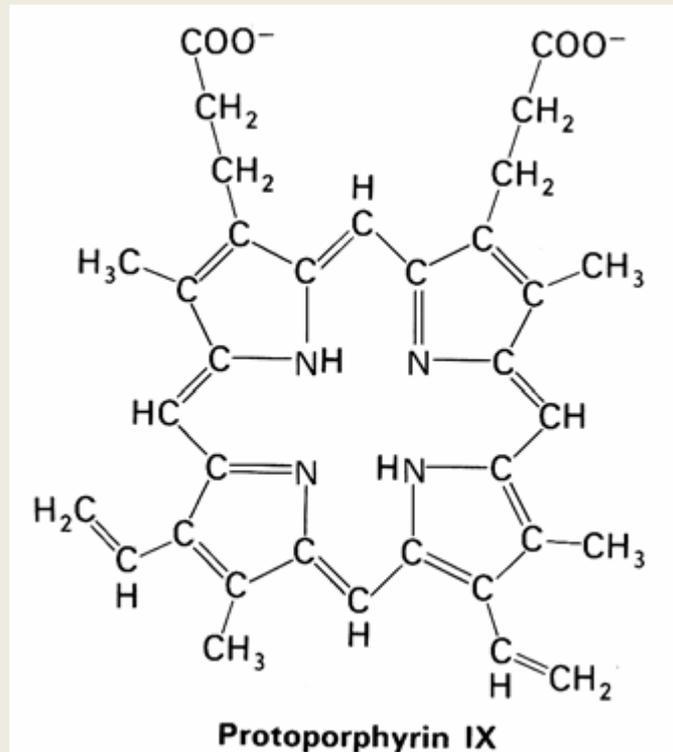




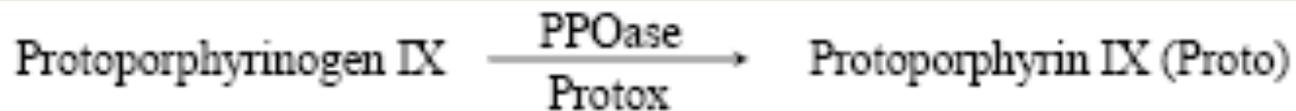
Pedro Jacob Christoffoleti - ESALQ - USP

- ✓ Desconhecido até bem pouco tempo
- ✓ Porfirinas são importante biologicamente (transferência de energia)
- ✓ Requer luz para ação dos herbicidas, porém não é necessária a fotossíntese

## Inibidores da Protox ou PPO



✓ Os herbicidas são muito diversos com relação a translocação e entrada na planta



