

The Japanese Traditional Applied Microbiology may Contribute to the Argentine

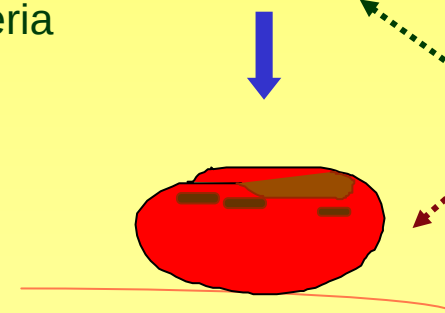
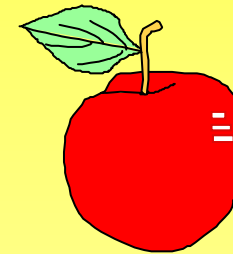
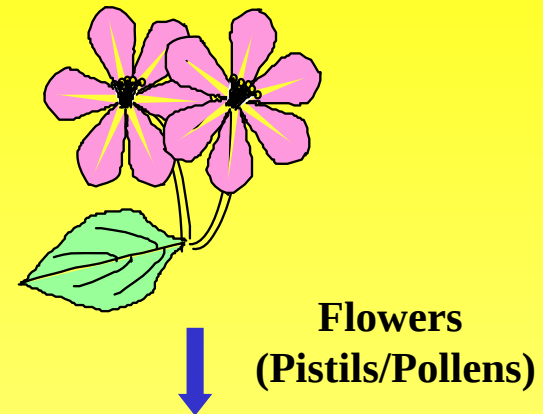
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Growth Habitats of Acetic Acid Bacteria



Fruits and Flowers
(high sugars or sugar alcohols)



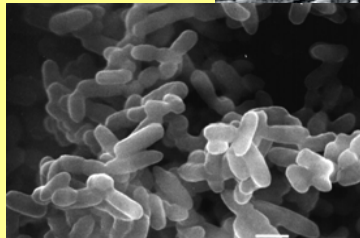
In high conc. of sugars and sugar alcohols



Fruit fly
Vinegar fly
Wine fly



Yeast, Fungi
Lactic acid bacteria
Zymomonas



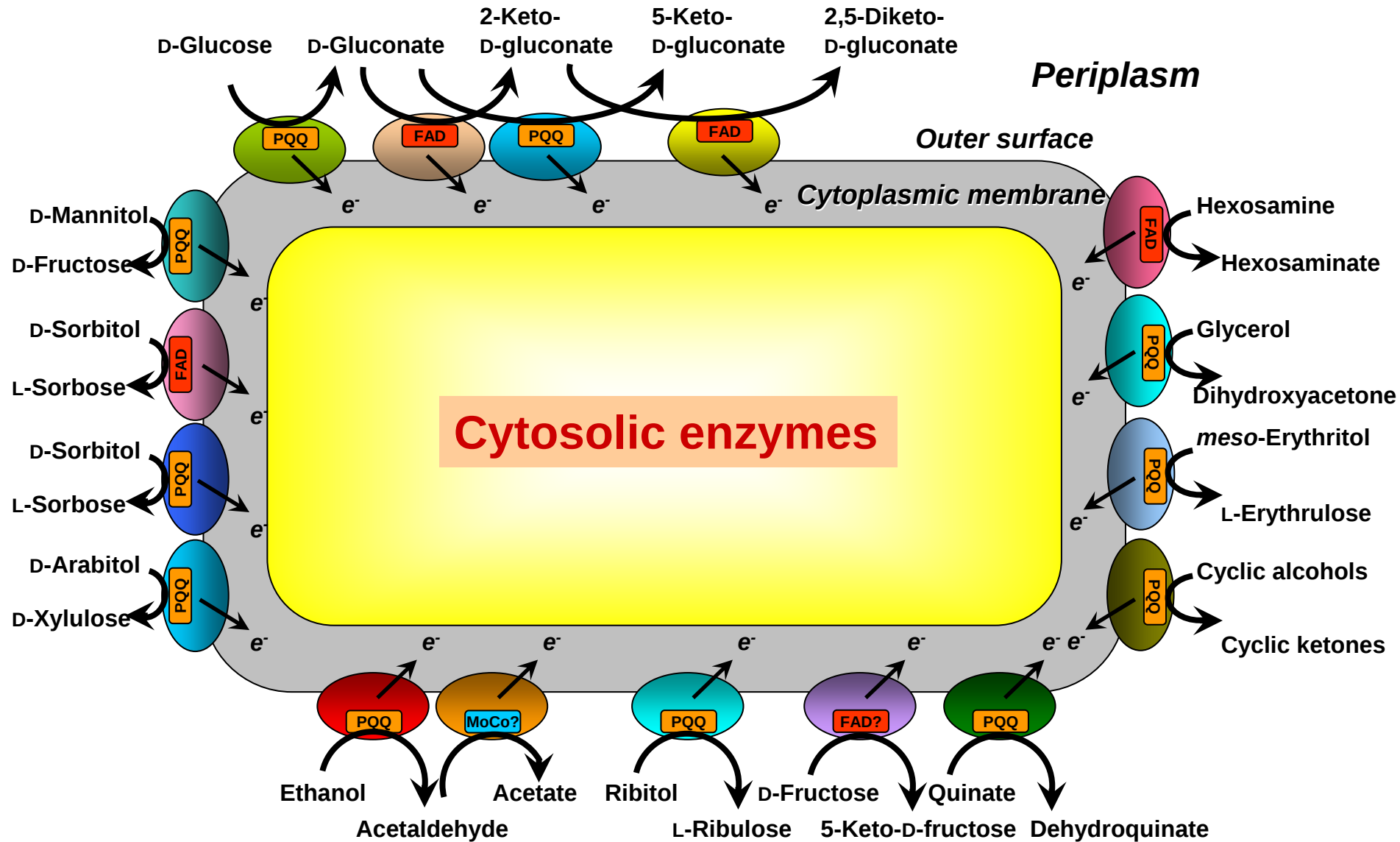
Competitive microbes

Sushi based on Rice Vinegar



Static Rice Vinegar Fermentation





Strong Enzymes in Acetic Acid Bacteria

Membrane-bound	Cytoplasmic
Alcohol dehydrogenase (PQQ)	Glucose dehydrogenase (NADP)
Glucose dehydrogenase (PQQ)	2-Ketogluconate reductase (NADPH)
Gluconate dehydrogenase (FAD)	5-Ketogluconate reductase (NADPH)
Sorbitol dehydrogenase (PQQ)	Aldehyde dehydrogenase (NAD/NADP)
Glycerol dehydrogenase (PQQ)	Dioxyacetone reductase (NADH/NADPH)
Aldehyde dehydrogenase (Mo)	5-Ketofructose reductase (NADPH)
Fructose dehydrogenase (FAD)	Shikimate dehydrogenase (NADP)
Quinate dehydrogenase (PQQ)	Mannitol dehydrogenase (NADP)
Polyol dehydrogenase (PQQ)	Sorbitol dehydrogenase (NAD)

Coenzymes (NAD/NADP, NADH/NADPH, PQQ, FAD, CoQ₁₀)

Fermentation-based Biotechnology of AAB

Physiological features



Basic Research

Industrial development

Acetobacter • *Gluconacetobacter*

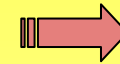
Acetic acid
fermentation



Vinegar

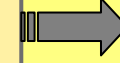
Gluconobacter

Ketogulonate
fermentation



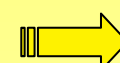
Vitamin C

Dihydroxyacetone
fermentation



DHA
(Cosmetics)

