

Ministry of Higher Education
Salahaddin University-Erbil
Field Crops and Medicinal Plants Department



Production site of plant natural products

Third Grade

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Lecture 4



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Production site of plant natural products

Plant natural products are synthesized within various cellular structures and tissues of plants. The biosynthesis of these compounds occurs primarily in specialized plant cells and organelles. Here are some key locations where plant natural products are synthesized:



Production site of plant natural products

1. Chloroplasts: Chloroplasts are organelles responsible for photosynthesis in plant cells. Some natural products, particularly terpenes and terpenoids, are synthesized in chloroplasts using the precursors produced during photosynthesis.

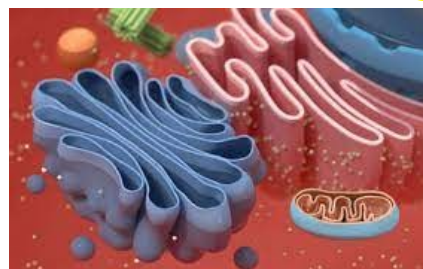


2. Cytoplasm: Several biosynthetic pathways for plant natural products take place in the cytoplasm of plant cells. These pathways involve enzymes and precursors that are present in the cytoplasm.

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Production site of plant natural products

3. Endoplasmic Reticulum (ER): The endoplasmic reticulum is involved in the synthesis of various lipophilic natural products, including certain terpenes and alkaloids. The ER provides a site for enzymatic reactions and lipid metabolism.



4. Golgi Apparatus: The Golgi apparatus plays a crucial role in modifying and packaging natural products before they are transported to their final destinations within the plant cell or for export outside the cell.



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Production site of plant natural products

5. Vacuoles: Vacuoles are membrane-bound organelles in plant cells that can store a variety of compounds, including natural products. Some compounds, like anthocyanins responsible for the color of flowers and fruits, are stored in vacuoles.



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6. Specialized Secretory Structures: Some plant species have specialized secretory structures like glandular trichomes, resin ducts, and secretory cavities. These structures store and secrete natural products, especially those involved in defense mechanisms.

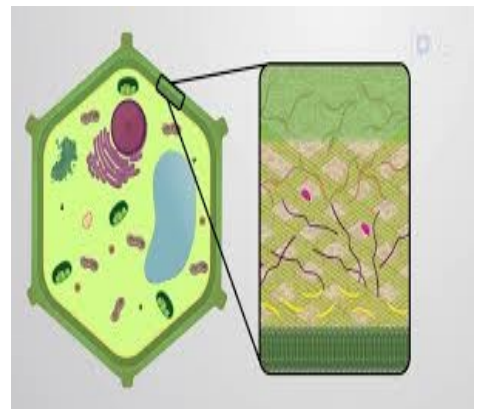
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Production site of plant natural products

7. Cell Wall: Certain compounds, such as lignin and cell wall-bound phenolic compounds, are integrated into the plant cell wall. These compounds contribute to the structural integrity and defense of plant cells.

8. Specific Tissues and Organs: Natural products can be synthesized in specific tissues or organs of plants. For example, alkaloids like nicotine are produced in the roots of tobacco plants, while essential oils rich in terpenes are synthesized in the glandular trichomes of mint leaves.



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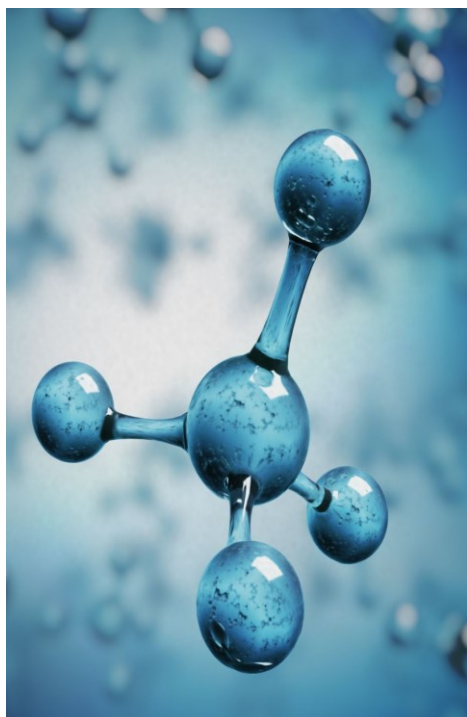
Production site of plant natural products

9. Seed Endosperm and Embryo: Some natural products are stored in the endosperm and embryo of seeds. These compounds may serve as reserves for the developing seedling.

10. Roots, Leaves, Stems, and Flowers: Different plant parts may synthesize and store specific natural products. For instance, alkaloids are often found in roots, while essential oils are more commonly produced in leaves and flowers.



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Chemistry of Plant Natural Products



- The chemistry of plant natural products is a diverse and complex field that involves the study of the chemical compounds produced by plants.
- These compounds are essential for various biological functions in plants and often have important ecological and pharmacological roles. Here are some key aspects of the chemistry of plant natural products:

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Chemistry of Plant Natural Products

Structural Diversity: Plant natural products encompass an extensive range of chemical structures.

- They can be classified into various chemical classes based on their structural features, including alkaloids, terpenoids, phenolics, polyketides, and peptides. Each class has distinct structural characteristics.



