



PHYTOCHEMICALS: THE CHEMICAL COMPONENTS OF PLANTS



Phytochemicals

- the individual chemicals from which plants are made.
 - Of the roughly 350,000 species of plants believed to exist
 - one-third of those have yet to be discovered.
 - Of the quarter million that have been reported, only a fraction of them have been chemically investigated
- 



Phytochemicals

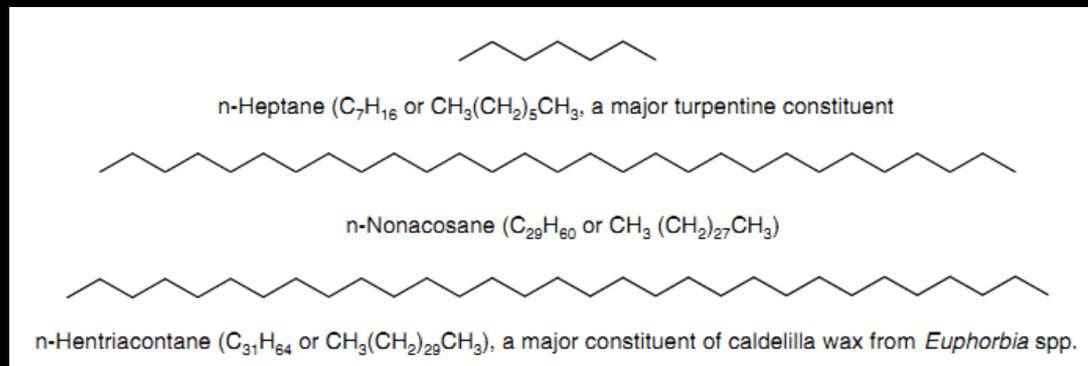
- Lipids and Derivatives
 - Aromatics
 - Carbohydrates
 - Amines and Alkaloids
 - Amino Acids, Nonprotein Amino Acids, and Proteins
 - Nucleic Acids, Nucleotides, and Nucleosides
- 

Lipids and Derivatives

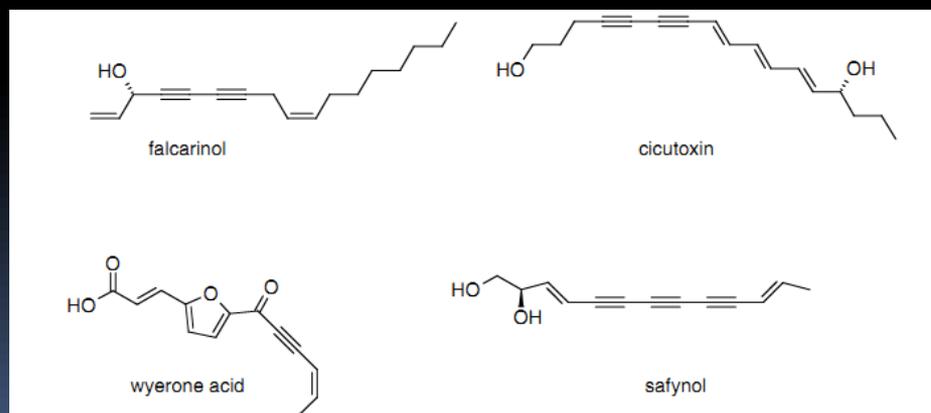
- Hydrocarbons
 - Saturated Hydrocarbons
 - Unsaturated Hydrocarbons
- Functionalized Hydrocarbons
 - Halogenated Hydrocarbons
 - Alcohols
 - Sulfides and Glucosinolates
 - Aldehydes and Ketones
 - Esters
 - Fatty Acids
- Terpenes
 - Hemiterpenes: C₅
 - Monoterpenes: C₁₀
 - Sesquiterpenes: C₁₅
 - Diterpenes: C₂₀
 - Triterpenes: C₃₀
 - Tetraterpenes: C₄₀ .

