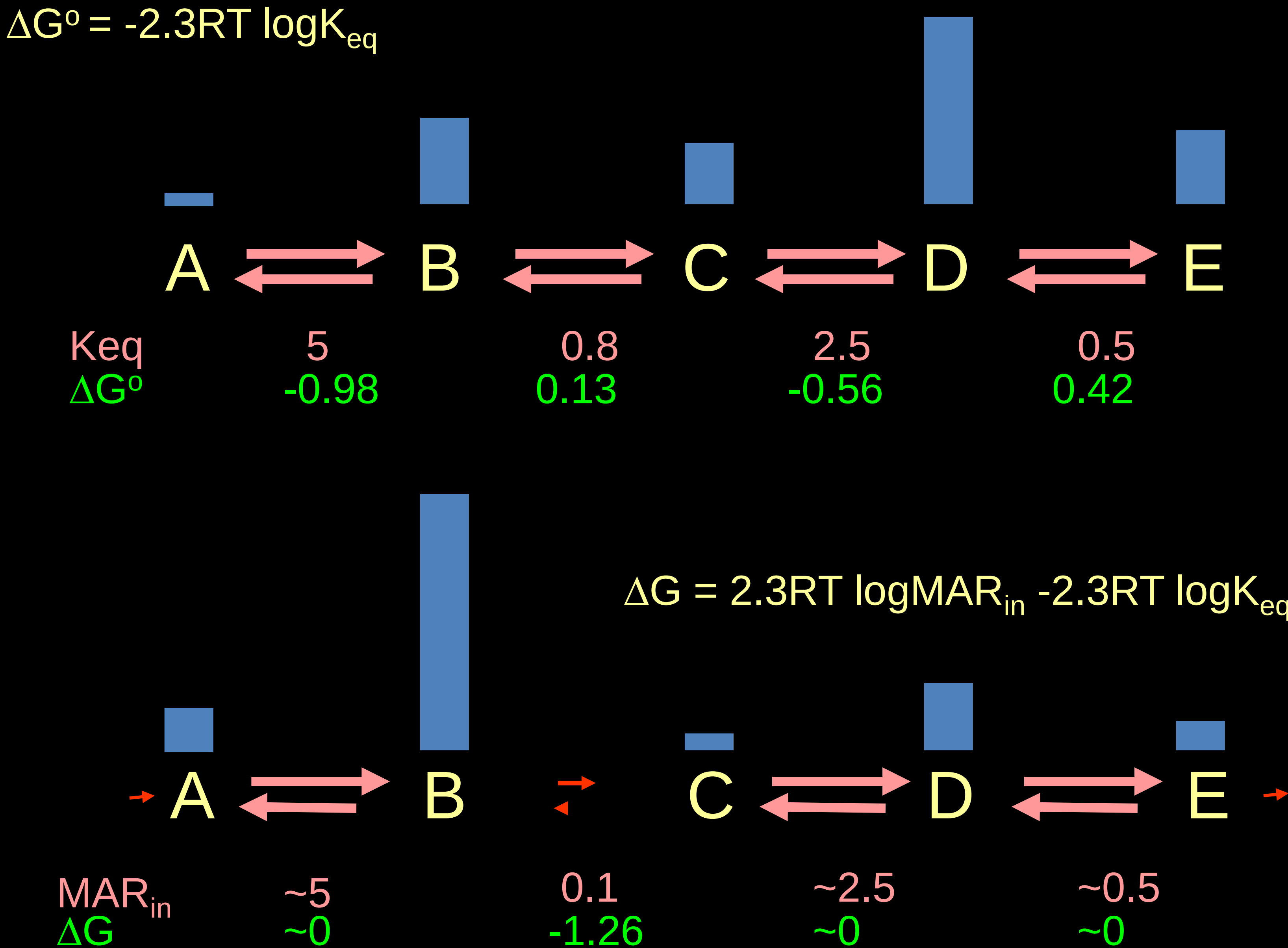
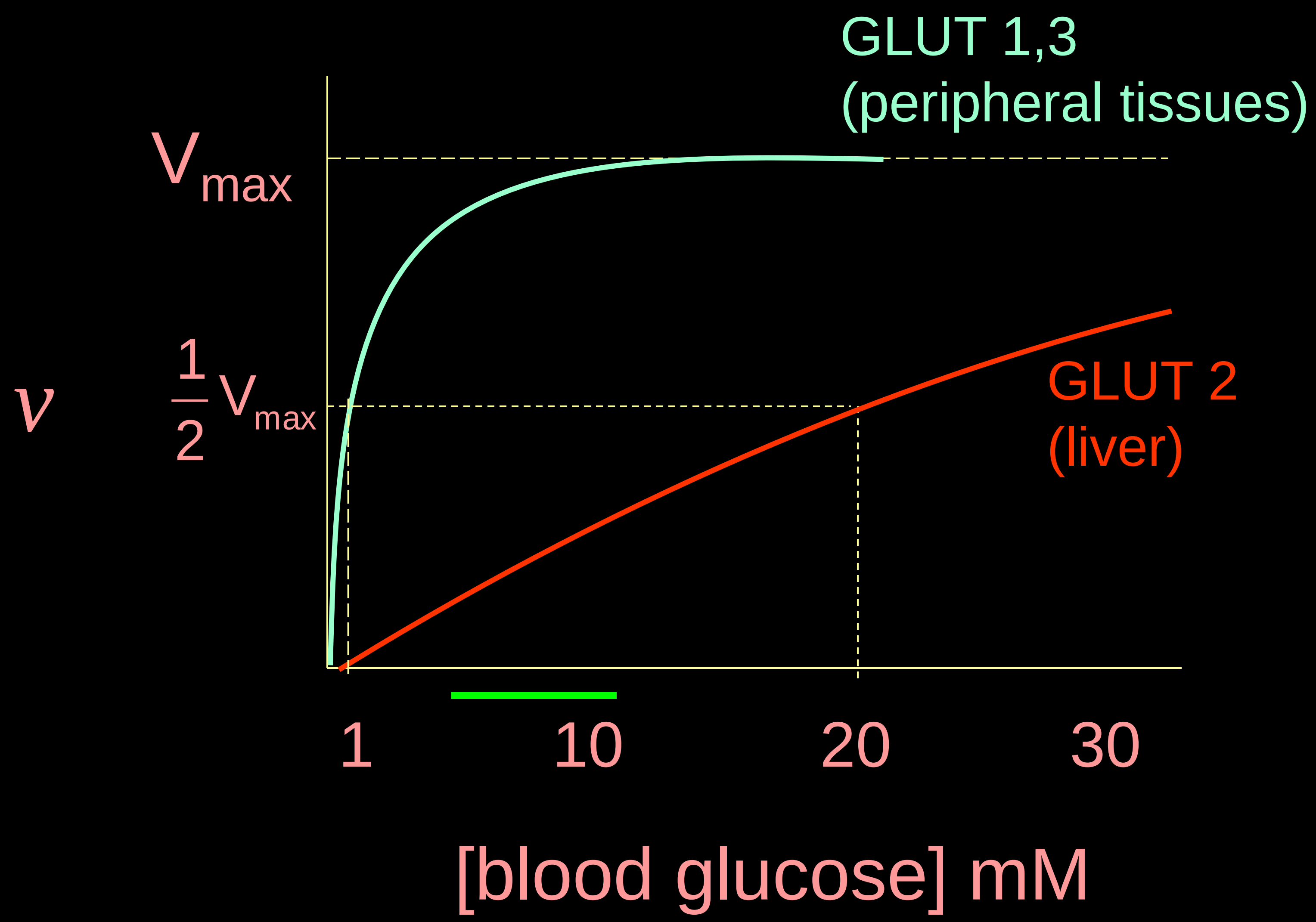
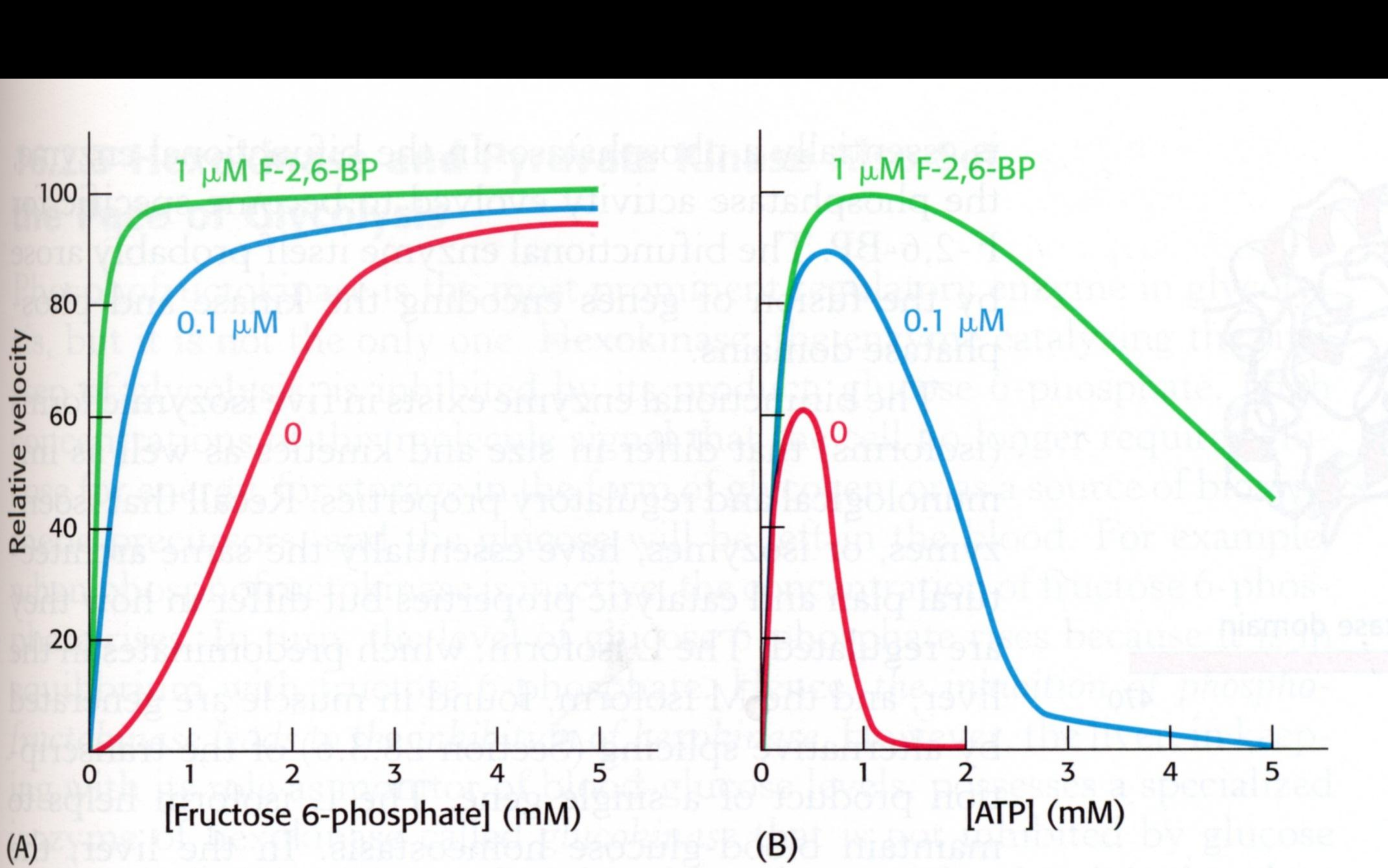


