none"> <li>• Where is your school located?</li> <li>• What grades or age groups does your school serve?</li> <li>• How many students are enrolled in your school?</li> <li>• What makes you most proud of your school?</li> <li>• What is your greatest challenge?</li> </ul>
<b>1400 - 1600</b> Horwitz	<b>EXECUTIVE WORKING GROUP MEETING</b>
<b>1600 - 2200</b> Navy Pier and the Odyssey	<p><b>PRINCIPAL NETWORKING</b></p> <p>The principals will have the opportunity to enjoy dinner and the Chicago lakefront upon the Odyssey. With breathtaking skyline views, creative menus, refreshing cocktails, and great music- it's Chicago, served tableside. The principals will experience unmatched views of Chicago's world-famous skyline, from the Willis Tower, the John Hancock to the Shedd Aquarium, Aon Center and much more. The boat will depart from Navy Pier at 6:00 pm. The cruise will last approximately 2-3 hours. Cocktail or business attire is encouraged.</p>

## THURSDAY, JUNE 28

TIME	PROGRAM
<b>0730 - 0845</b> Hampton Inn, St. Andrew's Conference Room (First Floor)	<b>BREAKFAST DISCUSSION: DIVERSIFYING STEM EDUCATION TO CAREER PIPELINE</b> Dr. Adrienne Coleman, IMSA's Director of Equity and Inclusion, will present the results of the Diversifying STEM Think Tank and provide strategies to enhance diversity in the STEM industry. With an understanding of strategies to diversify, matriculation to higher education may improve. STEM engagement may be enhanced, and visibility in STEM careers may increase.
<b>0800 - 1200</b> IN2	<b>ZSPACE VIRTUAL REALITY DEMONSTRATION</b>
<b>0900-1130</b> Old Café, Science Atrium, Pillow Wall Commons	<b>POSTER SESSIONS</b>
<b>1100 - 1200</b> Staff Lounge	<b>LUNCH</b>
<b>1200 - 1630</b> Various	<b>CHICAGO EXCURSIONS</b> Meet in the Old Cafe for departures
<b>1630 - 2100</b> University of Chicago	<b>AN EVENING AT THE UNIVERSITY OF CHICAGO</b>

## FRIDAY, JUNE 29

TIME	PROGRAM
<b>0730 - 0845</b> Hampton Inn	<b>BREAKFAST</b>
<b>0900 - 1000</b> Auditorium	<b>AFFORDABLE AND CLEAN ENERGY PANEL</b>
<b>1015 - 1115</b> Horwitz	<b>ISSN STEERING COMMITTEE MEETING</b>
<b>1130 - 1230</b> Cafeteria	<b>LUNCH</b> Pick up box lunches in Cafeteria to eat on bus
<b>1230 - 1700</b> Various	<b>FIELD TRIPS</b>
<b>1700 - 1830</b> Main Gym Patio	<b>BBQ DINNER</b>
<b>1830 - 2030</b> Auditorium	<b>INTERNATIONAL CELEBRATION</b>
<b>2030 - 2130</b> Main Gym Hallway	<b>ICE CREAM SOCIAL</b>

<b>SATURDAY, JUNE 30</b>	
<b>TIME</b>	<b>PROGRAM</b>
<b>0730 - 0845</b> Hampton Inn	<b>BREAKFAST</b>
<b>0900 - 1200</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b>
<b>1200 - 1300</b> Staff Lounge	<b>LUNCH</b>
<b>1300 - 1500</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b>
<b>1600 - 1715</b> Staff Lounge	<b>DINNER</b>
<b>1700 - 2200</b> Northwestern Medicine Field	<b>EVENING SOCIAL ACTIVITY: KANE COUNTY COUGARS BASEBALL GAME AND FIREWORKS</b>
<b>1730 - 2100</b> 1650 Premium Outlet Blvd., Aurora, IL	<b>EVENING SOCIAL ACTIVITY: CHICAGO PREMIUM OUTLETS</b> <a href="http://www.premiumoutlets.com/outlet/chicago">http://www.premiumoutlets.com/outlet/chicago</a>



SUNDAY, JULY 1	
TIME	PROGRAM
<b>0730 - 0845</b> Hampton Inn	<b>BREAKFAST</b>
<b>0900 - 1000</b> Auditorium	<b>CLEAN WATER AND SANITATION PANEL</b>
<b>1015 - 1215</b> IN2	<b>TEACHER PRESENTATION OF PROJECT IDEAS</b> Teacher working groups will share their proposals with the rest of the community, teachers, and principals. At that time, a group discussion will be facilitated on taking the projects forward over the course of the next year. All future development will be reported on the ISSN website.
<b>1215 - 1315</b> Staff Lounge	<b>LUNCH</b>
<b>1315 - 1445</b> Academic (AC) Pit	<b>PROFESSIONAL DEVELOPMENT: MINDFULNESS</b> Principals and teachers will participate in a session on mindfulness. In this session, participants will learn the definition of mindfulness, neurophysiological underpinnings of mindfulness and learning, experiential learning of mindfulness techniques, and how to create mindful spaces on their own campuses. The session will be facilitated by Ms. Marissa Rivera, Wellness Counselor at The Liberal Arts and Science Academy (LASA).
<b>1500 - 1600</b> Academic (AC) Pit	<b>PRINCIPAL MEETING</b>
<b>1615 - 2200</b> Museum of Science and Industry	<b>CLOSING CEREMONY</b>

WEDNESDAY, JUNE 27

TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1030</b> Auditorium	<b>OPENING CEREMONY</b>
<b>1045 - 1130</b> Auditorium	<b>RETHINK FOOD: A CONVERSATION</b>
<b>1200 - 1300</b> Staff Lounge	<b>LUNCH</b>
<b>1330 - 1530</b>	<p><b>TEACHER PROJECT IDEATION</b></p> <p>The first session will be devoted to a discussion of the sustainability goals and sharing of project ideas. If a teacher is unable to submit a project idea prior to the event, the teacher will have the opportunity to propose it during this working session.</p> <p>The participants will choose a project idea they would like to collaborate on throughout the five-day event and take back to their respective schools to share and further develop. Teachers will be broken out into three groups:</p> <ul style="list-style-type: none"> <li>● <b>Zero Hunger (UN SDG 2)</b> Location: A117</li> <li>● <b>Clean Water and Sanitation (UN SDG 6)</b> Location: A121</li> <li>● <b>Affordable and Clean Energy (UN SDG 7)</b> Location: A129</li> </ul>
<b>1600 - 1630</b> Auditorium	<b>DESIGN SPRINT SHAREBACK</b>
<b>1730 - 2100</b> Two Brothers Roundhouse, Aurora	<p><b>TEACHER NETWORKING</b></p> <p>Teachers will have a chance to network and enjoy a casual dinner at the Two Brothers Roundhouse. The Roundhouse was constructed in 1856 to serve Aurora on the Chicago &amp; Aurora Railroad. The walls of the structure were constructed with locally quarried limestone from Batavia, IL. The building is the oldest limestone roundhouse in the United States and is listed on the National Register of Historic Places.</p>

THURSDAY, JUNE 28	
TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0800 - 1200</b> IN2	<b>ZSPACE VIRTUAL REALITY DEMONSTRATION</b>
<b>0900-1130</b> Old Café, Science Atrium, Pillow Wall Commons	<b>POSTER SESSIONS</b>
<b>1100 - 1200</b> Staff Lounge	<b>LUNCH</b>
<b>1200 - 1630</b> Various	<b>CHICAGO EXCURSIONS</b> Meet in the Old Cafe for departures
<b>1630 - 2100</b> University of Chicago	<b>AN EVENING AT THE UNIVERSITY OF CHICAGO</b>

FRIDAY, JUNE 29	
TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1000</b> Auditorium	<b>AFFORDABLE AND CLEAN ENERGY PANEL</b>
<b>1015 - 1215</b>	<p><b>TEACHER PROJECT DESIGN AND PLANNING</b></p> <p>Participants will continue to work together to design a project that addresses a particular problem that fits their chosen global challenge. The ultimate goal is to create a project that allows for the collaboration of teachers and students across multiple schools and areas of expertise.</p> <p>Teachers will remain with the same working group:</p> <ul style="list-style-type: none"> <li>● <b>Zero Hunger (UN SDG 2)</b> Location: A117</li> <li>● <b>Clean Water and Sanitation (UN SDG 6)</b> Location: A121</li> <li>● <b>Affordable and Clean Energy (UN SDG 7)</b> Location: A129</li> </ul>
<b>1130 - 1230</b> Cafeteria	<p><b>LUNCH</b></p> <p>Pick up box lunches in Cafeteria to eat on bus</p>
<b>1230 - 1700</b> Various	<b>FIELD TRIPS</b>
<b>1700 - 1830</b> Main Gym Patio	<b>BBQ DINNER</b>
<b>1830 - 2030</b> Auditorium	<b>INTERNATIONAL CELEBRATION</b>
<b>2030 - 2130</b> Main Gym Hallway	<b>ICE CREAM SOCIAL</b>

SATURDAY, JUNE 30	
TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1200</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b>
<b>1200 - 1300</b> Staff Lounge	<b>LUNCH</b>
<b>1300 - 1500</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b>
<b>1600 - 1715</b> Staff Lounge	<b>DINNER</b>
<b>1700 - 2200</b> Northwestern Medicine Field	<b>EVENING SOCIAL ACTIVITY: KANE COUNTY COUGARS BASEBALL GAME AND FIREWORKS</b>
<b>1730 - 2100</b> Aurora	<b>EVENING SOCIAL ACTIVITY: CHICAGO PREMIUM OUTLETS</b> <a href="http://www.premiumoutlets.com/outlet/chicago">http://www.premiumoutlets.com/outlet/chicago</a>

SUNDAY, JULY 1	
TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1000</b> Auditorium	<b>CLEAN WATER AND SANITATION PANEL</b>
<b>1015 - 1215</b> IN2	<b>TEACHER PRESENTATION OF PROJECT IDEAS (PRINCIPALS INVITED)</b> Teacher working groups will share their proposals with the rest of the community, teachers, and principals. At that time, a group discussion will be facilitated on taking the projects forward over the course of the next year. All future development will be reported on the ISSN website.
<b>1215 - 1315</b> Staff Lounge	<b>LUNCH</b>
<b>1315 - 1445</b> Academic (AC) Pit	<b>PROFESSIONAL DEVELOPMENT: MINDFULNESS</b> Principals and teachers will participate in a session on mindfulness. In this session, participants will learn the definition of mindfulness, neurophysiological underpinnings of mindfulness and learning, experiential learning of mindfulness techniques, and how to create mindful spaces on their own campuses. The session will be facilitated by Ms. Marissa Rivera, Wellness Counselor at The Liberal Arts and Science Academy (LASA).
<b>1615 - 2200</b> Museum of Science and Industry	<b>CLOSING CEREMONY</b>