5-Ketogluconate
fermentation



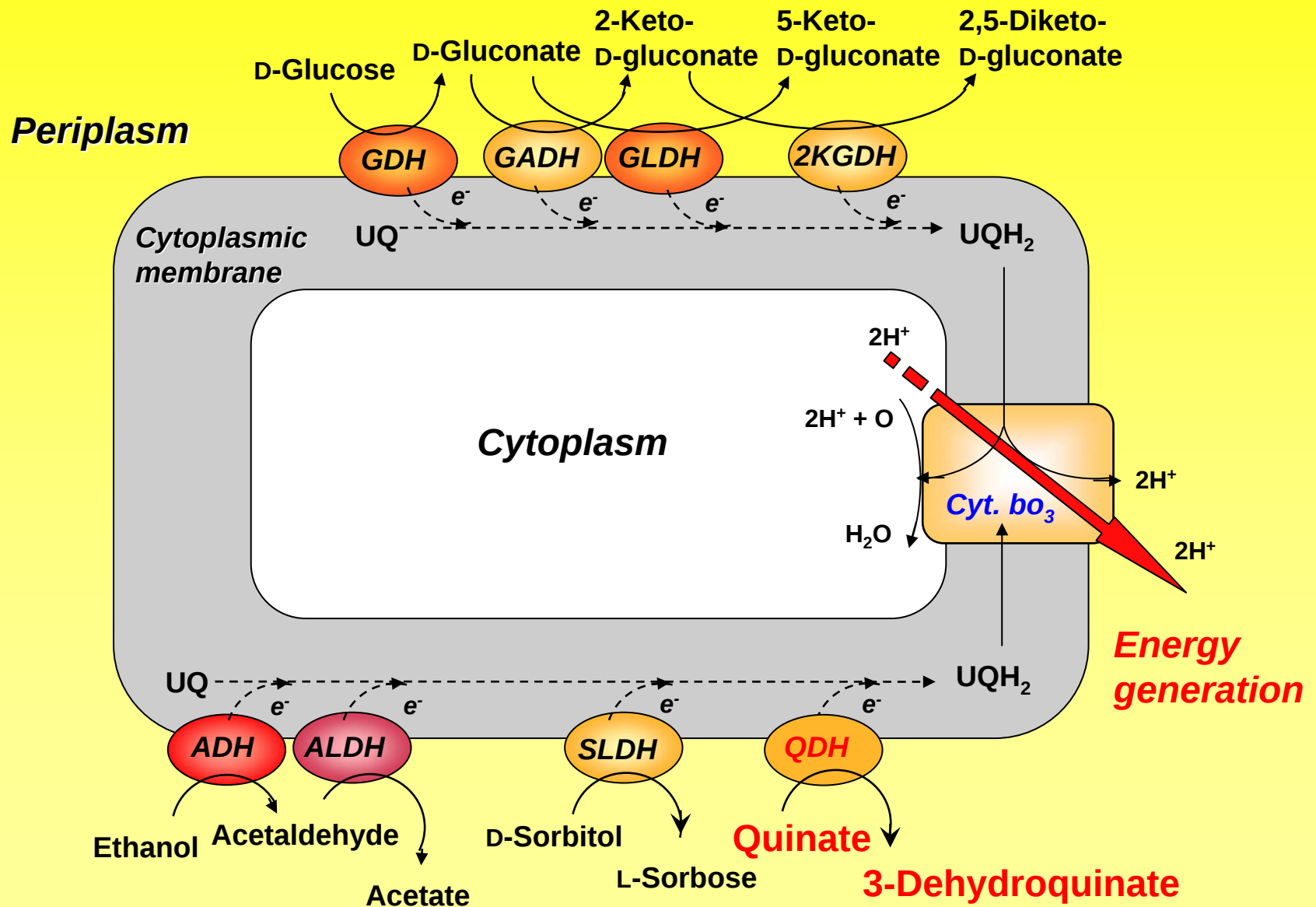
Tartaric acid
(Chemicals)

