LEADERSHIP & INNOVATION LAB

SPRING 2024 RESEARCH & INNOVATION SHOWCASE

20 AND 21 APRIL
9AM ET | 9PM CST

▶▶▶ Scan to Register ▶▶▶

SHOWCASE DAY 1

TIME (IN ET)	ITEM
9 - 9.05am	Warm up
9.05 - 9.10am	Opening remarks
9.10 - 9.20am	**Justice Blueprint** | *A Project by Dora Chen*
9.20 - 9.30am	**Mutation Bio Journal** | *A Project by Taili Gao*
9.30 - 9.40am	**The Effect of Music Training in Young Children** | *A Paper by Carolyn Foo*
9.40 - 9.50am	**Wise Charity Fund** | *A Project by Matt Zhang*
9.50 - 10am	**Wheely and AI Conference** | A Paper & Project by William Zhang
10 - 10.25 am	**Beginners' Guide to 3D Design** | *A lecture by LIL Student Instructor Alex Huang*
10.25 - 10.30am	Wrap up

SHOWCASE DAY 2

TIME (IN ET)	ITEM
9 - 9.05am	Warm up
9.05 - 9.15am	**A Review of Global Oral Health** | *A paper by Renee Jia*

9.15 - 9.30am	**Repairing the Public Health Crisis in Venezuela** | *A paper by Vanessa Catalano*
9.30 - 9.40am	**Food For Thought** | *A project by Alicia Li*
9.40 - 9.50am	**Current and Developing Treatments to Target EGFR for NSCLC** | *A paper by Linda Luo*
9.50 - 10.05am	**Examining the Effects of Fracking on Groundwater Using the United States Fracking Well Data** | *A paper by William Lin*
10.05 - 10.25am	**LIL Venture Fund** • Announcement of winners of IdeAction Global Pitch Competition • Award of funding from LVF
10.25 - 10.30am	Wrap up

SPEAKERS

Maya Gobert
Founder & Director, Leadership & Innovation Lab
BA, Economics and Political Science, Cornell University

Avi-Yona Israel
LIL Instructor
Colgate University & U Penn Law School

Alex Huang
- **MIT, Class of 2028 & LIL's Student Instructor**
- Alex is an inventor, entrepreneur, educator, and 3D designer passionate about empowering youth to bring their ideas to life.
- Alex participated as a finalist in the International Science and Engineering Fair, was named the National Diamond Challenge Champion, and received the 2022 Future Innovator of the Year award from the Arizona Governor.
- Since 2020, Alex has taught more than 25+ students CAD and 3D printing, helping them launch their own projects and prototypes. When he's not teaching or building things, you will find him dancing or swimming with his friends!

LEADERSHIP & INNOVATION LAB

# 3D Design Fundamentals for Young Innovators

LEARN HOW TO:

- 3D print objects
- Design custom 3d models
- Use computer aided design software including

