Increasing Efficacy of Antibiotics

For Prelims: AMR

For Mains: AMR, Health

Why in News?

Recently, Scientists have developed **a new approach to revitalise the efficacy of existing antibiotics.**

What are the Findings?

- Scientists **used antibiotics in combination with antibiotic adjuvants** -- ingredients that can help counter resistance to existing antibiotics.
    - Antibiotic adjuvants are **nonantibiotic compounds that enhance antibiotic activity** either by blocking resistance or by boosting the host response to infection.
- The Scientists incorporated **cyclic hydrophobic moieties (portion of a molecule) in a triamine-containing compound,** the adjuvants thus developed, weakly perturbed the membrane of bacteria.
    - **Resistance to antibiotics occurs through a variety of molecular mechanisms,** including decreased drug permeability, active efflux, alteration or bypass of the drug target, production of antibiotic-modifying enzymes, and physiological states such as biofilms that are less susceptible to antibiotic activity.
    - Triamine: A compound containing three amino groups.
    - Hydrophobic Moieties: These are water fearful and they will not dissolve in water.
    - Cyclic: A molecule is cyclic if its atoms form a ring structure.
- It resulted in **countering of membrane-associated resistance elements like permeability barrier and expulsion of antibiotics** by efflux pumps.
    - The efflux pumps lower the intracellular antibiotic concentration, allowing bacteria to survive at higher antibiotic concentrations.
- When these adjuvants are used in combination with antibiotics that had been rendered ineffective due to such membrane-associated resistance elements, **the antibiotics are potentiated,** and the combination is **effective in killing bacteria.**

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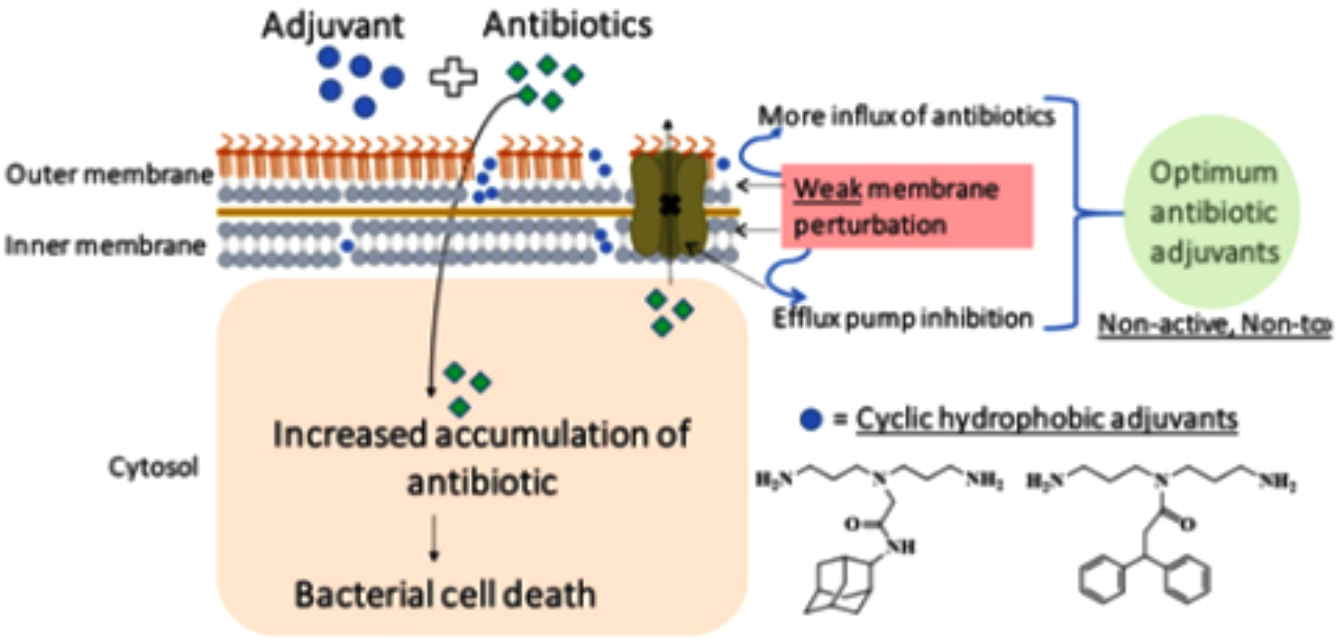

What is the significance of the Study?

