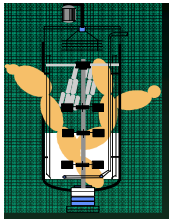


AERATION-AGITATION

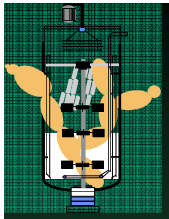
The role of oxygen , respiration, oxygen demand

MASS TRANSFER UNIT OPERATIONS

Aeration agitation

Scale up

Bioreaktors



Role of oxygen , respiration

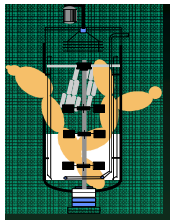
RESPIRATION is an energy yielding metabolic process , in which an organic or inorganic compound (energy source) is oxidized by the organism with an inorganic compound.

If oxidizing agent is not oxygen, it is an

ANAEROBIC RESPIRATION

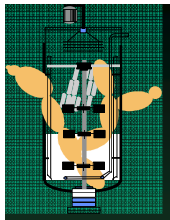
If it is oxygen, we call it

AEROBIC RESPIRATION



Role of oxygen, respiration

Energy source (reducing=oxi-dized compound)	Oxidant (terminal elect-ron acceptor)	Products of respiration	example
H_2	O_2	H_2O	Hydrogen bacteria
*H_2	SO_4^{2-}	H_2O+S^{2-}	*Desulfovibrio*
NH_3	O_2	$NO^{2-} + H_2O$	Nitrifiing bacteria
NO^{2-}	O_2	$NO^{3-}+H_2O$	Nitrifiing bacteria
*organic cpd.	NO^{3-}	N_2+CO_2	Denitrifiing bacteria
Fe^{2+}	O_2	Fe^{3+}	*Ferrobacillus*
S^{2-}	O_2	$SO_2 + H_2O$	*Thiobacillus*