WEDNESDAY, JUNE 27

TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1030</b> Auditorium	<b>OPENING CEREMONY</b>
<b>1045 - 1130</b> Auditorium	<b>RETHINK FOOD: A CONVERSATION</b>
<b>1130 - 1200</b> Student	<b>DESIGN SPRINT ICE BREAKERS AND INSTRUCTIONS</b> Location: IN2, Academic (AC) Pit
<b>1200 - 1300</b> Cafeteria	<b>LUNCH</b>
<b>1300 - 1500</b> Academic Pit, IN2	<b>ZERO HUNGER DESIGN SPRINT</b> Ending hunger is an engaging team problem solving event. Students will participate in a fast-paced and immersive learning experience. Students hear from a panel of subject matter experts, receive a prompt (end hunger, achieve food security, promote sustainable agriculture) and assemble into sprint teams. Teams will leverage the onsite subject matter experts and available resources to ideate, prototype and share back ideas.
<b>1600 - 1630</b> Auditorium	<b>DESIGN SPRINT SHAREBACK</b>
<b>1700 - 2200</b> Cafeteria and Other Locations	<b>STUDENT NETWORKING</b> Students will enjoy dinner in the cafeteria. After dinner they will have an opportunity to visit a local store (Target), participate in a scavenger hunt, and Build a Bear. The evening will conclude with the viewing of an outdoor movie with popcorn and movie candy!

<b>THURSDAY, JUNE 28</b>	
<b>TIME</b>	<b>PROGRAM</b>
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0800 - 1200</b> IN2	<b>ZSPACE VIRTUAL REALITY DEMONSTRATION</b>
<b>0900-1130</b> Old Café, Science Atrium, Pillow Wall Commons	<b>POSTER SESSIONS</b> Students will present posters of projects from their home school across a variety of subjects. This will provide students an opportunity to share their research with the ISSF community.
<b>1100 - 1200</b> Cafeteria	<b>LUNCH</b>
<b>1200 - 1630</b> Various	<b>CHICAGO EXCURSIONS</b> Meet in the Old Cafe for departures
<b>1630 - 2100</b> University of Chicago	<b>AN EVENING AT THE UNIVERSITY OF CHICAGO</b>

FRIDAY, JUNE 29	
TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1000</b> Auditorium	<b>AFFORDABLE AND CLEAN ENERGY PANEL</b>
<b>1015 - 1215</b> B116, B108	<b>AFFORDABLE AND CLEAN ENERGY WORKSHOPS</b> <b>Workshop 1: Nuclear Energy—Then, Now and the Future</b> Nuclear power is one of the most feared and misunderstood energy sources available. Its unique advantages, extraordinary power production with no emissions are weighed against its disadvantages: possibility of meltdown, difficulty of waste disposal, and potential weatherization. This session will explore some of the basics of nuclear power through a variety of interactive activities, including designing a radiation shield for space travel and will provide an overview of the economics and risks associated with nuclear power. It will also discuss potential future technologies, including fusion, and how these technologies would change worldwide energy production.
A200, A202	<b>Workshop 2: Building a Microbial Fuel Cell (MFC)</b> This project introduces students to the science behind MFCs and provides a practical demonstration of this type of renewable energy technology. The technology produces electricity from the byproducts of bacteria breaking down organic matter. MFCs can operate using organic matter in soil or even wastewater.
A207, A209	<b>Workshop 3: Energy Explorations in the Windy City</b> This project enables students to work together to design, construct and test wind turbines. Students will first have the opportunity to design the shape of the turbine blades and determine the optimal number of blades to produce the most energy. The second half of the workshop will focus on wind tracking and generator gearing.
<b>1130 - 1230</b> Cafeteria	<b>LUNCH</b> Pick up box lunches in Cafeteria to eat on bus
<b>1230 - 1700</b> Various	<b>FIELD TRIPS</b>
<b>1700 - 1830</b> Main Gym Patio	<b>BBQ DINNER</b>
<b>1830 - 2030</b> Auditorium	<b>INTERNATIONAL CELEBRATION</b>
<b>2030 - 2130</b> Main Gym Hallway	<b>ICE CREAM SOCIAL</b>



<b>SATURDAY, JUNE 30</b>	
<b>TIME</b>	<b>PROGRAM</b>
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1200</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b> Students will share their research projects from their home schools across a variety of subjects. This will provide students an opportunity to share their research with the ISSF community.
<b>1200 - 1300</b> Cafeteria	<b>LUNCH</b>
<b>1300 - 1500</b> Academic Pit, Math Study Area, IRC	<b>RESEARCH PRESENTATIONS</b>
<b>1600 - 1715</b> Cafeteria	<b>DINNER</b>
<b>1700 - 2200</b> Northwestern Medicine Field	<b>EVENING SOCIAL ACTIVITY: KANE COUNTY COUGARS BASEBALL GAME AND FIREWORKS</b>
<b>1730 - 2100</b> Aurora	<b>EVENING SOCIAL ACTIVITY: CHICAGO PREMIUM OUTLETS</b> <a href="http://www.premiumoutlets.com/outlet/chicago">http://www.premiumoutlets.com/outlet/chicago</a>

SUNDAY, JULY 1	
TIME	PROGRAM
<b>0730 - 0845</b> Cafeteria	<b>BREAKFAST</b>
<b>0900 - 1000</b> Auditorium	<b>CLEAN WATER AND SANITATION PANEL</b>
<b>1015 - 1215</b> B108/B109, B110/B111  A207, A209  A200, A202	<p><b>CLEAN WATER AND SANITATION WORKSHOPS</b></p> <p><b>Workshop 1: Be the Solution to Water Pollution—Every Drop Counts</b> During this workshop students will explore the water filtration system as well as the chemical cleaning of grey water. Students will first become familiar with physical water filter design, analyze the chemical aspect of grey water, and design a 3D model of a plumbing system for a future home by applying the filtration systems knowledge acquired in the previous activities. The goal is to reuse as much grey water as possible.</p> <p><b>Workshop 2: Survivor Daphnia Island</b> In this session, students will use a bioassay to monitor water quality in a fictitious community. <i>Daphnia Magna</i> will be subjected to potential environmental pollutants present in six different water samples. Students will observe and measure the physiological response of the <i>Daphnia</i> after submersion in a sample and will determine if any of the samples are potable.</p> <p><b>Workshop 3: Don't Acid Rain in My Water</b> Rising carbon dioxide levels have led to increasing temperatures on the planet that lead to global climate change. Large bodies of water, such as oceans, have become reservoirs for this excess carbon dioxide. The increase in carbon dioxide is now lowering the pH of our oceans and having dire effects on marine life. In this session, students will learn how carbon dioxide lowers the pH of the ocean, the effects on marine life, and will work on a solution to mitigate the global problem.</p>
<b>1215 - 1315</b> Cafeteria	<b>LUNCH</b>
<b>1315 - 1530</b> Academic (AC) Pit	<p><b>REFLECT AND CONNECT</b></p> <p>During this session, students will collaborate, connect, and share their learnings and insights from the week at ISSF. They will make visible with each other the ideas that most resonated with them and the projects they are committed to working on as an individual and school, as they travel back to their home countries. Space will also be made for students to connect and discuss ways to work together into the future, creating change and significantly influencing life on our planet through cooperation and collaboration.</p>
<b>1615 - 2200</b> Museum of Science and Industry	<b>CLOSING CEREMONY</b>



# International Student Science Fair 2018

*To significantly influence life on our planet  
through cooperation and collaboration*

**June 27 - July 1, 2018**

**UNITED STATES OF AMERICA**

Illinois Mathematics and Science Academy, Aurora, IL

**excursion and  
field trip program**



*"Belonging to a community requires  
a commitment to the common good."*

The goal of the ISSF 2018 Excursion and Field Trip Program is to introduce attendees to IMSA's partners and collaborators across the Chicagoland area. From leading universities, science museums, and art institutes to private sector STEM partners, IMSA has a rich network of people and organizations who support the academy and allow it to be the leading learning laboratory it is today. During ISSF, attendees will have the opportunity to participate in field trips and visit partner locations.

## ISSF 2018 EXCURSIONS

*Fun Social Experiences*

Chicago's **Adler Planetarium** is America's first planetarium and a premier resource for inspiring the next generation of space explorers. The Adler Planetarium is a public museum dedicated to the study of astronomy and astrophysics. It was founded in 1930 by Chicago business leader Max Adler. The Adler is home to three full-size theaters, extensive space science exhibitions, and a significant collection of antique scientific instruments and print materials. In addition, the Adler boasts the Doane Observatory, one of the only research-active, public urban observatories. This lakeside observatory is the only place in Chicago where the public can see planets, stars, and galaxies up-close and in person.

**The Art Institute of Chicago**, founded in 1879 and located in Chicago's Grant Park, is one of the oldest and largest art museums in the United States. Recognized for its curatorial efforts and popularity among visitors, the museum hosts approximately 1.5 million guests annually.

During this museum tour and art-making experience, attendees will practice scientific and creative thinking. Through observation, imagination, and reasoning in the galleries of the Art Institute of Chicago, students will explore three works of art in depth. They will then respond to what they have experienced through a studio-based activity.

**The Field Museum** has been inspiring curiosity about life on earth for more than a century. The Field Museum was founded in 1893 as the Columbian Museum of Chicago and has spent more than 120 years in the pursuit of scientific knowledge about the world around us. The Field Museum's scientific and education efforts are organized around four centers with distinct and complementary priorities: The Gantz Family Collections Center, The Integrative Research Center, The Keller Science Action Center and The Learning Center. All four centers contribute to education in the sciences at all levels and increase the Museum's ability to understand the past, explore the present, and shape a future rich with biological and cultural diversity.

**Museum of Science and Industry** One of the largest science museums in the world, MSI has both an illustrious history and a focus on the future of science and science education. From field trips to teacher resources, MSI provides learning experiences both inside and outside the classroom—because improving science education is critical.

