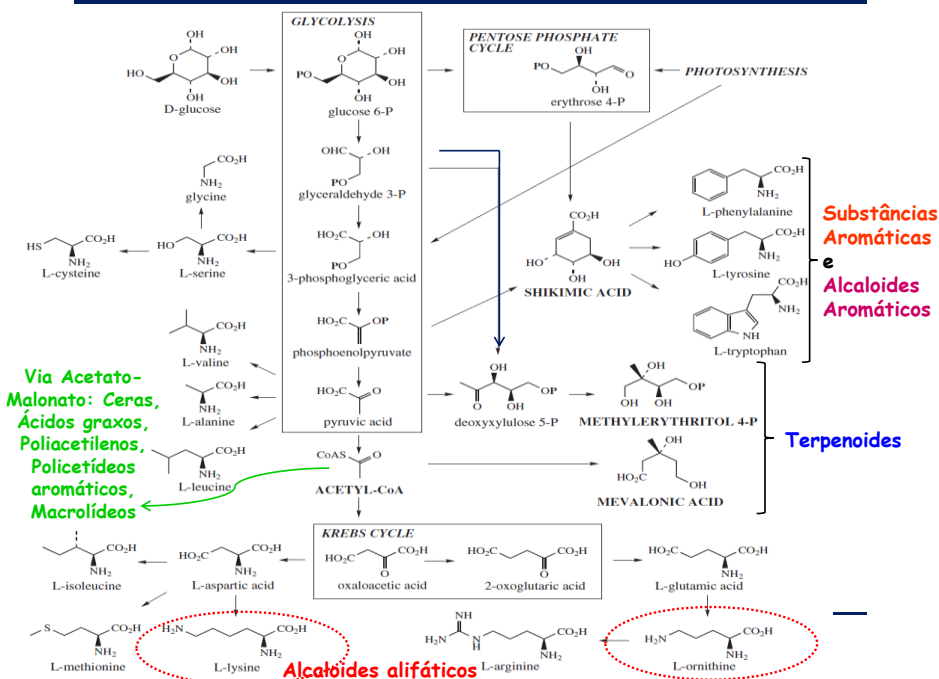


Via do Ácido Chiquímico

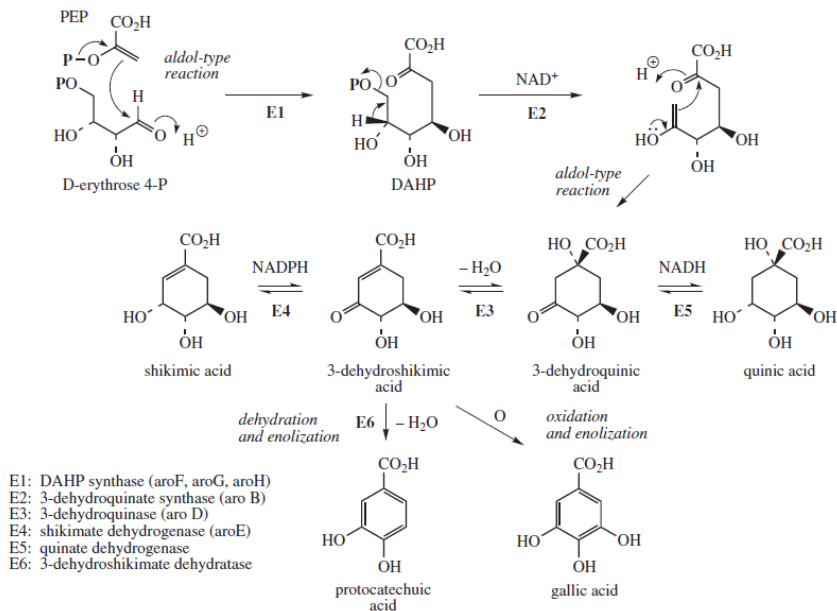
(Chiquimato):

Derivados C_6-C_1 , C_6-C_2 e C_6-C_3

Prof. Marcelo J. Pena Ferreira

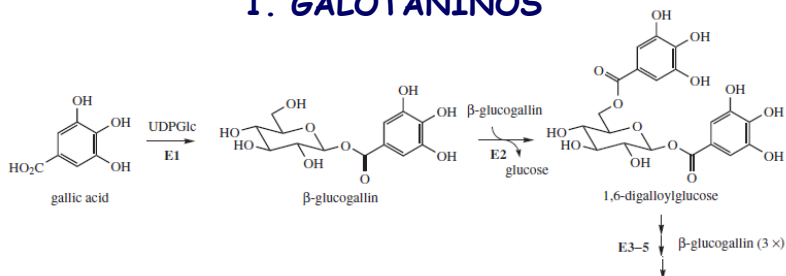


FORMAÇÃO DO PRECURSOR DA VIA



DERIVADOS C₆-C₁: TANINOS HIDROLISÁVEIS

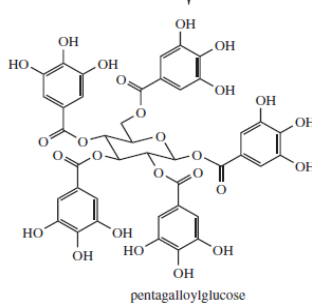
1. GALOTANINOS



Taninos

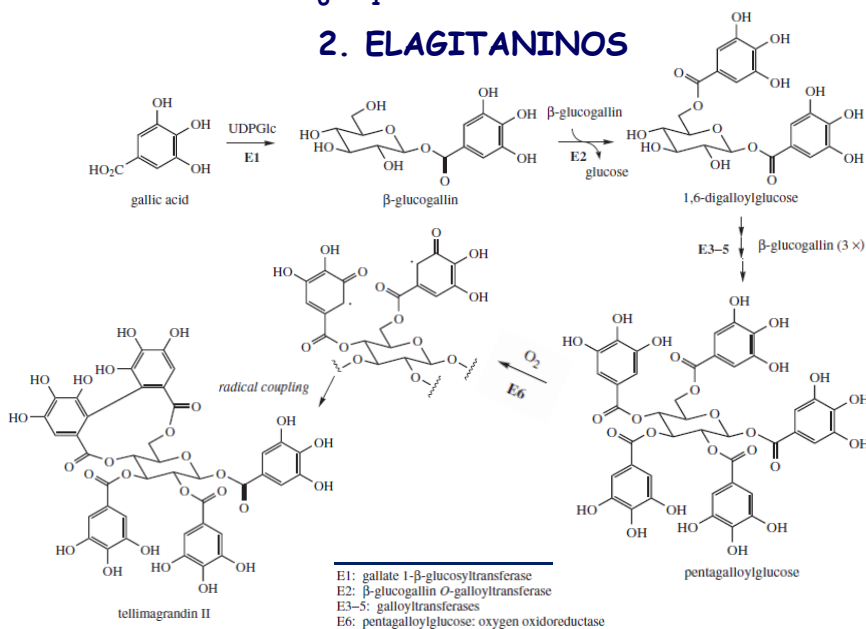
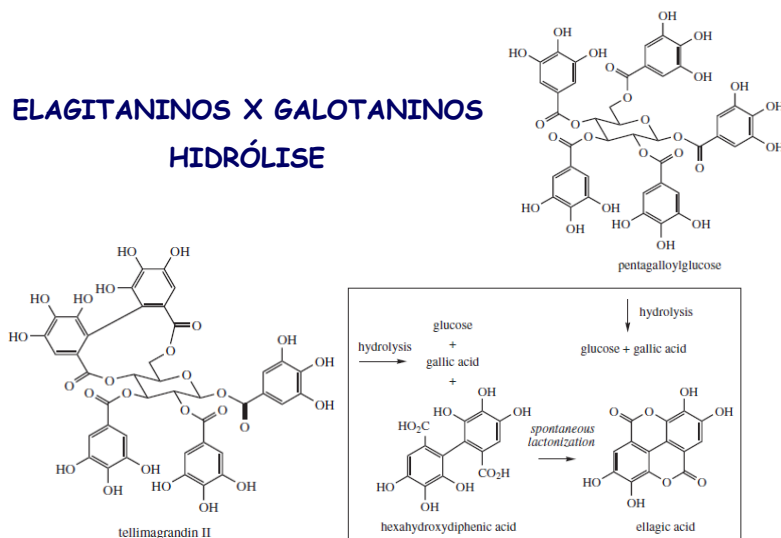
- ✓ promovem adstringência de alimentos e bebidas
- ✓ utilizados em curtimento de peles de animais

