



Dragon Science

May 2025





Macromolecules Food Lab



Stomata Lab



Yeast & Balloon Lab

MYP 3 Science

Jiyu Kim & Julian Kuang - Grade 8

In grade 8 (MYP 3) science, we are currently in a biology unit exploring macromolecules, photosynthesis, and cellular respiration. Macromolecules, which are essential nutrients in our daily life, play a significant role in our body. Through an effective combination of lectures, collaborative worksheets, and interactive video sessions, we have learned about the four main types of macromolecules. Carbohydrates, composed of sugars (monosaccharides), serve us as an energy source and provide structural support for our body. Examples include glucose, starch, and cellulose. Lipids, portrayed as unhealthy fats, are made up of fatty acids and glycerol and are vital for energy storage, cell membrane formation, and cellular signaling. Proteins, usually associated with muscle building, are a lot more versatile, helping our body in a variety of aspects. They are crucial for muscle contraction (thanks to proteins like actin and myosin), enzymatic reactions, structural support, and cell communication. Finally, nucleic acids, such as DNA and RNA, are constructed from nucleotides and are responsible for storing and transmitting genetic information.

Our learning has been conducted through thought-provoking discussions, worksheets that challenge our understanding, and engaging activities in our school labs that have helped us improve our collaboration skills and the ability to record and analyze data. This adequate approach has allowed us to not only grasp, but also effectively incorporate these biological concepts in our learning.

Photosynthesis and cellular respiration. These are the plant equivalents of us humans eating and digesting food. Photosynthesis refers to the process by which plants gather light energy and convert it into chemical energy (sugars like glucose) for later distribution. Cellular respiration refers to the metabolic process by which plants will break down earlier gathered glucose, providing energy in the form of adenosine triphosphate for the plant to then distribute to other functions (the previously referred to "later distribution").

Our current science biology unit revolves around these two key concepts for life in plants. I feel that science is one of the fastest progressing subjects as of now. The HIS science curriculum greatly promotes hands-on lab exercises: these help us students develop a deeper understanding for knowledge covered much more effectively than reading science textbooks. To deepen our understanding of biology concepts, in recent weeks the Grade 8 science cohort conducted a set of 3 labs.

The first one involved microscope and the observation of surface-level plant structures and stomata. This lab cultivated our understanding of a plant's internal structure, and the function of different organelles within the plant. The second lab involved the observation of different saccharides' (sugars) rate of cellular respiration using CO₂ production through a balloon's circumference expansion as an indicator. Our final lab expanded upon the prior, giving us the option to develop our own method and research question on how different elements can affect CO₂ production regarding the fermentation of yeast.

AI in Science: Transforming Research and Innovation

Ms. Kushner

Artificial Intelligence (AI) has swiftly become a transformative influence across various fields, changing how scientists perform research, analyze data, and tackle complex challenges. From climate modeling to genomics, AI technologies are deepening our understanding of the natural world and leading the way for groundbreaking discoveries.

Uses in Experimental Science

AI is proving invaluable in automating repetitive tasks and optimizing experimental design. Robotic systems powered by AI can conduct experiments with precision and speed, allowing scientists to focus on analysis and interpretation, significantly reducing the time needed for discovery.

Uses to Accelerate Research Through Data Analysis

Traditional data analysis methods often struggle with the sheer volume and complexity of modern datasets. AI algorithms can sift through millions of data points to identify patterns and correlations that might elude human researchers. In genomics, the study of the entirety of an organism's genes, AI is used to analyze genetic sequences, helping researchers identify mutations linked to diseases. Tools employ deep learning to improve the accuracy of genomic variant calling, enabling more precise diagnostics and personalized medicine.

Uses in Drug Discovery

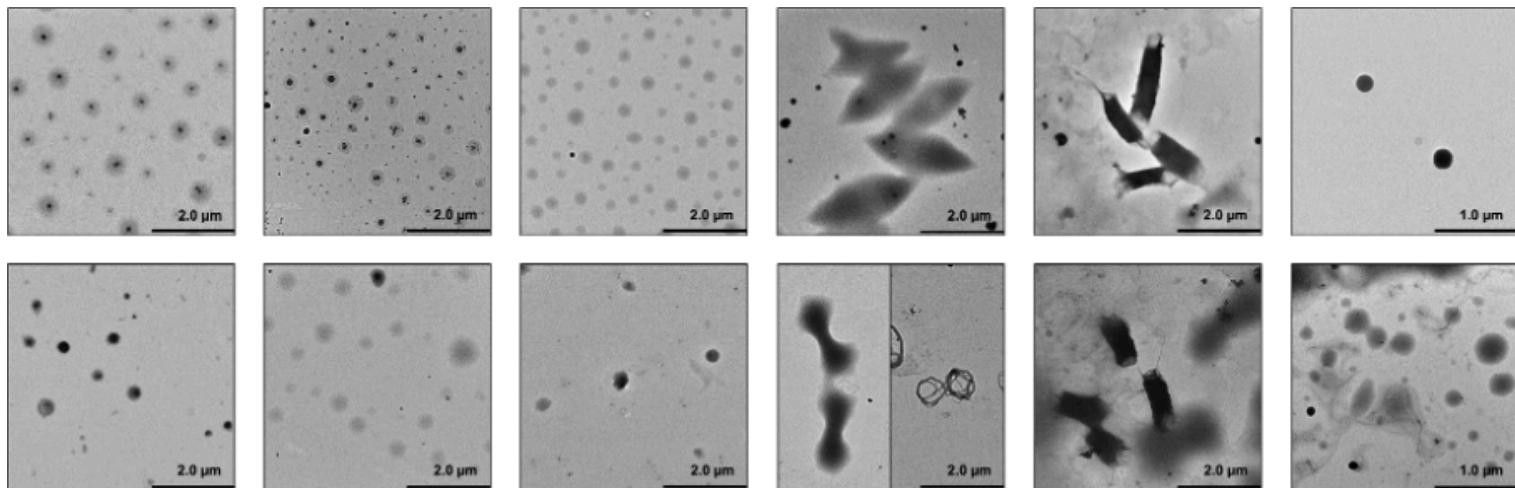
Drug discovery in the pharmaceutical industry is a time-consuming and costly process, often taking over a decade and billions of dollars to bring a new drug to market. AI is changing this by predicting how different compounds will interact with biological targets. AI is being used to screen millions of potential drug candidates in a fraction of the time it would take using traditional methods. By predicting the efficacy and safety of compounds, these AI-driven approaches ultimately lead to quicker and more cost-effective treatments.

Uses in Enhancing Climate Research

Climate models depend on the integration of various factors, including atmospheric conditions and ocean currents. AI algorithms can improve these models by uncovering complex relationships among these variables and forecasting future climate scenarios. Additionally, AI models can more accurately predict the likelihood of extreme weather events. By examining historical data and current trends, these models assist scientists and policymakers in making informed decisions about climate adaptation and mitigation strategies.

