

Polycyclic Aromatic Hydrocarbons (PAHs)

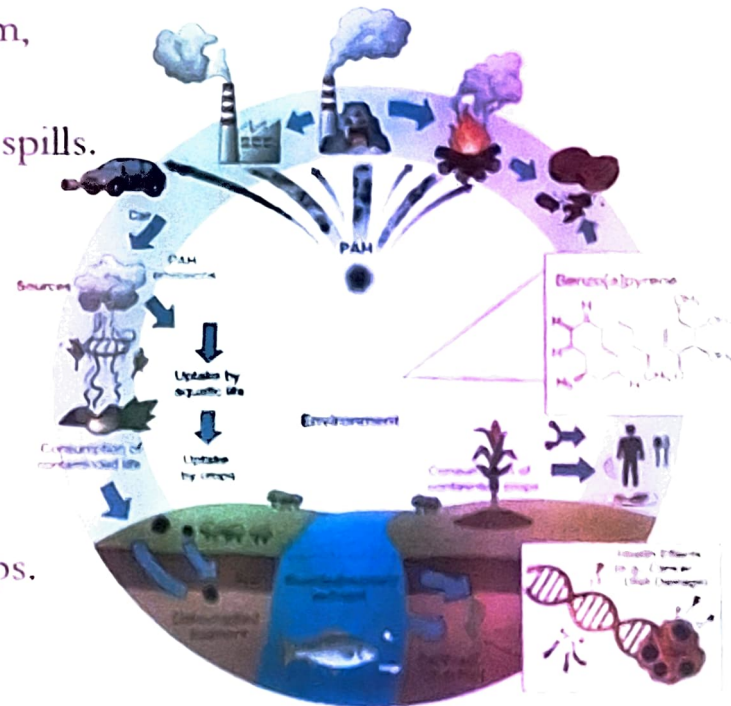
✓ Organic compounds containing **two or more fused aromatic rings**, highly hydrophobic and persistent.

✓ Sources:

- Incomplete combustion of coal, petroleum, wood, tobacco, biomass.
- Vehicle exhausts, industrial emissions, oil spills.
- Charred or grilled food.

✓ Environmental Fate:

- Strongly adsorb onto soil/sediment particles.
- Persistent, undergo slow microbial degradation.
- Can enter the food chain via fish and crops.



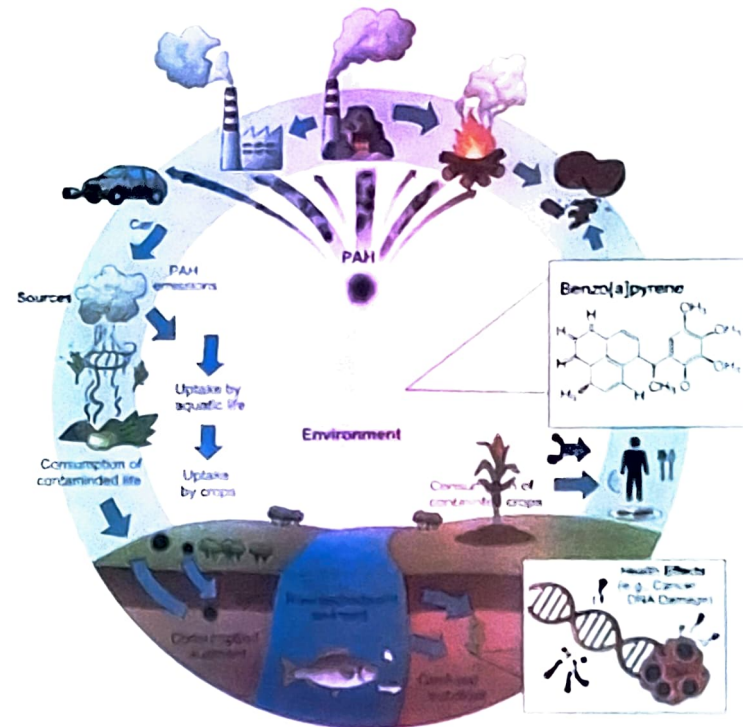
Polycyclic Aromatic Hydrocarbons (PAHs)

✓ Health Impacts:

- Many PAHs (benzo[a]pyrene, anthracene) are **carcinogenic, mutagenic, teratogenic**.
- Chronic exposure → lung, skin, bladder cancers; DNA damage.

