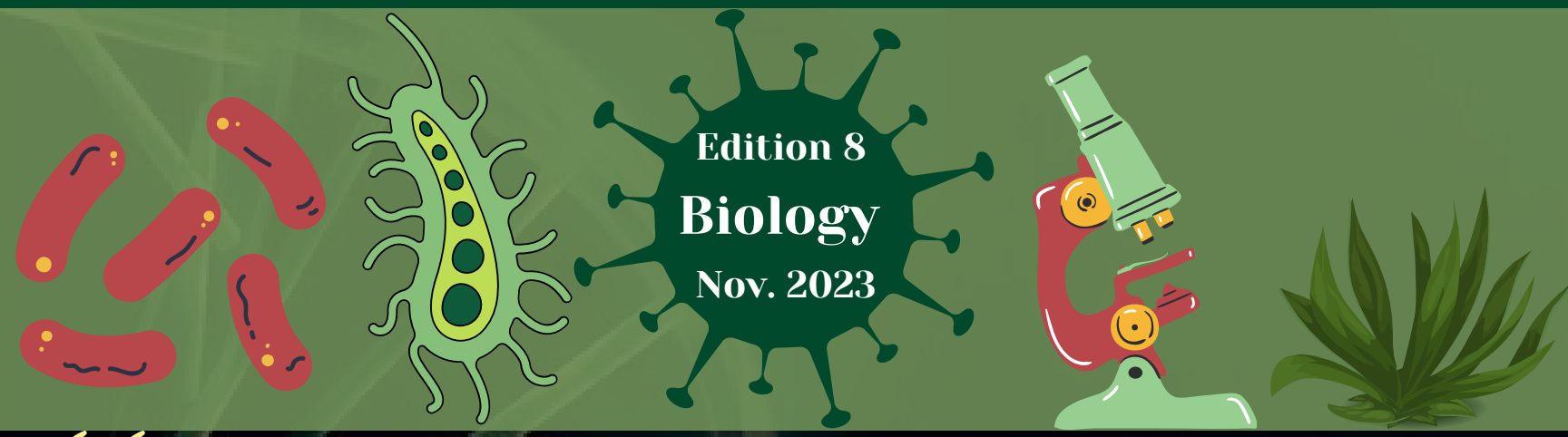
The **STEAM-STEINETTES** Gazette



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Biology
Nov. 2023

"THINK OF THE FUTURE THAT AWAITS YOU, THINK ABOUT WHAT YOU CAN DO AND DO NOT FEAR ANYTHING."

– Rita Levi-Montalcini

Impact of the Organ on a Chip

By: Bailey

The study of diseases and cures is something that continues to be developed every year and for good reason. It helps us learn more about biology, but at the same time aids in the prevention of future infectious diseases. Recently, there have been new developments in this field. Scientists have been working to create a new way of drug testing that involves something you may not expect -- organs on a chip. The scientists at Wyss Institute describe this chip as "...microfluidic culture devices that recapitulate the complex structures and functions of living human organs." They explain how these chips allow the study of cures without testing on animals or humans. They simply take cells and place them in these polymer chips which can be used for research. The National Library of Medicine explains how this could cut down on cost and the time period that previous drug testing required. It also stops the potential "mismatch in biology" that occurs when using animals as a template for human cures (Wyss Institute). Just imagine a future where drug testing could be accurate, low cost, and not involve humans or animals. This may all be possible as the Organ on a Chip continues to develop.

Read on!

SCIENTIST SPOTLIGHT

By: Hitej

Barbara McClintock

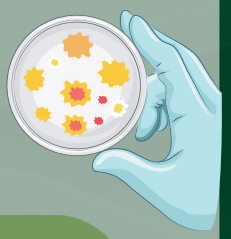
Barbara McClintock was born on June 16th, 1902 in Hartford, Connecticut. At the age of 6, she moved to Brooklyn, New York. Fearing her daughter would end up married, her mother did not want her to go to college. However, contrary to her mother's opinion, McClintock was "married" to her job. In an interview, she stated, "I was so interested in what I was doing I could hardly wait to get up in the morning and get at it." But what exactly did she do? McClintock made a substantial impact on the field of cytogenetics, discovering what are now known as transposons or more colloquially, "jumping genes."