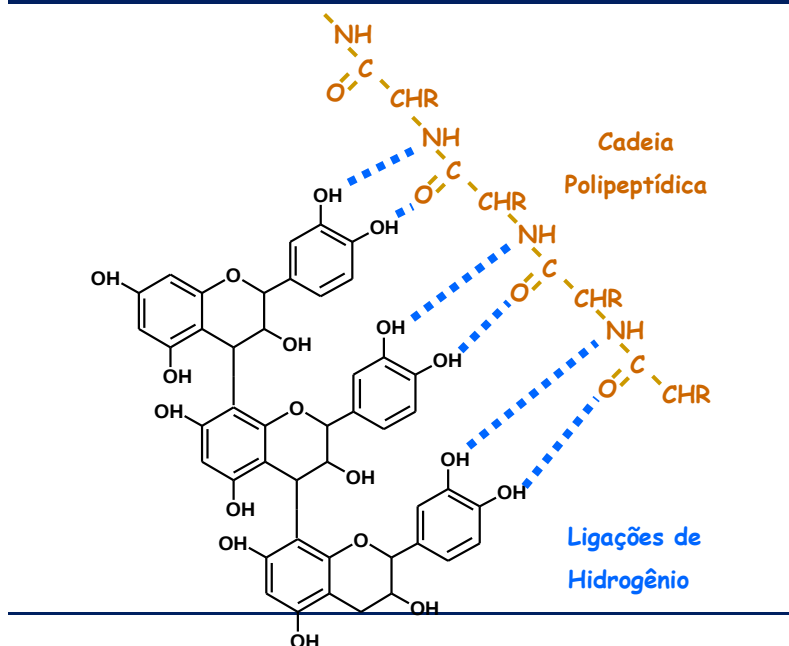
E1: gallate 1-β-glucosyltransferase
E2: β-glucogallin O-galloyltransferase
E3-5: galloyltransferases



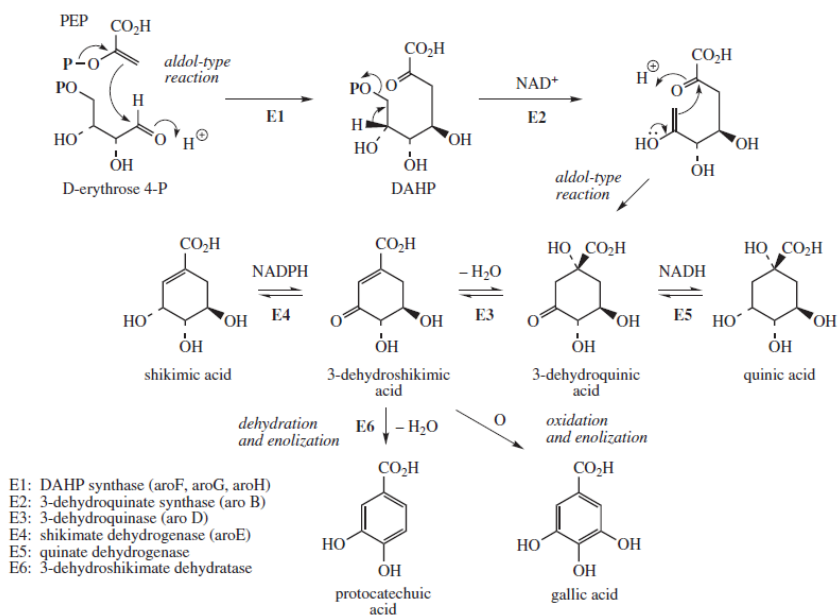
DERIVADOS C₆-C₁: TANINOS HIDROLISÁVEIS

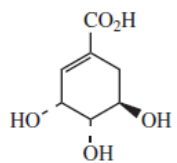
2. ELAGITANINOS

DERIVADOS C₆-C₁: TANINOS HIDROLISÁVEISELAGITANINOS X GALOTANINOS
HIDRÓLISE



FORMAÇÃO DO PRECURSOR DA VIA

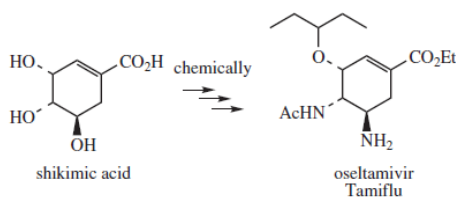




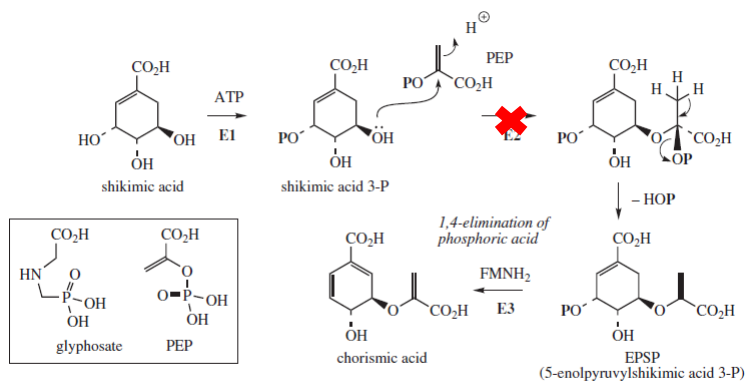
Ácido chiquímico

*Illicium verum* (Schisandraceae)

Anis-estrelado - "Shikimi"