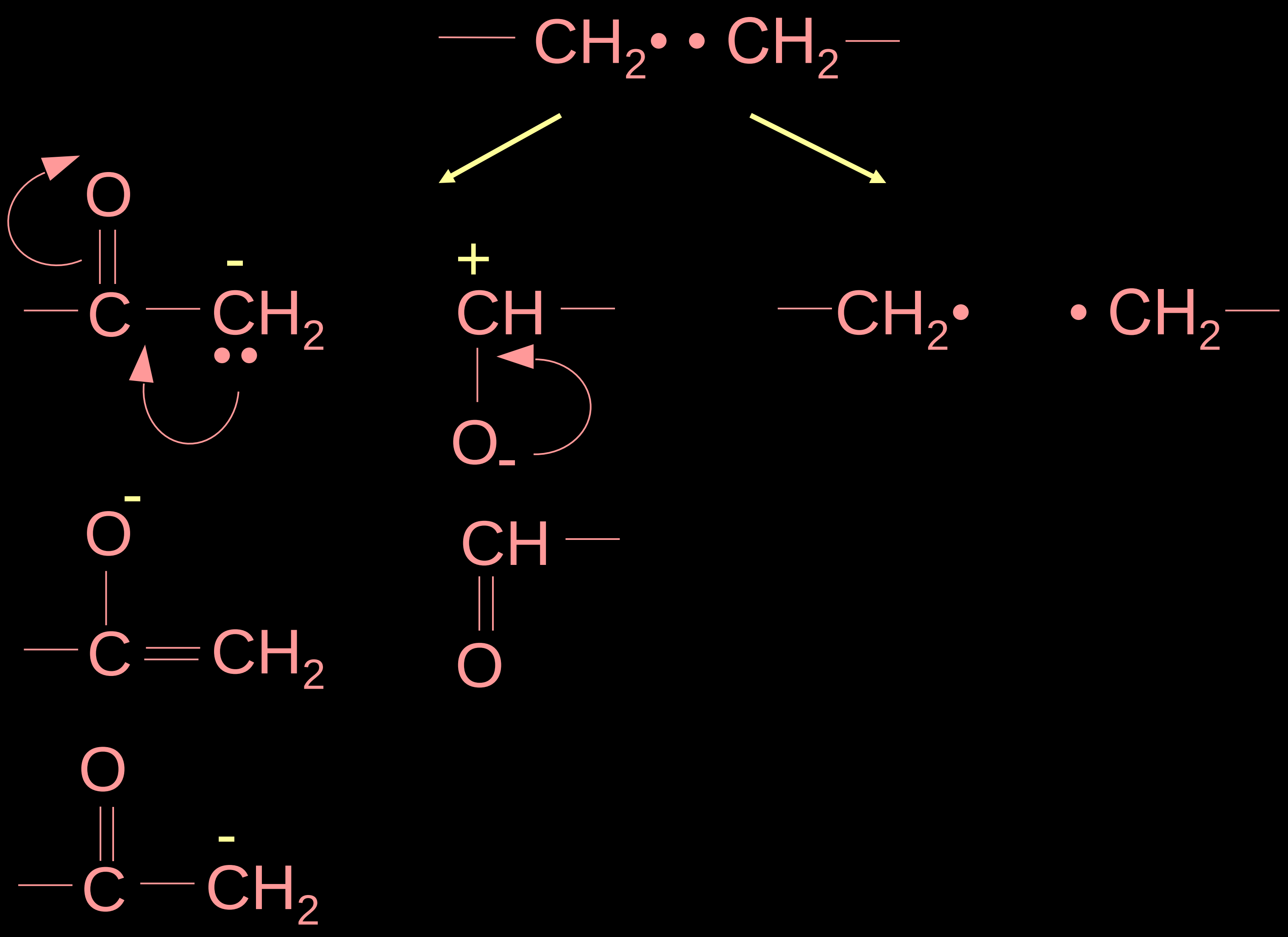
ΔGº = -2.3RT logKeq
A B C D E
Keq 5 0.8 2.5 0.5
ΔGº -0.98 0.13 -0.56 0.42
ΔG = 2.3RT logMARin -2.3RT logKeq
A B C D E
MARin ~5 0.1 ~2.5 ~0.5
ΔG ~0 -1.26 ~0 ~0

Kinetics of Glucose Transport

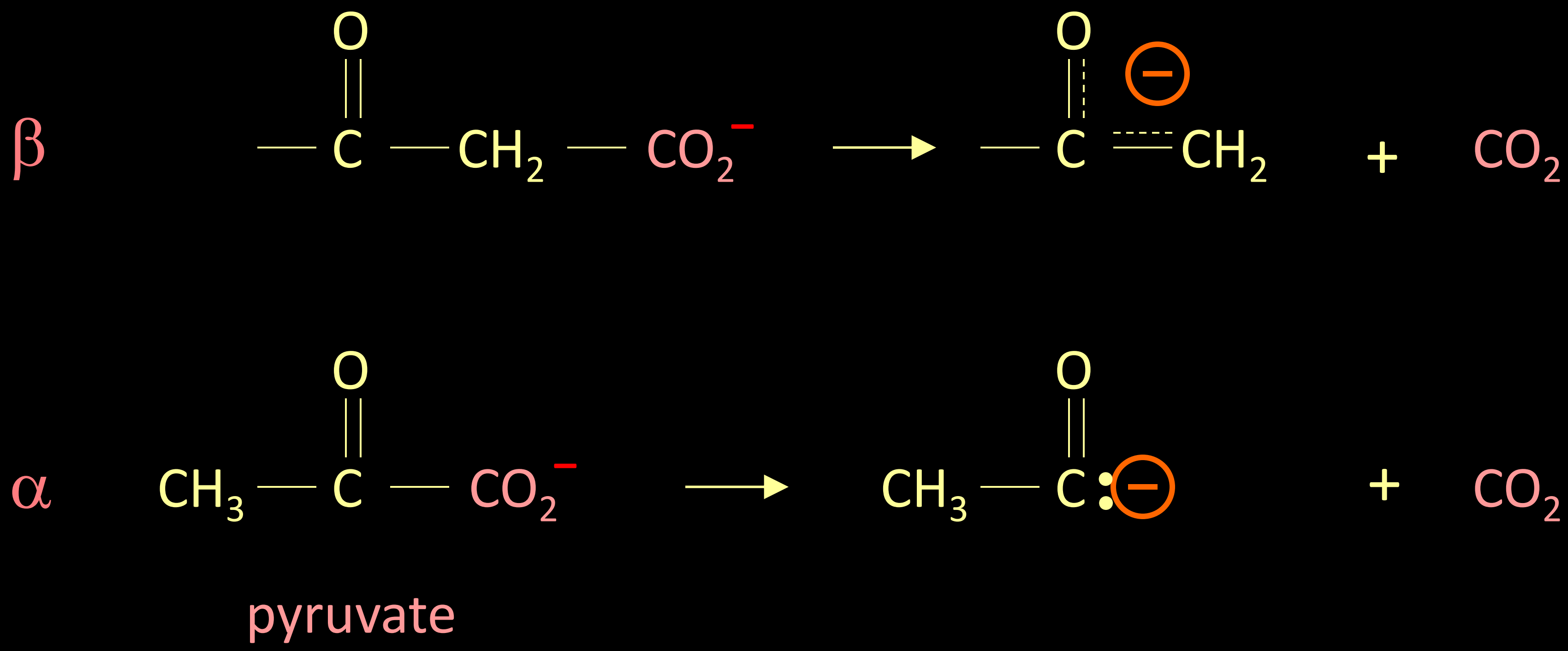



1 μM F-2,6-BP
0.1 μM
0
Relative velocity
100
80
60
40
20
0
1
2
3
4
5
[Fructose 6-phosphate] (mM)
(A)
1 μM F-2,6-BP
0.1 μM
0
[ATP] (mM)
(B)

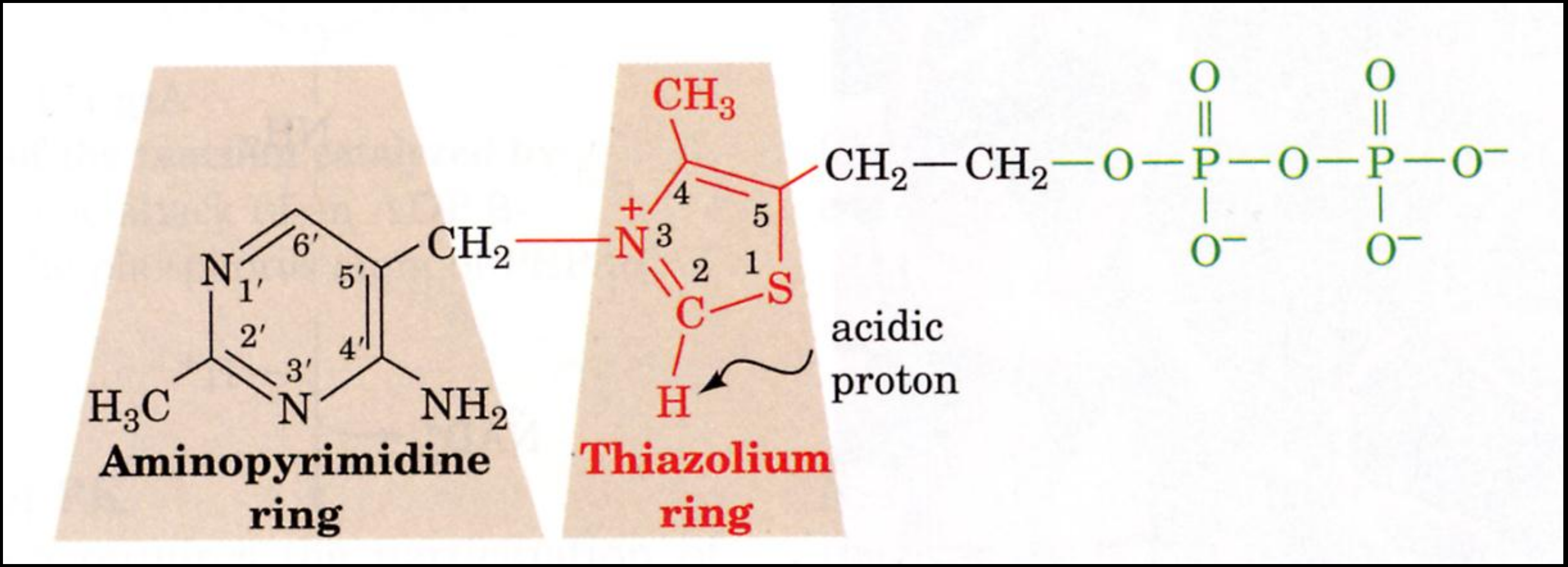
Chemical strategy for C-C cleavage



General Decarboxylation



Thiamine Pyrophosphate

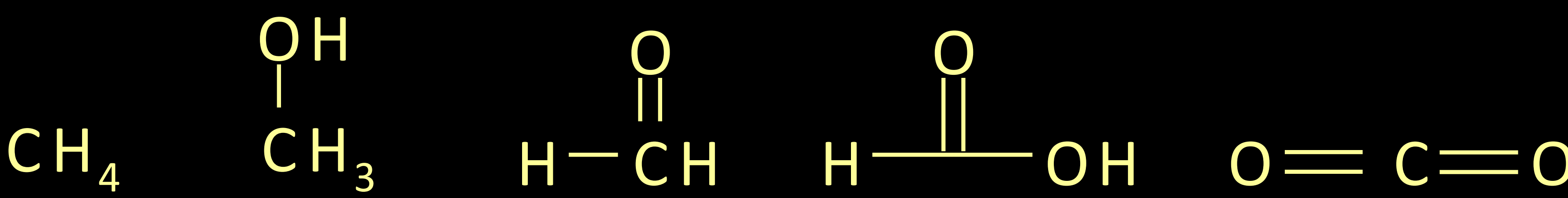


Voet & voet 3rd ed.

