

SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai
Approved by Pharmacy Council of India, New Delhi.
Coimbatore -641035

COURSE NAME : PHARMACOGNOSY AND PHYTOCHEMISTRY II (BP504T)

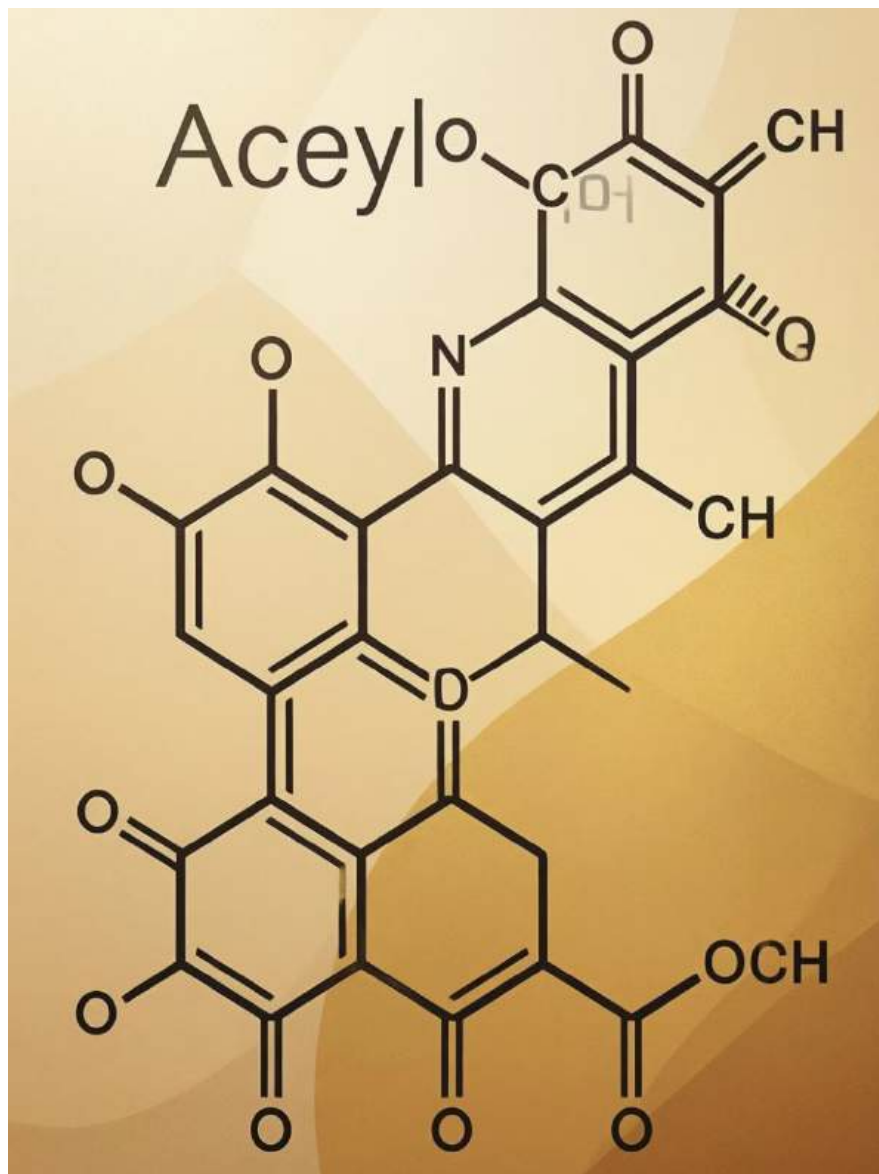
V SEM / IIIYEAR

TOPIC 1 : ACETATE PATHWAYS

Metabolic Pathways in Higher Plants

The Acetate-Malonate Pathway and Secondary Metabolite Formation

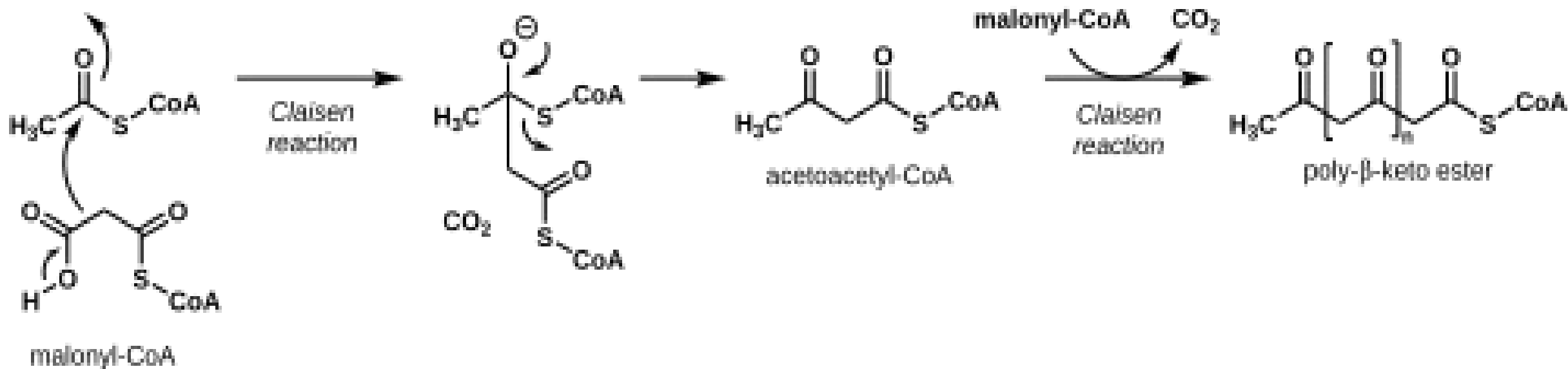
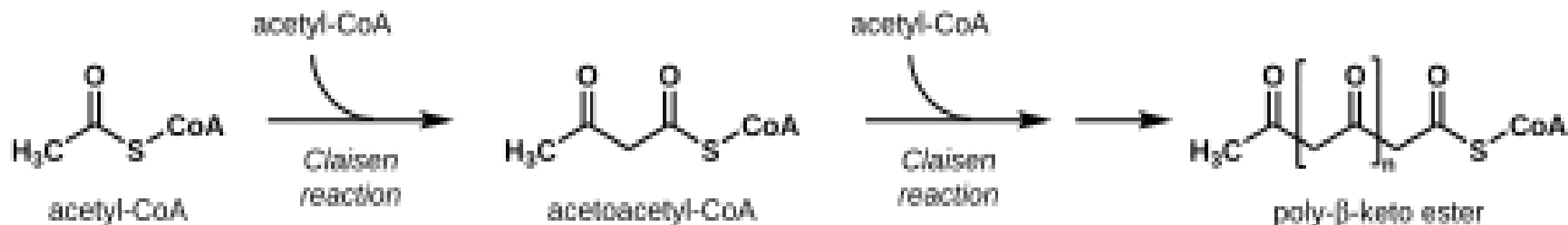