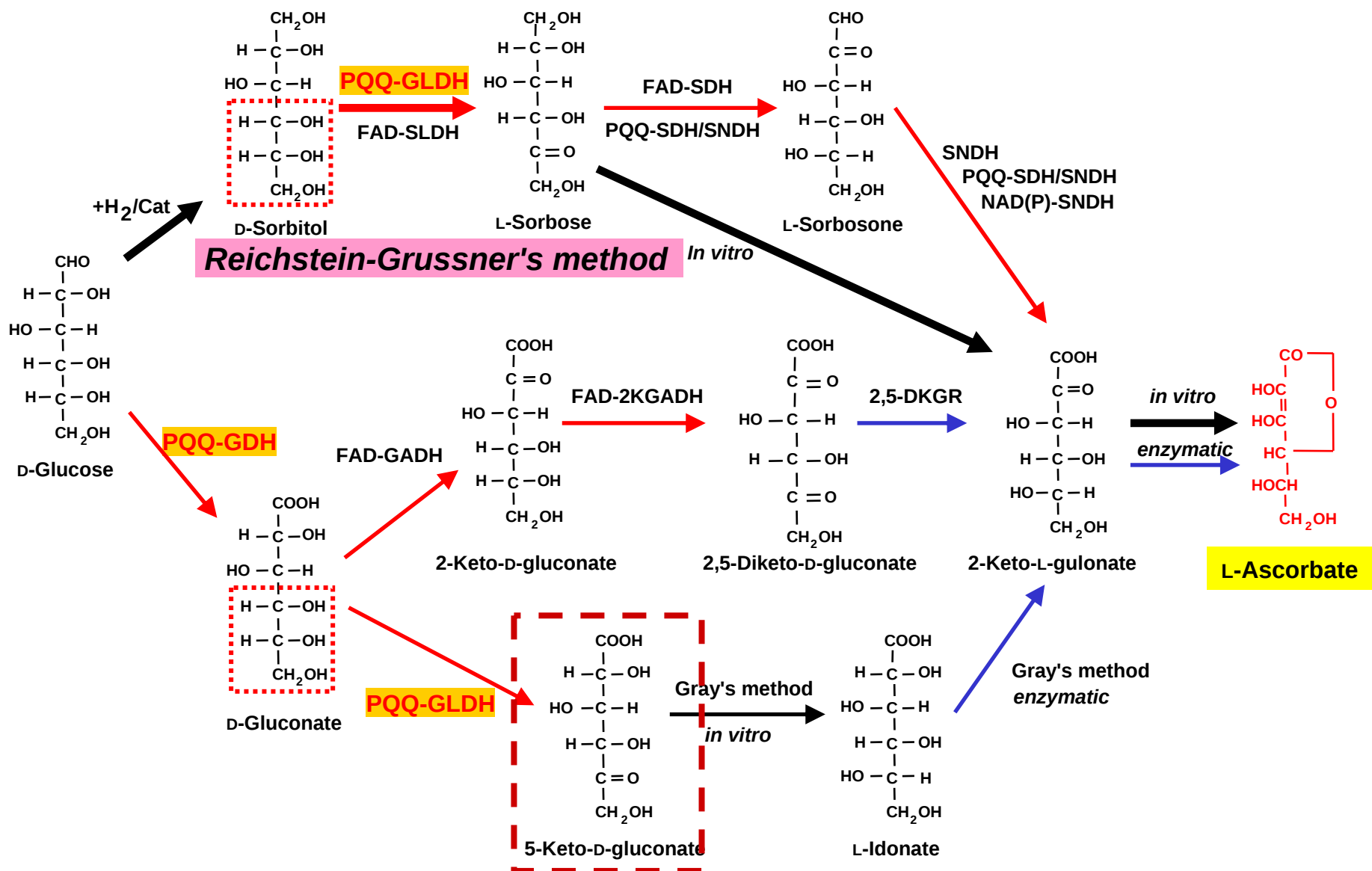
Dehydroquinate
fermentation



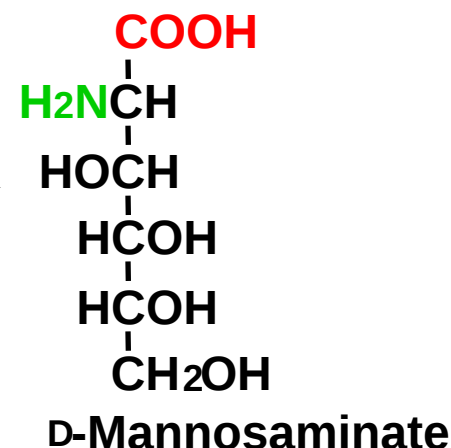
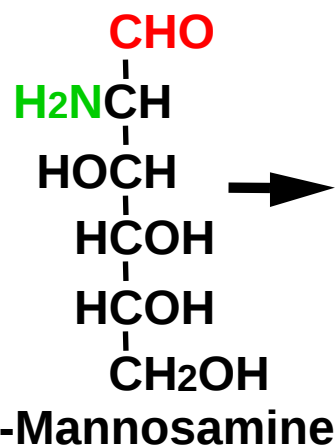
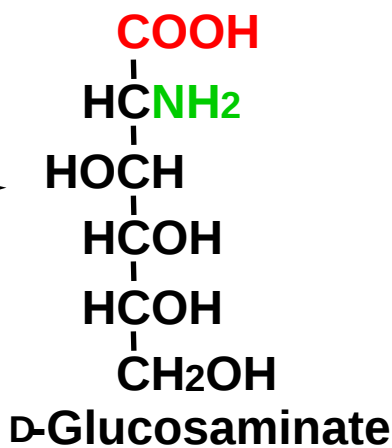
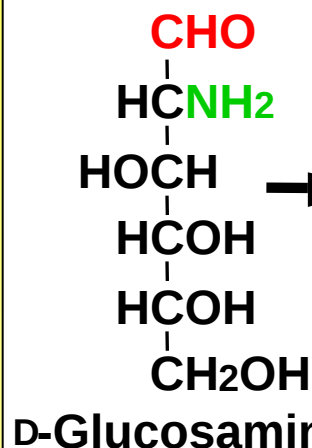
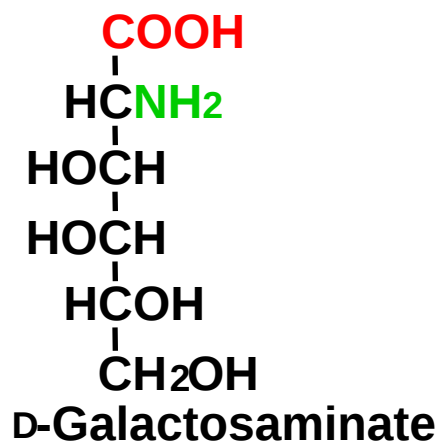
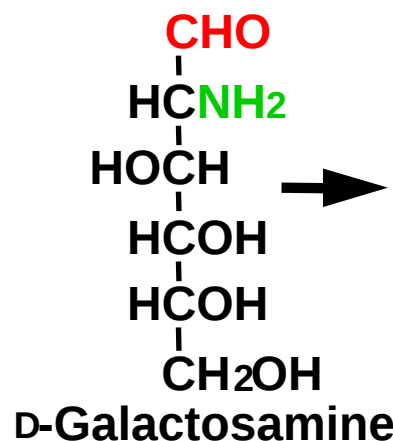
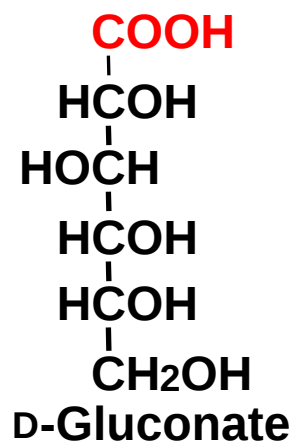
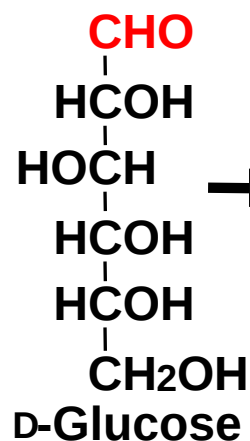
Shikimate
(Medicine)

Membrane-bound Enzymes in Acetic Acid Bacteria and Energy Generation by Substrate Oxidation

