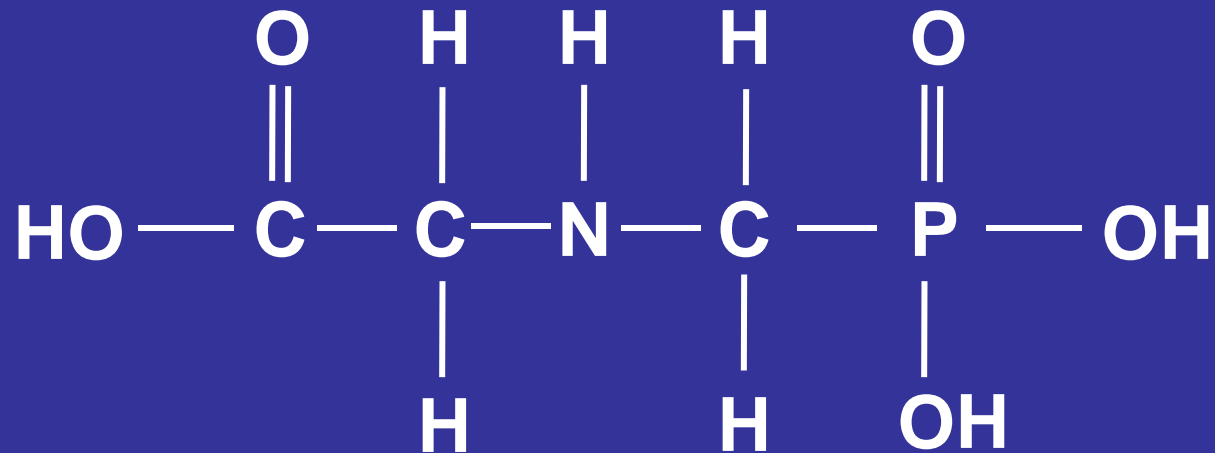


A ROTA DO ÁCIDO SHIQUÍMICO E SUA IMPORTÂNCIA PARA A DEFESA VEGETAL



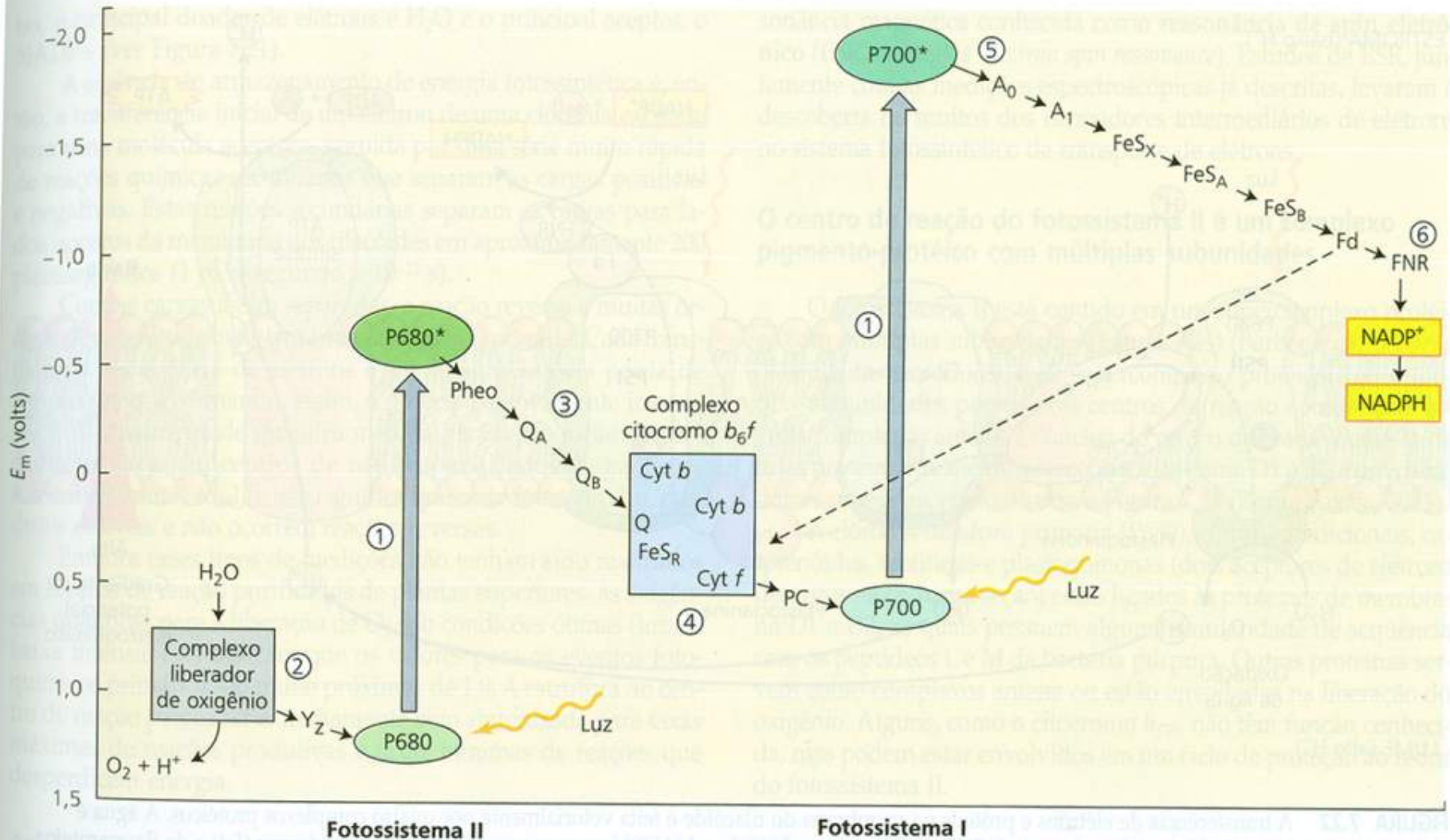
Prof. Dr. PAULO R.C. CASTRO
ESALQ/USP – PIRACICABA/SP