Considerations and Challenges of AI in Science

While the potential applications of AI in science are promising, ethical considerations must be taken into account. Critical issues include data privacy, algorithmic bias, and the transparency of AI decision-making processes. As AI systems become more embedded in research, scientists need to ensure that these technologies are utilized responsibly and fairly. The increasing reliance on AI also raises questions about the future role of human researchers. Although AI can boost productivity, it should serve as a complement to, rather than a replacement for, human creativity and intuition. AI is undoubtedly transforming the landscape of scientific research and innovation by speeding up data analysis, revolutionizing drug discovery, enhancing climate research, and changing experimental science. The future of science is upon us, driven by AI.



Research on Drug Delivery

Joseph Fu - Grade 11

This year I participated in the Sichuan Science Fair which is an affiliate fair to the International Science and Engineering Fair (ISEF), the world's largest international STEM research competition for high school students.

My research relates to drug delivery which plays an important role in treating a wide range of diseases and has been one of the most impactful innovations of the last century, offering hope to patients globally. Many types of nanoparticles have been created as drug delivery systems: polymer nanoparticles, liposomes, inorganic nanoparticles, drug conjugates, hydrogel nanoparticles, viral nanoparticles, metal-organic framework (MOF), etc. In particular, polymer-based carriers have made great contributions to the advancement of novel therapeutics, for chemotherapy, immunotherapy, and photothermal/dynamic therapy.

My study investigates the influence of polymer architecture and the self-assembly behavior of amphiphilic block copolymers (BCPs) synthesized from poly(lactic acid) (PLA) and polyethylene glycol (PEG) for novel drug delivery systems. Specifically, the study explored how changes in the number of arms in multiarm BCPs affected the morphology of self-assembled nano aggregates by synthesizing a variety of PEG_m-b-PLA_n polymers via ring-opening polymerization and self-assembling them through a co-solvent method. Various characterization methods were used to confirm the composition of polymers, characteristics of nanoaggregates, and pharmacokinetic profiles. Gel permeation chromatography and proton nuclear magnetic resonance were used to ensure that the polymers were desired. The characteristics of nanoaggregates, such as morphology and size, were found using transmission electron microscopy. Pharmacokinetic profiles were calculated through fluorescence data by loading nano aggregates with a model drug, fluorescein sodium.

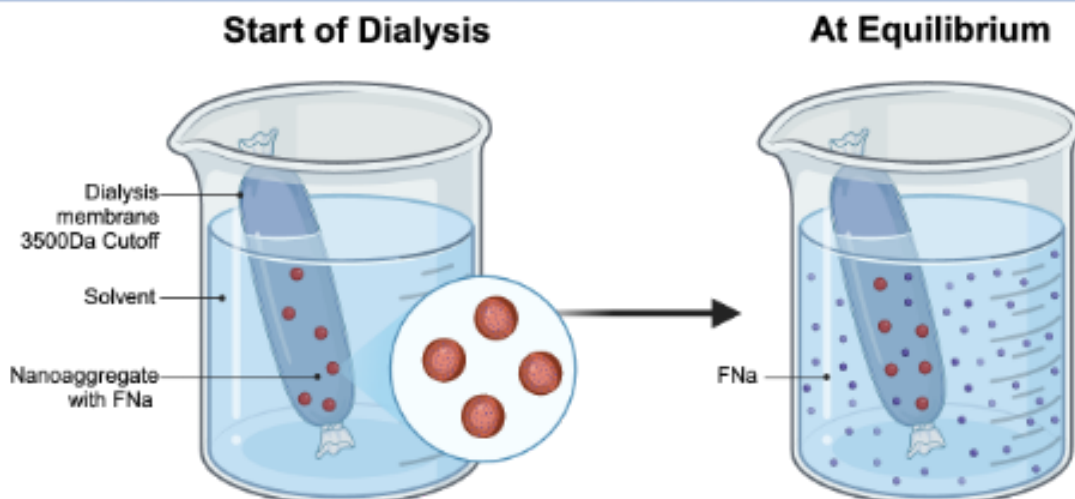
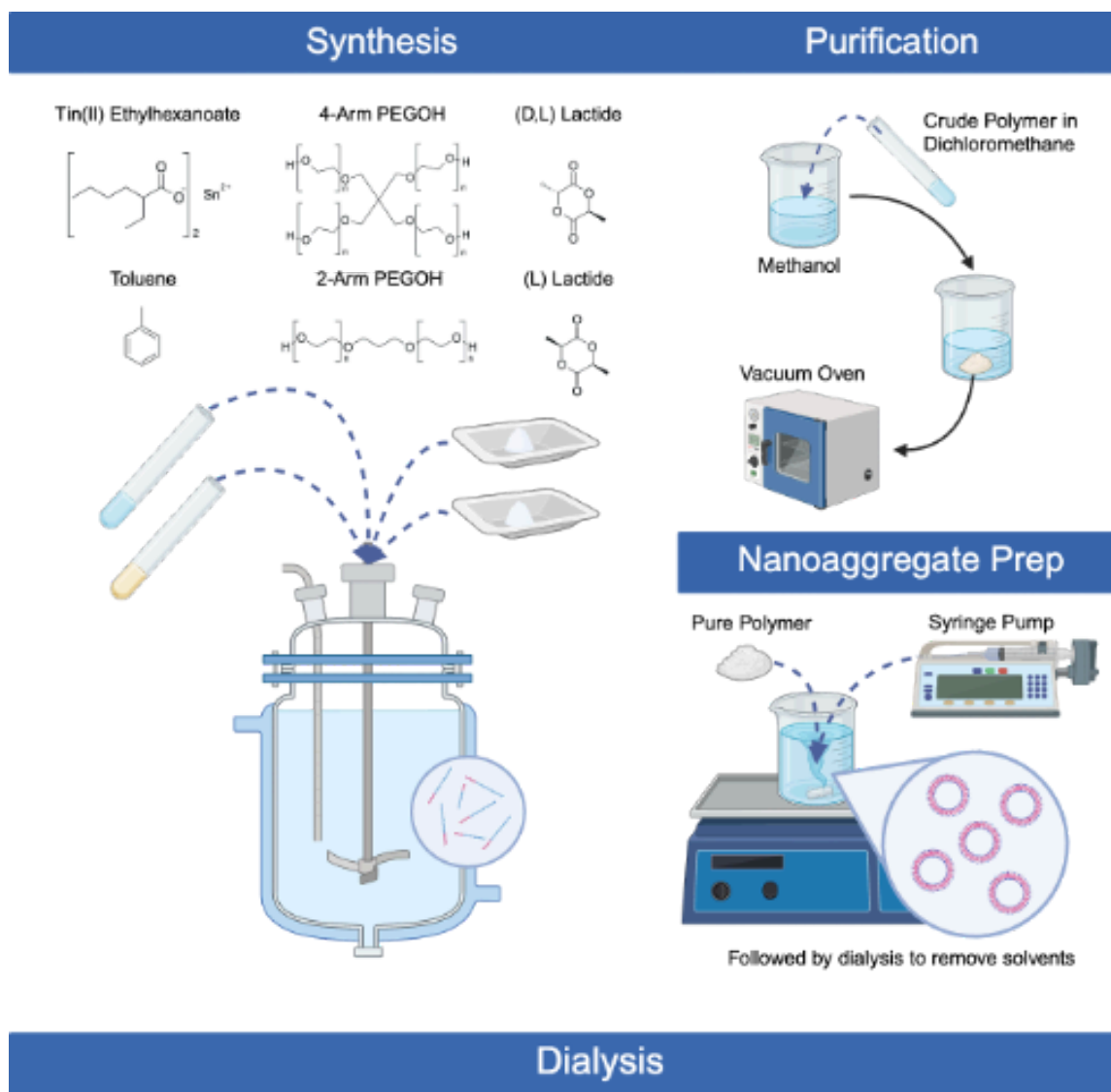
The results show how the morphology and size of nano aggregates were impacted by polymer features such as crystallinity, block ratio, architecture, and common solvents. The research demonstrated that the self-assembled structures show distinct pharmacokinetic profiles under physiological conditions, with pH and nanoaggregate characteristics such as drug loading efficiency and release kinetics of the nanoaggregates playing critical roles.

