

CSB IAS ACADEMY

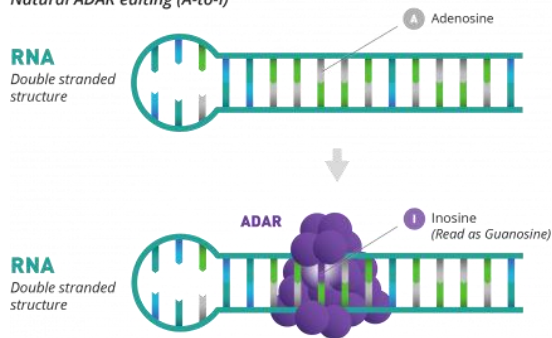
THE ROAD MAP TO MUSSORRIE...

PRELIMS EDGE – 2025 – 10/11/2024

RNA Editing

Context: In October, a biotechnology company in Massachusetts in the U.S. named Wave Life Sciences made headlines for becoming the first company to treat a genetic condition by editing RNA at the clinical level.

Natural ADAR editing (A-to-I)



About RNA Editing:

- RNA editing is the process of **modifying Messenger RNA (mRNA)** nucleotides, after Deoxyribonucleic acid (DNA) creates mRNA but before it begins protein synthesis.
- mRNA is made up of portions called **exons** and **introns**.
 - **Exons** eventually **code for a protein** whereas the **introns** are **non-coding parts** and are removed from the RNA before it is used to make a protein.
- **Types:** There are **three types of RNA modifications** i.e., **addition, deletion, and substitution**.

- **Addition** is when a nucleotide is inserted.
- **Deletion** is when one is removed while **substitution** refers to the replacement of one nucleotide with another.

- **Mechanism:** The technique involves a group of enzymes called **adenosine deaminase acting on RNA (ADAR)**.
- Scientists pair ADAR's effects with a **guide RNA (or gRNA)** that guides ADAR to a specific part of the mRNA, where the ADAR does the designated job.
- **Clinical Use:** Wave Life Sciences used RNA editing to treat **α -1 antitrypsin deficiency (AATD)**, an inherited disorder through a therapy dubbed as WVE-006.
- RNA editing shows promise for treating **Huntington's disease, Duchenne muscular dystrophy, obesity, Parkinson's disease, neurological conditions, heart diseases, and more.**

RNA

- RNA is a **nucleic acid present in all living cells**.
- It is structurally similar to DNA but **typically single-stranded**.
- Its backbone consists of alternating phosphate groups and ribose sugars, with bases **adenine (A), uracil (U), cytosine (C), and guanine (G)**.

Types of RNA:

- **Messenger RNA (mRNA):** Carries genetic information from DNA to ribosomes for **protein synthesis**.

- **Ribosomal RNA (rRNA):** Forms the core of the ribosome's structure and **catalyzes protein synthesis**.
- **Transfer RNA (tRNA):** Transfers amino acids to ribosomes during protein synthesis.
- **Regulatory RNAs:** Play roles in gene expression regulation.

Functional Significance: RNA plays essential roles in cellular processes like building cells, immune responses, and transporting amino acids.

Role in Viruses: Certain viruses use RNA as their genetic material.

Source: RNA editing promises to go where DNA editing can't (The Hindu)

Cyanobacteria Chonkus

Context: Researchers have found a new mutant cyanobacteria called Chonkus, which could help fight climate change.



About Cyanobacteria:

- Also called **blue-green algae**, these are microscopic organisms **found naturally** in all types of water.
- These **single-celled organisms** live in fresh, brackish (combined salt and fresh water), and marine water.
- These organisms **use sunlight to make their own food**.

- In warm, nutrient-rich (high in phosphorus and nitrogen) environments, cyanobacteria can multiply quickly, creating blooms that spread across the water's surface.
- **Cyanobacteria blooms** can form in warm, slow-moving waters that are rich in nutrients from sources such as fertilizer runoff or septic tank overflows.
- It **needs nutrients** to survive.
- The blooms can form at any time, but most often form in late summer or early autumn.