GLYPHOSATE – COMPOSIÇÃO QUÍMICA

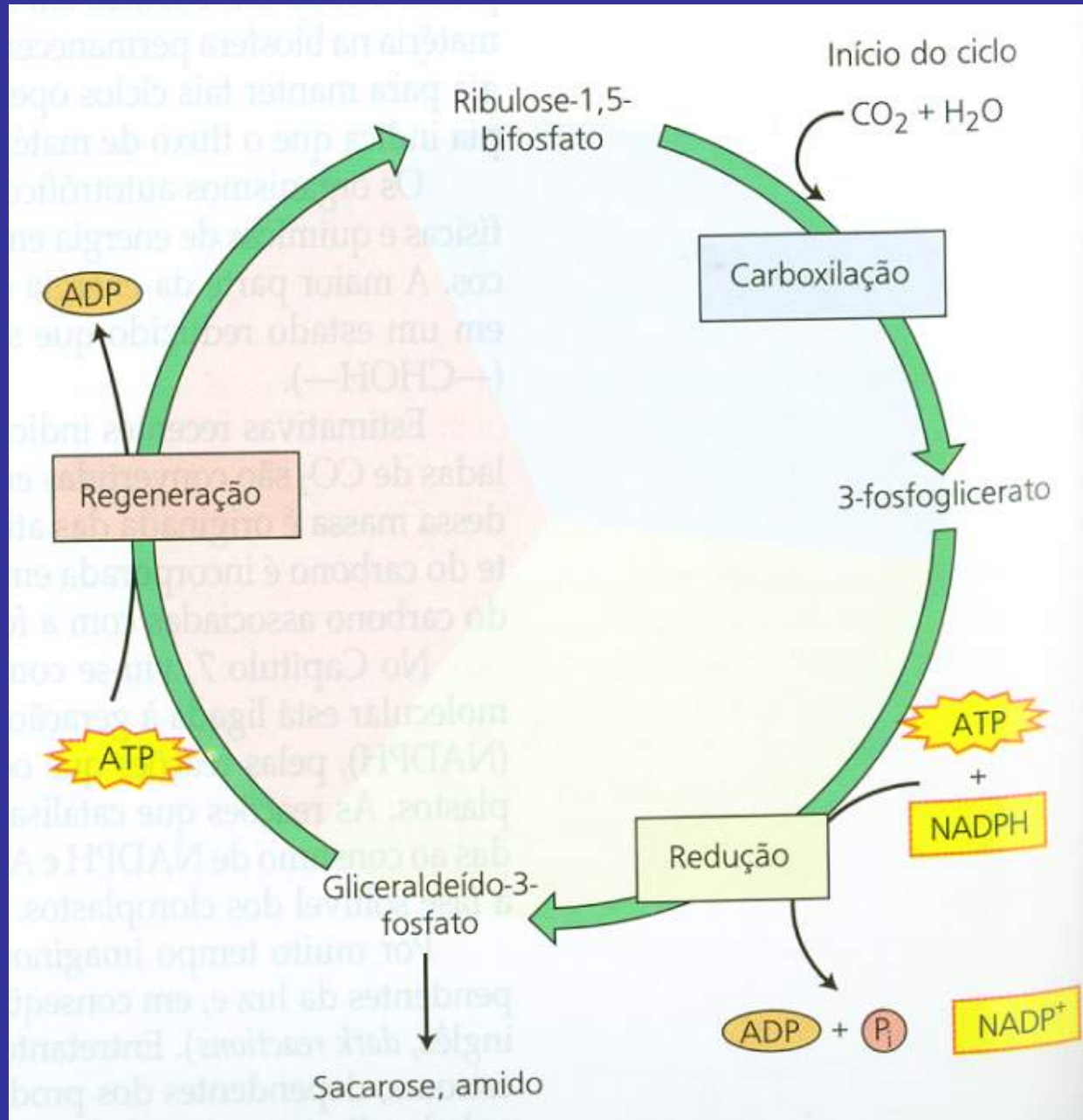


N-PHOSPHONOMETHYL GLYCINE

FOTOSSÍNTESE: FASE FOTOQUÍMICA



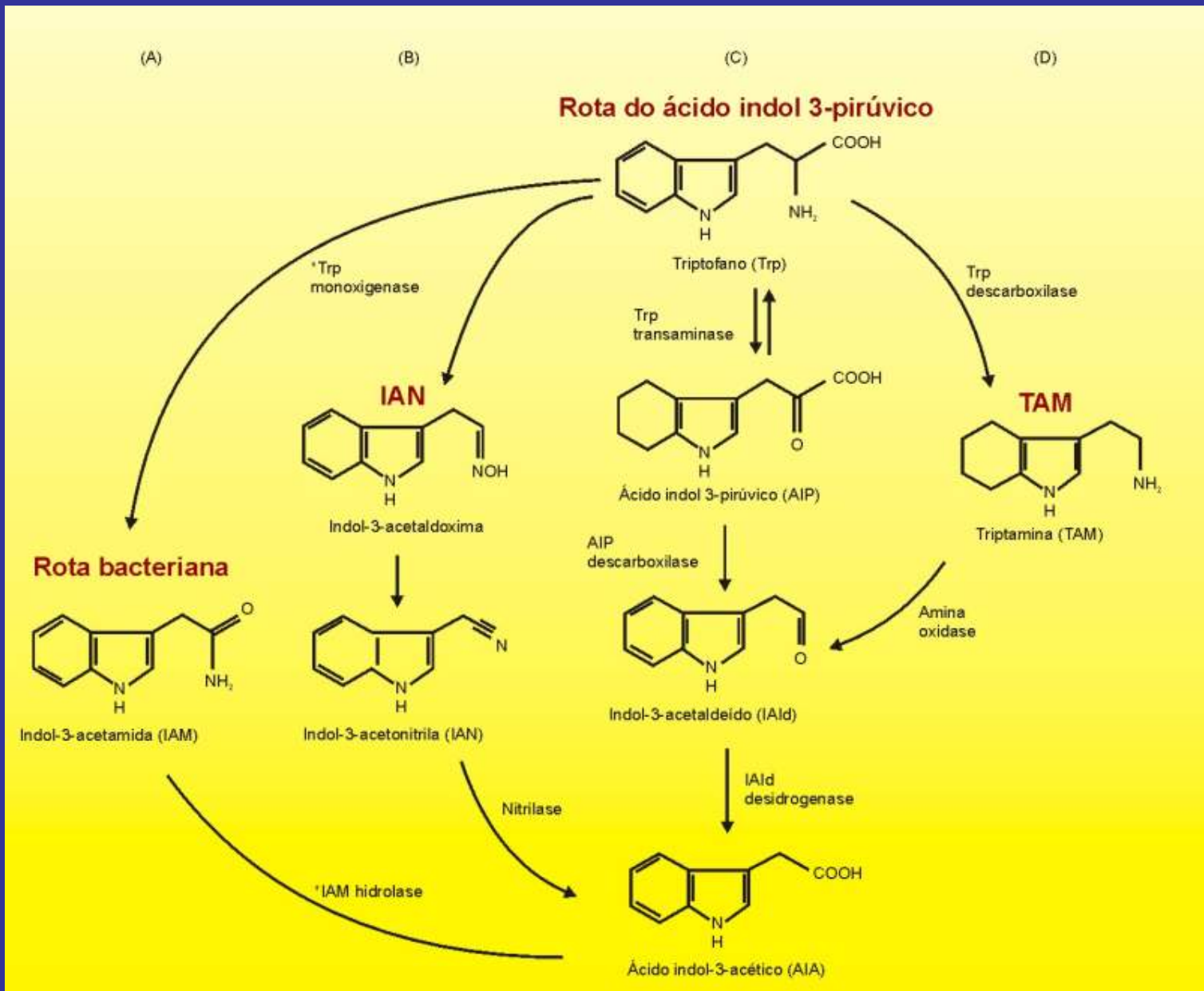
FOTOSSÍNTESE: CICLO DE CALVIN



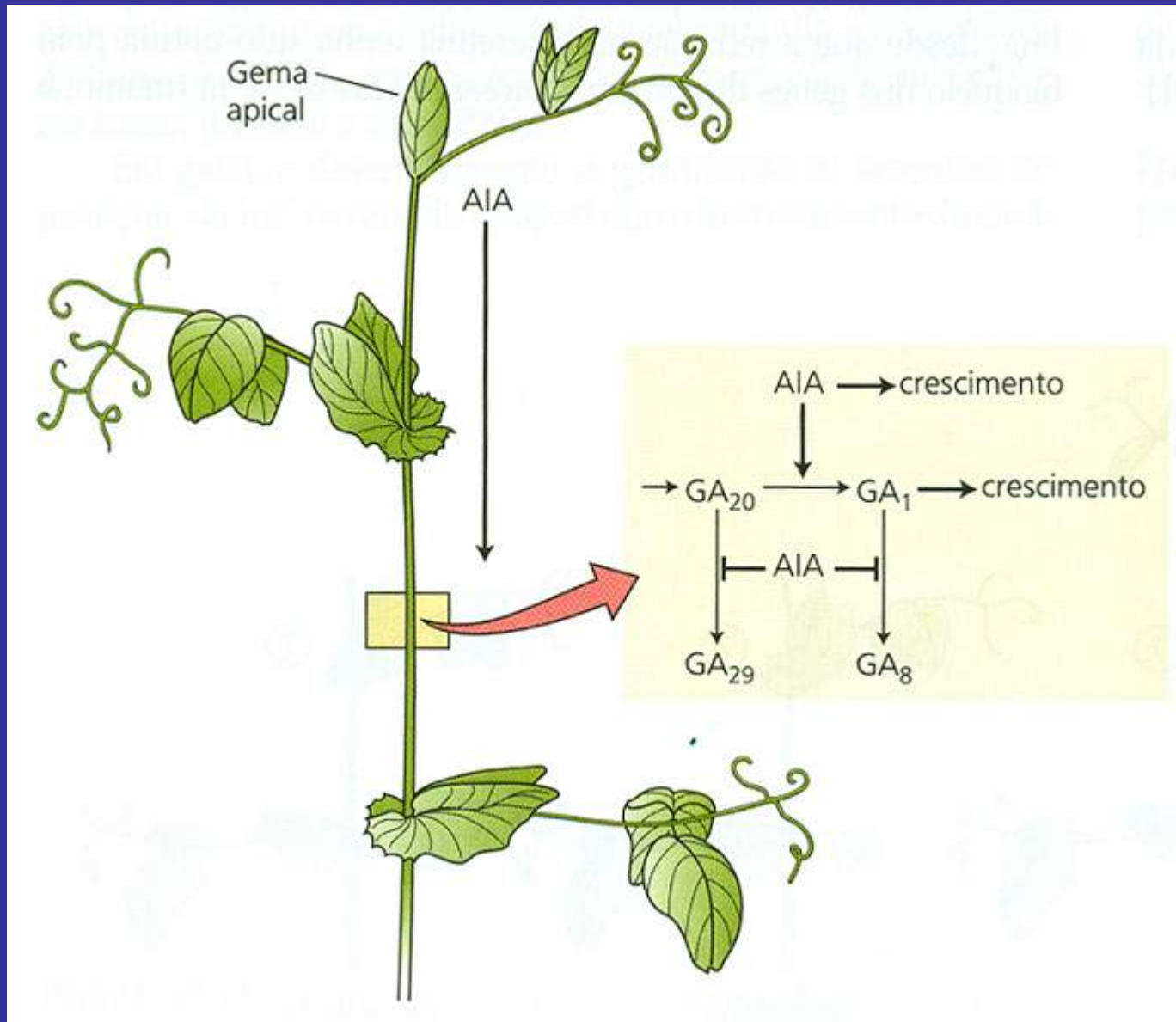
AÇÃO DO GLYPHOSATE



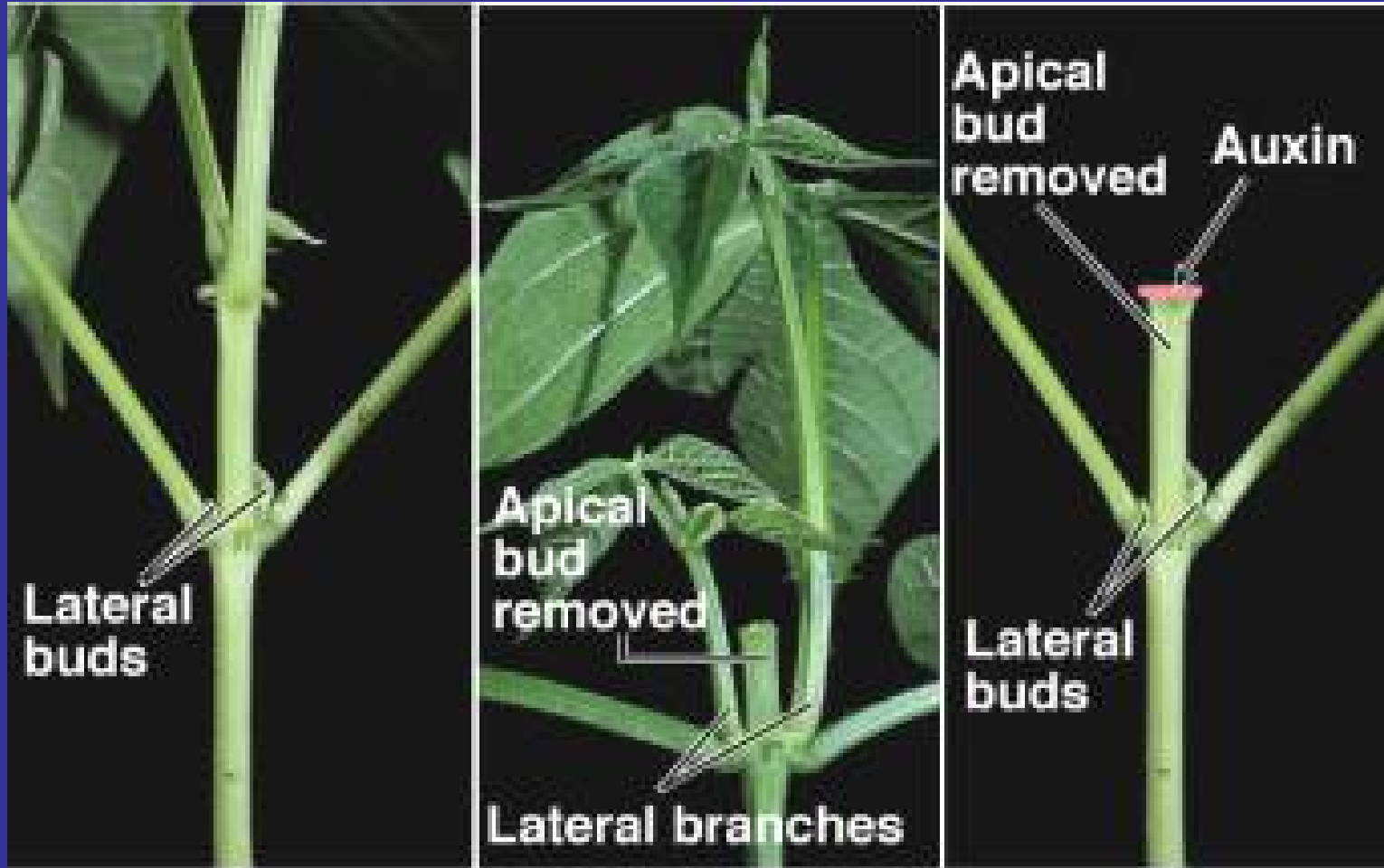
BIOSSÍNTESE DE IAA

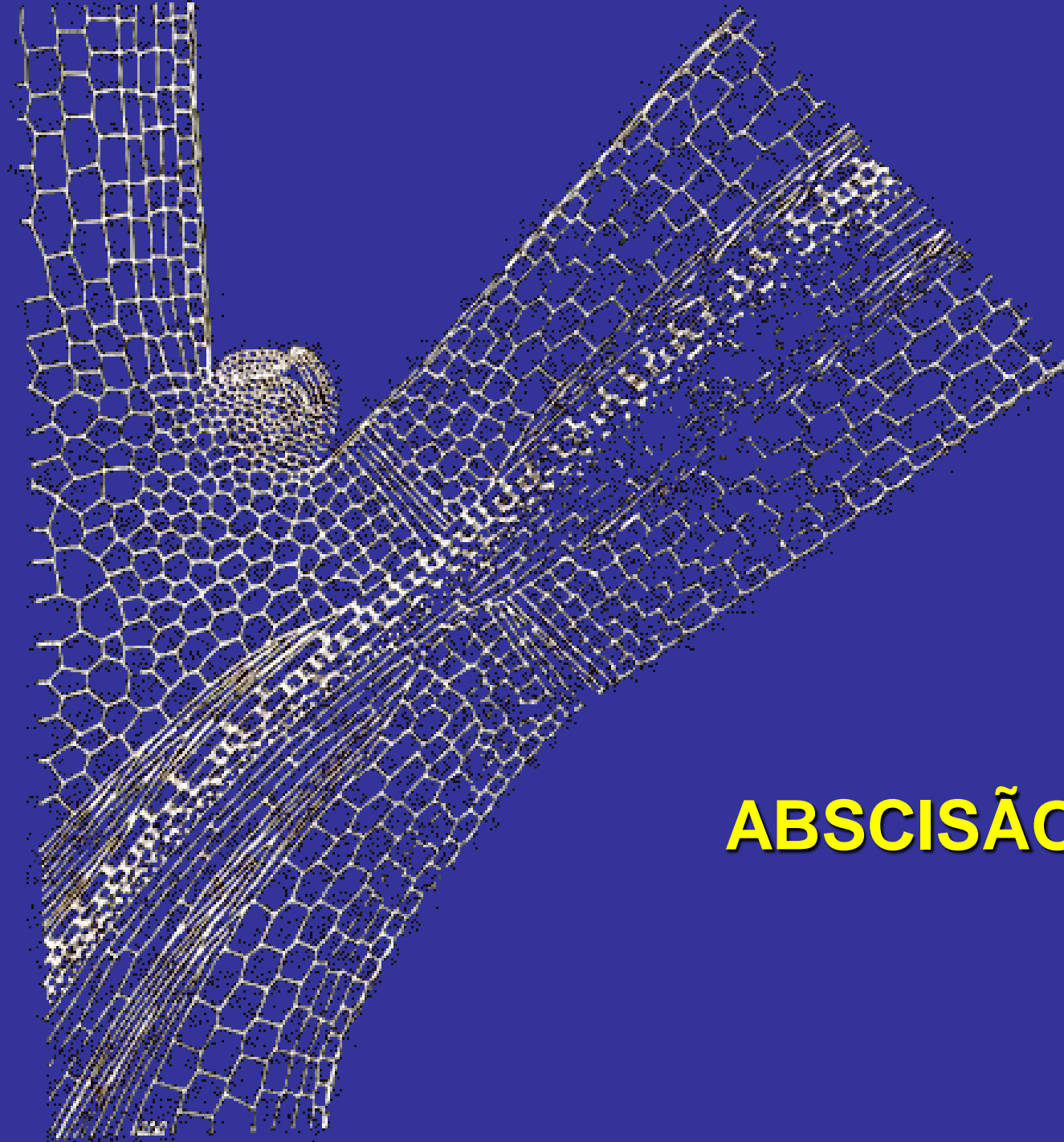


IAA APICAL PROMOVE SÍNTESE DE GA1 E INIBE DEGRADAÇÃO DE GA



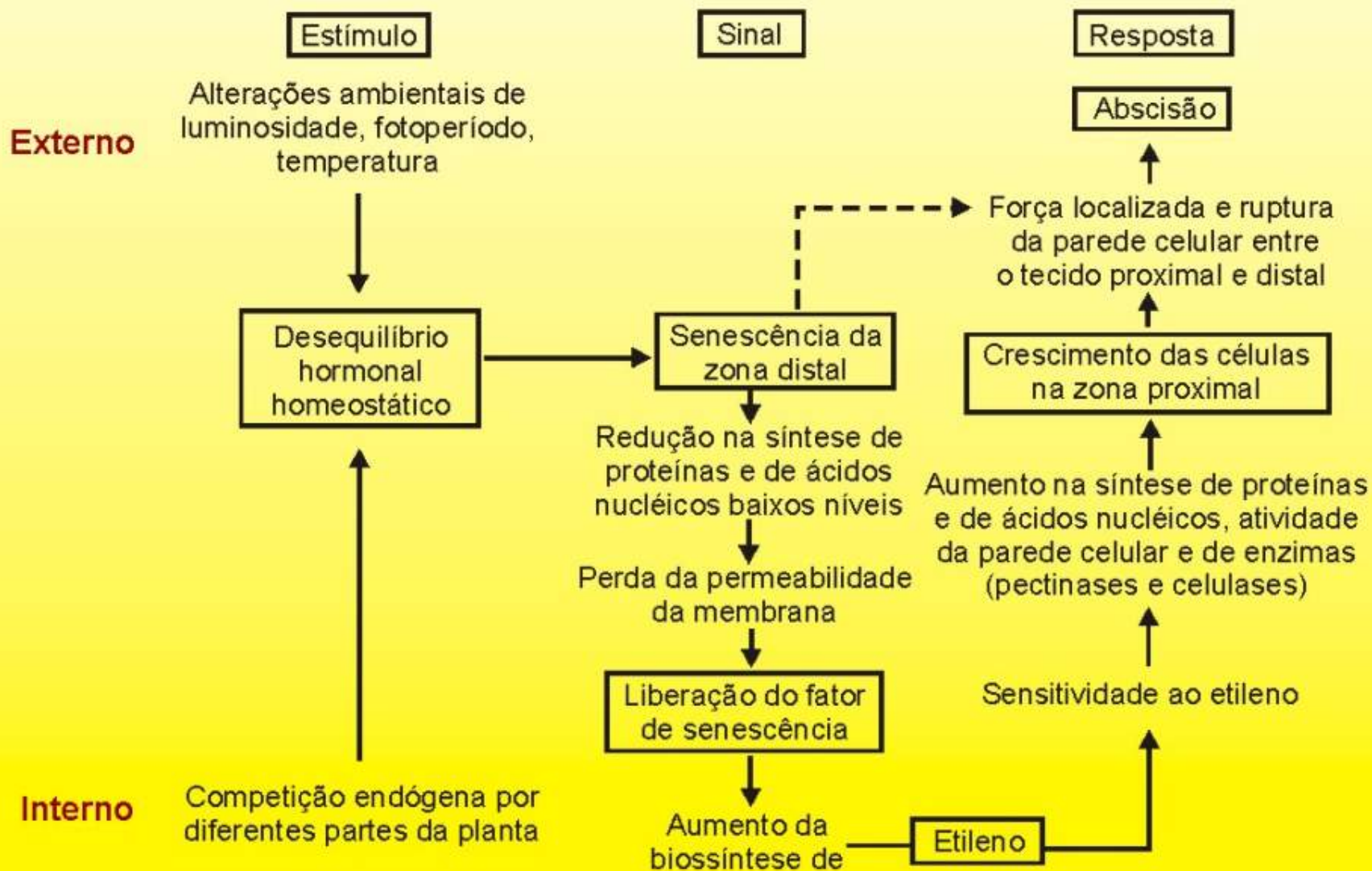
QUEBRA DA DOMINÂNCIA APICAL E AUXINA



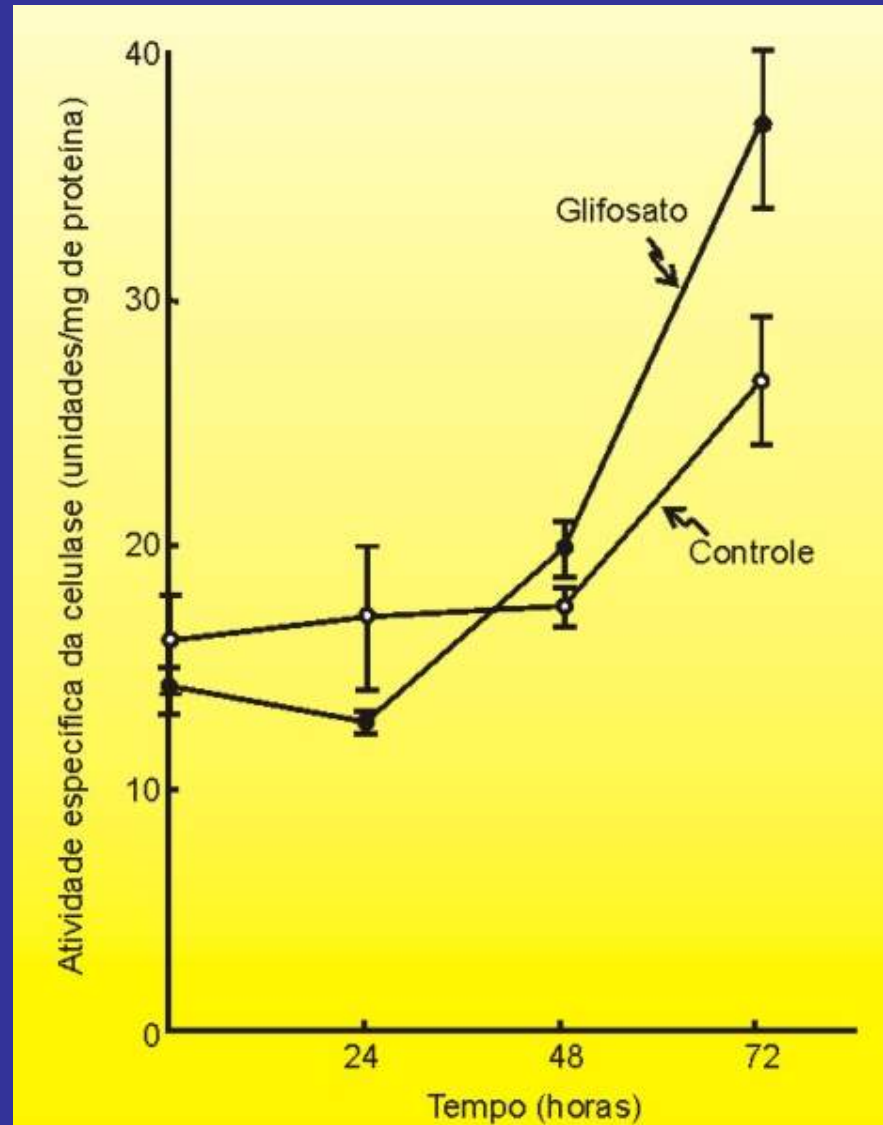


ABSCISÃO

ABSCISÃO FOLIAR

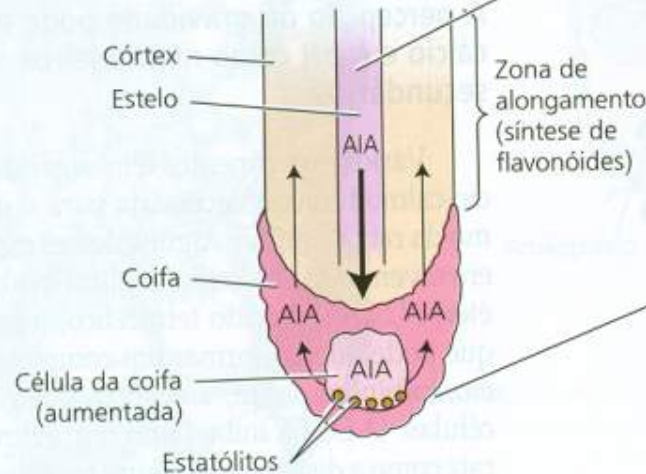


EFEITOS DE 20 mM DE GLYPHOSATE NA ATIVIDADE DA CELULASE NA REGIÃO DE ABSCISÃO



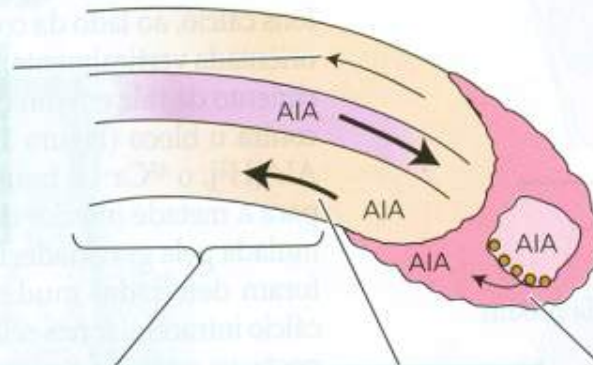
REDISTRIBUIÇÃO DO IAA DURANTE O GRAVITROPISMO

(A) Orientação vertical



(B) Orientação horizontal

6. O decréscimo de auxina na metade superior estimula o crescimento desta região. Como resultado, a raiz curva-se para baixo.