   + Tinkercad & fusion 360

ALEXANDER HUANG
Hamilton High School
Class Of 2024

- Autodesk Certified Professional In Design For Manufacturing Certification
- 2022 Isef Finalist
- 2023 Diamond Challenge Champion - Grand Prize Winner For Business Innovation
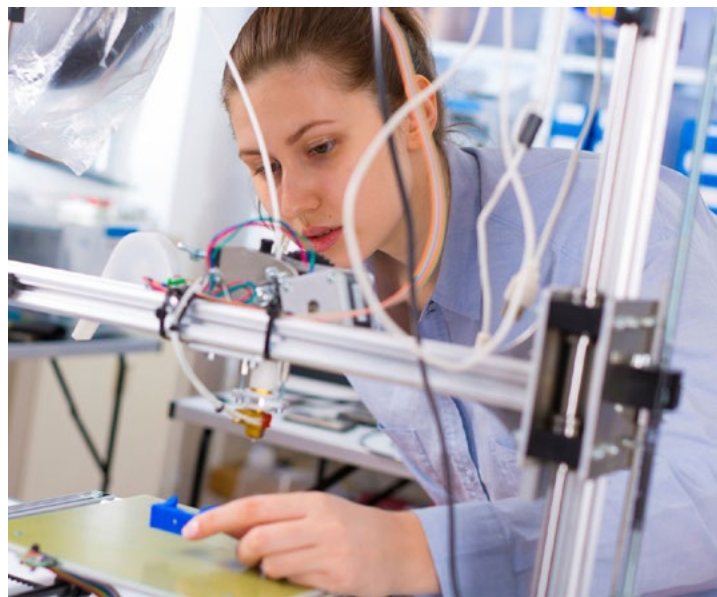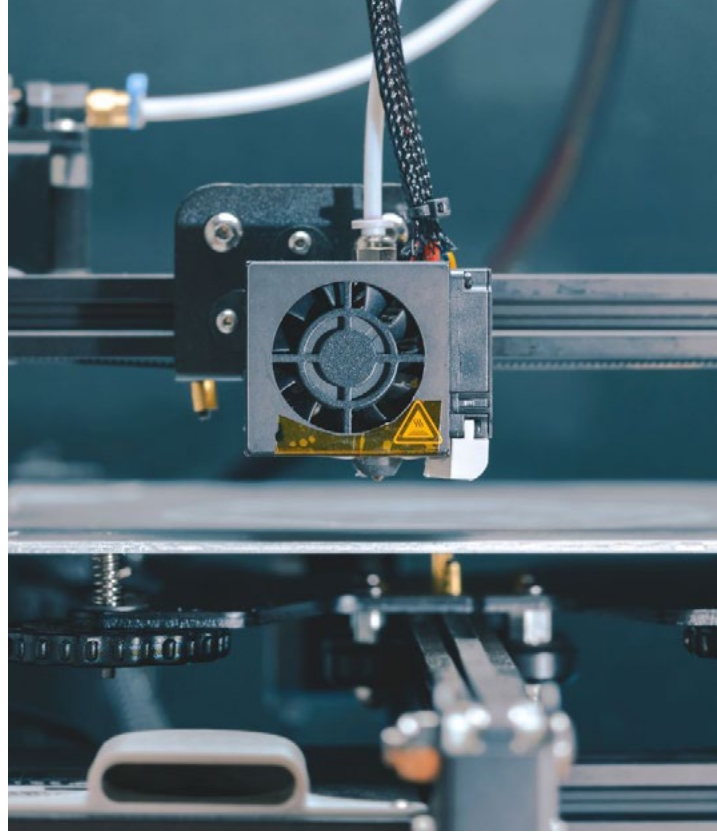
Dora Chen

- The Justice Blueprint is a student-run organization that aims to close the gap in legal knowledge. Our purpose is to aggregate existing information about different legal areas under the guidance of local law firms and experts. The law is all around us – be it the breakfast this morning that is regulated under the FDA, or the music that you listen to on the way to school or work that is protected under IP law – it dictates how we live and how we interact with society. It is crucial then, to be aware of the rights you hold, and the JB hopes to assist you in learning more about the law.

Taili Gao

- Taili is a member of the class of 2025 at Lexington High School. She is a current student researcher at MIT, a two-time USA Biology Olympiad Semifinalist, and a British Biology Olympiad Gold Award winner. Outside of biology, she enjoys problem-solving and poetry writing. She is the senior division poetry Second-place winner in the international 2022 Bow Seat Ocean Awareness Contest and a Senior Editor at Polyphony Lit.

- Mutation is a global student-led biology journal aiming to raise genetic disease awareness and expand biology education. All articles are published online after edited, and a selection of well-written articles are featured in our quarterly and special edition issues. We welcome all students to submit to our journal at https://www.mutationbiologyjournal.org/ and/or apply to join our administrative team! Follow us on social media to receive updates, tips, and to learn more biology!

Matt Zhang

- Hello! I am Matt Zhang, the CEO of Wise Impact Charity Fund. I am a 17 year old high school junior from Rochester Adam High School in Michigan.
- Problem: Our High School Clubs receive little to no funding.
- Hinders students from participating in competitions & creating opportunities
- Our Solution: Wise Impact Charity!
- Grow our skills & pursue our interests by learning how to invest in the stock market
- Donate the profits to these clubs

4

William Zhang

- William is a high-achieving 11th grader at Weston High School in Boston.

- Wheely is a small and inexpensive wheeled-legged quadruped robot made to be an accessible method of experimenting with wheeled-legged robots. The current robotics environment lacks economic wheeled-legged quadrupedal robots for low stakes experimentation and use. The robot uses low-cost and easy to acquire servo motors for a simple, but reliable build. With total costs within $600 dollars, Wheely is around 0.2 m tall and weighs roughly 3 kg. Wheely's simplistic and small-scale nature allows it to be deployed by a single operator and is modification friendly.

