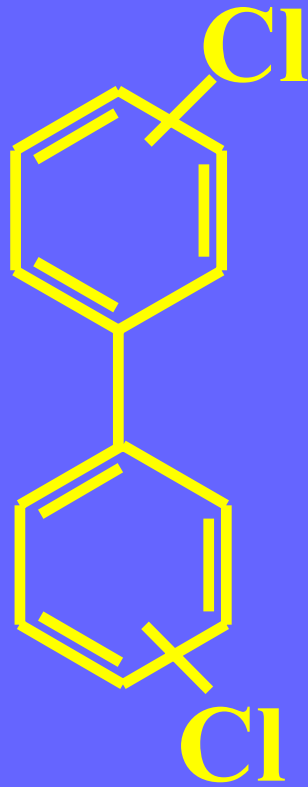


Engineering Enzymes and Plants to Remediate Persistent Pollutants

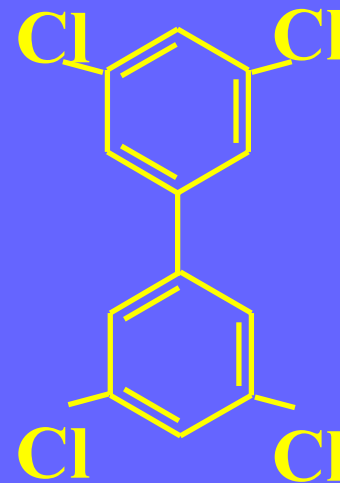
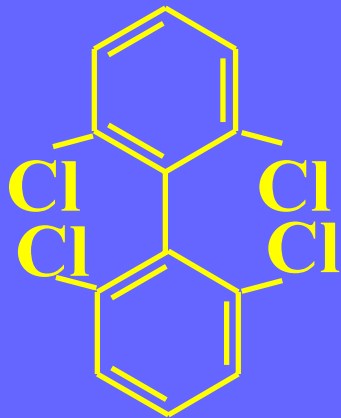
Michel Sylvestre

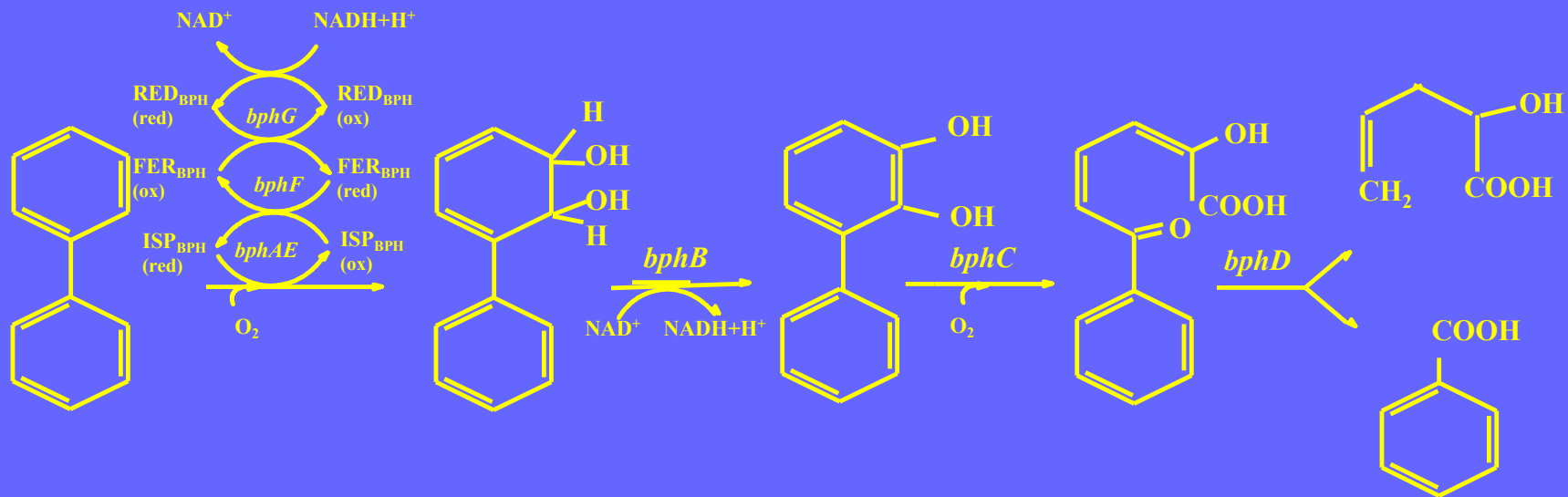
**Institut national de la recherche scientifique, INRS-
Institut Armand-Frappier, Pointe-Claire, Québec,
Canada, H9R 1G6**

PCB structure

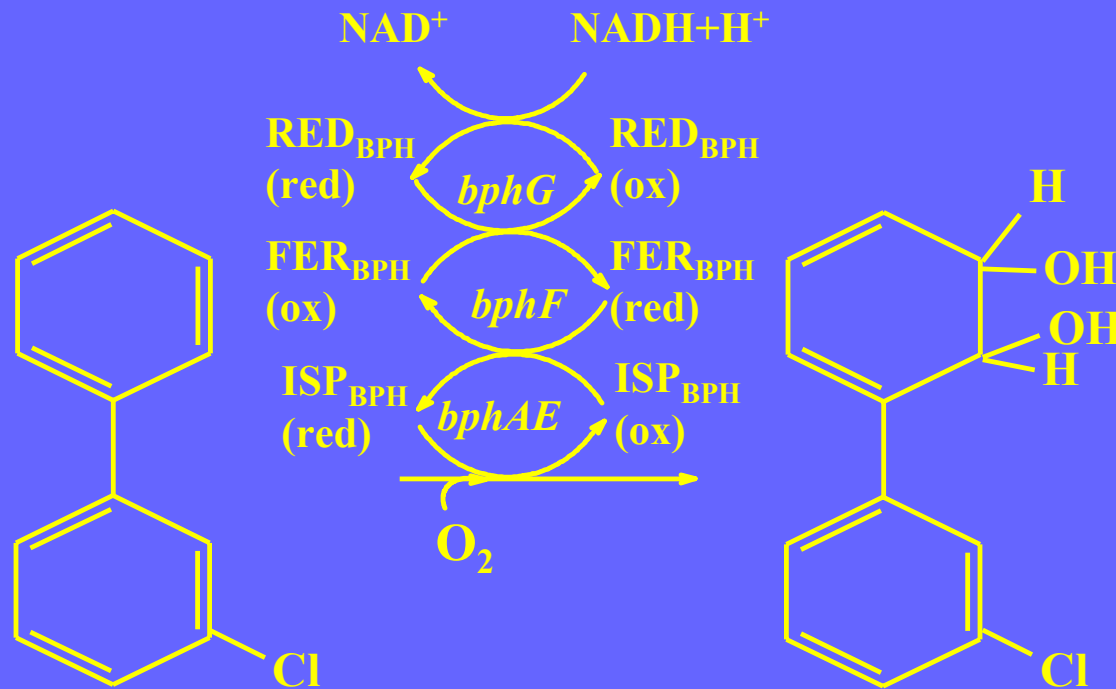


PCB Congeners structure





BPDO reaction

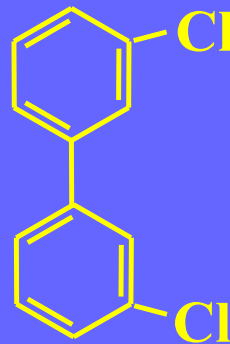


Multicomponent enzyme that catalyzes the 2,3-dioxygenation of the least chlorinated ring