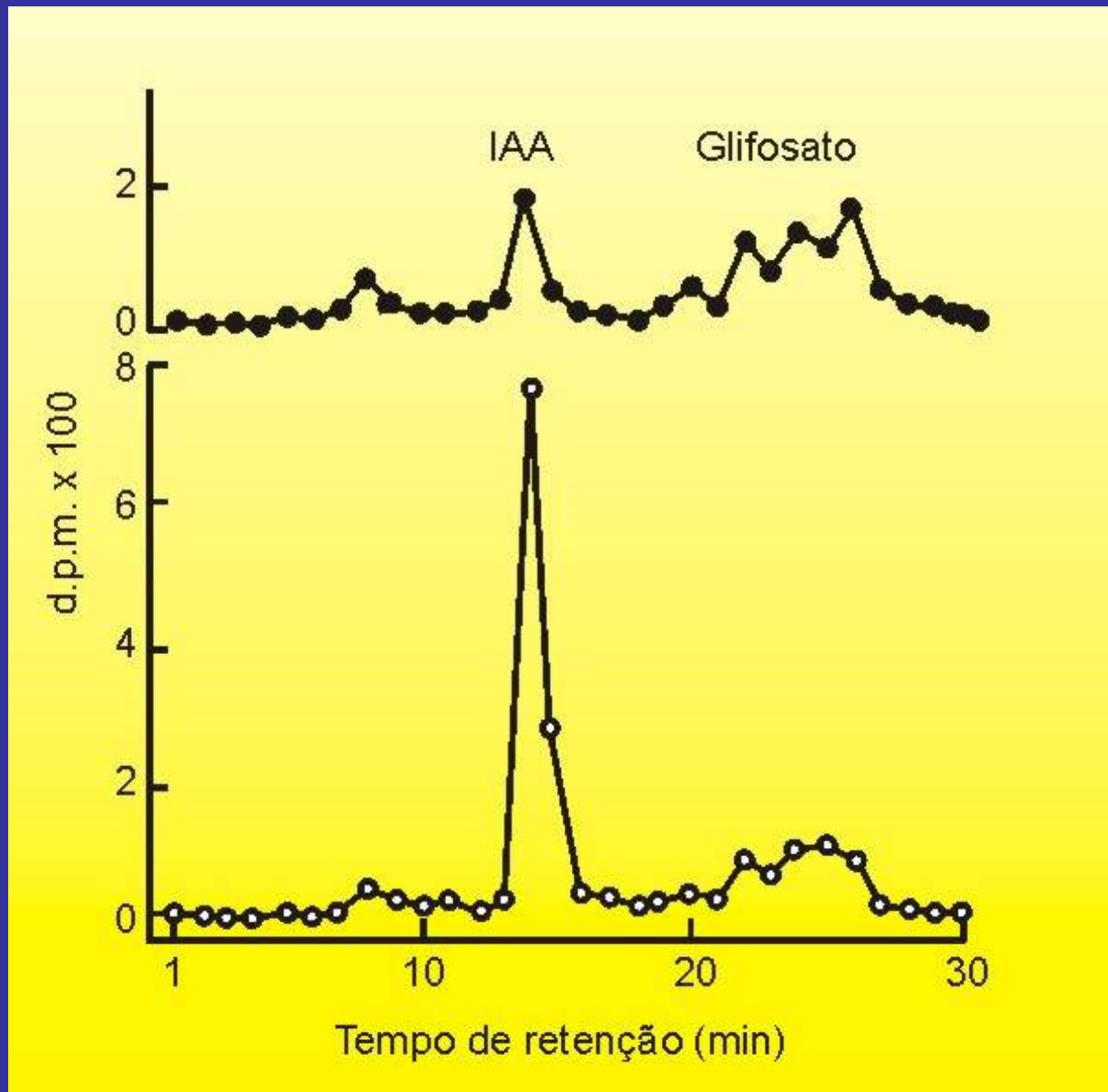


5. A alta concentração de auxina na metade inferior da raiz inibe o crescimento.

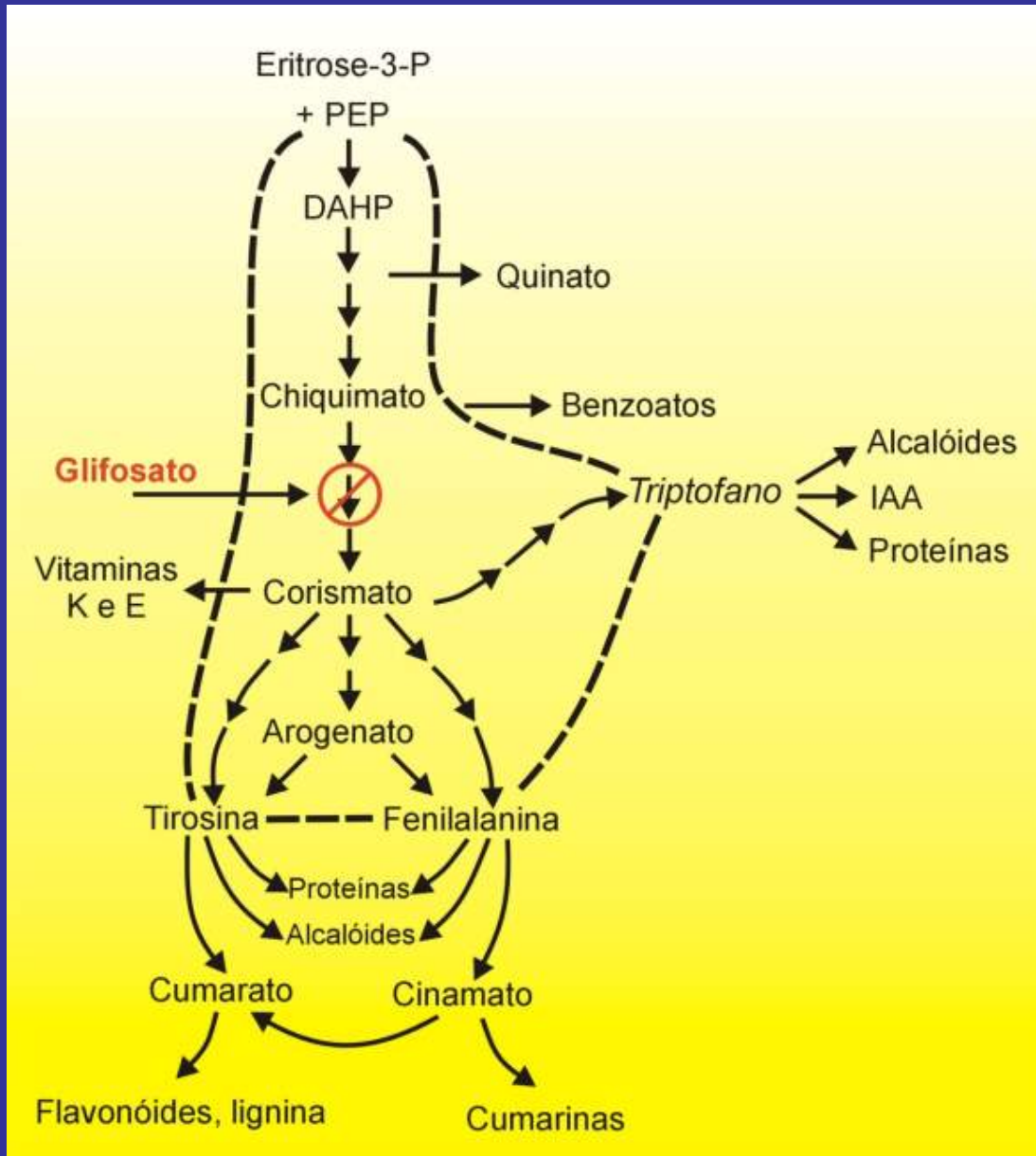
4. A maior parte da auxina da coifa é então transportada em direção basípeta no córtex na metade inferior da raiz.

3. Em uma raiz horizontal, os estatólitos sedimentam para a lateral das células da coifa, desencadeando o transporte polar de IAA para a metade inferior da coifa.

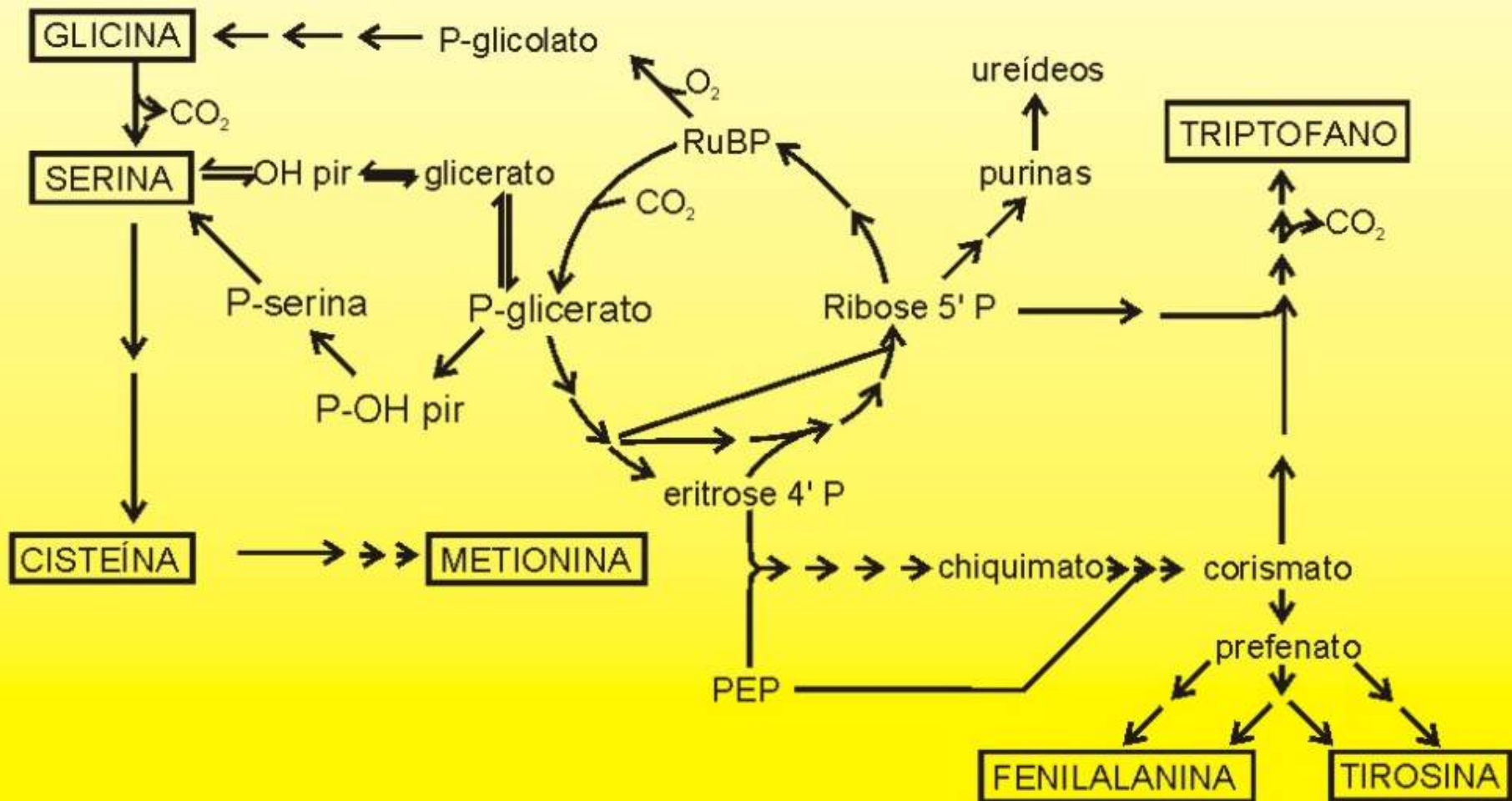
REDUÇÃO DO IAA EM CALO DE TABACO TRATADO COM GLYPHOSATE



VIA DO SHIQUIMATO E OUTRAS



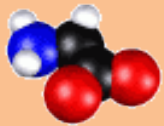
FLUXO DE CARBONO NA BIOSSÍNTESE DE AMINOÁCIDOS E UREÍDEOS



20 aminoácidos encontrados em proteínas

Não-polar
(hidrofóbicos)

Tendem-se a agregar no interior da estrutura proteica



Gly



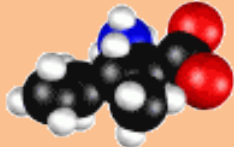
Ala



Val



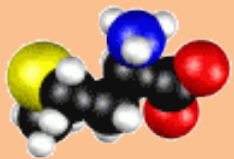
Leu



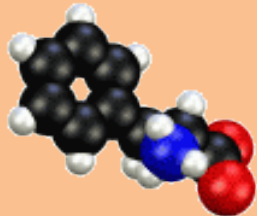
Ile



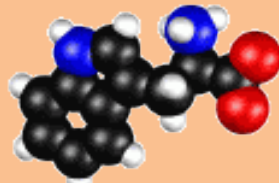
Pro



Met



Phe



Trp

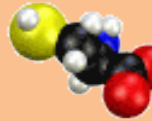
Polares não-carregados
(hidrofílicos)



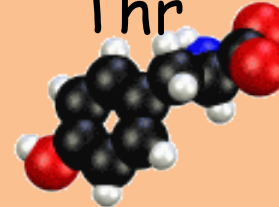
Ser



Thr



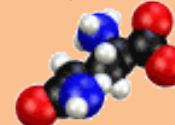
Cys



Tyr

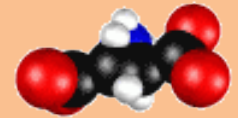


Asn

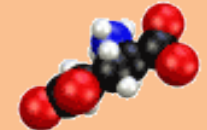


Gln

Polares,
Negativam.
carregados
(hidrofílicos)

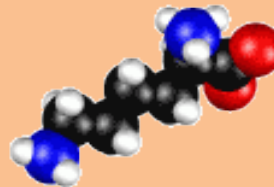


Asp

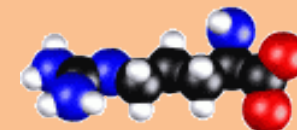


Glu

Polares, positivam.
carregados
(hidrofílicos)



Lys



Arg



His

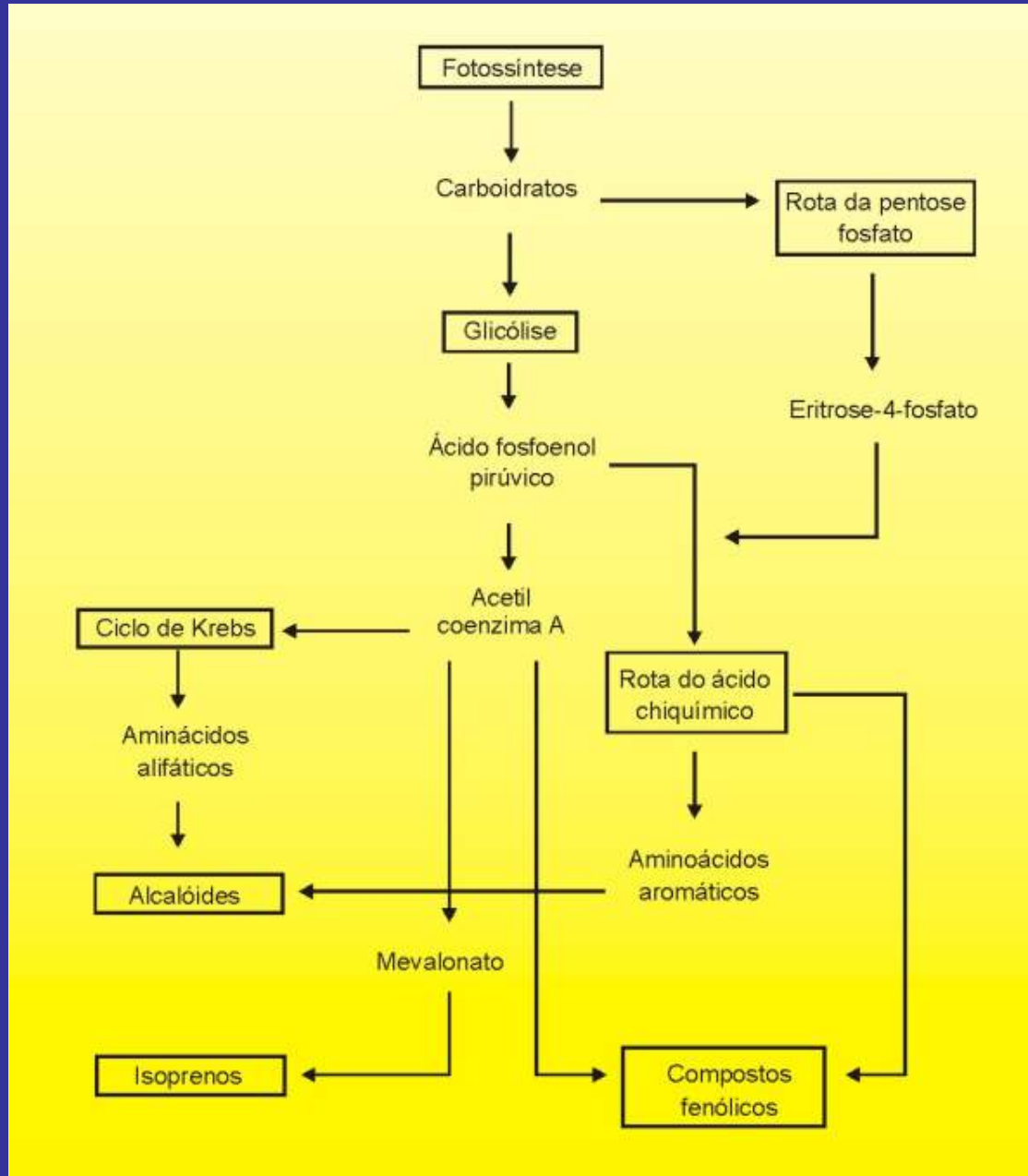
EFEITO DO GLYPHOSATE NA SÍNTESE DE AMINOÁCIDOS

Efeitos do glifosato nos pools livres de aminoácidos aromáticos em quatro espécies vegetais.