2. Combination with O

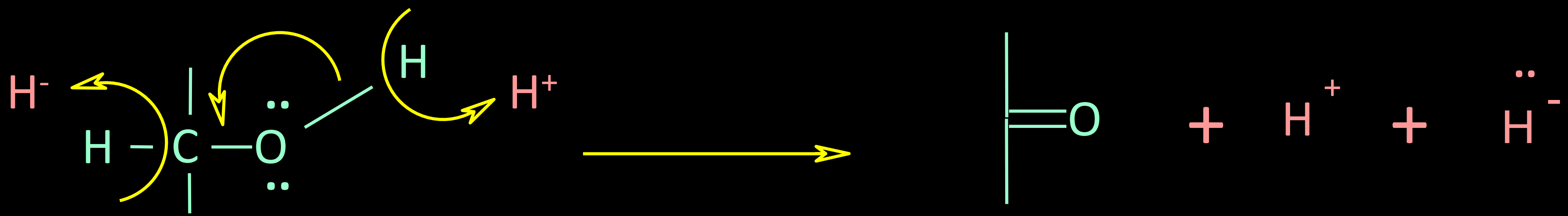
- Removal of e^{-}’s by O which “pulls” e-’s away from the C or H nucleus. C or H becomes oxidized ; O becomes reduced.

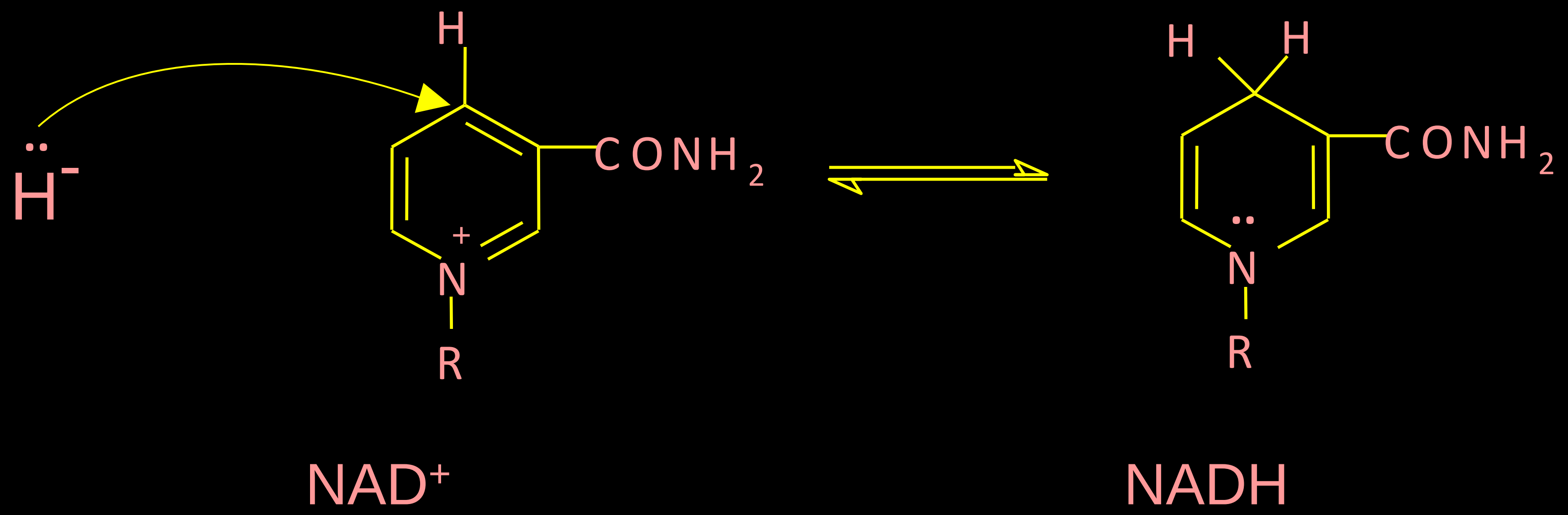
- These reactions are catalyzed by <u>oxidases</u>