✓ Environmental Effects:

- Toxic to aquatic life, bioaccumulate in organisms.
- Contribute to smog and particulate matter.

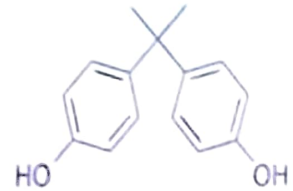


Endocrine Disrupting Chemicals (EDCs)

✓ Exogenous chemicals that interfere with the **endocrine (hormonal) system** in humans and wildlife.

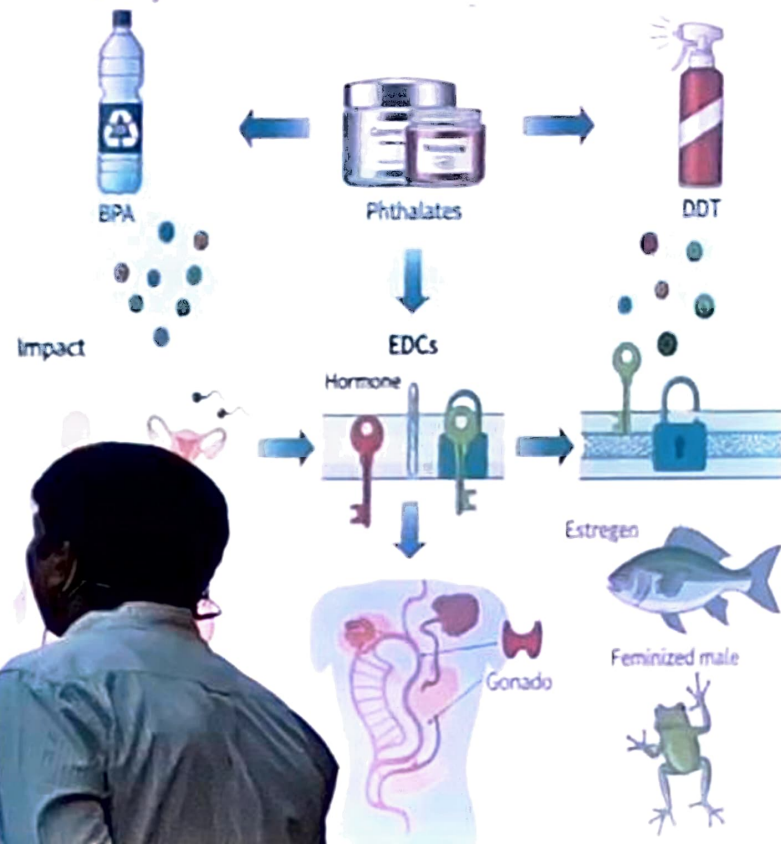
✓ Examples:

- **Bisphenol A (BPA)**: Used in plastics, epoxy resins, food containers.
- **Phthalates**: Plasticizers in PVC, cosmetics, toys.
- Others: pesticides, parabens, certain flame retardants.



✓ Mechanism:

- Mimic natural hormones (estrogen, androgens, thyroid hormones).
- Block or alter hormone receptor binding.
- Disrupt hormone synthesis, transport, or metabolism.