Every year **Shedd Aquarium** welcomes 2 million guests for unforgettable encounters with 32,000 animals from the world's aquatic environments. But Shedd is more than a destination. The Shedd scientists are saving endangered species and their habitats. Shedd animal care experts rescue and rehabilitate wildlife in need, across the country, and around the world. Shedd conservationists are restoring the health of the Great Lakes. Building operators are setting the standard for conserving water and energy and educators spark compassion, curiosity and conservation for the aquatic animal world.

## AN EVENING AT THE UNIVERSITY OF CHICAGO

*One of the World's Greatest Intellectual Destinations*

Located on a 217-acre campus in the culturally rich neighborhood of Hyde Park, the University of Chicago offers a community where students of all backgrounds thrive and ideas matter. Combining a traditional liberal arts college with a premier research university, UChicago gives students access to world-renowned faculty, discussion-based classes from the fine arts to the physical sciences, double majors, dual degrees, and innovative research experiences. Their latest academic opportunities include a minor in Architectural Studies, a major in Public Policy Studies, and interdisciplinary science research options on-campus at the Institute for Molecular Engineering and off-campus at the Marine Biological Laboratory in Woods Hole, MA.

## ISSF 2018 FIELD TRIPS

*Innovative Learning Experiences*

**Argonne National Laboratory** seeks solutions to pressing national problems in science and technology. The nation's first national laboratory, Argonne conducts leading-edge basic and applied scientific research in virtually every scientific discipline. Argonne researchers work closely with researchers from hundreds of companies, universities, and federal, state and municipal agencies to help them solve their specific problems, advance America's scientific leadership and prepare the nation for a better future. With employees from more than 60 nations, Argonne is managed by the University of Chicago for the US Department of Energy's Office of Science.

**Ball Horticultural Company** is a worldwide leader in all facets of horticulture. The organization has plant breeders, research and development teams, seed and vegetative producers and distribution companies on six continents in 18 countries. Headquartered in West Chicago, IL, the home office includes seed technology research, advanced plant biotechnology research, a plant tissue culture lab, a seed distribution center, and over 10 acres of gardens where Ball shows off the best of its genetics to the trade.

**Fermilab** is America's particle physics and accelerator laboratory. What are we made of? How did the universe begin? What secrets do the smallest, most elemental particles of matter hold, and how can they help us understand the intricacies of space and time? Since 1967, Fermilab has worked to answer these and other fundamental questions and enhance our understanding of everything we see around us. As the United States' premier particle physics laboratory, Fermilab does science that

matters. They work on the world's most advanced particle accelerators and dig down to the smallest building blocks of matter. Fermilab also probes the farthest reaches of the universe, seeking out the nature of dark matter and dark energy.

Students touring the **Oak Valley Water Reclamation Facility (Illinois American Water Co.)** will be introduced to the microbiological treatment processes required in cleaning our community's wastewater before its release to the environment for reuse by wildlife, and ultimately, human consumption. While touring the facility, students will have an opportunity to view the wastewater treatment stages, including an added stage designed specifically for phosphorus reduction. Phosphorus reduction in wastewater is key to limiting algae growth, which diminishes oxygen levels to fish and other aquatic species that require it for life. Before its final destination (Spring Creek), Oak Valley's treated wastewater will flow past the facility's ultraviolet lighting system as part of a sterilization process which ensures the non-existence of harmful pathogens in the discharging water.

**Illinois Institute of Technology**, is a private, technology-focused, research university, located in Chicago, offering undergraduate and graduate degrees in engineering, science, architecture, business, design, human sciences, applied technology, and law. At the Wanger Institute for Sustainable Energy Research (WISER), more than 80 faculty members are currently involved in energy and sustainability research and educational activities across the colleges and institutes at IIT.

**Invenergy** captures, generates and stores power at scale to solve today's energy challenges. They are powered by decades of entrepreneurial experience and unparalleled execution. They provide power generation and storage solutions at scale around the world to create a cleaner energy future. The world is just beginning to accept what Invenergy has known for years — clean power and renewable energy sources are the future. Invenergy's successful track record of developing, building and operating facilities proves that clean energy can be safe, reliable, and affordable. They work for the future and are not constrained by the next earnings call. With more than 100 projects in development or operation across the U.S., Canada, Europe, Japan, and Latin America, they are leveraging innovative design and next-generation technology to create a new paradigm for energy production.

**The Plant** is a 94,000 sq/ft former meatpacking plant. It now houses 25 food businesses, all focused on reusing waste and creating a circular economy. In a circular economy, waste becomes an opportunity; outputs from one industry can be used as an input for another. Plant Chicago (the educational non-profit inside the building) seeks to change the way cities develop the critical infrastructure — waste, water, energy, and food access — that will support an increasingly urbanized population. A linear economy follows a "take-make-dispose" system, designed to extract resources from the earth for limited or single use. Instead of accepting the linear, "resource in, waste out" economy, a circular economy re-imagines the economy as a circular system of resource flows.

**posters and  
presentations**





## **GOALS**

The goal of the ISSF 2018 Poster and Research Presentation session is for students to present projects and research work from their home schools across a variety of subjects. This will foster opportunities for students to develop their learning and presentation skills as they share their projects with the ISSF community. IMSA believes that these sessions will provide the impetus for students to build international and interdisciplinary relationships that will continue after ISSF with students collaborating and sharing into the future.

## **POSTER SESSIONS**

During ISSF, students will share project posters with their peers and attendees. The poster sessions will be held on Thursday, June 28th, and each poster will be evaluated by three evaluators. Student poster awards will be presented during the closing ceremony. Poster presentations will be presented across a variety of subjects such as Biology, Chemistry, Computer Science, Earth Science, Engineering, Environment, Mathematics, Physics, Robotics, and other related fields.

## **RESEARCH PRESENTATIONS**

During ISSF, students will share research presentations with their peers and attendees. The research presentations will be held on Saturday, June 30th. Each presentation will be evaluated by three evaluators. Student research awards will be presented during the closing ceremony. Research presentations will be presented across a variety of subjects such as Biology, Chemistry, Computer Science, Earth Science, Engineering, Environment, Mathematics, Physics, Robotics, and other related fields.

The image features a dark gray background with a pattern of hexagons. A central hexagon is white and contains the word "abstracts" in a bold, black, sans-serif font. The surrounding hexagons are dark gray and are separated by thin black lines.

**abstracts**

<b>SCHOOL</b>	Camborne Science & International Academy
<b>PRESENTER(S)</b>	Ross Winter, Jamie Burnell
<b>PRESENTATION TITLE</b>	Investigating Sports Drinks, Are They Worth the Money?
<b>CATEGORY</b>	Biology

The sports drinks industry is a huge global business which shows no signs of slowing down. The inspiration to conduct this investigation came from an observation that there is an increasing consumption of sports and energy drinks within our community, particularly amongst children. The message from the advertisers is clear: athletes should replace lost body fluid with drinks that contain electrolytes, such as sports drinks. However, there are conflicting suggestions from conducting literature reviews that, not only are these drinks unhealthy in terms of the high sugar content, but instead water and milk are sufficient to hydrate children and adults before, during, and after exercise. Indeed, it is claimed that there are no beneficial effects of sports drinks for non-elite athletes and children. This investigation compares the electrolyte composition of a range of drinks marketed as sports drinks, as well as other drinks including milk and tap water. This was done by measuring the conductance, which is proportional to the electrolyte concentration. In addition an assessment of the reducing sugar present in each drink was undertaken using colorimetry. A comparison was also made of the relative cost of each drink.

# abstracts

<b>SCHOOL</b>	Center for Young Scientists
<b>PRESENTER(S)</b>	Chynara Leticia Harisinta, Leo Mahendra, Rosa Nathalia
<b>PRESENTATION TITLE</b>	Effectiveness of Yogurt of Dayak Maanyan Based on the Combination of Kambe Onion with Peperomia Weeds Folium in Decreasing Uric Acid Level
<b>CATEGORY</b>	Biology

Gout is a term which is used to name a group of metabolic syndromes due to elevated levels of uric acid in the blood. The plant species used in traditional treatment by the Dayak Maanyan tribe for gout therapy is kambe onion with peperomia weeds in the form of yoghurt. The purpose of this is to test the effectiveness of Dayak Maanyan yoghurt based on the combination of kambe onion and peperomia weeds in decreasing uric acid level on wistar rats (*Rattus norvegicus*) and male subjects.

The type of the study used was pure experimental research, using Completely Randomized Design method with one-way pattern, a direct test was conducted on the influence of Dayak Maanyan Yoghurt in decreasing the level of uric acid in the blood of 24 wistar rats. The dose given to the rats was 4,1 mg/grBW. Then, for the next step, Quasi experiment was conducted using the arrangement of Before and After no Control Group Design. The population of this study was the patients of hyperuricemia who got treatment from Doris Sylvanus Public Hospital in which there were 6 participants in total. The dose given to the human participants was 57,14 mg/grBW. The parameter in this study was the measurement of uric acid level in the blood using test strips.

The result of the statistical analytic test showed that the effect of the decreasing of uric acid level by Dayak Maanyan yogurt on treatment T3 was significantly different compared to the other treatments. Meanwhile, the result of statistical analytic test of the uric acid level of male clients showed significantly different effects between subjects before intervention and subjects after intervention. Thus, it can be concluded that Dayak Maanyan yogurt brings anthy peruricemia effects.

<b>SCHOOL</b>	Kamnoetvidya Science Academy
<b>PRESENTER(S)</b>	Damrongrat Siriwanna
<b>PRESENTATION TITLE</b>	Influence of Calcium Chloride and Urea in Self-Healing Concrete Using <i>Bacillus Subtilis</i> , <i>Bacillus Megaterium</i> and <i>Bacillus Licheniformis</i>
<b>CATEGORY</b>	Biology

Concrete is a non-flexible and breakable material that is widely used in building construction. Concrete cracking may affect the strength of buildings. Due to difficulties of concrete fixing process, this research focus on developing a self-healing concrete by using biocementation process from bacteria. As bacteria have a property of producing calcium carbonate from calcium chloride, urea, and water, *Bacillus licheniformis*, *Bacillus megaterium* and *Bacillus subtilis* were chosen. In this research, the concentration of calcium chloride and urea were varied from 0.1 - 0.7 M and 0.6 -1.2 M, respectively to find the optimal concentrations which potentially yield the most calcium carbonate precipitate from bacteria. Bacterial cultures were monitored by observing growth, pH and urea consumption. The results indicated the number of bacterial cells and urea consumption showed slightly increasing trends with the decrease of pH, which confirming the usage of substrates. The results of investigating optimal substrates concentration showed that concentration of calcium chloride in the range of 0.1 M - 0.7 M and concentration of urea in the range of 0.1 M - 0.7 M did not significantly affect biocementation of bacteria. This could be because the usage of substrates affected pH level in solution, resulting in sub-optimal bacterial growth. However, the rates of biocementation from bacteria culturing with various substrate concentrations were obtained. It was found that *B. subtilis* produced the highest amount of calcium carbonate, followed by *B. licheniformis* and *B. megaterium*, respectively. This indicates the potential for developing self-healing concrete by using bacteria.