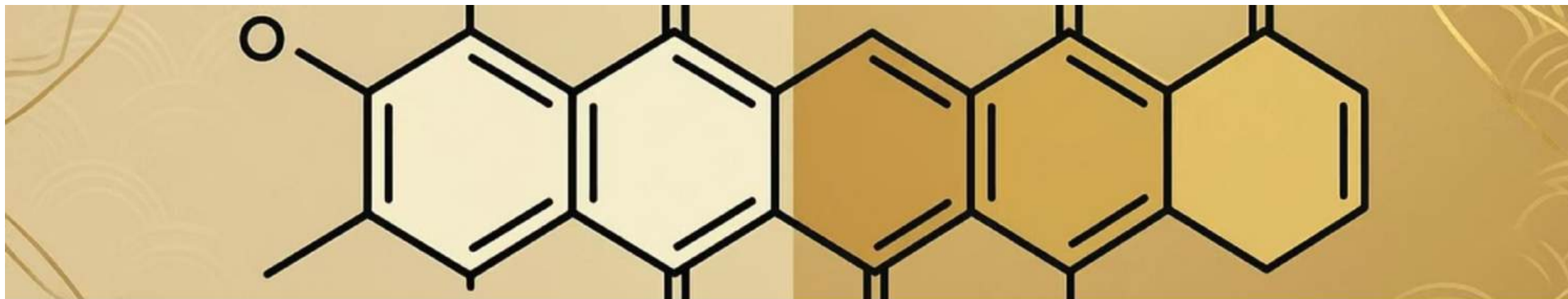


CHAPTER 1

The Acetate Pathway: An Overview

A fundamental biosynthetic route using acetyl-CoA as the primary building block for diverse secondary metabolites including polyketides, fatty acids, and aromatic compounds.





