

ONLY COMPETITION IAS

DAILY
Editorials &
Articles



30 March 2026



UPSC 360°

The Hindu Unwrapped - Daily Current Affairs Mastery for UPSC CSE (Clear that it's based on The Hindu editorials / news analyses - very aspirant-friendly)

Significance

The discovery of extracellular RNA (exRNA) is significant for advancing molecular biology and medical science. It enables early disease detection, especially cancer and neurological disorders, through non-invasive diagnostics, improves understanding of cell communication, and opens new avenues for targeted therapies, precision medicine, and biomarker-based healthcare innovations.

exRNA Discovery

Why in News?

- A study published in the journal **Clean Water** on **28 March 2026** has reported that **extracellular RNA (exRNA)** released by bacteria can survive in disinfected drinking water even after the bacteria themselves have been killed.
- Led by researchers who analysed exRNA in treated water, the study shows that these RNA molecules carry signatures of the bacteria's final survival strategies and stress responses just before death.
- This breakthrough allows scientists to decode **how bacteria evade disinfectants**, paving the way for the design of more effective water treatment technologies.
- Additionally, the study highlights exRNA's broader role as a cellular communication system in the human body, with potential applications in early detection of cancer and heart

Head. Office: 201, Ansal Building No. A-12-13, Commercial Complex, Dr. Mukherjee Nagar, Delhi-110009.

Assam Center: House no. 12, 3rd Floor, Bylane -6 Hriday Ranjan Path, Guwahati 781003.

Ph.: 011-460-448-9312, 999012-60-23, 999012-60-24/Web: www.onlycompetition.com



disease through non-invasive blood or fluid testing. The findings have significant implications for public health, water safety, and precision medicine.

Key Details of the Discovery

- **exRNA in Disinfected Water**

- Bacterial exRNA persists even after disinfection kills the parent bacteria.
- By analysing exRNA sequences, researchers could reconstruct the bacteria's last-ditch survival mechanisms (e.g., biofilm formation, stress-response genes).
- This provides a new tool to study disinfectant resistance and develop next-generation water treatment methods.

- **What is exRNA?**

- RNA molecules released outside the cell into body fluids (blood, saliva, urine, cerebrospinal fluid).
- Packaged in protective molecular containers to survive harsh environments and reach target cells.
- Acts as a **long-distance communication system** – cells use exRNA to send instructions that alter gene activity in distant cells.

- **Role in Human Health**

- Coordinates immune responses, tissue repair, and development.
- Cancer cells exploit exRNA to promote tumour growth and metastasis.
- Testing exRNA patterns in blood/body fluids can help detect specific signatures linked to cancer or cardiovascular diseases.

- **Scientific Significance**

- Challenges the long-held belief that RNA only functions inside cells.
- Demonstrates intentional export of RNA by cells for intercellular signalling.

Head. Office: 201, Ansal Building No. A-12-13, Commercial Complex, Dr. Mukherjee Nagar, Delhi-110009.

Assam Center: House no. 12, 3rd Floor, Bylane -6 Hriday Ranjan Path, Guwahati 781003.

Ph.: 011-460-448-9312, 999012-60-23, 999012-60-24/Web: www.onlycompetition.com



Background: Understanding exRNA

- **Traditional View of RNA**
 - RNA was thought to function only inside the cell (mRNA for protein synthesis, tRNA, rRNA, etc.).
 - Any RNA “leaking” into blood was assumed to be degraded quickly by enzymes.
- **Recent Breakthroughs**
 - Discovery that cells actively export RNA in protective vesicles.
 - exRNA found in various body fluids and linked to physiological and pathological processes.
- **Relevance to India**
 - Water quality and disinfection challenges remain significant (contamination, AMR).
 - Non-invasive diagnostics using exRNA could transform cancer and cardiac screening, especially in resource-limited settings.

Implications

- **Public Health & Water Safety**
 - Better understanding of bacterial survival strategies → improved disinfectant formulations.
 - Potential reduction in waterborne diseases and antimicrobial resistance (AMR).
- **Medical Diagnostics**
 - exRNA-based liquid biopsies could enable early, non-invasive detection of cancer and heart disease.
 - Opens new avenues in precision medicine and biomarker research.
- **Biotechnology & Research**
 - Advances in RNA therapeutics and intercellular communication studies.