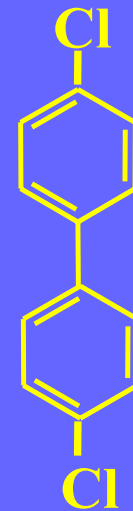
Substrate specificity of PCB degraders



LB400

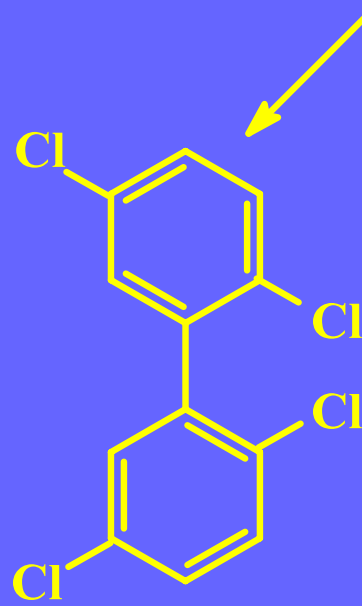


B-356

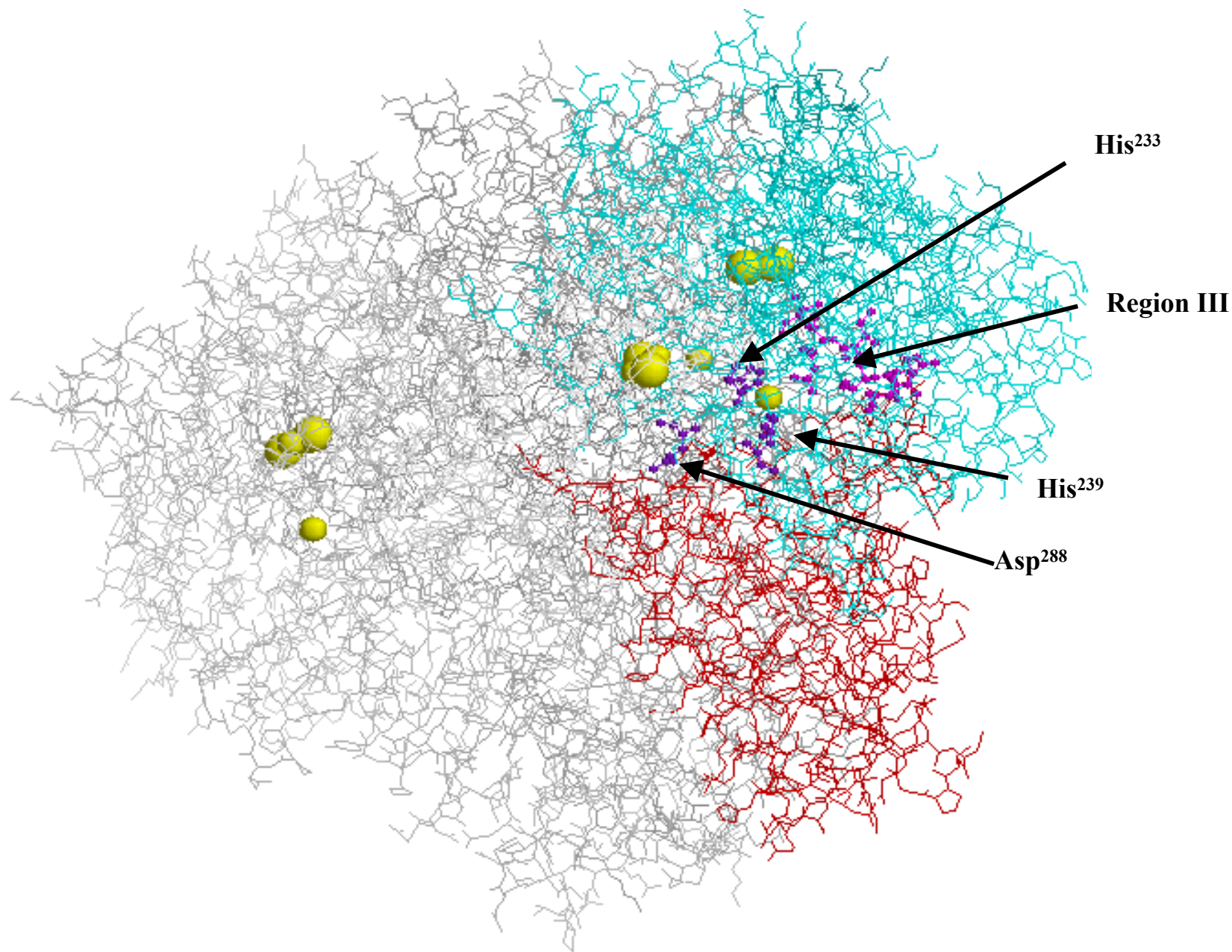


KF707

LB400 BPDO



2,2',5,5'-tetrachlorobiphenyl

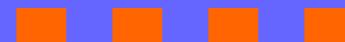


DNA shuffling

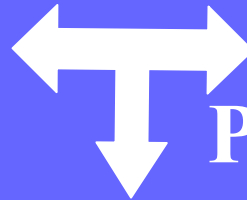
LB400 *bphA*



B-356 *bphA*



DNase

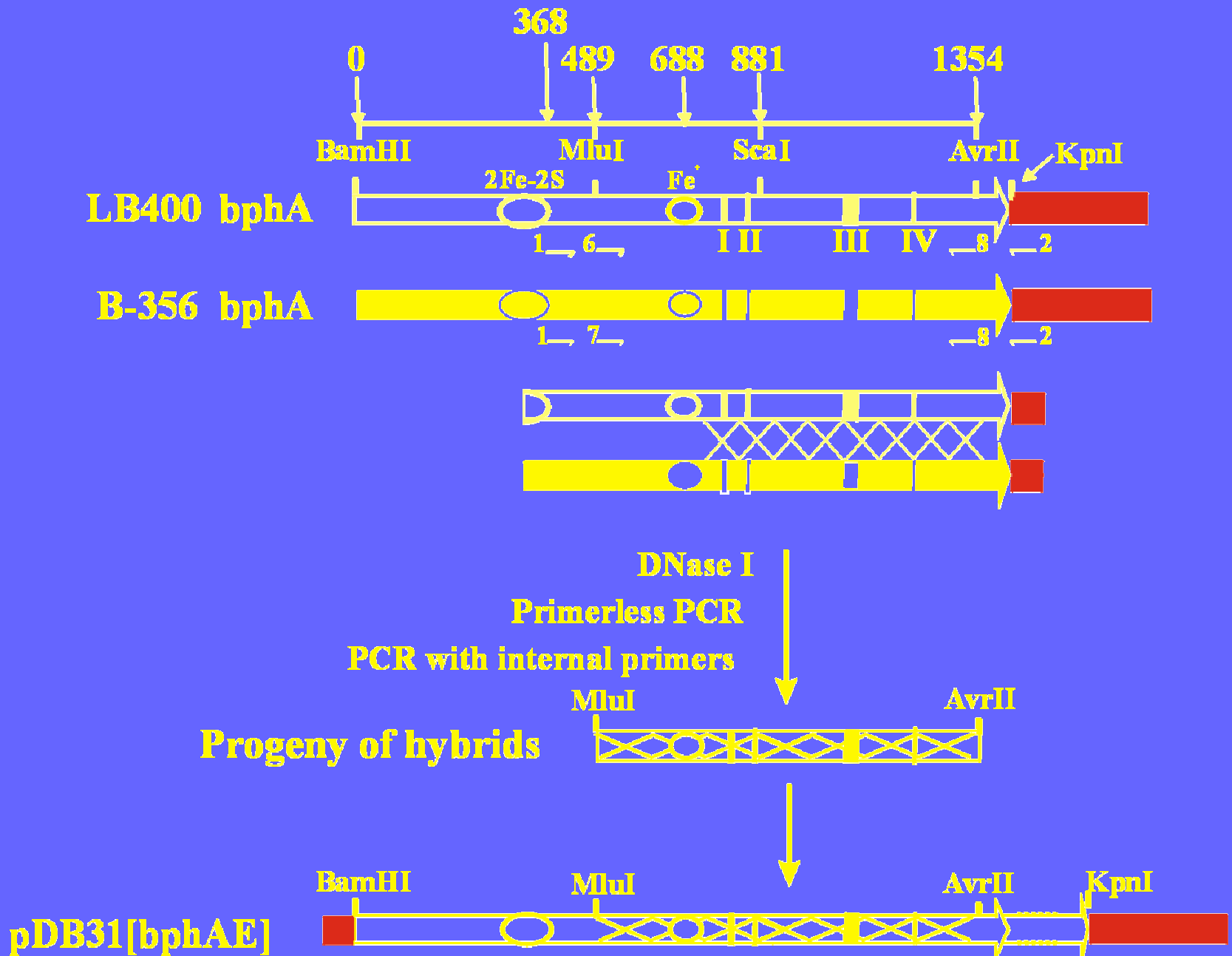


PCR

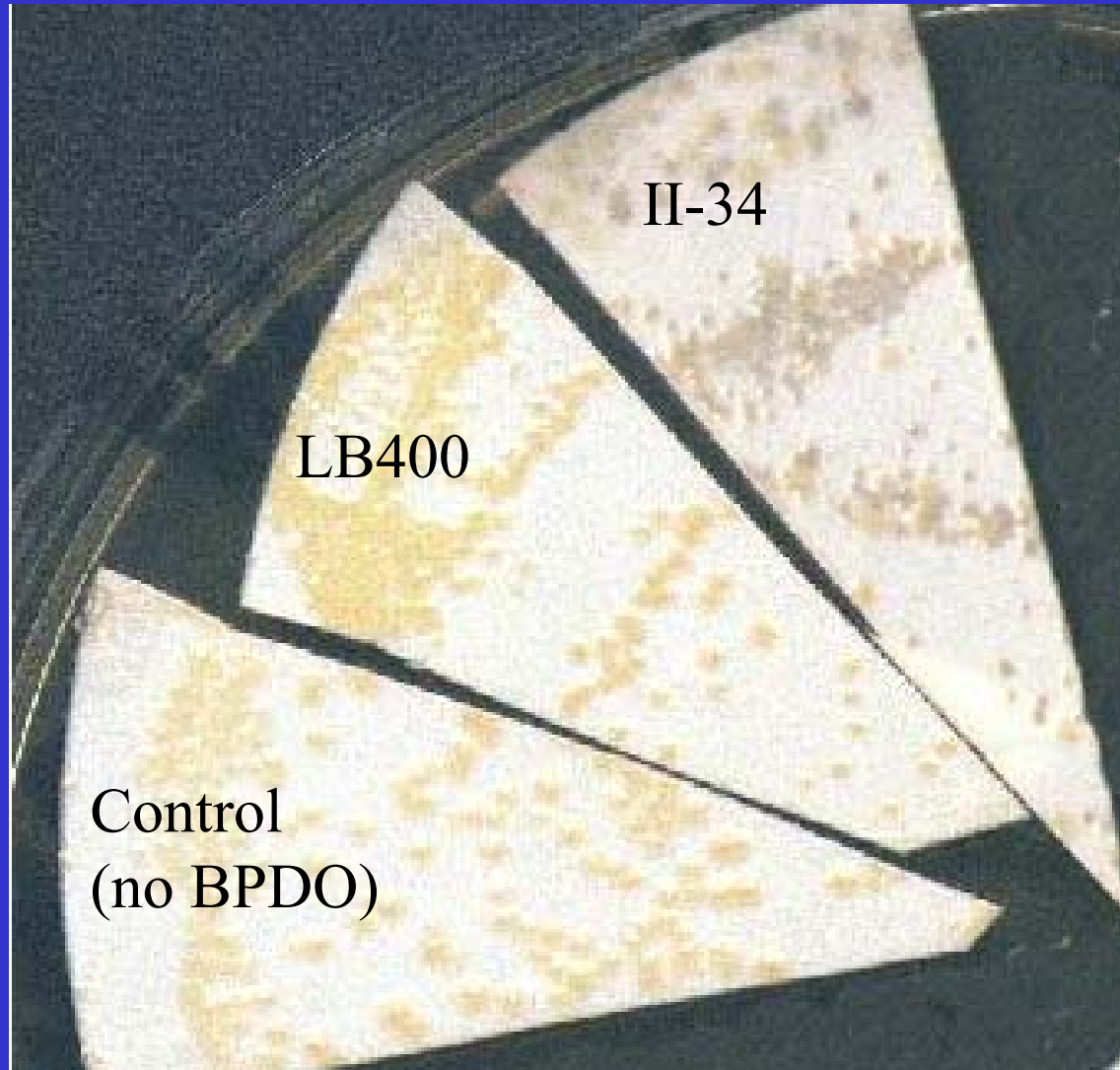


PCR



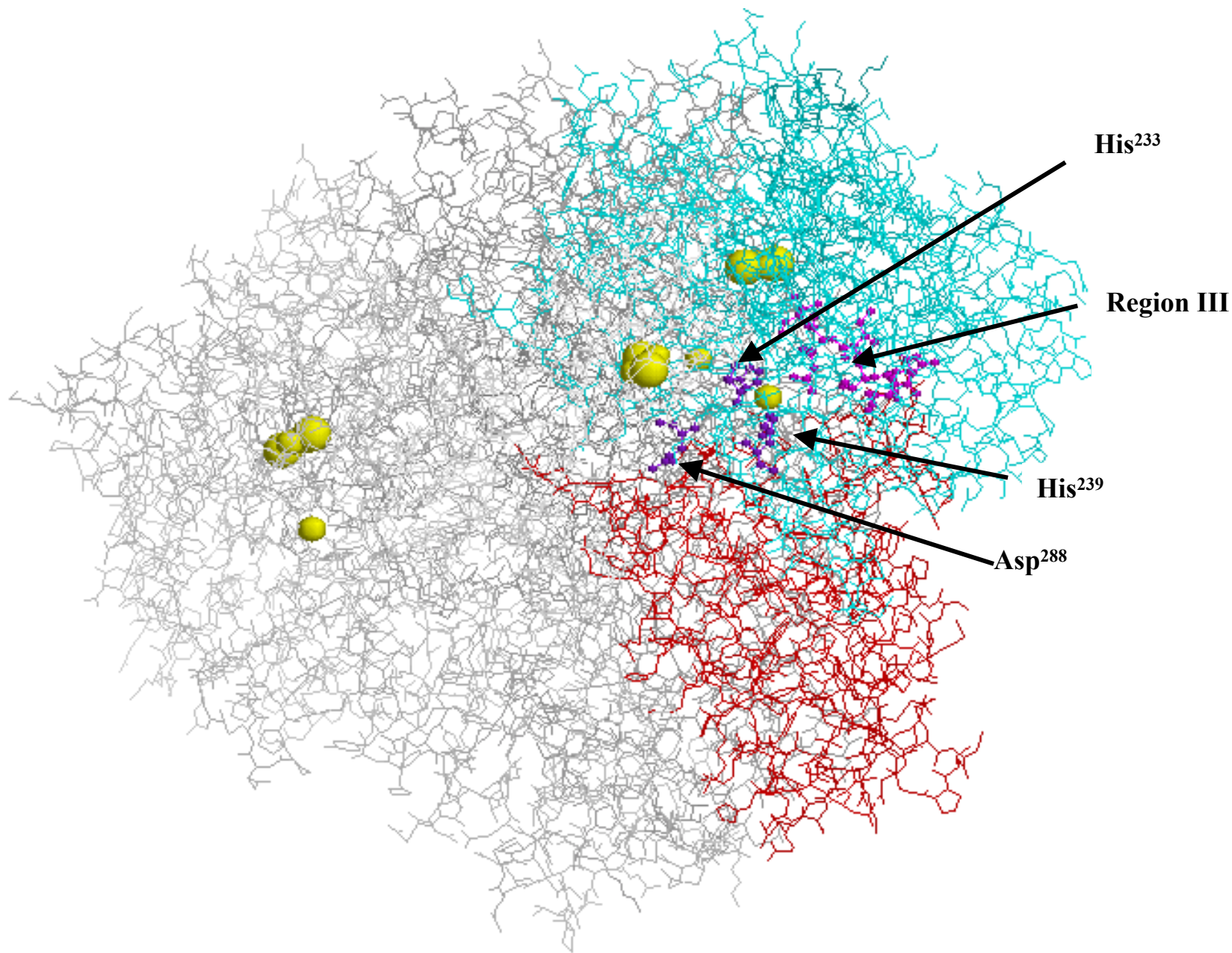