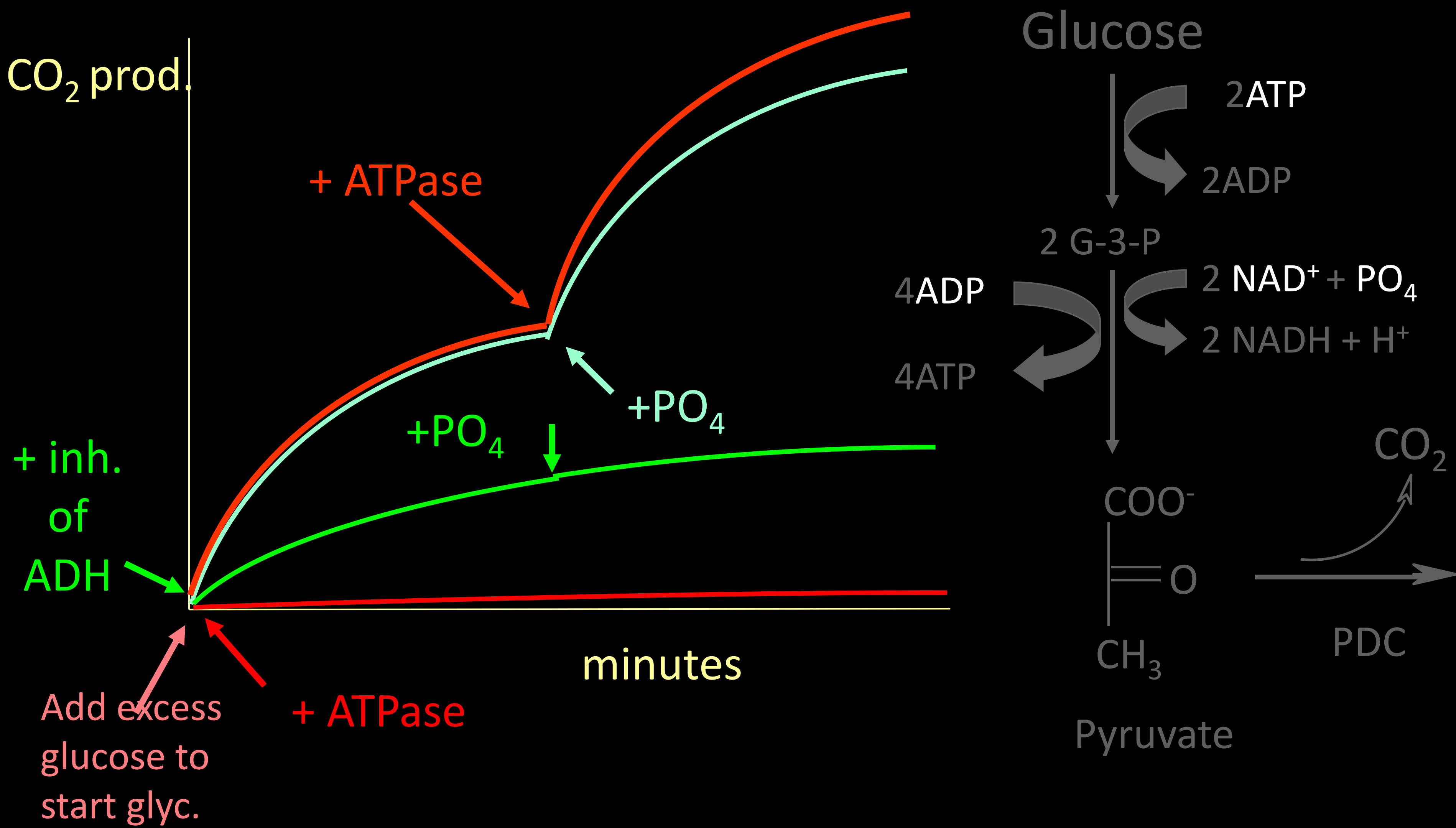


8 6 4 2 0

Mechanism

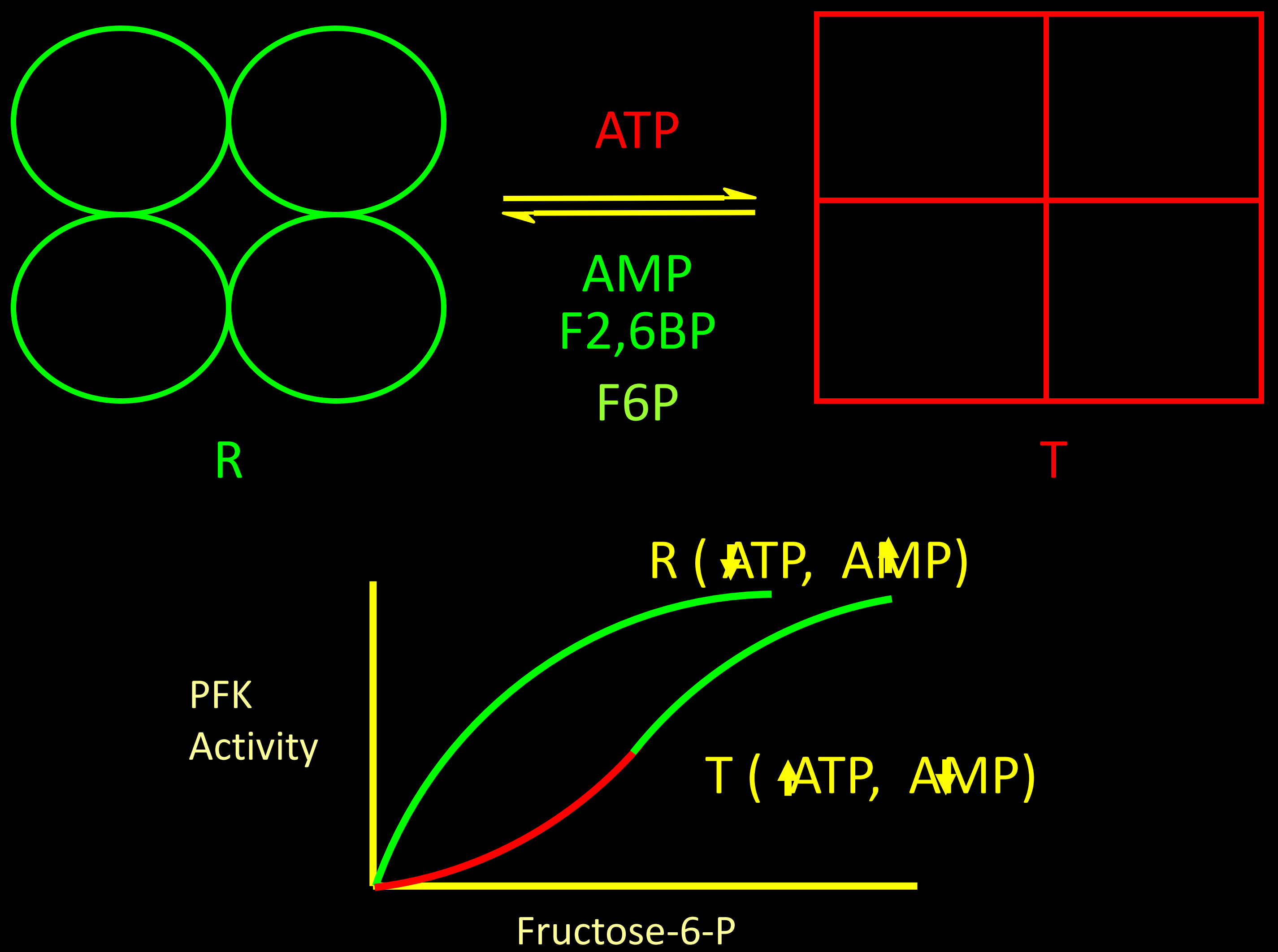


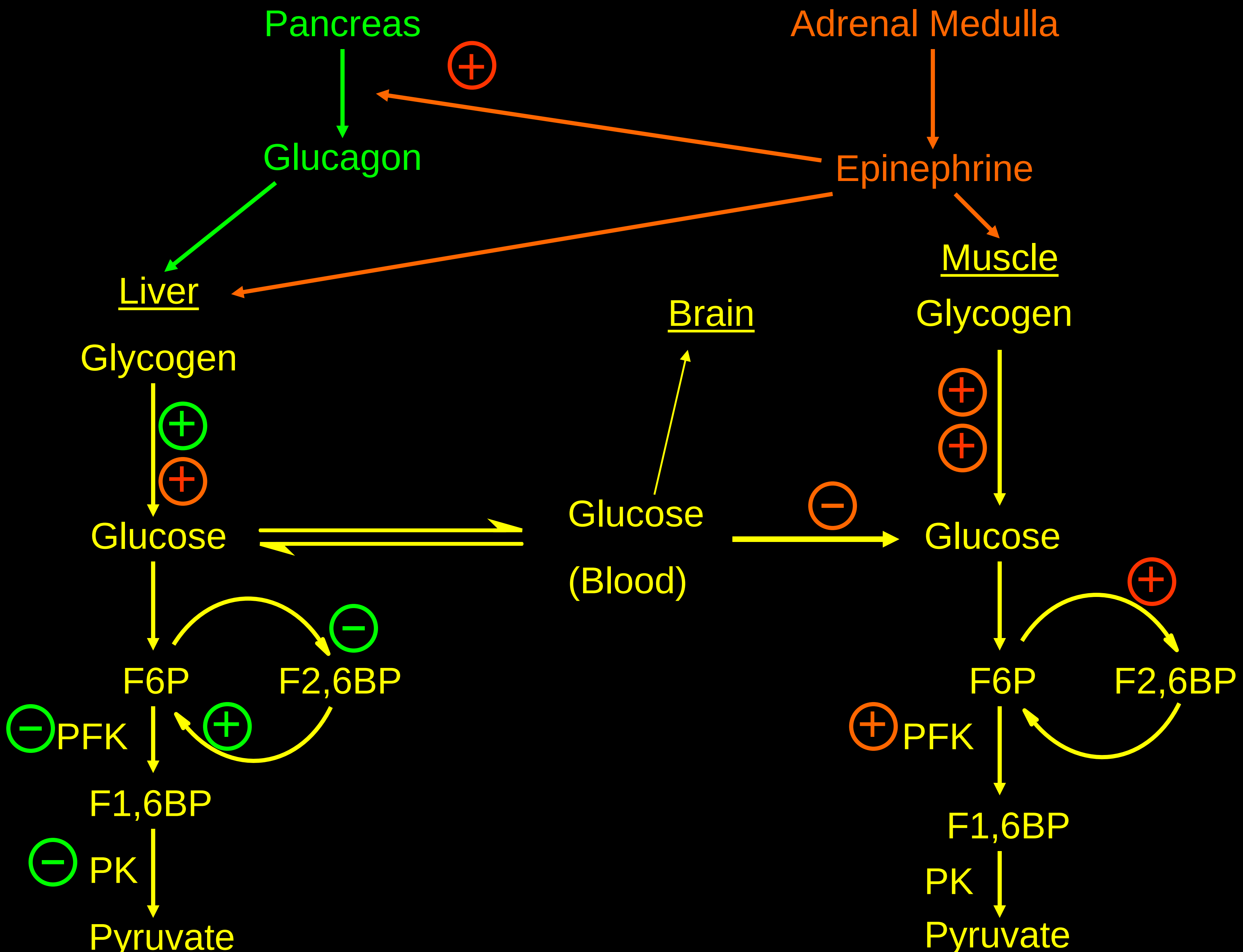




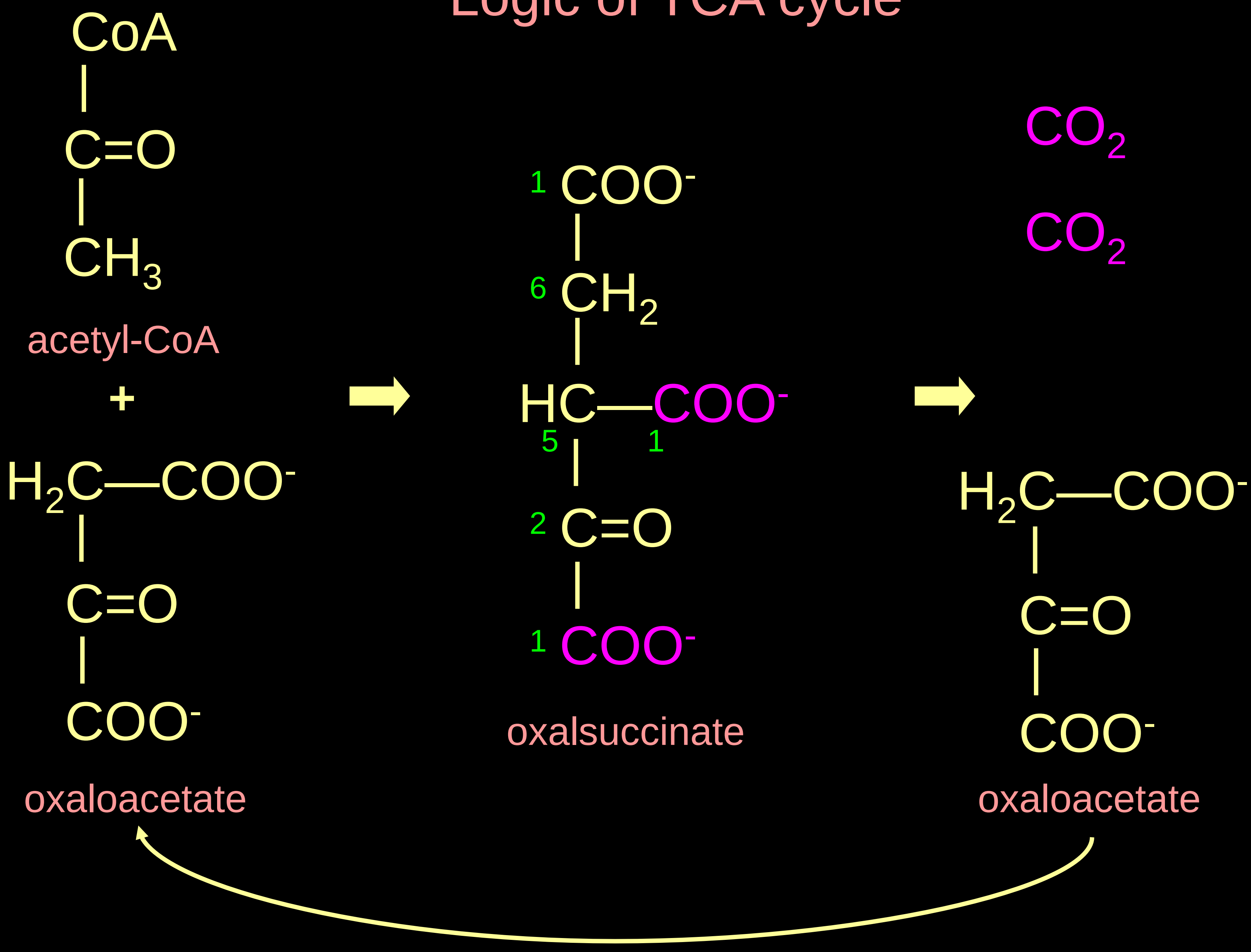
CO_2 prod.
+ ATPase
+ inh. of ADH
$+PO_4$
$+PO_4$
minutes
Add excess glucose to start glyc.
+ ATPase
Glucose
2ATP
2ADP
2 G-3-P
$2\ NAD^+ + PO_4$
$2\ NADH + H^+$
4ADP
4ATP
COO^-
O
CH_3
Pyruvate
CO_2
PDC