# abstracts

<b>SCHOOL</b>	New Beginning International School of Mongolia
<b>PRESENTER(S)</b>	Khongorzul Turkhuu, Tuguldur Battulga, Tuguldur Turbaatar
<b>PRESENTATION TITLE</b>	Assets of Sheep's Dock
<b>CATEGORY</b>	Biology

Traditionally, Mongolians used sheep tail fat for infants' food and massage medication. Nowadays, the fat from sheep tail is industrially processed and added to beauty and cosmetic products. However, this product remains widely unknown worldwide. This study aims to determine the chemical components in sheep tail fat and to identify its assets.

The fat from three different sections of sheep tail was isolated and characterized using titration with potassium hydroxide followed by reaction with iodine and chromatography. It was found that the amount of saturated acids such as palmitic and stearic acids was 1.59% - 5.32% greater in the front part of the tail than in the other two parts. While unsaturated fatty acids were 4.92% - 9.04% more abundant in the tip of the sheep tail. Fatty acids with 2 double bonds (biencarboxylic acids), fatty acids with a single double bond (monocarboxylic acids) and saturated fatty acids in the sheep tail fat were found to be 3.85:38.5:57.65 percent, respectively, or a ratio of 0.4:4:6. This indicates that sheep tail fat is suitable for use in food.

Given this information on sheep tail fat composition and location, people can make their own nourishing cream at home or use sheep tail fat in their food as it contains no toxins. Moreover, sheep's tail fat turns out to be a rare product which contains a wide range of valuable organic compounds.

<b>SCHOOL</b>	NUS High School of Mathematics & Science
<b>PRESENTER(S)</b>	Ragavi Vijayakumar, Maxine Minxin Hong
<b>PRESENTATION TITLE</b>	A Humanized Hypertrophic Cardiomyopathy Model to Elucidate Molecular Mechanism in Disease Pathology
<b>CATEGORY</b>	Biology

Hypertrophic Cardiomyopathy (HCM) is estimated to be the world's most prevalent hereditary heart disease, and yet, is largely unknown by the public and researchers alike. Clinically manifesting as an enlarged heart, it has a great propensity towards arrhythmia-induced sudden cardiac death. Its mechanism, diagnosis, and treatment remains a complex issue today, due to the difficulty of obtaining human cardiac biopsies to study, which all the more makes it important to further our understanding of the disease for improved therapeutic strategies. Using induced pluripotent stem cell technology, we successfully generated a humanised HCM model, representative of an actual diseased human heart cell, to investigate the molecular mechanisms of the disease. Our humanised HCM model recapitulated the diseased phenotype, and the subsequent findings lay the foundation for understanding the in-depth mechanism of HCM for therapeutic intervention. This model is superior to animal models as it removes concerns of species variation, such as ion channel profiles, yet has a non-invasive nature. Additionally, our model can be maintained indefinitely, and is able to undergo screening of multiple compounds at once, establishing its efficiency at studying the disease with its high throughput. Our generated model can also be used for further studies, such as drug development and testing, and proves this technique accurate to modelling diseases, representing a whole world of possibilities to understanding and treating other diseases.

# abstracts

<b>SCHOOL</b>	Philippine Science High School
<b>PRESENTER(S)</b>	Julliane Jeanne M. Negre
<b>PRESENTATION TITLE</b>	Cloning of an Overexpression Vector for the Rare and Uncharacterized KRAS Mutant R164L
<b>CATEGORY</b>	Biology

Mutations in the coding DNA of KRAS, which encodes for an active protein in the Ras signaling pathway regulating cell proliferation and growth, may be critical in the development of lung and colorectal cancer in humans. Clinical tests and therapies for cancer specifically target mutations, some of which may cause erroneous prognosis and prescription of cancer therapy, posing more danger for patients with unique mutations. Therefore, characterization of non-hotspot mutations is becoming more important, where, KRAS R164L is an existing uncharacterized mutation identified through the Catalogue of Somatic Mutations in Cancer (COSMIC).

The project aimed to clone a pTarget overexpression vector for the noncanonical KRAS mutant R164L. Splicing via overlapping extension – PCR (SOE-PCR) was first applied to amplify the KRAS coding sequence and to introduce the guanine to thymine point-mutation in codon 491 of the DNA. The genetic transcript of the KRAS mutant R164L was ligated into the pTarget vector, through the Universal TA cloning technique. A 6kb-long plasmid containing the KRAS R164L mutation was produced, subjected to transformation into *E. coli* DH5alpha cells via heat-shock method, and screened via Blue-White Screening. The successful transformants were verified through Restriction Enzyme digestion with EcoRI. The DNA sequence of the inserts in the successfully cloned plasmids was further verified through Sanger Sequencing and sequence alignment through NCBI Blast, yielding a 99% match with the coding sequence for *Homo sapiens* Ras family for KRAS. The DNA segment for KRAS mutation R164L was successfully cloned and may now be utilized in functional characterization assays.



<b>SCHOOL</b>	Rockdale Magnet School for Science and Technology
<b>PRESENTER(S)</b>	Jacqueline Gomez
<b>PRESENTATION TITLE</b>	Re-Designing Drug Delivery Nano-Mechanisms for Breast Cancer
<b>CATEGORY</b>	Biology

The purpose of this project is to synthesize an effective drug delivery system for synthetic and natural based breast cancer drugs. The biopolymer coating for the silver nanoparticles utilized in this project was synthesized using varying plasticizers that contributed to higher rates of degradability. The biopolymers' degradation rates were measured by applying the coatings to a stomach-acid simulation solution. Using Stoke's equation, the viscosity of the hydrochloric acid with water solution was measured, and this factor was considered when measuring the diffusion rate. Additionally, varying concentrations of lapatinib and oleocanthal were applied to Mouse Embryonic Fibroblasts (MEF) cells primarily because MEF cells metastasize and proliferate at the same rate as cancerous cells. The viability of the cells was measured using the ImageJ application, which predominantly measured the color intensity of the cells. A greater color intensity value correlated with higher rates of cell viability, and based off this observation, lapatinib was most effective at reducing the viability of the cells. This data disproved the initial hypothesis, which postulated that the oleocanthal-loaded silver nanoparticles were to be the most effective at reducing cell viability. Fluorescence spectroscopy studies were also conducted to differentiate between the absorption values of the synthetic and natural based cancer drugs. The purpose of these studies was to collect the highest absorption values at respective wavelengths to determine the excitation emission spectrums. Since magnetic nanoparticles are magnetically maneuverable, the excitation emission spectrum values further support these nanoparticles' compatibility in biomedical tests including MRI scans.

# abstracts

<b>SCHOOL</b>	Rockdale Magnet School for Science and Technology
<b>PRESENTER(S)</b>	Jada Grant
<b>PRESENTATION TITLE</b>	The Effect of Hyperthermia on Liver Cell Viability
<b>CATEGORY</b>	Biology

Hyperthermia is a treatment for liver cancer where the tumor is exposed to a relatively high heat temperature. This process is designed to make the tumor more susceptible to chemotherapy. My thought process was that if hyperthermia can kill cancerous cells, then there will be negative long term effects on the noncancerous cells surrounding the tumor. The project experimented on Kidney cells because the Kidney and Liver both go through the process of filtration. This means that the Kidney cells should give similar results that Liver cells would. Kidney cells were heated at 40 degrees Celsius for time amounts of 30 minutes, 1 hour and 2 hours. The control was not heated for any amount of time. The experiment was also performed on Danio rerio which was a model organism and they were heated for 30 minutes and 1 hour. During experimentation all of the zebrafish died. This may be because the zebrafish were heated to a temperature much higher than their normal temperature. The results from the cell experiment showed that very few cells died and the results of the MTT assay shows that all of the cells were healthy. Overall I supported my null hypothesis that hyperthermia would have no negative long term effects on the liver, and is a safe treatment for liver cancer. Overall the noncancerous cells are healthy after being exposed to heat.

<b>SCHOOL</b>	Saint Petersburg Lyceum Physical Technical High School
<b>PRESENTER(S)</b>	Daniil Moshnikov, Demid Osipov
<b>PRESENTATION TITLE</b>	Study of the Visual Adaptation Mechanism in Marine Species with the Change of Habitation Depth
<b>CATEGORY</b>	Biology

The goal of our work was to determine the principal mechanisms that provide the difference in visual perception of two marine species that live on different depths: *T. Pacificus* and *O. Vulgaris*. In nature, visual perception of species that live deeper is shifted towards the blue region. This is related to the fact that red, orange and yellow light is absorbed more strongly by water than the blue light. On the other hand, the visual perception spectrum of an animal is determined by the absorption spectrum of the "light sensor" located in rods and cones of its eye retina. These "light sensors" are proteins from the rhodopsin family, which generate an electrical signal upon light absorption. Thus, in order to understand the mechanism of visual adaptation one has to study the molecular difference between the corresponding rhodopsins of the target species. We proposed new algorithms for exploring this molecular difference based on methodology from computational biophysics and quantum chemistry. These algorithms allowed us to predict the absorption maxima of visual proteins on the basis of their amino acid sequence. First, we tested these algorithms by predicting the absorption maxima of visual rhodopsins from several species. Second, we calculated the structures and absorption maxima of wild types and mutants of two rhodopsins of the target species. These calculations allowed us to determine the key mutation that is responsible for the spectral shift between two rhodopsins and determine the molecular mechanism of visual adaptation between two target marine species.