Starting Precursors



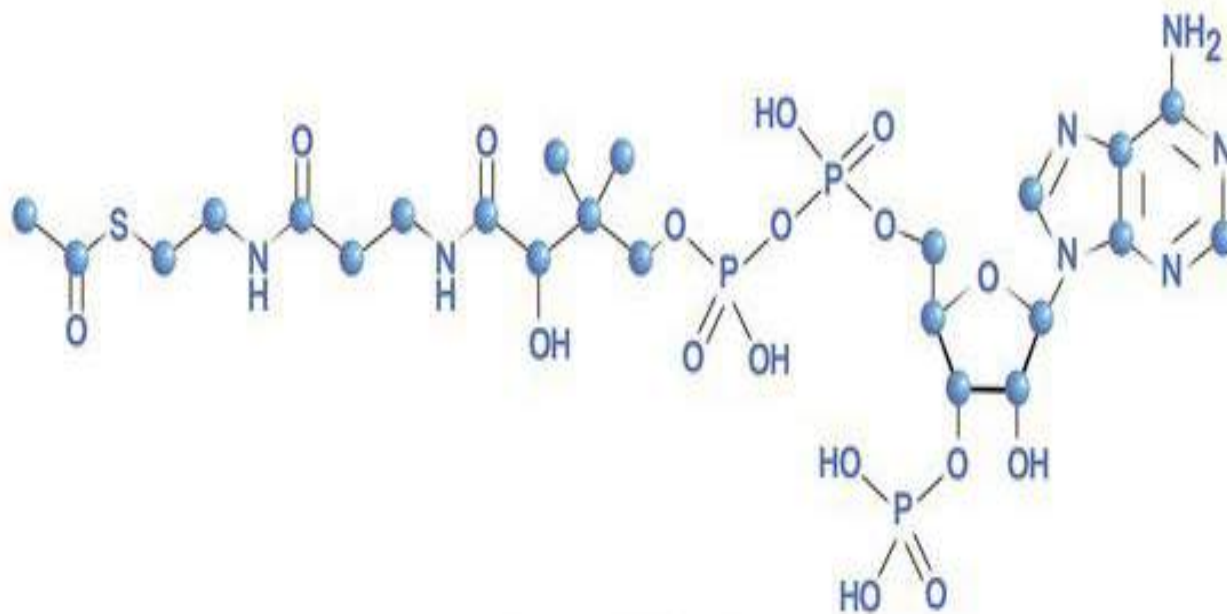
Acetyl-CoA

Primary starter unit that initiates the pathway

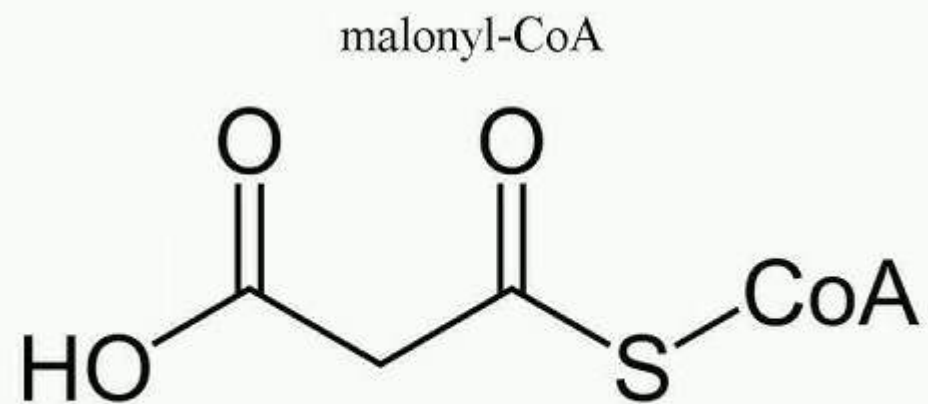


Malonyl-CoA

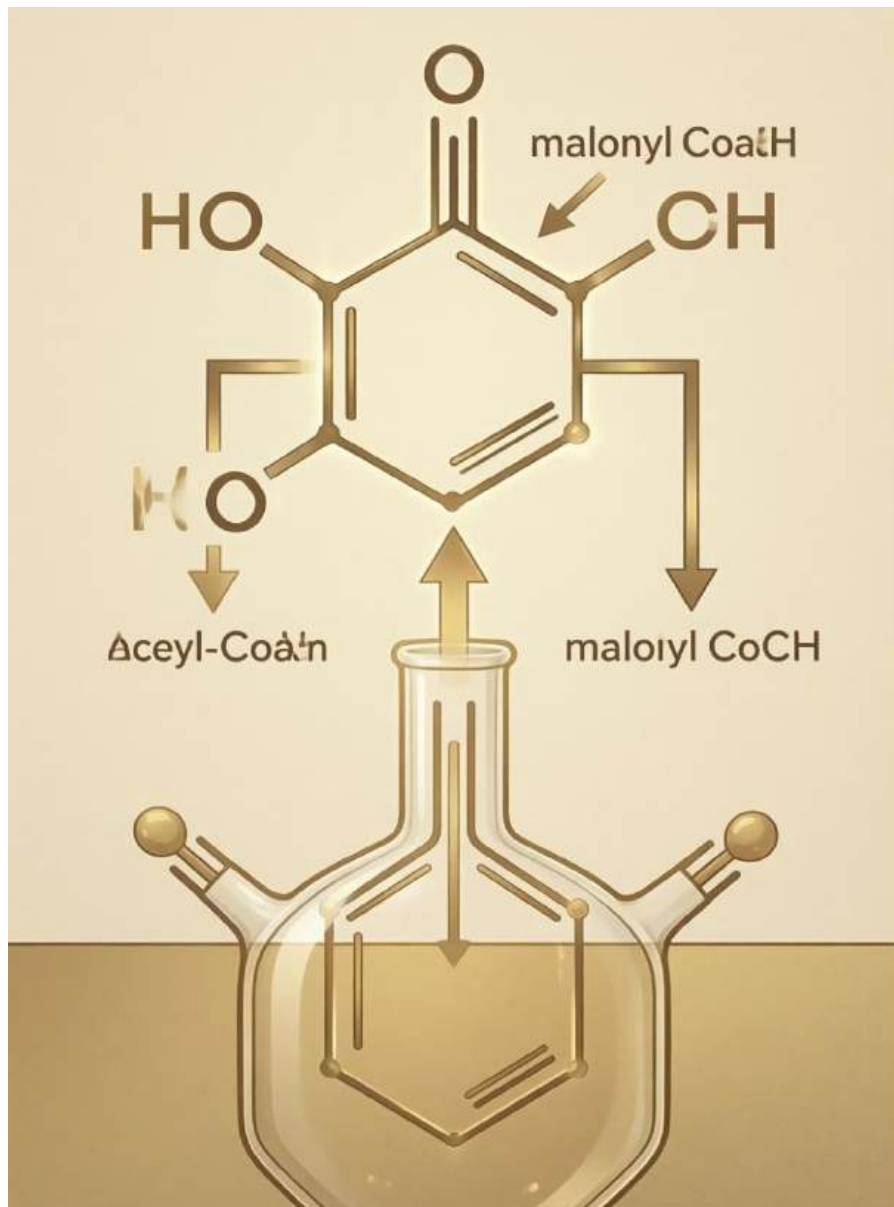
Chain-extending unit formed from acetyl-CoA