These findings provide a structural framework for nanoaggregate design with PLA-b-PEG setting up a clear methodology for the development of advanced drug delivery systems for specific therapeutic needs. Future research will focus on expanding polymer variations and characterization methods and conducting in vivo studies to validate the behavior of these systems in complex biological environments.

The Sichuan Science Fair is a great opportunity for students to display their research and enhance their research skills with the possibility of going to ISEF. If anyone is interested in participating, contact the school's counselors or ask science teachers who will guide you to the right people. The competition is very rigorous, and anyone interested should begin to prepare right away as the amount of work required is immense, and finding a mentor and lab that can support their ideas is crucial.

Further information on the science fair is linked below.

<https://ch-ssf.zfairs.com/app/info?f=168d347a-9aa4-4e9f-a8d2-1dd555d1bb0b>



Robotic Team

Jiachen Qu - Grade 11

From February 28 to May 3, the Hangzhou International School Varsity Robotics Team journeyed to Guangzhou to participate in a record-breaking VEX V5 Robotics Competition, the largest of its kind hosted among international schools. The event, attracting teams from across Asia, offered a rare qualification slot for the prestigious VEX World Finals in Dallas, Texas, heightening the stakes for participants.

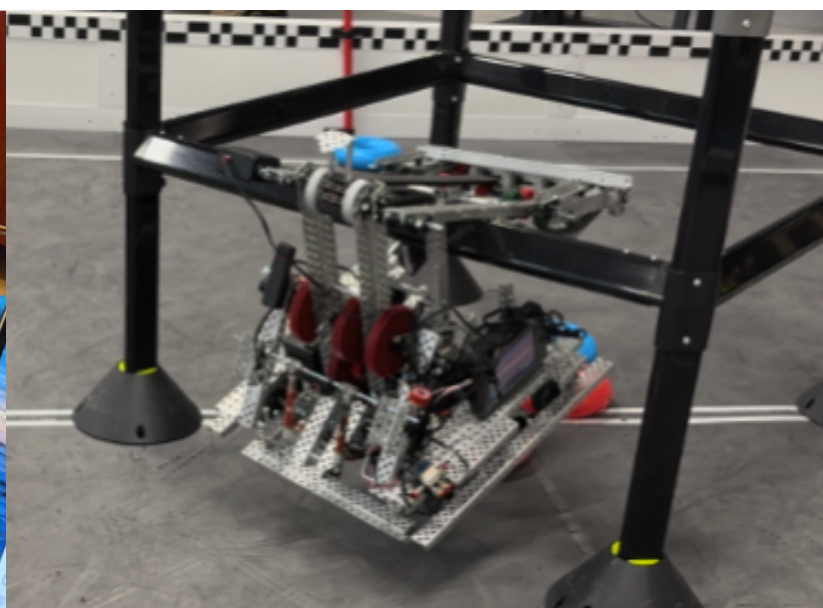
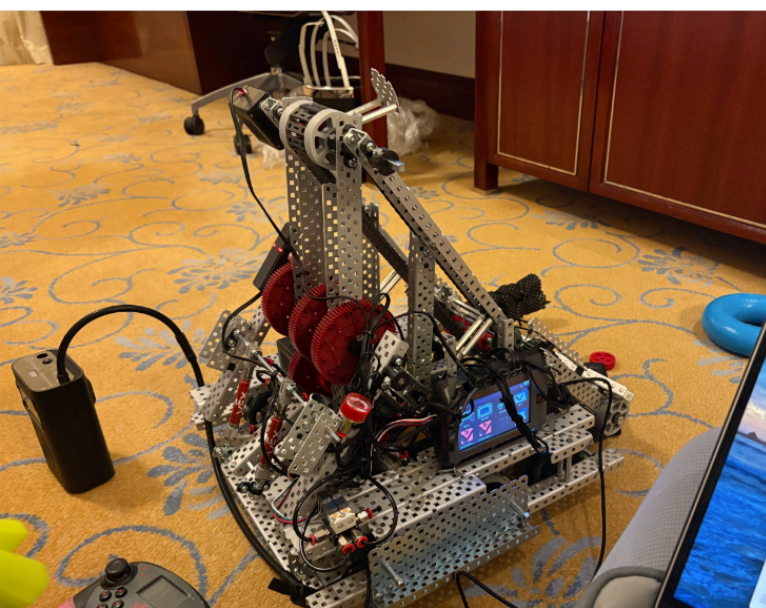
The team's journey began with an immediate challenge. Upon arrival, their robot suffered critical technical failures, jeopardizing their chances before the competition commenced. With limited time to troubleshoot, the students collaborated urgently, blending technical skill with inventive solutions to address sensor miscalibrations and motor malfunctions. Their synchronized efforts allowed repairs to conclude mere hours before the opening matches, showcasing their ability to thrive under pressure.