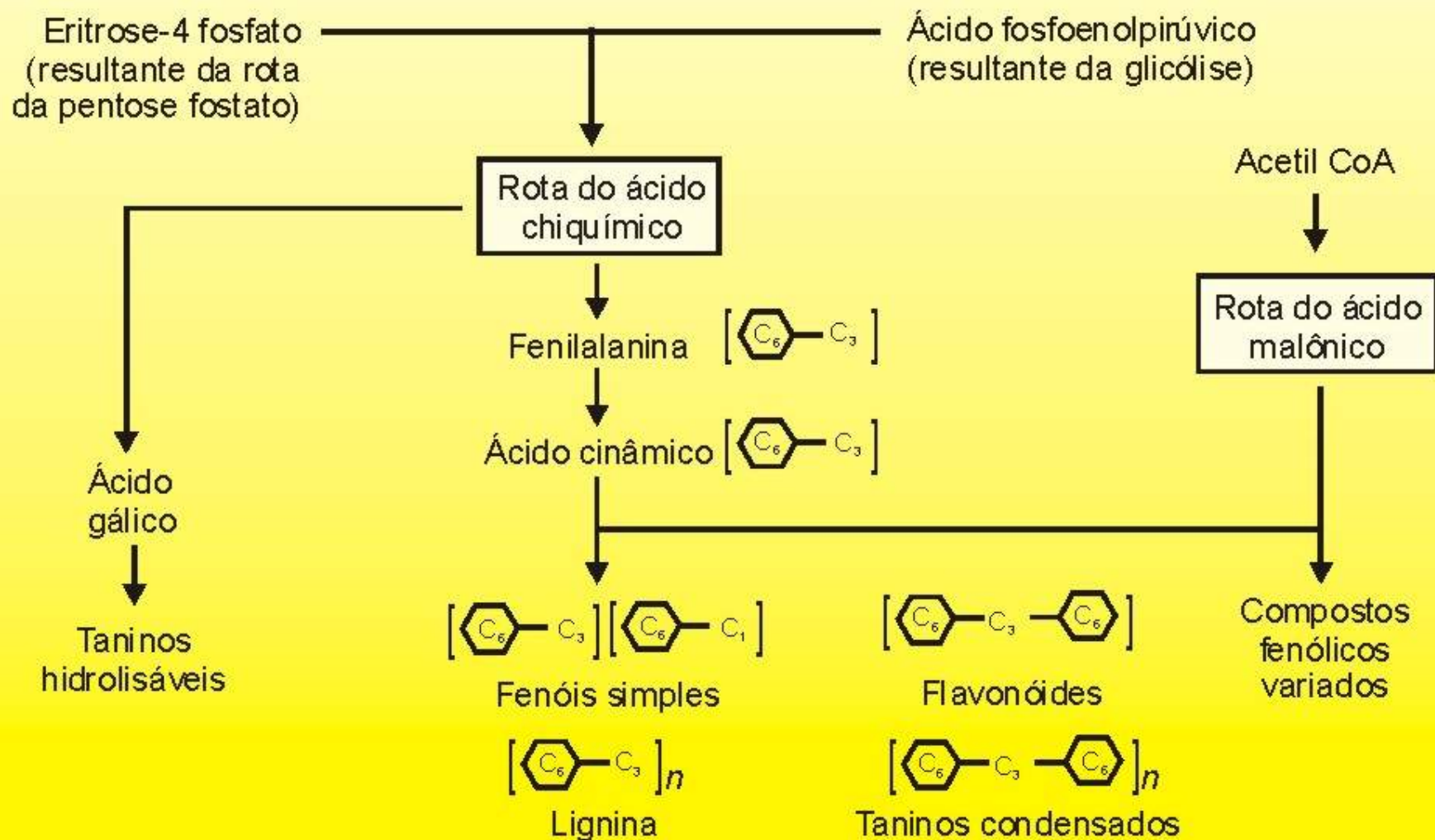
Espécie	Tecido	Concentração de glifosato mmol L ⁻¹	Fenilalanina		Tirosina	
			Controle	Tratamento	Controle	Tratamento
			----- nmol g ⁻¹ peso fresco -----			
Soja	Raiz	0,5	369	168	117	69
Milho	Raiz	1,0	128	77	171	88
Algodão	Raiz	0,2	307	173	125	149
Trigo mourisco	Hipocótilo	1,0	44	20	59	76

Fonte: Duke & Hoagland (1985).

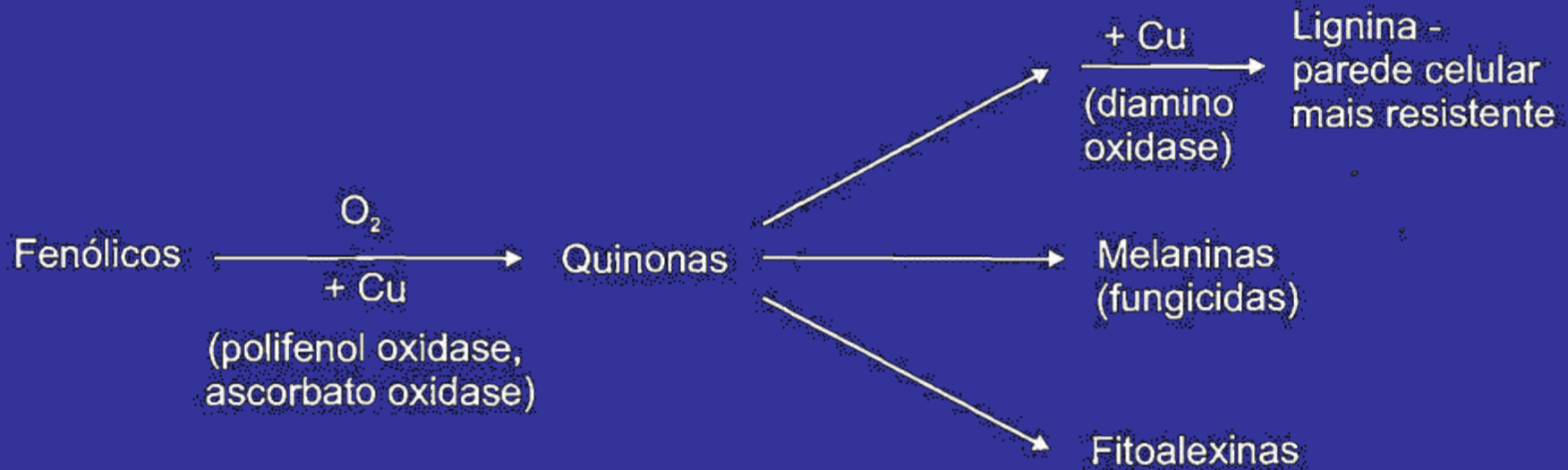
SÍNTESE DE FENÓIS, ISOPRENO E ALCALÓIDES