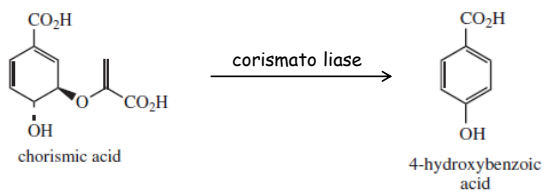
CONVERSÃO À ÁCIDO CORÍSMICO



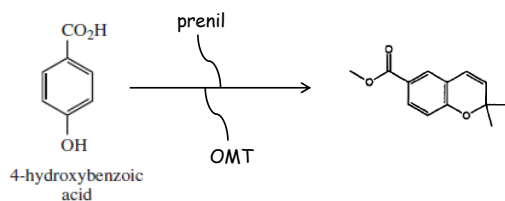
E1: shikimate kinase (aro L)
E2: EPSP synthase (aro A)

E3: chorismate synthase (aro C)
EPSP: 5-enol-piruvil-chiquímico 3-fosfato sintase

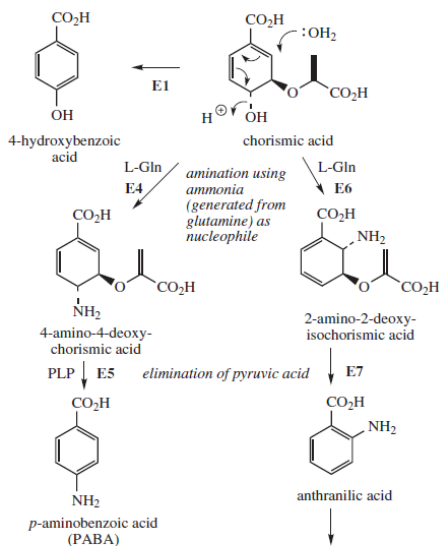
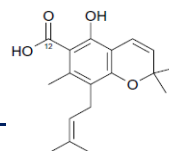




3. CROMENOS



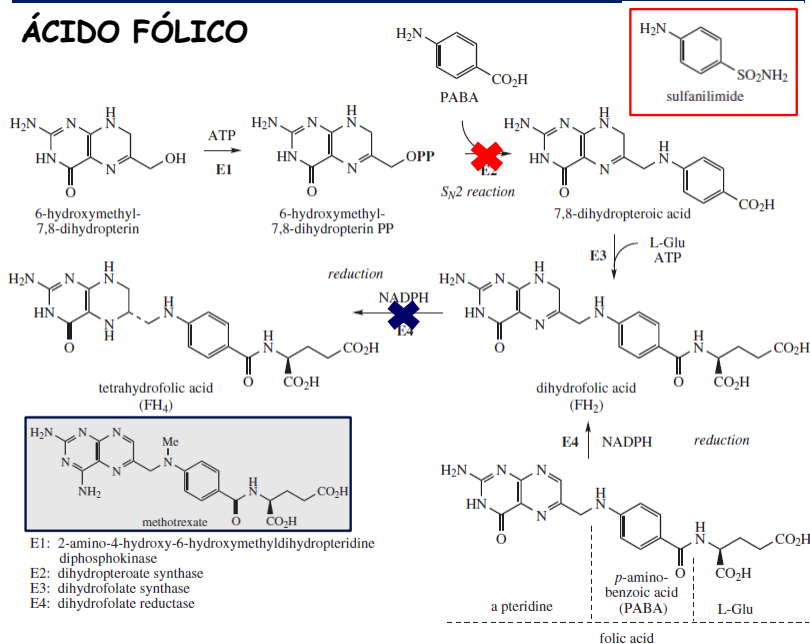
Cromeno policetídico



- E1: chorismate lyase
- E2: isochorismate synthase (EntC)
- E3: salicylate synthase
- E4: 4-amino-4-deoxychorismate synthase (PabA, PabB)
- PabA = glutamine amidotransferase
- E5: 4-amino-4-deoxychorismate lyase (PabC)
- E4 + E5: p-aminobenzoate synthase
- E6: 2-amino-2-deoxyisochorismate synthase
- E7: 2-amino-2-deoxyisochorismate lyase
- E6 + E7: anthranilate synthase (TrpE, TrpG)
- TrpG = glutamine amidotransferase
- E8: isochorismatase (EntB)
- E9: 2,3-dihydro-2,3-dihydroxybenzoate dehydrogenase (EntA)

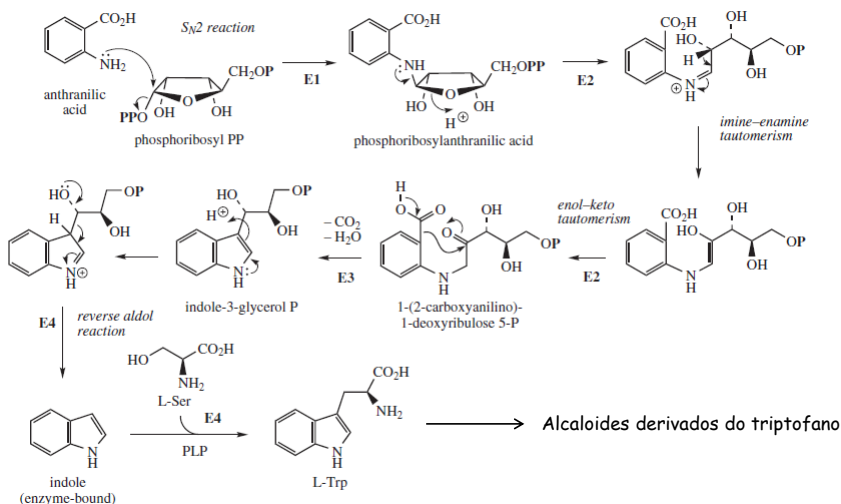
Alcaloides derivados do triptofano

ÁCIDO FÓLICO



Encontrado em vegetais verdes escuros (brócolis, espinafre, ...) e grãos (ervilha, lentilha, feijão, ...)