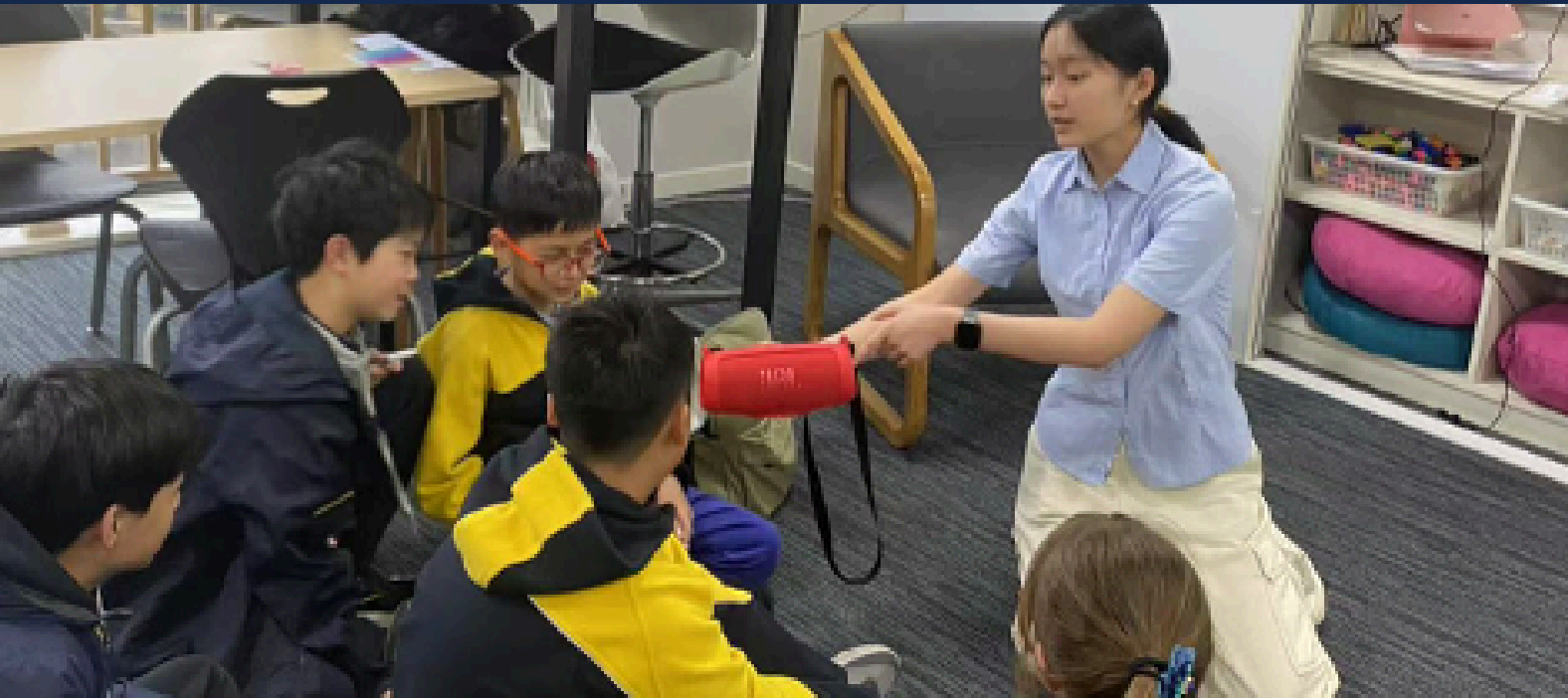
Across three grueling days, the team tackled a series of rigorous events, starting with the Skills Challenge, a precision-based solo trial, followed by the fast-paced Round Robin phase. Strategic adjustments to coding and hardware were made between matches to maximize scoring potential. Though the team narrowly missed advancing to the semifinals during the Elimination Rounds, their adaptability earned them a top ten finish in a fiercely competitive field.

Beyond the arena, the competition fostered international camaraderie. Participants connected with peers from schools across Asia, forming temporary alliances and exchanging technical insights. Cultural interactions flourished during breaks, with students exploring Guangzhou's vibrant tech districts and sampling local dishes, blending education with cultural immersion.

While the World Finals qualification remained out of reach, the team returned with heightened confidence and valuable experience. Coaches emphasized the broader lessons of resilience, collaboration, and global engagement that defined the trip.

Now back in Hangzhou, the team is already refining its robot design and strategy for next season. Energized by new connections and the thrill of competition, the students look ahead with renewed determination to secure their place on the world stage.





Anatomy in Harmony: A Science Journey for Younger Students

Anna Lu - Grade 10

My personal project goal is to research and design an engaging, age-appropriate, interactive course/class on the basics of human anatomy for upper primary school students (Grade 5), with the goal of sparking an interest in science.

This project comes from a personal interest in medicine, biology, and music which have been a passion of mine since a young age. I find how the human body works fascinating, and it has inspired me to study this subject as side tasks throughout my path education and to share this interest with others.

The opportunity to teach younger students aligns with my broader goal of inspiring curiosity and learning in others, while also allowing me to further develop my own knowledge on the field of medicine/biology and practice my organizational skills.

I aim to enhance my skills in educational design, particularly in creating engaging content for children. Additionally, I want to improve my organizational skills as I manage the project from research to final product. Learning how to simplify and explain scientific terminology for primary school students will secure my understanding on the topic, as teaching is the best way to learn. In terms of the content of the product itself, I aim to deepen my understanding of human anatomy in the process of researching, focusing on how to present complex biological concepts in a way that is accessible and interesting to young learners, while not overwhelming them. Therefore, I will investigate effective teaching strategies for biology, particularly how to engage students in learning about the human body through interactive and visual means. The focus would be on two things: effective ways of communicating complex processes to young children to understand the concepts of the way we perceive the world around us and how we think, and content wise, the auditory system, which include the structure, transduction process, and the function.

Personal connection

As the oldest sibling of two younger brothers, I have always assisted my parents in my brothers' growth as a person as well as their education. I observe how my mother lectures my brothers on their everyday activities, how she assists them in their schoolwork and extensions, and the way my brothers receive these interactions. As the older sister, I have a responsibility to be an example of not just being a good person, but also being academically motivated. Therefore, I have an interest in how to push my younger siblings to be the best they can, and spark interest in the field of science or medicine, as that is the standard that our parents wish that we achieve. This concept inspired me from the moment that I realized that my own learning impacted my siblings, as I was their example and someone who they look up to.

Its relation to this project is that I have always been observing and sometimes participating in the education of young people, and I find fascinating, the processes of how a young mind works, and the differences in the methods that are effective for children to learn. Moreover, it is rewarding for both the teacher and the student when the student has a “Eureka moment” when learning a new concept, or when a student asks questions that show their interest.

My previous experiences include the World of Work where I assisted in teaching younger students. This has given me insight into what captures their interest and how they learn best. During my time assisting the fourth graders, I observe fascinating points about child education and the differences between students of similar ages. This experience provoked thought on how I can be the teacher, instead of the assistant, and teach valuable lessons while having a positive impression on the children. Thus, I wish to set an example as someone not too much older than them, showing them what they will be capable of understanding and what they will be capable of doing in just 5 years.

Furthermore, the selection of this topic stems of my passion for science and its relation to music. One of my core activities and interest extracurricularly is making music. As a pianist and a student, I am interested in particularly how sound waves work, how we hear, and how we perceive them. Hence, I will be sharing exactly these things with the children.