Colonies of *E. coli* expressing LB400 or III-34
BPDO and exposed to 2,2'CB vapors



PCB degradative potency of BphA variants.

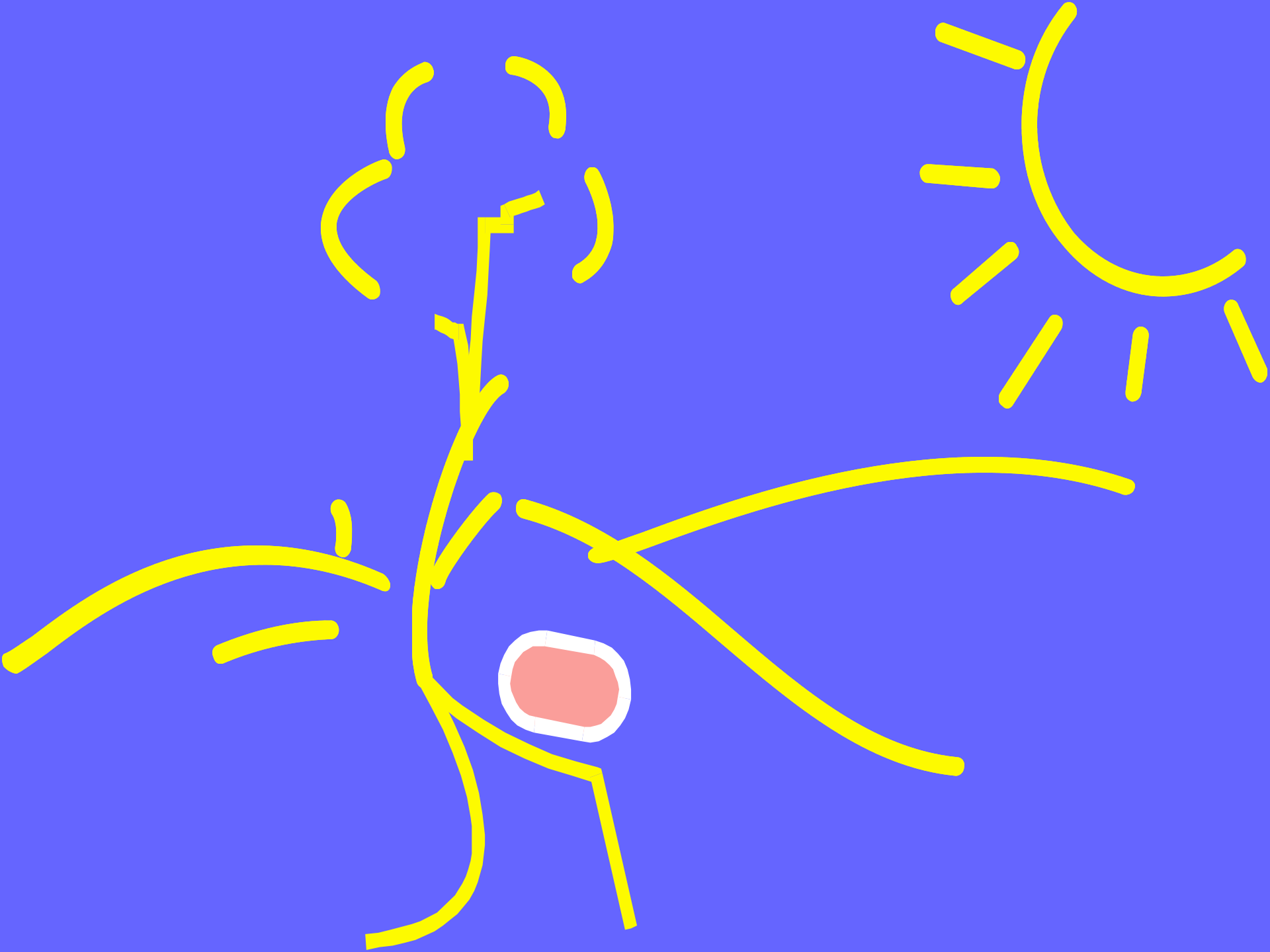
BPDO	% Depletion							
	2,6CB	3,3'CB	4,4'CB	2,3',4CB	2,3,4'CB	2,4,4'CB	2,2',5,5'CB	2,2',3,3'CB
LB400	<10	<10	<10	<10	<10	-	94	76
B-356	<10	35	<10	96	63	-	-	-
II-4	-	-	-	-	-	-	84	47
II-10	<10	<10	<10	<10	<10	-	56	24
III-17	-	-	-	73	60	-	20	27
III-34	<10	<10	<10	79	88	<10	63	23
II-9	58	45	53	99	98	44	93	87
III-37	36	58	43	96	98	29	85	65
III-52	57	51	52	97	99	50	92	83

