

1. Sample Return Mission from asteroid Bennu

Introduction

- NASA's OSIRIS-REx mission collected samples from the asteroid Bennu, located billions of kilometers from Earth.
- The mission, which started in 2016, involved mapping the asteroid, collecting samples, and returning them to Earth.

OSIRIS-REx Sample Return Process

- Journey to Bennu: The spacecraft took over two years to reach Bennu after its launch in 2016.
- Mapping and Sample Collection: OSIRIS-REx spent considerable time mapping the asteroid and collecting approximately 250 grams of rock.
- Return to Earth: The spacecraft has released its sample capsule above the Earth at an altitude of 250 kilometers over the Great Salt Lake Desert in Utah, USA.
- Continued Mission: After releasing the capsule, OSIRIS-REx is headed towards a new target, the asteroid Apophis.



Figure 1 NASA Capsule with asteroid sample

Sample Return Missions

- Definition: Sample return missions involve sending spacecraft to celestial bodies like moons, asteroids, or planets to collect samples of soil, minerals, and rock.

Benefits of Collecting Space Samples

- Scientific Insights: Samples provide information about early Earth history and the formation of the solar system.
- Resource Potential: Asteroids could serve as a resource for essential minerals.
- Sample Components: Samples can include atoms, molecules, complex compounds, and even particles from solar wind or cometary debris.

Analysis of Bennu Samples

- Significance: NASA's samples from Bennu offer insight into the formation of the solar system and the origins of life.
- Distribution: NASA plans to distribute samples among 200 mission members at 35 institutions worldwide, reserving 25% for its own research.

Previous Sample Return Missions

- Apollo Missions: NASA collected around 382 kilograms of moon rock and soil during the Apollo era.
- Soviet Missions: Soviet-era Russia conducted three successful robotic missions, gathering about 326 grams of samples.
- Recent Missions: JAXA's Hayabusa mission from 2003 to 2010 was the first time humans had brought back samples from a near-Earth object: the asteroid Itokawa. Japan followed that with Hayabusa2, which returned samples from an asteroid called Ryugu in 2020. And, also in 2020, China's Chang'e 5 mission returned samples from the moon.

Upcoming Sample Return Missions

- Japan's Martian Moons eXploration (MMX) is scheduled to launch in 2024. It aims to invest Mars' moons, Phobos and Deimos and collect samples from Phobos, the larger of the two moons, and then return to Earth in 2029.
- ESA and NASA Mars Mission: The European Space Agency and NASA are planning a sample return mission from the surface of Mars, expected to return in 2033.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: The Indian Express and The Hindu

2. Understanding Monoclonal Antibodies and their Role in Nipah Virus Outbreak

Introduction

- India seeks monoclonal antibody doses from Australia to combat the Nipah virus outbreak in Kerala. The current Nipah outbreak is Kerala's fourth since 2018.
- The Nipah virus outbreak has claimed lives and raised concerns in the Kozhikode district, Kerala.

- India currently has the antibody doses available for ten persons only. According to doctors, no one in the country has been administered the dosage so far since it needs to be given at an early stage of infection.

What Are Monoclonal Antibodies?

- Definition: Monoclonal antibodies are lab-made proteins that mimic the immune system's natural antibodies, targeting diseases and foreign substances.
- Function: They attach to specific antigen, aiding the immune system in eliminating disease-causing molecules. An Antigen is a foreign substance and is usually responsible for disease.

Understanding m102.4

- Description: m102.4 is a fully human monoclonal antibody effective against Hendra and Nipah viruses.
- Clinical Trials: Phase-one clinical trials demonstrated its safety and effectiveness.
- Compassionate Use: It's currently used under "compassionate use" conditions when no other authorized treatments are available.

How Monoclonal Antibodies Work

- Specific Targeting: Monoclonal antibodies are engineered to bind to disease-causing antigens. For instance, most successful monoclonal antibodies during the pandemic were engineered to bind to the spike protein of the SARS-CoV-2 virus. The binding prevented the protein from exercising its regular functions, including its ability to infect other cells.
- Historical Development: Dr. Köhler and Dr. Milstein pioneered monoclonal antibody production in 1975 using hybridoma methodology. In this methodology, a fusion cell made up of B cells (white blood cells that produce antibodies) and myeloma cells (abnormal plasma cells) is produced. These hybrid cells allowed the researchers to produce a single antibody clone, which came to be known as a monoclonal antibody.
- Modern Production: Recombinant DNA technology is now used to create monoclonal antibodies efficiently.
- Virus Interaction: Glycoproteins are one of the major components of viruses that cause diseases in humans. m102.4 binds to the Nipah virus's glycoprotein, potentially neutralizing it.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: The Indian Express

3. Ruixiang Zhang to Receive 2023 SASTRA Ramanujan Prize

Introduction

Ruixiang Zhang, a mathematician from the University of California, Berkeley, is the recipient of the 2023 SASTRA Ramanujan Prize.

About Ruixiang Zhang

Education: Zhang pursued his initial education in China and continued his studies in the United States.

Current Role: He currently serves as an assistant professor at the University of California, Berkeley.

The SASTRA Ramanujan Prize

Origin: Established by the Shanmugha Arts, Science, Technology & Research Academy (SASTRA), located near Kumbakonam, India, the hometown of Srinivasa Ramanujan.

Purpose: The prize is of \$10,000 is awarded annually to young mathematicians who have made remarkable contributions in fields aligned with Ramanujan's mathematical interests.

Age Limit: The age limit for this prestigious award is set at 32, the age at which Ramanujan himself passed away.

Award Ceremony: The prize will be presented during the International Conference in Number Theory, scheduled for December 20-22 at SASTRA University in Kumbakonam, Ramanujan's hometown.

Relevance: GS Prelims & Mains Paper III; Environment

Source: The Indian Express