



KAMARAJ IAS ACADEMY
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2024 NOBEL PRIZE IN MEDICINE

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Context:

Scientists Victor Ambros and Gary Ruvkun won the **2024 Nobel Prize in Physiology or Medicine** for the **discovery of microRNA and its role in gene regulation.**

Nobel Prize in Medicine 2024

The Nobel Prize in Physiology or Medicine is **awarded yearly by the Nobel Assembly at the Karolinska Institute for outstanding discoveries in physiology or medicine**

The winners in medicine receive a prize sum of **11 million Swedish crowns (\$1.1 million).**

In 2024, The scientists were honoured for their **“discovery of a fundamental principle governing how gene activity is regulated.”**

Victor Ambros and Gary Ruvkun **discovered microRNA, a new class of tiny RNA molecules that play a crucial role in gene regulation**

Their groundbreaking discovery in the small worm *C. elegans* revealed a completely new principle of gene regulation

This turned out to be **essential for multicellular organisms, including humans. MicroRNAs are proving to be fundamentally important for how organisms develop and function.**

MicroRNA

In **1993, Ambros and Ruvkun** discovered **microRNA**, a new gene regulation mechanism.

MicroRNA can **inhibit the expression of specific genes.**

MicroRNA investigations

Ambros and Ruvkun investigated the ***C. elegans* roundworm**, which possesses cell types like those of larger mammals.

They **targeted the lin-4 and lin-14 genes**, which are **essential for the timing of cell maturation.**

Findings

Ambros discovered that lin-4 inhibited lin-14, although it was not evident how.

Ambros discovered through additional research that **lin-4 generated a non-coding RNA that inhibited the function of lin-14.**

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Ruvkun found that lin-4 prevented the synthesis of lin-14's protein but did not halt the mRNA.

Their combined results demonstrated that through binding to mRNA, microRNAs can regulate gene expression.

The Discovery's Impact

At first, the finding of microRNAs was largely ignored because it was thought to be specific to *C. elegans*.

Ruvkun's finding in 2000 that let-7 microRNA is present in many species, including humans, aroused a great deal of interest.

This led to the identification of hundreds of microRNAs crucial for gene regulation in multicellular organisms.

The Significance of Gene Regulation

Certain genes in cells are activated by gene regulation.

It guarantees that cells carry out their assigned responsibilities efficiently.

Diabetes and cancer are two conditions that can result from improper gene control.

Transcription Factor

Transcription factors are **proteins involved in the process of converting, or transcribing, DNA into RNA. Transcription factors include a wide number of proteins, excluding RNA polymerase, that initiate and regulate the transcription of genes.**

Scientists discovered transcription factors that attach to DNA in the 1960s.

These variables function as on/off switches for genes.

The identification of thousands of transcription factors has improved our knowledge of how genes are regulated.

Many transcription factors, especially some that are **proto-oncogenes or tumor suppressors, help regulate the cell cycle and as such determine how large a cell will get and when it can divide into two daughter cells. One example is the Myc oncogene, which has important roles in cell growth and apoptosis.**

Chromosomes as Toolboxes

Genetic information is carried by chromosomes in DNA.

The genes in every cell are the same, similar to the tools in a toolbox.

Based on their distinct roles, various cells use different genes.