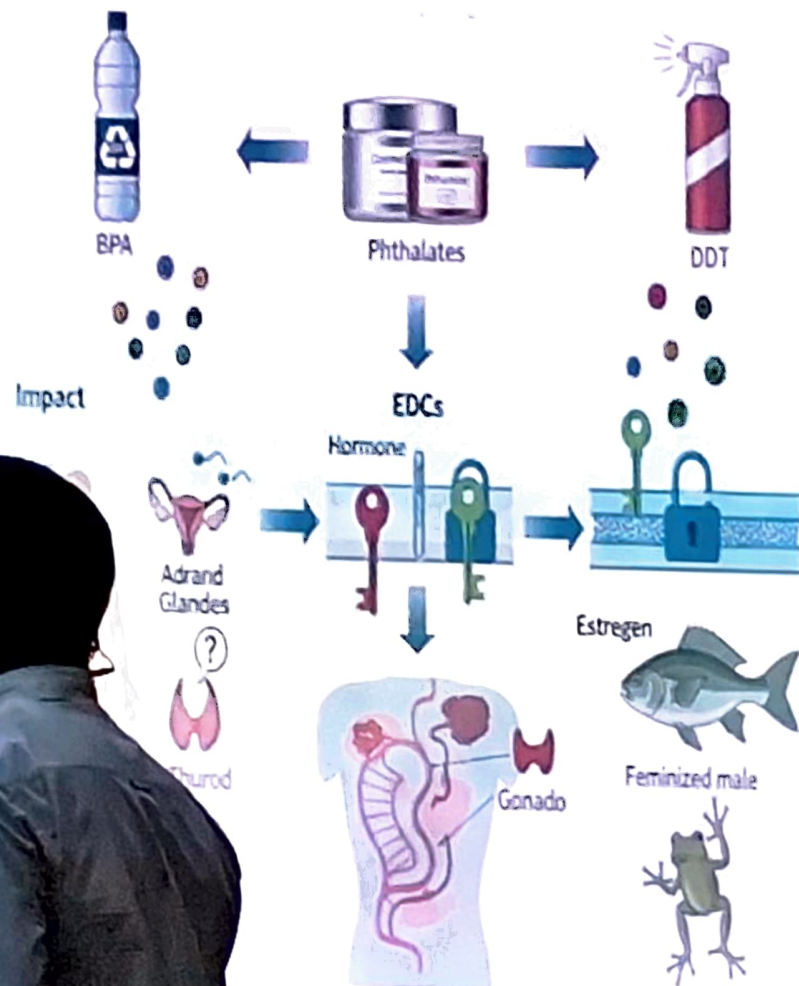
Endocrine Disrupting Chemicals (EDCs)

✓ Health Impacts:

- Reproductive disorders, reduced fertility, developmental issues.
- Early puberty, obesity, thyroid dysfunction.
- Links to hormone-sensitive cancers (breast, prostate).

✓ Ecological Impacts:

- Feminization of fish (male fish producing eggs).
- Reproductive decline in amphibians, birds, reptiles.



Pharmaceutical & Personal Care Products (PPCPs)

✓ Group of emerging contaminants including drugs, veterinary medicines, and cosmetic ingredients.

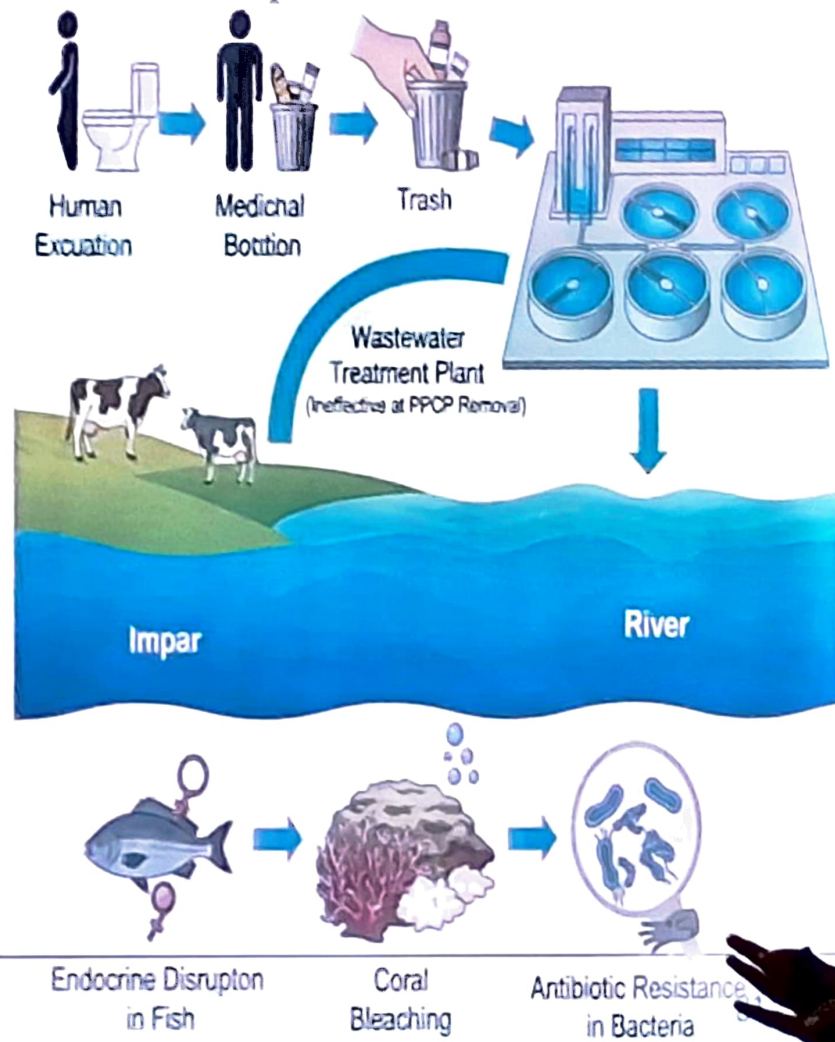
✓ Examples:

- **Pharmaceuticals:** Antibiotics, painkillers, antidepressants, hormones (contraceptives).

- **Personal Care Products:** Sunscreens (oxybenzone), fragrances, shampoos, lotions, cosmetics.

✓ Sources:

- Excretion by humans/animals → sewage systems.
- Improper disposal of unused medicines.
- Runoff from agricultural use of veterinary drugs.



Pharmaceutical & Personal Care Products (PPCPs)

✓ Environmental Fate:

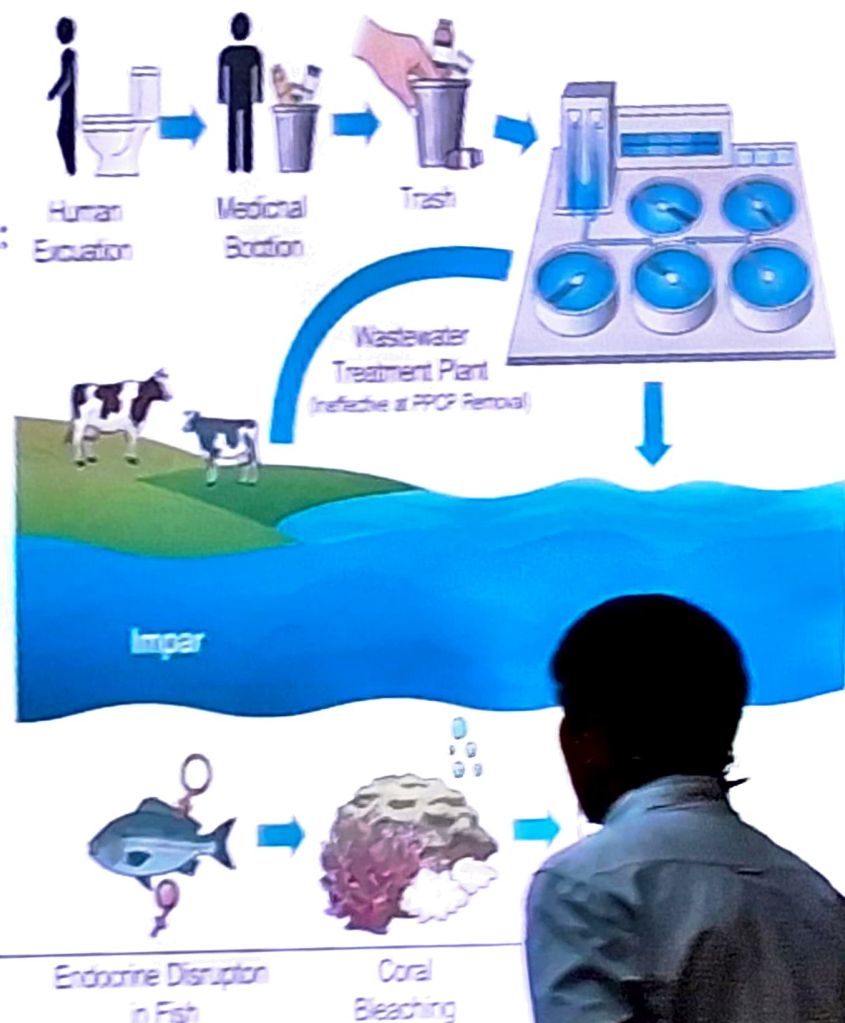
- Many are poorly biodegradable.
- Persist in wastewater, rivers, and groundwater.
- Detected in trace levels (ng- μ g/L) but widespread ("pseudo-persistent").