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Chemistry of Plant Natural Products

Alkaloids: Alkaloids are a class of nitrogen-containing compounds found in plants. They often have pronounced pharmacological effects and include well-known examples like caffeine, nicotine, and morphine.



Ricine

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Chemistry of Plant Natural Products

- **Terpenoids:** Terpenoids are derived from isoprene units and have diverse structures and functions.
- They include monoterpenes (e.g., limonene), sesquiterpenes (e.g., β -caryophyllene), and diterpenes (e.g., taxol).



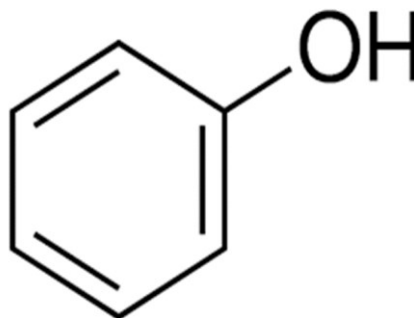
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Chemistry of Plant Natural Products

- **Phenolics:**

Phenolic compounds contain an aromatic ring with one or more hydroxyl groups. They include flavonoids, phenolic acids, and lignans. These compounds are known for their antioxidant properties.



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Chemistry of Plant Natural Products

- **Polyketides:**

Polyketides are synthesized through the condensation of acyl-CoA precursors and are involved in the production of various compounds, including antibiotics (e.g., erythromycin) and toxins (e.g., aflatoxins).



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Chemistry of Plant Natural Products

- **Biological Activities:**

Many plant natural products have diverse biological activities, such as antimicrobial, anti-inflammatory, antioxidant, and anticancer properties. These compounds often serve as defense mechanisms against pests and diseases.



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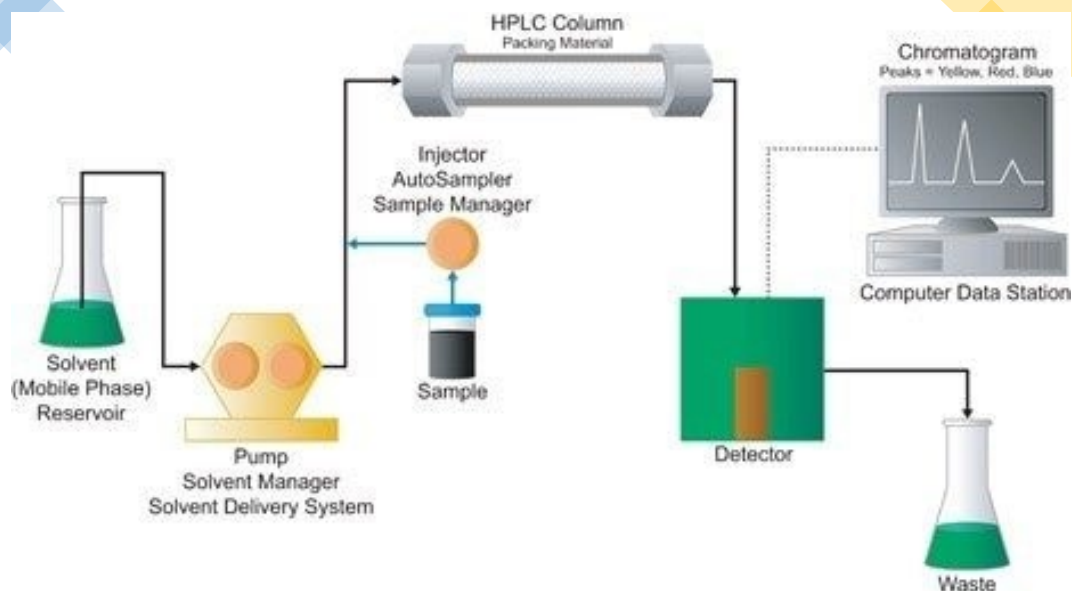
Chemistry of Plant Natural Products

• Analytical Techniques:

The study of plant natural products involves various analytical techniques, including nuclear magnetic resonance (NMR) spectroscopy, mass spectrometry (MS), and chromatography, for compound identification and characterization.



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Chemistry of Plant Natural Products

Drug Discovery:

Plant natural products have historically been a source of inspiration for drug discovery and the development of pharmaceuticals.

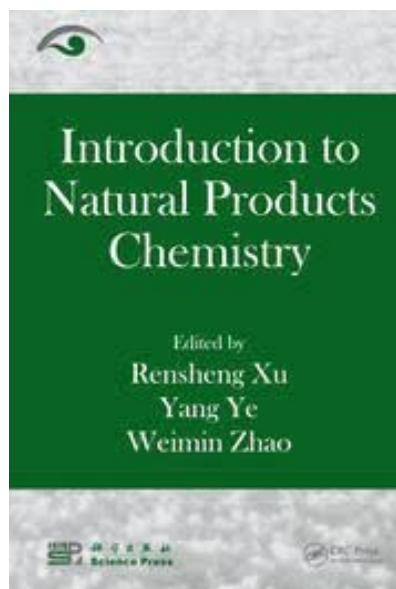
Many drugs, such as aspirin and quinine, have their origins in plant compounds.



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Reference



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