# ATAVISM

A STUDENT-RUN SYNAPSE NEWSLETTER

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## ABOUT US

With an aim to nurture the skills of students, the Department of Biotechnology and Bioinformatics, JUIT, has created a platform called Synapse, for students to develop and exhibit their technical, outreach, arts and other skills. And the newsletter is a tiny idea of the members of Synapse Club.

Atavism is a phenotypic trait that appears suddenly in an organism. Yes, it is that feature we have always had the genes for, but have never expressed. Have you heard of the dolphin with legs or the baby born with a tail? Because if you have, you know what we're talking about!

Just like its name, this newsletter is a little something that we always had the genes for, but we never expressed. We agree that the newsletter isn't as weird as the chicken with teeth but it sure is something out of the blue to bring all of us at Department of BT & BI together. We aim to make this newsletter the place you can go for the latest news in the biotechnology world, bizarre but true science headlines, and conversations that you should hear more of.

## The salivary glands no one knew about!

After millenniums of careful slicing and dicing, it seemed like scientists had figured out everything about human anatomy. But despite centuries of investigation, the human body has yet again surprised everyone.

A team of scientists from the Netherlands have discovered a pair of previously unnoticed, bilateral, macroscopic, salivary glands located in the human nasopharynx. These are being referred to as the fourth pair of salivary glands or Tubarial Glands.

Salivary glands are incredibly valuable and fragile, especially to oncologists as they can zap and lose their utility if accidentally hit with radiation. It can affect patients by impairing their food intake, digestion and speech. It can also increase the risks of oral infections and cause a chronic dry mouth, with significant impact on the quality of life. This concern led scientists to use Positron Emission Tomography with prostate-specific membrane antigen ligands (PSMA PET/CT) to visualize the throat tissue in detail on patients with prostate or urethral gland cancer. This study helped them to discover these Tubarial Glands which have a ligand uptake similar to the already known salivary glands.

Though it is still not very clear whether the Tubarial Glands are an addition to the pre-existing salivary glands, or are simply one of the 1,000 minor salivary glands (many of which have not yet been mapped). This discovery helped the scientists to avoid or spare the Tubarial Glands while administering radiation to cancer patients.

**ARE YOU EVEN READING?**

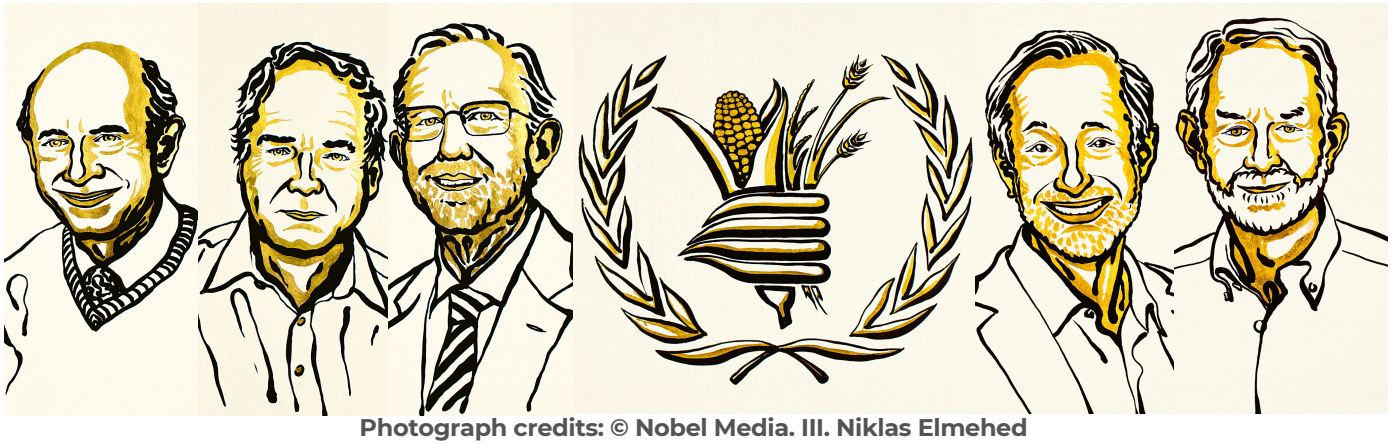
If you are, you're sure to have feedback for the team. Send it in to 181824@juitsolan.in so that we can know. We are also open to featuring your opinion on biology or your coverage of the latest research in the next issue. So, shoot that email to us and we'll talk.