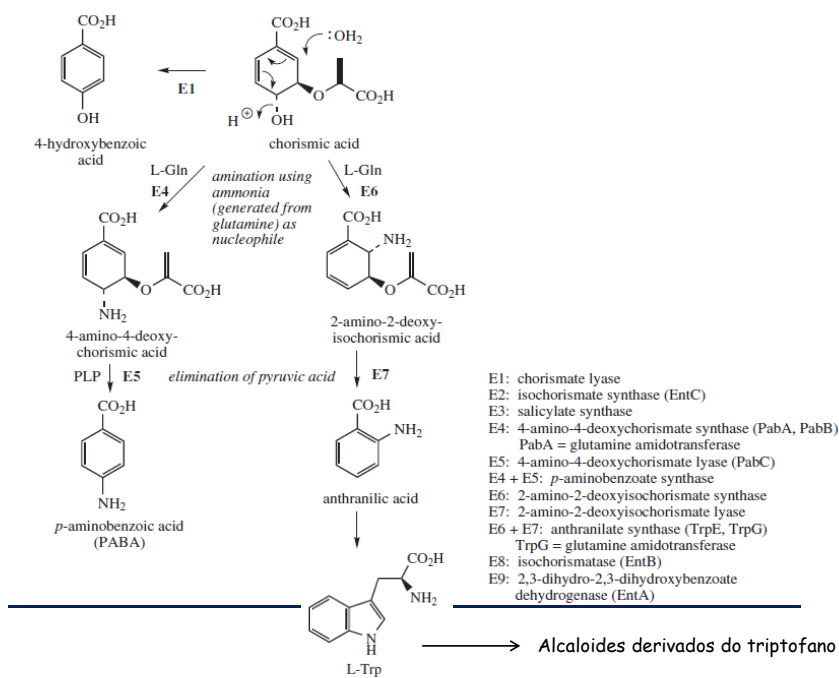
FORMAÇÃO DO AMINOÁCIDO TRIPTOFANO



E1: anthranilate phosphoribosyltransferase (TrpD)
 E2: phosphoribosylanthranilate isomerase (TrpC)
 E3: indole-3-glycerol phosphate synthase (TrpC)
 E4: tryptophan synthase (TrpA, TrpB)

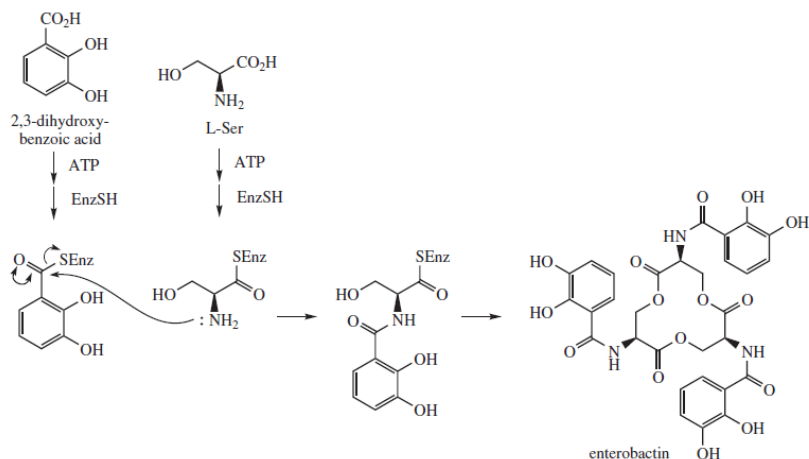
BIB 5754 – Produtos Naturais I: Biossíntese e Distribuição em Espécies Vegetais

EM MICRORGANISMOS



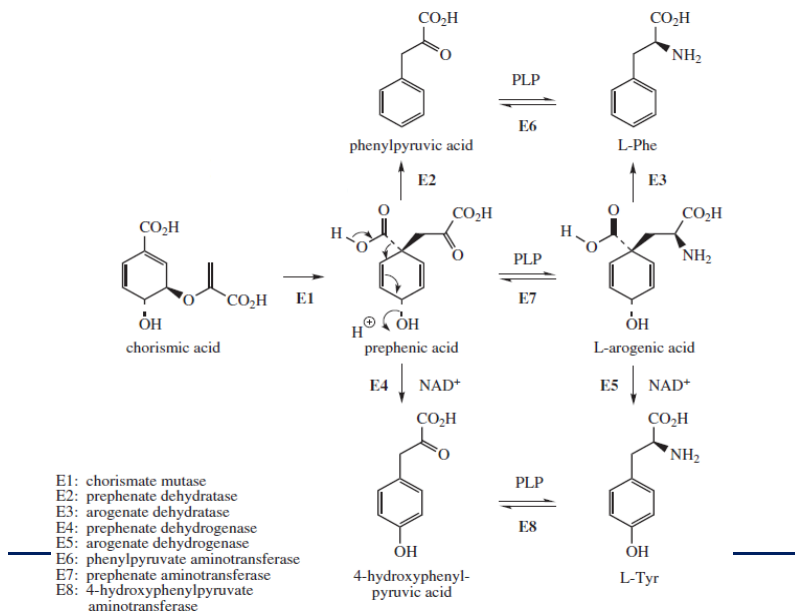
BIB 5754 – Produtos Naturais I: Biossíntese e Distribuição em Espécies Vegetais

EM MICRORGANISMOS



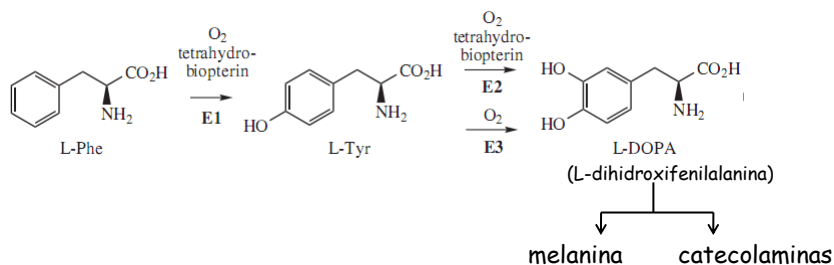
✓ Atua como um sideróforo

FORMAÇÃO DOS AAS. FENILALANINA E TIROSINA

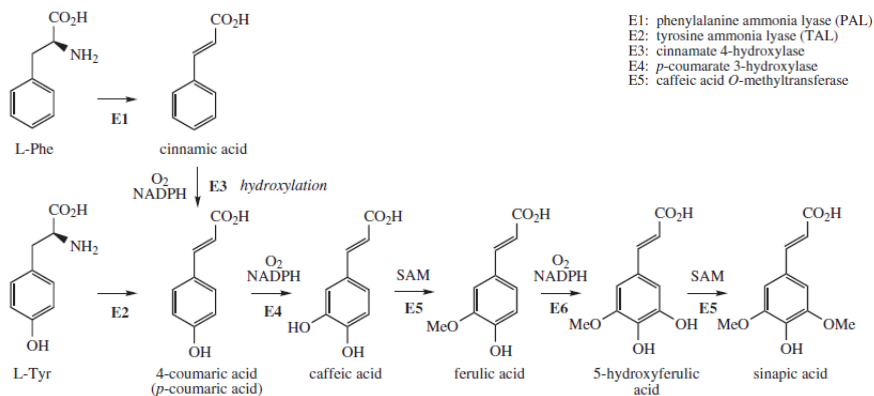


Em Animais....