McClintock received her B.S., M.S., and Ph.D. in Botany at Cornell University. At the time, women were not allowed to major in genetics at the university, but this did not stop her from studying the field in her spare time. Upon earning her doctorate, she traveled to Germany for 6 months and engaged in genetic research. In 1936, she became an assistant professor at the University of Missouri, Columbia. After 5 years, she transferred to the Carnegie Institution of Washington's Department of Genetics where she would go on to make some of the most important discoveries of her lifetime.

By studying the genes involved in maize, such as ones responsible for the size of kernels, McClintock was able to discover these "jumping genes." They are called this because they are parts of DNA strands that are transposed to another section or strand of DNA. This can result in the creation or reversal of existing mutations. Her discovery, instead of being celebrated, was met with criticism and skepticism. It was not until 30 years after her trailblazing discovery at the Carnegie Institution that her research would earn the recognition it deserved.

Eventually, after her findings were accepted by the general public, she earned the National Medal of Science from President Nixon, and later the Nobel Prize (National Science Foundation). She remained committed to her research at the institution for 20 years until her death in 1992. Thanks to her discovery of jumping genes, we are further in our current studies of gene expression, and thus, much closer to curing tens of millions of people with genetic diseases worldwide.

Science Experiments!



By: Ace & Sofia

Easy

Investigate Osmosis

To complete this experiment, you will need an egg, vinegar, two containers big enough to hold an egg, water, and sugar. Fill the first container with vinegar and place the egg inside. (Pour enough to fully cover the egg.) Leave the egg to soak for 24 hrs. Remove the egg from the container and rinse, taking out the shell. Soak again in vinegar for 24 hrs, then rinse. Fill the second container with water and place the egg inside for 2 hrs. Watch the egg expand as water is absorbed. Then, take the egg out and create a concentrated sugar solution in the container. Place the egg back in and watch the egg shrink as water is released into the sugar solution. And there you go—osmosis demonstrated with an egg!

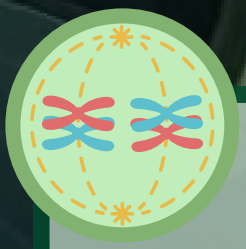
CLICK HERE FOR THE STEPS!

Medium

DNA Extraction

For this experiment, you will need a few materials – sliced fruit, dish soap, water, salt, ice-cold isopropyl alcohol (70%+), a zipper-style plastic bag, a coffee filter, a funnel, a wooden coffee stirrer, and test tube or clear glass. Measure 240 mL of water and add 35 mL of liquid dish soap and 5g of salt – the extraction solution. Mix! Add several slices of fruit to the baggie, mash it up, add 15 mL to 30 mL of the solution, and squish for about 1 min. Remove the solids by pouring the contents of the baggie into the funnel lined with the coffee filter and squeeze the liquid into the test tube. Slowly pour 30 mL to 45 mL of the isopropyl alcohol into the test tube, and watch as cotton-like fluff appears – this is DNA!

CLICK HERE FOR THE STEPS!



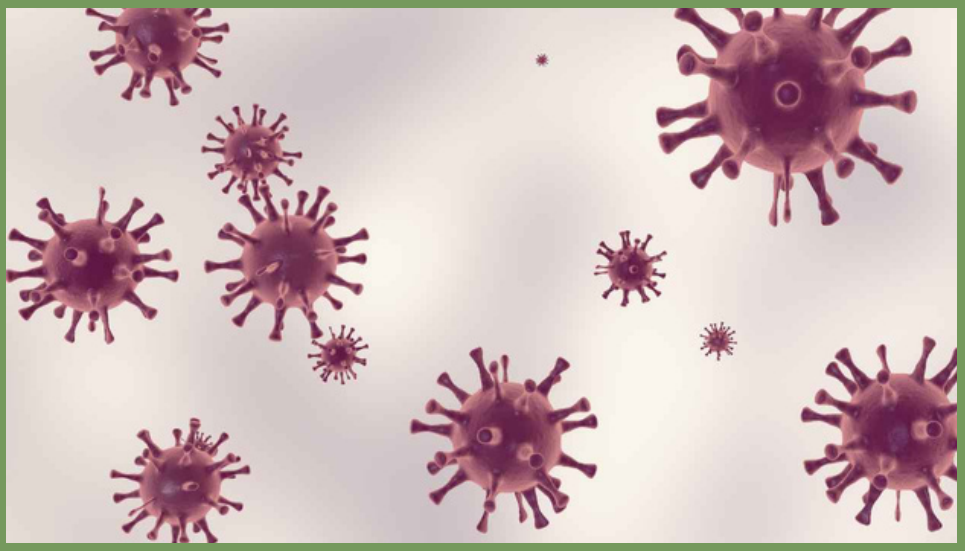
Global Science Happenings

By: Ace

Scientists at Tufts University build tiny biological robots that could help patients heal wounds.