Role of oxygen, respiration

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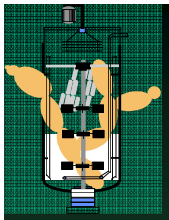
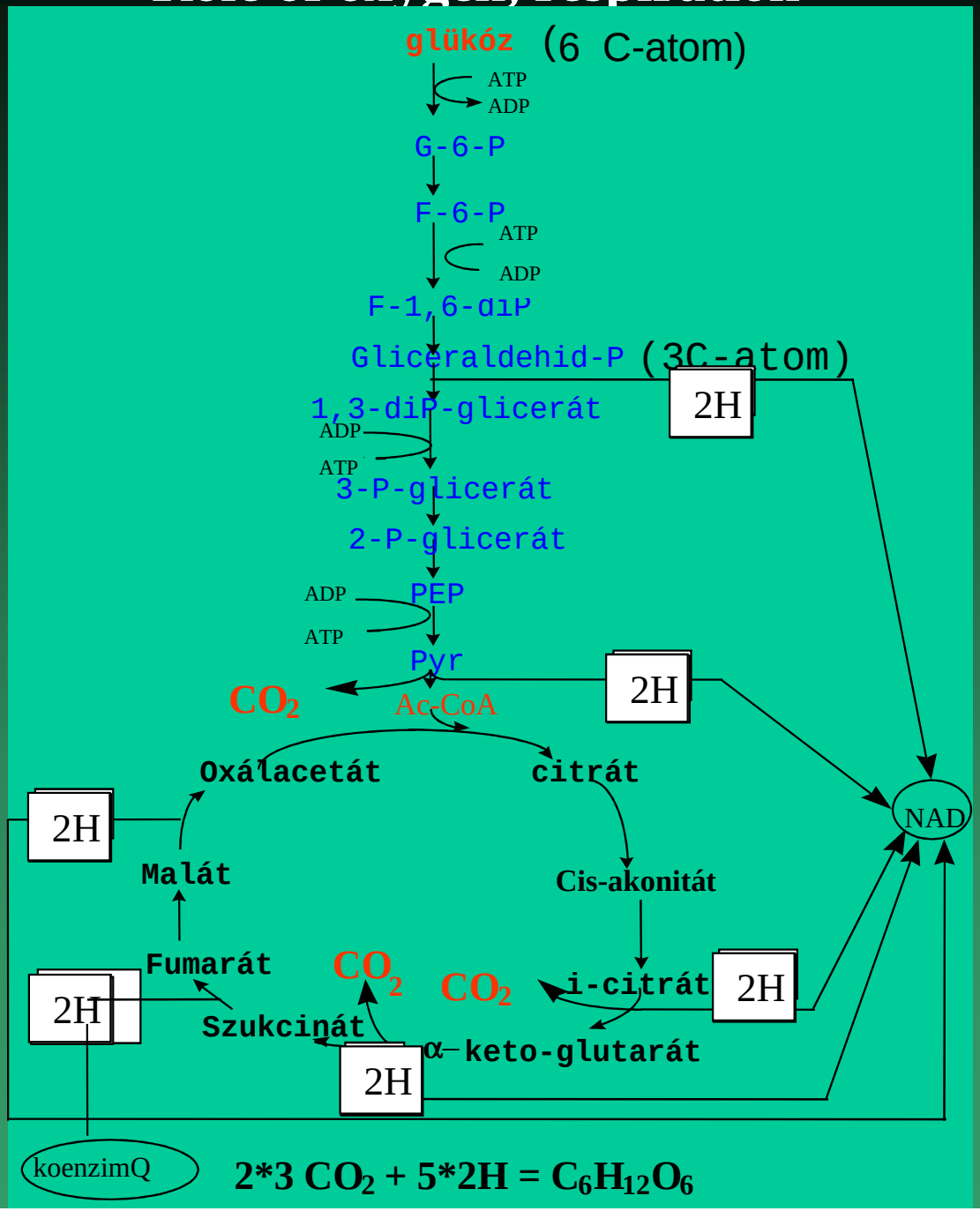
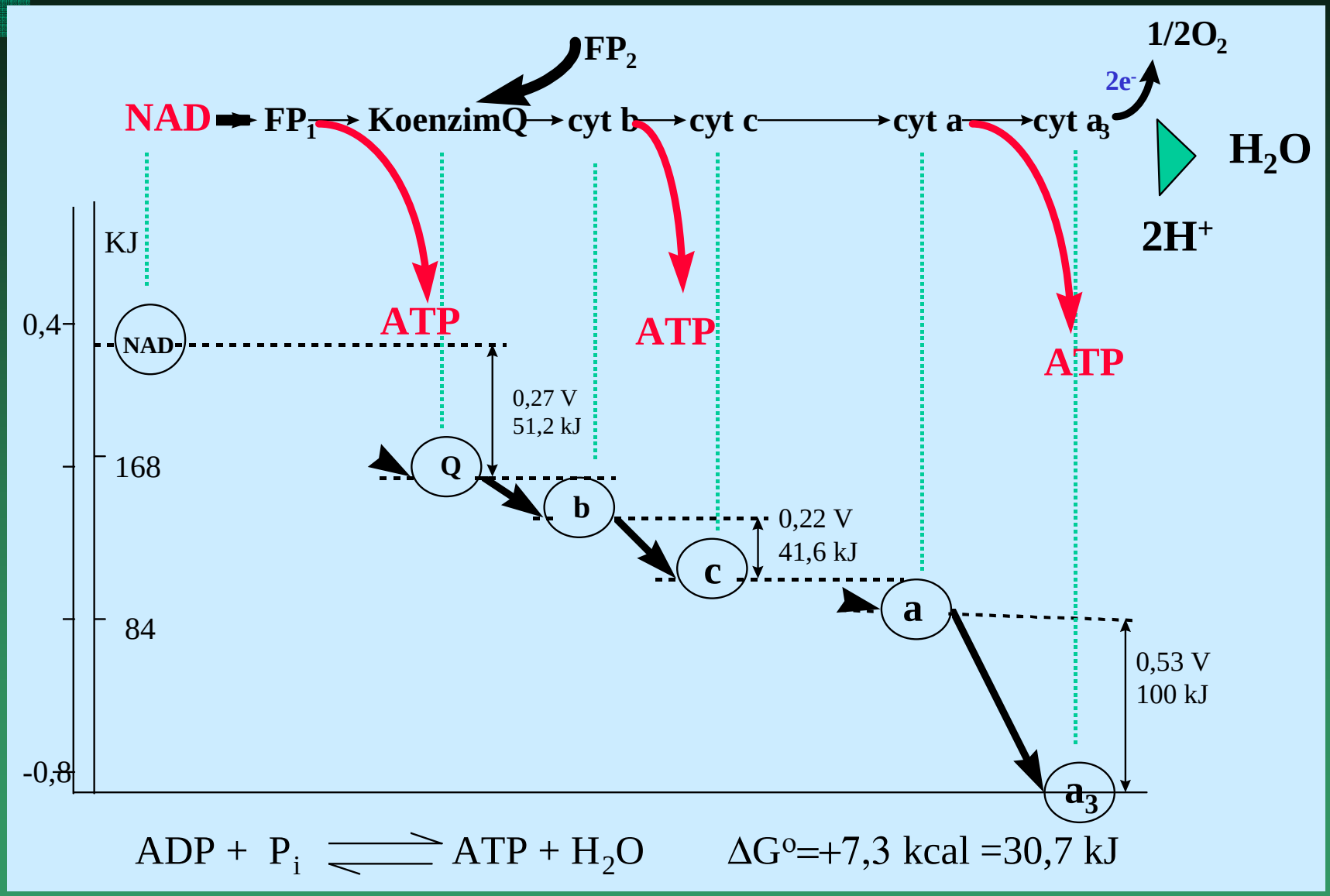
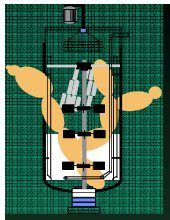
Role of oxygen, respiration