Phosphofructokinase

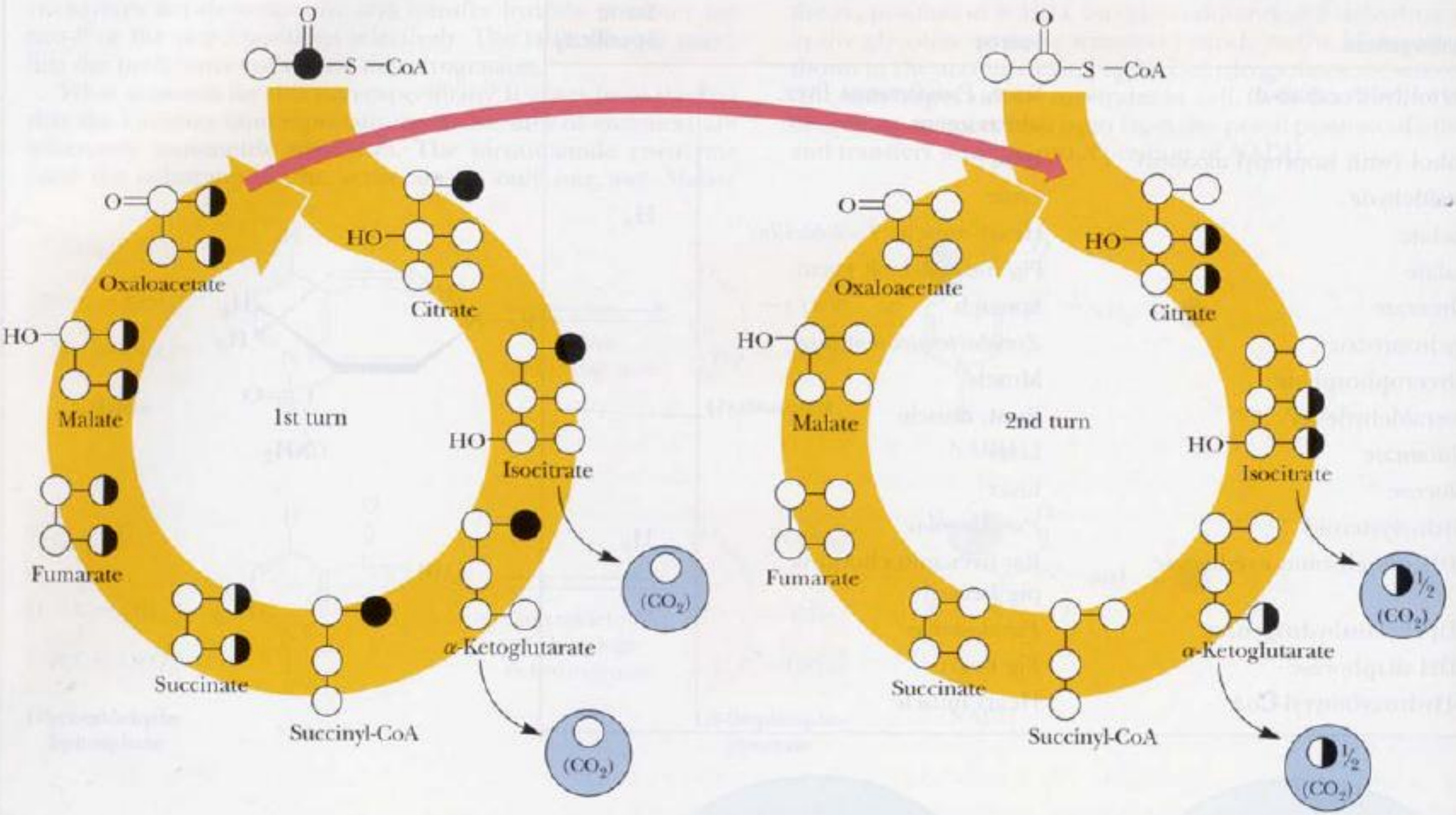



Pancreas
Adrenal Medulla
Glucagon
Epinephrine
Muscle
Liver
Brain
Glycogen
Glycogen
Glucose
Glucose
(Blood)
Glucose
F6P
F2,6BP
PFK
F1,6BP
PK
Pyruvate
F6P
F2,6BP
PFK
F1,6BP
PK
Pyruvate

Logic of TCA cycle



(a) Fate of the carboxyl carbon of acetate unit



High NADH favors Gluconeogenesis

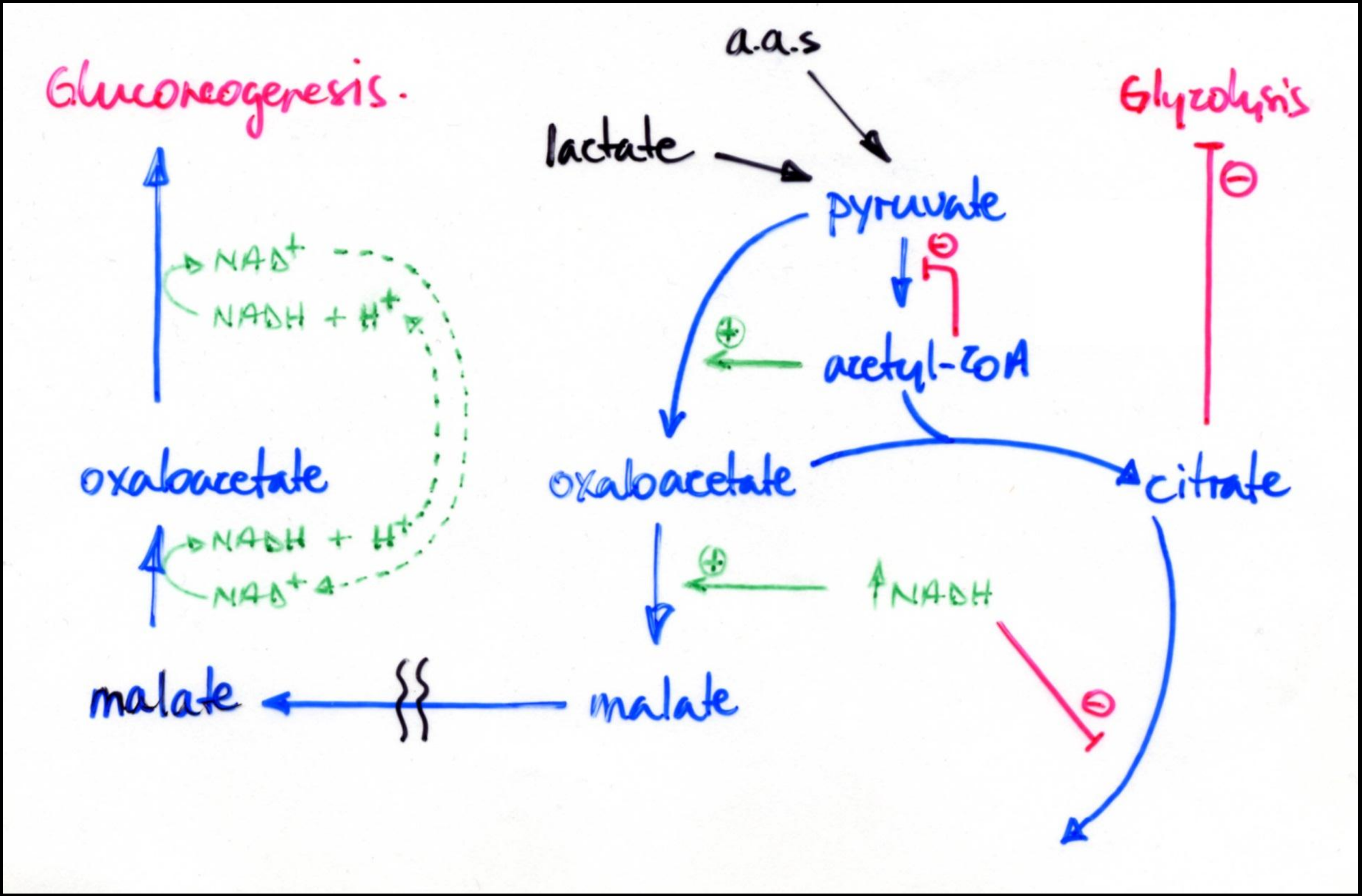
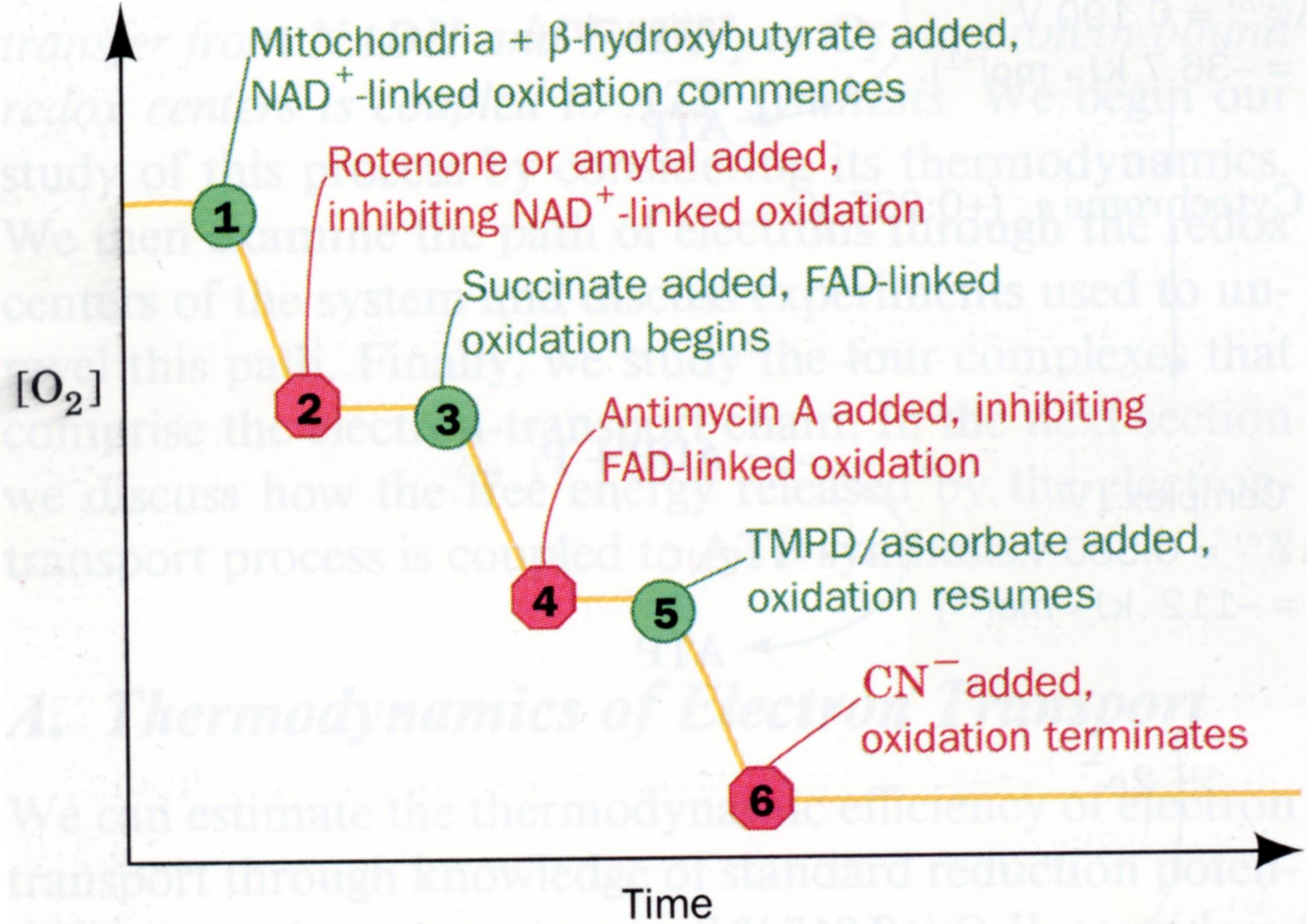
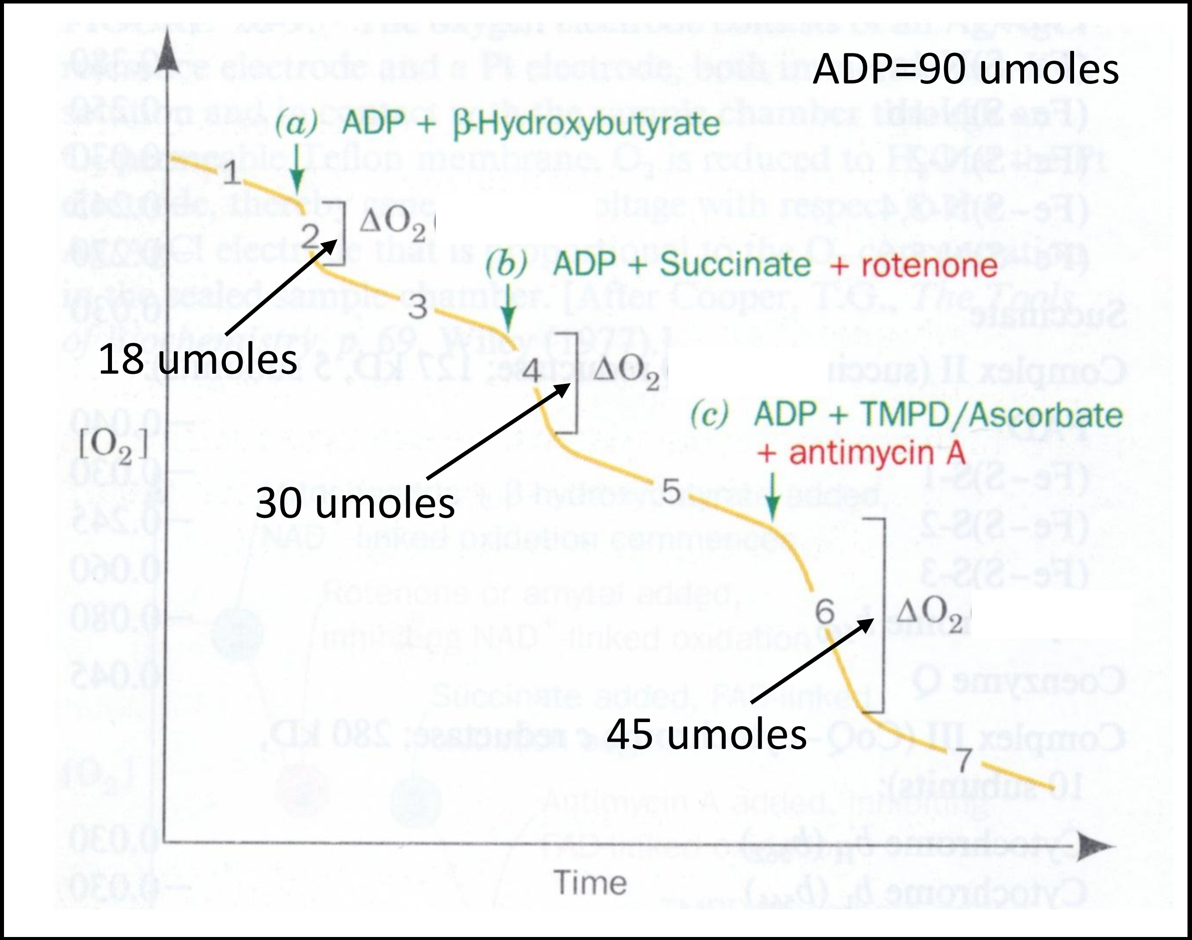