✓ Impacts:

- Antibiotics: Promote antimicrobial resistance in bacteria.
- Hormones (e.g., ethinyl estradiol): Cause feminization of fish, intersex conditions.
- UV filters & fragrances: Toxic to aquatic organisms, coral bleaching.

✓ Health Concerns:

- Bioaccumulation in food chain.
- Chronic low-level exposure
→ potential endocrine disruption, allergies, skin irritation.



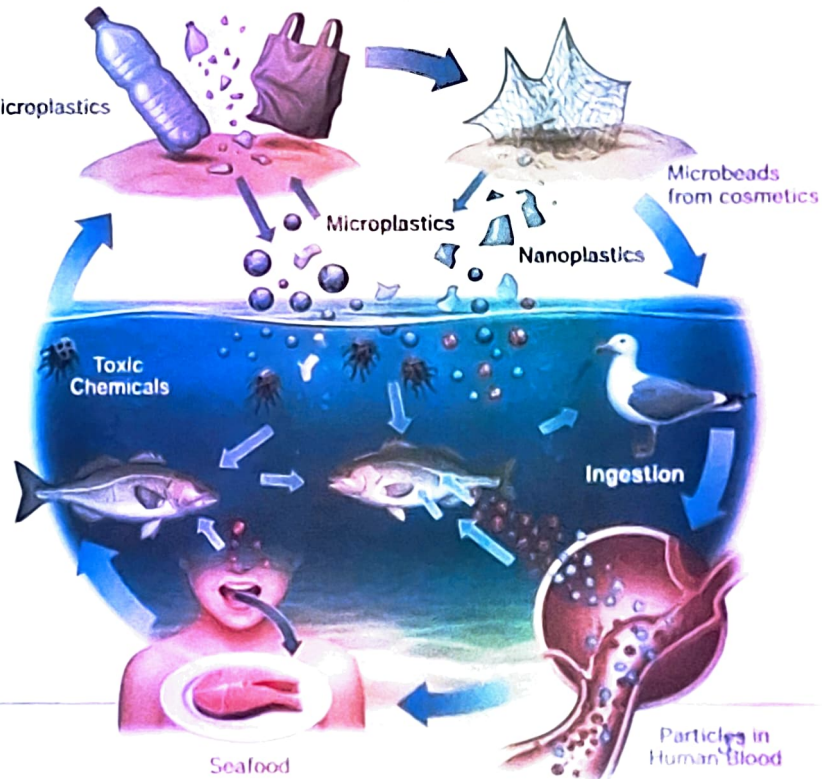
Microplastics & Nanoplastics

✓ Definition

- Microplastics: plastic fragments $< 5 \text{ mm}$
- Nanoplastics: particles $< 1 \mu\text{m}$
- Formed by degradation of larger plastics or manufactured (e.g., microbeads)

✓ Sources

- Primary: microbeads in cosmetics, toothpaste, industrial abrasives
- Secondary: breakdown of bottles, bags, fishing nets, tire wear, synthetic fibers



Microplastics & Nanoplastics

✓ Environmental Fate

- Persistent & non-biodegradable → fragment into smaller pieces
- Accumulate in oceans, rivers, sediments
- Adsorb toxic chemicals (pesticides, PCBs, heavy metals)

✓ Impacts

- Ingested by fish, seabirds
→ starvation, reproductive issues
- Enter human food chain via seafood & drinking water
- Found in human blood and placenta
- Potential health risks:
inflammation, endocrine disruption,
chemical transport