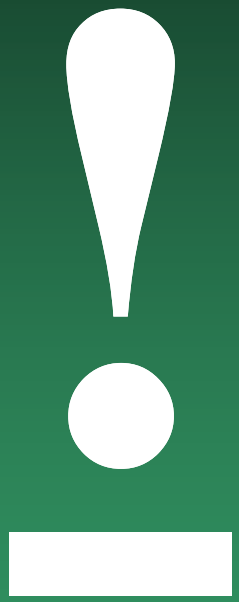


Role of oxygen, respiration

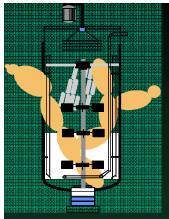




Role of oxygen, respiration



OXYGEN DEMANDS OF MICROORGANISMS



Role of oxygen, respiration

Oxygen can be limiting substrate

Oxygen demand is expressed in two ways:

1. Respiration rate = $\frac{dc}{dt}$

[mmol O_2/ dm^3.h], [kg O_2/ m^3 .h]

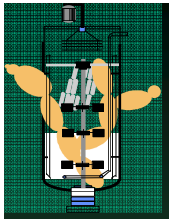
2. Specific respiration rate

$$Q = \frac{1}{x}\frac{dc}{dt}$$

[h^{-1}]