FENÓIS DERIVADOS DA FENILALANINA

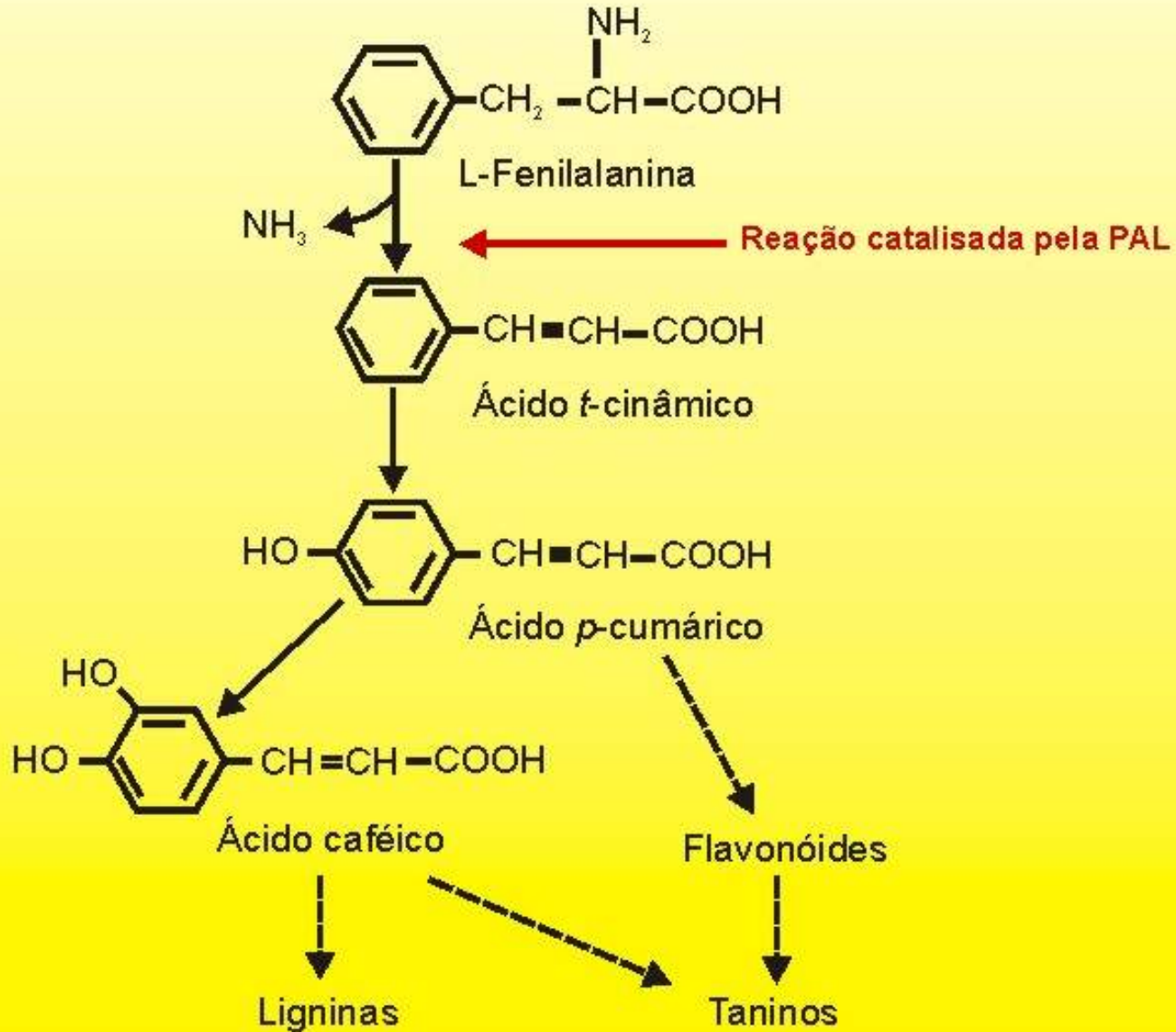


FUNÇÃO DO COBRE NAS VIAS DE TRANSFORMAÇÃO DE FENOL

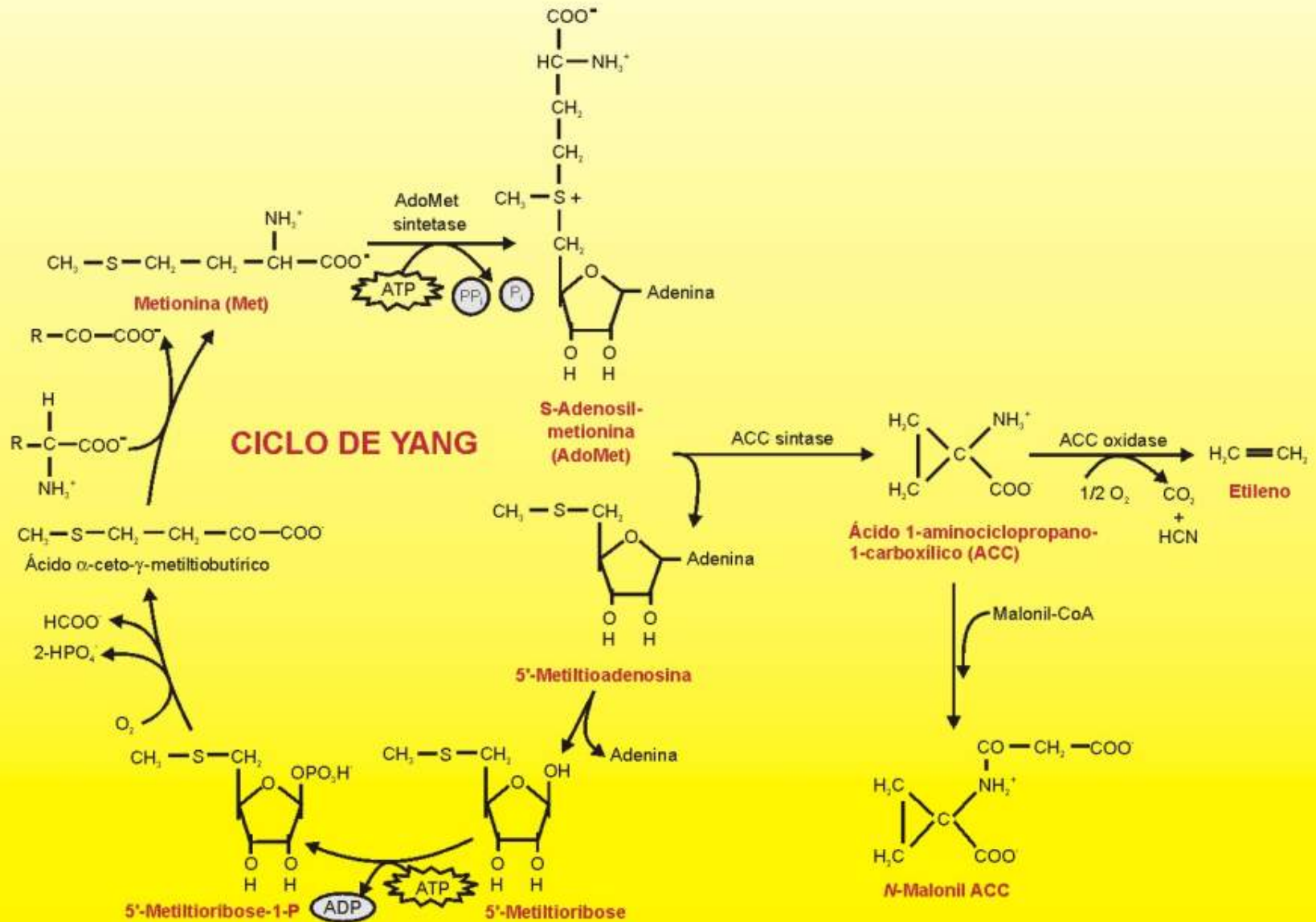


VIA DOS FENÓIS SECUNDÁRIOS

CONTROLADA PELA PAL



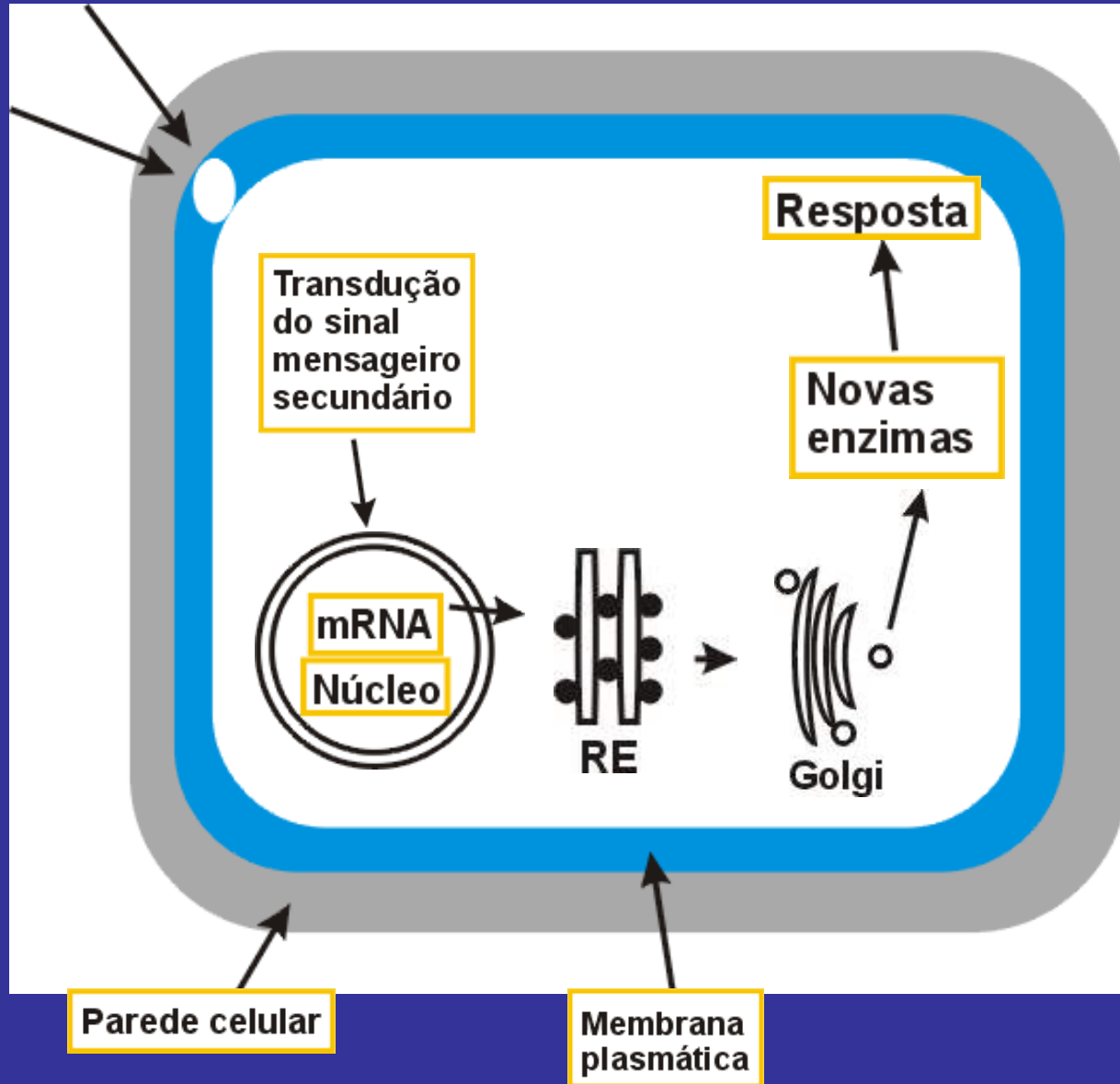
SÍNTESE DE ETILENO



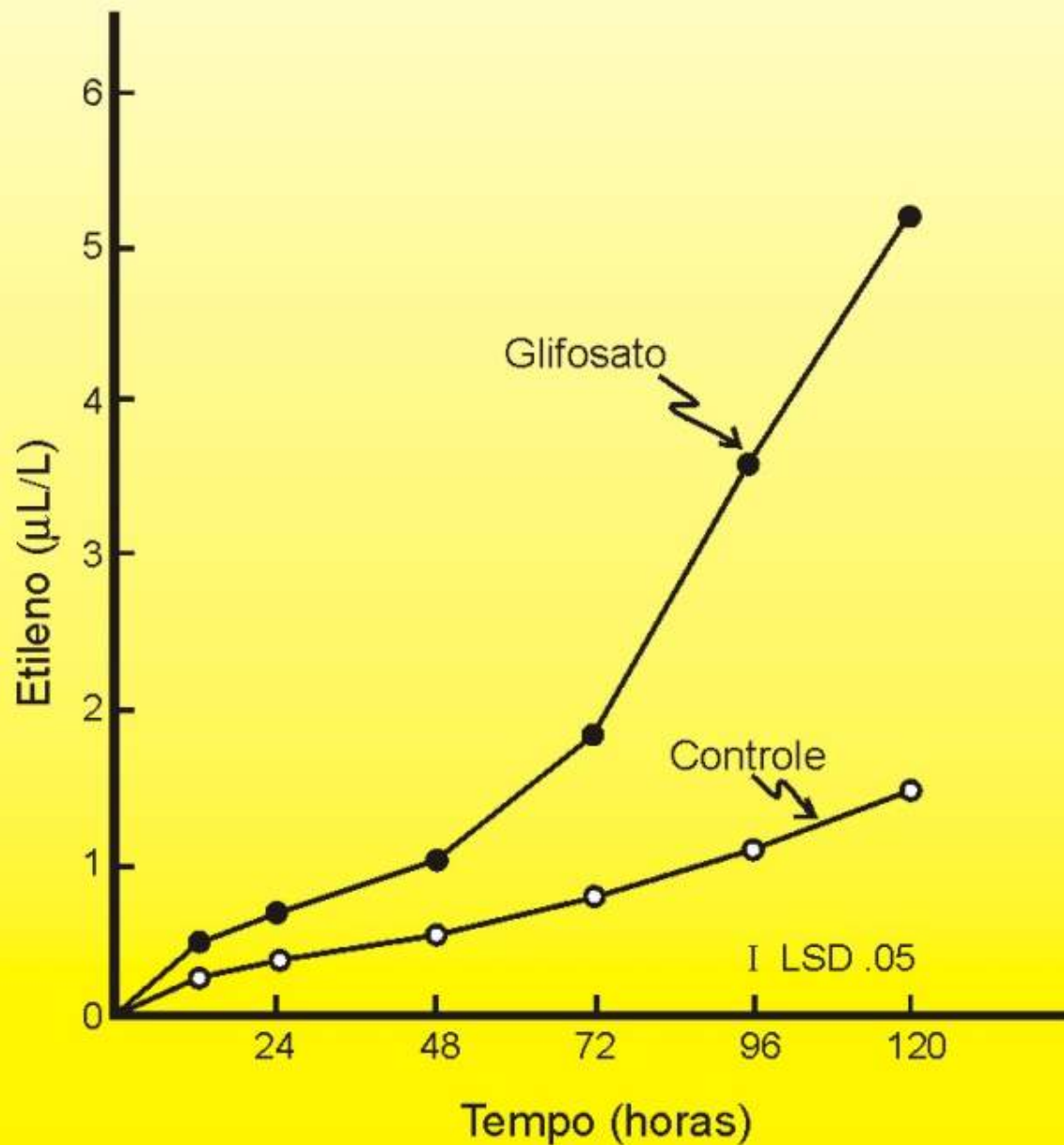
MODO DE AÇÃO

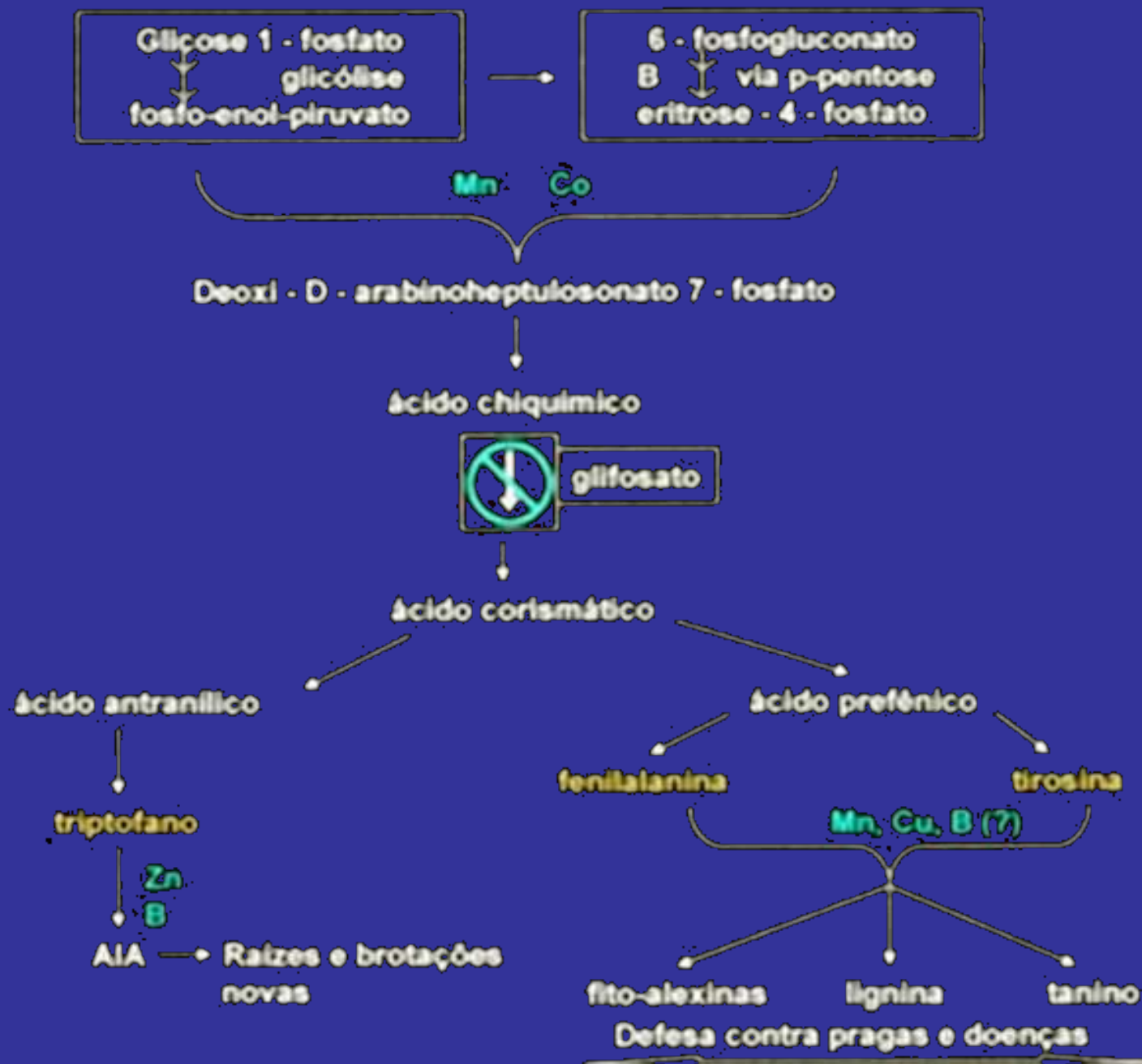
Receptor de etileno

Ef

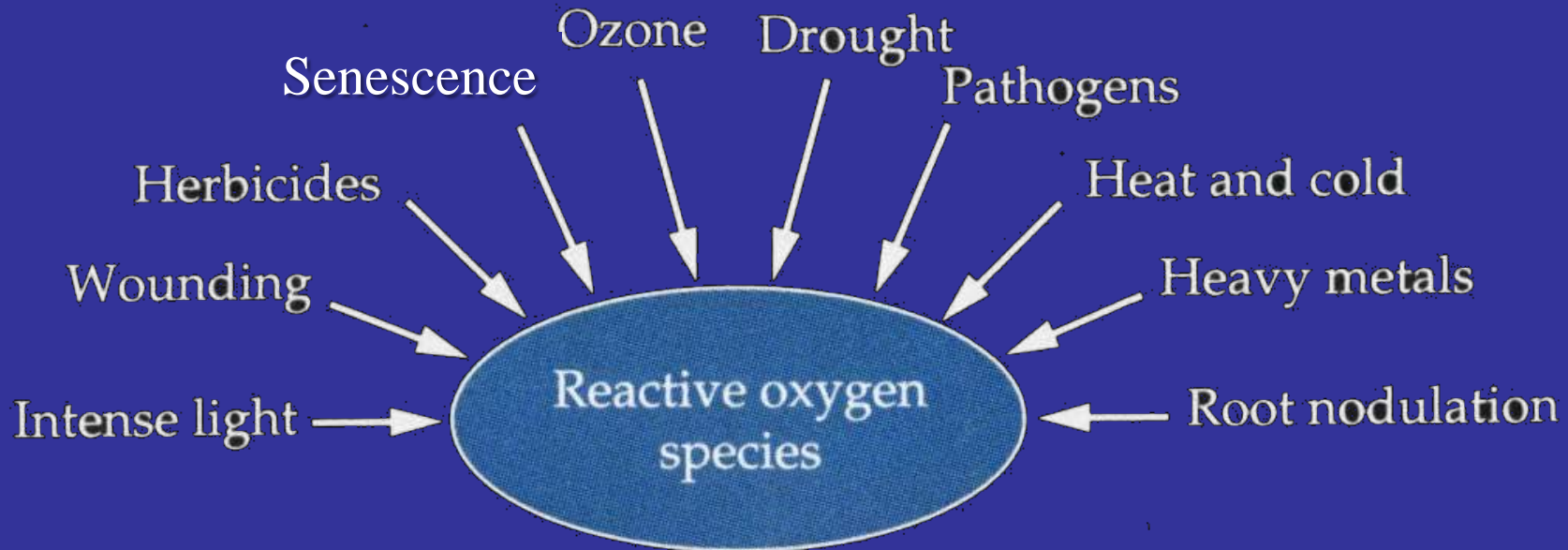


EFEITOS DE 20 mM DE GLYPHOSATE NA PRODUÇÃO DE ETILENO





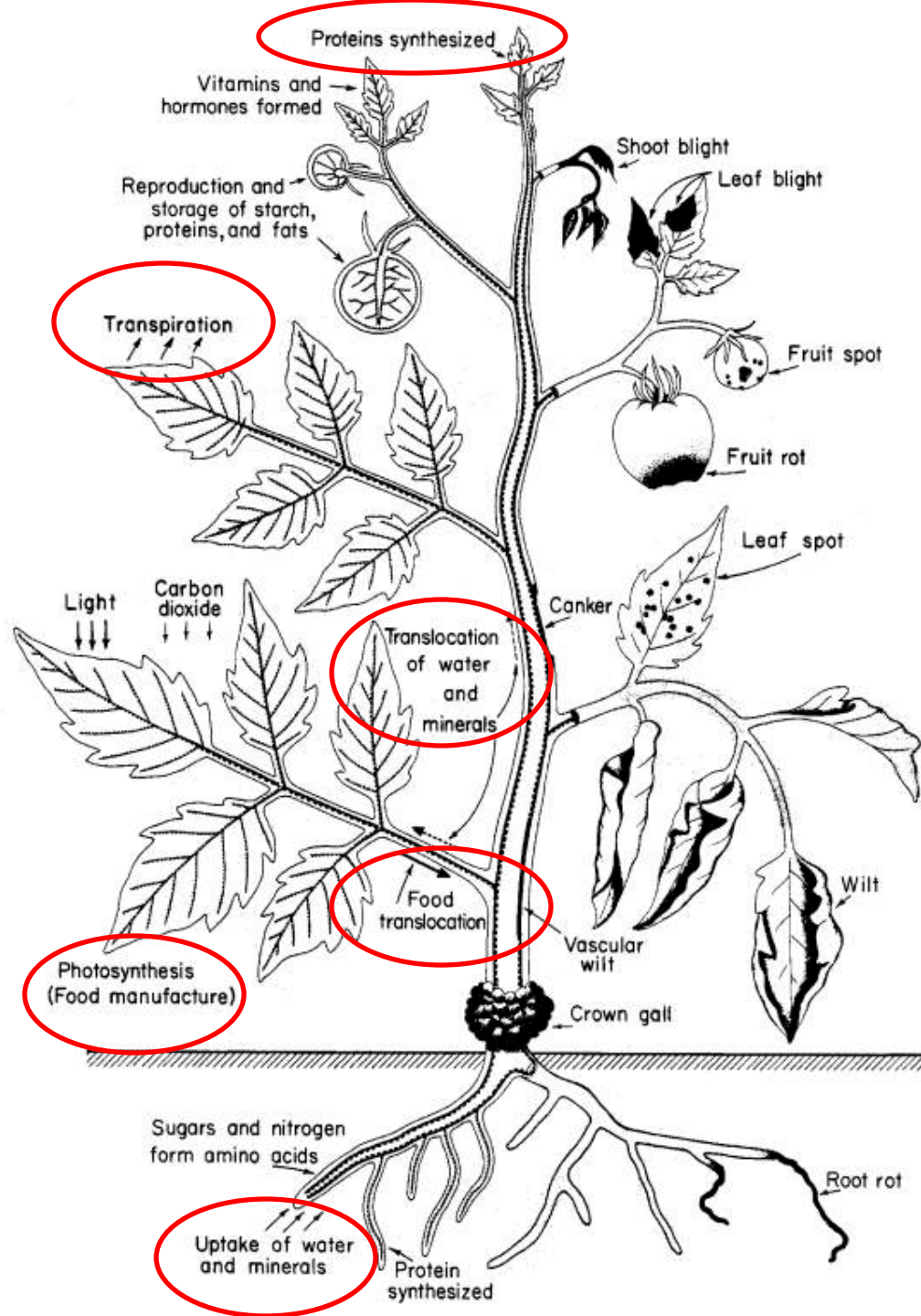
Ação do glifosato e de micronutrientes na síntese de AIA, fitoalexinas, lignina e tanino