Acetyl-CoA

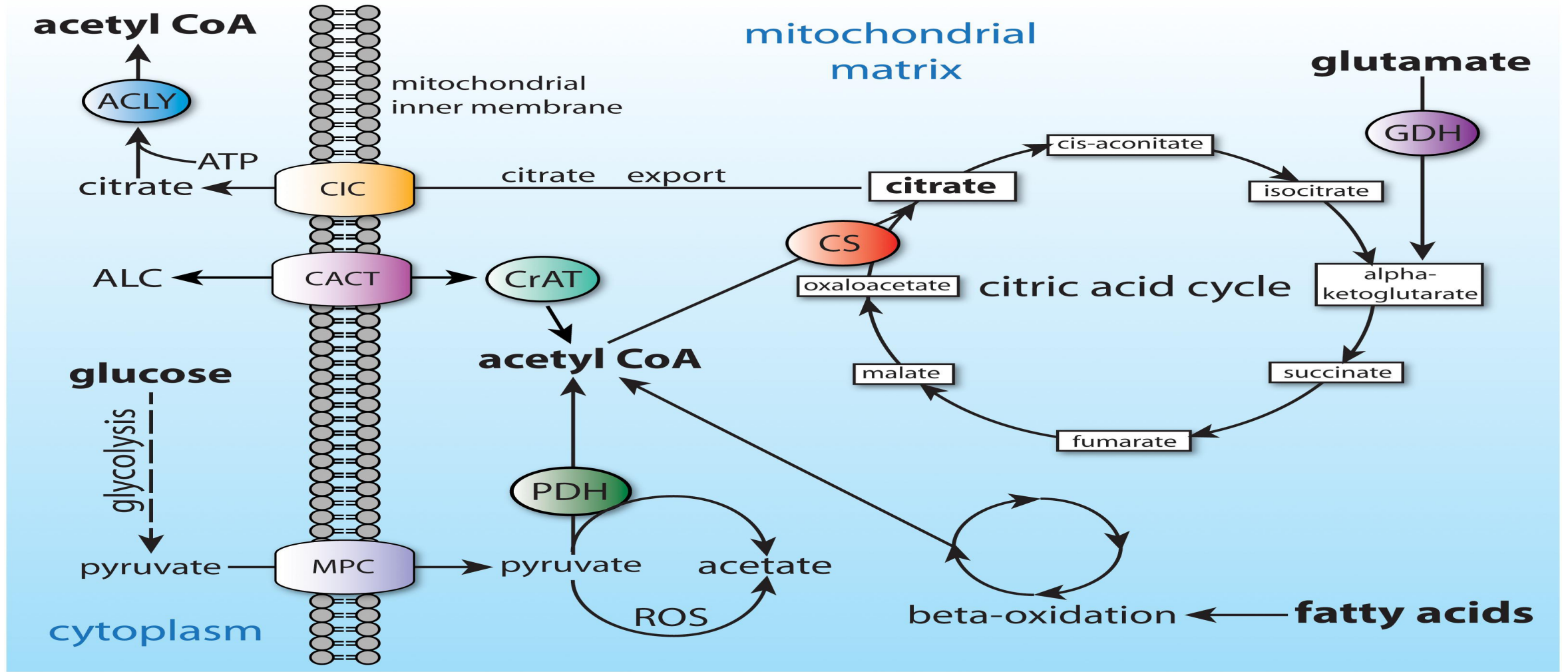


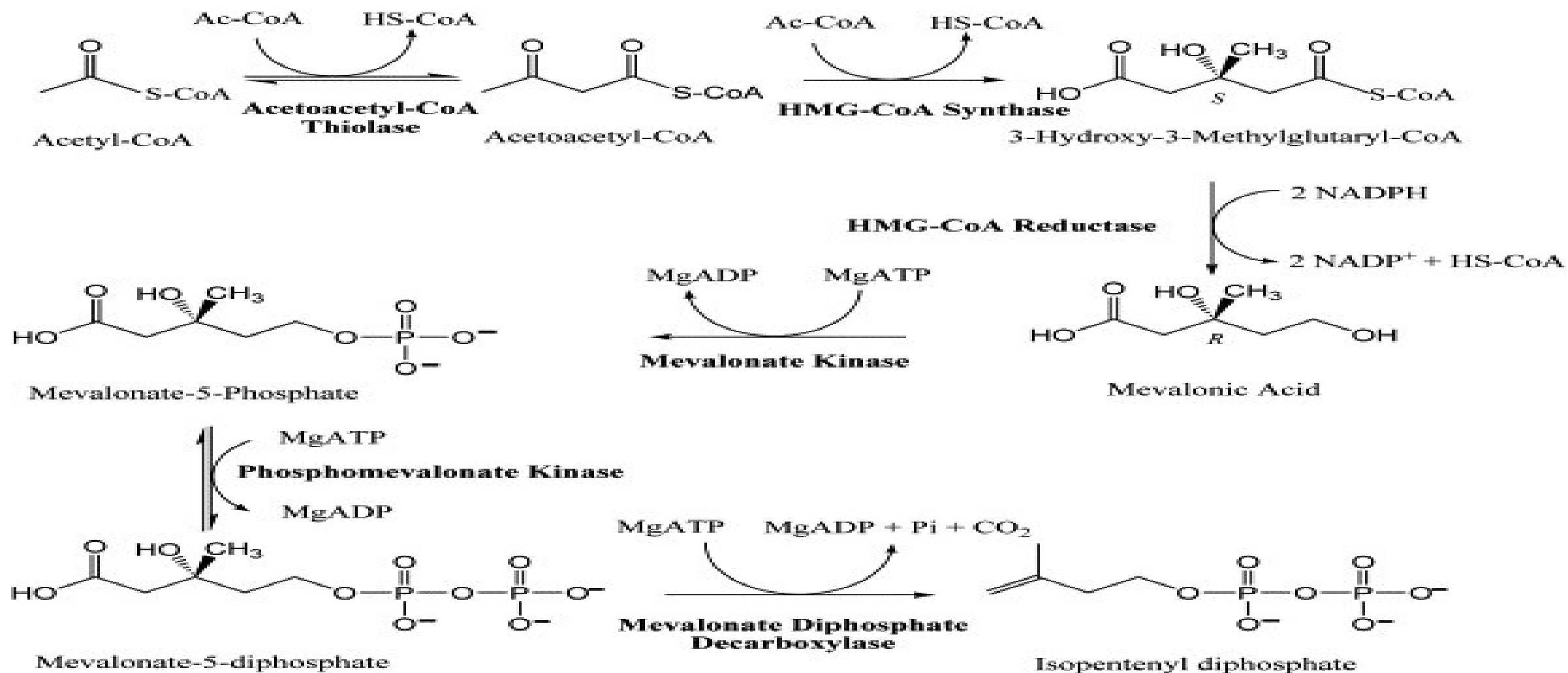
Coenzyme A derivative of malonic acid.



Mechanism: Sequential Condensation







CHAPTER 2

Secondary Metabolites Formed

Fatty Acids

Palmitic, stearic, oleic acids



Polyketides

Anthraquinones, naphthoquinones



Phenolic Compounds

Simple phenols, phenolic acids



Macrolides

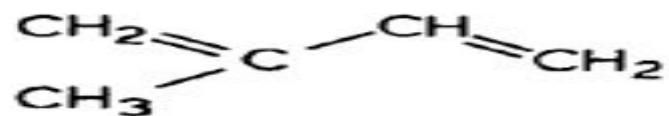
Lactones and bioactive compounds



Flavonoids

Partial contribution via malonyl-CoA

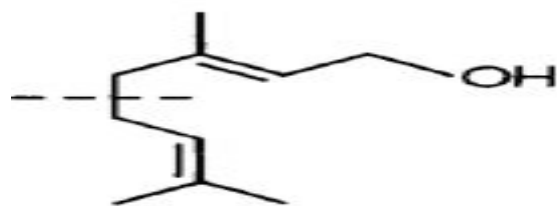




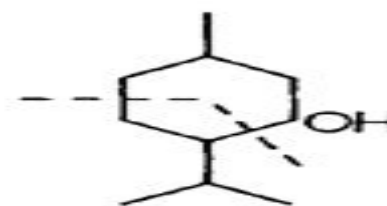
isoprene
(5.1)



(a) Monoterpenoids

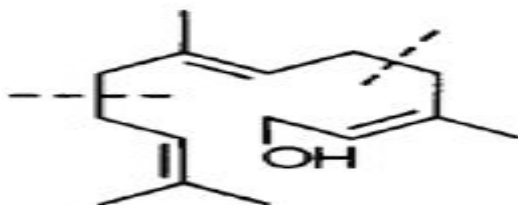


geraniol
(2 isoprene units)

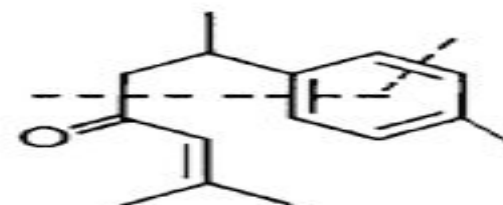


menthol
(derived from 2 isoprene units)

(b) Sesquiterpenoids

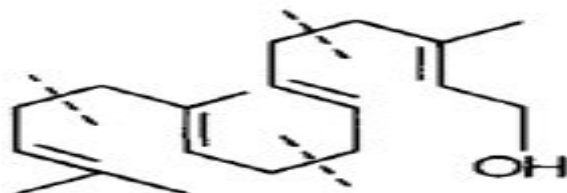


farnesol
(3 isoprene units)

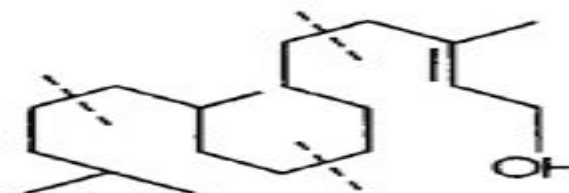


tumerone
(derived from 3 isoprene units)