Hydrocarbons

□ Saturated Hydrocarbons

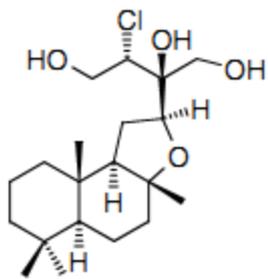


□ Unsaturated Hydrocarbons

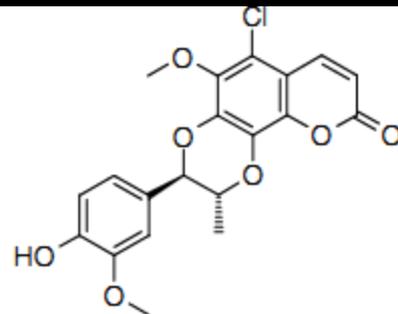


Functionalized Hydrocarbons

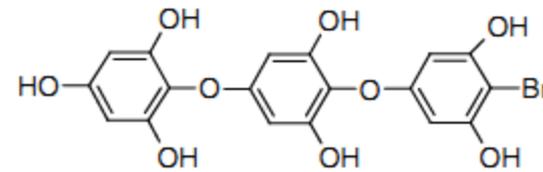
- Halogenated Hydrocarbons
 - A halogen is any of the group 7A elements found on the periodic table of elements (fluorine, chlorine, bromine, iodine, or astatine)
- Alcohols
 - An alcohol can be any of a class of compounds characterized by the presence of a hydroxyl group ($-OH$ group) covalently bonded to a saturated carbon atom
- Sulfides and Glucosinolates
 - Hydrocarbon sulfides have at least one sulfur atom and are found in relatively few plants. Those that contain them, such as skunk cabbage (*Symplocarpus foetidus*)
- Aldehydes and Ketones
 - Aldehydes are any of a class of compounds characterized by the presence of a carbonyl group ($C=O$ group) in which the carbon atom is bonded to at least one hydrogen atom. Ketones, on the other hand, are compounds where the carbon atom of the carbonyl group is bonded to two other carbon atoms
- Esters
 - Esters are any class of compounds structurally related to carboxylic acids but in which the hydrogen atom in the carboxyl group ($-COOH$ group) was replaced by a hydrocarbon group, resulting in a $-COOR$ structure (where R is the hydrocarbon).
- Fatty Acids
 - The essential fatty acids — linoleic acid and α -linolenic acid — cannot be synthesized de novo by humans



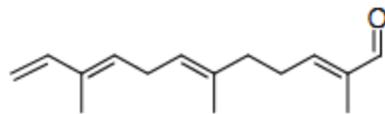
chlorosilphanol A



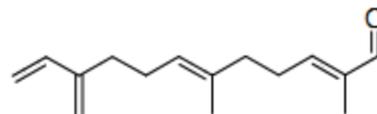
5-chloropropacin



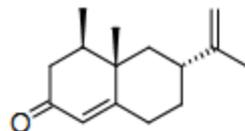
bromotriphloroethol A₂



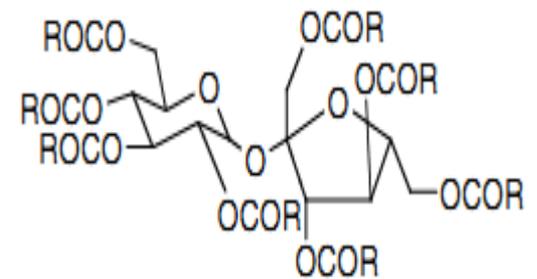
α -sinensal



β -sinensal



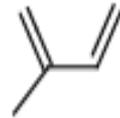
olestra



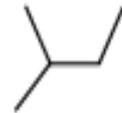
Terpenes

- Hemiterpenes: C₅
- Monoterpenes: C₁₀
- Sesquiterpenes: C₁₅
- Diterpenes: C₂₀
- Triterpenes: C₃₀
- Tetraterpenes: C₄₀