# abstracts

<b>SCHOOL</b>	University High School
<b>PRESENTER(S)</b>	Jorge Rosa Vidal
<b>PRESENTATION TITLE</b>	The Effect of Kalanchoe Pinnata in Astrocytoma Metastasis
<b>CATEGORY</b>	Biology

The effect of Kalanchoe pinnata in the metastasis of astrocytomas will be examined using three main methods: lyophilization, a cytotoxicity assay and a wound healing assay. The first one to be carried out, lyophilization, is done to extract the necessary components of the leaf. To begin the leaves must be frozen at  $-80^{\circ}\text{C}$ . After this step is complete they are crushed to obtain a larger surface area. Once this has been carried out the water molecules of the leaves are extracted using a lyophilizer at  $-46^{\circ}\text{C}$  and  $-0.2$  millibars, therefore allowing the leaves to remain in solid state. This process takes a total of three days and allows for a more accurate measurement of concentration. After this the extract is mixed with water using a magnetic agitator for 24 hours and upon completion it is filtered with a Büchner flask. Once this is done ethanol is added to prevent the growth of bacteria. Later a rotary evaporator is used to separate water from the volatile components. The next step, addition of dry methanol, is done to precipitate salts. When this is completed the rotary evaporator is used to separate the dry methanol from the extract. Once the extract is ready, a cytotoxicity assay must be performed to determine the necessary amount for the wound healing assay. After this has been completed the wound healing can be carried out without fear of killing the cells. The wound healing assay consists of scratching a layer of cells and applying the Kalanchoe pinnata extract to compare their metastasis with that of the control group. Using a microscope and the Axiocam 105 Color the effect of the extract is measured and quantified in square millimeters.

<b>SCHOOL</b>	University High School
<b>PRESENTER(S)</b>	Juan A. Padilla La Llave
<b>PRESENTATION TITLE</b>	The Effects of Oxytocin in Cocaine Addicted Rats Suffering from the Abstinence Syndrome
<b>CATEGORY</b>	Biology

Rehabilitation from a history of drug abuse is a very difficult and life changing process. Abstinence syndrome forces the rehabilitating patient to go through anxiety like symptoms. The Oxytocin hormone has been believed to be a potential facilitator in the rehabilitation process. This hormone is very present during interactions of affection (hugs) and birth, it foments trust while it associates to a feeling of calmness. Oxytocin would theoretically be a calming agent to the anxiety like symptoms such as craving. The experiment aimed to test the calming effects of the hormone, consisted of a five-day systemic cocaine injections treatment schedule and a sixth day of intranasal administration of Oxytocin or saline. Six Sprague-Dawley male rats were assigned to two separate groups of three: one group was given Oxytocin on the sixth day and the other was given a saline solution. Both groups were introduced to the Elevated Plus Maze (EPM) test to measure the anxiety. Throughout the first five days the locomotion was monitored and recorded. The collected data showed a constant rising of locomotion from day two through day five where is reached a peak and then lowered down, this occurred for all rats. The rats that received intranasal Oxytocin treatment spent more time in the open arms when put in the EPM test in contrast to the rats that received saline that spent more time inside the closed arms even though the difference between the groups was not significant. These results suggest that Oxytocin could possibly have anxiolytic effects.

# abstracts

<b>SCHOOL</b>	University High School
<b>PRESENTER(S)</b>	Araceli I. Francisco Berdasco
<b>PRESENTATION TITLE</b>	The Effect of Sweeteners in Drosophila Melanogaster's Locomotion
<b>CATEGORY</b>	Biology

This research aims to measure how much locomotion is affected in *Drosophila melanogaster* taking into consideration alimentionation. The experiment was divided in three groups: a control group, a group fed with natural sugar and another fed with artificial sugar. The diets were prepared based on standard laboratory food by varying the sugar. Several generations were grown. The locomotion was measured through monitors with infrared lasers. They calculated the number of times the fly passed through the infrared laser. They were accustomed to a day and night cycle and were kept under observation for a period of 13 days. As a result, the group that ingested natural sugar had a greater effect on locomotion compared to the other two groups. In conclusion, to get more energy and to carry out tasks with better performance is ideal to ingest natural sugar.

<b>SCHOOL</b>	Budi Mulia Dua International High School
<b>PRESENTER(S)</b>	Naila Aliyahandra Anzani, Nabila Fikria Santoso, Muhammad Dzulfikhar Farkhan
<b>PRESENTATION TITLE</b>	Utilization of Papaya's Sap ( <i>Carica papaya</i> L.) and Water Lettuce ( <i>Pistia stratiotes</i> ) to Reduce Protein Amount on Liquid Tofu Waste
<b>CATEGORY</b>	Chemistry

Water that has been contaminated by tofu production waste is very dangerous for human health. Papaya's sap can be used to binds the protein from tofu waste and pistia plant can be used to neutralize the tofu waste. The purpose of this research is to know the effect of papain enzyme to binds the protein from tofu waste and the effect of pistia plant to neutralize the tofu waste. This method is done by 5 steps. First by giving the tofu waste 50 ml of papain enzyme, second is filtering the tofu waste, third is to put a pistia plant into the tofu waste. after the treatment, the waste is analysis with healthy water content according to SNI ( National Standard of Indonesia). The hypothesis is the protein in tofu waste will be separated by Papain enzyme and as a result it can reduce the smell that it produce. First, precipitate the tofu waste in 24 hours to separate the liquid and the solid material. Second, gather papaya's sap as much as 50ml by tapping small line in Papaya's fruit. Third, pour the sap into the pail which contain the tofu waste that has been precipitated. In the first 6, 18, and 24 hours, the sample will be taken as much as 350ml. Fourth, Each sample will be strain with sand, pebble, charcoal, coconut fibers, and cotton. After strained, each sample will be placed in a small bowl and will be given 1 pistia. They differentiated by the duration of they were given a sap. The lab result showed that the utilization of papaya's sap can reduce the protein amount on liquid tofu waste and the protein disappeared after 18 hours given sap.

# abstracts

<b>SCHOOL</b>	Korea Science Academy of KAIST
<b>PRESENTER(S)</b>	Hangyeol Kim, Junseok Ahn, Sukwoo Jung
<b>PRESENTATION TITLE</b>	An Entirely New Molecular Glue for MOF Using Unusual Structural Transformation of a Coordination Polymer
<b>CATEGORY</b>	Chemistry

Metal Organic Framework (MOF) is a new kind of hybrid microporous material based on the combination of metal connectors and organic linkers, which possess high surface area and adsorption ability. MOF film is better than MOF powder for practical applications like gas separation and sensing devices. Therefore, synthesizing thin, homogeneous MOF films is becoming an important task to broaden the applications of MOF. Despite the boundless possibilities of MOF films, the current fabrication methods still face major challenges. Conventional MOF film forming methods commonly require expensive modified substrates such as self-assembled monolayers (SAM) and are unable to incorporate pre-synthesized MOFs. In this research, an entirely disparate new molecular glue is reported. This 'coordination polymer glue' is synthesized from zinc metal and BDC-NPE-2,5-bis[4-[1-(4-nitrophenyl)ethylamino]butoxy]terephthalic acid). Molecular glue transforms from a 1D coordination polymer to a 3D cross-linked framework, resulting in an unusual phase change of a solution into a solid. Moreover, the carboxylate group in this glue allows the preformed MOF to bind to its framework. Therefore, when a solution of molecular glue is applied to a preformed MOF, a thin, homogeneous MOF film is fabricated. This novel, facile, MOF film forming method using molecular glue is unlike conventional MOF film forming methods: it is (1) irrelevant to the kind of its substrate and (2) outstanding at forming a homogenous film with a pre-synthesized MOF incorporated. This molecular glue is expected to be developed as a basic method when fabricating MOF films for industrial use.



<b>SCHOOL</b>	Mahidol Wittayanusorn School
<b>PRESENTER(S)</b>	Thunyarus Rodsawatchuchoke, Papidchaya Chanpong, Pantaree Sodkhoksoong
<b>PRESENTATION TITLE</b>	Removal of Pb <sup>2+</sup> Ions from Consuming Water Using a Fabricated Water Filter for Home Use
<b>CATEGORY</b>	Chemistry

Lead contamination in water is one of the worldwide concerned environmental problems. For example, lead leaking from pipe corrosion and solder has been found contaminated in consuming water in many U.S. areas. The uncontrolled release of effluents containing lead from various industries has also caused lead-contaminated water in Thailand. Exposing to lead-contaminated water can lead to serious symptoms (e.g. fatigue, headaches, abdominal pain, irritability, depression, and seizures) or even death. Therefore, the elimination of lead ions (Pb<sup>2+</sup>) from consuming water or from effluents before releasing into the environment is necessary. The selection of adsorbents and the fabrication of a water filter used in households for Pb<sup>2+</sup> removal from water were performed in this work. The efficiencies of Pb<sup>2+</sup> removal from water using different particle sizes of grounded chicken eggshells (25 - 272  $\mu\text{m}$ ) and synthesized CaCO<sub>3</sub> (0.5 – 3.5  $\mu\text{m}$ ) employed as adsorbents were studied. By passing 100 ppm Pb<sup>2+</sup> solution at pH 4.4 through small scale columns packed with these adsorbents, it was found that more than 90% of Pb<sup>2+</sup> ions were removed from water with no significant difference among using any particle sizes of eggshells or synthesized CaCO<sub>3</sub> in this study. Grounded eggshells, cheap natural source of CaCO<sub>3</sub>, were then chosen as adsorbents packed in a fabricated water filter that could be directly attached to a water tap. The Pb<sup>2+</sup> removal efficiency and the adsorption capacity using this design of water filter were investigated. To this end, this fabricated water filter could provide a homemade and replaceable adsorbent for Pb<sup>2+</sup> removal from consuming water.

# abstracts

<b>SCHOOL</b>	Moscow South-Eastern School named after V.I. Chuikov
<b>PRESENTER(S)</b>	Alexander Sharipov
<b>PRESENTATION TITLE</b>	Reduction Of Nitro Groups By Iron Carbonyl
<b>CATEGORY</b>	Chemistry

Reduction of nitro compounds lies at the centre of most of the major areas of modern chemical industries, such as pharmaceuticals and dye manufacturing. The precursors in these industrial processes predominantly possess multiple functional groups, including those highly susceptible to reduction by most of the currently-used reducing agents. Therefore, non-selective methods of reduction result in the loss of such functional groups, potentially triggering undesired intramolecular interactions between substrate molecules, and, in turn, making it impossible to obtain the end product. The rising demand for a cheap and efficient approach to reduction of nitro compounds makes searching for an optimal reducing agent increasingly relevant.