References and Photo credits:

1. Images from Pexels, journal article mentioned below and National Cancer Institute Netherlands.
2. The tubarial salivary glands: A potential new organ at risk for radiotherapy: https://doi.org/10.1016/j.radonc.2020.09.034

NOBEL PRIZE

# A look at the Nobel Prize winners of 2020!



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*In the last issue, we were able to cover only half the stories and works of the Nobel Laureates of 2020. In this issue, we bring you to some more fascinating stories and facts about the other half.*

Harvey J. Alter, Michael Houghton and Charles M. Rice won the 2020 Nobel Prize in Physiology or Medicine "for the discovery of Hepatitis C virus."

***Harvey Alter*** is a senior investigator for the National Institutes of Health in Maryland. An early morning phone call was made to him, informing him about the win which left him completely baffled. He has stated that it was the best alarm clock that he has ever had! and feels that his 50-year long study has finally paid off.

***Michael Houghton*** is a British scientist who is currently the Canada Excellence Research Chair in Virology and the Li Ka Shing Professor of Virology at the University of Alberta. He has always felt that the hepatitis C virus is like a pandemic which claims the lives of 400,000 people every year. His team saw a new hotel being built around their institute and thought that their research would be over by the time the construction gets completed. About ten hotels got built around by the time they cracked the solution. His inspiration has been Louis Pasteur since the age of 17.

***Charles M. Rice is*** the Scientific and Executive Director at the Rockefeller University, New York, NY, USA and the third recipient of the 2020 Nobel prize for physiology and medicine. He sent his first-ever selfie on Twitter after hearing about his victory. He has always felt happy while working with the molecular virologist community as he finds it to be very inclusive and generous in terms of both ideas and reagents.

The Nobel Memorial Prize in Economic Sciences 2020 was awarded to Paul R. Milgrom and Robert B. Wilson "for improvements to auction theory and inventions of new auction formats."

***Robert B. Wilson*** is an economist and a Professor Emeritus at Stanford University. His work on auction theory and market design is exemplary as is the fact that he shared the prize with Milgrom, his third student to win the Nobel Prize.

***Paul R. Milgrom*** is a student of Robert Wilson's also shares the prize for Economics this year. He came to know of the honor only after Wilson knocked on his door to share the news at 2 AM. The theory which they worked upon was first implemented when the auction for the radio spectrum had to take place in the US and he says that his work can presently improve the allocation of environmental resources. Paul also admits that he chose the topic of auctions because he wanted Wilson as his PhD advisor.

The Nobel Peace Prize 2020 has been awarded to the UN-backed ***World Food Programme (WFP)*** for working relentlessly to provide food to the malnourished in war-torn and developing countries, providing rations in 88 countries in 2019. The organization also has done phenomenal work during the pandemic. The Nobel committee says the prize has been given to WFP "for acting as a driving force in efforts to prevent the use of hunger as a weapon of war and conflict."

# THE PANDEMIC NEWS

## Bats: The virus repositories and mammals believed to be the origin of COVID-19

With over 1400 estimated species, Bats belong to the second-largest order of mammals, Chiroptera. Not only do they have forelimbs adapted as webbed wings, but they are also the sole mammals inherently capable of true and sustained flights. Yet their most striking feature has got to be their capability to act as an excellent host for numerous viruses.

Bats have been identified to carry around 137 viruses in total with 61 of them being zoonotic. Each Bat species on average contains 1.8 zoonotic viruses, making them the source of more dangerous viruses than any other taxonomic order. Bats are known to carry deadly viruses like Hendra, Marburg, Rabies, Menangle, Tioman and Henipavirus to name a few. They are also considered to be the original hosts of Ebola, Nipah and SARS-CoV- like viruses. On the contrary, Bats don't fall prey to these lethal viruses. But why? Let's find out.

Scientists have theorized that in addition to evolving to fly from being earthbound originally, Bats also developed high metabolic rates. The high metabolic rate along with highly developed defence mechanisms help protect Bat DNA during their flight, which is a physiologically very demanding process. These also prevent Bats from falling sick to huge microbial loads present in their body. Researchers at Wuhan Institute of Virology, China observed that an antiviral immune pathway called the STING-interferon pathway is less activate in bats, which helps Bats to maintain just enough defences against illness but doesn't trigger the immune system from going into overdrive whereas in other mammals including humans an immune-based over response to pathogenic viruses triggers the severe illness. Scientists at University College Dublin discovered that in Bats the macrophages rapidly induce a vigorous antiviral response on detection of a pathogen, but quickly reverses this response by the release of inflammatory cytokines. Bats have also adapted to minimize inflammation. So, this near-perfect health combined with their ultimate defence strategies makes Bats a perfect breeding ground and a disease incubator for several viruses.

## The race for vaccine: Pfizer, Moderna vaccines show high efficacy


Initial evaluation of the data from the Phase III trials shows that the COVID-19 vaccine candidate, BNT162b2 from Pfizer and BioNTech has around 90% efficacy. The clinical trials enrolled 43,538 participants, of which 42% were from diverse ethnic backgrounds. The vaccine could soon be available in the US for emergency use after the required tests complete in November. The company has also said it aims to produce up to 50 million doses in 2020 and more than a billion doses in 2021.