Unveiling the Hidden Colors of Chili Peppers: A Study of Carotenoid Pigments

Lucia Wang - Grade 12

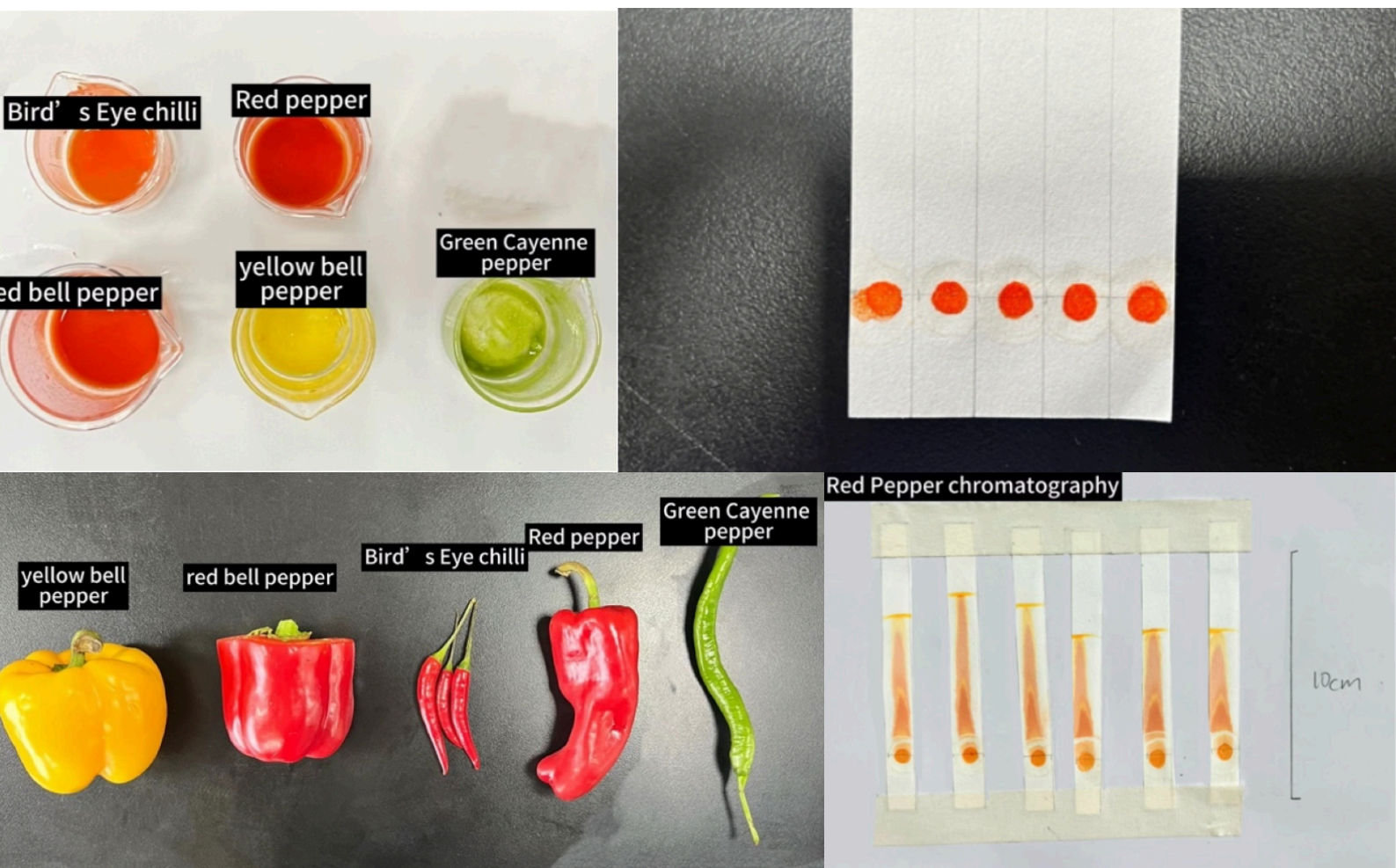
Chili peppers, known for their vibrant hues and fiery flavors, are not only a staple in kitchens worldwide but also a subject of scientific curiosity. Among their many fascinating properties, the pigments responsible for their striking colors—known as carotenoids—have intrigued researchers for years. These pigments, which contribute to the peppers' yellow, orange, and red hues, play a vital role in both plant biology and human nutrition. At HIS, we did an engaging study on carotenoids using chromatography, diving into the pigments that give chili peppers their vibrant colors.

Methodology: Thin Layer Chromatography

Our experiment was designed to answer the following question: How do the TLC mobility (R_f values) of carotenoid pigments differ among three *Capsicum* species and five chili pepper types? The varieties included were *C. annuum* (e.g., Red Pepper and Cayenne Pepper), *C. frutescens* (e.g., Bird's Eye Chili), and *C. pubescens* (e.g., Bell Peppers). By investigating the movement of carotenoid pigments on TLC plates, we aimed to uncover patterns in pigment composition that could provide insight into the genetic diversity of these peppers and their market traits.

To analyze the carotenoid pigments, we used Thin Layer Chromatography (TLC), a technique that separates chemical compounds based on their movement through a medium. For this experiment, we used petroleum ether as the solvent, which was effective in separating the carotenoids from the chili extracts. The chili samples were ground to extract the pigments, and the extracts were then spotted onto TLC plates. As the solvent moved up the plates, it carried the pigments along with it, allowing us to measure how far each pigment traveled.

The R_f (retention factor) value, which is the ratio of the distance traveled by the pigment to the distance traveled by the solvent, was the key parameter we used to quantify the migration of the pigments.



Results: A Colorful Spectrum

The results from the TLC chromatograms revealed several distinct carotenoids in the chili pepper samples. Each chili type exhibited a unique combination of pigments, which varied in their polarity and mobility. For instance, Bird's Eye Chili (*C. frutescens*) showed five distinct pigment bands, whereas Bell Peppers (*C. pubescens*) exhibited fewer, mostly yellow pigments.

We identified the pigments based on their color: orange-red (Pigment 1), deep red (Pigment 2), bright yellow (Pigment 3), pale orange (Pigment 4), and dark yellow (Pigment 5). By calculating the R_f values for each pigment, we observed that the pigments migrated at different rates depending on the Capsicum species. For example, the red pigments (Pigment 2) exhibited lower R_f values, indicating they were more polar and traveled less compared to the yellow pigments (Pigment 3), which were more mobile.

