EXHIBIT

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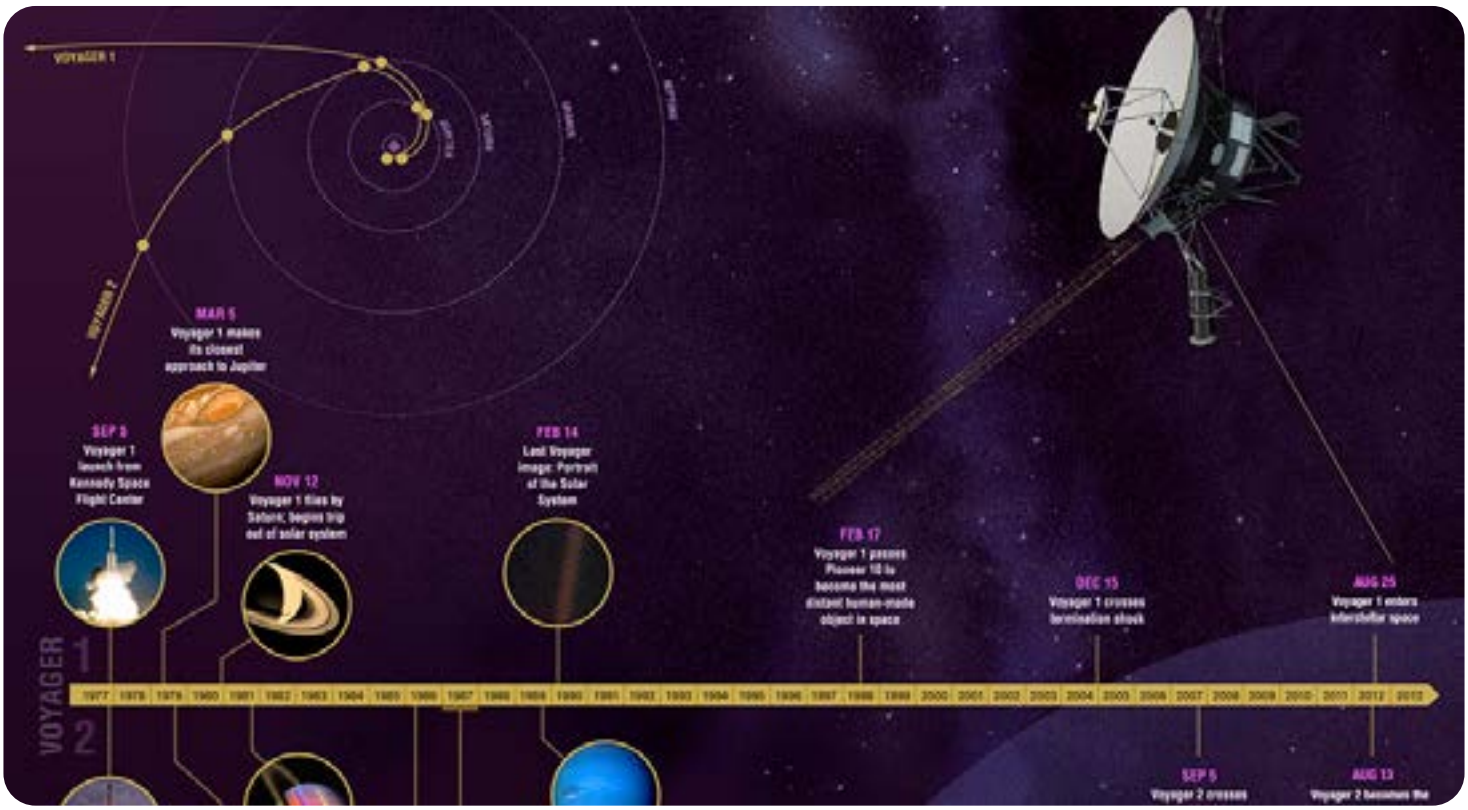
AN INITIATIVE BY:

Pranav

IISER

THIRUVANANTHAPURAM

More 'Space Sounds' Detected by Voyager 1



From almost 23 billion kilometres away, Voyager 1, initially launched in 1977, continues to transmit data back to Earth. Plasma wave observations have previously let people listen to the sounds of deep space, and a 'persistent hum' has now been found.

Voyager 1 overtook Voyager 2 in the 1990s by gaining excess speed from flybys of Saturn and Jupiter. In 2012, Voyager 1 became the first human-made object to cross the heliopause and enter the interstellar medium. The interstellar medium is the matter and radiation that fills the space between stars and other celestial objects. Interstellar matter consists of dust grains, cosmic rays, and gas that is present in the gaseous, solid, and ionized states. Between 30% and 70% of the interstellar medium is composed of gases at temperatures well above 10^4 Kelvin, i.e., of plasma. The heliopause is the boundary that separates the interstellar medium and the heliosphere, a 'bubble' formed in the medium due to solar wind (a stream of charged particles originating from the Sun's corona).