$$\frac{dx}{dt} = \mu_{max}\frac{c}{K_{O_2} + c}x$$

$$Y_O = \frac{\Delta x}{\Delta c}$$



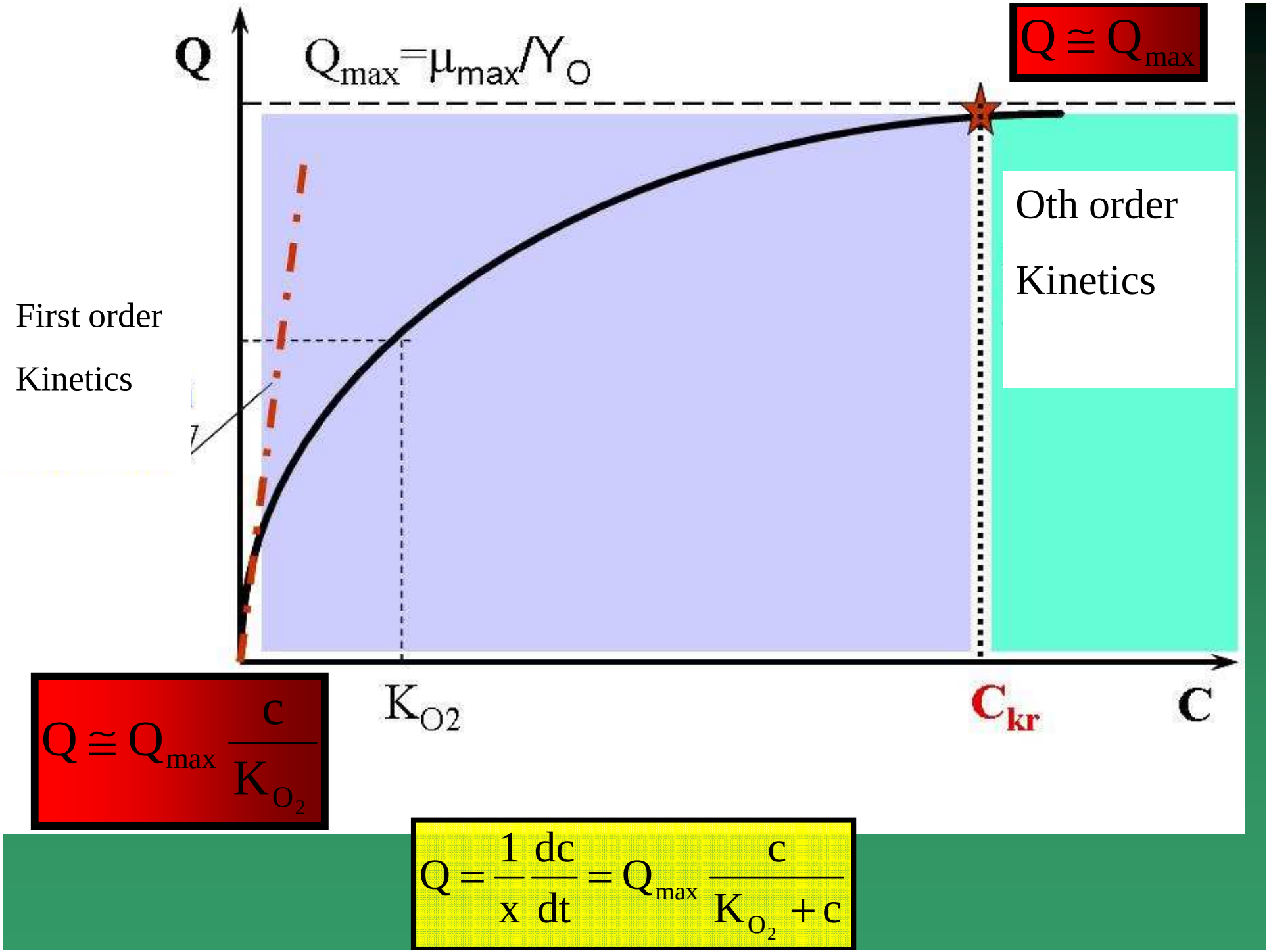
Role of oxygen, respiration

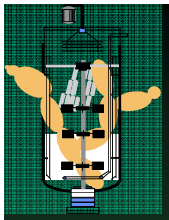
$$\frac{dc}{dt} = -\frac{1}{Y_O}\frac{dx}{dc} = -\frac{1}{Y_O}\mu_{max}\frac{c}{K_{O_2} + c}x$$

$$Q = \frac{1}{x}\frac{dc}{dt} = -\frac{1}{Y_O}\mu_{max}\frac{c}{K_{O_2} + c}$$

$$Q \cong Q_{max}$$

$$\frac{1}{Y_O} = \frac{1}{Y_{OG}^{max}} + \frac{m_O}{\mu}$$


Q
$Q_{max}=\mu_{max}/Y_O$
$Q \cong Q_{max}$
Oth order
Kinetics
First order
Kinetics
K_{O2}
C_{kr}
C
$Q \cong Q_{max} \frac{c}{K_{O_2}}$
$Q = \frac{1}{x}\frac{dc}{dt} = Q_{max}\frac{c}{K_{O_2}+c}$



Role of oxygen, respiration

μ_{max} - SPECIFIC GROWTH RATE

Y_o - OVERALL YIELD COEFFICIENT FOR OXYGEN

m_O – specific maintenance coefficient for oxygen

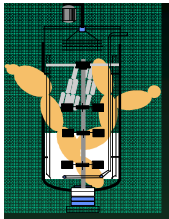
[$g0_2$/g cell.h]

