Self-Replicating RNA Discovery

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Why in News?

Recently, scientists have reported RNA may have been Earth's first genetic material.

- **Key Findings –** Scientists have discovered a very small RNA molecule called ***QT45 that can copy itself.***
- This is the first clear evidence of a simple RNA molecule that can self-replicate.
- It strengthens the idea that RNA may have been the first genetic material on Earth, but it *does not prove it.*
- **Experiments on Life's Origin –** In 1953, scientists (in the Miller-Urey experiment) recreated early Earth conditions in a lab.
- They showed that *amino acids* (building blocks of proteins) could form naturally. However, they ***did not find DNA or RNA in it.***
- This meant that forming proteins was only part of the story of how life began.
- **Core Issue –** Life needs genetic material (DNA or RNA) to store information and a way to copy it to make new life.
- Modern cells use proteins to copy DNA or RNA, but DNA and RNA are needed to make those proteins, creating a "***chicken-and-egg" problem*** for the origin of life.
- **RNA's Special Role –** In the 1980s, scientists found that RNA, being a single molecule, could both store information and carry out chemical reactions.
    - It stores genetic instructions and also acts like a basic enzyme, doing jobs needed for life on its own.
- **Early Life** – This suggested that early life may have depended only on RNA, before proteins evolved.
- **Limitations** – Earlier lab-made RNA was large and complex, and it could

help copy others but not itself.

- **Development of QT45 –** The researchers selected rare RNA sequences from large pools and improved them step by step until QT45 was developed.
- *QT45 is only 45 nucleotides long* and can copy its own genetic information.

Nucleotides are the tiny building blocks that make up DNA and RNA.

- **QT45 Replication –** QT45 copies itself by three-nucleotide building blocks. That is the joining of small three-letter pieces.
  - First, it makes a matching copy and then uses that copy to rebuild the original version.
- **Slow Replication –** The copying is very slow and needs special conditions — it can take weeks, while modern cells do it in seconds.
- But early Earth had millions of years, so even slow copying could have worked.

Quick facts

- **DNA –** Stores and replicates genetic information as a long, stable double-stranded molecule, acting as the blueprint for life.
- **RNA –** It is shorter, single-stranded, and carries genetic instructions from DNA to build proteins, while also being chemically more reactive.

Reference

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