This May, an article published in Nature Astronomy reported that a 'hum' indicating persistent plasma waves has been found by Voyager 1. The hum is present in a class of weak plasma wave emission with a narrow frequency bandwidth. The emission has been persistent from 2017, and gives a steadily sampled measurement of the interstellar plasma density over a distance of around 10 astronomical units. This density measurement is likely the first continuous reading taken in interstellar space. The Plasma Wave Subsystem, one of the instruments on board the probe that is still active, measures the electron density of the surroundings by measuring the frequency of vibrating electrons. As stellar winds, radiation pressure, outflows from star formation regions, and other sources in the interstellar medium cause turbulence, electrons start vibrating, and the pitch of these oscillations is what has famously been called the 'sound' of space. The new observations imply that there may be more low-level activity even in quiescent areas than previously thought.

The hum has several implications for astrophysics—the study explores a few possible mechanisms for the narrowband emission, such as thermally excited plasma oscillations, and quasi-thermal noise that produces a local electric field. The density of the interstellar medium is an important measurement for understanding star formation and evolution, the shape of the heliosphere, and the various mechanisms that influence activity in space; the electron density increases as the probes exit the heliosphere, and understanding why can help us glean more information about the interactions between solar wind and the interstellar medium. Since the emission is persistent, Voyager 1 is expected to continue measuring the plasma density, barring major disruptions such as shock-generated plasma oscillation events. By 2025, however, the radioisotope thermoelectric generators (RTGs), the nuclear batteries

used on both the Voyagers, will no longer be able to power them. Researchers hope to gather as much data as possible before the probes are lost to us.

--Rithika Ganesan, B'19

The Truth Behind Advertisements

One of the primary modes of increasing people's interest in a particular product is advertising. Not long back, advertising strategies mainly focused on persuading people by showing off the results of their products. However, now, it has become a trend to superficially mention scientific terms to prove the quality of products. Several firms manufacturing daily-life products often use advertising verbiage like 'clinically proven' or 'inspired by groundbreaking DNA research' in their advertisements to convince people that their product is superior. But as science students, have we ever wondered if these claims are valid?

We get to know of several new brands and different daily life products such as cosmetics, bath products, sanitary and hygiene products through advertisements. We know that all of these products are chemicals, but we rarely take the time to find out what these chemicals are and how they function.

Cosmetic products are chemicals that come in contact with our face. Their advertisements use several scientific terms such as 'hi-res crystal radiance', '100% glycerine', '100% neem oil', and so on. However, there is no scientific article giving solid proof for the presence of such qualities in these products. We, as consumers, should have the right to know about their documented research on these chemicals and their reactions. A survey of these cosmetic products reveals that more than 50% of these products make false advertisements to attract people.

It is the same case for other beauty products such as soaps and lotions. It is no wonder why these products are not universally accepted, and many people do not find any benefit from using them. A survey taken to find irritancy of several advertised popular face cleanser lotions showed that many products highly advertised in the market have high irritancy and negatively impact the skin. Claims such as acne and pimple removal are very hard to believe as manufacturers do not show any solid scientific research proving these results.

The situation is even worse in the case of hair products. How many of you can honestly say that the shampoos they advertise have shown the same result in your hair? Every video is cleverly edited to attract its customers. There are several complaints against many hair products because of their main side effects of excessive hair loss and balding.

In India, such advertisements with false claims are prohibited by the Trademarks Act, the Consumer Protection Act and the ASCI Code. The Advertising Standards Council of India (ASCI) is a self-regulatory organisation established for regulating the advertising industry and safeguarding the interests of the consumers. The ASCI has also adopted a code for self-regulation in advertising products in India. One of the rules clearly states that the source and date of advertising claims based on or supported by independent research should be indicated in the advertisement. Being science students, we should question these marketing companies and demand solid proof for all scientific claims that they mention in their advertisements.

However, some companies have detailed scientific proof for all their claims that they make for their products in their advertisements. Such efforts should be done by all such companies. People trust them and buy their products. To uphold this trust, the manufacturers should allow people to check the proof for the viability of their products.

On the marketing side, rather than stating the incomprehensible research results, significance and importance of the scientific description of any product, these companies should provide concrete evidence of the ingredients, research processes and results using non-technical terms so that consumers can understand it. Marketers should equally justify their claims in advertisement with more transparent evidence without assuming the people to be dumb, and they should stop using false, exaggerated descriptions for products.