Statistical Analysis: Unveiling Patterns

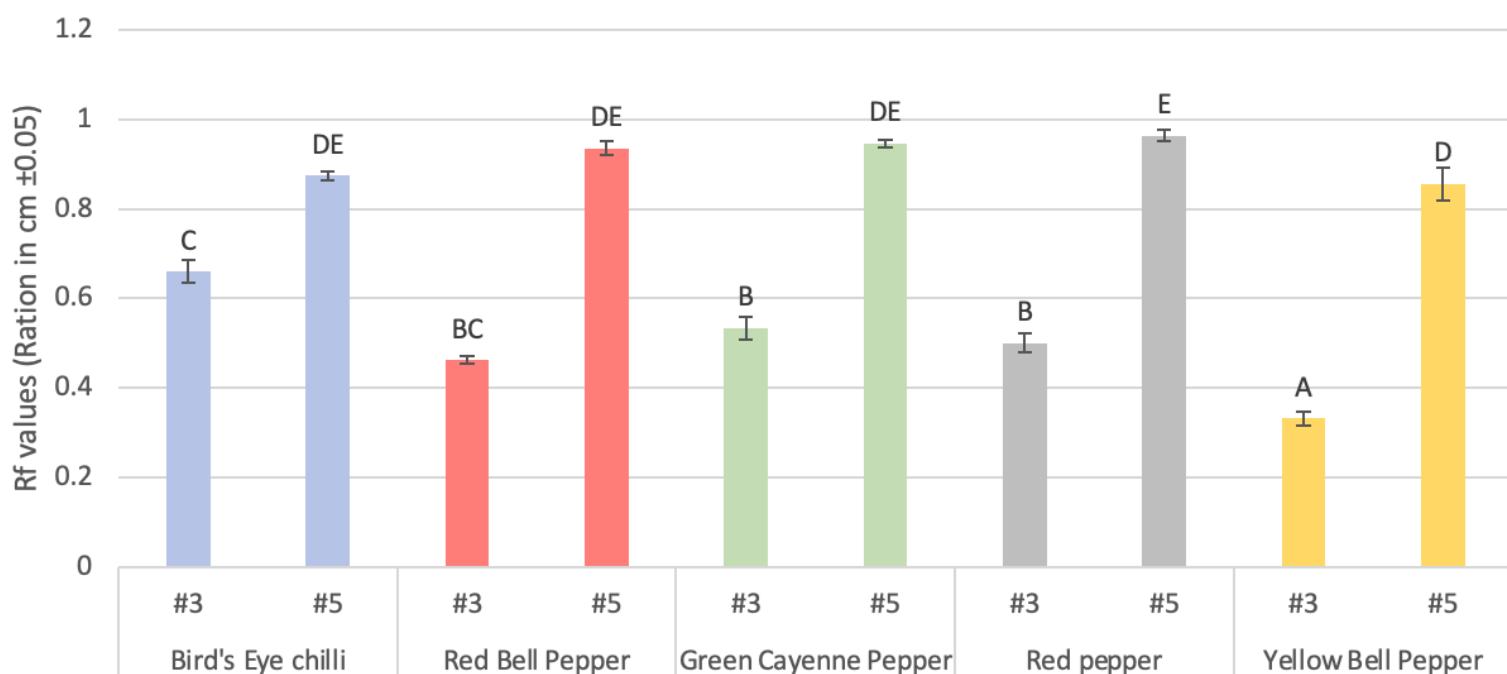
To understand whether the differences in how the pigments moved were meaningful, we used a statistical method called two-way ANOVA. This test helps us determine if there are any significant differences between groups, and in this case, it helped us look at the relationship between two factors: the Capsicum species and the type of pigment. By comparing the movement of two specific pigments (Pigments 3 and 5), we wanted to see if the type of chili pepper and the pigment itself affected how far the pigment traveled on the chromatography plate.

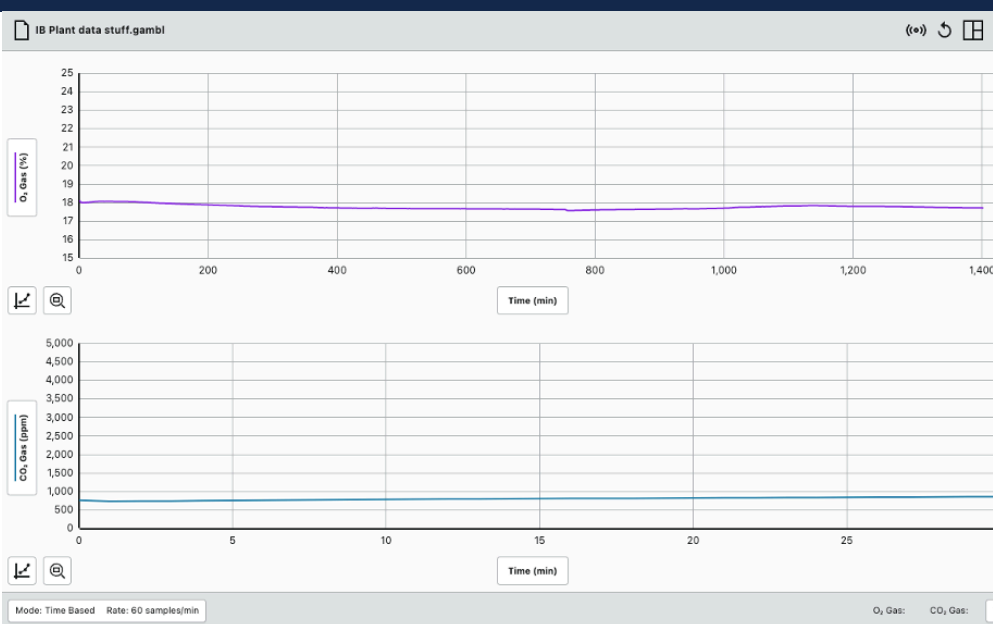
The results of our two-way ANOVA test showed that both the species of chili pepper and the type of pigment had a significant impact on how far the pigment moved. For example, Bird's Eye Chili (a type of *C. frutescens*) had higher R_f values for Pigment 5 compared to Red Pepper (*C. annuum*). This means that the pigment in Bird's Eye Chili traveled further, suggesting that this chili variety may contain a higher concentration of certain carotenoids.

These findings support the idea that different chili varieties, due to their genetic differences, accumulate different types and amounts of carotenoids. This is important because carotenoids, the pigments that give peppers their color, are not only responsible for the visual appeal of the fruit but also contribute to nutritional benefits.

This experiment highlights the importance of carotenoids in chili peppers, not only for their role in coloration but also for their nutritional value. The differences in pigment profiles among the chili varieties suggest that breeding could focus on enhancing specific colors or nutritional content. Understanding how genetic and environmental factors influence carotenoid accumulation could lead to the development of chili varieties with higher antioxidant properties or improved market appeal.

Moreover, the research provides a glimpse into how scientists can use chromatography to study and compare natural pigments in plants, offering insight into plant biology and even agricultural practices. It also shows how the unique characteristics of different chili varieties could influence consumer preferences in the marketplace.