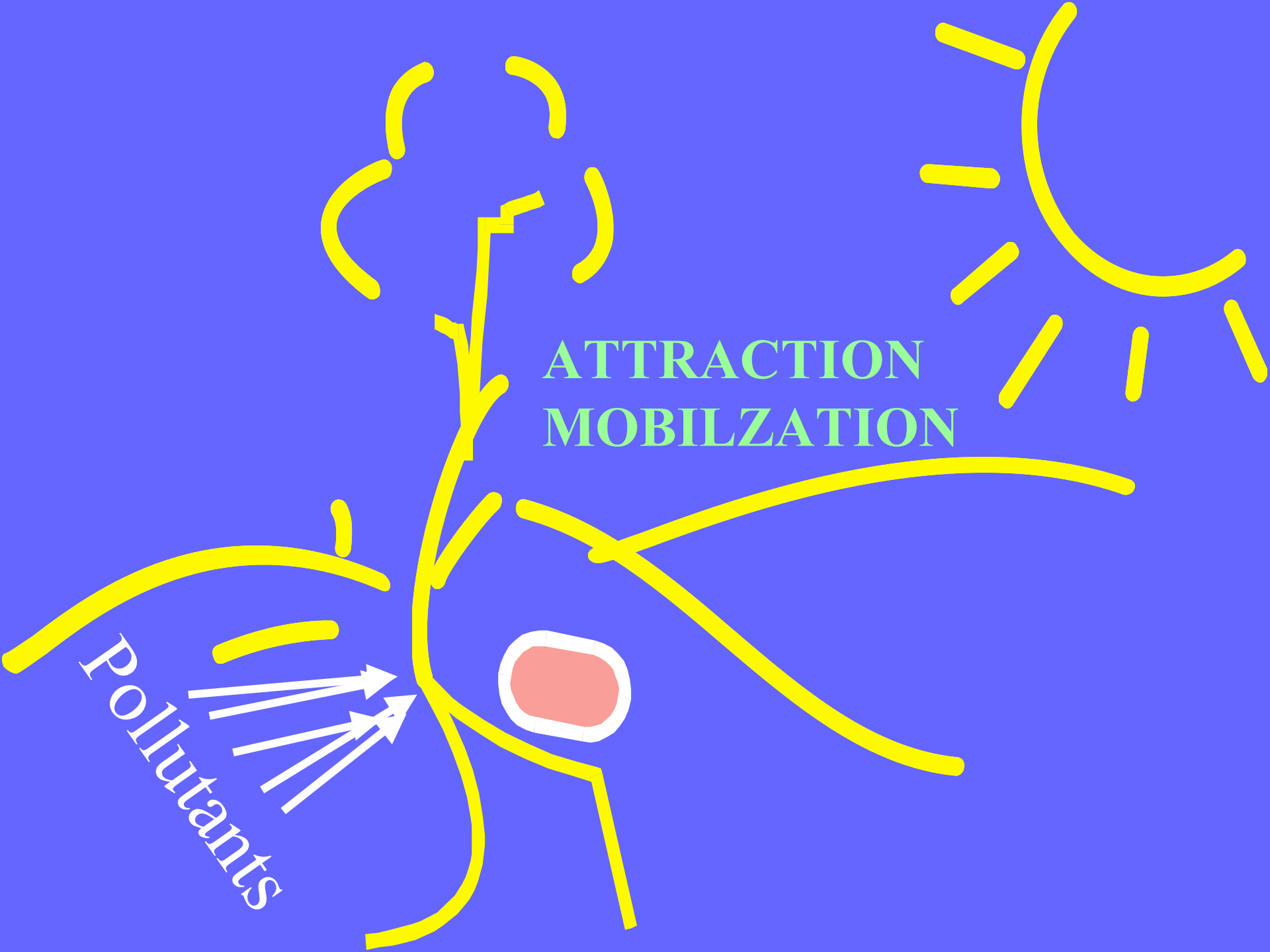


PCB degradative potency of MAP84 variants.

% Depletion

BPDO	2,6-CB	3,3'-CB	4,4'-CB	2,2',6,6'-CB	2,3',4-CB	2,4,4'-CB	2,3,4'-CB	2,2',5,5'-CB	2,2',4,4'-CB	2,2',3,3'-CB	2,3',4,4'-CB	3,3',4,5'-CB
LB400	<10	<10	<10	<10	<10	<10	<10	95	<10	75	<10	<10
MAP84	70	100	99	100	64	90	100	100	54	99	28	47