- ✓ Aminoácidos aromáticos essenciais
- ✓ Tirosina formada pela hidroxilação da fenilalanina
- ✓ Síntese de catecolaminas (noradrenalina, adrenalina) e melanina



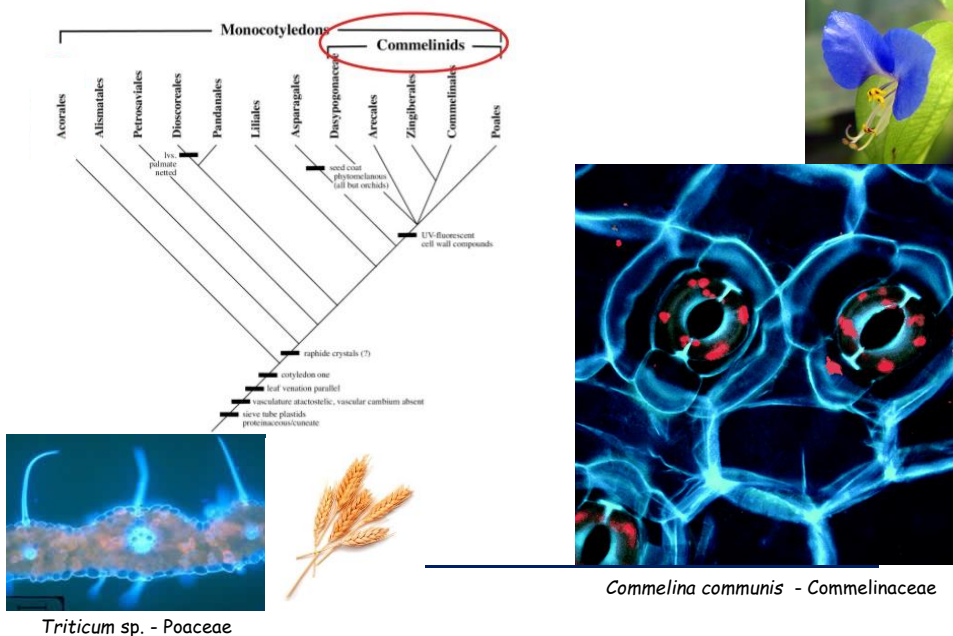
4. DERIVADOS DO ÁCIDO CINÂMICO (C₆-C₃)



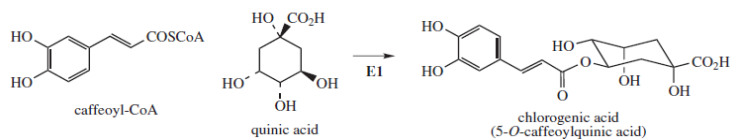
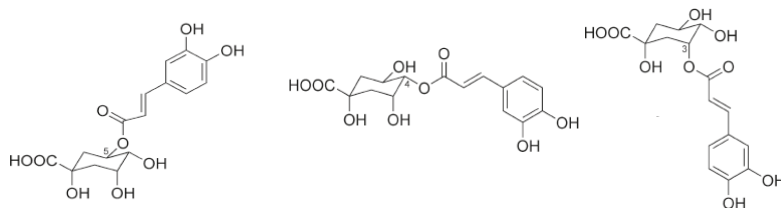
✓ podem ocorrer na forma livre ou esterificados

✓ (?) distribuição universal

COMPONENTES UV-FLUORESCENTES NA PAREDE CELULAR

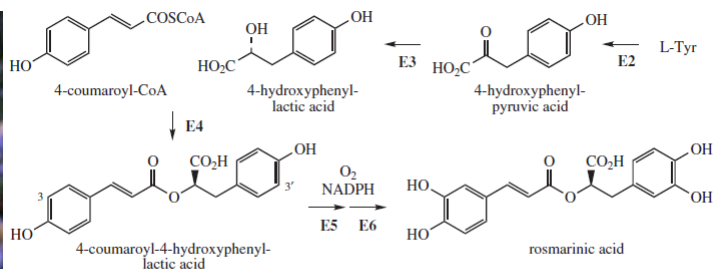
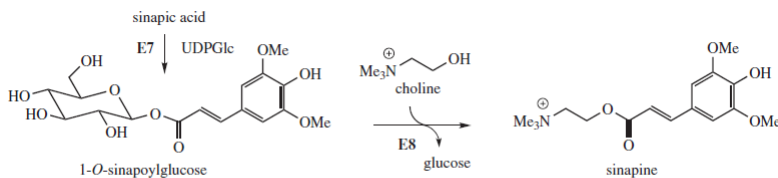


$C_6-C_1 + C_6-C_3$: ÁCIDO CLOROGÊNICO E DERIVADOS

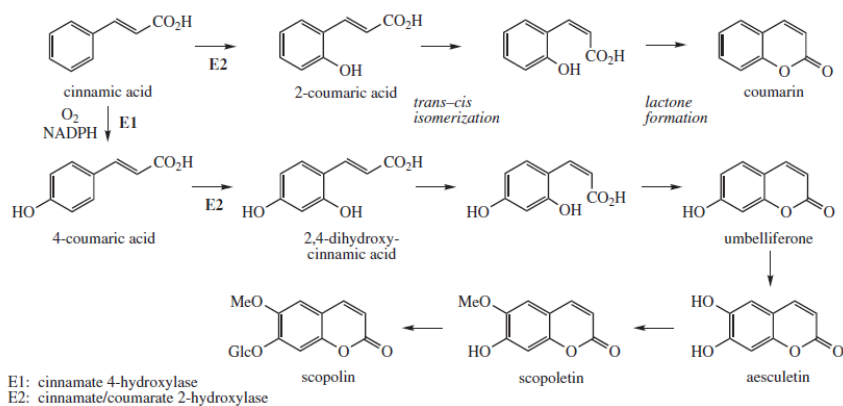
E1: quinate *O*-hydroxycinnamoyltransferase

O café torrado tem aproximadamente 5 vezes mais ácido clorogênico do que cafeína.

O ácido clorogênico tem alta atividade antioxidante, controla o dano celular e reduz a [glicose].

E2: tyrosine aminotransferase
E3: hydroxyphenylpyruvate reductaseE4: hydroxycinnamoyl-CoA:hydroxyphenyllactate
hydroxycinnamoyl transferase (rosmarinic acid synthase)
E5, E6: hydroxycinnamoyl-hydroxyphenyllactate 3- and 3'-hydroxylasesE7: sinapate 1-glucosyltransferase
E8: sinapoylglucose:choline *O*-sinapoyltransferase (sinapine synthase)

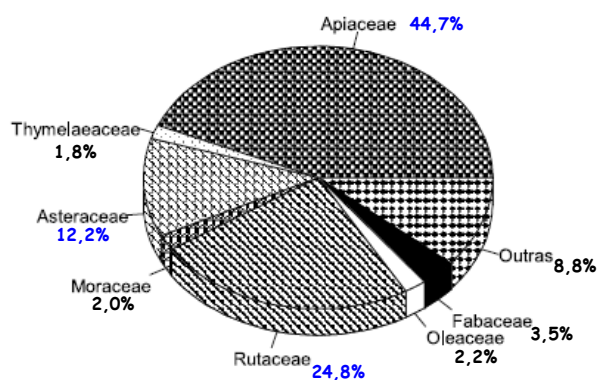
5. CUMARINAS



✓ Lactonas de C_6-C_3

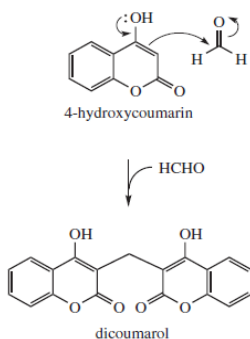
✓ Frequentes em várias famílias de Angiospermas