In the present research, iron pentacarbonyl was chosen as an efficient and sustainable alternative to the primarily hydrogen-based reducing agents currently in use. Iron pentacarbonyl is a cheap and widely available species, with thousands of tons produced annually. Unlike other available reducing agents, iron pentacarbonyl makes the selective and tolerant reduction of nitro compounds in the presence of other functional groups possible. Therefore, the implementation of iron pentacarbonyl as the reducing agent allows for simplification, and significant cost reduction, in the synthesis of a number of pharmaceuticals, such as Cinacalcet, Maraviroc, Pramipexole and Sertraline.

The primary model reaction used to investigate the reducing properties of iron pentacarbonyl is reductive amination of ortho-nitrobenzaldehyde with pyrrolidine. During the course of this research, reductive amination of the aldehyde group and the reduction of the nitro group was successfully carried out with high yields in only one step.

<b>SCHOOL</b>	National Junior College
<b>PRESENTER(S)</b>	Chelsea Wong Jiahui
<b>PRESENTATION TITLE</b>	FeCo <sub>2</sub> O <sub>4</sub> as an Anode Material for Lithium-Ion Batteries
<b>CATEGORY</b>	Chemistry

Lithium ion batteries (LIBs) are commonly found in many portable electronic appliances due to their ability to be rechargeable. Currently, commercial anodes in Li-ion batteries (graphite) have a theoretical capacity of around 372 mAh/g, while FeCo<sub>2</sub>O<sub>4</sub> that will be investigated as the anode material has a theoretical capacity of 901.985mAh/g, more than double of the current commercial anode's capacity. Earlier work done by Sharma et al also showed that FeCo<sub>2</sub>O<sub>4</sub> has a very promising initial capacity of 827mAh/g. As such, the engineering goal is to produce a battery that will have a higher capacity than the current commercial Li-ion batteries through increasing the capacity of the anode material. The molten salt method and the citric acid combustion method were used to synthesise the anode active material as they are of lower cost. SEM and XRD analysis showed that FeCo<sub>2</sub>O<sub>4</sub> synthesised by the Molten Salt Method (MSM) was of a higher purity than that synthesised by the Citric Acid Combustion Method (CAC). This further supports our findings that FeCo<sub>2</sub>O<sub>4</sub> synthesised by the MSM has a higher cyclic stability than the one synthesised by CAC. However, both samples reflected a high capacity fade and resistance to charge transfer.

# abstracts

<b>SCHOOL</b>	NUS High School of Mathematics & Science
<b>PRESENTER(S)</b>	Dejoy Shastikk Kumaran
<b>PRESENTATION TITLE</b>	Using EEG-validated Music Emotion Recognition Techniques to Classify Multi-Genre Popular Music for Therapeutic Purposes
<b>CATEGORY</b>	Chemistry

Music is observed to possess significant beneficial effects to human mental health, especially for patients undergoing therapy and older adults. Prior research focusing on machine recognition of the emotion music induces by classifying low-level music features has utilized subjective annotation to label data for classification. We validate this approach by using an electroencephalography-based approach to cross-check the predictions of music emotion made with the predictions from low-level music feature data as well as collected subjective annotation data. Collecting 8-channel EEG data from 10 participants listening to segments of 40 songs from 5 different genres, we obtain a subject-independent classification accuracy for EEG test data of 98.2298% using an ensemble classifier. We also classify low-level music features to cross-check music emotion predictions from music features with the predictions from EEG data, obtaining a classification accuracy of 94.9774% using an ensemble classifier. We establish links between specific genre preference and perceived valence, validating individualized approaches towards music therapy. We then use the classification predictions from the EEG data and combine it with the predictions from music feature data and subjective annotations, showing the similarity of the predictions made by these approaches, validating an integrated approach with music features and subjective annotation to classify music emotion. We use the music feature-based approach to classify 250 popular songs from 5 genres and create a musical playlist application to create playlists based on existing psychological theory to contribute emotional benefit to individuals, validating our playlist methodology as an effective method to induce positive emotional response.

<b>SCHOOL</b>	Philippine Science High School
<b>PRESENTER(S)</b>	Patricia Joy G. Sabido
<b>PRESENTATION TITLE</b>	Replacing L-Amino Acid with D-Amino Acid Residues on an Ultrashort Cationic Lipopeptide to Improve Antimicrobial Activity
<b>CATEGORY</b>	Chemistry

With the overuse, and misuse, of antibiotics, bacteria have become resistant to most commercial drugs. Hence, there is a need to develop new classes of antimicrobial agents. This project aims to evaluate if incorporating D-amino acid residues will improve the antimicrobial activity of lipopeptides. A known antimicrobial agent, Myr-L(orn)3-NH<sub>2</sub> and its mirror-image, myr-D(orn)3-NH<sub>2</sub>, were synthesized on a Rink-amide resin using the Fmoc solid phase synthesis strategy. The UV spectra of the Fmoc deprotection solutions confirmed that the Fmoc protecting group was released on each stage of deprotection. Major peaks around 21.6 - 21.8 minutes were observed in the HPLC profiles of the crude lipopeptides. Purification of the desired fractions was achieved by preparative HPLC using a reverse phase column. Mass spectrometry confirmed that the target lipopeptides were successfully synthesized with [M+H<sup>+</sup>] at 570 and [M+H+Na<sup>+</sup>] at 593. Circular dichroism data displayed positive and negative peaks distinguishing the enantiomers. The D-lipopeptide was observed to have better antimicrobial activity in *S. aureus* than in *E. coli*, with MIC of 12.5 µg/ml and 25 µg/ml respectively. However, the D-isomer it was slightly less active than the L-lipopeptide. Nevertheless, these results verify that lipopeptides kill bacteria through non-specific interaction, unlike drugs that bind to specific enzymes. These enantiomeric lipopeptides have shown potential as drugs.

# abstracts

<b>SCHOOL</b>	Tokyo Tech High School of Science and Technology
<b>PRESENTER(S)</b>	Norie Kato, Natsuki Morimoto
<b>PRESENTATION TITLE</b>	Synthesis of Double Network Hydrogels Which can be Shaped Freely
<b>CATEGORY</b>	Chemistry

Double network (DN) hydrogels have specific characteristics such as flexibility and high mechanical strength which make them great candidates for use in biomaterials such as artificial cartilages and meniscuses. The purpose of this study is to synthesize DN gels which can be shaped freely. DN gels were synthesized using polyvinyl alcohol (PVA) as a mold, 2-acrylamide-2-methylpropane sulfonic acid (AMPS) as a first monomer, N,N'-methylene-bis-acrylamide (MBAA) as the crosslinker, 2-oxoglutaric acid (OGA) as an initiator and acrylamide (AAm) as a second monomer. To synthesize the DN gels, first, PVA (polymerization degree; 1000) was dissolved in water to create a 20% aqueous solution. This solution was poured in the silicone mold and kept in the freezer at -28°C and thawed before use. Second, the PVA gels were immersed in the first monomer solution containing AMPS (1 mol/L), MBAA (4 mol%) and OGA (0.1 mol%). They were irradiated with UV light (360 nm) in a nitrogen atmosphere for 8 hours. Third, the (PVA-PAMPS) gels were immersed in the second monomer solution containing AAm (2 mol/L) and OGA. They were then irradiated with UV light under the same conditions as before. Through these methods, DN gels were obtained by the desired shape. In the future, we would like to synthesis DN gels that are made of natural materials.

<b>SCHOOL</b>	Ritsumeikan High School
<b>PRESENTER(S)</b>	Haruka Kishi, Azusa Hashimoto
<b>PRESENTATION TITLE</b>	Creating a Sturdier Picket to Reduce Human Suffering
<b>CATEGORY</b>	Computer Science

Japan has earthquakes almost every day. Liquefaction is usually the second disaster after an earthquake that causes the most damage. It refers to the process by which the ground turns into a liquid. It is believed that pickets are a useful measure to protect buildings from collapsing during earthquakes and liquefaction. But, they have two problems: cost and time to develop. In previous research, structures built on a spinning top picket prevented damage from liquefaction the best. The purpose of this research is to determine the most effective picket during a simulated earthquake.

# abstracts

<b>SCHOOL</b>	Australian Science and Mathematics School
<b>PRESENTER(S)</b>	Julia Erceg
<b>PRESENTATION TITLE</b>	The Effectiveness of Using Solar Power to Charge Mobile Phones
<b>CATEGORY</b>	Engineering

The most disadvantaged people such as the poor, homeless, sick and elderly are reliant on their mobile phones. Being able to charge them for general use or during an emergency could be a matter of life or death, but charging stations aren't readily available. The development of a solar phone charger that is cheap and transportable would solve this problem, giving these people the chance to have the connection services they need and hence feel less isolated. Using simple scientific methods and inexpensive electronic components, a device has been created to power electronic devices. While the prototype provides enough charge in full sun to maintain the battery charge, it is not enough to increase this on some devices. Future refinements such as improved electronic parts will make a working model of this mobile phone charging case possible, creating a smaller, more efficient, low cost charger. This will significantly influence the lives of the most disadvantaged and allow people to live their lives using clean, affordable energy to conduct business, live productive lives, better manage illness and keep in contact with others.



<b>SCHOOL</b>	Chulalongkorn University Demonstration Secondary School
<b>PRESENTER(S)</b>	Sarasit Sirawattanakul
<b>PRESENTATION TITLE</b>	Smart Vertical Farm System (SVFS)
<b>CATEGORY</b>	Engineering

The unremitting trends of increasing population, urbanization, diminishing water supply, and continuing climate change have contributed to the declining stocks of arable land per person. Land available for farming is shrinking, and the demand for food is growing. All of these lead to food insecurity. Smart Vertical Farm System is designed to increase food productions by an automatic system. It is built with shelves which support soil and hydroponic systems, stacked vertically. The system first shovels the soil in the tray, sows the seeds, and contains an additional watering system. The second and third trays contain hydroponic technology. The Smart Vertical Farm System is an innovation that helps to produce high-quality, clean food while reducing time and water resources. It brings greater yields in smaller areas, increases access to healthy food in urban area, and helps save the environment since it allows farmers to monitor their farms with greater accuracy and plan how to maximize yields.