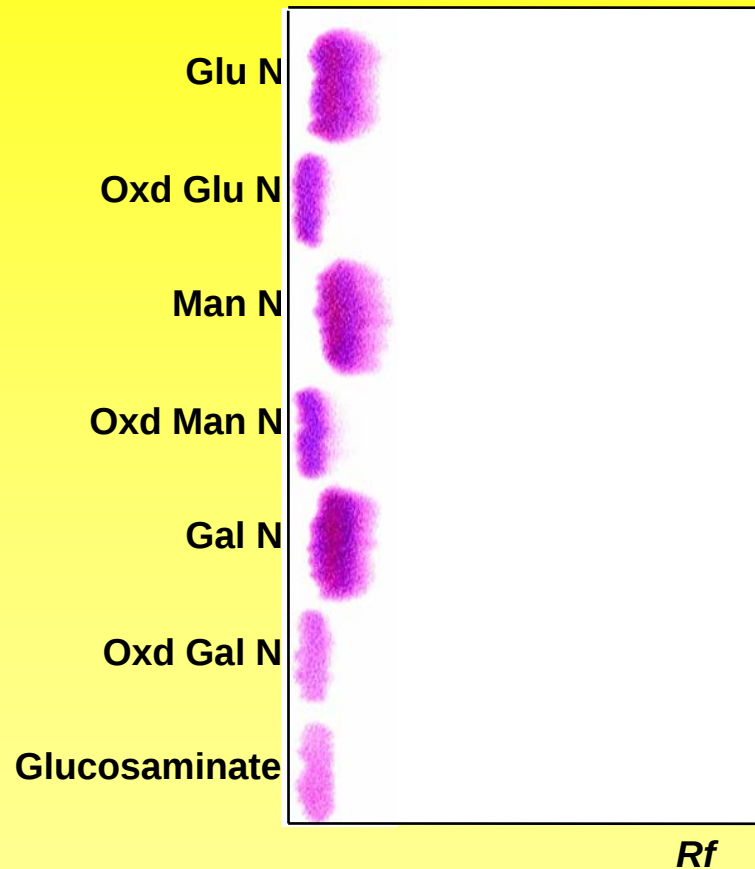




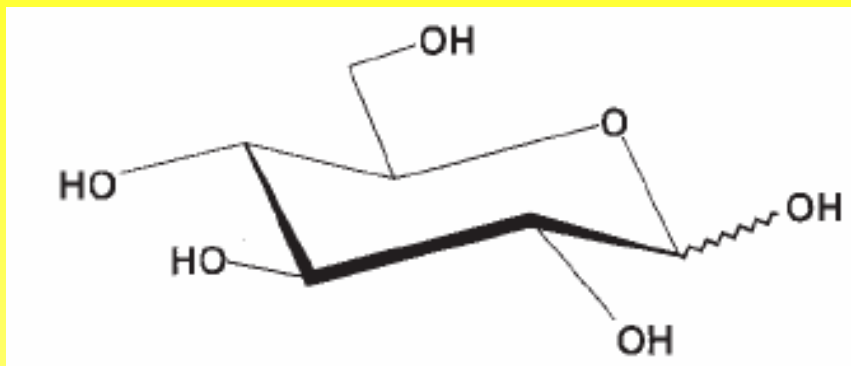
Different Routes for Vitamin C



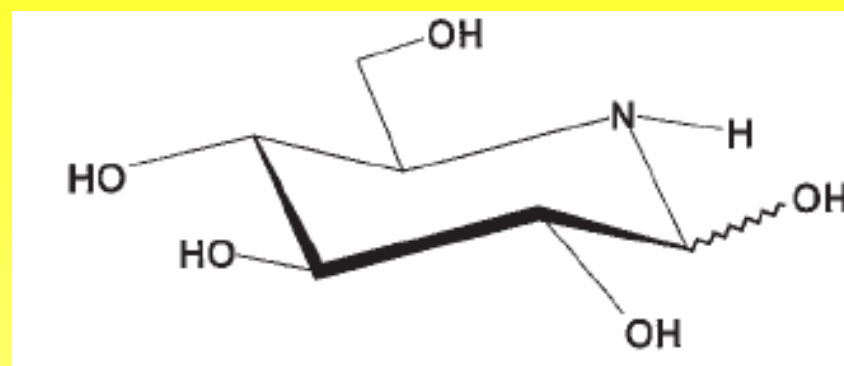
**Alternative Membrane-bound GDH from
*Gluconobacter***



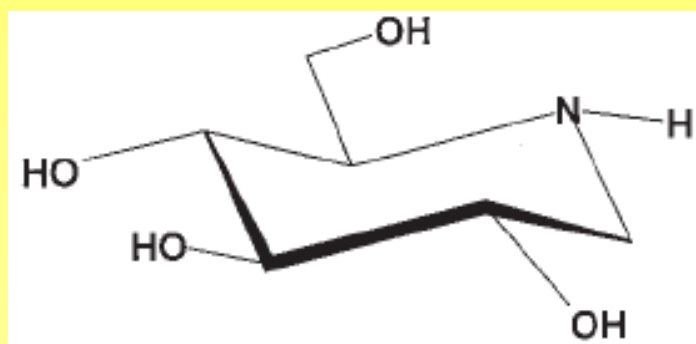
Hexosamine Oxidation



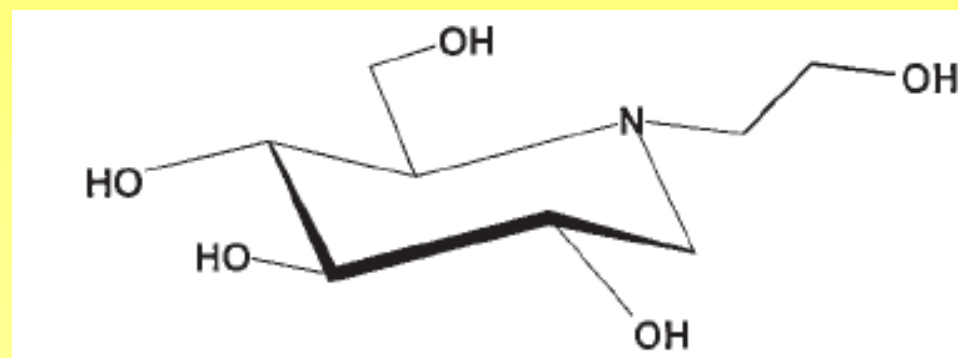
D-glucose



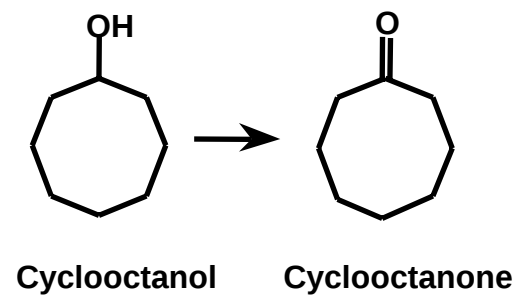
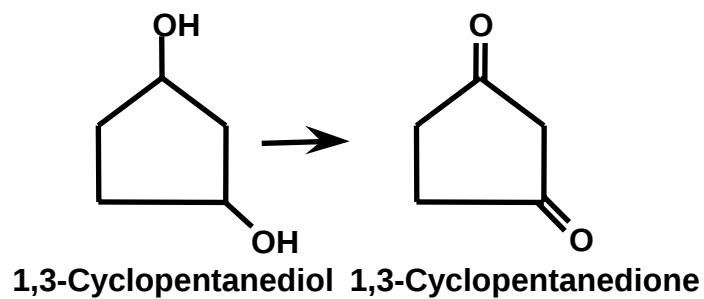
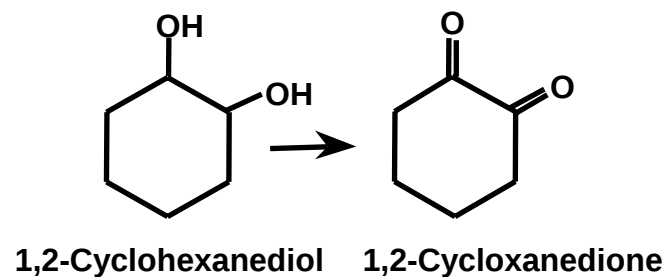
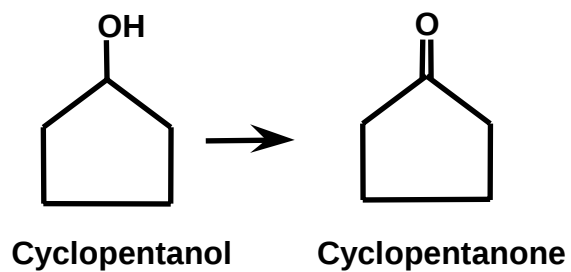
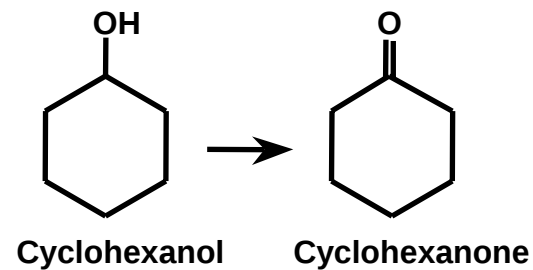
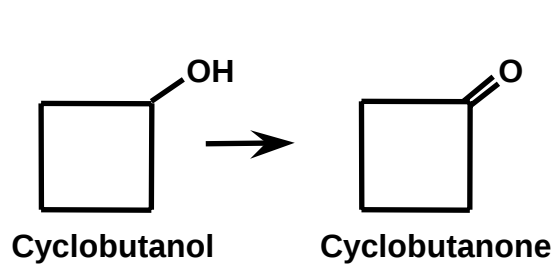
1-deoxynojirimycin



