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microRNA: Nobel Prize in Physiology or Medicine

(The Hindu, 08-10-24)

Context: 2023 Nobel Prize in Physiology or Medicine was awarded for the discovery of microRNA and its role in gene regulation.

- Discovered by Victor Ambros and Gary Ruvkun using mutant roundworms (C. elegans)
- Initially thought to be specific to C. elegans, later found in all organisms

What is the four-step process of protein synthesis?

To understand how microRNA works, it's helpful to know how cells use a gene's DNA to make a protein. It happens through a four-step process called protein synthesis.

- **Step 1- Gene Activation:** A cell begins making a protein by activating the gene that contains the information for the protein. A protein called a transcription factor binds with the gene, and this activates it.
- **Step 2 - Gene Transcription:** The DNA for the activated gene opens up, exposing the gene's DNA sequence. The gene's DNA sequence is copied in the form of RNA. This RNA copy of the gene is called messenger RNA, or mRNA.
- **Step 3 – editing of the mRNA:** Unneeded bits of the mRNA are cut out and removed. The remaining, mature, mRNA molecule then leaves the cell nucleus and enters the cell cytoplasm
- **Step 4 – translation:** In the cytoplasm, small structures – molecular machines – called ribosomes attach to the mRNA. The ribosomes begin at one end and move along the mRNA strand, "reading" the sequence of bases (i.e., the copy of the gene). As they do so, they attach amino acids one by one to make a growing chain that becomes the final protein

What is microRNA and how it works?

- **microRNA** (**miRNA**) are small, single-stranded, non-coding RNA molecules containing 21–23 nucleotides.
- Molecules of microRNA are found in cells and in the bloodstream
- microRNA helps cells control the kinds and amounts of proteins they make. That is, cells use microRNA to **help control gene expression.**
  - Gene expression refers to whether a particular gene is making too much, too little or the normal amount of its protein at a particular time.
- microRNA controls gene expression mainly by **binding with messenger RNA (mRNA)** in the cell cytoplasm. Instead of being translated quickly into a protein, the marked **mRNA will be either destroyed and its components recycled**, or it will be preserved and translated later.
- So, if the level of a particular microRNA is underexpressed (its level in the cell is abnormally low), the protein it normally regulates may be overexpressed (its level will be unusually high in the cell);
  - if the microRNA is overexpressed (its level is unusually high), its protein will be underexpressed (its level will be unusually low).

Why is the discovery of miRNA significant?

- The discovery of miRNAs was significant because it revealed a previously unknown mechanism of gene regulation. Before their discovery, it was thought that gene expression was primarily controlled at the level of transcription (the process of making mRNA from DNA). However, miRNAs

showed that gene expression could also be regulated post-transcriptionally (after the mRNA has been made)
- Many diseases, including cancer, heart disease, and neurological disorders, are associated with abnormal miRNA expression
- miRNAs are being investigated as potential therapeutic targets for a variety of diseases

Can you answer the following question?
Discuss the significance of microRNA discovery in our understanding of gene regulation.

Unpacking the Centre's affidavit on marital rape

(The Hindu - 08-10-24)

Context: Centre had filed an affidavit in support of the Marital Rape Exception (MRE) in Indian law.
- MRE states that sexual acts by a man with his wife (18 or older) is not rape
- **Section 375 of IPC**→ "Sexual intercourse or sexual acts by a man with his own wife, the wife not being under 18 years of age, is not rape". This allows the husband to exercise his right to consensual or non-consensual sex with his wife.
- It's being challenged in the Supreme Court of India for potential constitutional violations

What are the main arguments presented by the Centre in support of MRE?
- Marriage creates a "continuing expectation of reasonable sexual access"
- Recognizing marital rape could affect the sanctity of marriage
- Could lead to an increase in divorce rates
- Concerns about potential false allegations and difficulty in disproving them
- Marital rape is a social, not a legal issue
- Non suitability Indian context due to → illiteracy, poverty, social customs

What are the criticisms of India's legal regime on marital rape?
- **Against international norm**→ india is one of the only 36 countries where marital rape is not criminalised
- **Concerns of Implied Consent→** notion implying meaning of marriage to mere sexual consent
- **Against fundamental rights of women**
  - **Article 14**→ discrimination against man and woman, discrimination against married and unmarried woman
  - **Article 21**→ freedom to make choice regarding sexuality
- **Patriarchal outlook of laws**→ considering women as property of men
- **More dangerous form of rape**→ victim has to live with the rapist
- **Colonial hangover in laws** while UK has criminalised marital rape in 1991 itself
- **Violative of UN convention**→ United Nations Declaration on the Elimination of Violence against Women, Beijing declaration

Can you answer the following question?
Critically examine the legal and ethical implications of the Marital Rape Exception in Indian law.