# abstracts

<b>SCHOOL</b>	School of Science and Technology, Singapore
<b>PRESENTER(S)</b>	Matthew Liang
<b>PRESENTATION TITLE</b>	Investigation of the Skin Effect in Alternating Currents
<b>CATEGORY</b>	Engineering

Skin effect is the tendency of an alternating electric current (AC) to become distributed within a conductor such that the current density is largest near the surface of the conductor, and decreases with greater depths in the conductor. The electric current flows mainly at the "skin" of the conductor, between the outer surface and a level called the skin depth. In this project, we intend to fulfill the following objectives: (1) Mathematically model the distribution of current in the diameter of the wire using Maxwell equations to arrive at a Bessel function of the second kind; (2) Plot the current distribution across the diameter of a wire using MathLab; (3) Carry out a measurement of the current in a hexagonal wire cage; (4) Compare the experimental results with the mathematical model. Our results have shown that the mathematical model is in agreement with the experimental results. With these experimental results, we can redesign the structure of an electrical conductor by using a copper pipe instead of a copper cylinder. This research can be applied to AC power transmission lines as well as signal transmission in sound systems. By reducing the amount of copper material needed, we can reduce the cost of these materials without compromising the quality of power and signal transmission.

In our current experimental design, we have simulated the copper conductor as a hexagonal wire cage with only 1 layer beyond the central core of wire. Future studies could look at the effect of more layers of wires. This will improve the precision in which we can model the skin effect for alternating currents in copper wires.

<b>SCHOOL</b>	Australian Science and Mathematics School
<b>PRESENTER(S)</b>	Constance Gladwin
<b>PRESENTATION TITLE</b>	Effective Potable Water Filtration Device
<b>CATEGORY</b>	Environment

Following recent water crises in Asia and Africa including Ethiopia, Nepal, Ghana, and Congo, populations are left to survive on dirty, contaminated water. This water contains diseases, sand, gravel deposits, river water and groundwater. While some of these contaminants can be reduced or removed by settling and decantation, others are dissolved into the water and must be removed using other means. The purpose of this experiment is to purify and filter contaminated water through a portable hand-held device. This portable device, commonly referred to as a 'French press', is a device that can be easily accessible in all areas of the world. This project replicates the water that is most commonly collected in these countries and is tested to discover the Nitrite, Nitrate, pH and Phosphate levels. The contaminated water is passed through the portable device, which includes filtering membranes, to filter out the larger and smaller particles in the water. The results are collected and tested through spectrophotometer trials to identify the cleanest water samples of the filtering trial. This idea is simple, affordable, portable and reliable. However, it should be noted that sometimes simple ideas can be the best ones and can change the world. Clean and affordable water is a basic human right and ways of producing it should be distributed widely as a matter of urgency. This idea may be part of the solution.

# abstracts

<b>SCHOOL</b>	Australian Science and Mathematics School
<b>PRESENTER(S)</b>	Ngan Lai
<b>PRESENTATION TITLE</b>	Benefits of Basic Water Filtration
<b>CATEGORY</b>	Environment

Contaminated water kills millions of people around the world every year; never before has a low-cost purification system been needed more. The central purpose of this scientific practical is to purify contaminated water to make it fit for human consumption. An uncomplicated water purification system will be introduced, in which a range of easily accessible materials are used as filters to eliminate dangerous chemicals from contaminated water. Achieving the standard drinking water levels according to the Australian Environmental Protection Agency (EPA) requirements would enable people to filter their own polluted water to an acceptable standard for use. As water purification is the procedure of discharging hazardous chemicals, biological contaminants, suspended solids and gases from contaminated water, an experiment was designed using various water sources simulated from Vietnam. These included freshwater rivers, saltwater rivers and groundwater. Varying pollutants were identified, as well as the means by which the water source was contaminated. The results derived will enable close examination at the pollutants tested allowing the identification and separation of the contaminated water from the purified water, measuring the degree of purity in accordance to the healthy drinking water standards.

<b>SCHOOL</b>	Brookhouse School
<b>PRESENTER(S)</b>	Dwaha Ali Daud, Catherine Achieng Olang, Gouri Rajagopal
<b>PRESENTATION TITLE</b>	Degradation and Rehabilitation of Urban Water Course
<b>CATEGORY</b>	Environment

Businesses and other informal settlements are said to be the key of polluters of the Kabuthi River. The population pollutes streams of water, especially Kabuthi River by disposing waste into the rivers. This makes the water unsafe for domestic use by the big slums population that has to buy water for drinking, cooking, washing clothes and feeding animals yet there is a stream that passes by their homes. The settlements include Gachui, Kwanjiku, Mutuini, Kirigu, Mutego and Waithaka among others.

The study was also set out to establish the key polluters of Kabuthi River by investigating the activities the river and other mentioned informal settlements where the stream passes.

To make this study possible both primary and secondary data were used. Primary data sources included field observations and 150 questionnaires completed by the residents. A total of 16 villages around the streams were selected where interviews were conducted and questionnaires filled through random sampling.

Three water samples were taken from River Kabuthi at 1Km interval and tested in the laboratory. Two other waste water samples results were borrowed from study on slaughter houses located in the areas along which the stream flows to establish whether they too contributed to the pollution of urban streams.

Data analysis and presentation was undertaken using both general qualitative and quantitative methods. The analysis of samples was undertaken in the Environmental Health Engineering Laboratory at University of Nairobi with additional help by Davis and Shirliff.

# abstracts

<b>SCHOOL</b>	Chulalongkorn University Demonstration Secondary School
<b>PRESENTER(S)</b>	Norakamon Ariyakanon
<b>PRESENTATION TITLE</b>	Application of Biochar from Agricultural Waste for Canteen Wastewater Treatment in Chulalongkorn University
<b>CATEGORY</b>	Environment

The potential use of biochar, made from rice straw, bagasse and coir, in canteen wastewater treatment is investigated in this study. Pyrolysis at 300°C for 1 hour is used to produce the biochar. The physical and chemical parameters of wastewater, including pH, biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), oil and grease, total phosphorus (TP), and total nitrogen (TN), are analyzed before and after treatment with three different types of biochar. The biochar derived from rice straw contains the highest biomass content (39.5 + 2.1%), followed by coir (38.6 + 2.2 %), and bagasse (32.7+ 1.5 %). In general, the water quality is improved after biochar treatment. The removal of oil and grease is approximately 98% while the removal of TSS was 92-95%. This study suggests that biochar made from agricultural wastes is effective for wastewater treatment and these materials could be value-added for eco-friendly products in the market.

<b>SCHOOL</b>	Doregos Private Academy
<b>PRESENTER(S)</b>	Faith Odusanya
<b>PRESENTATION TITLE</b>	PLEASE, MORE NOISE!!!
<b>CATEGORY</b>	Environment

One of the major pollutants of our environment especially in Nigeria is noise. Despite the persistency and negative impact of noise on humans, there has been no sustainable economic use that noise has been put to over years. This project seeks to put this supposed nuisance to an economic use. The project consists of a rectangular collector horn made of 0.0075m thick Perspex measuring 0.27m by 0.07m. The V shaped horn condensed at the tip to a rectangle of sides 0.07 by 0.0025m. The trapped noise collected by the horns is compressed and fed into three piezo electric wafers, 0.0025m in diameter, arranged in series, consisting of sound activated crystals of containing Barium titanate (BaTiO<sub>3</sub>) and lead zirconate titanate (PZT). The sudden release of the compressed sound waves into a boom chamber where the crystals are located generates high sound energy output which is then incidented on the crystals causing them to vibrate, thereby generating electrical energy. The alternating current generated is rectified and then smoothened through the 470uF electrolytic capacitor and voltage multiplier to power LEDs and charge phones. To ensure that continuity of power supply, the power generated was used to charge two 1.5V batteries arranged in series so as to ensure the supply of electrical energy even when the noise level has significantly reduced. The output voltage varies from 5.84V to 10.52V, directly proportional to the incidented frequency of the noise. The project if further developed can significantly serve as an alternative energy source in many developing economies.

# abstracts

<b>SCHOOL</b>	Fort Richmond Collegiate
<b>PRESENTER(S)</b>	Kathleen Bradie
<b>PRESENTATION TITLE</b>	How Do Different Levels of pH Affect the Growth of Heritage and Regular Radish Plants?
<b>CATEGORY</b>	Environment

The purpose of this experiment was to discover how the pH levels in water affect heritage and regular radish mass. I predicted that if the pH levels are near neutral the plants mass will increase. PH solutions of 3, 5, 7, 9, and 11 were added to my regular and heritage plants over the course of several weeks. After using the pH solutions the radishes were pulled and massed to reveal the results. The results showed that the heritage pH 5 and regular pH 7 radishes grew best.



<b>SCHOOL</b>	Fort Richmond Collegiate
<b>PRESENTER(S)</b>	Dylan Walker
<b>PRESENTATION TITLE</b>	Effect of Various De-Icers on Grass Health
<b>CATEGORY</b>	Environment

De-icers are a common chemical product that cities and homeowners across the world use to melt ice on the roads and around their home. The purpose of this experiment was to determine the effect of various de-icers on grass health and compare it to the efficiency from which these de-icers actually melt ice. This was done through placing pots of soil into separate containers each filled with a little bit of a different de-icer solution to test its effect on grass by measuring the percentage of green grass is left in each pot. The efficiency was tested by filling different containers with ice and pouring each of the different de-icers on it and then after a set time, any water in the container was poured out and the container was massed to find out how much ice melted. This project and the results that come from it have very relevant implications as de-icers are a commonly used product throughout the world and with how often they're used, the impact they can have on the environment can be substantially negative. Finding the least environmentally impactful de-icer as well as the one that is the most economically efficient one was the main focal point of this project.

# abstracts

<b>SCHOOL</b>	Lewiston-Porter High School
<b>PRESENTER(S)</b>	Ciaran Edwards, Bailey Hoplight, Justin Pavan
<b>PRESENTATION TITLE</b>	Analysis of Oncorhynchus Mykiss Tissue to Determine Lead Ion Concentration
<b>CATEGORY</b>	Environment

The variation in potential lead ion ( $Pb +2$ ) concentration in various tissue samples of *Oncorhynchus Mykiss* (steelhead) trout caught in the Niagara River was investigated. This was used to develop a kinetic model of trace element bioaccumulation of lead in various tissues. By employing experimentally determined trace element influx and efflux from environmental food and water exposures, lead ion concentrations were determined using atomic absorption spectroscopy on homogenized fillet, liver, and gonad tissues collected from steelhead trout caught in the Niagara River. Lead ion concentrations were also determined from water samples collected at a GPS noted catch site. All sample testing was conducted under the direction of Dr. David Stewart, Ph.D. at D'Youville College.