--Ananya Aravind, B'19

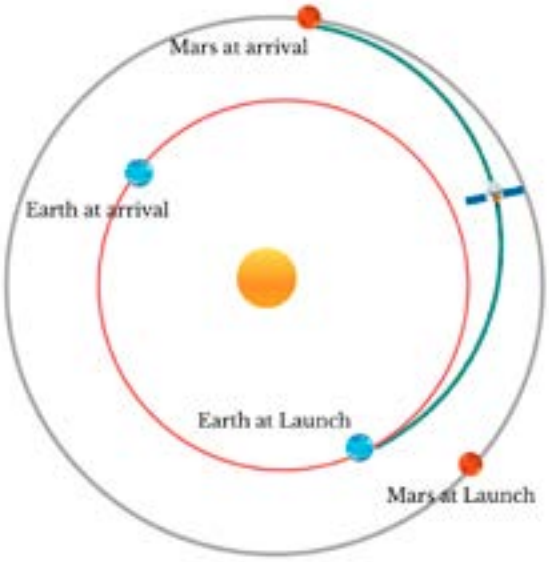
Who will be our guinea pig?
A dive into the models used for COVID-19 research

Models are representatives of the structure and function of biological systems. Developing accurate models for diseases is crucial to advance our collective understanding of them. Models enable us to test potential drugs, vaccines and prophylactics, and inform public health policies. Below are the non-human models currently in use today in the field of COVID-19 research.

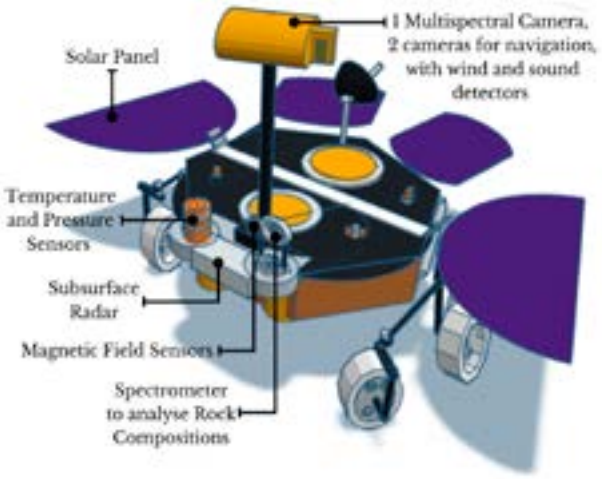
MODEL	EXAMPLES USED IN COVID-19 RESEARCH	KEY POINTS
Primary human cells Isolated directly from human tissues	Human airway epithelium cells	Directly retain functional and morphological characteristics of the tissue of origin Undergo ageing Cannot self-renew indefinitely Expensive Vary based on the individual from which they were isolated.
Immortal cell lines Cell lines which have been manipulated to proliferate indefinitely	Vero E6 (from African Green Monkey kidney epithelium), Calu-3 (from human lung cancer), Huh7 (from human liver carcinoma)	Can renew indefinitely Easy to culture Cheaper than primary cells Identical across replicates Differ from source tissues in their genomes or functioning Do not provide organ/system wide view
Organoids Miniature and simplified organs grown outside the body and have realistic anatomy	Human lung, intestine, liver duct organoids	Provide a more realistic model of disease than cell lines Faster results and more ethical than animal models Can be contaminated by other tissues Suffer from poor result reproducibility
Organ-on-chips 3D organ models with many fluid channels lined cell cultures	Human airway-on-chip	Allow for the study of tissue-air or tissue-liquid interface Mimic organ-blood vessel anatomy that is difficult in organoids Not widely available Do not provide organ system-wide model
Rodents and ferrets Used in their wild type or transgenic forms	Mice, syrian hamsters, ferrets	Provide an organism-wide view of disease Highly studied model animals Pose ethical issues Take longer to reproduce than cell cultures/ organoids Do not accurately mimic human symptoms and pathology
Primates Used in their wild type or transgenic forms	Rhesus macaques, Cynomolgus macaque	Closely related to humans Established in biomedical research Better models than rodents Slow to reproduce More difficult to maintain than above models Raise ethical questions

--Ira Zibbu, B'19
[Source]

Tianwen-1 China Lands its First Rover on Mars



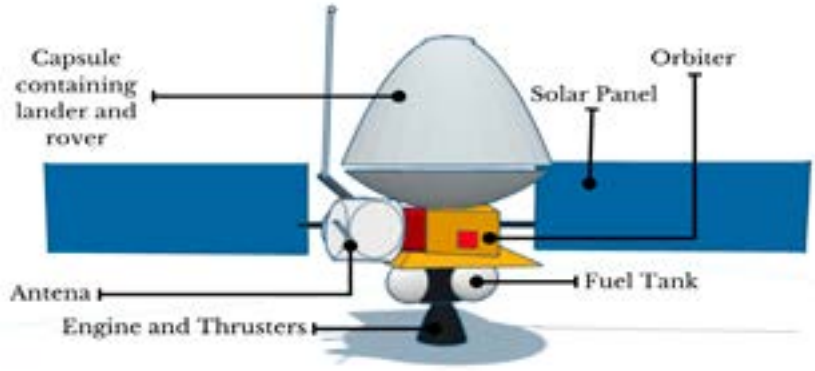
China's Tianwen-1 successfully landed the rover Zhurong, named after the Chinese god of fire. The orbiter is expected to collect data on Mars for years, and the rover for at least three months.

