Lec4 \ Microbial biotransformation

قسم علوم التقنيات الاحيائية الطبية
المرحلة الاولى

اعداد

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الايميل :

رمز الصف :

Microbial biotransformation

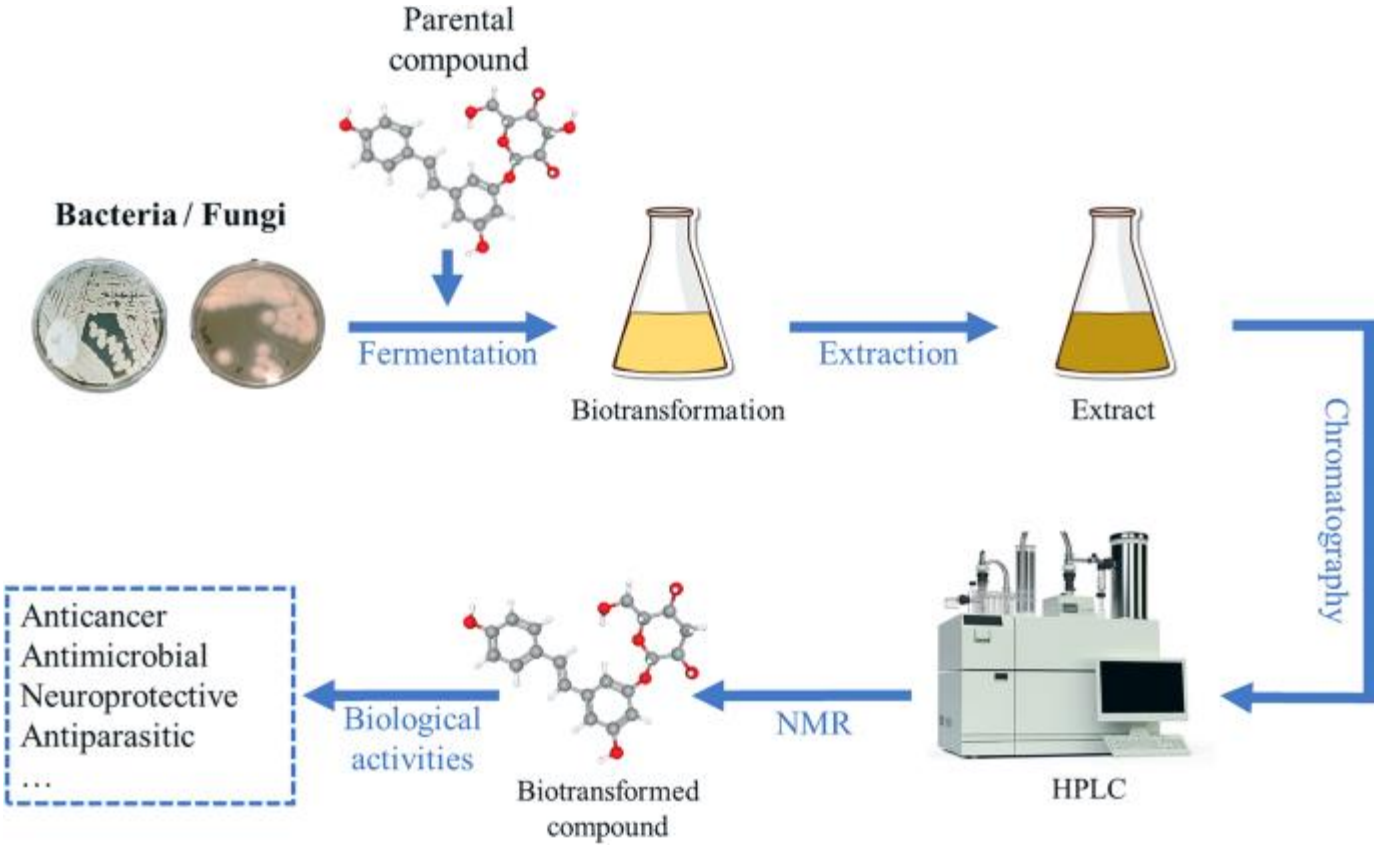
Microbial biotransformation involves using microorganisms to convert one compound into another, often to produce high-value chemicals, drugs, or metabolites that would be difficult to synthesize through traditional chemical methods.