5. CUMARINAS



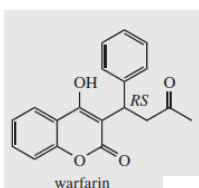
✓ Distribuídas em todos os clados do APG-IV

5. CUMARINAS

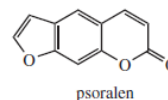


Melilotus officinalis (Fabaceae)
Trevo-doce

- ✓ Intoxicação do gado no pasto
- ✓ Interfere com Vitamina K na coagulação sanguínea conduzindo à hemorragia letal
- ✓ Dicoumarol – pacientes em risco de trombozes

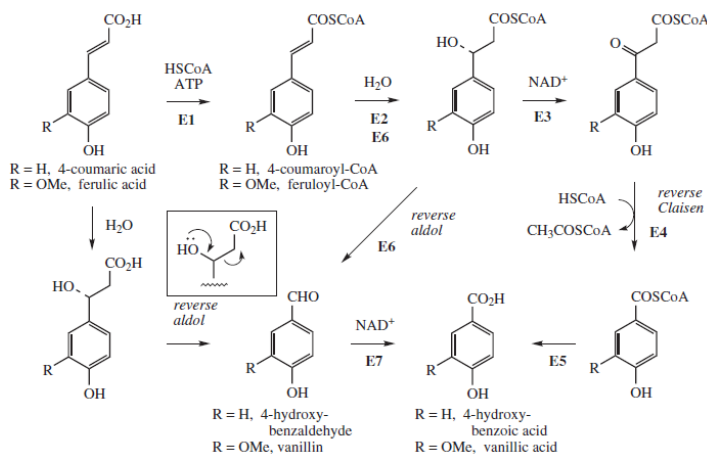


- ✓ Warfarina: cumarina sintética
- ✓ Empregada como rodenticida



- ✓ Fotosensibilização

6. DERIVADOS C₆-C₁ OBTIDOS POR UNIDADES C₆-C₃

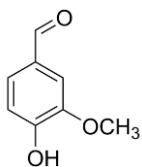


- ✓ Ácidos fenólicos C₆-C₁: distribuição universal

E1: CoA ligase
E2: enoyl-CoA hydratase
E3: dehydrogenase

E4: thiolase
E5: thioesterase

E6: enoyl-CoA hydratase/lyase
E7: dehydrogenase

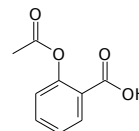
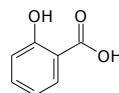
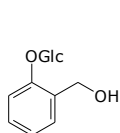


✓ Orquídeas vaniloides

✓ Baunilha - Vanilina

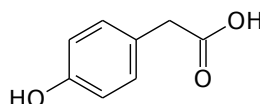
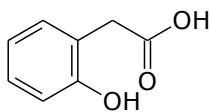


Vanilla spp. (Orchidaceae)



Salicina; Aspirina: inibe a atividade da COX, por transferência de um grupo acetil para o grupo hidroxílico do aa. serina da enzima. A aspirina reduz o processo inflamatório e inibe a síntese de prostaglandinas.

7. DERIVADOS C_6-C_2 OBTIDOS POR UNIDADES C_6-C_3

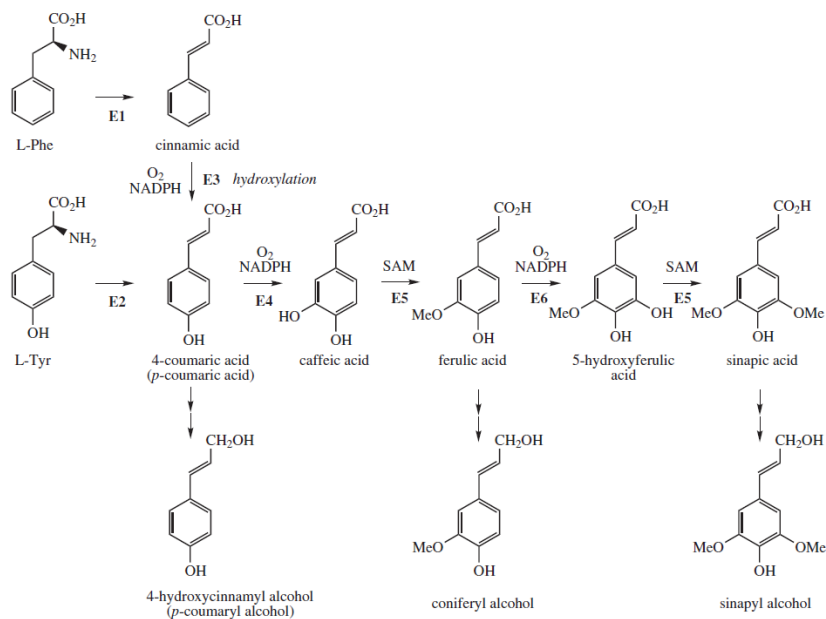


Astilbe sp. - Saxifragaceae

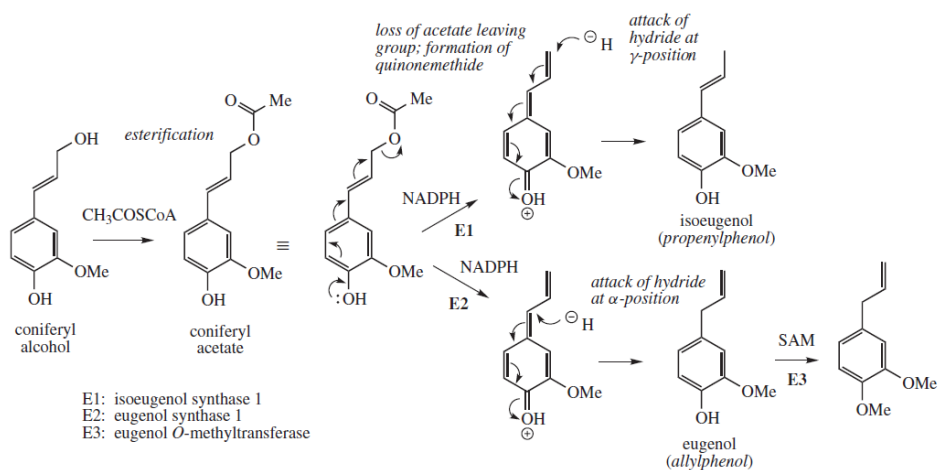
Taraxacum officinalis
Asteraceae

✓ Ácidos fenólicos C_6-C_2 : distribuição restrita

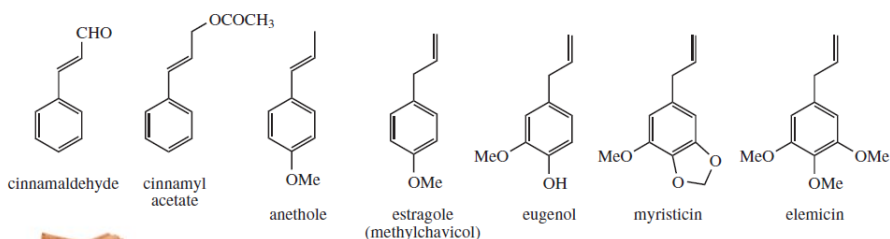
REDUÇÃO DOS ÁCIDOS A ÁLCOOIS



CONVERSÃO DOS ÁLCOOIS A FENILPROPENÓIDES



8. FENILPROPANOIDES (C_6-C_3)

Funcho - *Foeniculum vulgare*Anis - *Pimpinella anisum*Anis-estrela - *Illicium verum*Noz-moscada - *Myristica fragrans*