**ESTRESSES QUE LEVAM
À SÍNTESE DE ROS EM
PLANTAS**

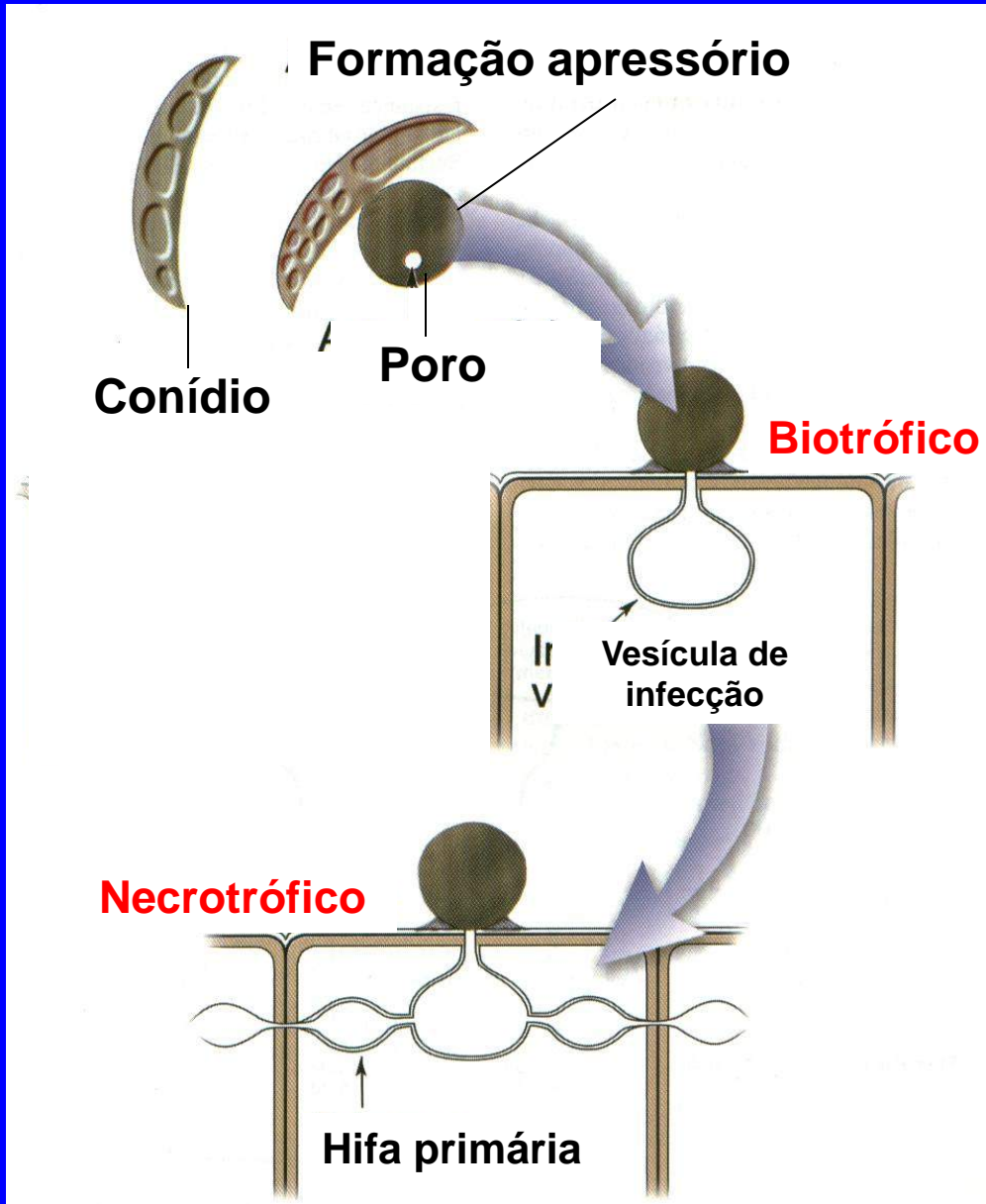


Processo fisiológico afetado



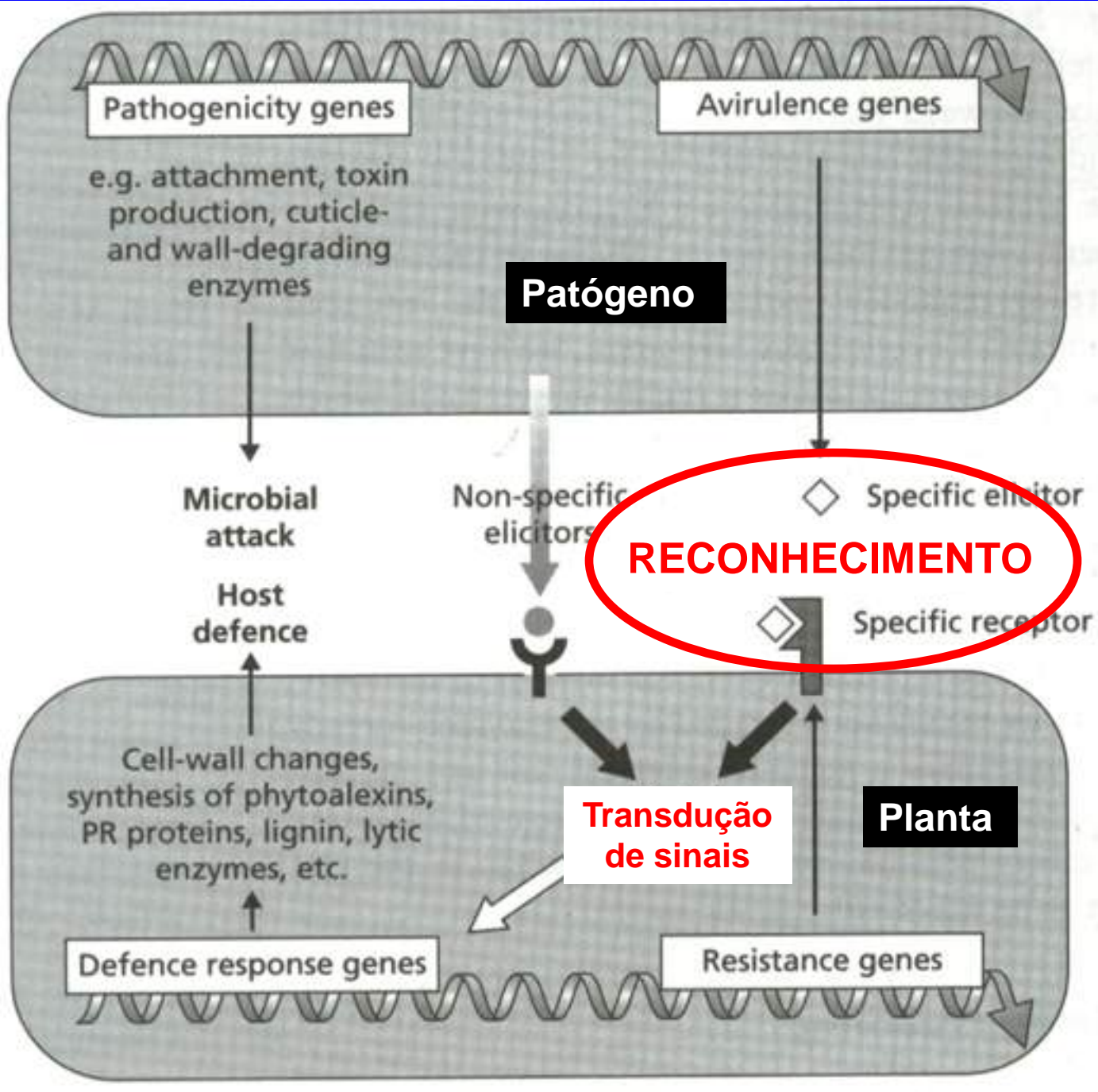
Tipos de doenças

O processo da infecção



Mecanismos de ataque

- Enzimas
- Toxinas
- Hormônios



Pathogenicity genes

Avirulence genes

e.g. attachment, toxin production, cuticle- and wall-degrading enzymes

Patógeno

Microbial attack

Host defence

Non-specific elicitors

Specific elicitor

RECONHECIMENTO

Specific receptor

Cell-wall changes, synthesis of phytoalexins, PR proteins, lignin, lytic enzymes, etc.