Results from the study may be used to predict the level of lead ion exposure to humans through the consumption of the steelhead trout fillets and may be used predict the environmental conditions of lead accumulation in human food sources caught in local waters, such as Lake Erie, the Niagara River, and Lake Ontario. Lead measurements may suggest (a) accumulation of lead concentration in steelhead trout fillet tissue consumed by humans, and (b) processes of influx and efflux governing bioaccumulation in these animals in their natural environment, such as accumulation in the fish from ingested particles, or accumulation mostly through the food web, or that the relative accumulation varies with environmental conditions.

<b>SCHOOL</b>	National Junior College
<b>PRESENTER(S)</b>	Ashley Chng
<b>PRESENTATION TITLE</b>	Optimising a Plant (Red Flame Ivy) Microbial Fuel Cell as a Sustainable Electricity Source
<b>CATEGORY</b>	Environment

This project is targeted at bettering the lives of people in the rural areas who do not have easy access to electricity by creating a sustainable Plant Microbial Fuel Cell (PMFC). The concept of a PMFC is fairly new and holds a lot of potential to be explored. By referencing previous research papers, optimum operating conditions were selected, including the concentration of chemicals used and the temperature the set-up was placed such that all elements of a MFC were present, with room for a plant. In order to produce a self-sustainable PMFC, the plant had to be able to generate an electrical voltage first. After optimising the physical setup and operating conditions, a peak voltage of approximately 0.4V was successfully generated. In order to align the project more closely with the aim, we sought to replace the chemicals with commonly found oxidising and reducing agents that are more environmentally friendly and easy to obtain. Through a serendipitous discovery, we managed to achieve a peak voltage of approximately 0.4V that is sustained over a period of 70 hours by using a combination of tap water and salt water to replace the chemicals.

# abstracts

<b>SCHOOL</b>	Sint-Osulphuslyceum
<b>PRESENTER(S)</b>	Lora Vogels, Kinah Deekman
<b>PRESENTATION TITLE</b>	The Global Goals
<b>CATEGORY</b>	Environment

In 2015, world leaders and the United Nations agreed to 17 goals for a better world by 2030. These goals have the goal to end poverty, fight inequality and stop climate change. Guided by the goals, it is now up to all of us - governments, businesses, civil society, and the general public - to work together to build a better future for everyone.

We investigated if these goals are actually achievable within the next years. We also wanted to find out if the people of the Netherlands were aware of these goals, and if they would do something to contribute to the goals. We then came up with ideas to make these goals easier to achieve.

<b>SCHOOL</b>	Rockdale Magnet School for Science and Technology
<b>PRESENTER(S)</b>	Shivam Vohra
<b>PRESENTATION TITLE</b>	The Effect of Different Semiconductor Materials on Solar Cell Efficiency
<b>CATEGORY</b>	Environment

The purpose of this project was to ascertain the effect of infusing semiconductors with different metals on the efficiency of solar energy production. The hypothesis was that if the semiconductors were infused with metals, the solar cells would produce an increased amount of energy that was statistically significant. Different mixtures of lead iodide and titanium dioxide were created, which were then layered upon the semiconductors of solar cells that had been heated until dried and left to settle overnight. The solar cells were then placed under a 120-watt lamp and tested, using the three solar cells per group as individual trials. The data were then placed under into an ANOVA test and a two-tailed T-test against the control. The data showed that any differences in power production between groups were not statistically significant, but the differences in within groups were statistically significant.

# abstracts

<b>SCHOOL</b>	Chulalongkorn University Demonstration Secondary School
<b>PRESENTER(S)</b>	Thipok Bovornratanaraks
<b>PRESENTATION TITLE</b>	Energy Conversion System for Traveler (ECoST)
<b>CATEGORY</b>	Physics

The Energy Conversion System for Traveler (ECoST) is composed of two parts - one for energy harvesting and another for energy storage. Other clean energy sources, such as piezoelectric materials, solar cells, and thermoelectric materials, were also studied, however, the electromagnetic technology to convert kinetic energy from rolling wheels into electricity was chosen for energy harvesting. The output voltage was measured and compared for five different generators. The electricity generated is stored in the energy storage unit which employs the most recent supercapacitor technology - without chemical process and generating no heat loss - making the energy conversion more efficient. The electricity is then transferred via a USB port. The patent submission number (1703000492) is issued.

<b>SCHOOL</b>	Doregos Private Academy
<b>PRESENTER(S)</b>	Michael Omotoye, David Odusanya
<b>PRESENTATION TITLE</b>	DON'T FORGET YOUR KEYS
<b>CATEGORY</b>	Physics

The project seeks to assist busy executives who are always plagued with crowded schedules resulting in them misplacing many important small items such as car and house keys and are confronted with searching for them at vital hours. It also seeks to assist people confronted with amnesia especially the aged. It works on the principle of sending and receiving radio signals. The transmitter which contains a colpitts oscillator inserted into the keys or any property which can be easily forgotten due to its small size sends out a weak radio signals within a range of 10 metre. For as long as the transmitter and receiver which is very portable and attached to the belt of the key owner are within this range, the triac switch remains deactivated, hence the alarm is in a zero or dormant state. However, this signal is cut off whenever the key owner moves outside this range leaving the keys behind. Whenever this occurs, the sudden loss of signal will reset the switching circuit thereby activating the alarm systems on both the keys and the receiver attached to the belt, alerting the owner that he has left the keys or any such property behind. The buzzing of the alarm on the keys and the intermittent blinking of the light emitting diode on it helps the key owner to easily locate the keys, thereby saving precious time. This project, when well developed and implemented will bring a great relief to many busy executives and the aged.

# abstracts

<b>SCHOOL</b>	Fort Richmond Collegiate
<b>PRESENTER(S)</b>	Josephine Zhao
<b>PRESENTATION TITLE</b>	Light, Electricity and Semi-Conductors
<b>CATEGORY</b>	Physics

Since their invention, computers have been playing an important role in human society, and are even more important now. As a comparison, people would find that computers are getting smaller and smaller, faster, more efficient, and more energy efficient. It is the base stone of modern information era. A CPU is the brain of a computer, and as the evolution of computers continues, CPUs are getting smaller and smaller, too. That is due to the using of semiconductors.



<b>SCHOOL</b>	Illinois Mathematics and Science Academy
<b>PRESENTER(S)</b>	Alice Liu
<b>PRESENTATION TITLE</b>	Classification of proton treatment plans between SFUD, MFO and hybrid plans
<b>CATEGORY</b>	Physics

**Purpose:**

Create a method to aid physicists and dosimetrists in the classification of Intensity Modulated Proton Therapy treatment plans.

**Method:**

A Python program was developed to read structure sets and dose grids from radiation treatment plans. The program outputs field-specific histograms of the number of voxels within the planning target volume that received dose and normalizes each histogram to the percent volume of the target that received each field's contribution of the total dose. It then determines the number of Gaussian distributions in each histogram, which serves as an initial classification metric, and calculates additional metrics, including the width and maximum dose in each distribution, and the rate at which the number of voxels decrease per change in dose. Twenty-five patients (9 SFUD, 12 hybrid MFO and 4 MFO) were analyzed, and compared to data from a standard Single-Field Uniform Dose (SFUD) treatment plan and assessed for similarity.

**Results:**

The program can classify hybrid treatment plans by assigning them a score based on calculated metrics that represent their correlation with a standard SFUD treatment plan.

**Conclusions:**

The program and its outputs can aid in improved classification and differentiation of hybrid treatment plans to facilitate the precision of patient and target volume positioning.

# abstracts

<b>SCHOOL</b>	Philippine Science High School
<b>PRESENTER(S)</b>	Lorenzo Gabriel P. Joquiño
<b>PRESENTATION TITLE</b>	Dynamics of a Vibration Doubly Tethered Granular Chain
<b>CATEGORY</b>	Physics

Polymer physics studies the structure and dynamics of polymers and polymeric systems. Results from polymer physics have been used in various fields such as biology, polymer processing, and electronics. Mechanical analogs like granular chains have been utilized in studying polymer dynamics as they are able to demonstrate coarse-grained behavior of polymer motion while still being accurate about a polymer's properties at a larger length scale. In this study, a vibrated granular chain of beads was used as an analog system to represent the polymer motion in a solution. The granular chain was confined to a circular container. Both its ends were fixed at designated positions on the wall of the container, and the bottom surface of the container was made of a monolayer of randomly distributed identical beads to provide random motion to each bead and simulate polymer-solvent interaction. Different amplitudes and frequencies were applied to the system. Statistical properties of chain dynamics were analyzed by video analysis and these properties were correlated to different vibration parameters and distance between the ends of the chain. From the results it was found that anomalous subdiffusion was experienced by the beads. The diffusion coefficients as a function of bead index (position of bead along the chain) follow a platykurtic distribution suggesting an effect of container size and chain geometry (length, bead size). These results can suggest the feasibility of using a vibrated granular chains as a model to describe polymeric structure and motion.

<b>SCHOOL</b>	Saint Petersburg Lyceum Physical Technical High School
<b>PRESENTER(S)</b>	Evgenii Levdik
<b>PRESENTATION TITLE</b>	The Development of a Diffraction Grating for an Element of Directional Output of Radiation from Microlasers
<b>CATEGORY</b>	Physics

In nanophotonics, axisymmetric microlasers became widespread. As they have lots of advantages, they can be used in many scientific and industrial areas, such as microchips for data transfer in order to make electrical circuits smaller. But there is a drawback: they radiate in all directions in the plane of the substrate. This is why elements of directional output of radiation are being developed. A necessary part of such element is the diffraction grating applied to the surface of the waveguide. Such gratings are already being created, but with very expensive methods, for example, electronic lithography. We present a technique for creating diffraction gratings by the method of atomic force microscopy lithography.

To create a prototype of the necessary diffraction grating, we used cheap samples: fragments of a CD. We created probes for an atomic force microscope by electrochemical etching and calibrated the unit using calibration nanostructures. Next, we investigated the relief of the samples to create a matrix of interaction between the probe and the surface.

To find the necessary depth of lithography, we formed the relief in several stages, gradually increasing the force of interaction between the probe and the surface. As a result, we made a prototype of a diffraction grating with the necessary period and a satisfactory profile. In addition, as the emission angle depends on the grating period, we have investigated the range of allowed periods. As a result, we created prototypes of gratings on a CD with periods about  $1\ \mu\text{m}$  and higher.

**notes**



**notes**

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