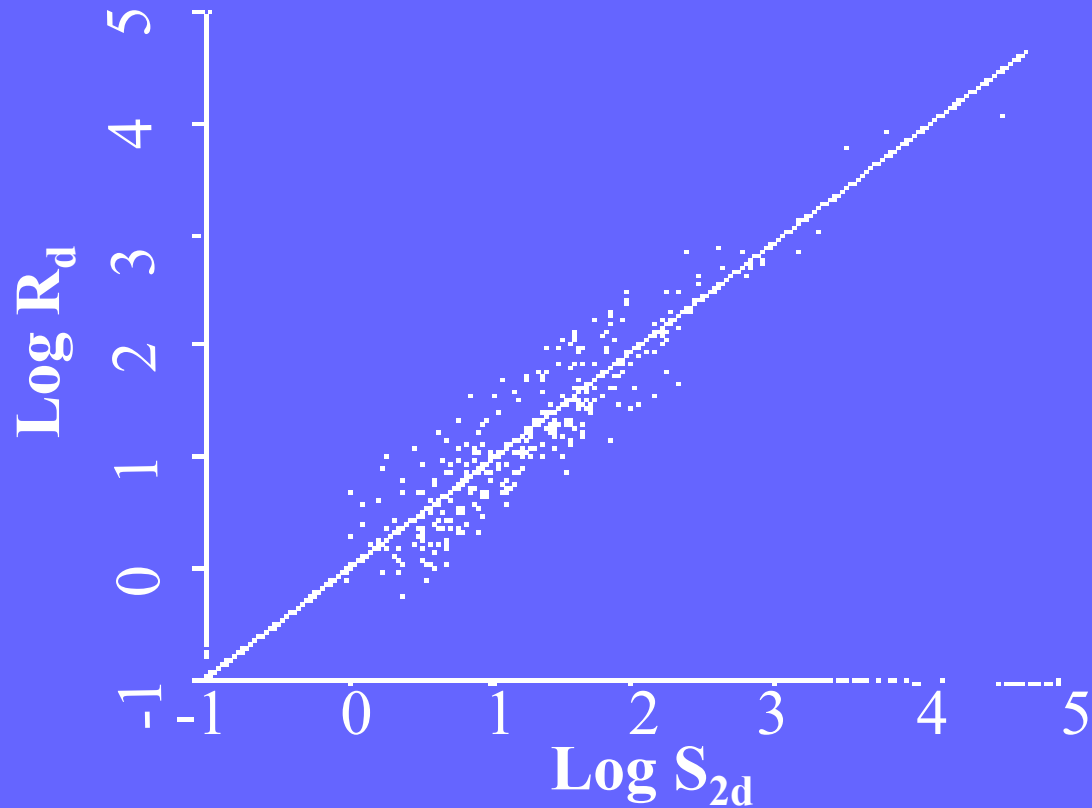




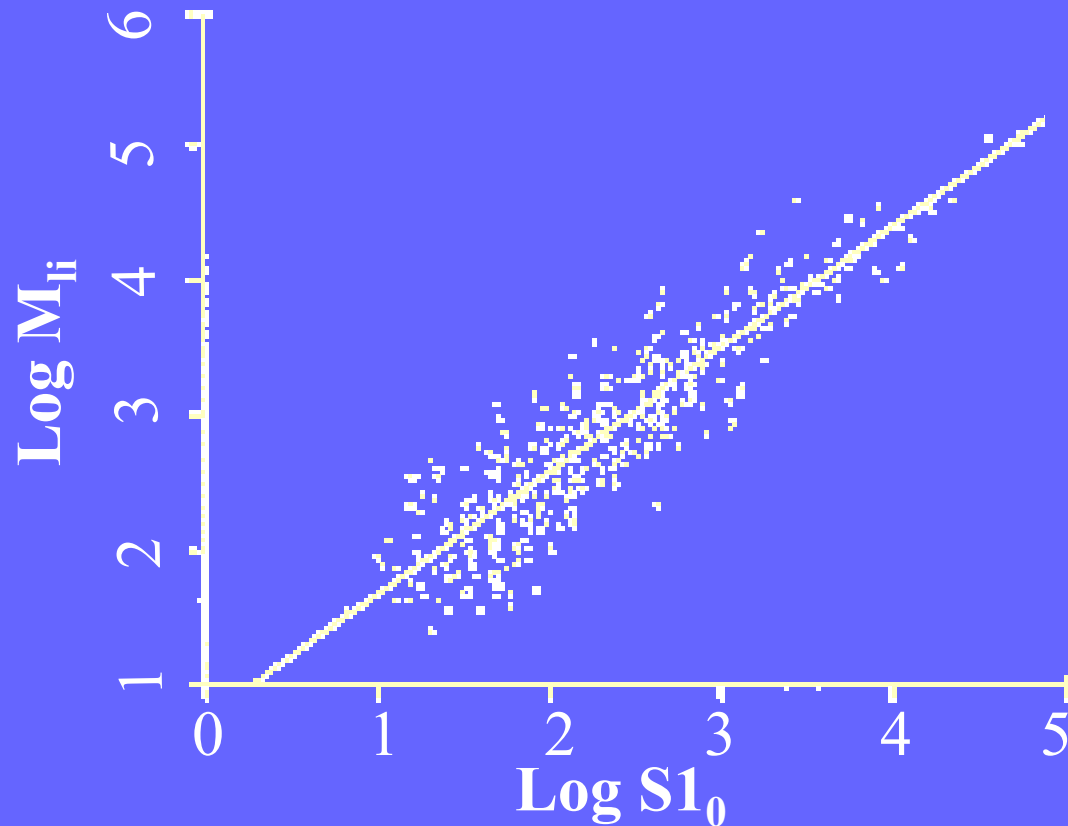
ATTRACTION
MOBILIZATION

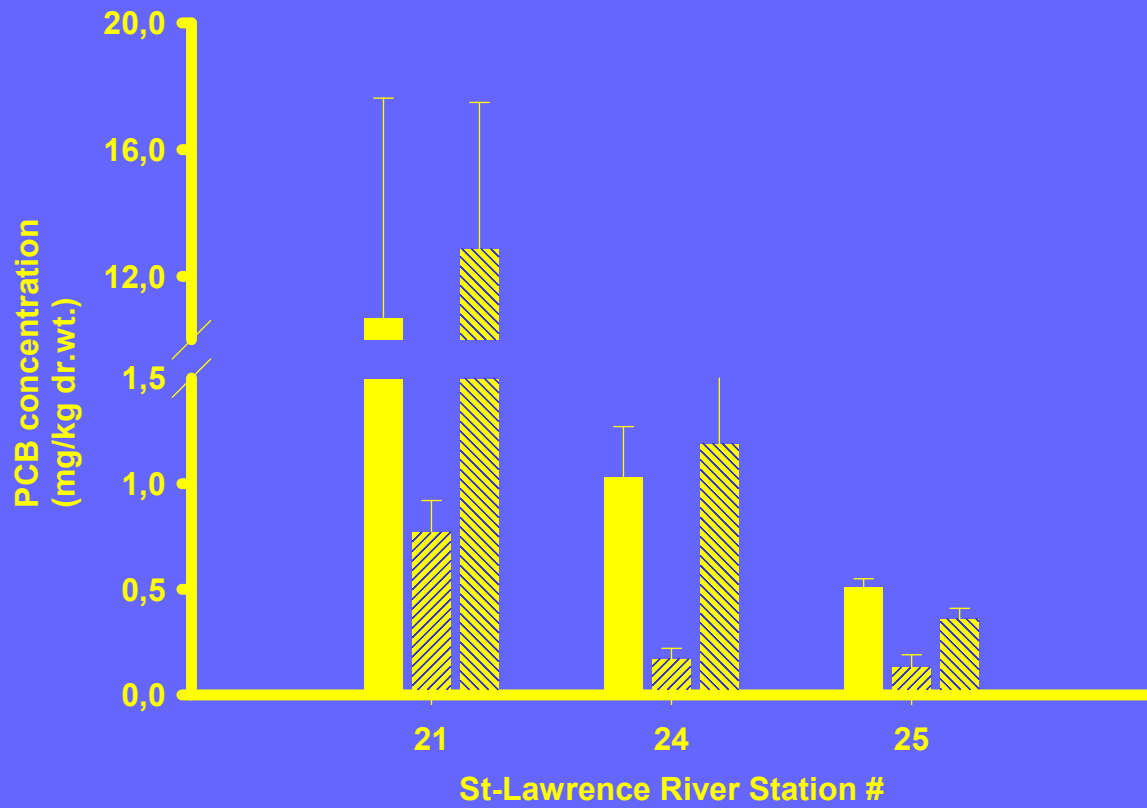
Pollutants

**Correlation between PCB concentration in roots of
macrophytes (dry wt) and
in sediment (dry wt)**

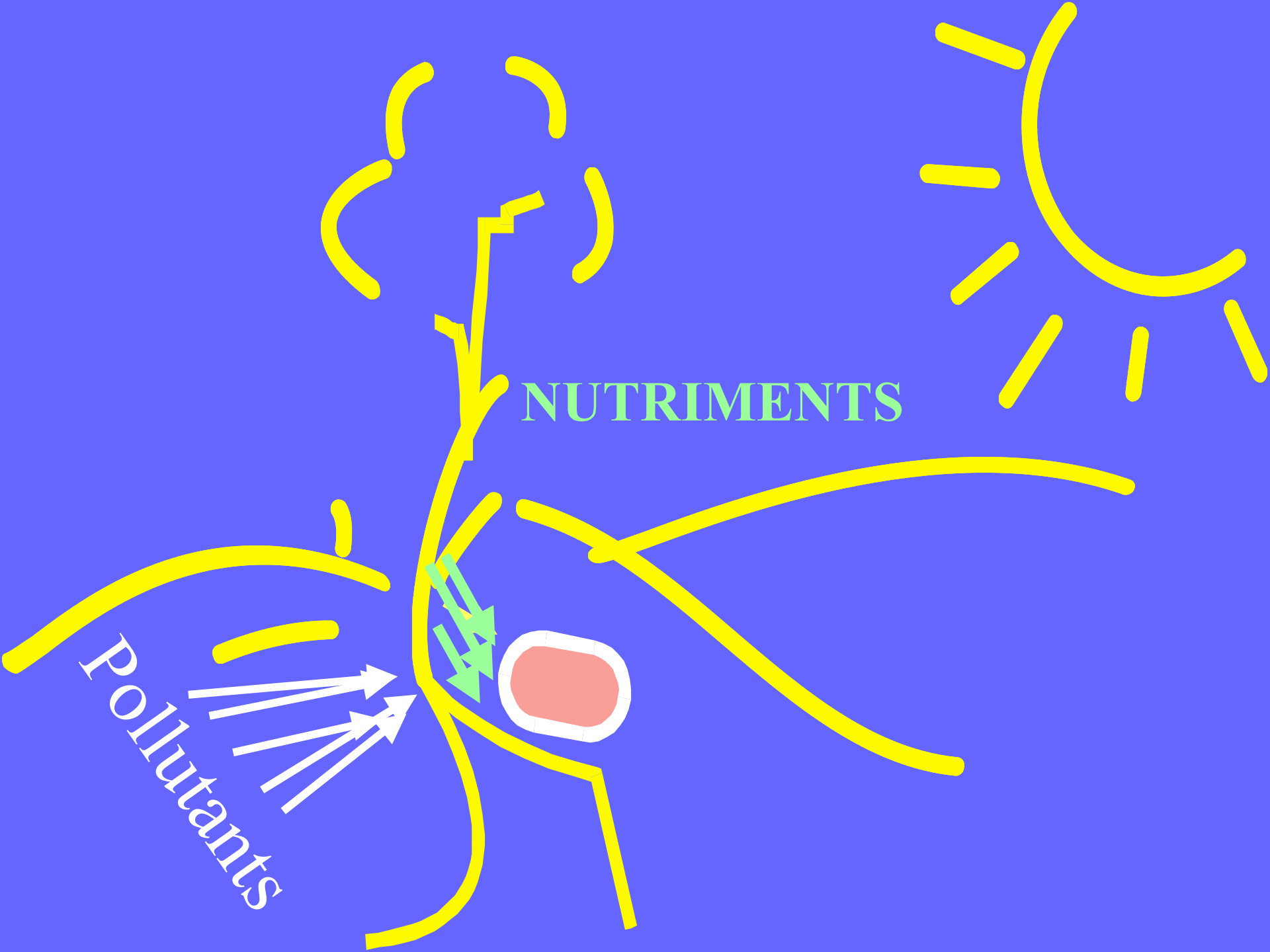


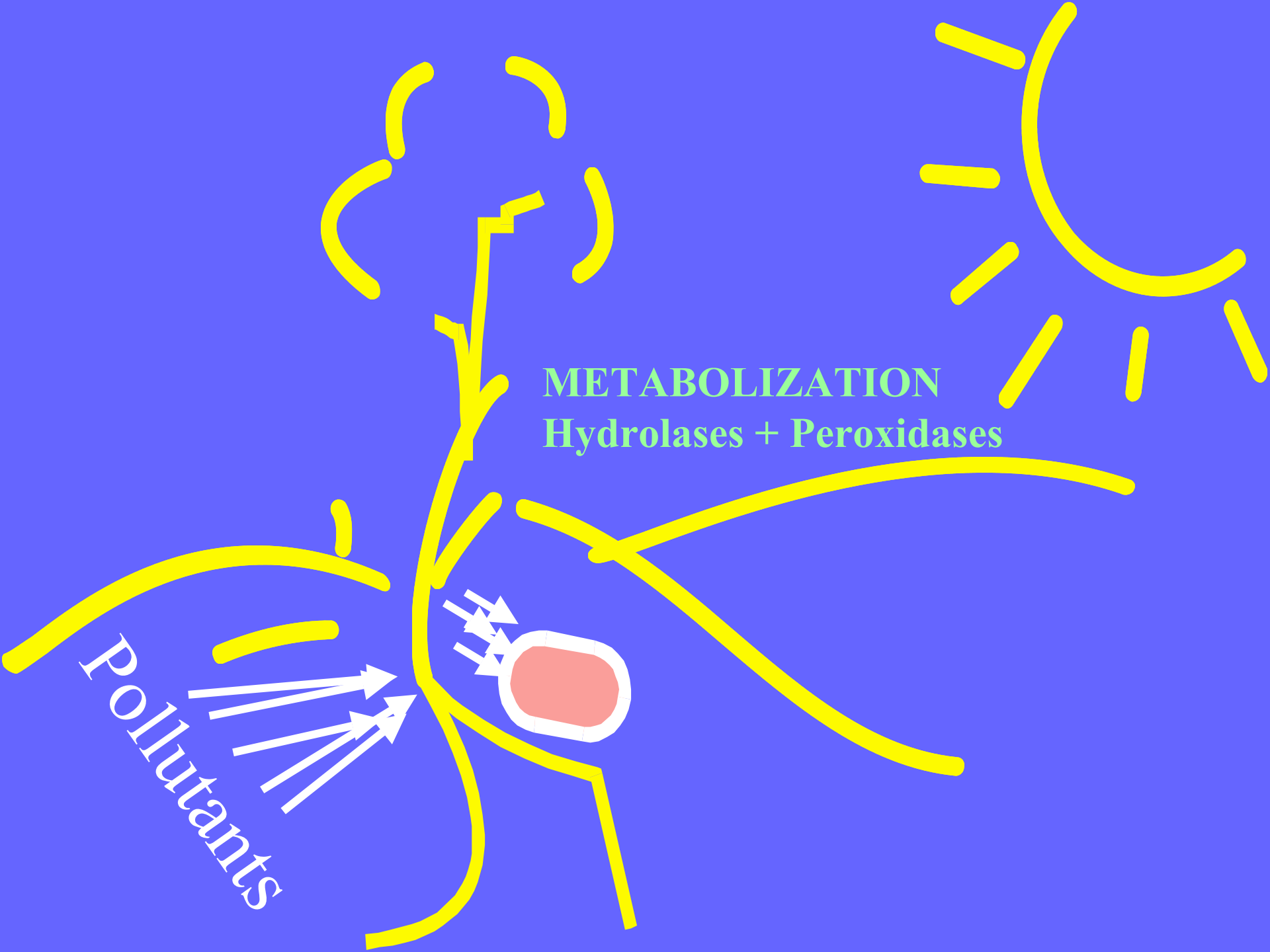
**Correlation between PCB concentration in shoots
of macrophytes (lipid wt) and
in sediment (organic wt)**