  Wheely is the combination of the best of two worlds, wheeled and legged locomotion, allowing efficient travel on both smooth and rugged terrain. Experiments on robot were conducted in a simulated environment using Pybullet. Wheely is capable of autonomously surmounting stairs 0.05 m tall, 25% of its normal body height, using open loop gaits generated using Bezier curves. On flat surfaces, Wheely can reach speeds of up to 0.09 m/s using wheeled and 0.04 m/s using legged locomotion. Wheely's relatively low-cost and accessible nature will allow for the proliferation of wheeled-legged quadruped technologies and freedom of experimentation.

Alicia Li

- Alicia Li is a sophomore at the Horace Mann School in New York City. She's dedicated to using her background in AI to mitigate important environmental issues. Besides being passionate about food waste, she also loves doing math and making music. She's been playing the violin for ten years and sings both solo and in choirs during her free time.

- Food for Thought is a project focused on food waste education and waste-conscious action. Food for Thought comprises two main initiatives: the first aspect is a workshop tackling the impacts of food waste, including global warming and food insecurity, and how individuals can actively reduce their food waste. The other main component is a food tracker that uses AI to identify items in your fridge, keep track of expiration dates, and provide helpful recipes so as little food is thrown away as possible.

Carolyn Foo

- Carolyn Foo is a current senior at Montgomery High School in New Jersey. She is interested in neuroscience and healthcare, as her favorite subject is biology and anatomy. Additionally, she is passionate about music and art. Carolyn has played piano since she was five and is part of her school's audition choir group. Because music has been very beneficial to her throughout her life, Carolyn started this research project to combine her passion for music and neuroscience and highlight the benefits of music education. She hopes to continue cross-disciplinary research and pursue these interests in her future.

- Music training, the active participation in learning music, can lead to changes in the brain's structure also known as brain plasticity. The impact of experiences that cause brain plasticity is especially strong during a child's developmental period.

  These changes in the brain due to music training can impact domains outside of music itself, suggesting a possible impact on a child's cognitive development. This literature review intends to determine whether there is evidence to support the idea that music training improves cognitive development. Through different literature, the effects of music training on the brain are shown from a measure of brain plasticity and near and far transfer effects.

  However, studies on this relationship do not consider external factors such as socioeconomic status, genetic predisposition, and reward value, that can impact the effect of music training in children. The findings reveal a possible positive correlation between music training in young children and improvement in cognitive development, but a causation relationship cannot be determined.

Vanessa Catalano

- Vanessa Catalano, a junior at Marymount High School in Los Angeles, has an unwavering commitment to the fusion of public health advocacy and her Latin heritage. Her participation in her school community is evident through her leadership and active involvement in many activities. Vanessa is the co-founder and co-president of the Pre-Med Club, contributes to the school newspaper as a features section editor, and is a player on the varsity volleyball team. She amplifies her connection to her Latin roots as a writer for her school's Spanish newspaper and literary magazine. Additionally, she further explored and gained insights into her passions through an internship with a plastic and reconstructive surgeon. This diverse range of experiences supports her pursuit of addressing and repairing the public health crisis in Venezuela.

- Venezuela is struggling with a multifaceted crisis encompassing environmental, economic, and health issues. The healthcare system in Venezuela, known as Barrio Adentro, is declining, leading to the deterioration of the health and well-being of its citizens. These harmful causes include low immunization rates, water contamination, and the effects of droughts, in addition to the corruption of their government. Following these root issues, this paper explores these challenges in Venezuela's healthcare system and proposes solutions aimed at improving public health in Venezuela.

  These proposals include the introduction of a water and food stamp program, the allocation of a reserved amount of clean water for hospitals, increased transparency in government spending, the mass production of drought-resistant crops, water recycling initiatives, and the expansion of wells and filtration systems. The degradation of Venezuela's healthcare system is alarming, and the responsibility for implementing positive change rests upon the global community. The solutions in this paper serve as a foundation for revitalizing the healthcare system and emphasize the urgent need for intervention and reform. Ultimately, these efforts promote and lead to better health and quality of life for Venezuelan citizens.

Renee Jia

- Hi, I'm Renee Jia! I am a junior in Johns Creek, Georgia, and I am interested in a career in dentistry. I am very passionate about music and the arts, and I love to create paintings to share on social media. My favorite subjects in school are biology and math, and I enjoy volunteering on the weekends with my family.