TABLE 16-4 Standard Reduction Potentials of Some Biochemically Important Half-reactions

Half-Reaction	$\mathscr{E}^{\circ\prime}$ (V)
$\frac{1}{2}O_2 + 2H^+ + 2e^- \rightleftharpoons H_2O$	0.815
$SO_4^{2-} + 2H^+ + 2e^- \rightleftharpoons SO_3^{2-} + H_2O$	0.48
$NO_3^- + 2H^+ + 2e^- \rightleftharpoons NO_2^- + H_2O$	0.42
Cytochrome a_3 (Fe^{3+}) + e^- $\rightleftharpoons$ cytochrome a_3 (Fe^{2+})	0.385
$O_2(g) + 2H^+ + 2e^- \rightleftharpoons H_2O_2$	0.295
Cytochrome a (Fe^{3+}) + e^- $\rightleftharpoons$ cytochrome a (Fe^{2+})	0.29
Cytochrome c (Fe^{3+}) + e^- $\rightleftharpoons$ cytochrome c (Fe^{2+})	0.235
Cytochrome c_1 (Fe^{3+}) + e^- $\rightleftharpoons$ cytochrome c_1 (Fe^{2+})	0.22
Cytochrome b (Fe^{3+}) + e^- $\rightleftharpoons$ cytochrome b (Fe^{2+}) (*mitochondrial*)	0.077
Ubiquinone + $2H^+ + 2e^-$ $\rightleftharpoons$ ubiquinol	0.045
Fumarate$^-$ + $2H^+ + 2e^-$ $\rightleftharpoons$ succinate$^-$	0.031
FAD + $2H^+ + 2e^-$ $\rightleftharpoons$ $FADH_2$ (*in flavoproteins*)	−0.040
Oxaloacetate$^-$ + $2H^+ + 2e^-$ $\rightleftharpoons$ malate$^-$	−0.166
Pyruvate$^-$ + $2H^+ + 2e^-$ $\rightleftharpoons$ lactate$^-$	−0.185
Acetaldehyde + $2H^+ + 2e^-$ $\rightleftharpoons$ ethanol	−0.197
FAD + $2H^+ + 2e^-$ $\rightleftharpoons$ $FADH_2$ (*free coenzyme*)	−0.219
$S + 2H^+ + 2e^- \rightleftharpoons H_2S$	−0.23
Lipoic acid + $2H^+ + 2e^-$ $\rightleftharpoons$ dihydrolipoic acid	−0.29
$NAD^+ + H^+ + 2e^- \rightleftharpoons NADH$	−0.315
$NADP^+ + H^+ + 2e^- \rightleftharpoons NADPH$	−0.320
Cystine + $2H^+ + 2e^-$ $\rightleftharpoons$ 2 cysteine	−0.340
Acetoacetate$^-$ + $2H^+ + 2e^-$ $\rightleftharpoons$ β-hydroxybutyrate$^-$	−0.346
$H^+ + e^- \rightleftharpoons \frac{1}{2}H_2$	−0.421
Acetate$^-$ + $3H^+ + 2e^-$ $\rightleftharpoons$ acetaldehyde + H_2O	−0.581

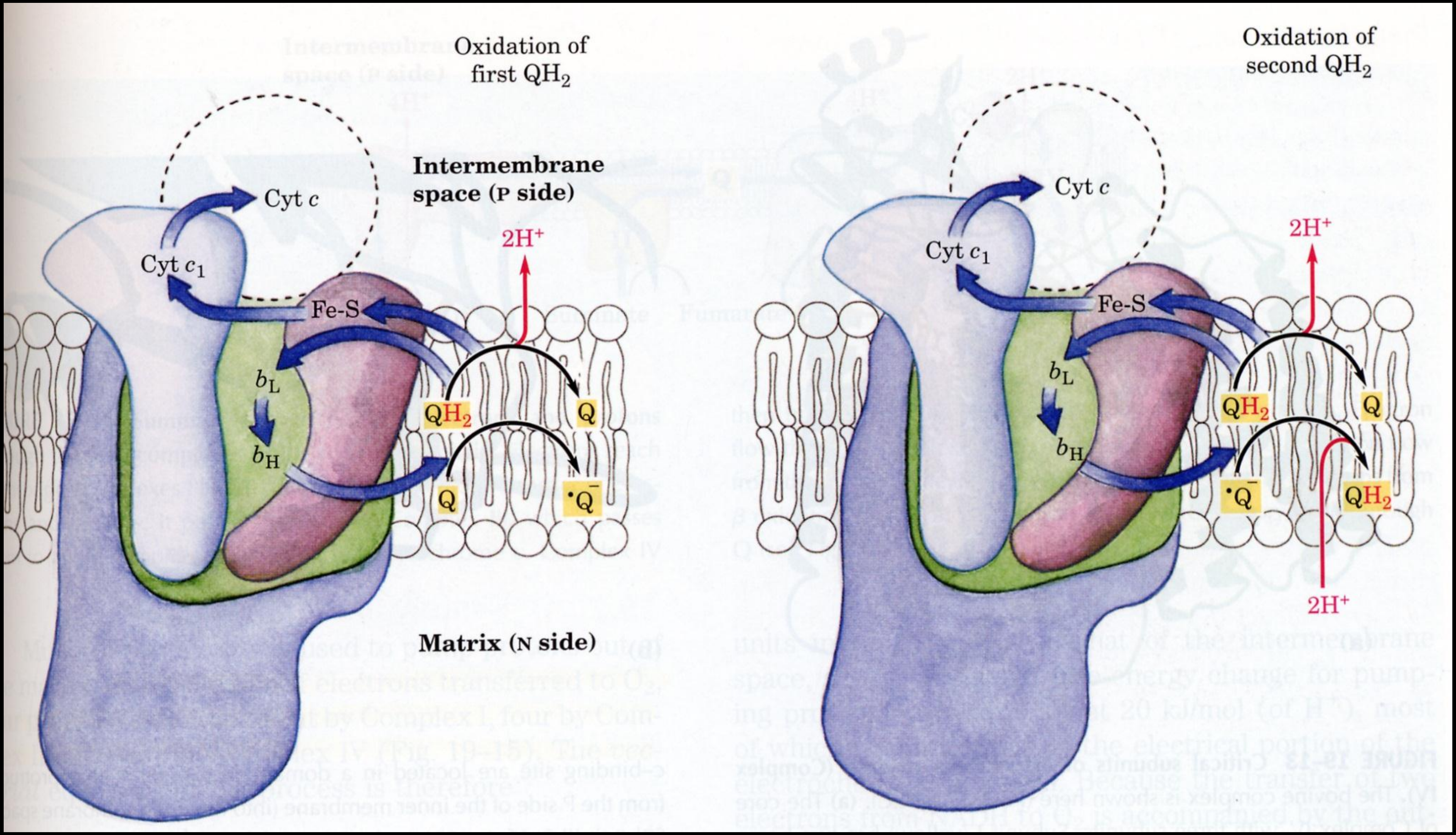

Mitochondria + β-hydroxybutyrate added, NAD$^+$-linked oxidation commences
Rotenone or amytal added, inhibiting NAD$^+$-linked oxidation
Succinate added, FAD-linked oxidation begins
Antimycin A added, inhibiting FAD-linked oxidation
TMPD/ascorbate added, oxidation resumes
CN$^-$ added, oxidation terminates
1
2
3
4
5
6
$[O_2]$
Time

O_2 Consumption as a function of ADP P'n



Conditions: Isolated mitochondria in buffer containing excess PO_4.
Reaction is initiated by addition of ADP and e- donor.