**For vacuolar terrestrial plants,
there are evidences for genus
specific differences in PCB
uptake and in PCB
metabolizations**



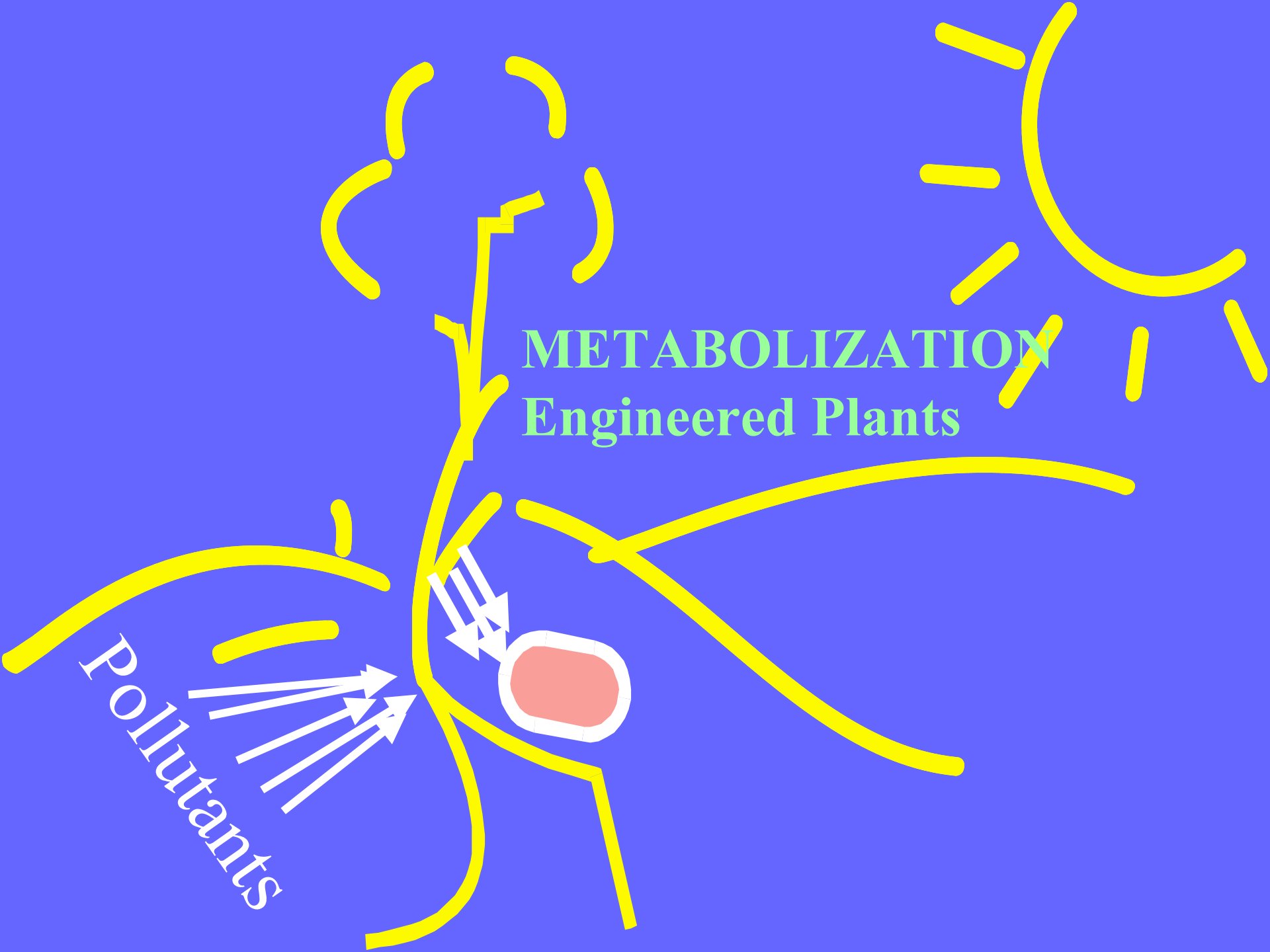


METABOLIZATION
Hydrolases + Peroxidases

Pollutants

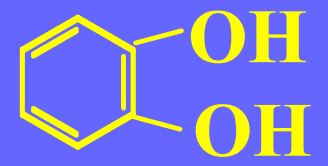
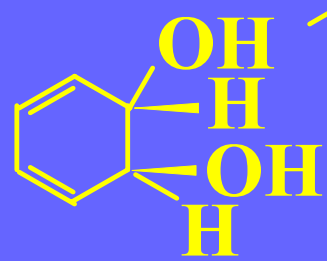
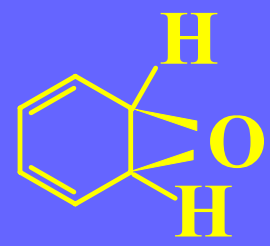
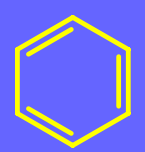
METABOLIZATION Engineered Plants

Pollutants

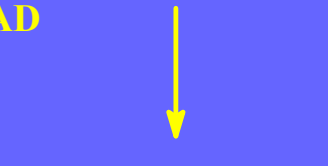
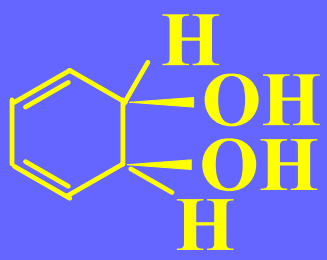
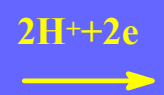
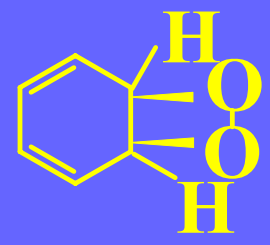