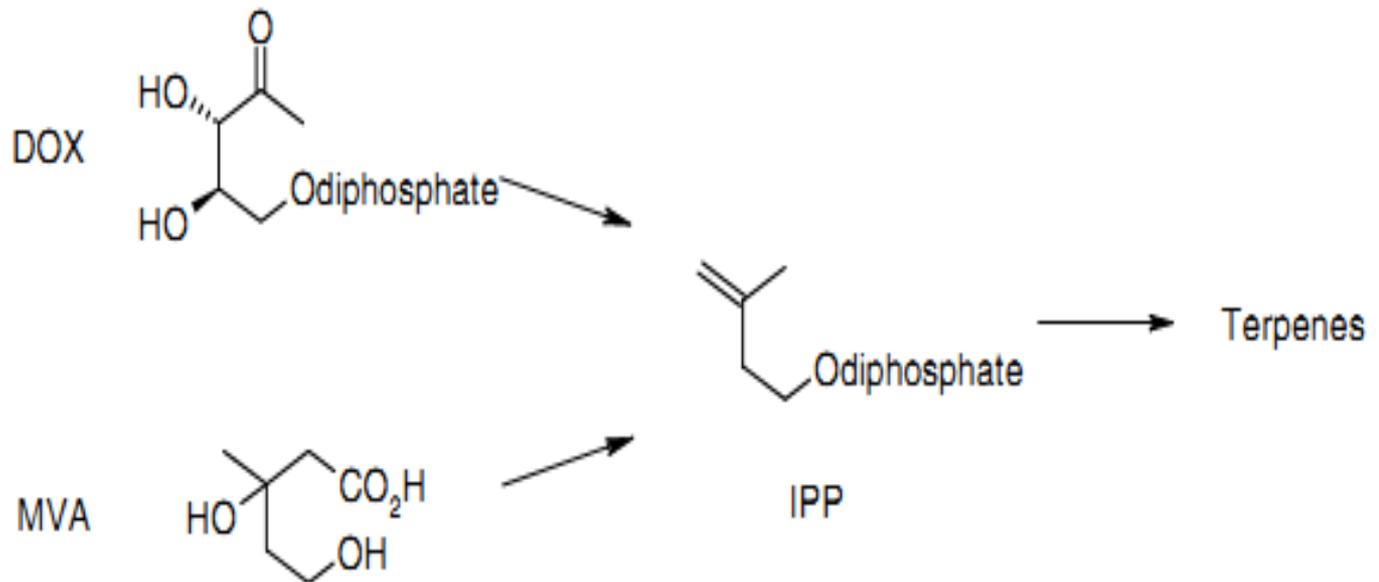
Terpenes



isoprene



isopentane



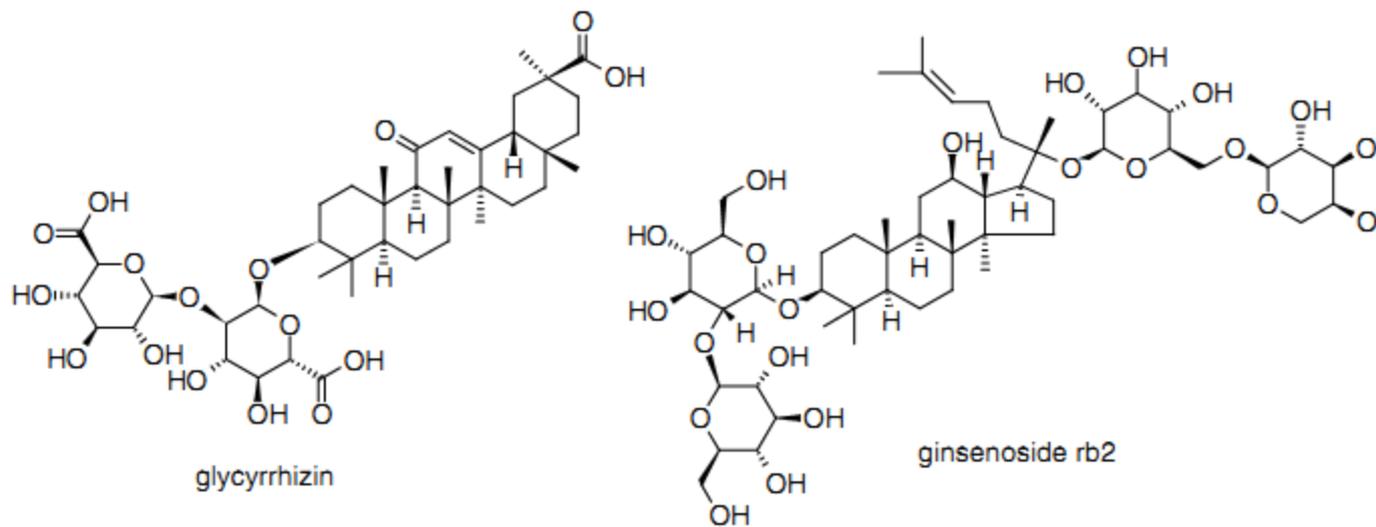
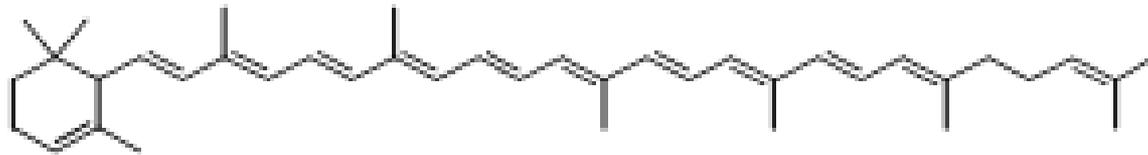