# Revisão da síntese de clorofila e ação dos herbicidas inibidores da PROTOX



**Resource**



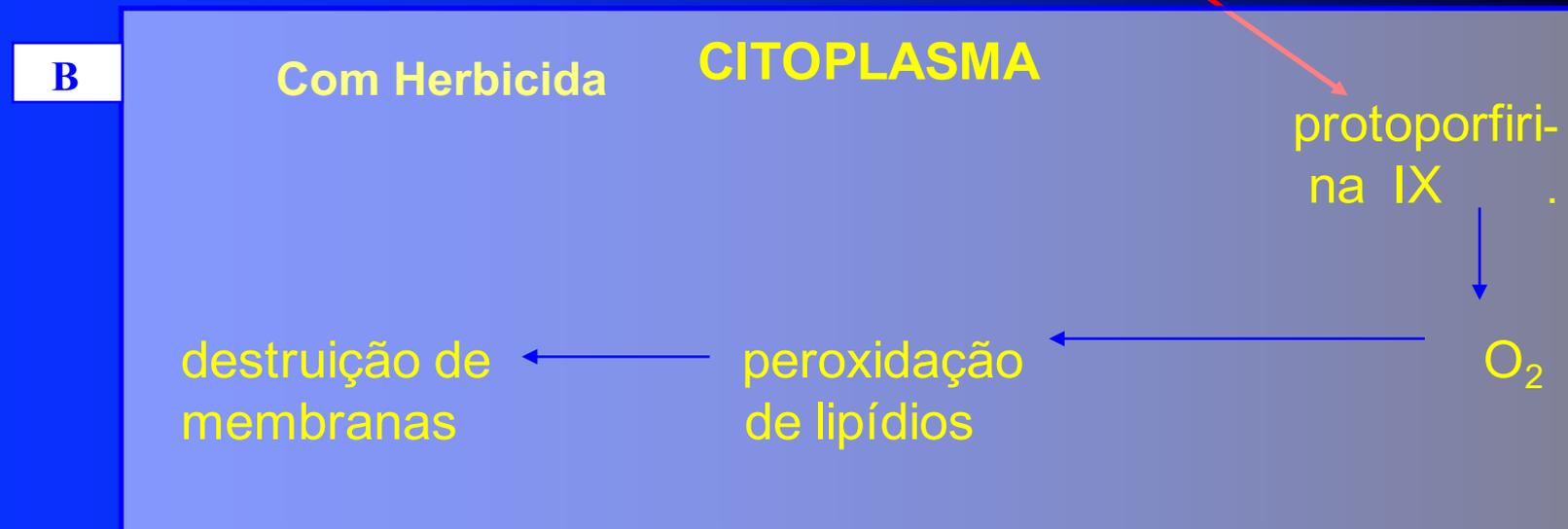
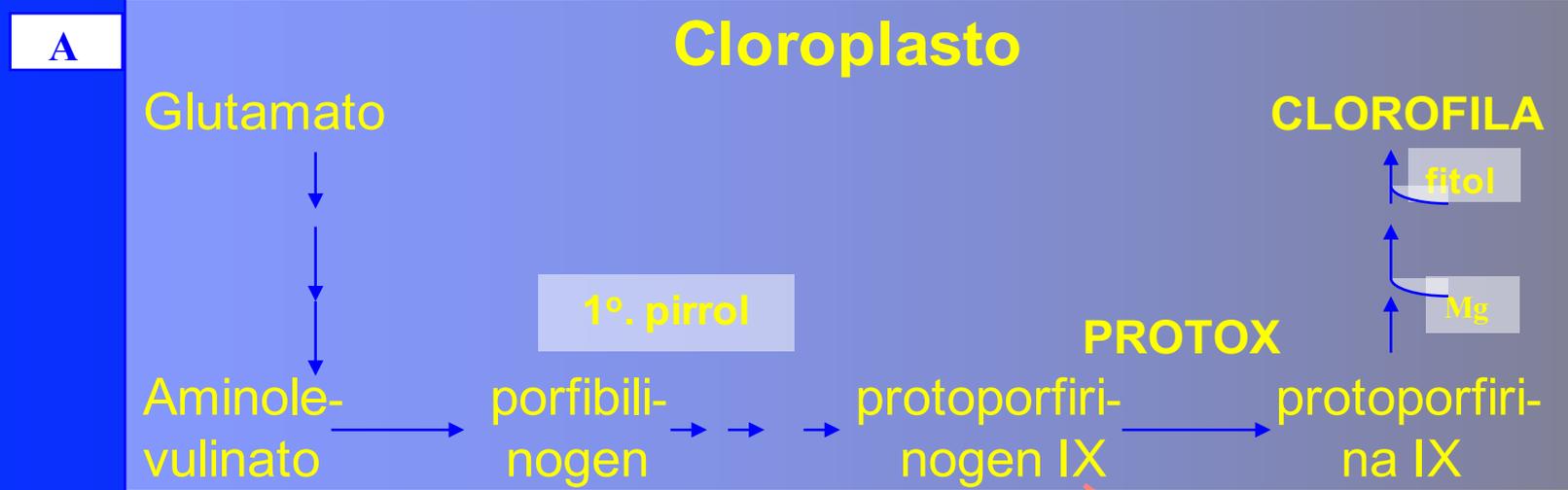
**Blazer**