nojirimycin



Miglitol



Cyclic Alcohol Oxidation

Nata de coco

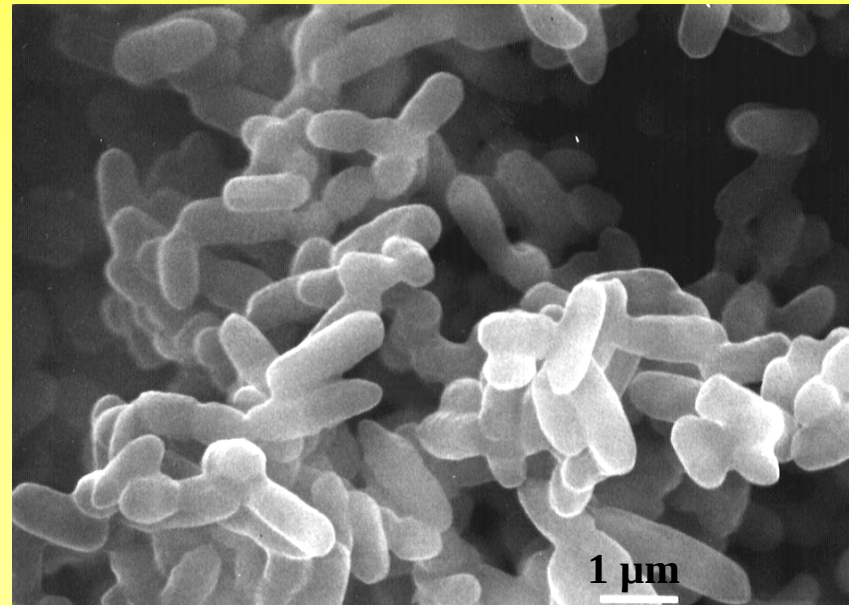
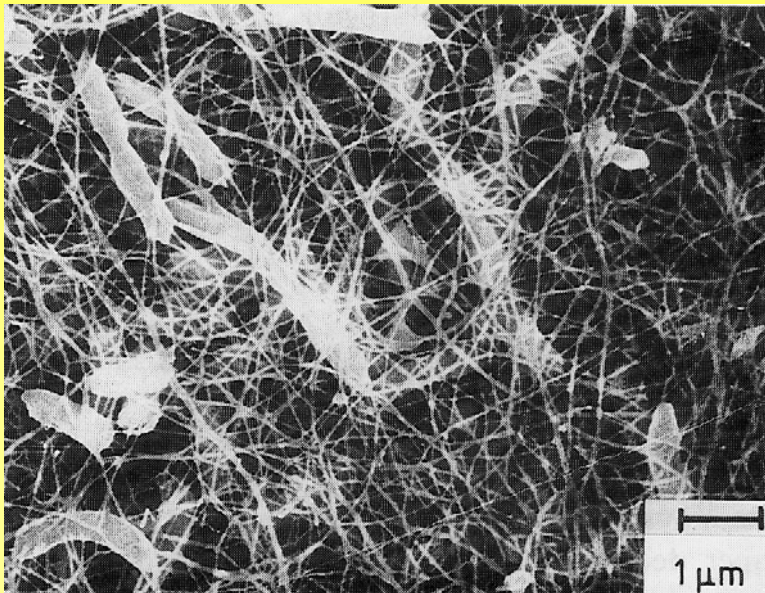


Biocellulose and heteropolysaccharides of AAB

S strain

Pellicle **Static**  **Aerobic growth**
Biofilm  **Drug resistance**

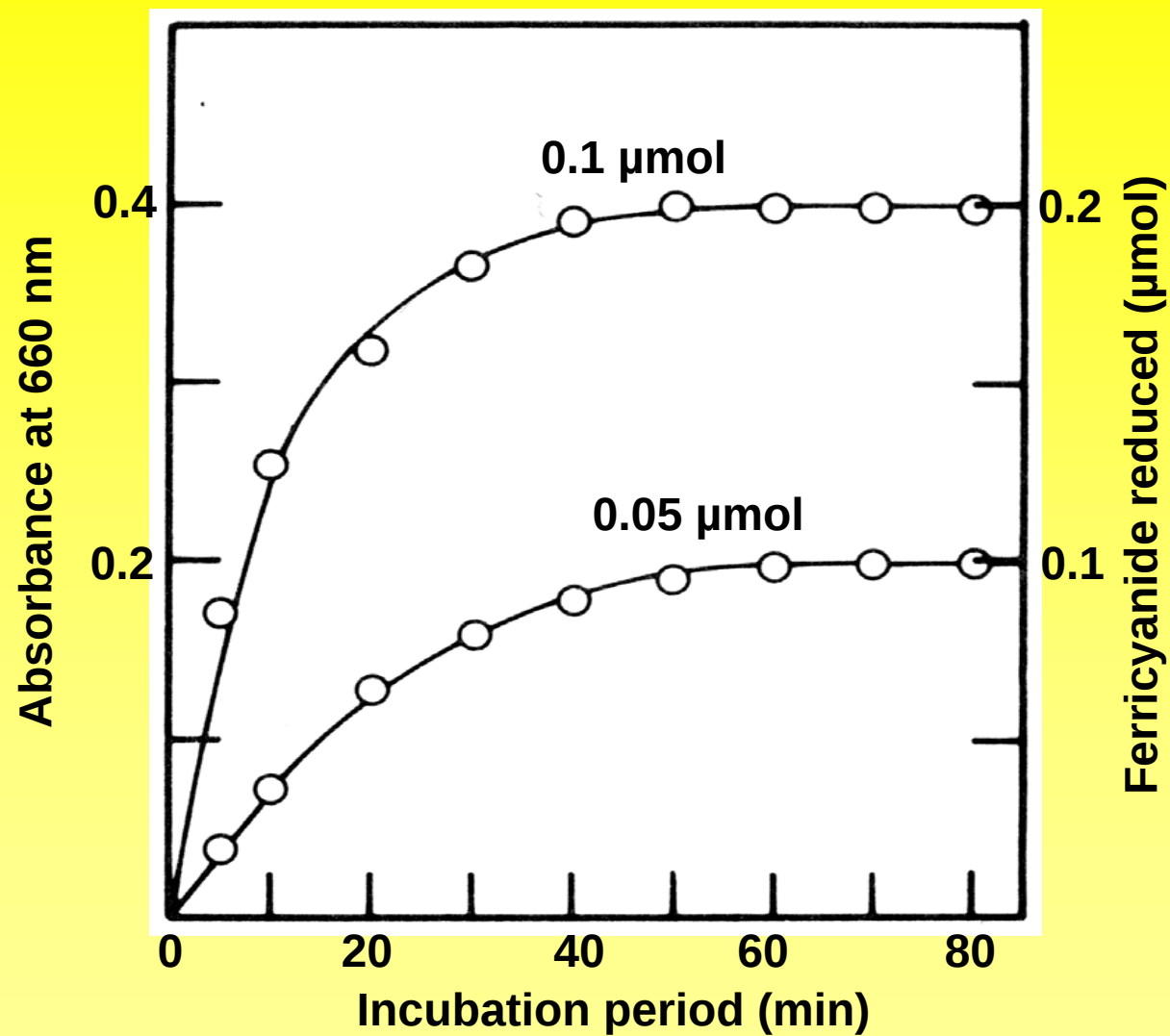
Gluconacetobacter xylinus *Acetobacter lovaniensis*
NBRC 3284