About Chonkus:

- It was discovered in the **shallow sunlit waters** off the coast of **Italy's Vulcano Island**, where **volcanic gas-rich groundwater seeps into the sea**.
- It has the capacity to **absorb a lot more carbon than the average cyanobacteria** floating in the ocean.

Source: Introducing Chonkus: The Carbon devouring algae that sinks to the ocean floor (Carbon Herald)

Terms in News

Digital Population Clock



- Bengaluru's first digital population clock was inaugurated at the Institute for Social and Economic Change (ISEC) recently.
- It will access **real-time estimates** of Karnataka's and population of India.

- The project was jointly taken up by ISEC, **and the Union Ministry of Health and Family Welfare (MoHFW)**.
- It would update the figures of the state's population for every 1.10 minute (one minute 10 seconds) and the country's population at **every two seconds**.
- It aims to increase awareness of population dynamics and provide accurate data for research.
- The Ministry of Health and Family Welfare (MoHFW) is installing similar clocks in 18 Population Research Centers across India.
- The clock has been **equipped with a satellite connection** for precise timekeeping.
- It operates autonomously with all necessary components integrated into the system.
- It is also equipped with state-of-the-art software and tools to facilitate detailed demographic studies.
- **Significance:** The clock will play a pivotal role in advancing our understanding of population trends.
- The new census data research workstation would further strengthen the academic research, policy analysis, and capacity building in population studies.

Thrombotic Thrombocytopenic Purpura (TTP)

- Thrombotic thrombocytopenic purpura (TTP) is a **rare, life-threatening blood disorder** that occurs when blood clots form in small blood vessels throughout the body.
- This can **restrict blood flow to vital organs**, such as the brain, heart, and kidneys, and can cause serious medical problems.
- A recent study published in the journal *Frontiers of Medicine* has found an association between the **inactivated**

COVID19 vaccine CoronaVac and immune thrombotic thrombocytopenic purpura (TTP).

Inactivated vaccine:

- Use viruses or bacteria that have been **killed or rendered non-functional**.
- **How it works:**
 - **Dead pathogens** are identified as **foreign invaders** by the immune system.
 - **Production of antibodies and memory cells** ensures response to future exposures.

Ransomware

- A ransomware is a **type of malware** that **hijacks computer data and then demands payment** (usually in bitcoins) in order to restore it.
- Ransomware can be **traced back to 1989** when the "**AIDS virus**" was used to extort funds from recipients of the ransomware.
- Payments for that attack were made by mail to Panama, at which point a decryption key was also mailed back to the user.
- In 1996, ransomware was known as "**crypto viral extortion**," introduced by Moti Yung and Adam Young from Columbia University.
- Attackers have grown creative over the years by **requiring payments that are nearly impossible to trace**, which helps cybercriminals remain anonymous.
- For example, notorious mobile ransomware **Fusob** requires victims to pay using **Apple iTunes gift cards** instead of normal currencies, like dollars.
- Ransomware attacks began to **soar in popularity with the growth of crypto currencies**, such as Bitcoin.

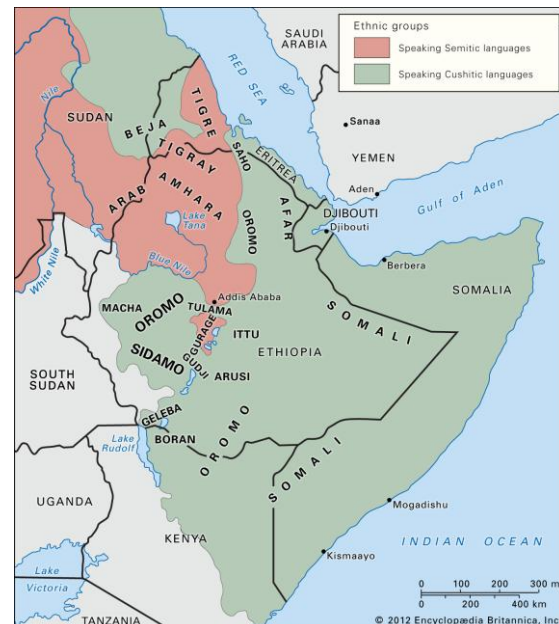
Examples of ransomware:

1. **WannaCry:** A powerful Microsoft exploit was leveraged to create a worldwide ransomware worm that infected over 250,000 systems before a kill switch was tripped to stop its spread.
2. **CryptoLocker:** This was one of the first of the current generation of ransomware that required cryptocurrency for payment (Bitcoin) and encrypted a user's hard drive and attached network drives.
Cryptolocker was spread via an email with an attachment that claimed to be FedEx and UPS tracking notifications.
3. **NotPetya:** Considered one of the most damaging ransomware attacks, NotPetya leveraged tactics from its namesake, Petya, such as infecting and encrypting the master boot record of a Microsoft Windows-based system.
4. **Bad Rabbit:** Considered a cousin of NotPetya and using similar code and exploits to spread, Bad Rabbit was a visible ransomware **that appeared to target** Russia and Ukraine, mostly impacting media companies there. Unlike NotPetya, Bad Rabbit did allow for decryption if the ransom was paid.
5. **REvil:** REvil is authored by a group of financially motivated attackers. It exfiltrates data before it encrypts it so that targeted victims can be blackmailed into paying if they choose not to send the ransom.
6. **Ryuk:** Ryuk is a manually distributed ransomware application mainly used in **spear-phishing**.
7. **Akira:** Designed to encrypt data and create a ransomware note with a unique **.akira** extension appended to encrypted filenames.

Capable of **deleting Windows Shadow Volume copies** and shutting down Windows services to prevent interference during encryption.

Places in News

Horn of Africa



- It is the **easternmost extension** of African land.
- It comprises the countries of **Djibouti, Eritrea, Ethiopia, and Somalia**.
- Part of the Horn of Africa region is also known as the **Somali peninsula**.
- It contains such diverse areas as the highlands of the **Ethiopian Plateau**, the **Ogaden desert**, and the **Eritrean and Somalian coasts** and is home to the **Amhara, Tigra, Oromo, and Somali** peoples, among others.
- **Costal line:** Its coasts are washed by the **Red Sea, the Gulf of Aden, and the Indian Ocean**, and it has long been in contact with the Arabian Peninsula and southwestern Asia.
- The Horn of Africa is **separated from the Arabian Peninsula by the Bab el-Mandeb Strait** (the strait connecting the Red Sea and the Gulf of Aden).

- The region faces severe food insecurity, worsened by the climate crisis and conflict, and malnutrition and cholera are key challenges.

Practice Questions

Q1. With reference to RNA editing, consider the following statements:

1. RNA editing modifies guide RNA (gRNA) to redirect mRNA to different locations.
2. A group of enzymes called Adenosine Deaminase Acting on RNA (ADAR) is used for RNA editing.
3. It has the potential to help cure Huntington's disease.

How many of the above statements is/are correct?

- (a) Only one
- (b) Only two
- (c) All three
- (d) None

Q2. Chonkus, a term recently seen in news, relates to:

- (a) A new cryptocurrency aimed at promoting eco-friendly mining
- (b) An artificial intelligence model for climate prediction
- (c) Newly discovered cyanobacteria with superior carbon absorption capabilities
- (d) A new species of herb found in the Himalayas

Q3. With reference to the recently installed Digital Population Clock in India, consider the following statements:

1. The project has been undertaken by the Ministry of Health and Family Welfare.
2. It provides population figures for the country updated every two seconds.

Which of the above statements is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Q4. The terms "WannaCry, NotPetya and Akira" sometimes mentioned in news are related to:

- (a) Exoplants
- (b) Cryptocurrency
- (c) Cyber attacks
- (d) Mini satellites

Q5. How many of the following countries are situated along the Horn of Africa?

1. Eritrea
2. Sudan
3. Somalia
4. Kenya

Choose the correct answer:

- (a) Only one
- (b) Only two
- (c) Only three
- (d) All four

Answers:

1. (b)
2. (c)
3. (c)
4. (c)
5. (b)