Chemotaxis by E.coli

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In news- Recently, scientists tracked the behaviour of Intestinal Bacteria-E-coli.

Key findings of the study-

- The study was conducted by the scientists from S. N. Bose National Centre for Basic Sciences, an Autonomous Research Institute established under the Department of Science and Technology, Govt. of India.
- They have theoretically shown that there is an optimum size of the receptor clusters at which the **E.coli cell shows the best-directed motion guided by chemical signals received from its environment.**
- To quantify performance, **they measured how fast the cell climbs up the concentration gradient** or **how strongly the cell is able to localize in the nutrient-rich region.**
- According to the team, **good performance also means a strong ability of the cell** to distinguish between nutrient-rich and nutrient-depleted regions in space.
- According to the present study, **as cluster size increases, sensing is enhanced, which improves chemotactic performance**.

The study can improve understanding of chemotactic behavior, particularly of an organism forming the bulk of bacterial samples for experiments owing to its ability to replicate fast and adapt easily to change in its environment. **The new finding will help track behavior of E-Coli bacteria** in response to chemical signals. The response of E-Coli to chemicals in the intestine bacteria plays a crucial role in the functioning of the human intestine

What is Chemotaxis?

- It is the **movement of an organism or entity in response**

to a chemical stimulus.

- Somatic cells, bacteria, and other single-cell or multicellular organisms direct their movements according to certain chemicals in their environment.
- This is important for bacteria to find food (e.g., glucose) by swimming toward the highest concentration of food molecules, or to flee from poisons (e.g., phenol).

- Many organisms in nature respond to the chemical signal received from their environment by showing bodily motion or as chemotaxis.
- White blood cells that are needed for healing injuries find the site of injury or inflammation by chemotaxis.
- Butterflies also track flowers, and male insects reach their targets by using chemotaxis.
- **In multicellular organisms, chemotaxis is critical to early development (e.g., movement of sperm towards the egg during fertilization) and subsequent phases of development** as well as in normal function and health (e.g., migration of leukocytes during injury or infection).

Escherichia coli (E.coli)-

- E. coli is a **Gram-negative, facultative anaerobic, rod-shaped, coliform bacteria of the genus** Escherichia that is commonly found in the **lower intestine of warm-blooded organisms.**
- It is transmitted to humans primarily through consumption of contaminated foods, such as raw or undercooked ground meat products, raw milk, and contaminated raw vegetables and sprouts.
- Most E.coli strains are harmless, but some can cause serious food poisoning.

- **Shiga toxin-producing E. coli (STEC) is a bacterium that can cause severe foodborne disease.**

- **Primary sources of STEC outbreaks are** raw or undercooked

ground meat products, raw milk, and faecal contamination of vegetables.

- In most cases, the illness is self-limiting, but it may lead to a life-threatening disease including haemolytic uraemic syndrome (HUS), especially in young children and the elderly.
- E.coli bacteria show chemotaxis in response to different chemicals present in the human gastrointestinal tract.
- **E. coli cells swim toward amino acids** (serine and aspartic acid), sugars (maltose, ribose, galactose, glucose), dipeptides, pyrimidines and electron acceptors (oxygen, nitrate, fumarate).

E.coli uses its run-and-tumble motion to migrate towards the region with more nutrients.