**Cobra**

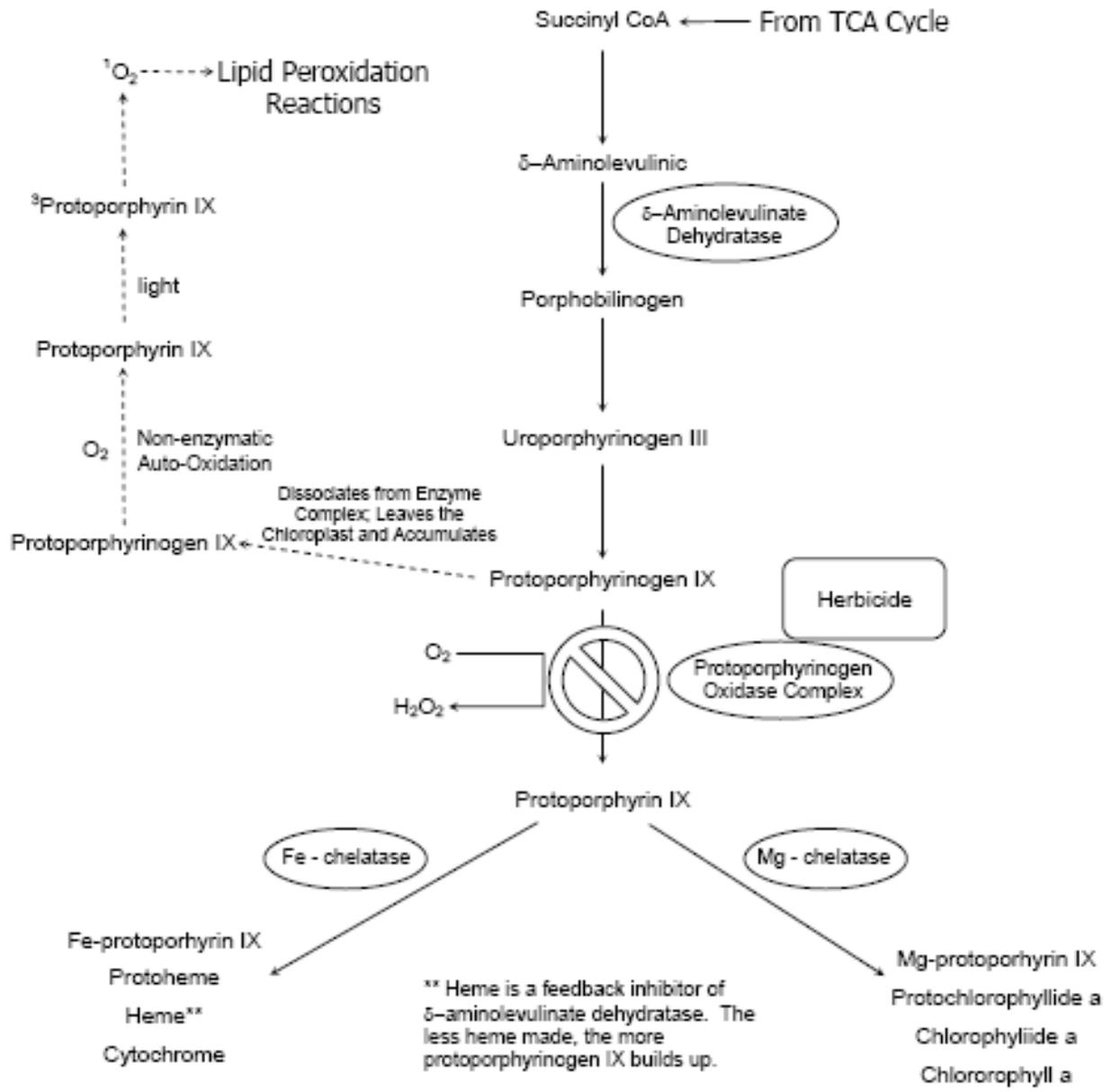


**Reflex**

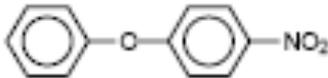
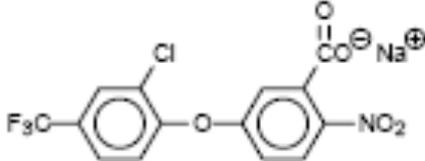
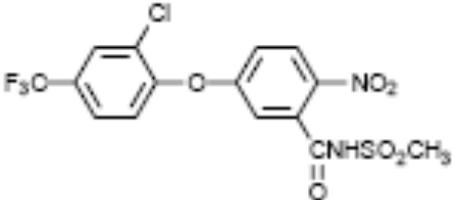
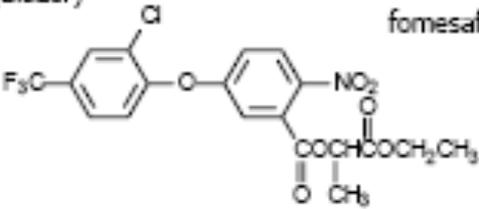
# inibidores da PROTOX