✓ Componentes de óleos voláteis

✓ Funções: Alelopatia, antimicrobiana

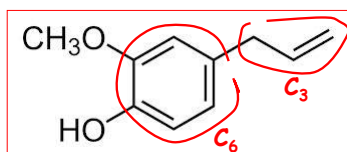


Syzygium aromaticum - Myrtaceae
cravo



www.shutterstock.com · 50809489

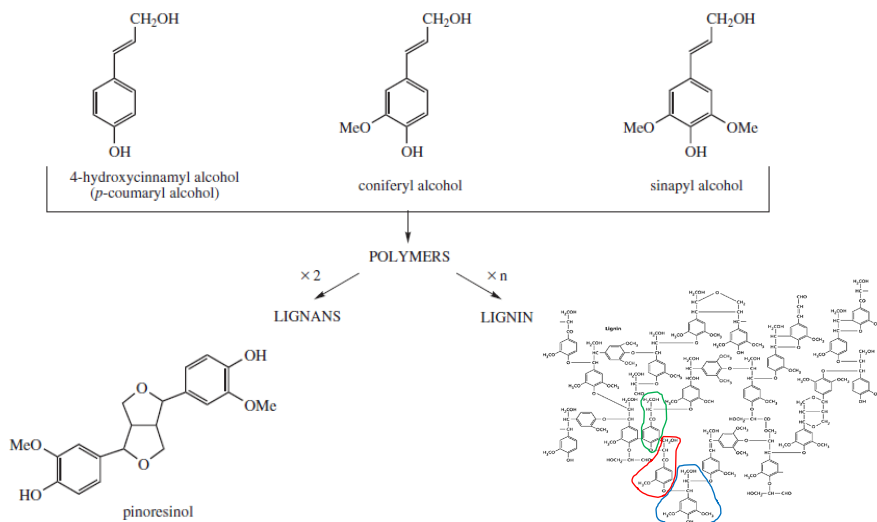
Botões florais de cravo, fonte
de óleo volátil.



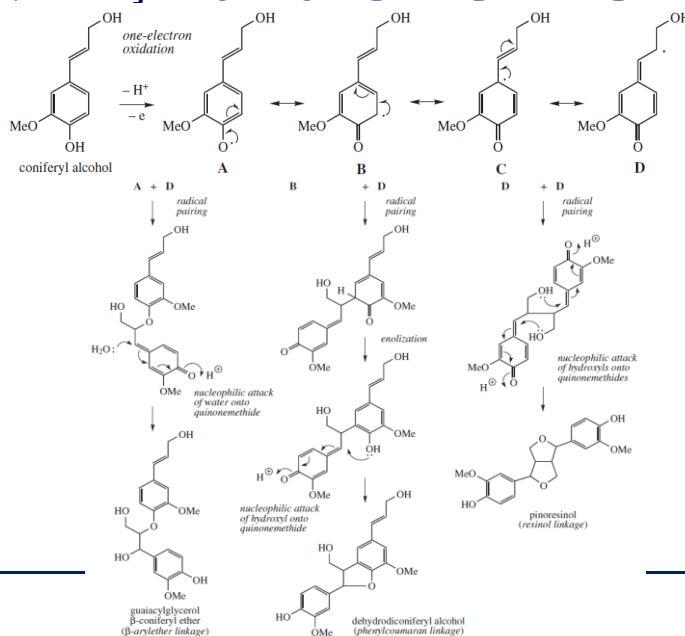
Eugenol: principal componente do óleo
de cravo.

Atua: anestésico bucal.

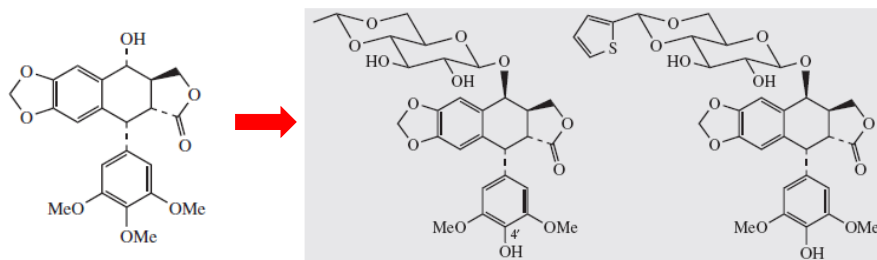
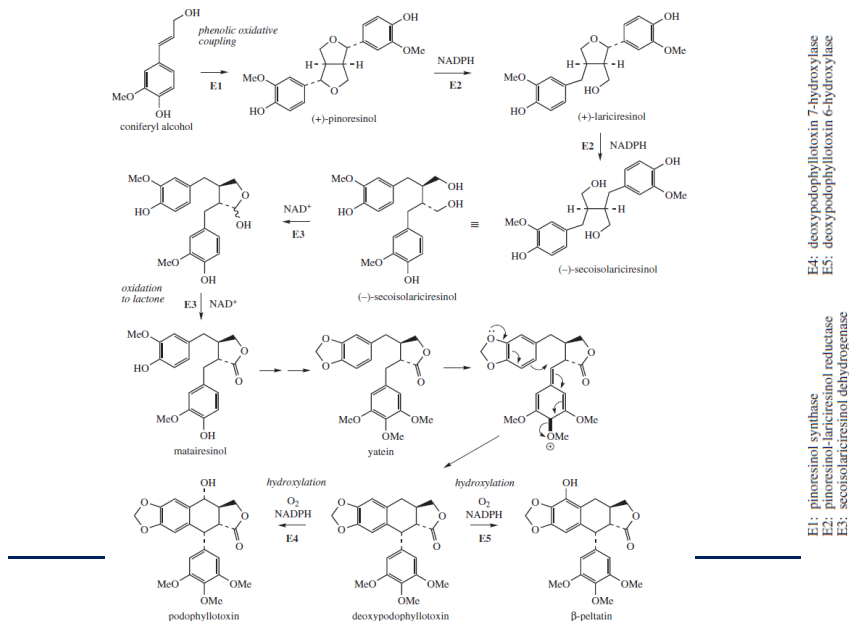
DÍMEROS (C₆-C₃)₂ E POLÍMEROS (C₆-C₃)_n



FORMAÇÃO DOS DÍMEROS E POLÍMEROS



9. LIGNOIDES (C_6-C_3)₂

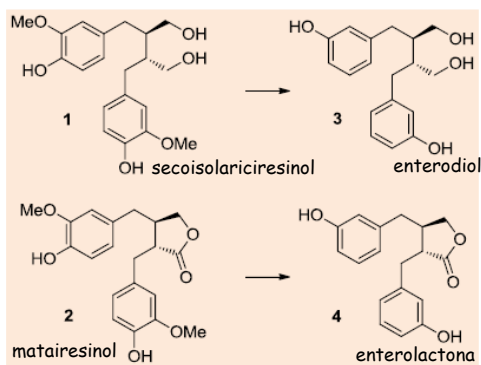


Podofilotoxina: isolado das raízes de *Podophyllum hexandrum* e *P. peltatum* e usado na quimioterapia do câncer de pulmão, entre outros.