Grade 8 Innovators Drive Sustainability Through Plant Science in IB MYP Project

Jia-heng Qu - Grade 8

Over a six-month period, a dedicated Grade 8 team at Hangzhou International School merged scientific inquiry with environmental advocacy through their International Baccalaureate Middle Years Programme (IB MYP) community project. Partnering with the school's Global Issues Network (GIN) club, the students spearheaded a research initiative to test the ecological properties of various plants, aiming to advance campus greenery and promote sustainable practices.

The project, aligned with GIN's mission to address global environmental challenges, focused on identifying plant species with optimal air-purifying abilities, drought resistance, and growth efficiency. Utilizing the school laboratory, the team conducted controlled experiments on over 15 plant varieties, including native grasses, flowering shrubs, and hardy succulents. Measurements tracked factors such as carbon dioxide absorption, water retention, and biomass growth under simulated urban conditions. Collaborating with science faculty, students employed microscopes, soil sensors, and air quality monitors to gather precise data, transforming the lab into a hub of eco-focused innovation.

Initial hurdles emerged as some species underperformed in controlled settings, requiring rapid adjustments. When early tests on ornamental plants revealed high water demands, the team pivoted to analyzing resilient local flora. Iterative trials and mentorship from biology teachers helped refine methodologies, ensuring accurate comparisons between species. A breakthrough came when bamboo and spider plants demonstrated exceptional air filtration and low maintenance needs, making them prime candidates for scalable green solutions.

Beyond the lab, the project emphasized community impact. The team drafted a "Green Guide" detailing their findings, which recommended specific plants for urban spaces and home gardens. They partnered with the school's gardening club to design a pilot green wall near the campus entrance, incorporating their top-performing species. Workshops were organized to educate peers on sustainable gardening, while a seedling donation drive encouraged families to adopt eco-friendly practices.

The initiative's outcomes resonated schoolwide. Preliminary air quality readings near the green wall showed a measurable drop in particulate matter, and the project's visibility spurred broader interest in sustainability. GIN club membership surged, with younger students eager to contribute to future efforts.

Though the IB MYP project has concluded, the team's work continues. Plans are underway to expand the green wall, apply for community grants, and present findings at regional youth environmental conferences. By bridging classroom science with tangible action, these Grade 8 innovators have rooted a legacy of sustainability, proving that small-scale research can blossom into meaningful change.

Exploring the Mind: The Neuroscience & Psychology Club @ HIS

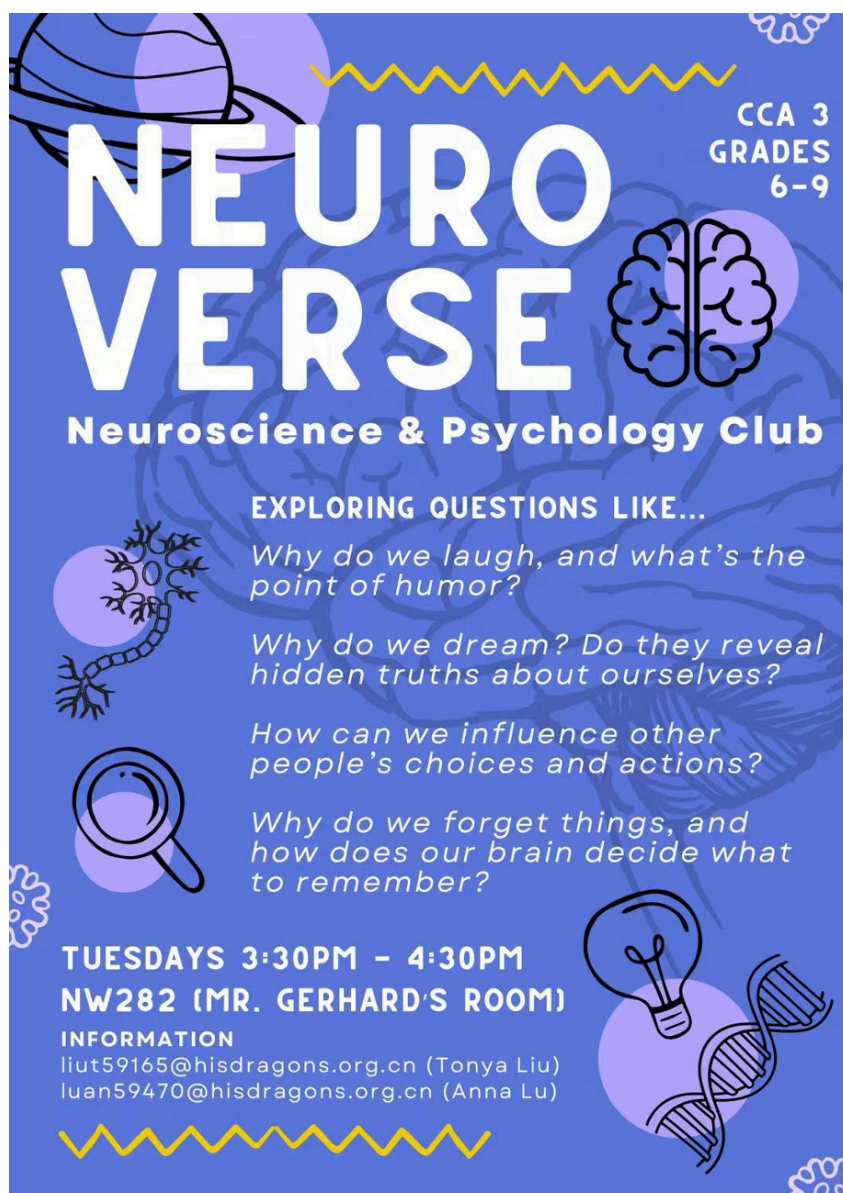
Tonya Liu & Anna Lu - Grade 10

What do dreams, love, and social media/game addictions all have in common? They're all products of our incredible brains - and exactly the kinds of topics we explore in our Neuroscience & Psychology Club. Every week, we have fascinating discussions about how the mind works, from the biology of brain cells to the psychology behind our everyday choices.

So far, we've uncovered the science behind sleep and dreams, how memory works, the psychology of attraction, examined how persuasion works, and learned how addiction literally rewires neural pathways. But we're just getting started!

As a new and growing club, your ideas can shape our future. Want to investigate lucid dreaming? Debate how AI affects our brains? Explore the neuroscience of music or sports? With more regular members, we could even run hands-on experiments like testing memory techniques or conducting social psychology surveys.

The best part? No experience needed! All you need is an interest in how the mind and behavior works. Whether you want to lead discussions, suggest topics, or simply listen and learn, there's a place for you here. We meet every Tuesday from 3:30-4:30 PM in Mr. Gerhard's classroom (NW282). Come to one session... or stay for them all :)



NEUROVERSE

CCA 3 GRADES 6-9

Neuroscience & Psychology Club

EXPLORING QUESTIONS LIKE...