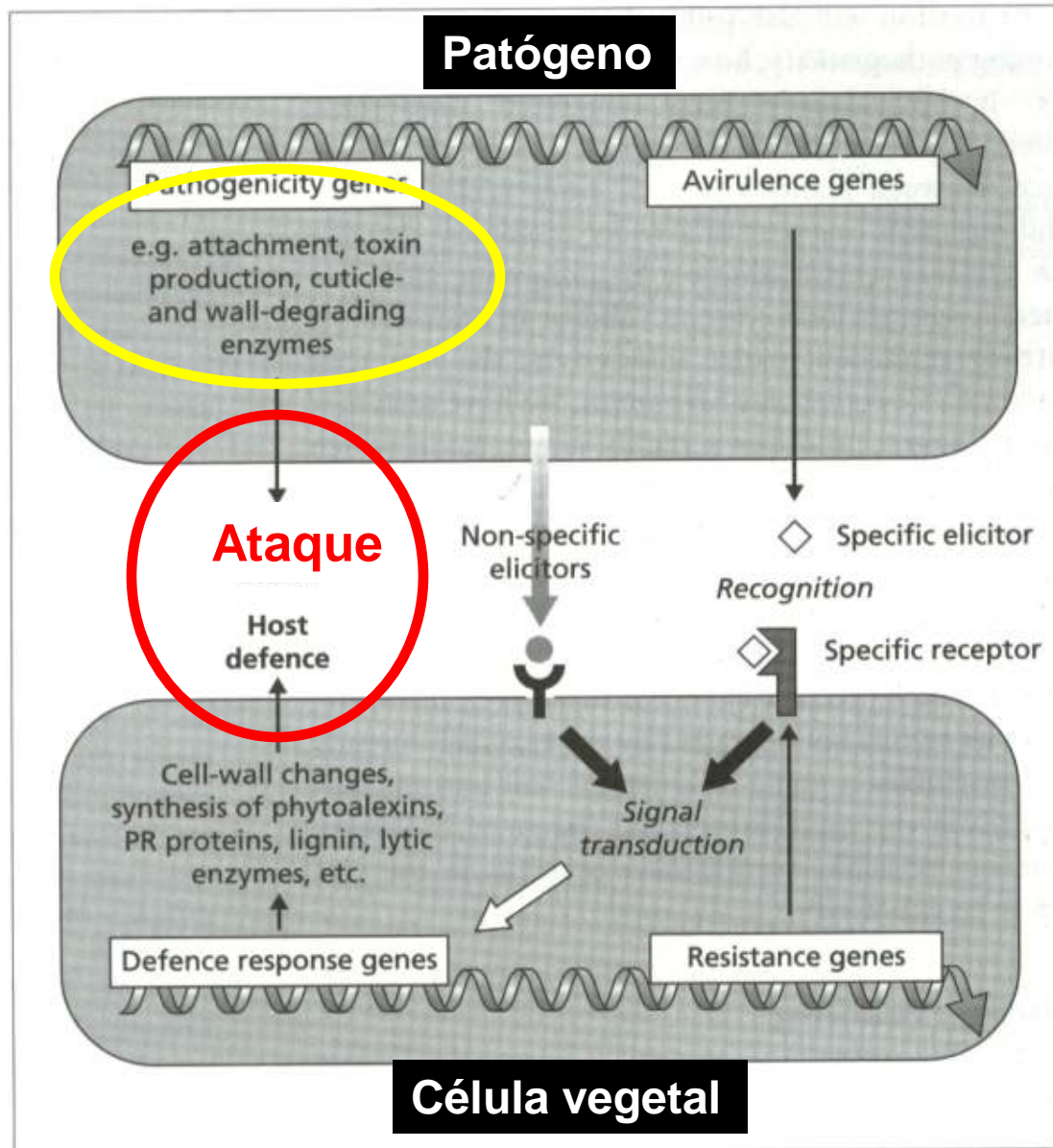
Transdução de sinais

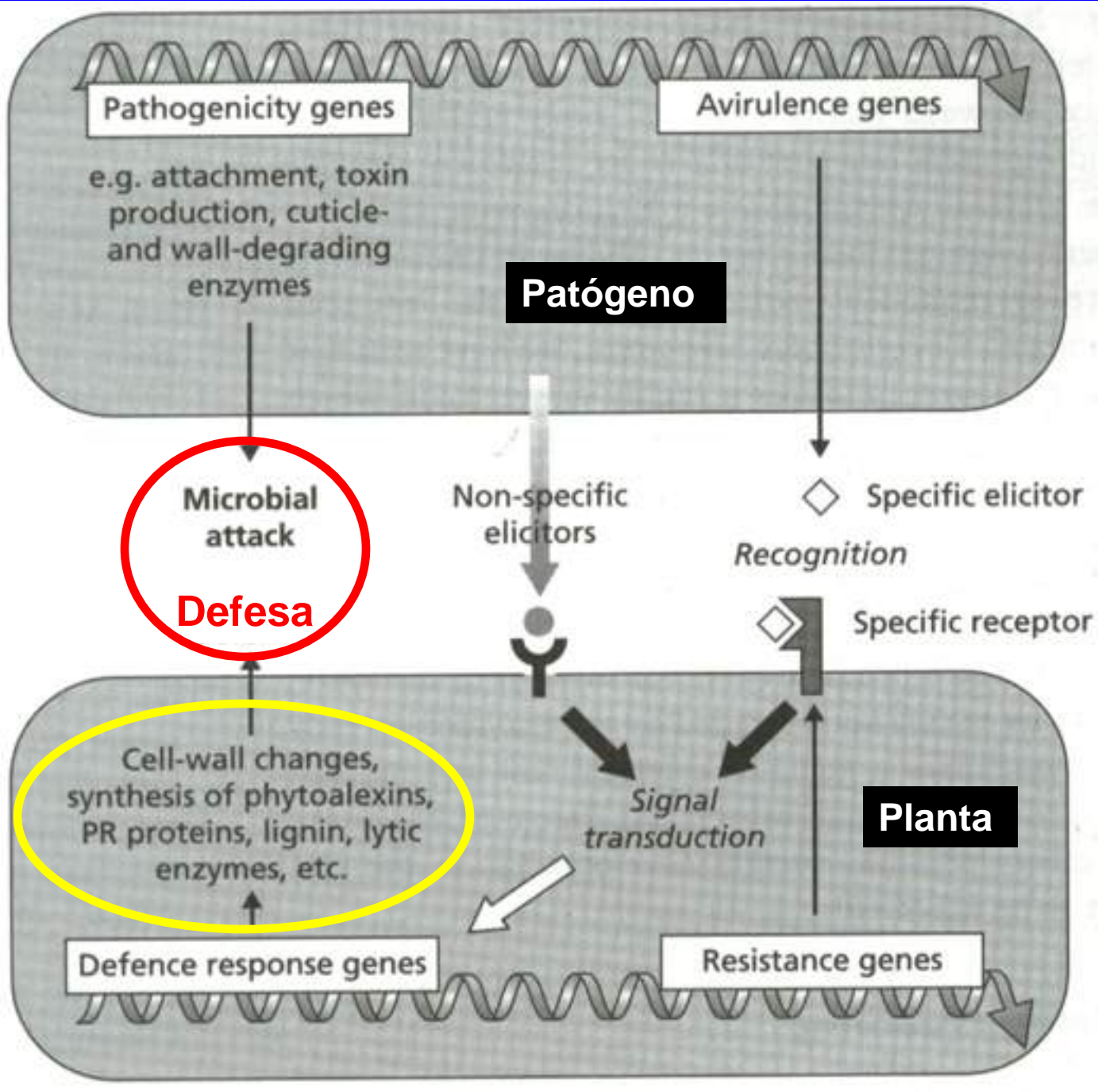
Planta

Defence response genes

Resistance genes

Patógeno x Planta



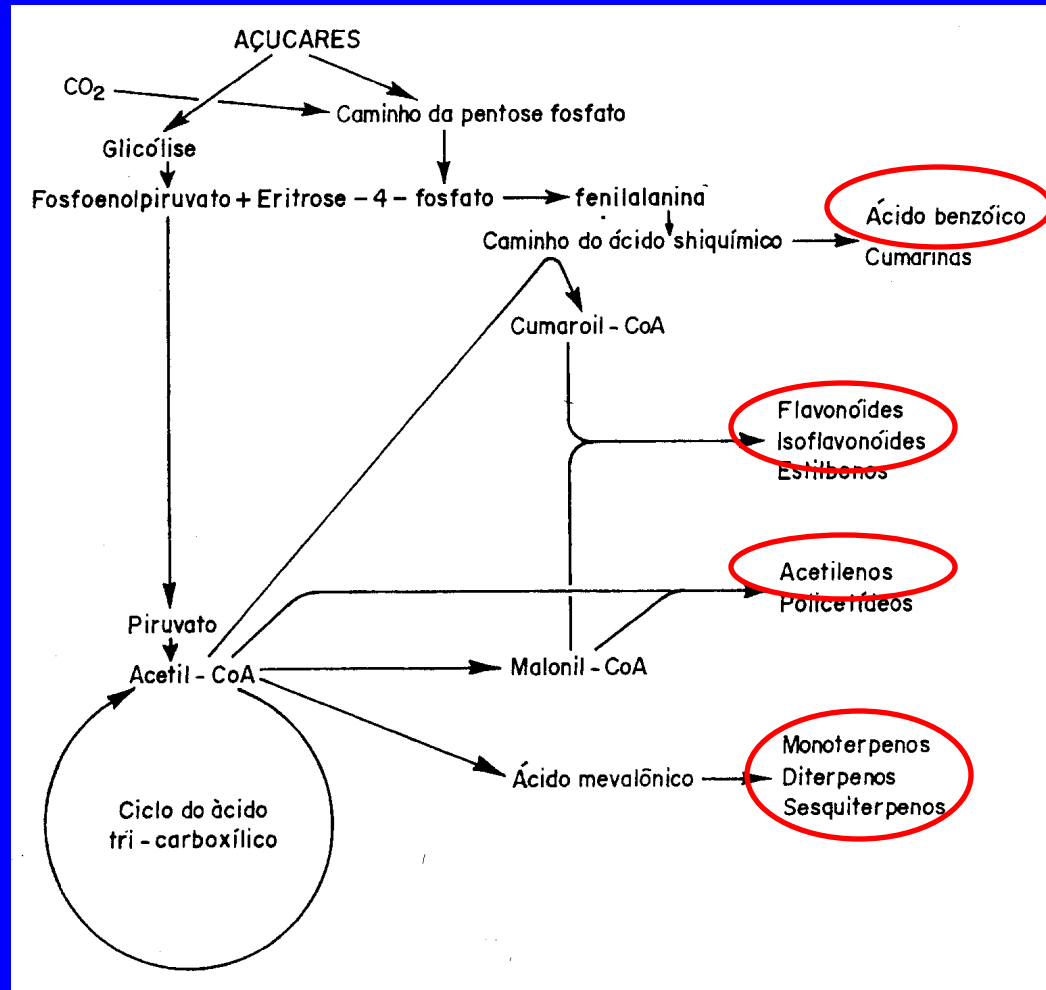
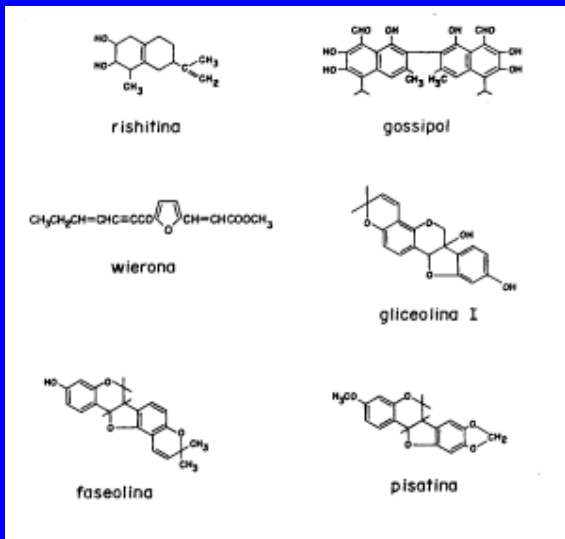


MECANISMOS DE RESISTÊNCIA

Bioquímicos pós-formados

⇒ Fitoalexinas

- Compostos antimicrobianos de baixa massa molecular, sintetizados pelas plantas, que acumulam em células vegetais em resposta à infecção microbiana.

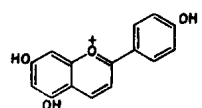


Mecanismos de Defesa

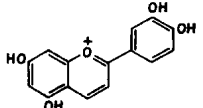
Fitoalexinas

Sorgo
X
*Colletotrichum
Sublineolum*

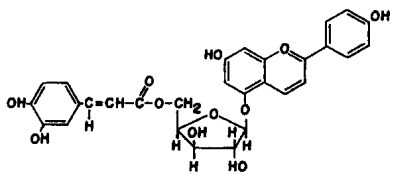
(Ralph L. Nicholson)



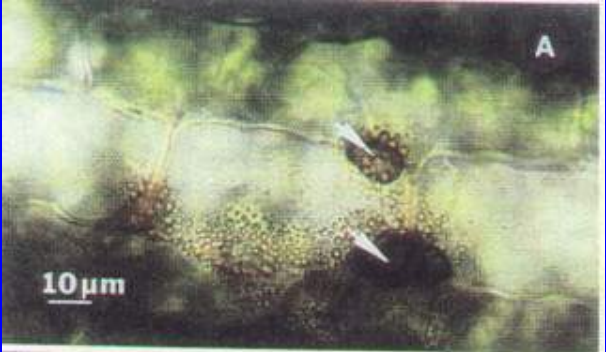
apigeninidina



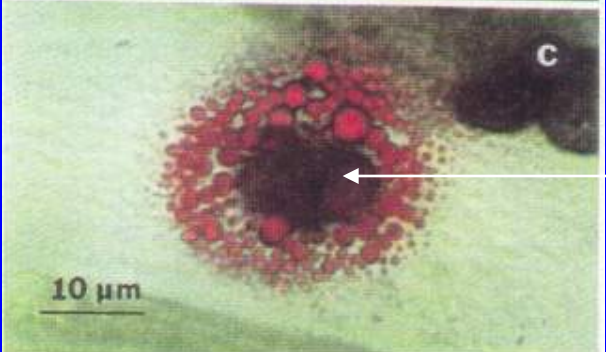
luteolinidina



éster do ácido cafeico com arabinosil 5-O-apigeninidina



22 horas



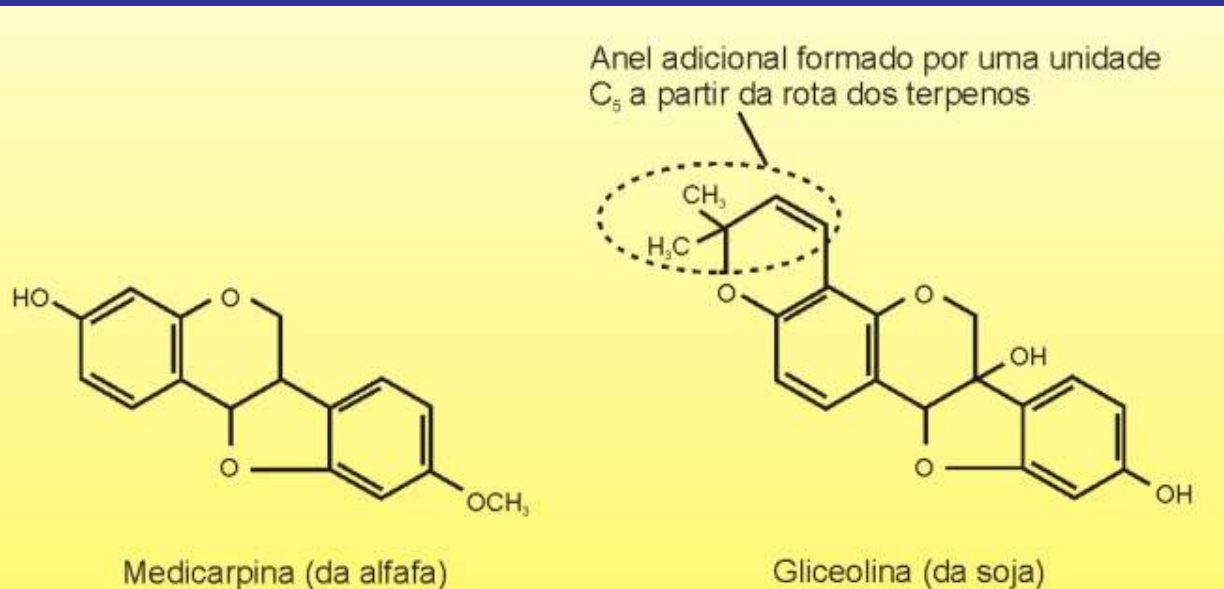
30 horas

Apressório

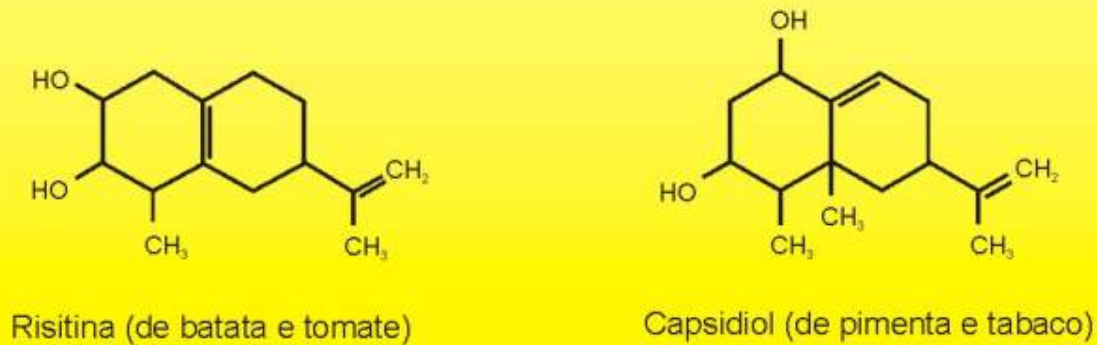


45 horas

ESTRUTURA DE ALGUMAS FITOALEXINAS



Isoflavonóides de leguminosas (família da ervilha)



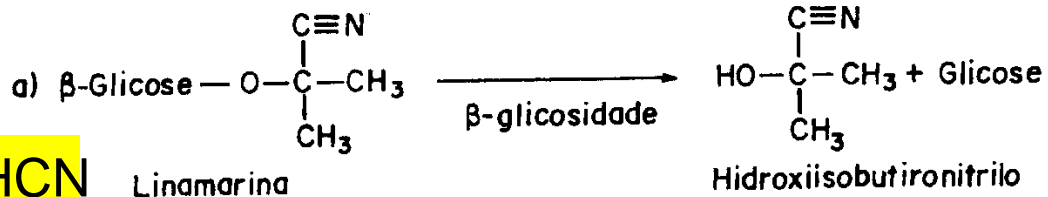
Sesquiterpenos de *Solanaceae* (família da batata)

MECANISMOS DE RESISTÊNCIA

Bioquímicos pré-formados

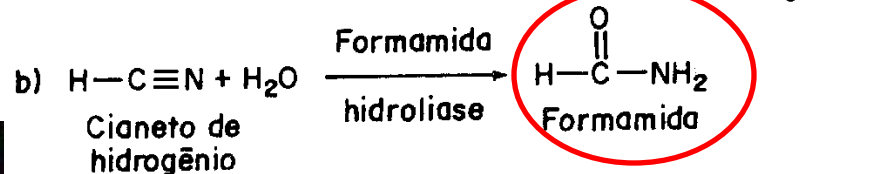
⇒ Glicosídeos
cianogênicos

Produção HCN



⇒ Linamarina – plantas de trevo (*Lotus corniculatus*)

