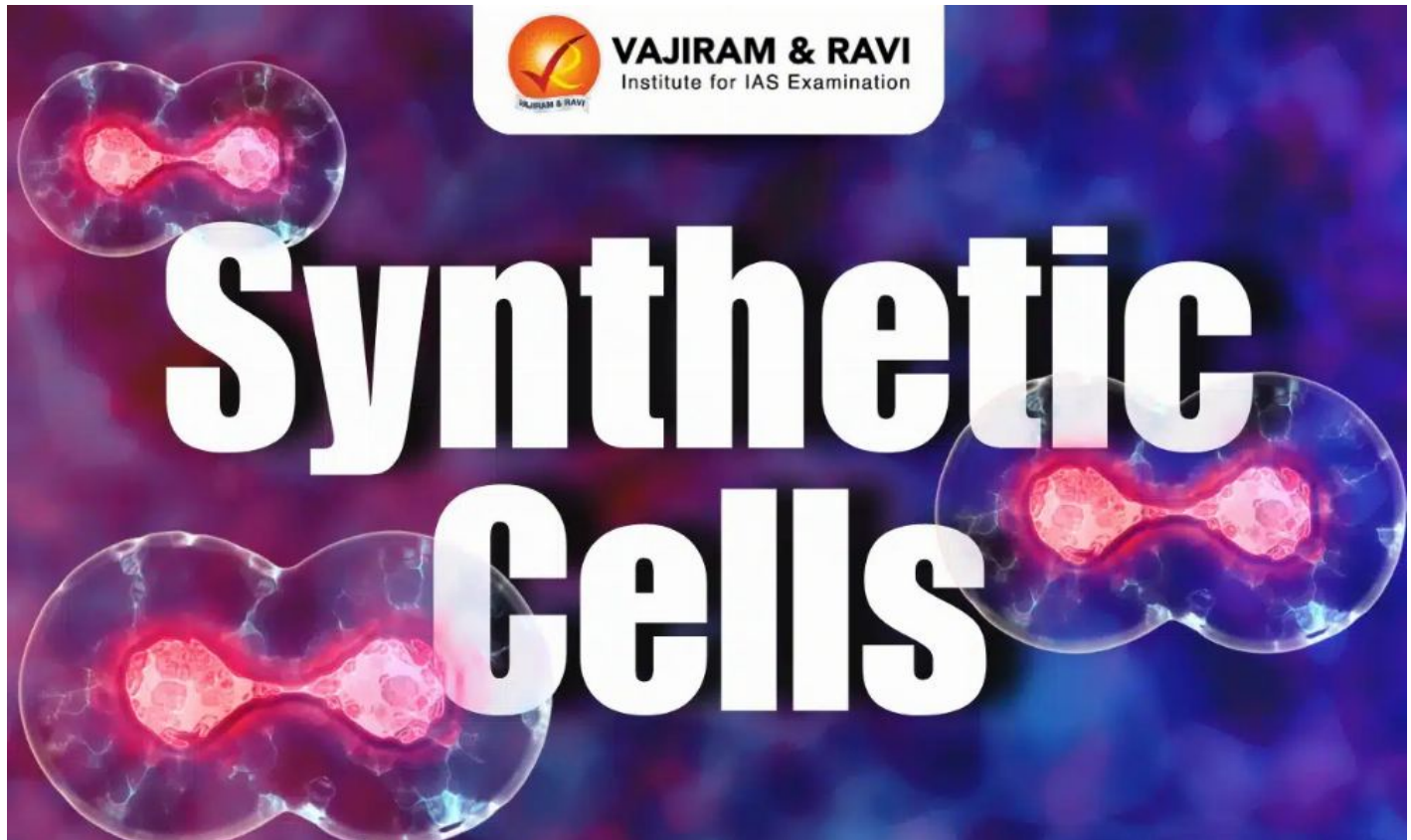


Scientists Build a Synthetic Cell, A Major Breakthrough in Synthetic Biology

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Scientists have successfully created a **synthetic cell from non-living chemical components** that can **feed, grow, and replicate**, marking a major milestone in **synthetic biology**. Although the cell is still a simple and fragile prototype, it represents a significant step toward understanding the origins of life and developing programmable living systems.