- This strategy can **combat the most critical group of bacteria enabling the existing antibiotic arsenal** to be used again for complicated infections. It can help counter the rising menace of **Antimicrobial Resistance (AMR).**
- It can **help strengthen the activity of obsolete antibiotics** and bring them back into use for treating complicated infections.

What are Antibiotics and Drug Resistance?

- **Antibiotics:**
  - Antibiotics are **remarkable drugs capable of killing biological organisms** in one's body without harming the body.
  - These are used for everything from **preventing infections during surgeries to protecting cancer patients undergoing chemotherapy.**
    - India is **the world's largest consumer of antibiotics**. India's excessive antibiotic usage is leading to a powerful never before seen mutation within bacteria.
- **Drug Resistance:**
  - Drug resistance happens when **one overuses antibiotics in the treatment of humans,** animals as well as plants.
    - When a new antibiotic is introduced, it can have great, even lifesaving results but only for some time. After that, the bacteria adapts and gradually the antibiotics become less effective.
  - Antibiotic resistance **has the potential to affect people at any stage** of life. When a person is infected with antibiotic resistant bacteria, not only the treatment of that patient becomes difficult, but antibiotic resistant bacteria may spread to other people as well.
  - When antibiotics do not work, **the situation may lead to more complicated diseases,** the use of stronger and expensive drugs and gradually more deaths caused by bacterial infections.
  - The spread of antibiotic resistance worldwide is **undermining decades of progress in fighting bacterial infections.**

What are the Initiatives Related to Drug Resistance?

- **India:**
  - **National Programme on AMR containment:** Launched in 2012. Under this programme,

AMR Surveillance Network has been strengthened by establishing labs in State Medical College.
    - **National Action Plan on AMR:** It focuses on **One Health approach** and was launched in April 2017 with the aim of involving various stakeholder ministries/departments.
    - **AMR Surveillance and Research Network (AMRSN):** It was launched in 2013, to generate evidence and capture trends and patterns of drug resistant infections in the country.
    - **AMR Research & International Collaboration: Indian Council of Medical Research (ICMR)** has taken initiatives to develop new drugs /medicines through international collaborations in order to strengthen medical research in AMR.
    - **Antibiotic Stewardship Program:** ICMR has initiated antibiotic stewardship program (AMSP) on a pilot project across India to control misuse and overuse of antibiotics in hospital wards and ICUs.
- **Global:**
    - **World Antimicrobial Awareness Week (WAAW)**:
        - Held annually since 2015, WAAW is a **global campaign that aims to raise awareness of antimicrobial resistance worldwide** and encourage best practices among the general public, health workers and policy makers to slow the development and spread of drug-resistant infections.
    - **The Global Antimicrobial Resistance and Use Surveillance System (GLASS):**
        - WHO launched the GLASS in 2015 to continue filling knowledge gaps and to inform strategies at all levels.
        - GLASS has been conceived to progressively incorporate data from surveillance of AMR in humans, surveillance of the use of antimicrobial medicines, AMR in the food chain and in the environment.

UPSC Civil Services Examination, Previous Year Questions (PYQ)

Prelims

Q. Which of the following are the reasons for the occurrence of multi-drug resistance in microbial pathogens in India? (2019)

1. Genetic predisposition of some people
2. Taking incorrect doses of antibiotics to cure diseases
3. Using antibiotics in livestock farming
4. Multiple chronic diseases in some people

Select the correct answer using the code given below.

(a) 1 and 2
(b) 2 and 3 only
(c) 1, 3 and 4
(d) 2, 3 and 4

Ans: (b)

Mains

Q. Can overuse and free availability of antibiotics without Doctor’s prescription, be contributors to the emergence of drug-resistant diseasesin India? What are the available mechanismsfor monitoring and control? Critically discuss the various issues involved. **(2014)**

Source: PIB