A substância e os derivados (etoposídeo e teniposídeo) possuem efeito antimitótico.



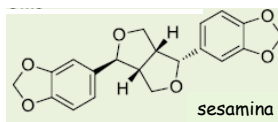
LIGNOIDES NA ALIMENTAÇÃO



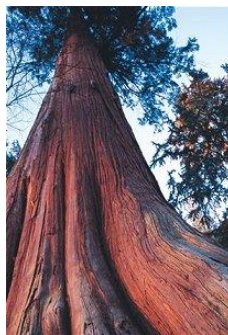
✓ Redução das taxas de incidência de tumores de próstata e mama



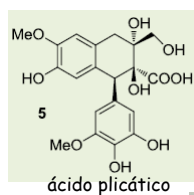
Sesamum indicum - Pedaliaceae



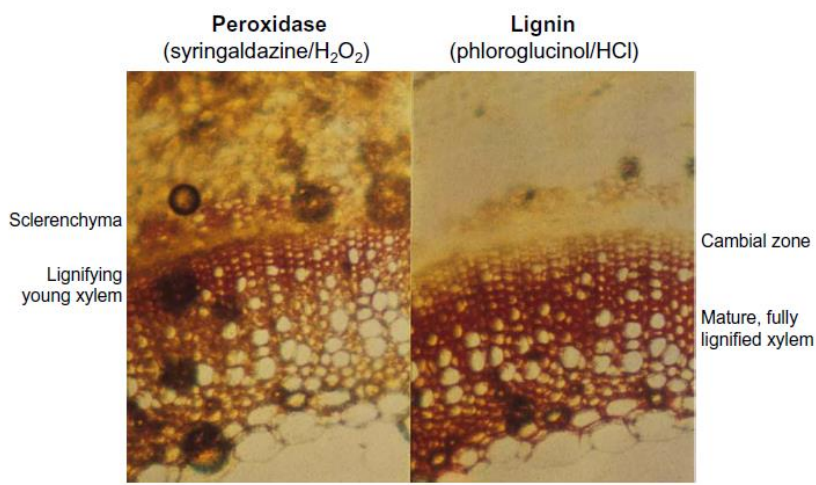
Cryptomeria japonica - Cupressaceae



Thuja plicata - Cupressaceae

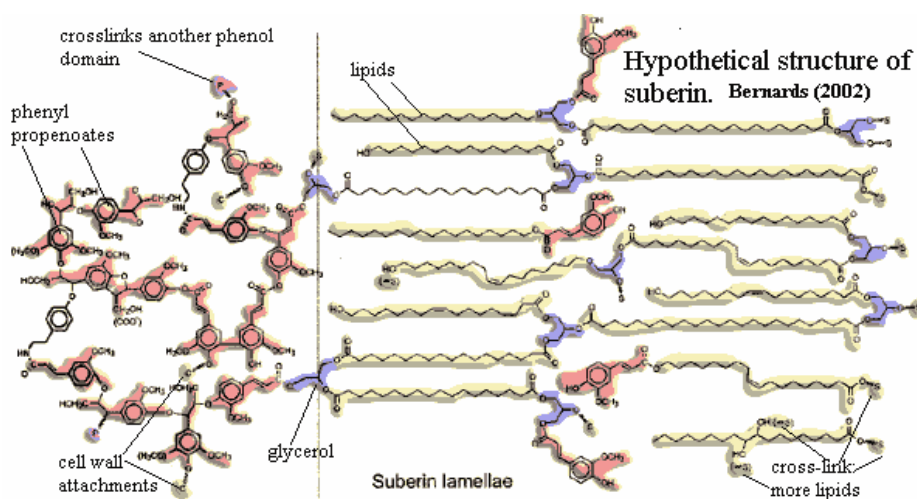


Detecção em *Forsythia* da atividade da enzima peroxidase e deposição de lignina



SUBERINA

- ✓ Suberina: derivados de ácidos graxos de cadeia longa e ácidos cinâmicos



<http://www.palaeos.com/Plants/Lists/Glossary/GlossarySi.html>

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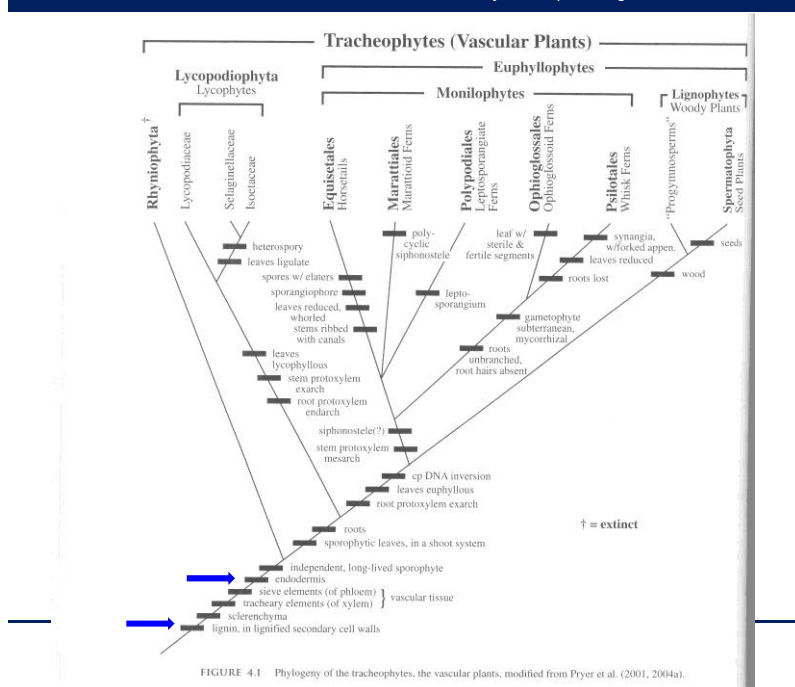


FIGURE 4.1 Phylogeny of the tracheophytes, the vascular plants, modified from Pryer et al. (2001, 2004a).

BIB 5754 – Produtos Naturais I: Biossíntese e Distribuição em Espécies Vegetais