(c) Diterpenoids



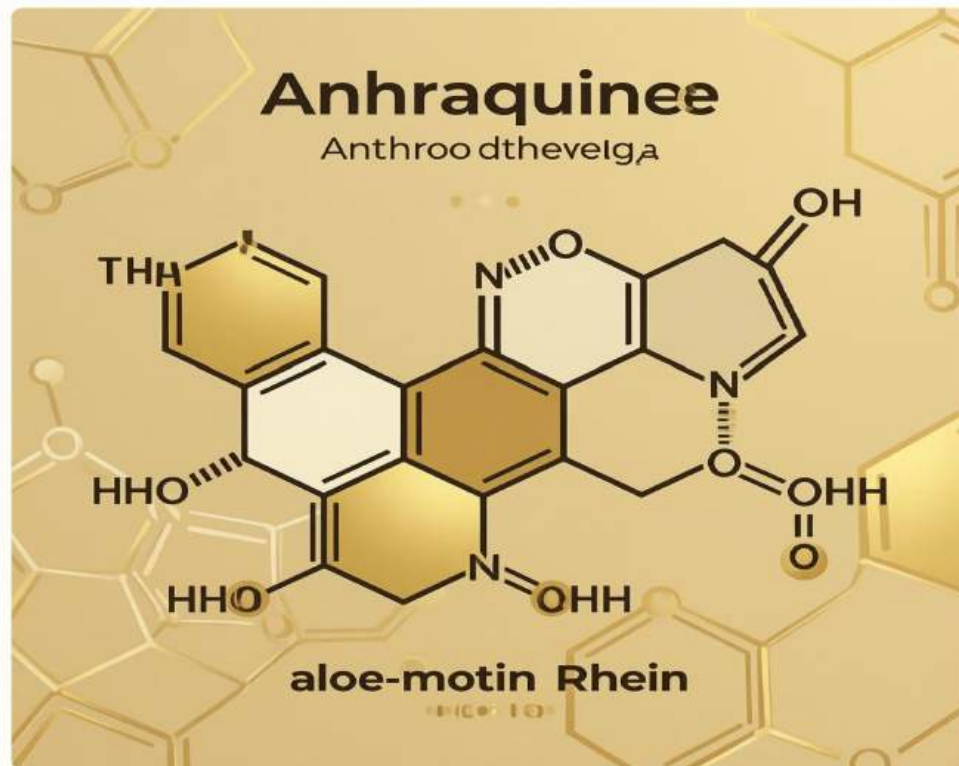
geranylgeraniol
(4 isoprene units)



phytol
(derived from 4 isoprene units)

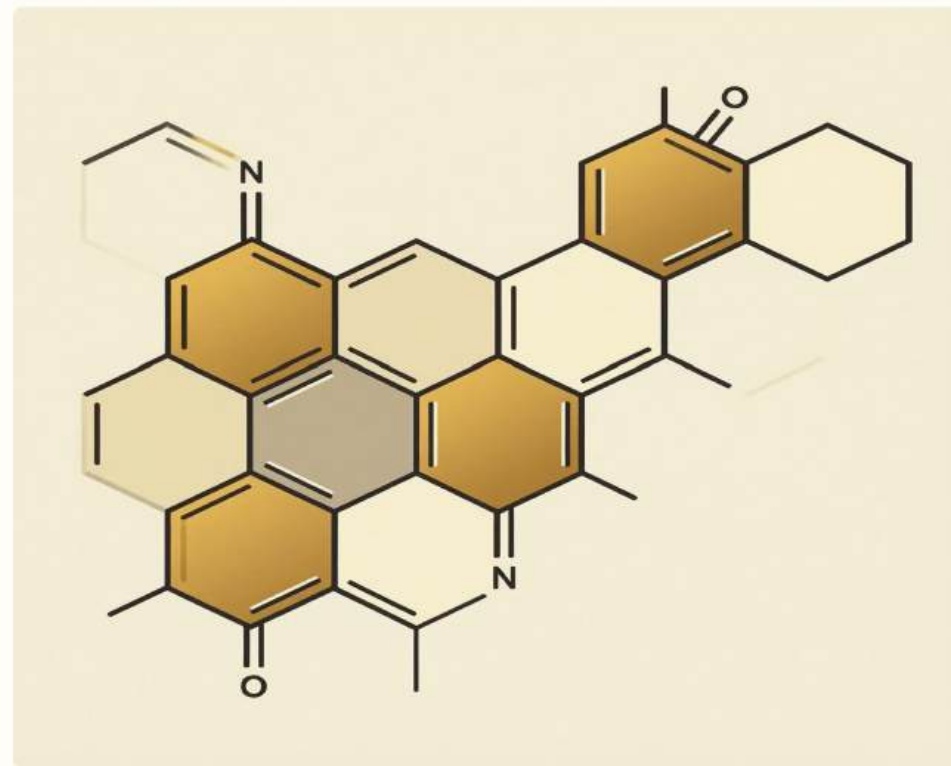
Important Polyketide Products

Anthraquinones

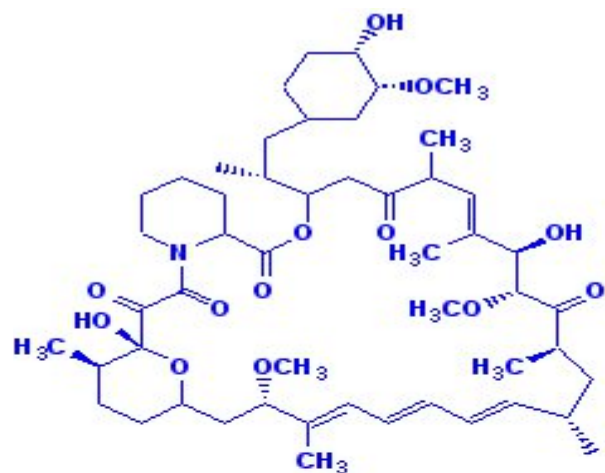


- Aloe-emodin
- Rhein
- Found in Senna, Aloe, Cascara

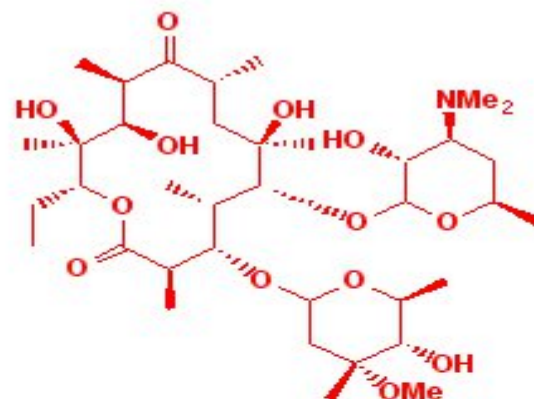
Naphthoquinones



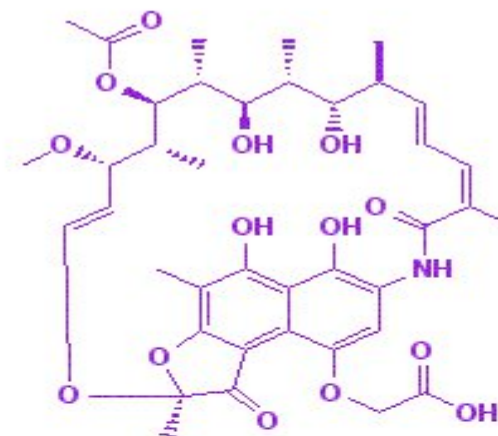
- Lawsone (from Henna)
- Used in cosmetics and dyes
- Natural pigment formation



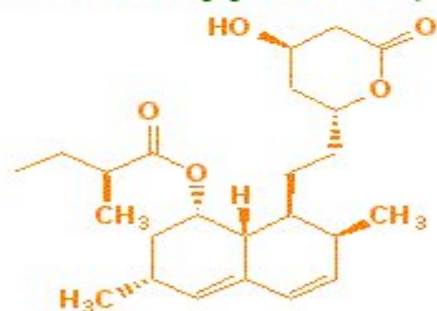
rapamycin
(immunosuppressant)