A research team led by **Kate Adamala**, a synthetic biologist at the **University of Minnesota**, assembled a cell **piece by piece using non-living chemicals** instead of modifying an existing living cell.

About Cell

A **cell** is the basic structural, functional, and biological unit of life that performs all essential activities required for the survival, growth, and reproduction of living organisms.

- The cell is known as the **basic unit of life**.
- All living organisms are made up of one or more cells.

- Cells carry out vital functions such as **nutrition, respiration, growth, excretion, and reproduction**.
- Cells contain **genetic material (DNA or RNA)** that controls their activities and passes hereditary information.
- Cells are broadly classified into **prokaryotic cells** (without a true nucleus) and **eukaryotic cells** (with a true nucleus).
- The study of cells is called **cytology (cell biology)**.
- The **cell theory** was proposed by **Matthias Schleiden** and **Theodor Schwann**, and later expanded by **Rudolf Virchow**, stating that all cells arise from pre-existing cells.
- Cells may exist as **single-celled (unicellular)** organisms or as part of **multicellular** organisms.
- In humans, the body contains **around 37 trillion cells**, each specialized to perform specific functions.
- Cells are the foundation of all biological processes, making them essential for life on Earth.

About Synthetic Cell

A **synthetic cell** is an artificially designed cell created from non-living chemical components that mimics certain functions of natural cells, such as metabolism, growth, and replication.

- A synthetic cell is **constructed from non-living molecules** using principles of synthetic biology.
- It is designed to perform **basic life-like functions**, including feeding, growth, and replication.
- Unlike genetically modified cells, it is **built from scratch** rather than modified from an existing living cell.
- Scientists know the **complete chemical composition** of a synthetic cell, making it programmable and easier to engineer.
- Most current synthetic cells resemble **simple bacterial cells** and are not fully living organisms.
- Synthetic cells help scientists study the **origin of life** and the fundamental processes of living systems.
- Potential applications include **drug discovery, cancer therapy, carbon capture, environmental remediation, and industrial biotechnology**.
- Synthetic cells are a major focus of the rapidly advancing field of **synthetic biology**.
- They provide a platform for developing **custom-designed biological systems** with specific functions.
- Although highly advanced, current synthetic cells remain **experimental** and are primarily used for scientific research.

Difference Between Synthetic Cells and Bioengineered Cells

Synthetic cells and bioengineered cells are both products of modern biotechnology, but synthetic cells are built from non-living chemical components, whereas bioengineered cells are naturally existing living cells that are genetically modified for specific purposes.

Difference Between Synthetic Cells and Bioengineered Cells		
Basis	Synthetic Cells	Bioengineered Cells
Definition	Artificially built from non-living chemical components.	Naturally existing living cells that are genetically modified.

Starting Material	Non-living molecules and chemicals.	Existing living cells (e.g., bacteria, yeast, or animal cells).
Method	Assembled from scratch using synthetic biology.	Modified using genetic engineering or biotechnology techniques.
Genetic Material	Artificially designed and incorporated.	Natural DNA is altered by adding, removing, or editing genes.
Dependence on Natural Cells	Does not require a pre-existing living cell.	Requires a living cell as the starting point.
Purpose	To create programmable cells and study the origin of life or perform novel biological functions.	To produce medicines, vaccines, enzymes, and other useful biological products.
Example	Laboratory-built synthetic bacterial-like cell.	<i>E. coli</i> engineered to produce human insulin.
Applications	Carbon capture, synthetic biology research, environmental solutions, and future medical therapies.	Insulin production, vaccine development, gene therapy, agriculture, and industrial biotechnology.

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