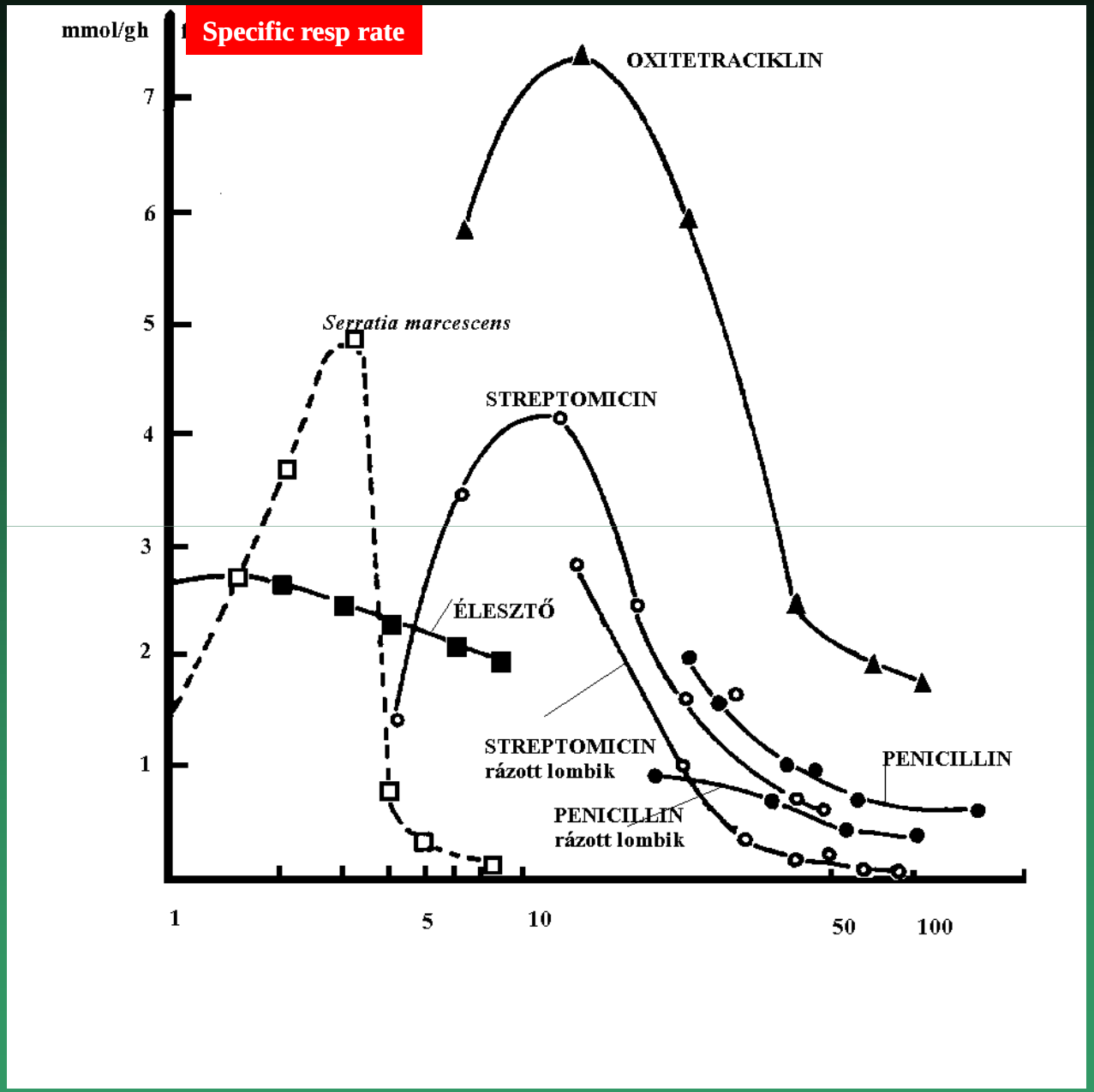
Y_{OG}^{max} -maximal yield for oxygen

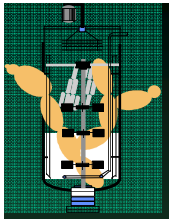
Q_{max} – maximal specific oxygen demand or sp. resp. rate

K_{O2} - substrate saturation constant

C_{cr} – critical oxygen concentration




Specific resp rate
mmol/gh
OXITETRACIKLIN
Serratia marcescens
STREPTOMICIN
ÉLESZTŐ
STREPTOMICIN
rázott lombik
PENICILLIN
PENICILLIN
rázott lombik
7
6
5
4
3
2
1
1
5
10
50
100



	Glucose	Oxygen
Concentration in broth	1% ≈10^4 mg/dm^3	7 mg/dm^3
Critical concentration	50 mg/dm^3	0,7 mg/dm^3
Specific consumptio rate	580 mg/g.h	208 mg/g.h

S U P P L Y

AERATION