- **Steroid transformation: Microorganisms like Rhodococcus رودوكوكوس are used for the biotransformation of steroids to produce pharmaceutical intermediates.**

لماذا تُفضَّل التحولات الستيرويدية الميكروبية على الطرق الكيميائية التقليدية في صناعة الأدوية؟

applications of microbial biotransformation

- Transformation of steroids and sterols.
- Transformation of Pollutants.
- Transformation of Non-Steroid Compounds.
- Transformation of Antibiotics.
- Transformation of Pesticides.
- Petroleum Biotransformation


Parental compound
Bacteria / Fungi
Fermentation
Biotransformation
Extraction
Extract
Chromatography
HPLC
NMR
Biotransformed compound
Biological activities
Anticancer
Antimicrobial
Neuroprotective
Antiparasitic
…

Biofuel and Bioremedation

- The material of plants and animals, including their wastes and residues ,is called biomass.

- **called biomass** :It is organic, carbon-based, material that reacts with oxygen in combustion and natural metabolic processes to release heat. Such heat, especially if at temperatures >400 C, may be used to generate work and electricity

Biofuel and Bioremedation

- **Biofuels**: Microbial biotechnology plays a significant role in the production of bioethanol, biodiesel, and biohydrogen as renewable energy sources.

Example: *Saccharomyces* cerevisiae (yeast) is used for ethanol production from sugars.

- **Bioremediation المعالجة الحيوية**: Microorganisms are used to break down or detoxify environmental pollutants such as oil spills, heavy metals, and organic pollutants.

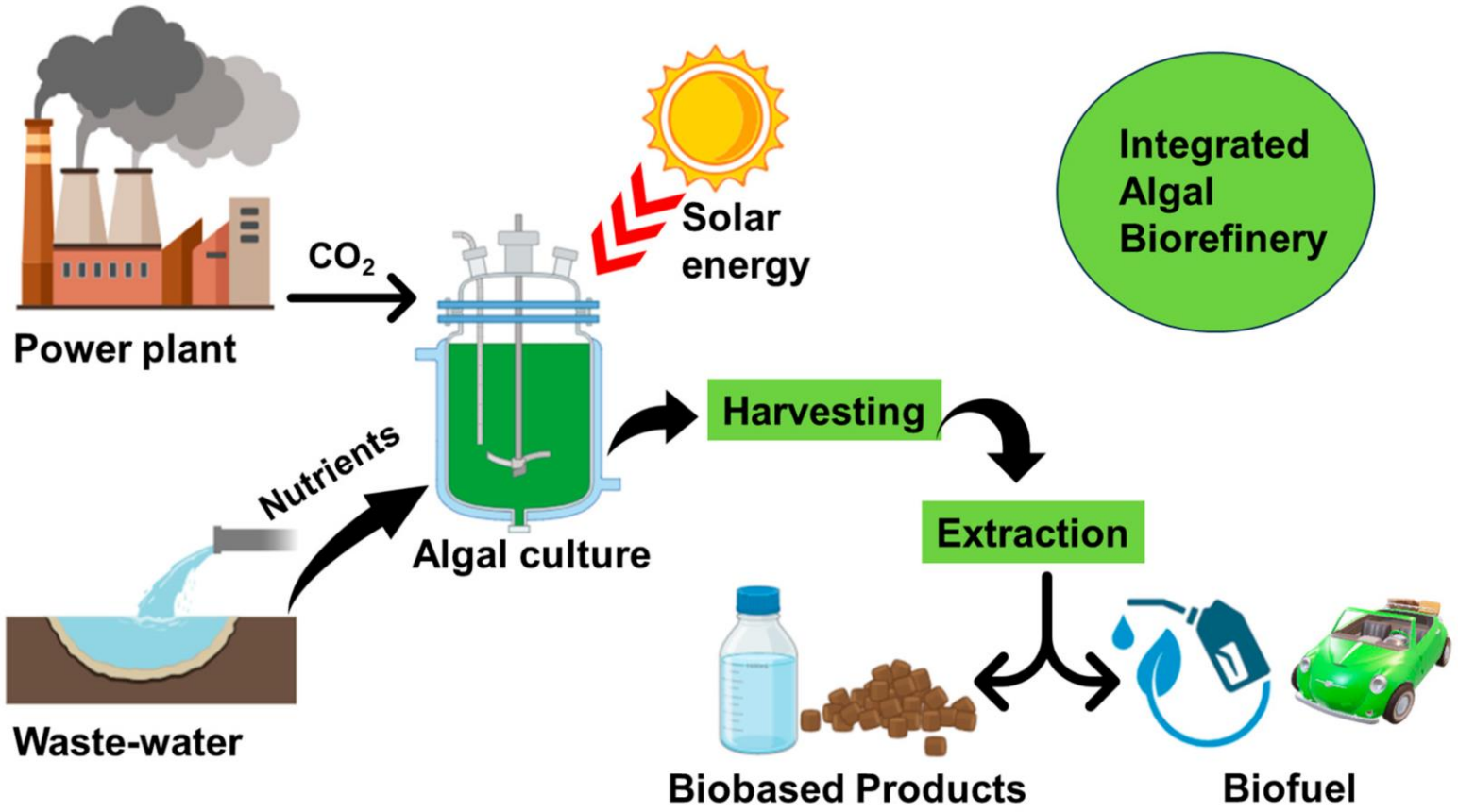
Example, certain types of *Pseudomonas* bacteria can break down hydrocarbons in oil-contaminated soil.يمكن لأنواع بكتيريا الزائفة تحليل الهيدروكربونات في التربة الملوثة بالنفط