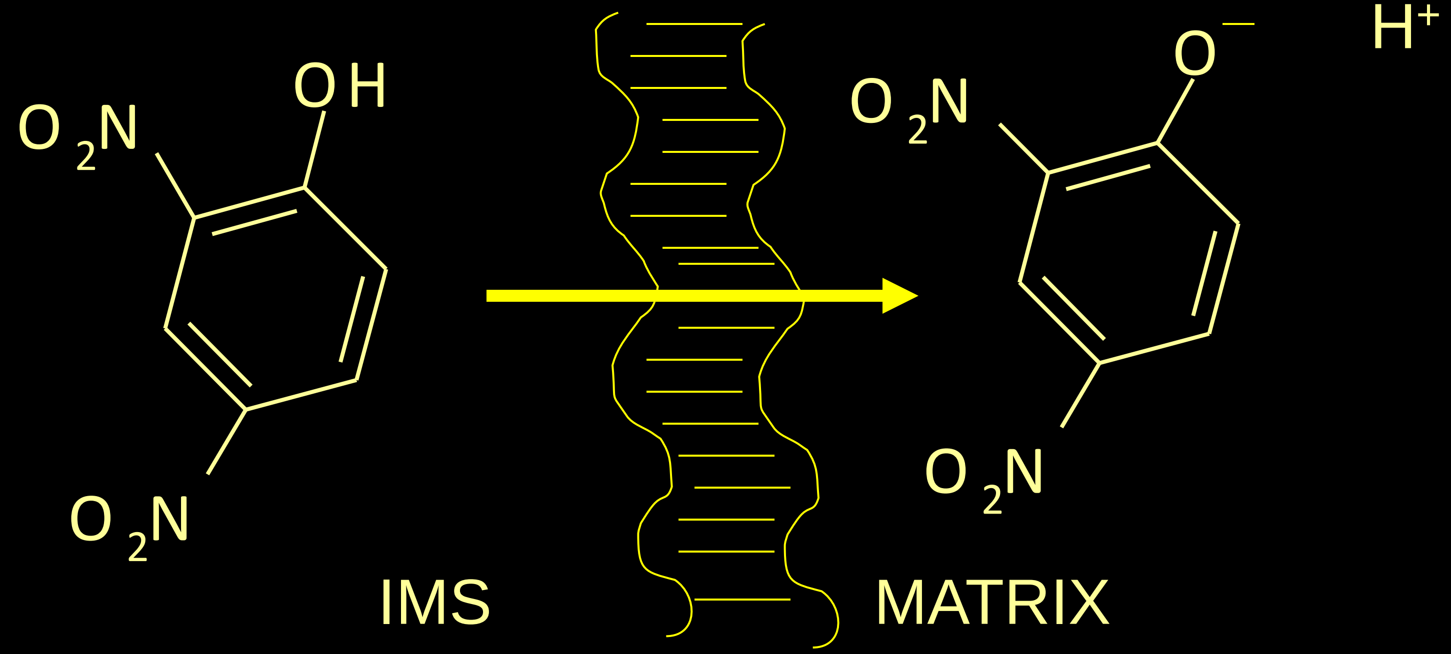
Complex III



Lehninger Fig 19-12

Inhibitors of Oxidative Phosphorylation

1. Inhibitors of Complexes I, III, & IV.
2. Oligomycin – antibiotic which binds to ATP synthase and blocks H^+ translocation.
3. Uncouplers:
   a) Dinitrophenol (DNP).



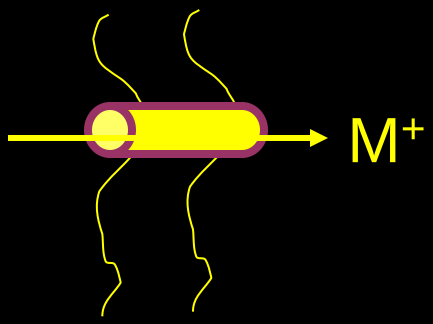
b) Ionophores

i) Valinomycin – carries charge but not H^+'s. -

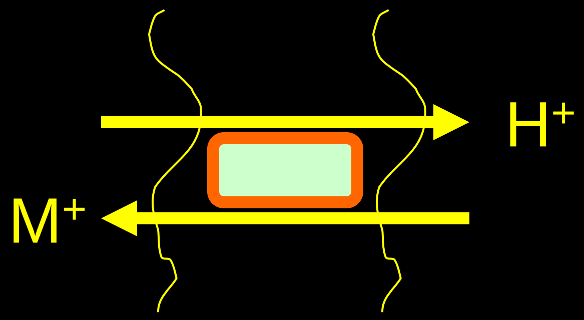
Dissipates electrical gradient.

ii) Nigericin – carries protons but not charge.

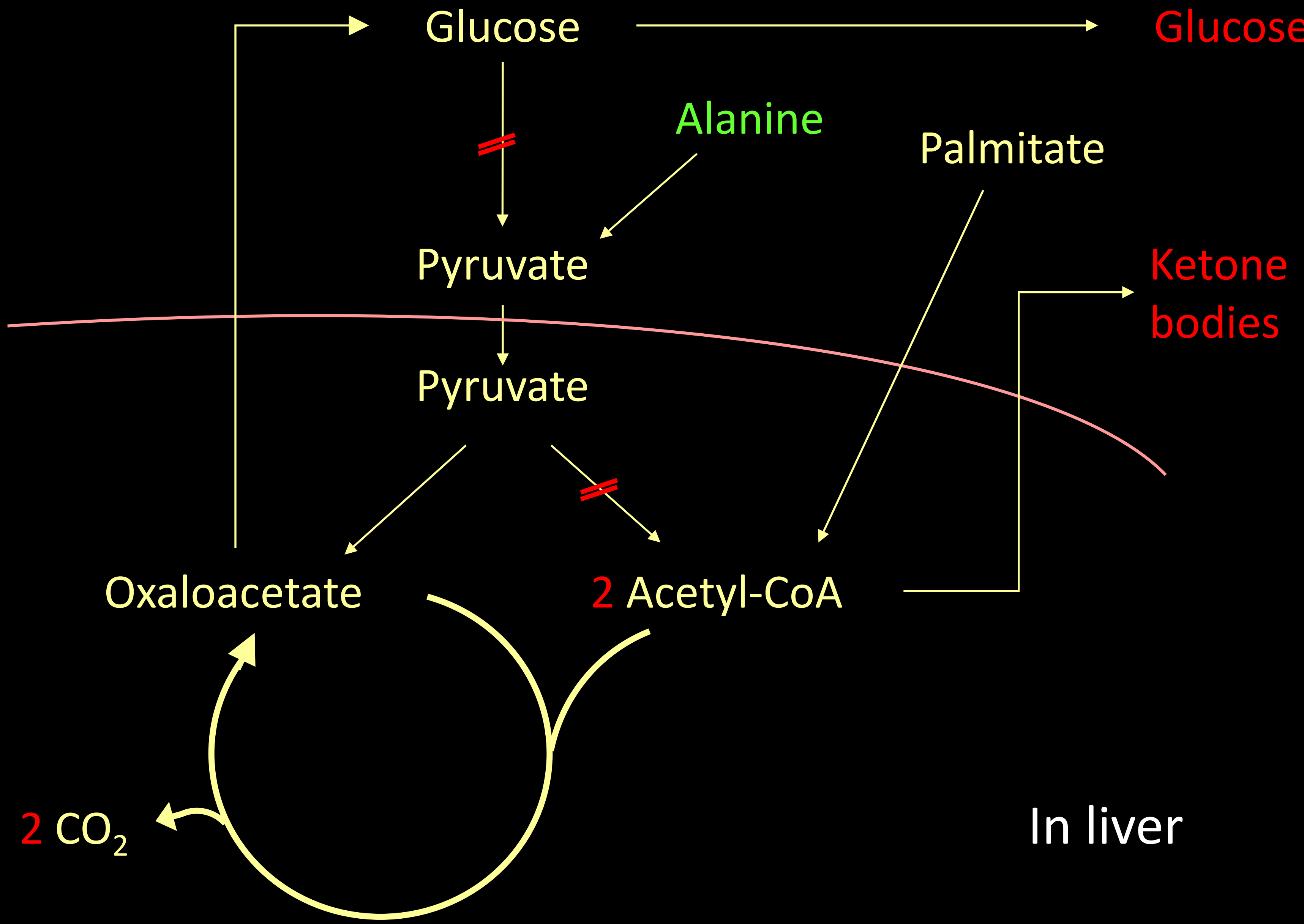
- Dissipates chemical gradient. (due to H^+)