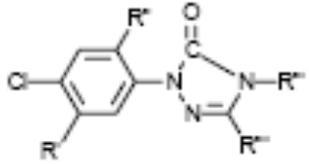
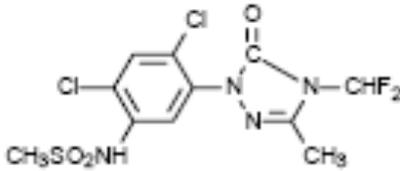
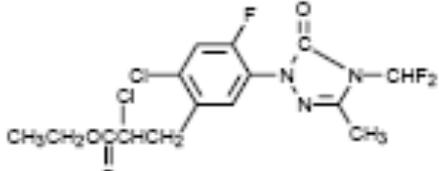
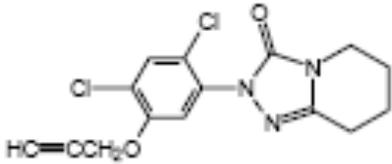
**Protox: protoporfirinogênio oxidase**



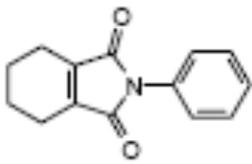
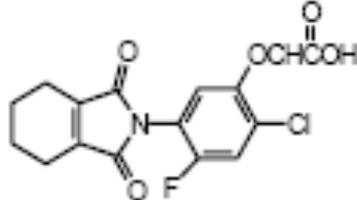
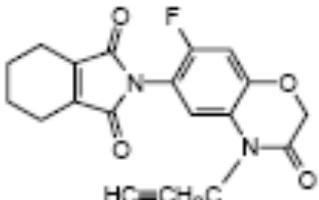
## Diphenyl Ethers

<p>Base Structure</p>		<p>base structure contains 2 benzene (phenyl) rings linked with an ether bridge and a nitro (NO<sub>2</sub>) group bonded to the 4-position (para position); herbicides in this family considered to be contact herbicides</p>
<p>Examples</p>	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>acifluorfen (Blazer)</p> </div> <div style="text-align: center;">  <p>fomesafen (Reflex/Flexstar)</p> </div> <div style="text-align: center;">  <p>lactofen (Cobra)</p> </div> </div>	
<p>Metabolism</p>	<p><u>plant</u>: cleavage of ether bond and further metabolism  <u>soil</u>: microbial          half-life – acifluorfen 14-60 d; fomesafen 100 d; lactofen 3 d</p>	
<p>Absorption &amp; Translocation</p>	<p>little to no translocation following root or foliar absorption other than local short distance movement in treated tissue</p>	
<p>Selectivity</p>	<p>selective – tolerant plants rapidly metabolize to inactive metabolites whereas susceptible plants are unable to do so</p>	

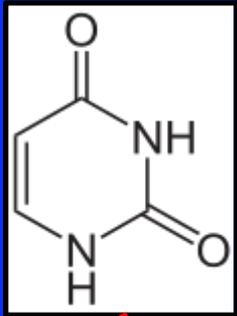
## Aryl Triazinones

<p>Base Structure</p>		<p>base structure contains a 5 member ring (triazole) of which there are 3 N's (2 of which are adjacent to one another) and 2 C's ; the "one" refers to the double bonded O to the C in the ring; a benzene ring is attached to one of the N's in the ring</p>
<p>Examples</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>sulfentrazone (Authority/Spartan)</p> </div> <div style="text-align: center;">  <p>carfentrazone (Aim)</p> </div> </div> <div style="text-align: center; margin-top: 20px;">  <p>azafeniden (Milestone)</p> </div>	
<p>Metabolism</p>	<p><u>plant</u>: oxidative hydroxylation, decarboxylation, ring cleavage  <u>soil</u>: microbial primary means of degradation          half-life – sulfentrazone 110-280 d; carfentrazone 2-4 d; azafeniden 25-40 d</p>	
<p>Absorption &amp; Translocation</p>	<p><u>sulfentrazone</u> – absorption by roots and foliage; symplastic phloem movement assumed to be limited because of rapid foliar desiccation  <u>carfentrazone</u> – absorption by foliage; symplastic movement limited  <u>azafeniden</u> – absorption by roots and shoots; translocation in xylem and phloem is minimal explaining the limited POST activity on well developed plants</p>	