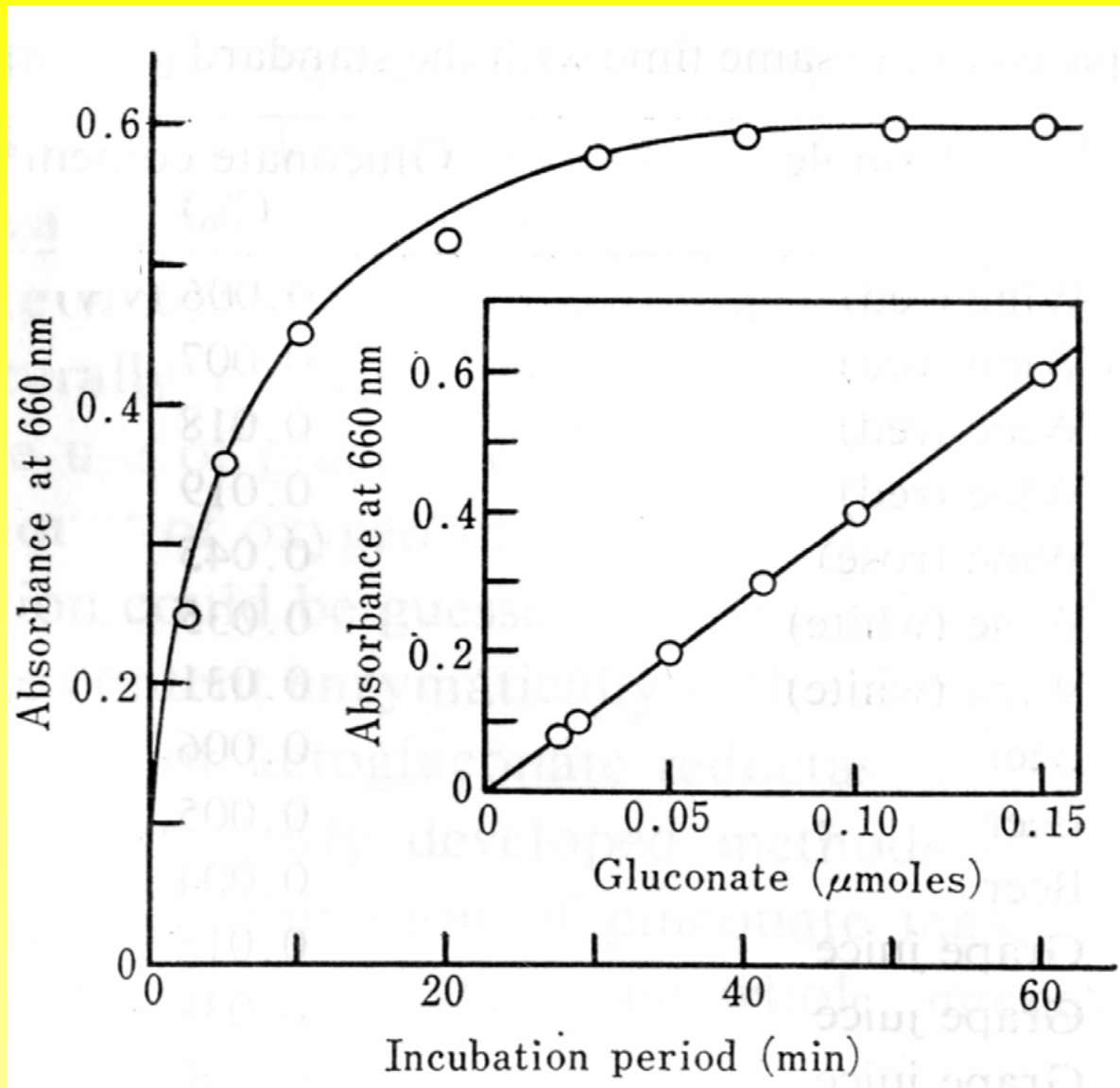
Acetobacter aceti AJ 12368

(S. Yamanaka et al., J. Materials Science 24, 3141-3145, 1989)