**Eukaryotes
P450**

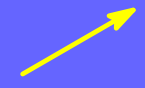


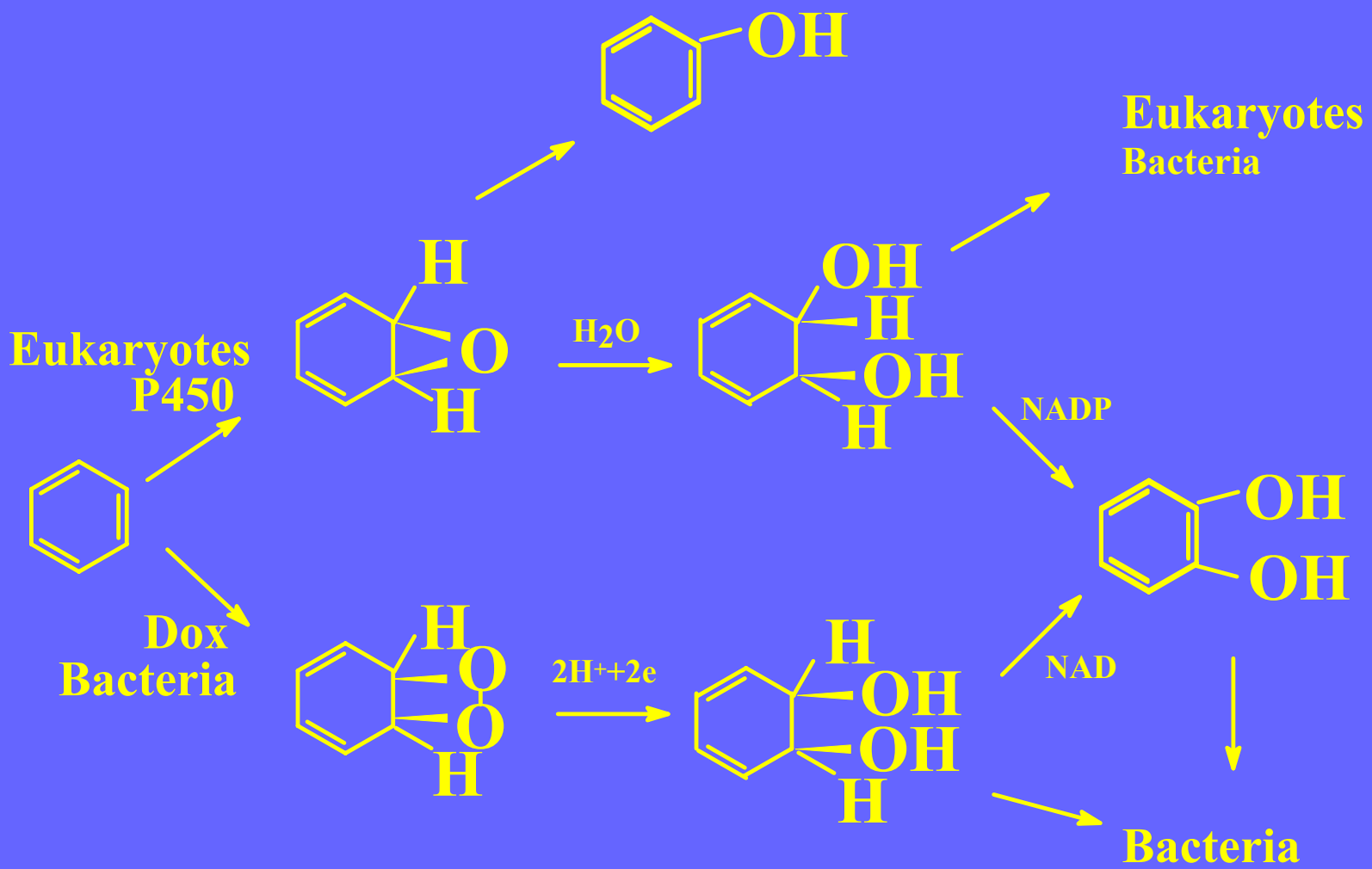
**Dox
Bacteria**



Bacteria

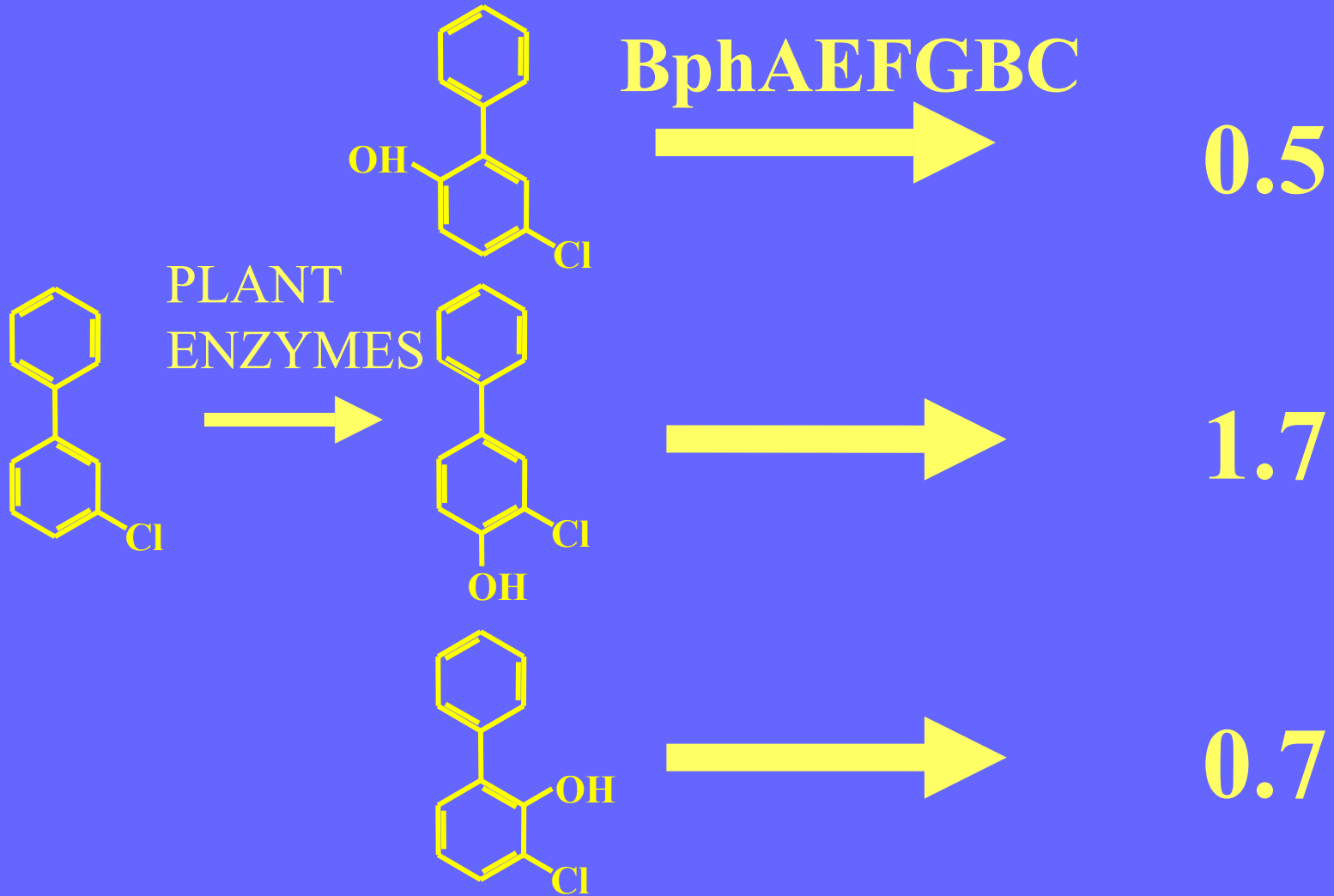
**Eukaryotes
Bacteria**





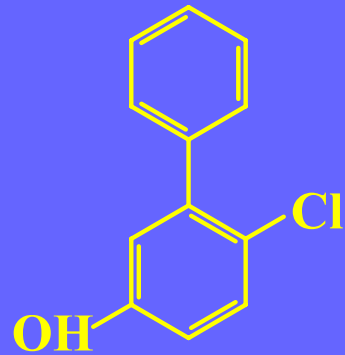
DO₄₃₄

BphAEFGBC



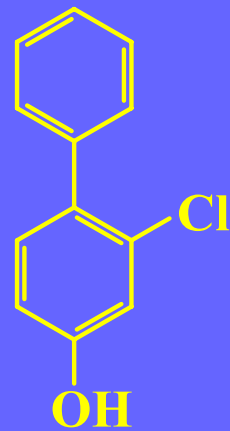
DO₄₃₄

ND

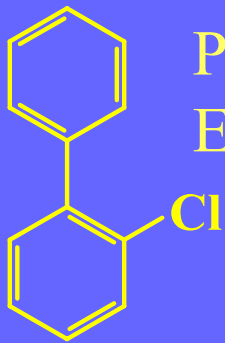


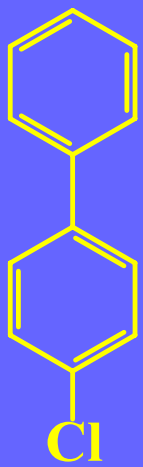
BphAEFGBC

1.0

