AR Gene Transfer by Nanoplastics

Why in News?

Recent study shows how discarded PET bottles can exacerbate the global menace of antibiotic resistance.

- **AR Gene transfer** – Antibiotic resistance gene transfer across the species.

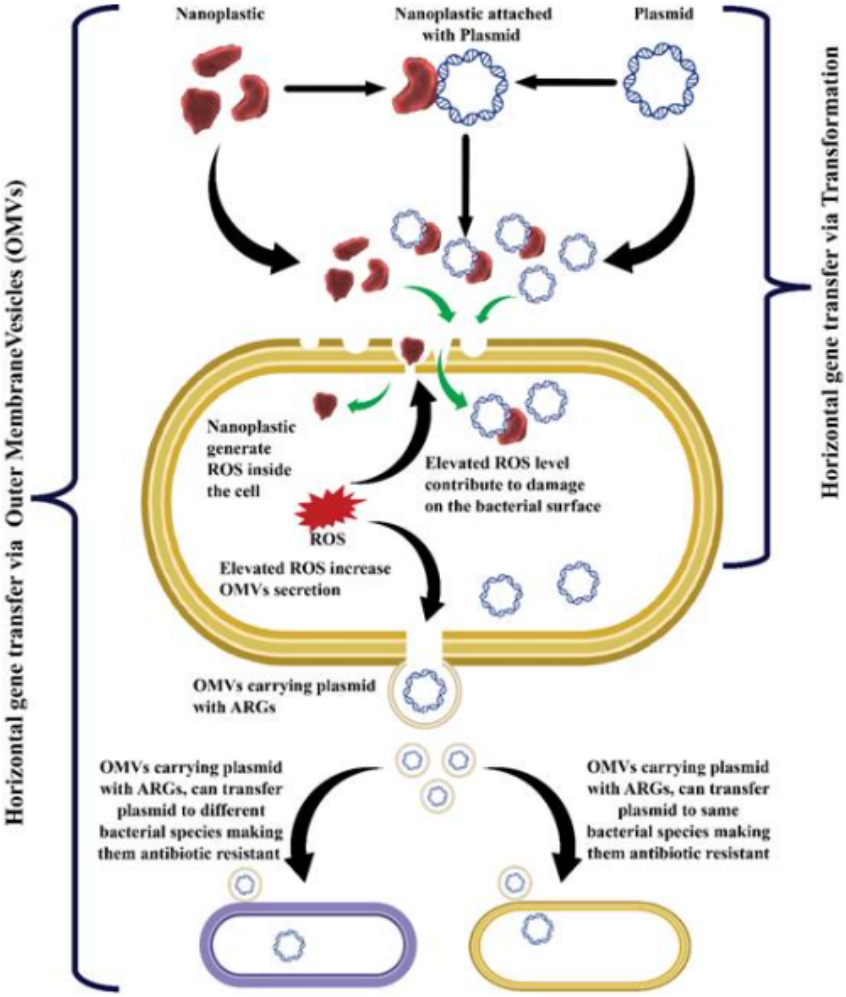
  Antibiotic Resistance (AR) *also known as Antimicrobial Resistance (AMR) occurs when bacteria develop defenses against the antibiotics designed to kill them.*

  Nanoplastics *are a type of microplastic, ranging from 1 nanometre (10^{-9}m) to 1 µm (10^{-6}m).*

- **Nanaoplastics in AR gene transfer** – Polyethylene Terephthalate Bottle-Derived Nano-plastics (*PBNPs*) facilitate the cross-species gene transfer ***from E-coli to Lactobacillus acidophilus***.
- It is done through a process called *horizontal gene transfer (HGT)*.

  E. coli and Lactobacillus acidophilus are a significant bacteria found in human gut microbiota. Protecting beneficial gut bacteria is crucial for immune support, digestion, and disease prevention.

- **2 novel Mechanism** – PBNPs facilitate AR gene transfer by
  - Direct transformation pathway
  - OMV-induced transfer pathway
- **Direct transformation pathway** – PBNPs act as *physical carriers, transporting AR plasmids* across bacterial membranes and promoting direct gene transfer between bacteria.
- **OMV-induced transfer pathway** – PBNPs *induce oxidative stress and damage to bacterial surfaces*, which activates the stress response genes and triggers an increase in OMV secretion.
- The OMV loaded with genes AR, becomes a potent vector for gene transfer across bacterial species.



- **Health impacts** – Lactobacillus acidophilus could act as reservoirs for AR genes, potentially *transferring them to pathogenic bacteria* during the course of infections.

Reference

The Hindu Business Line| Nano-plastics Contribution to AMR

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