R strain



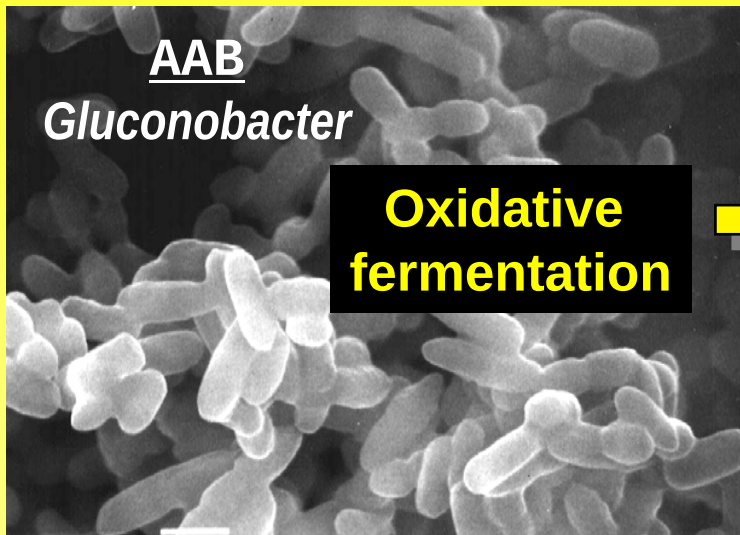
Time Course of D-Fructose Oxidation



Time Course D-Gluconate Oxidation

Enzyme-based Biotechnology by using AAB

Physiological features



Basic Research

Cytoplasmic
NAD(P) enzymes

**PQQ·FAD
Enzymes**

**Biosensor
Bio-fuel cell**

Industrial development

**Chemicals·
Medicines
(Bioconversion)**

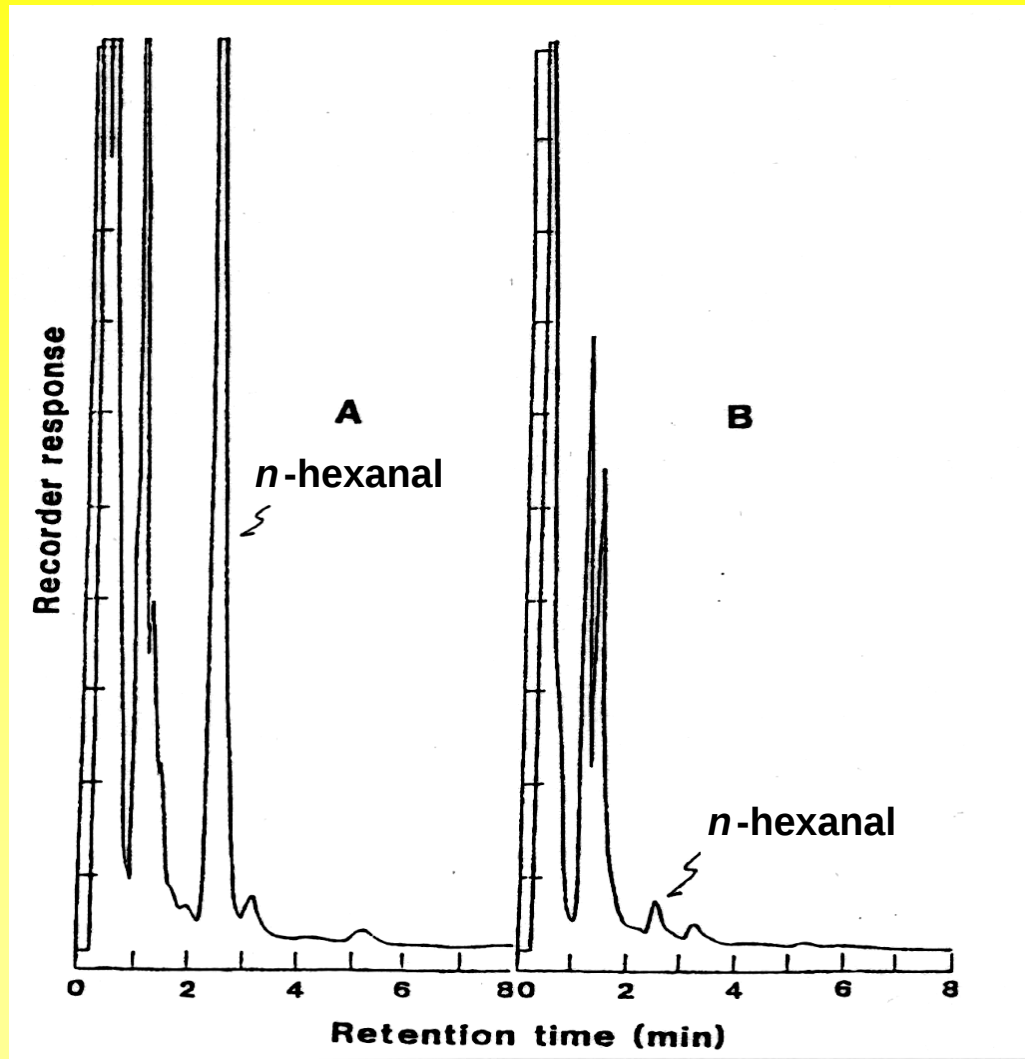
**PQQ
GDH**



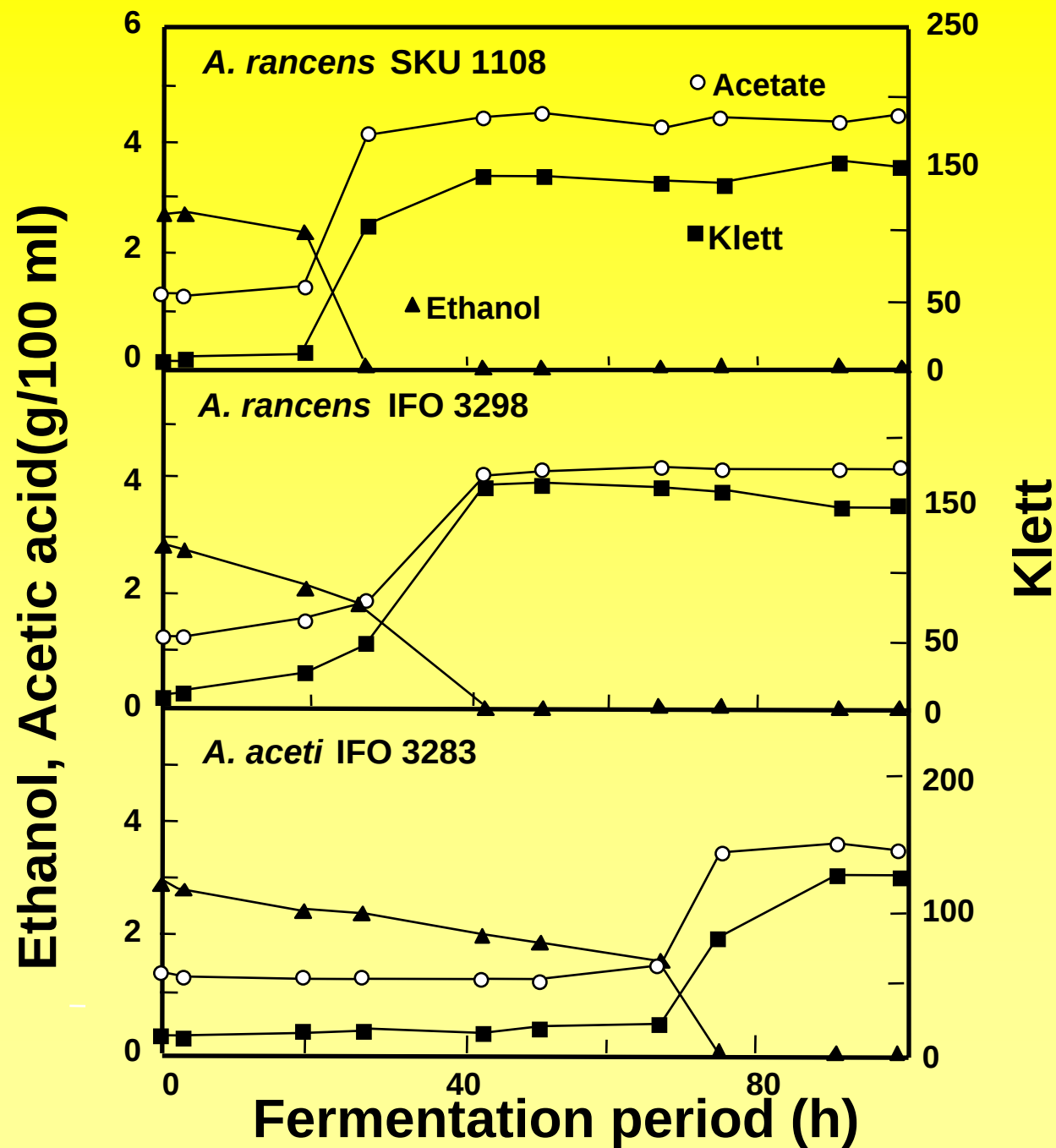
**FAD
FDH
Cyt c**

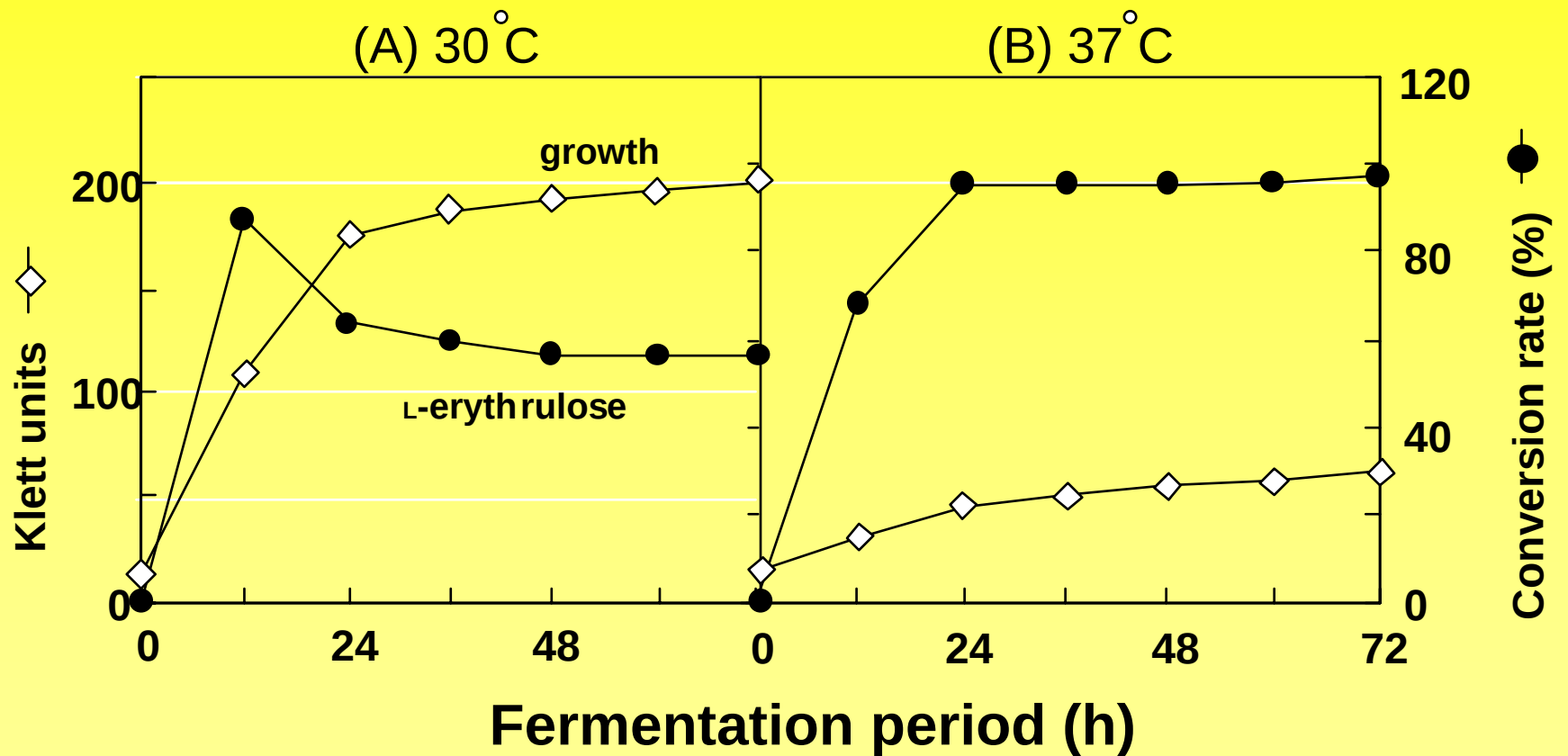
FDH-dependent battery
K. Kano et al. (2007)