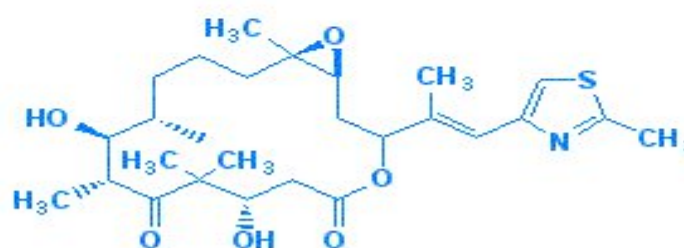
erythromycin A
(antibacterial)



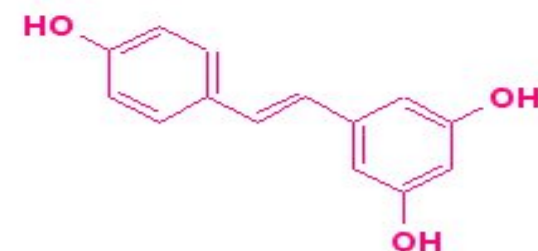
rifamycin B
(antituberculosis)



lovastatin
(anticholesterol)



epothilone B
(anticancer)



(E)-resveratrol
(chemopreventive)

Pathway Integration

Acetate Pathway

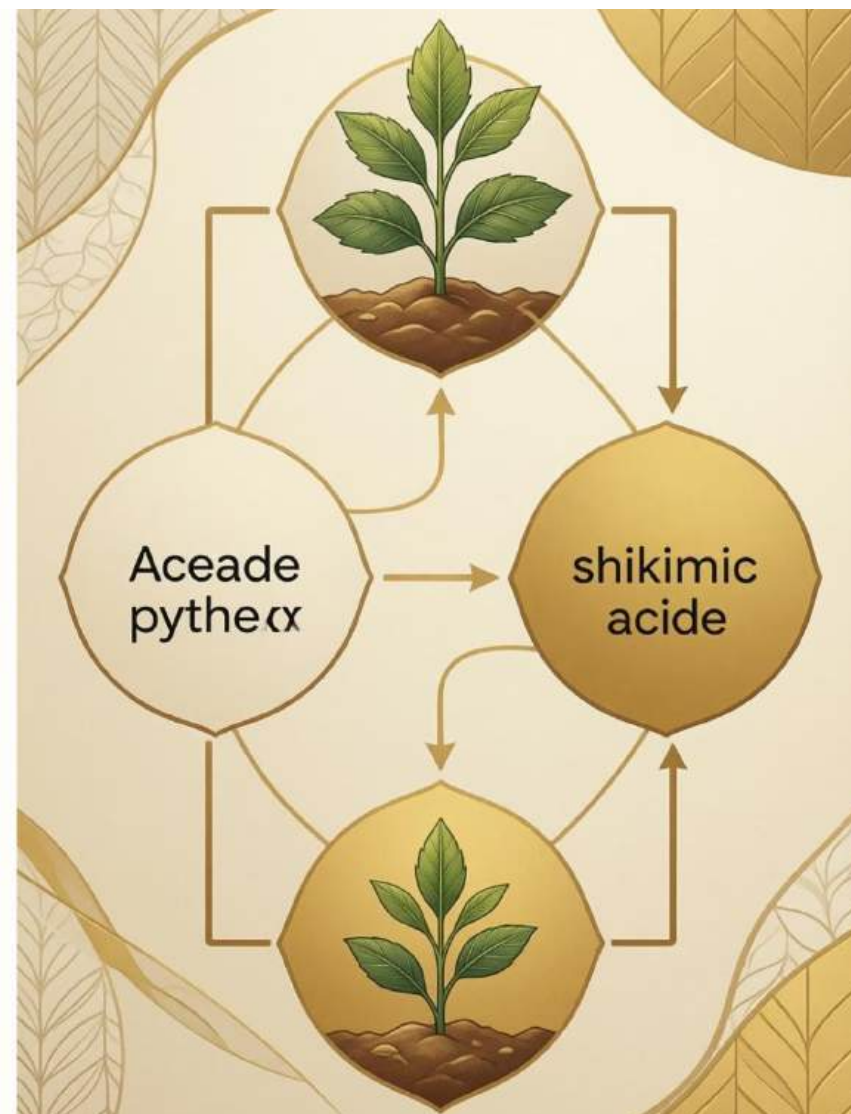
Provides malonyl-CoA units

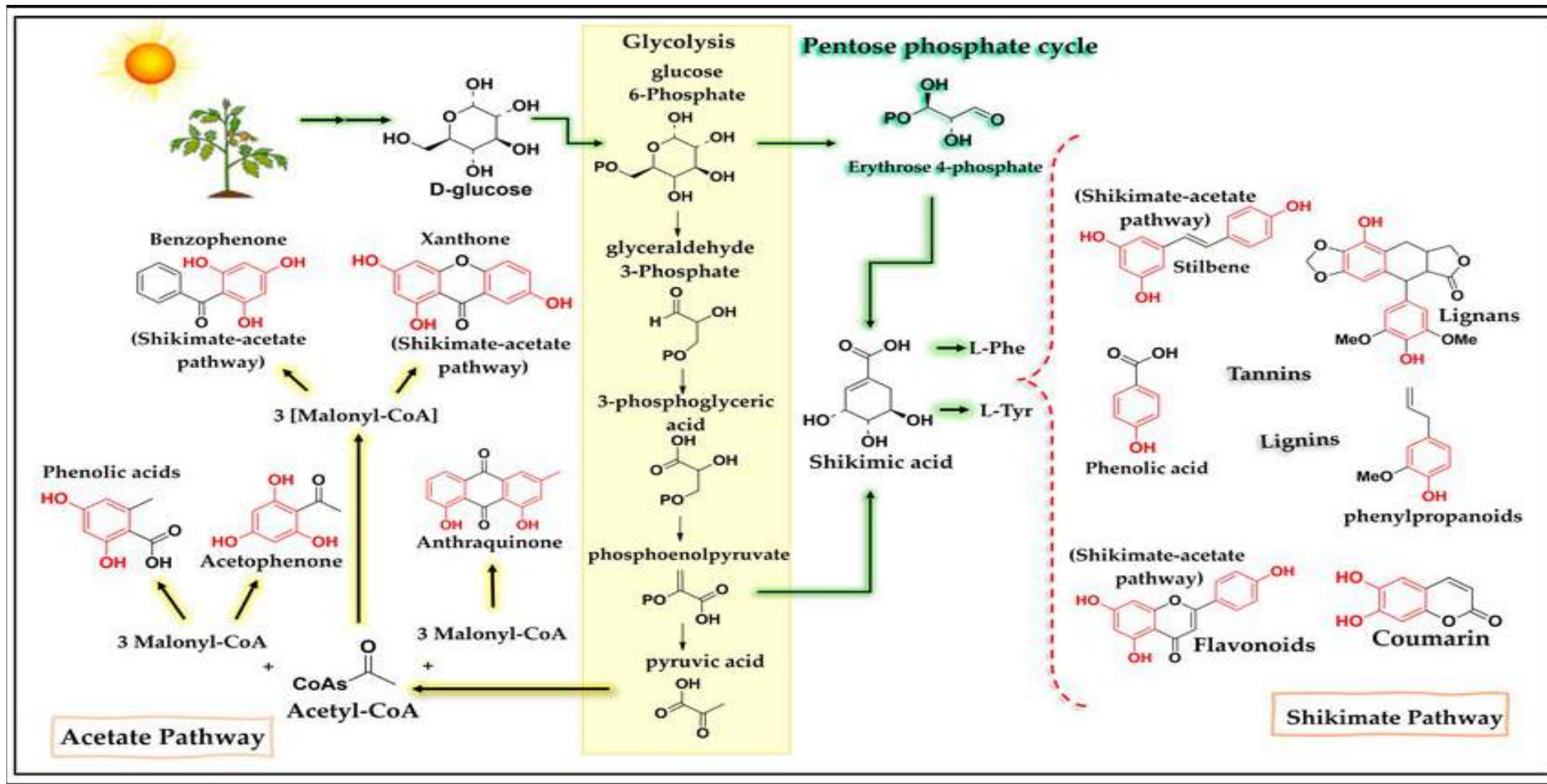
Shikimic Acid Pathway

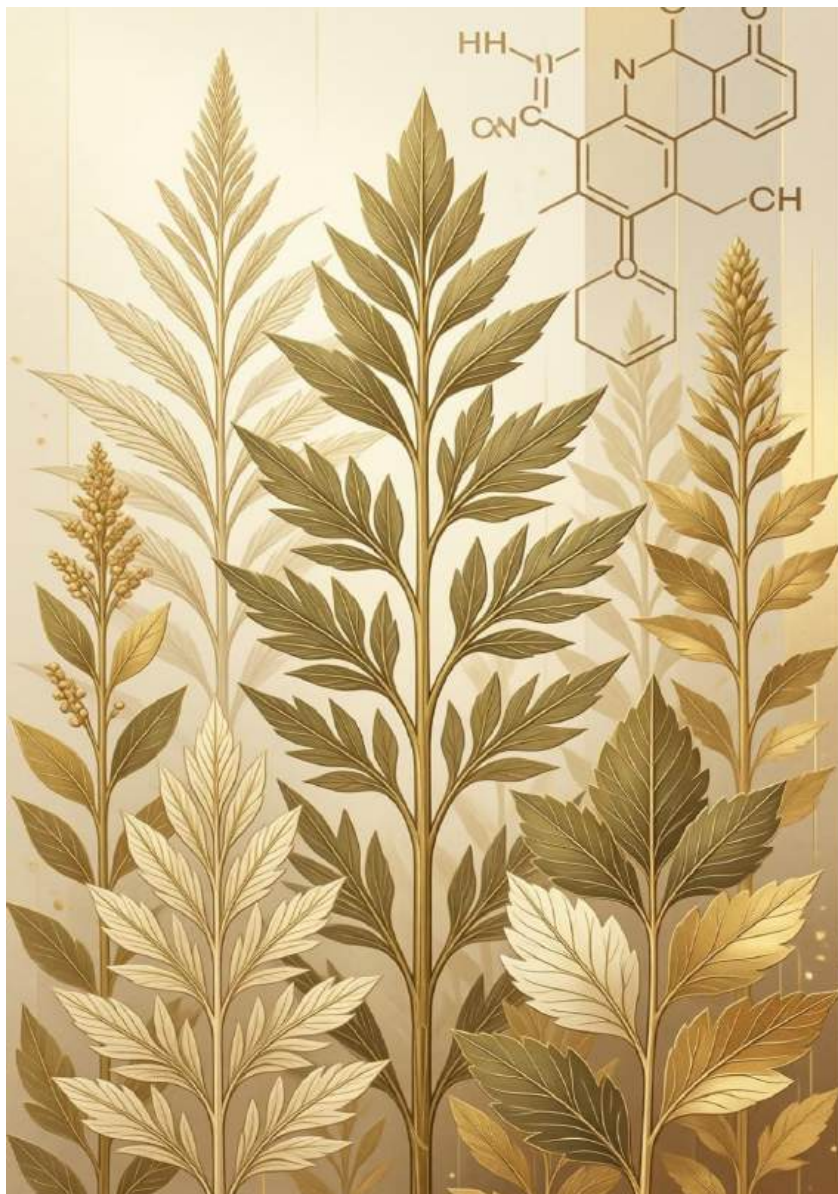
Contributes aromatic rings

Flavonoid Synthesis

Combined pathway output







CHAPTER 3

Biological and Pharmaceutical Significance

Plant Defense

Essential for protection against pathogens and herbivores