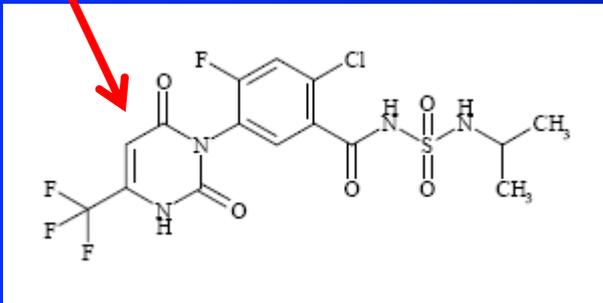
## N-phenylphthalimides

<p>Base Structure</p>		<p>in the base structure the N of the phthalimide group is attached to a benzene ring (phenyl), hence N-phenylphthalimide; phthalimide group contains a 5 member ring with 1 N and 4 C's - 2 O's are double bonded to C's</p>
<p>Examples</p>	 <p style="text-align: center;">flumiclorac (Resource)</p>	 <p style="text-align: center;">flumioxazin (Valor)</p>
<p>Metabolism</p>	<p><u>plant</u>: not available  <u>soil</u>: hydrolysis, microbial primary means of degradation          half-life – flumiclorac 1-6 d; flumioxazin 12-18 d</p>	
<p>Absorption &amp; Translocation</p>	<p><u>flumiclorac</u> - readily absorbed into leaves with little to no basipetal translocation in the phloem to roots</p> <p><u>flumioxazin</u> – absorbed by roots and foliage; symplastic movement limited because of rapid foliar desiccation</p>	
<p>Selectivity</p>	<p>selective – rapid metabolism by tolerant crops</p>	
<p>Herbicide Use</p>	<p>both herbicides control broadleaf weeds  <u>flumiclorac</u> used POST in soybeans and corn</p> <p><u>flumioxazin</u> used PRE in soybeans, peanuts (rapid burndown with residual)          both herbicides strongly adsorbed to clay and organic matter</p>	

Oxadiazoles	
Base Structure	<p>base structure has a 5 member ring (diazole) with 2-N's adjacent to one another and 2- C's; the other ring component can be an O or a S</p>
Examples	<p>oxadiazon (Ronstar)</p> <p>fluthiacet (Action)</p>
Metabolism	<p><u>plant</u>: not available</p> <p><u>soil</u>: microbial primary means of degradation</p> <p>half-life – oxadiazon 60 d; fluthiacet 1-2 d</p>
Absorption & Translocation	<p><u>oxadiazon</u> - readily absorbed by shoots of emerging seedlings, but less so by roots; if foliar applied readily adsorbed by leaves; in both cases little movement to growing points</p> <p><u>fluthiacet</u> – readily absorbed by leaves; little movement to growing points</p>
Selectivity	<p>selective – differential metabolism ?</p>
Herbicide Use	<p><u>oxadiazon</u> – controls annual grasses and broadleaf weeds when soil applied to established or newly established bermudagrass, perennial ryegrass, and fescue turf, and in various ornamentals; Regal Star II (active ingredient formulated with N fertilizer)</p> <p><u>fluthiacet</u> – controls velvetleaf and other broadleaves POST in soybeans; being developed in corn</p> <p>leaching potential of both herbicides is low due to strong adsorption to soils</p>



**Pirimidinedione (uracila)**



**Saflufenacil**

# **Características dos inibidores da PROTOX:**

- **Ação dependente de luz e a destruição de membranas é rápida**
- **Podem penetrar pelas raízes, caules e folhas de plântulas**
- **Baixa translocação nas plantas (apoplástica - xilema)**
- **Aplicados em pré ou pós-emergência**
- **Sorvidos ao solo pela MOS**
- **Seletividade:**
  - **pouca seletividade a folhagem (recuperação)**
  - **metabolização e posicionamento no solo**
- **Controle de folhas largas, estreitas e ciperáceas**
- **Sintomatologia:**
  - **pós-emerg.: manchas verde-escuras e necrose (2 a 3 dias)**
  - **pré-emerg.: no momento da emergência (necrose e morte)**