- The oral cavity and the structures within are essential to life processes such as eating, speaking, and breathing. Main components of the oral cavity include the tongue, teeth, gums, and oral microbiome. The health of the oral cavity has strong bidirectional associations with overall health, and frequent oral manifestations of systemic diseases gives the mouth strong diagnostic potential. With an estimated burden of over 3.5 billion cases, oral diseases are considered a public health crisis. There is a strong and consistent association between socioeconomic status and the prevalence and severity of oral diseases, establishing a disproportionate burden. Factors that can impact the integrity of the oral cavity include age, nutrition, and genetics.

   Modifiable risk factors include diet, quality of oral hygiene, unhealthy lifestyle choices, and their underlying social determinants. Challenges preventing access to oral care include high expenses, lack of insurance, lack of perceived need, unavailability of dental offices, transportation issues, fear of dental treatment, and scheduling difficulties. These barriers have varying impacts on individuals, but especially impact marginalized communities, and stretch beyond physical health to include mental health challenges.. The role of healthcare workers in community based oral health awareness programs is discussed and emphasized. There has been some evidence to show that oral health promotion programs are more effective when delivered by healthcare professionals and targeted towards parents and children under the age of 6.

Linda Luo

- Linda Luo is a junior attending Seven Lakes High School in Katy, Texas. She is passionate about the human body and biomedical-related research. Her interest in this field stemmed from an independent research project she started in her AP Statistics class. In 2023, she presented her research project on lung cancer statistics at the American Public Health Association's Annual Meeting and Expo. Aside from research, Linda is also passionate about music. She is a drum major for her school's marching band and has been a member of the top band ensemble since freshman year.

- Lung cancer is amongst the most diagnosed cancers with a relatively low five-year survival rate of around 20 percent. Currently, the most frequent first-line treatments for lung cancer, more specifically non-small cell lung cancer, consist of chemotherapy, radiation therapy, target therapy, and immunotherapy. However, challenges such as the high cost of treatment, drug resistance, and immunosuppressive tumor microenvironment make it difficult to treat the cancer effectively. While researching ways to overcome these challenges, new treatments involving CAR-T therapy which has shown promise in treating blood cancer, and CRISPR which has shown the precise targeting of genes are being developed intensively. This review will delve into the EGFR gene, and how targeting it could improve the prognosis due to its prevalence in patients diagnosed with NSCLC. Overall, this review will detail the advantages and disadvantages of each of the current treatments for NSCLC and present new treatments like CAR-T and CRISPR for NSCLC.

William Lin

- William Lin is a hardworking, compassionate, and enthusiastic high school junior student who enjoys academics, volunteering, and extracurricular activities. At school, William has demonstrated academic excellence in advanced coursework and long-term dedication in student clubs such as the math team and science team. While William has diverse interests in many areas of scientific research, he is particularly drawn to physics and environmental research. William is enthusiastic about climate issues and was selected as an FXB Climate Advocate in 2022 where he worked alongside like-minded climate advocates from all over the world. He is also committed to raising environmental awareness in his local community. In Summer 2023, William conducted a research project with Professor Koch at Boston University, aiming to address the impact on groundwater from the proliferation of fracking wells through analyzing up-to-date registry data on more than 200,000 fracking wells nationwide using statistical and machine learning techniques.

- Ever since fracking technology, drilling downward and then horizontally, has been developed to extract oil and gas from underground bedrock, the number of fracking wells has been drilled at an accelerating speed, and the amount of underground water consumed has also increased enormously. The goal of this paper is to address this alarming environmental and climate threat from the proliferation of fracking wells accompanied by a surge in groundwater consumption, through analyzing the up-to-date registry data available as of October 2023 from FracFocus.org on the fracking wells nationwide.

  The paper starts with a literature review to study the existing research findings on fracking water consumption issues. Next it provides a comprehensive data analysis of the water consumption by fracking wells at both national and state levels. It also explores the relationships between the water consumption with various other factors such as the vertical depth of the wells, the chemical ingredients of the fracking fluid, and the purposes of the additives, and aims to provide insights from the correlation and causality analyses that may offer potential strategies to reduce groundwater consumption in the fracking industry. In addition, the paper employs machine learning techniques such as Random Forest model to explore using predictive models to identify wells that have high likelihood of causing a water contamination issue so that proactive controls can be developed to reduce the occurrence of water quality issues.