Pigment Formation

Involved in coloration and light absorption

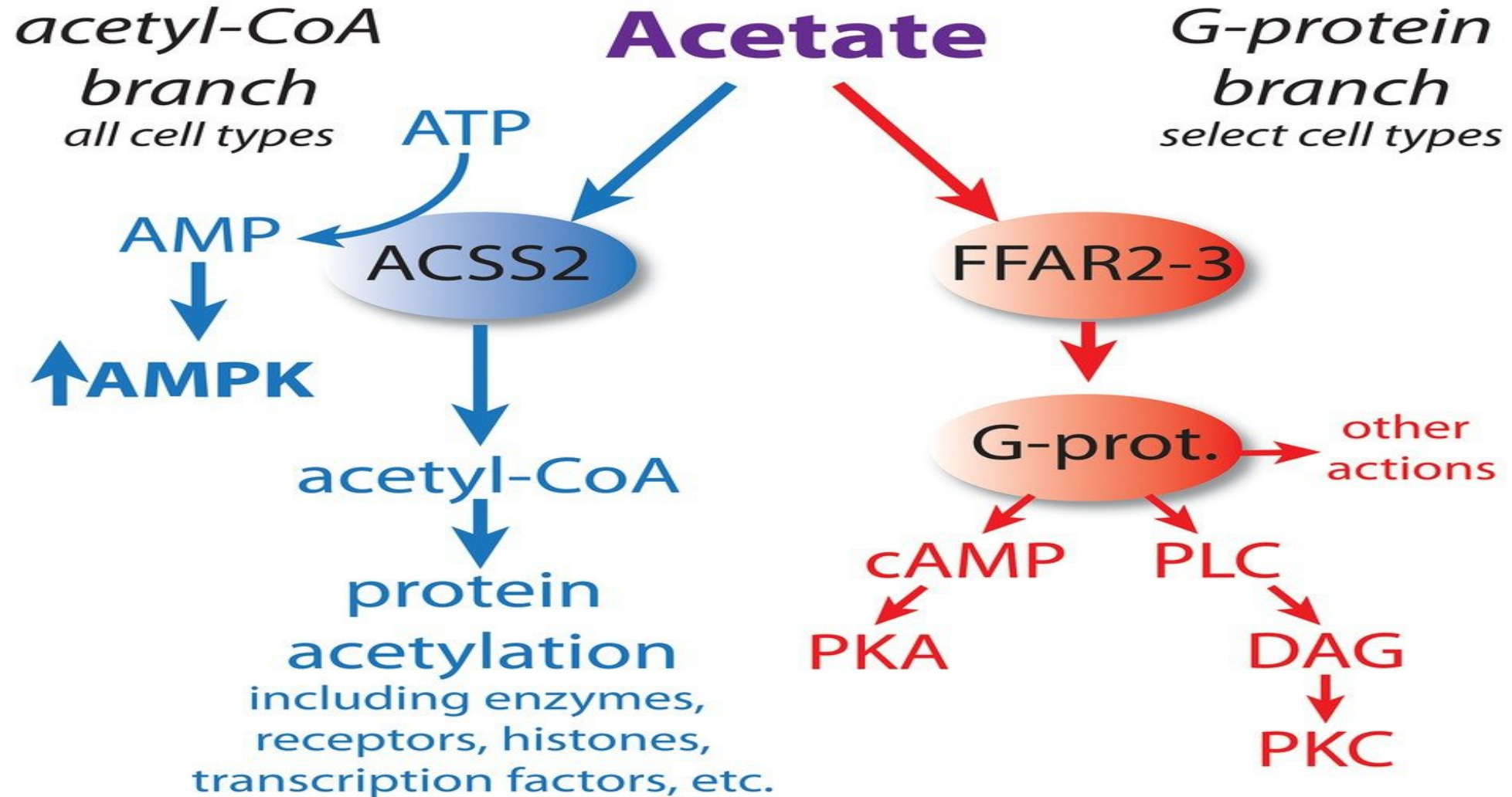
Energy Storage

Provides structural lipids and metabolic reserves

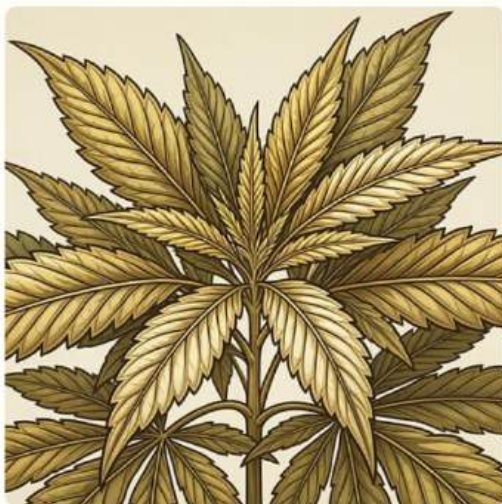
Pharmacological Activity

Antimicrobial, anticancer, antioxidant properties

Acetate signaling



Clinical and Commercial Applications



01

Laxatives

Anthraquinone glycosides from Senna, Aloe, Cascara



02

Cosmetics & Dyes

Lawson's from Henna for hair and skin coloration



03

Therapeutics

Antimicrobial, anticancer compounds under investigation



Key Takeaways

- Core Building Blocks**