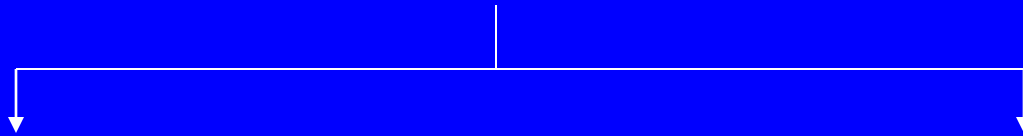
Detoxificação



- Sorgo x *Gloeocercospora sorghi* – detoxificação do HCN

Bioquímicos ⇒ Inibição do crescimento

⇒ Condições adversas para a sobrevivência

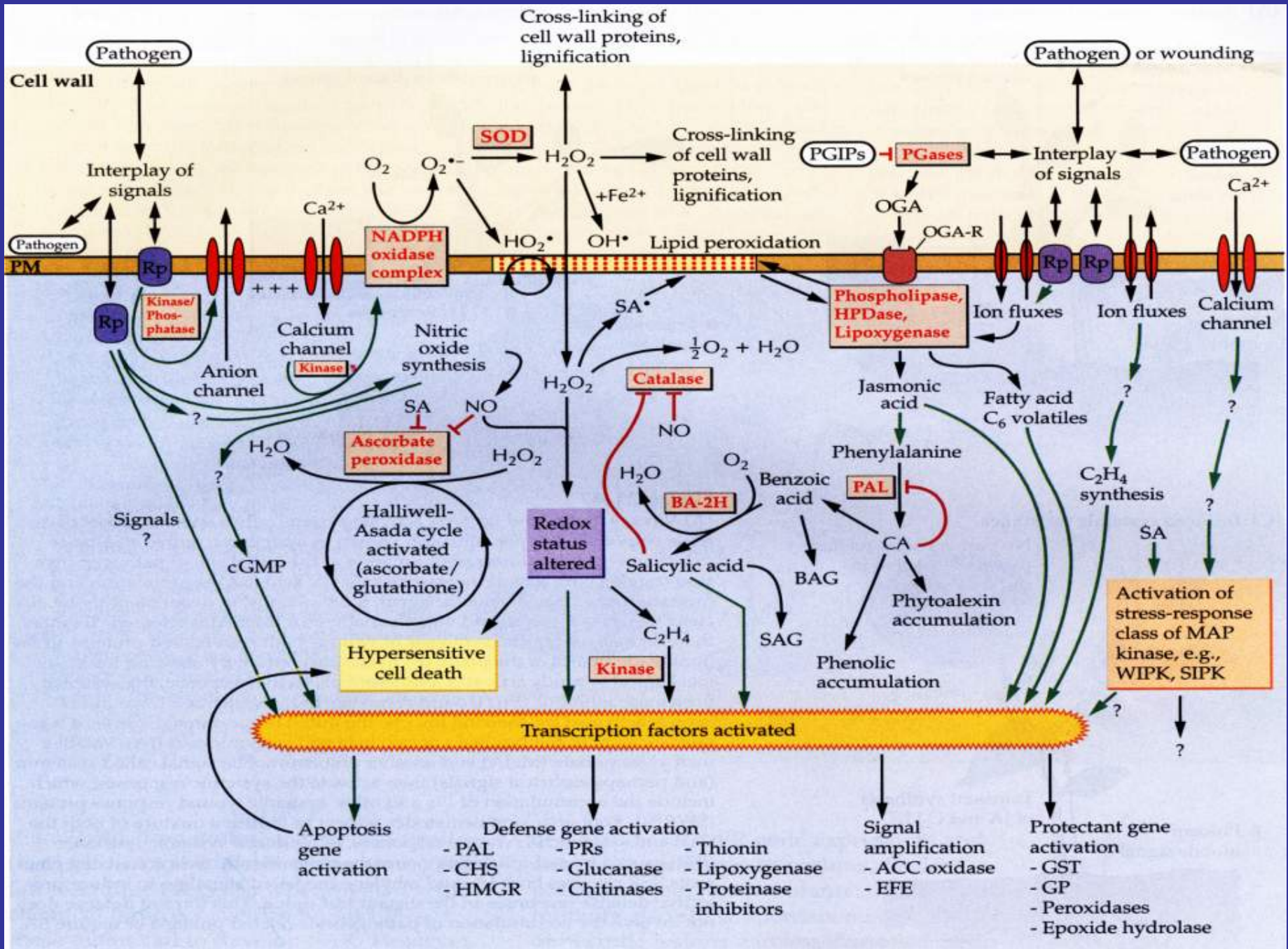


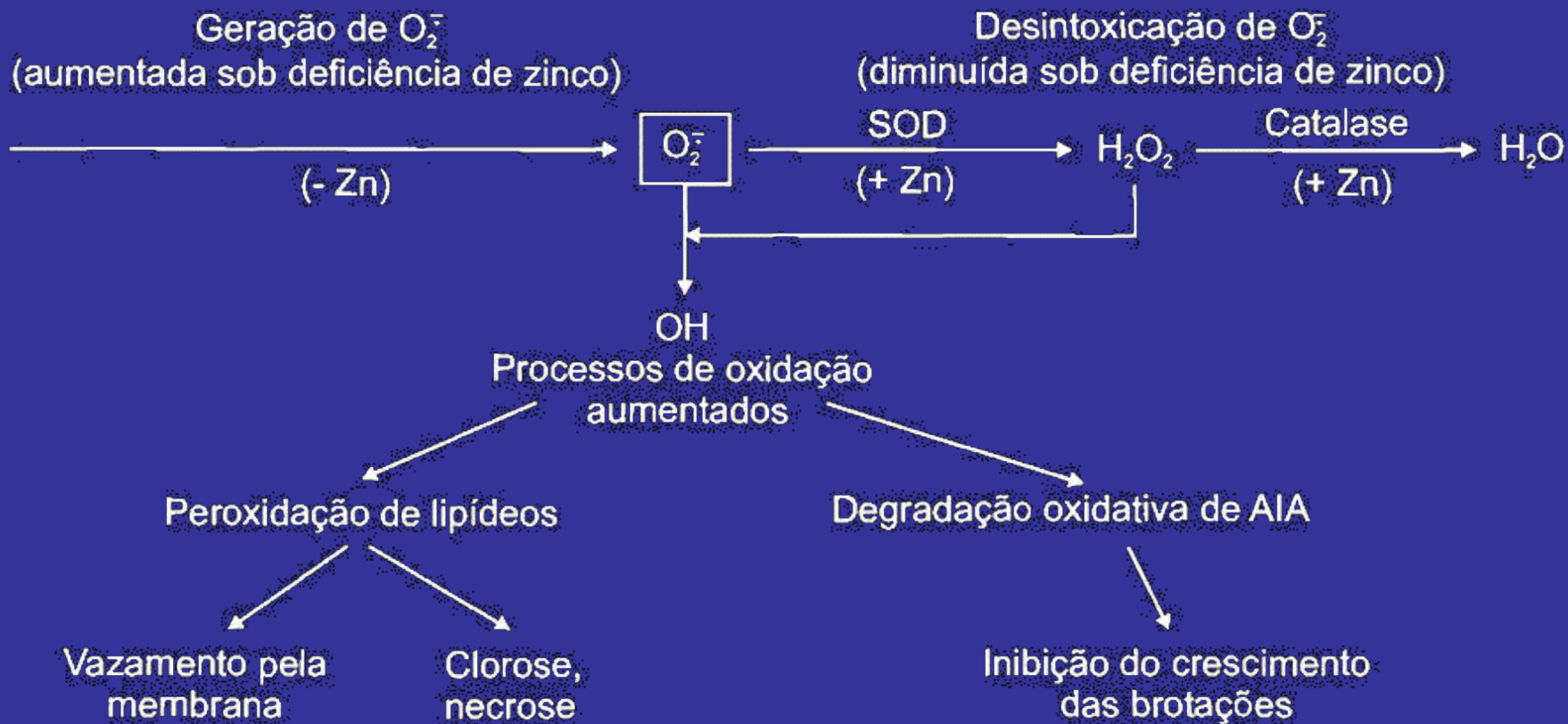
Pré-formados

- Fenóis
- Alcalóides
- Lactonas insaturadas
- Glicosídeos fenólicos
- Glicosídeos cianogênicos*
- Fototoxinas

Pós-formados

- Fitoalexinas*
- Quitinases*
- β -1,3-glucanases*
- Proteínas-RP
- Inibidores proteicos

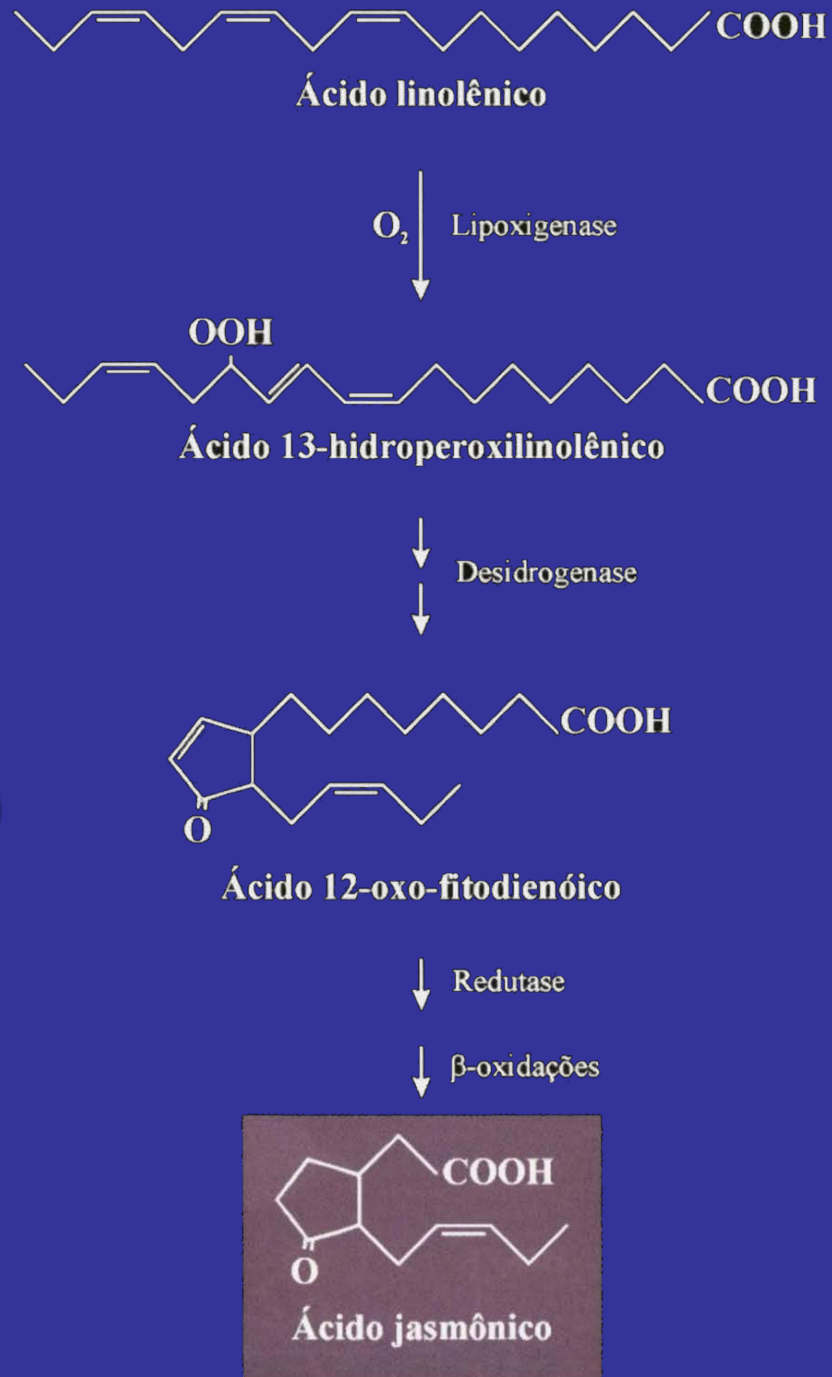




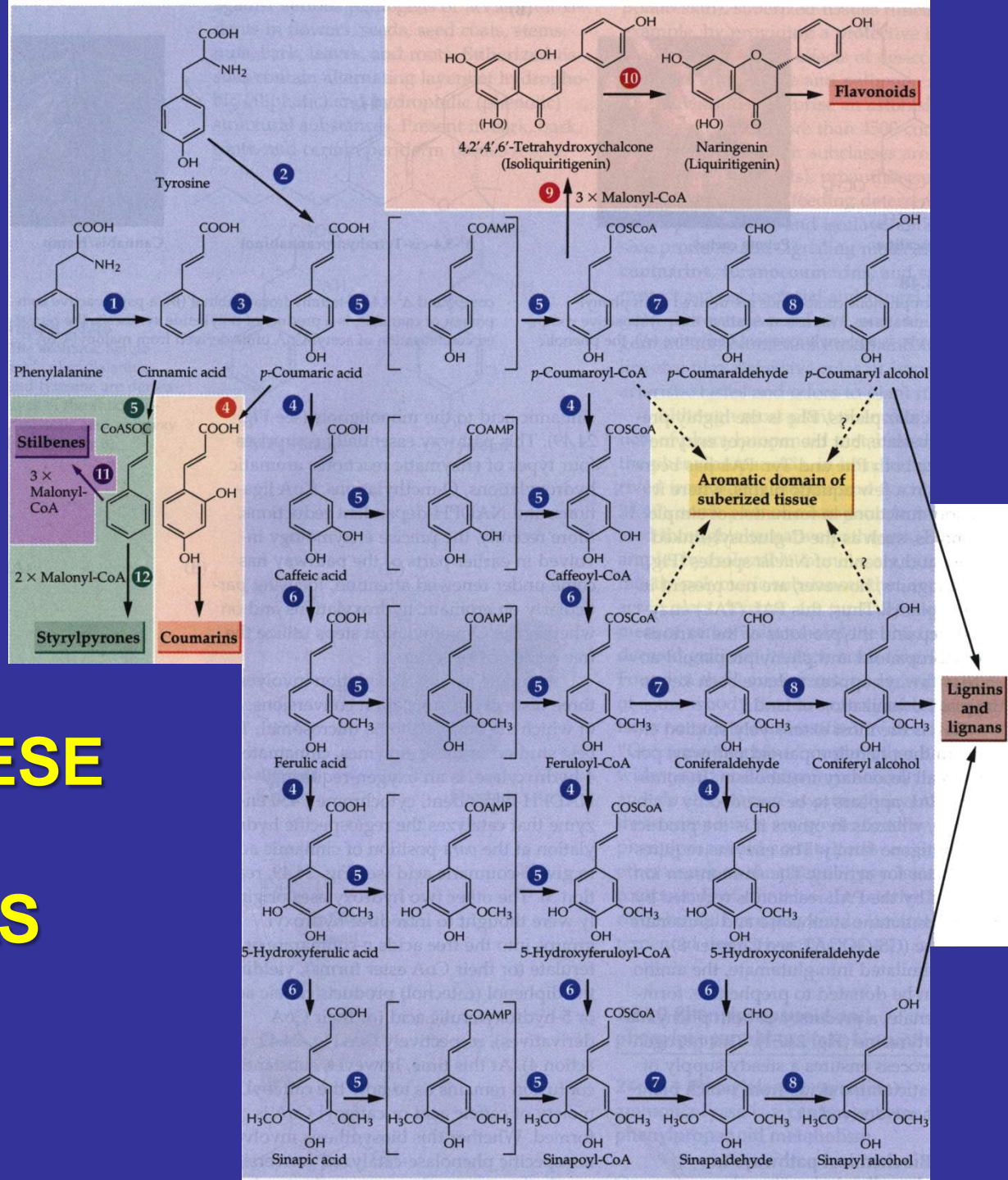
Envolvimento do zinco na geração e remoção de radicais superóxido e efeitos dos radicais livres de oxigênio sobre o funcionamento da membrana e o metabolismo de ácido indolacético.

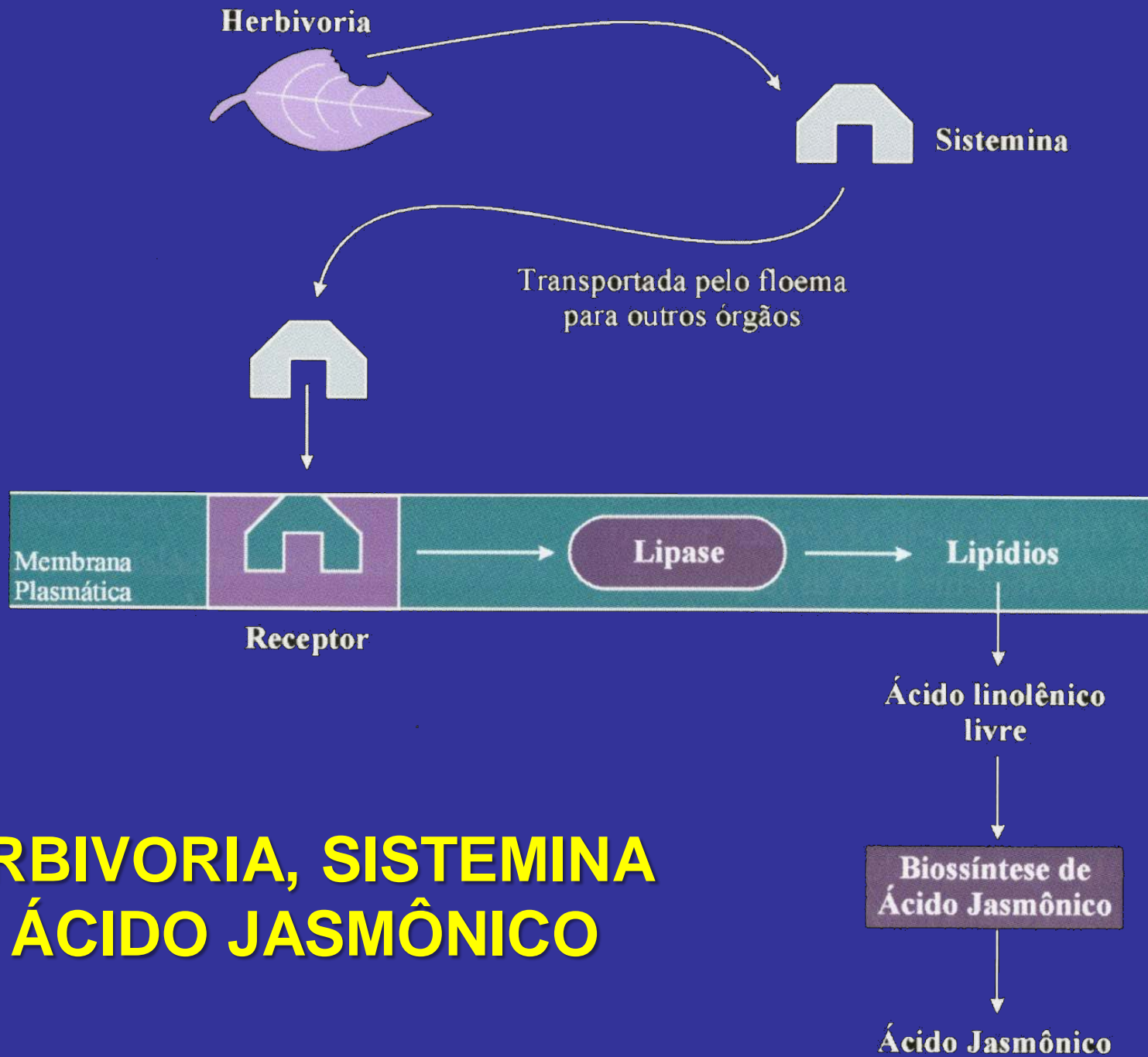
Fonte: MARSCHNER (1995).

BIOSSÍNTESE DO ÁCIDO JASMÔNICO

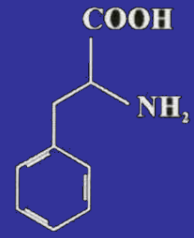


BIOSÍNTESIS DE LIGNINAS



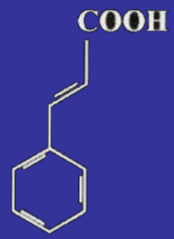


HERBIVORIA, SISTEMINA E ÁCIDO JASMÔNICO



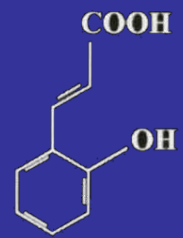
L-Fenilalanina

Fenilalanina
amônia-liase

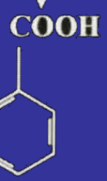


Ácido *trans*-cinâmico

?

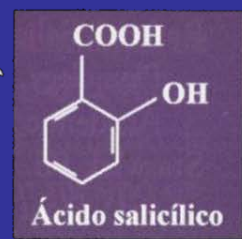


Ácido *orto*-cumárico

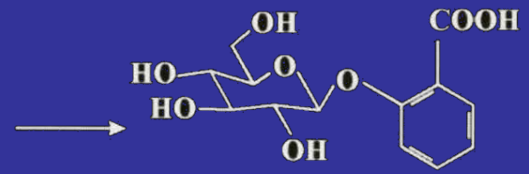


Ácido benzóico

?



Ácido salicílico



Ácido β-O-D glucosilicífico

BIOSSÍNTESE DO ÁCIDO SALICÍLICO

INTERAÇÕES EM FEIJOEIRO