Off-flavor Elimination from Soy Bean Meal with Acetic Acid Bacteria





**L-Erythrulose Production by Growing Cells of
G. frateurii CHM 43**

Fungal Strains for *Koji* Preparation and Rice Grains Covered with *Asp. oryzae* (Koji-gaku, H.Murakami(1985))

Asp. oryzae



12 h

Asp. oryzae



24 h

Asp. sojae

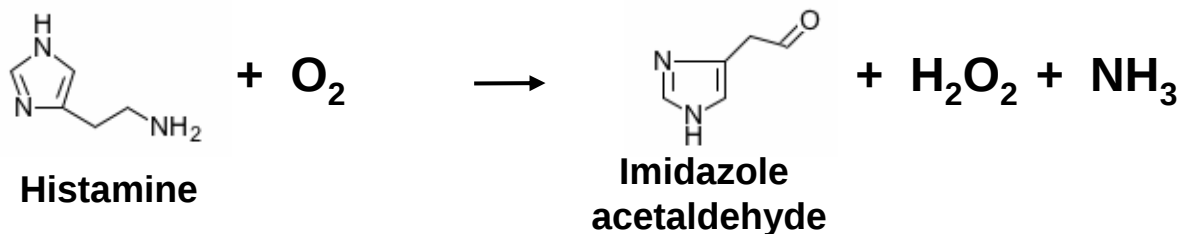


46 h

Rice *Koji*

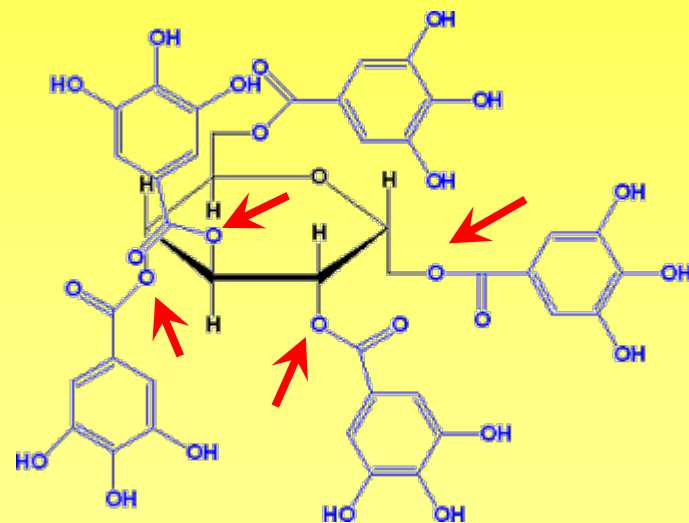
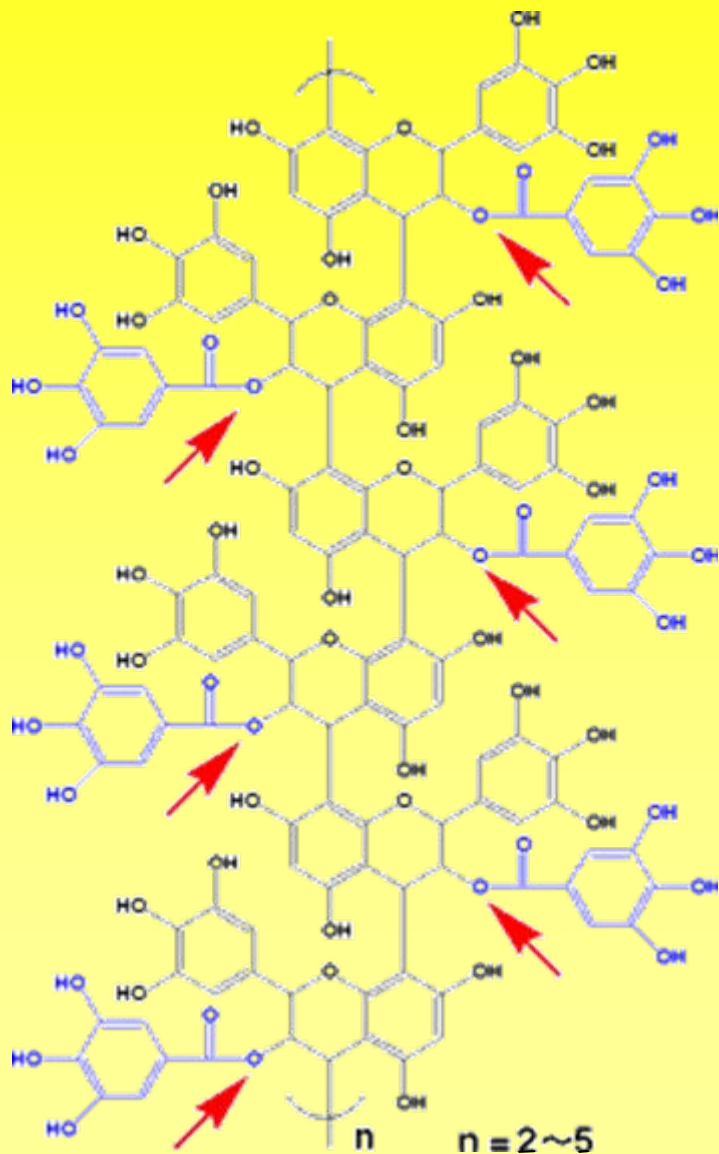


Oxidation of Various Amines by Fungal Amine Oxidase



Substrate	Relative rate	Substrate	Relative rate
Monoamine		Monoamine	
Ethylamine	4.0	Benzylamine	100*
<i>n</i> -Propylamine	108.0	Phenethylamine	150.6
<i>n</i> -Butylamine	195.2	Diamine	
<i>n</i> -Amylamine	194.8	Ethylenediamine	0
<i>n</i> -Hexylamine	194.5	Propylenediamine	0
Tyramine	75.1	Putrescine	13.2
Tryptamine	28.8	Cadaverine	13.6
Epinephrine	0	Hexylenediamine	13.9
Norepinephrine	67.3	Polyamine	
Serotonin	42.0	Spermine	0
Agmatine	89.0	Spermidine	0
Histamine	110.5		

Fungal Tannase and Release of Polyphenols



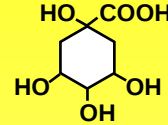
Coffee Pulp *Koji*



**Coffee
Pulp**

Chlorogenate Hydrolase

Quinate



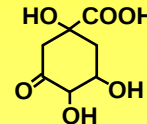
+

Caffeic acid

DOPA

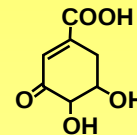
Quinate Dehydrogenase (QDH)

3-Dehydroquinate



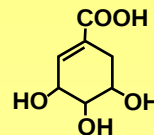
Dehydroquinate Dehydratase (DQD)

3-Dehydroshikimate



Shikimate Dehydrogenase (SKDH)

Shikimate

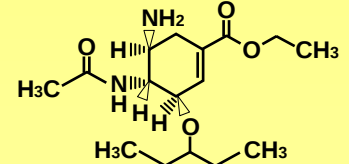


Several Antibiotics

Aromatic
Amino acids

Biodegradable
Herbicide/Agrochemicals

Oseltamivir (Tamiflu)



Phosphoenolpyruvate

Glucose

3-Deoxyarabino-
heptulosonate
7-phosphate

Erythrose 4-phosphate

*Shikimic acid
Pathway*