Why do we laugh, and what's the point of humor?

Why do we dream? Do they reveal hidden truths about ourselves?

How can we influence other people's choices and actions?

Why do we forget things, and how does our brain decide what to remember?

TUESDAYS 3:30PM - 4:30PM
NW282 (MR. GERHARD'S ROOM)

INFORMATION
 liut59165@hisdragons.org.cn (Tonya Liu)
 luan59470@hisdragons.org.cn (Anna Lu)

Microbiomes of the Human Body

Mr. Gerhard

When most of us think about what makes us human, we typically picture a living machine made up of many different kinds of cells doing specialized jobs, perhaps in a fight for survival against the rest of the world. That idea is mostly correct. But what if I told you that the cells that you think of as “you” are actually outnumbered by bacteria living inside your own body?

In 2016, scientists from the Weizmann Institute of Science and the University of Toronto performed a review of existing estimates of how many cells make up the human body, and found that the average adult male contains roughly 30 trillion human cells, while the average adult female is just behind at around 28 trillion cells. But they also suggested another fact that may surprise you: we’re also home to around 36 trillion bacterial cells! Before you start comparing yourself to the Ship of Theseus or spiral into existential questions about your identity as a human, it is important to keep in mind that most of these

bacteria are in the highest concentrations in the alimentary tract (the tube running from your mouth to the end of your digestive system), with populations orders of magnitude higher than anywhere else in the body in your colon. Interestingly, bacteria aren’t alone! Demodex mites, which look like translucent worms under a microscope, live in the pores and hair follicles of every single human. Seriously. Acarologists (scientists who study mites and ticks) say 100% of people on earth are hosts to either *Demodex folliculorum* or *Demodex brevis*, including your teachers, friends, and your crush! But mites are just one of the many colonies of hitchhikers that we carry around. Viruses, archaea, protists, fungi, and those 36 trillion bacteria form a collection of microscopic life forms collectively known as the human microbiome.

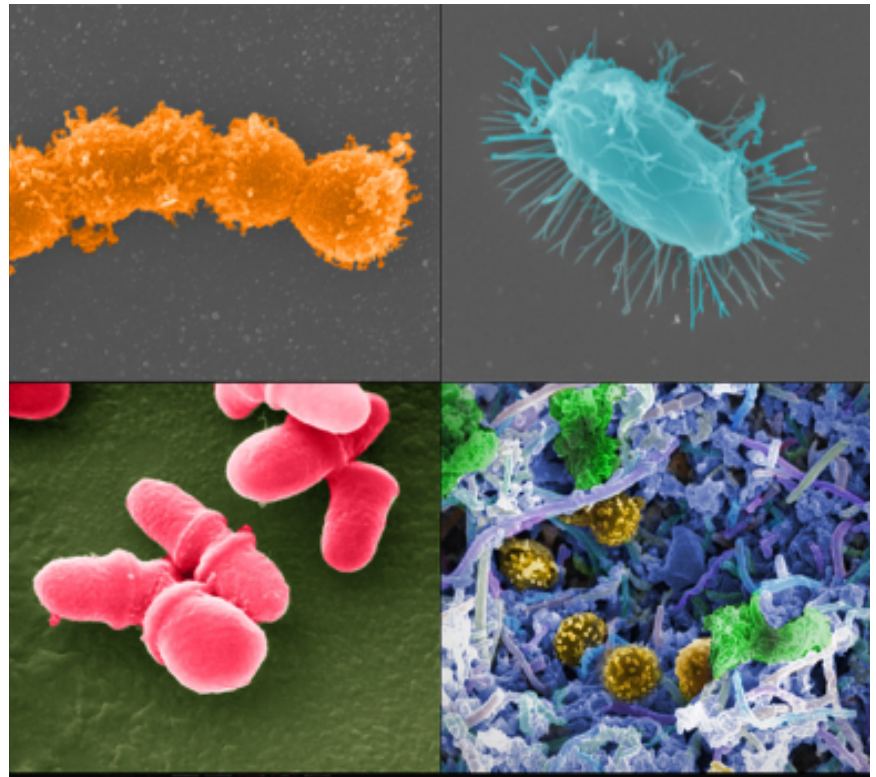


Figure 1: The Human Microbiome Project

Of the almost 0.2kg worth of microorganisms that inhabit “you”, most live in your gut, where they help you to break down complex nutrients, synthesize vitamins, and support your immune system. Even more fascinating is our growing knowledge about the connection between the gut microbiome and the brain. Human behavioral, dietary, and health science have recently begun to focus more intently on the somewhat newly identified gut-brain axis; the two-way communication network that your gut and brain use to communicate with one another. Most of the research we have today seems to indicate that the bacteria in your gut communicate with your brain using nerves, hormones, and even the immune system. A 2018 study led by researcher Clair Martin identified multiple pathways through which this communication happens. The idea is that not only can your brain affect your gut (like getting “butterflies” when you’re nervous) but that your gut bacteria might actually influence how you feel, what you crave, and even how you behave.

Here’s where things get weird.

For much of the most recent period of medical history, scientists believed that certain parts of the body, like the brain and placenta, were sterile, “human-only zones”. Emerging research is challenging that idea, with new studies suggesting that bacterial colonies may exist in the brain itself!

Early research into this brain microbiome is mostly centered around investigating possible links between certain bacterial strains and diseases like Alzheimer’s and other forms of dementia. Interestingly, many of the bacteria found in the brain are the same species found in the mouth and digestive tract, leading scientists to speculate as to whether microbes might be able to cross the blood-brain barrier and settle in the brain in ways that we hadn’t considered before. Furthermore, could the presence of certain species of bacteria be used as indicators for heightened risk for mental illness?

A vast bulk of the research on the brain microbiome has been performed in the last ten years – a blink of an eye in the context of most biological research, and so the field is of course still in its infancy. Many of these studies acknowledge that the prospect of finding alternative explanations for dysfunctions of the brain (“neuropsychiatric” and “neurodegenerative” disorders that currently don’t have explanations) is so tempting that it is enticing to see connections where there are none, but they also make sure to clarify that research is methodologically sound. Right now, the findings that we have are at best correlational, and mostly speculative, meaning they may show a relationship but not necessarily a cause, and are mostly attempting educated guesses to inspire more research in the field. That hasn’t stopped some people from getting excited about potential breakthroughs in diagnosing and treating brain-related illnesses that incorporate bacterial factors. While some have been quick to assign causal conclusions to correlational findings in this burgeoning field, the next couple of years should reveal the true nature of the role of microorganisms in the brain. If our current line of thinking proves to be true, we could see a revolution in the way that we address mental health and digestive disorders. A whole new branch of medicine, holistically driven, could result! Ultimately, all of this signals an incredibly exciting time to have the privilege to think about prospective careers in the sciences!