Macquarie University researchers are developing synthetic cultures to break down polyethylene.

Researchers at UMass Amherst discover sugar tag code in protein folding that could help in disease treatment.



NANO-SIZED CELL PARTICLES TOOL TREATING INFECTIOUS DISEASES

By: sofia

The widespread outbreak of COVID-19 clearly demonstrated the importance of being prepared with drug interventions to contain viral outbreaks. Scientists have since learned from the drastic consequences caused by the pandemic, and are now preparing to combat the next pandemic – “Disease X " – and other upcoming infectious diseases with repurposable technologies able to accommodate these other outbreaks. A team of researchers from the Institute for Digital Medicine and the National University of Singapore discovered something incredible – nano-sized particles released by cells, known as “extracellular vesicles” (EVs), can potentially restrain the viral infectivity of diseases, especially SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). According to lead researcher, Assistant Professor Minh Le from the Institute for Digital Medicine, their research showed that “...these cell-derived nanoparticles are effective carriers of drugs that target viral genes precisely. These EVs are therefore an efficient tool for therapeutic intervention in patients who are infected with COVID-19 or other infectious diseases.”

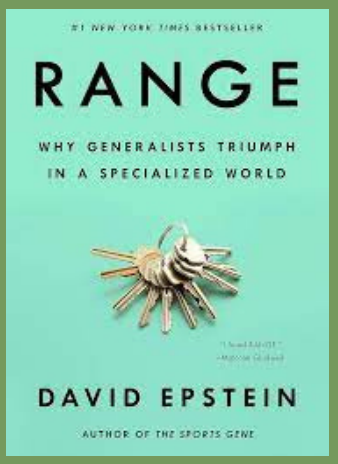
The study, conducted in partnership with NUS Medicine's Biosafety Level 3 (BSL3) Core Facility, the Cancer Science Institute of Singapore at the National University of Singapore, and the School of Physical and Mathematical Sciences at Nanyang Technological University (NTU), showed a combination of EV-based inhibition and antisense RNA therapy using antisense oligonucleotides (ASOs) effectively prevented COVID-19 infection in lab models. In this study, human red blood cell-derived EVs were used to deliver ASOs to infected areas, successfully suppressing the infection and replication of SARS-CoV-2. The findings suggest that using ASOs as antisense RNA therapy could be a promising approach to combat future viral outbreaks. Assistant Professor Le and her graduate students Migara Jay and Gao Chang, the original authors of this study, are currently using artificial intelligence prediction models to develop even more potent combinations of ASOs for enhanced viral inhibition – a crucial step closer to clinical validation studies.

Range: Why Generalists Triumph In a Specialized World

by David Epstein

BOOK REVIEW | BY: ACE

Book



Review Rating: 5/5

In some ancient past, "biologist" was the title for all those who studied life. A few centuries ago, we began to have microbiologists. Nowadays, with titles like microbial cytologist, you can find experts on subdivisions of microorganisms that themselves are subdivisions of larger microorganisms! The trend toward hyperspecialization has come with benefits but also some serious drawbacks. In his eye-opening book Range, David Epstein explores what we can learn from going back to a Renaissance mentality and valuing breadth as well as depth in learning and skill. With quirky stories and fascinating anecdotes, Range takes you through a journey that will connect psychology, biology, and many other fields in a way you've never thought to explore before.

I remember when thirteen-year-old-me first read this book. At the time I thought social studies was useless (being an aspiring physicist and mathematician), but Epstein helped me see the value of exploring other fields of study, and maybe he could do the same for you. So, if you want a broader perspective of the world, this is the book you need to read next.

Fantastic Facts!

By: Diana

Microbes are the oldest form of life.

There are about 100 trillion cells in the human body.

Your mouth produces about one liter of saliva each day.

Meet the Team

A STEAM Club + The Einsteinettes collab

Durga I.

Ace M.

Sofia J.

Hitej R.

Bailey WR.

Stephanie A.

Jan P.

Diana S.

Vasilisa B.

Jasmine P.

Special thanks to our awesome advisors, Ms. Cristen Jones and Mr. Chad Hamblin!

Not mentioned: Quote provided by Stephanie

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Fantastic Facts

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