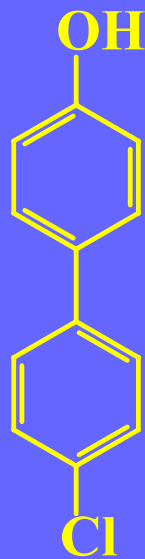


PLANT
ENZYMES





PLANT
ENZYMES



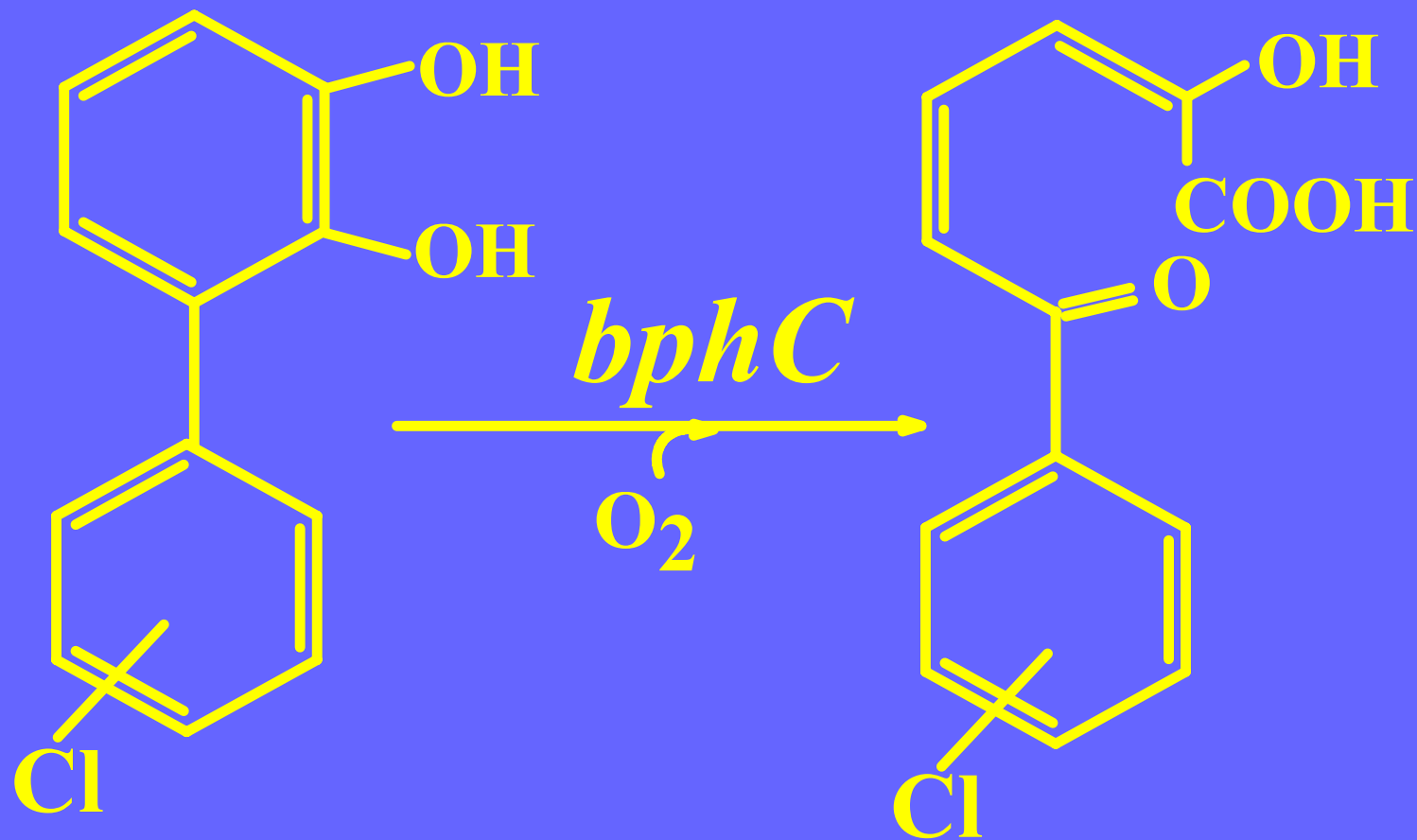
BphAEFGBC

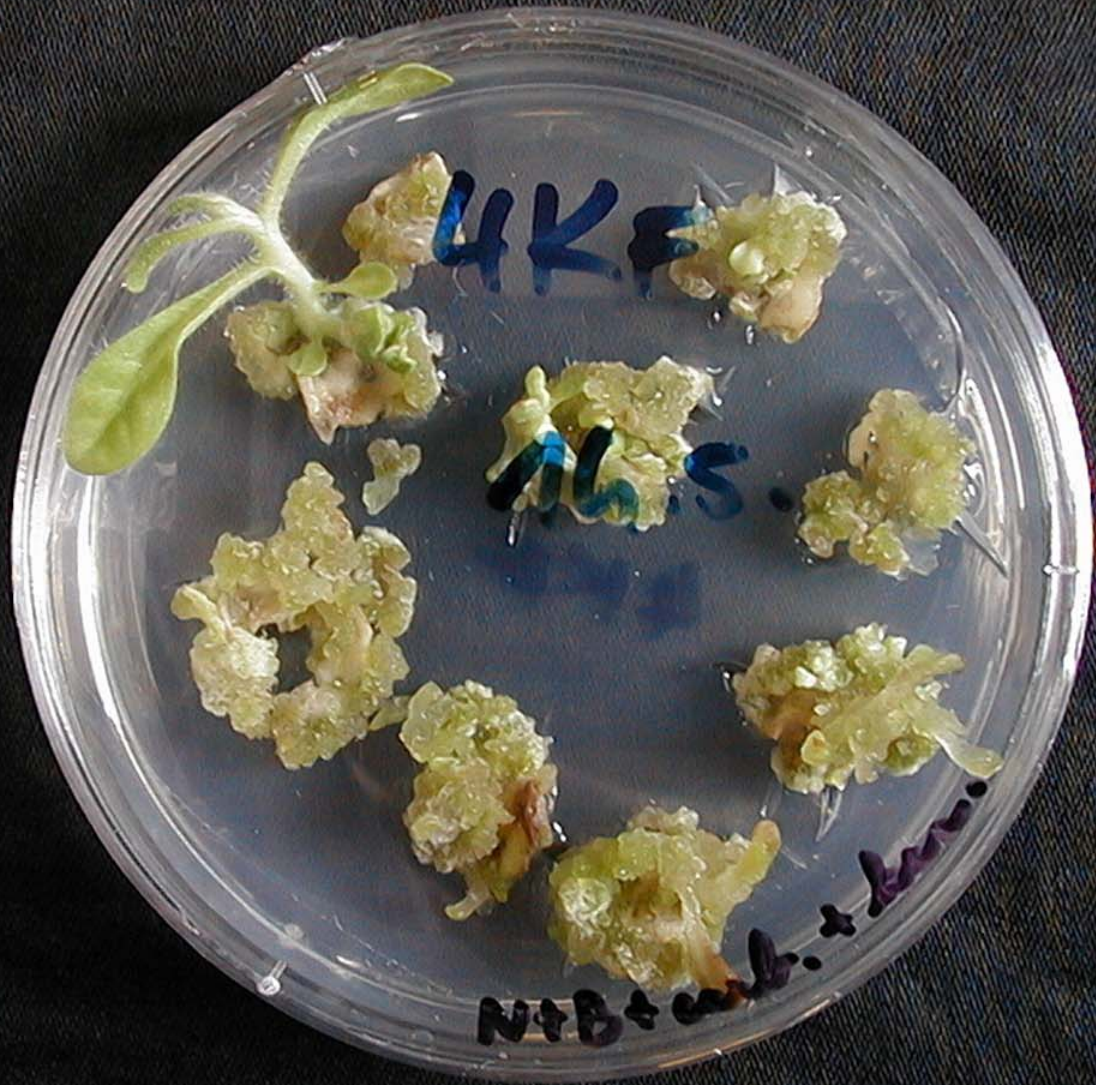


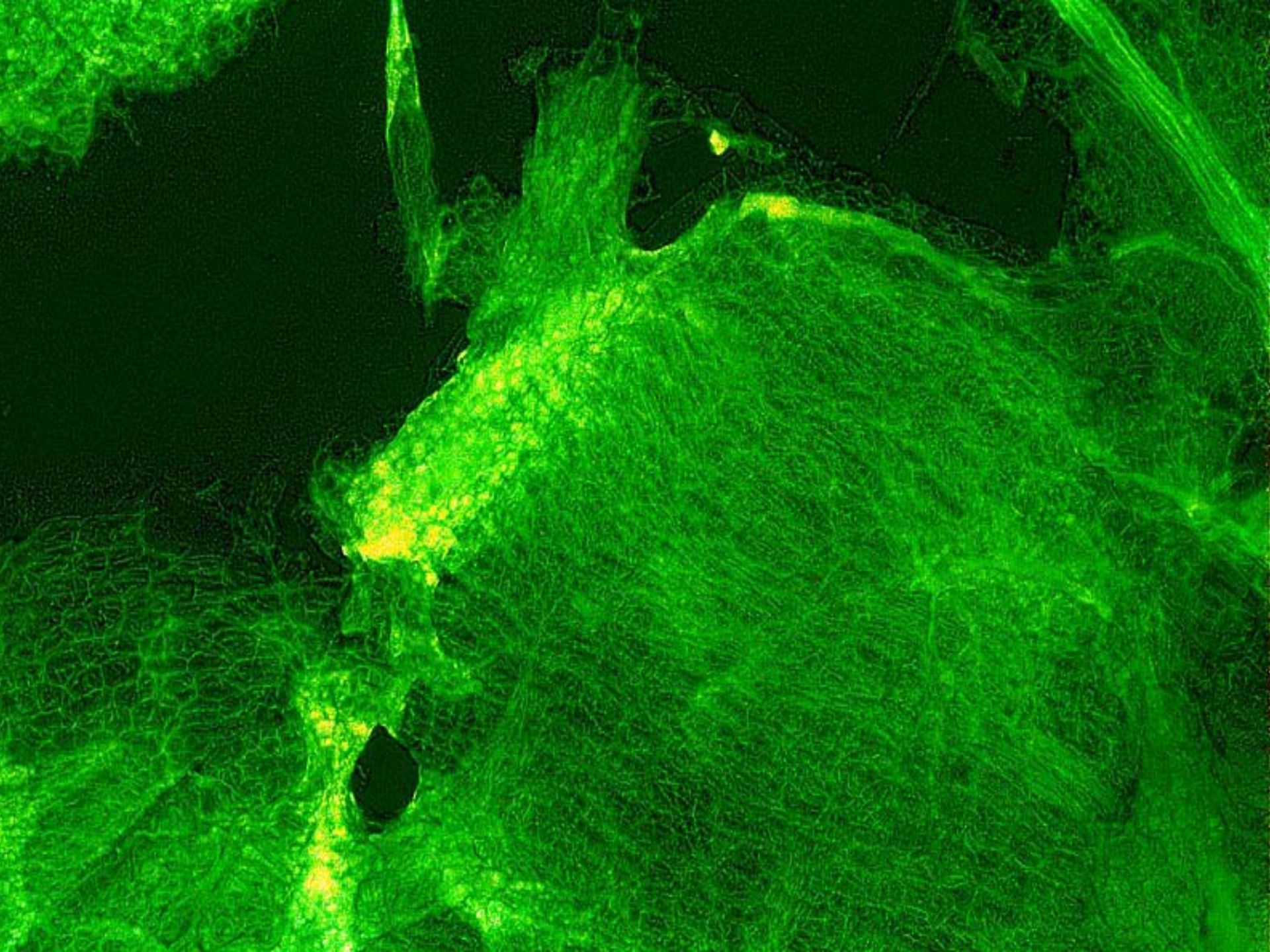
DO₄₃₄

0.0

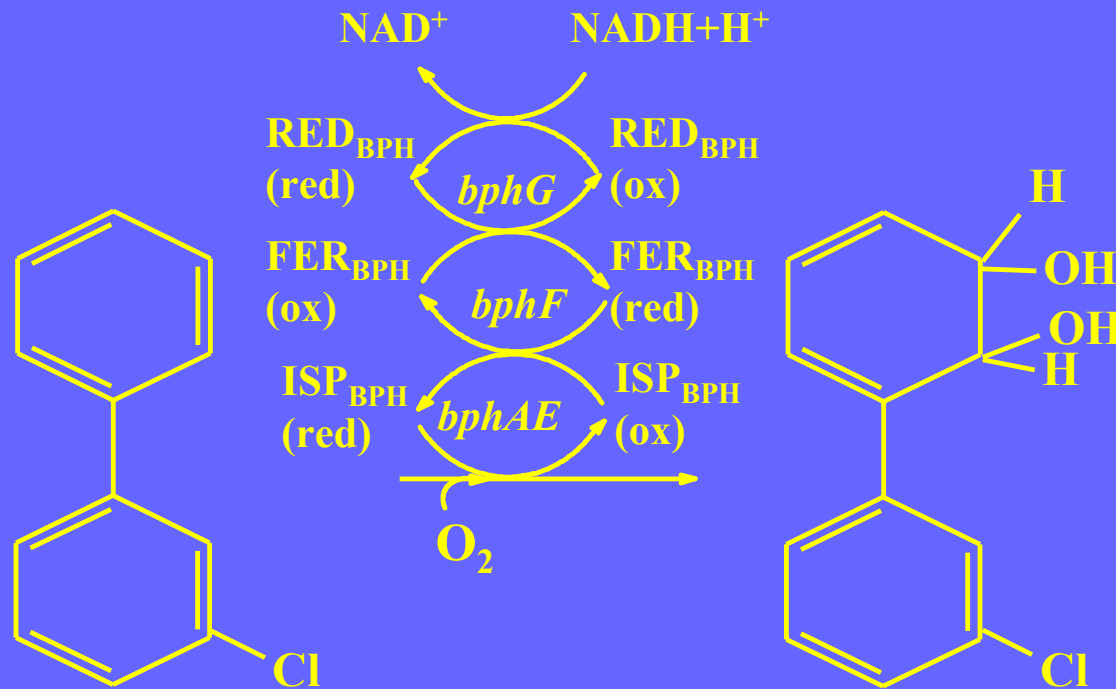
BphC reaction







BPDO reaction



Multicomponent enzyme that catalyzes the 2,3-dioxygenation of the least chlorinated ring

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