Applications of Microbial Biotechnology:

a-Pharmaceuticals :

Microbial biotechnology has revolutionized the production of antibiotics, vaccines, and other biopharmaceuticals.

- **Antibiotics: Microorganisms like *Streptomyces* species produce a variety of antibiotics, including penicillin and tetracycline.**
- **Vaccines: Recombinant microorganisms are used to produce vaccines against diseases like hepatitis and influenza.**


Integrated Algal Biorefinery
Power plant
CO_2
Solar energy
Nutrients
Waste-water
Algal culture
Harvesting
Extraction
Biobased Products
Biofuel

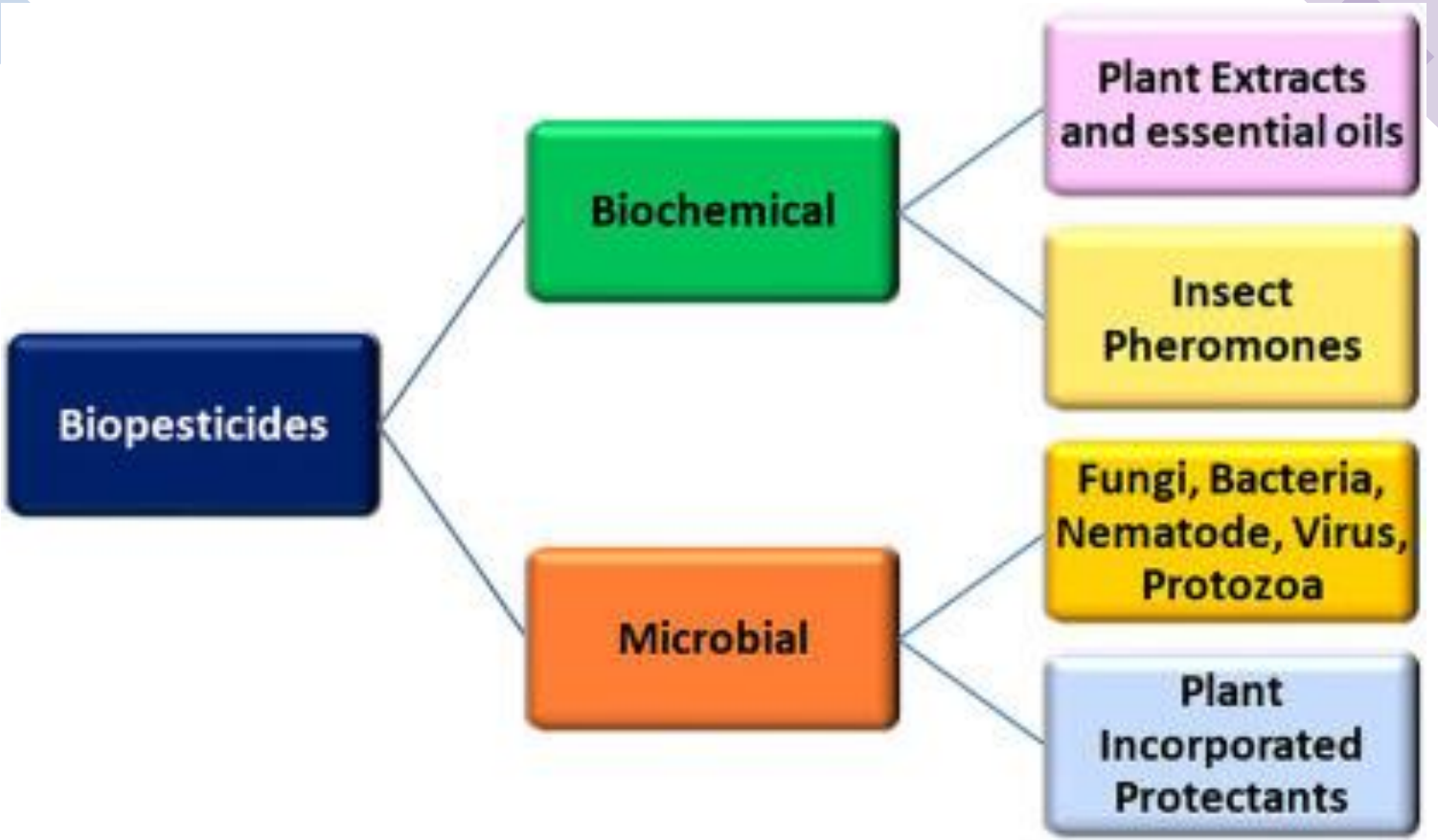
Applications of Microbial Biotechnology:

b- Agricultural Biotechnology :

Microbial biotechnology helps in enhancing agricultural productivity through biological control, nitrogen fixation, and biopesticides.

- **Biofertilizers الأسمدة الحيوية** : **Certain bacteria like *Rhizobium* الريزوبيوم help in fixing atmospheric nitrogen, promoting plant growth.**
- **Biopesticides المبيدات الحيوية** : ***Bacillus*** **thuringiensis produces proteins toxic to insect pests, reducing the need for chemical pesticides.**


CO_2
N
P
K


Biopesticides
Biochemical
Plant Extracts and essential oils
Insect Pheromones
Microbial
Fungi, Bacteria, Nematode, Virus, Protozoa
Plant Incorporated Protectants

Applications of Microbial Biotechnology:

c-Food and Beverage Industry:

Microbial biotechnology is fundamental in food fermentation processes that produce products like cheese, yogurt, bread, beer, and wine. Microorganisms such as *Lactobacillus* and *Saccharomyces* cerevisiae are commonly used.

Applications of Microbial Biotechnology:

d. Environmental Biotechnology:

Microbial biotechnology plays a crucial role in environmental conservation through waste treatment, bioremediation, and bioenergy production.

- **Wastewater treatmentمعالجة مياه الصرف الصحي : Microorganisms break down organic matter in sewage to reduce environmental pollution.**
- **Carbon sequestrationعزل الكربون : Microorganisms like algae are explored for their potential in capturing atmospheric CO2.**

Challenges and Future Directions

- **Strain improvement تحسين السلالات**: There is always a need for better microbial strains that can increase product yield and reduce by-products.
- **Safety concerns مخاوف السلامة**: Genetically modified organisms (GMOs) must be carefully monitored to avoid unintended consequences.
- **Cost-effectiveness فعالية التكلفة:** Scale-up processes for microbial biotechnology can be expensive. Efforts are ongoing to improve efficiency and reduce costs.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قادرا على تحقيق
النجاح