But, there are some challenges. The candidate vaccine BNT162b2 from Pfizer is an mRNA-based vaccine, which requires very low temperatures for storage. This could present a major problem in ensuring that the Indian population is vaccinated. Secondly, the data from the clinical trials is yet to be published and reviewed, which means conclusions from the data can only be drawn after it is published. Moreover, various factors are yet to be examined.

Early data from the clinical trial of the Moderna vaccine, which enrolled 30,000 participants has also shown that it is nearly 95% effective. Moderna's vaccine can be stored at -20 degrees celsius, unlike the Pfizer vaccine which requires -75 degrees celsius for storage. The company is going to apply for Emergency Use Authorization (EUA) in the coming weeks, but what remains to be seen is whether or not is the vaccine safe and how long can the vaccine provide safety.

The efficacy figures will continue to decline as the trial nears completion. The challenges that lie after the vaccines are out are the ones that our healthcare system needs to figure out and find solutions for.

References & Photo credits:

1. Photos credits: Pexels, Pixabay
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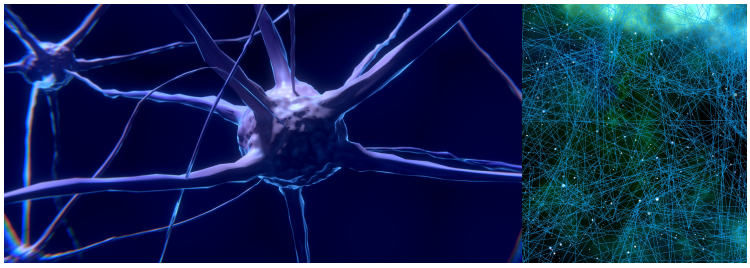
# IN FOCUS: NEUROSCIENCE

## What if the miniature brains growing in labs are all conscious?



The title does seem like the plot of a sci-fi movie, but it's a question that is making neuroscientists much more concerned about the mini-brains growing in laboratories. The mini-brains are better known as organoids and are grown from stem cells to form masses that resemble the human brain in some sense. And how can it not happen when increasing evidence of organoids resembling our organs has been coming up. One such example is Alysson Mutori's work, which shows that the waves of activity emitted by lab-grown brain organoids are similar to those produced by premature babies.

Studies like these have only led to a debate about the ethical use of organoids and whether or not they are conscious. Although neuroscientists say that most miniature brains that are cultured in the lab are too primitive to be conscious, they know that advanced organoid models having consciousness and similarities to the human brain aren't too far away. This prediction certainly becomes worrying given the fact that a few neuroscientists see no problems in growing mini-brains with consciousness to understand diseases better.

At present, there are no guidelines about using these organoid models, however, the need for regulations of this kind is real. But, the biggest hurdle with experiments like these is the fact that we don't have a strict definition of what we consider consciousness. Do we consider an organoid conscious if it displays some electrical activity or should we not compare organoids with brains since these are very tiny structures and not as complex? Moreover, should scientists continue working on complex organoid models to increase our understanding of diseases or are we crossing a line? There are too many questions and no definite answers.

This discussion leads us to a critical question which we want to ask you. Is developing miniature brains like the one Mutori's working on or infusing a dead brain with chemical cocktails as Yale researchers have done for pigs, ethical at all?

**You tell us.**

## This video game treats children with ADHD

The Neuroscape Center at UCSF is working to make video games that can work as therapy for children with mental disorders. And their first video game called EndeavorRX has earned FDA approval in June this year.

The game, marketed by Akili Interactive, is based on a Nature paper that investigated if a video game called Neuroracer showed improvement of attention in adults with ADHD. After that study showed impressive results, researchers were motivated to design a game that could help children with the disorder have greater attention.

Neuroracer and EndeavorRX both work on a similar principle of having players pay attention to the task while being distracted by other things in the game. The FDA approval was based on several studies, one of which was published in The Lancet Digital Health. The game helps better the attention levels of the players by improving their cognitive function and stimulating changes in the prefrontal cortex.

While the idea seems revolutionizing, critics say that this game could be a marketing hoax for all its worth. Many ADHD clinicians also oppose the idea as they say prescribing reduced screen time to children causes improvement.

**What do you think of games like EndeavorRX?**

Written by: **Yogesh Joshi (181807) , Simran Gohan (181802) , Janki Insan (181824)**
Edited by: **Literary Team, Synapse Club, Department of Biotechnology and Bioinformatics, JUIT Solan.**

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a. Photos from Pixabay, Pexels.
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