Head. Office: 201, Ansal Building No. A-12-13, Commercial Complex, Dr. Mukherjee Nagar, Delhi-110009.

Assam Center: House no. 12, 3rd Floor, Bylane -6 Hriday Ranjan Path, Guwahati 781003.

Ph.: 011-460-448-9312, 999012-60-23, 999012-60-24/Web: www.onlycompetition.com



- Potential applications in vaccine development and gene therapy.
- **Environmental & Regulatory**
 - Strengthens the case for rigorous water quality monitoring beyond conventional bacterial counts.

UPSC CSE & State PCS Relevance

Prelims

- Key terms: Extracellular RNA (exRNA), Liquid Biopsy, Antimicrobial Resistance (AMR), Water Disinfection
- Data: Published in *Clean Water* (28 March 2026)
- Related: Biotechnology, Public Health, Water Quality Standards

GS-3 (Science & Technology)

- Applications of RNA biology in health and environment
- Biotechnology and diagnostic advancements

GS-3 (Environment)

- Water quality, disinfection, and emerging contaminants

GS-2 (Health & Governance)

- Public health interventions and non-invasive diagnostics

Essay / Interview

- "From Intracellular to Extracellular: The Revolutionary Potential of exRNA in Medicine and Environmental Science"
- "Bridging Biotechnology and Public Health: How exRNA Research Can Transform Water Safety and Disease Diagnostics in India"

Head. Office: 201, Ansal Building No. A-12-13, Commercial Complex, Dr. Mukherjee Nagar, Delhi-110009.

Assam Center: House no. 12, 3rd Floor, Bylane -6 Hriday Ranjan Path, Guwahati 781003.

Ph.: 011-460-448-9312, 999012-60-23, 999012-60-24/Web: www.onlycompetition.com



MCQs

1. With reference to extracellular RNA (exRNA), consider the following statements:
2. exRNA is RNA that exists outside cells in body fluids such as blood and saliva.
3. Cells intentionally export RNA to communicate with other cells.
4. exRNA has been linked to promoting tumour growth in cancer cells.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 1 and 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

Answer: (d)

2. The recent study on bacterial exRNA in disinfected water was published in the journal:
 - (a) Nature
 - (b) Clean Water
 - (c) Science
 - (d) The Lancet

Answer: (b)

3. Which of the following is NOT a known function or application of exRNA?
 - (a) Intercellular communication
 - (b) Promoting tumour growth
 - (c) Serving as a biomarker for cancer detection
 - (d) Acting as a direct energy source for cells

Head. Office: 201, Ansal Building No. A-12-13, Commercial Complex, Dr. Mukherjee Nagar, Delhi-110009.

Assam Center: House no. 12, 3rd Floor, Bylane -6 Hriday Ranjan Path, Guwahati 781003.

Ph.: 011-460-448-9312, 999012-60-23, 999012-60-24/Web: www.onlycompetition.com



Answer: (d)

4. exRNA travels outside the cell in protective structures primarily to:
- (a) Avoid degradation by enzymes in body fluids
 - (b) Increase mutation rate
 - (c) Store genetic information long-term
 - (d) Replace DNA in cells

Answer: (a)

Mains Questions

1. "The discovery of extracellular RNA (exRNA) surviving in disinfected water opens new frontiers in both environmental science and medical diagnostics." Discuss its significance and potential applications. (15 marks / 250 words)
2. Examine the role of exRNA in cellular communication and its implications for understanding diseases such as cancer and cardiovascular disorders. (10 marks / 150 words)
3. "Advances in RNA biology are transforming traditional approaches to public health and water safety." Analyse this statement in the context of the recent exRNA study published in *Clean Water*. (15 marks / 250 words)
4. **Essay (250 marks)** "From Intracellular Messenger to Extracellular Signal: The Emerging Importance of exRNA in Biotechnology and Human Health."

Head. Office: 201, Ansal Building No. A-12-13, Commercial Complex, Dr. Mukherjee Nagar, Delhi-110009.

Assam Center: House no. 12, 3rd Floor, Bylane -6 Hriday Ranjan Path, Guwahati 781003.

Ph.: 011-460-448-9312, 999012-60-23, 999012-60-24/Web: www.onlycompetition.com