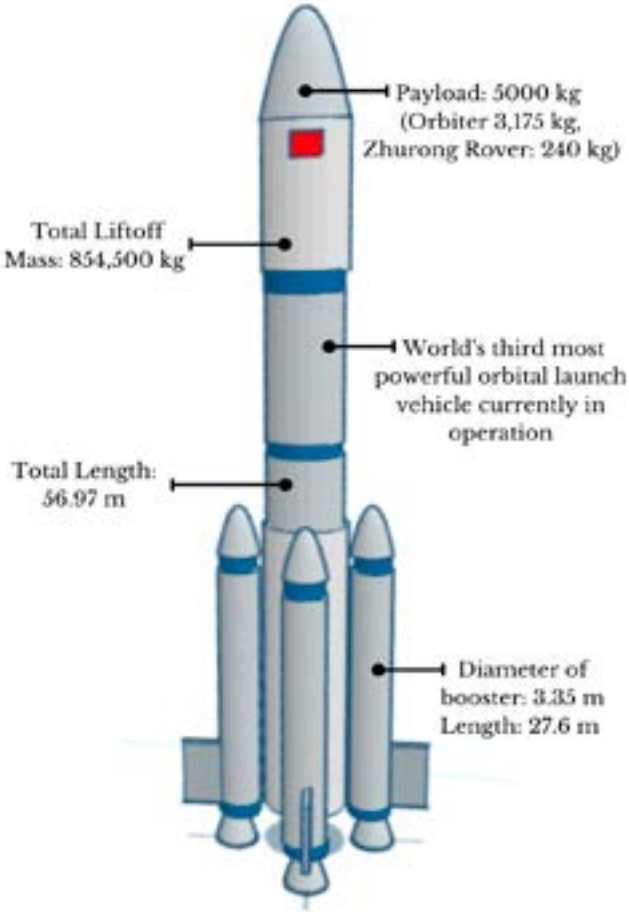


Why is it important?

-The mission was its first for China, and is a testing bed for many future endeavors.

-An orbiter-rover duo is the first of its kind on the Martian planet.





Mission Objectives:

-Engineering the spacecraft and landing was given precedence over exploration.

-Detecting permafrost in Utopia Planitia, region in the northern hemisphere of Mars.

-Studying the Martian magenetic field.

Text by Ravikiran Hegde and illustrated by Naveen Balachandran, B'19

ESI Species of the month: *Crocidura norcondamica*

A team from the Zoological Survey of India has discovered a new insectivorous mammal species in Narcondam Island, India. This is a one-of-a-kind discovery in India occurring after almost forty years—the last species to be discovered was Jenkin's Andaman shrew in 1978.

Shrews are small mole-like mammals from the family *Soricidae*.[1] They are not rodents, although their external appearance looks deceptively similar to that of mice. These mammals are widespread, and they possess an excellent sense of hearing and smell. There is not much information about shrews because of their secretive behaviour.

Crocidura norcondamica is the 12th Indian species to be discovered under this genus, and it proudly takes up the name of the place of discovery. Crocidura is the most species-rich genus of mammals, and this discovery adds another feather to the crown. The new species is medium-sized with darker-grey dense fur dorsally and a thick and darker tail.[2] The discovery was confirmed using morphological and molecular techniques. Currently, we don't know much about their distribution except the fact that they inhabit the thickets of Narcondam Island. All the four previously known species of the Crocidura genus from the Andaman Nicobar archipelago are categorised as threatened by the IUCN Red List of Threatened Species mainly due to high endemism and human disturbances. Currently, the new shrew species does not face a threat from anthropogenic factors as Narcondam is free from human intervention. Yet, researchers are worried that their restricted habitat and small population size could make them vulnerable to extinction.

--J. Vishwathiga, B'19

Our Team:

Ira Zibbu, B'19
Aiswarya P. S., B '18
Rithika Ganesan, B'19
Akshita Mittal, B'19
Ravikiran Hegde, B '19
Nikhil Alex Verghese, B'17
Shubham Chury, B '19

Ananya Aravind, B '19
Ashley Roby, B'18
Balaram Vishnu Subramani, B'17
J. Vishwathiga, B '19
Megha G., B '19
Shreya Venkatesan, B'19

Faculty Representatives:

Dr. Nisha Kannan and Dr. Sreedhar Dutta

We hope you enjoyed this month's edition of Exhibit A!

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anveshacontent@gmail.com

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