Acetyl-CoA and malonyl-CoA drive the pathway through sequential condensation with CO₂ release
- Diverse Products**

Generates fatty acids, polyketides, anthraquinones, quinones, and phenolic compounds
- Pathway Cooperation**

Works independently or integrates with shikimic acid and other biosynthetic routes
- Pharmaceutical Value**

Critical source of clinically important laxatives, dyes, and bioactive natural products



ASSESSMENT QUESTIONS

Acetate-Malonate Pathway

Secondary Metabolites

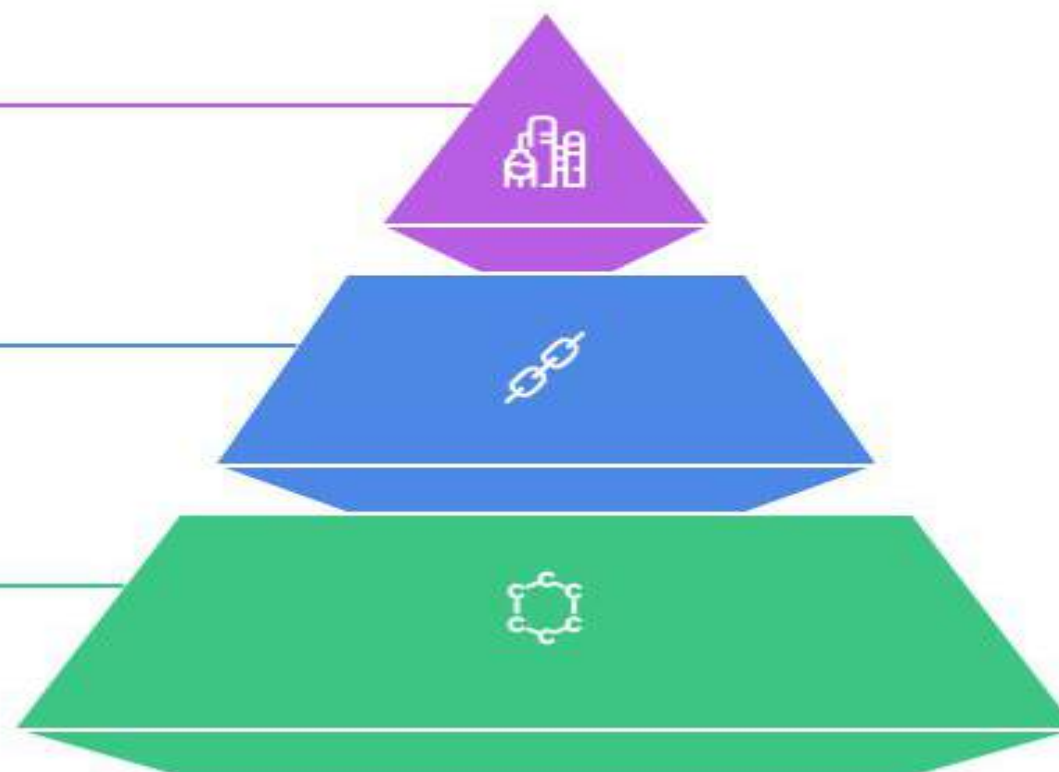
- Products formed through the acetate pathway

Malonyl-CoA

- Chain-extending unit in the pathway

Acetyl-CoA

- Primary building block for synthesis



THANK
YOU!