FIGURE 1.16 Saponins.

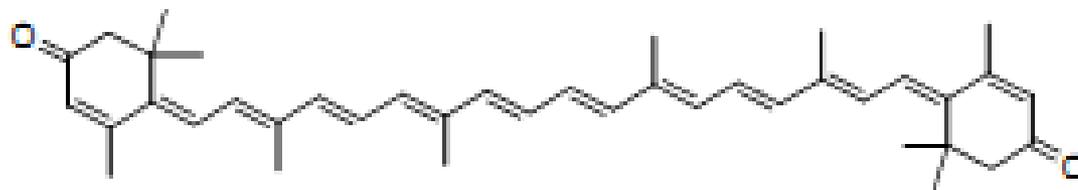
β -carotene



γ -carotene



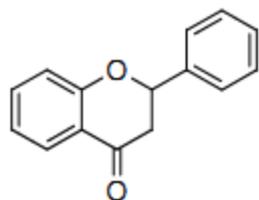
lutein



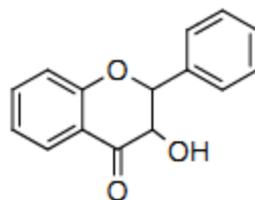
rhodoxanthin

Aromatics

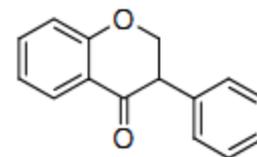
- Tetrapyrroles
- Phenols
 - Simple Phenols
 - Phenol Ethers
 - Phenylpropanoids
 - Flavonoids
 - The flavonoids have two benzene rings separated by a propane unit and are derived from flavone.
 - Tannins
 - Quinones .



flavanones

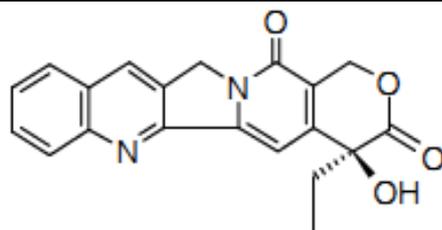


anthocyanins

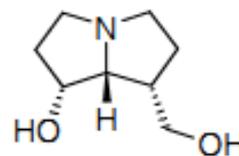


isoflavones

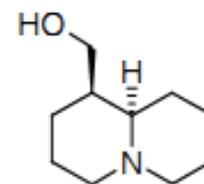
FIGURE 1.22 Flavonoid classes.



camptothecin



platynecine



lupinine

FIGURE 1.33 Additional alkaloids — part 1.



Carbohydrates

- Monosaccharides
 - Oligosaccharides
 - Polysaccharides
- 



Amines and Alkaloids

- Amines
 - Aliphatic Monoamines
 - Aliphatic Polyamines
 - Aromatic Amines
 - Alkaloids
- 



Amino Acids, Nonprotein Amino Acids, and Proteins

- Amino Acids
 - Nonprotein Amino Acids
 - Proteins
 - Storage Proteins, Lectins, and Diet
- 



Nucleic Acids, Nucleotides, and Nucleosides