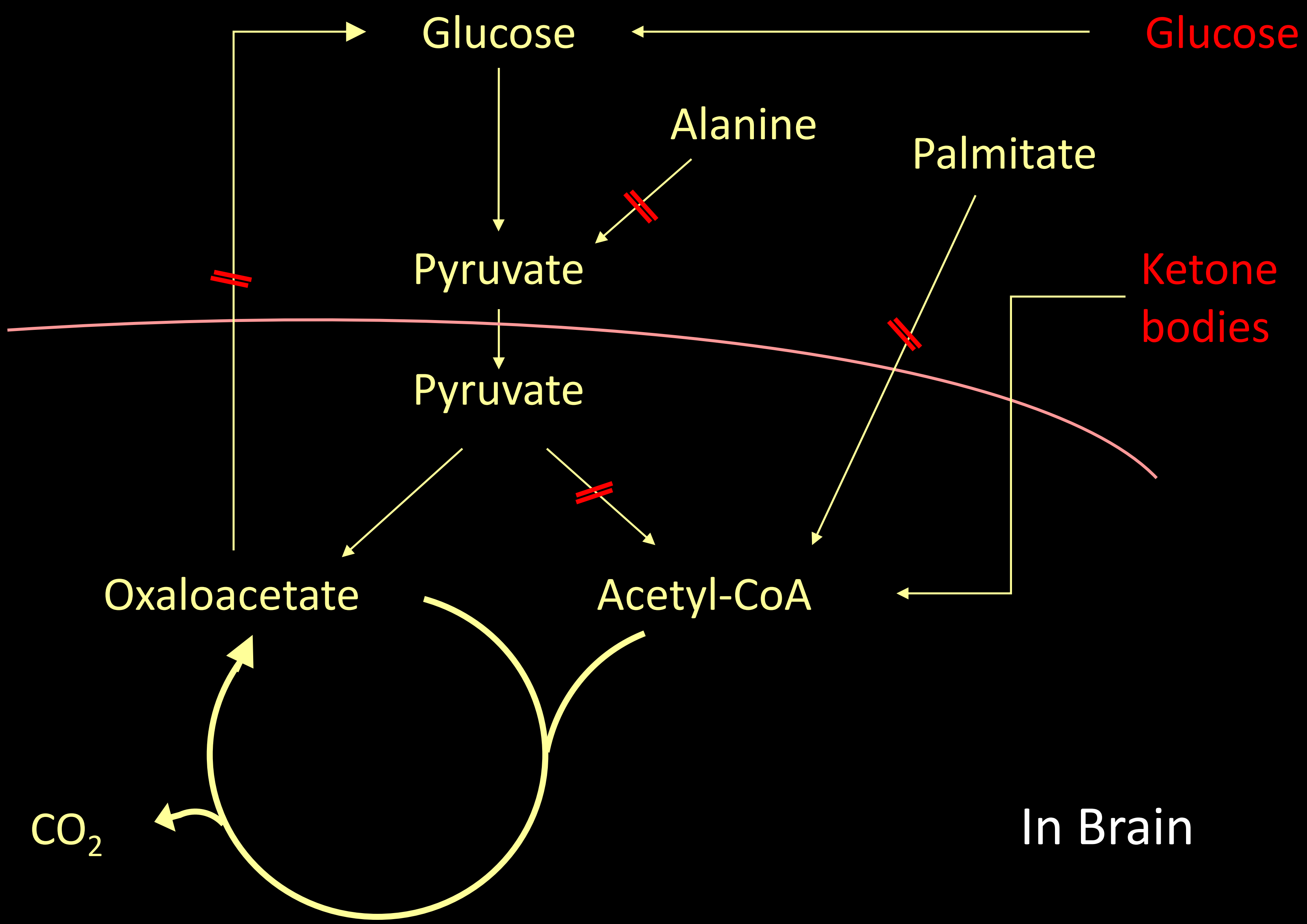
$M^+ = K^+ >> Na^+$

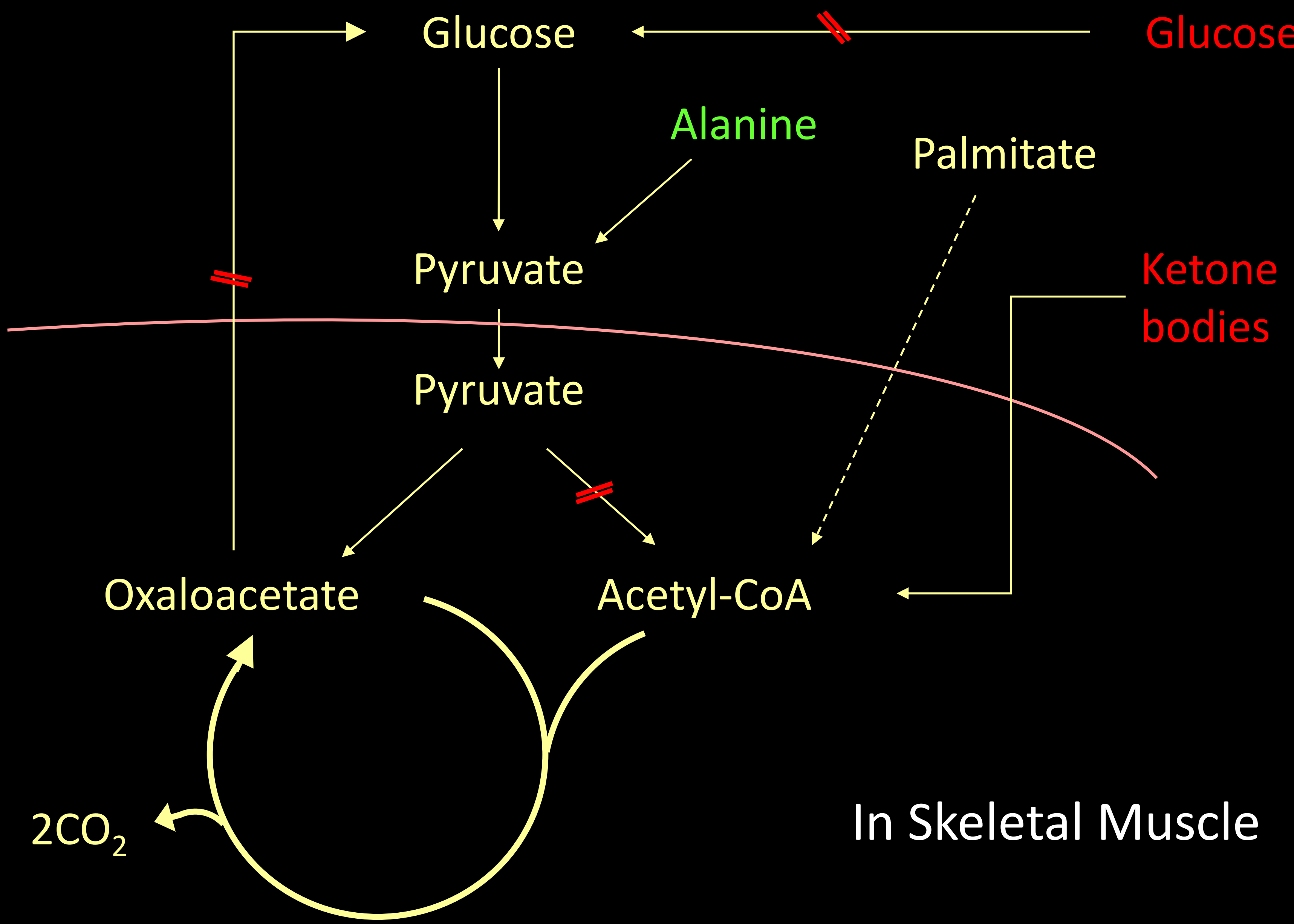


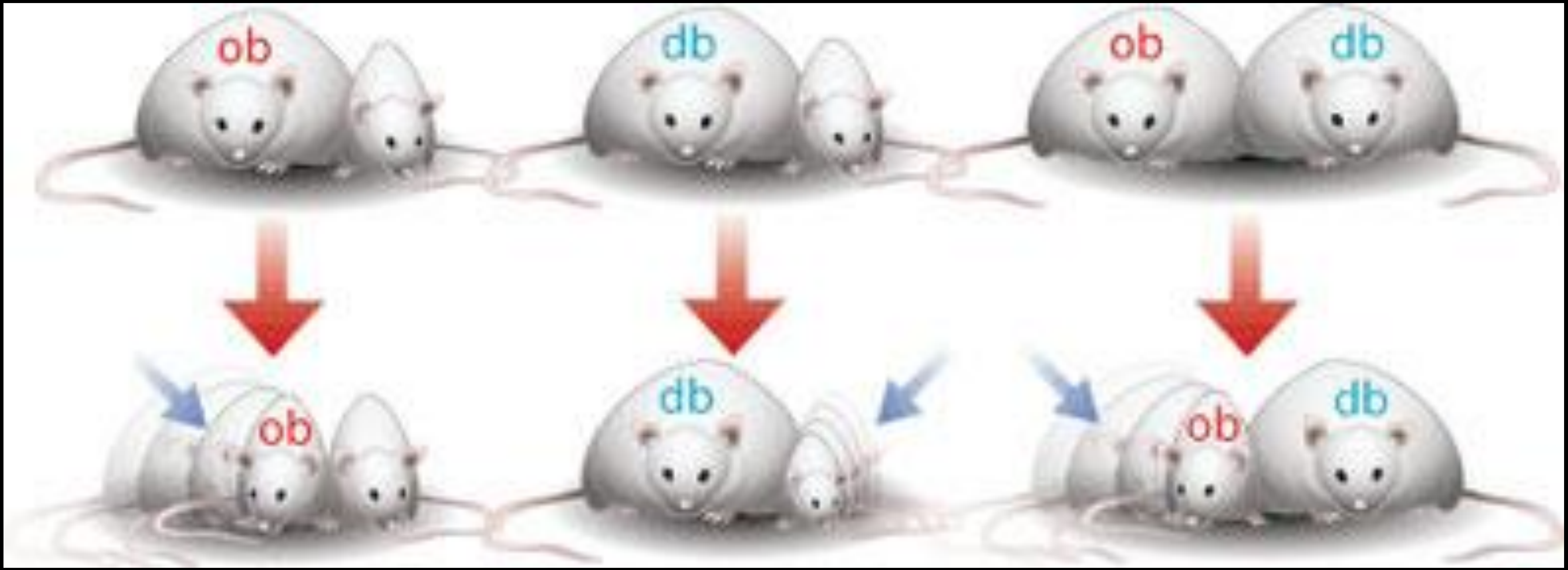
$M^+ = K^+ >> Na^+$



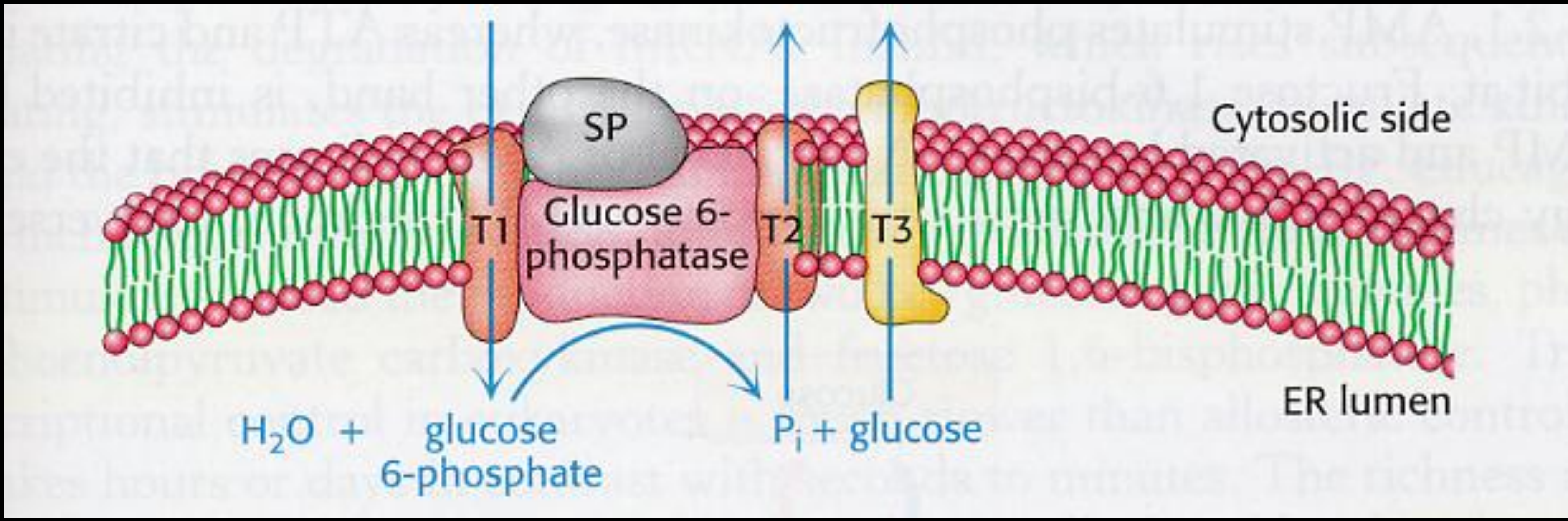
Glucose
Glucose
Alanine
Palmitate
Pyruvate
Ketone
bodies
Pyruvate
Oxaloacetate
2 Acetyl-CoA
2 CO_2
In liver

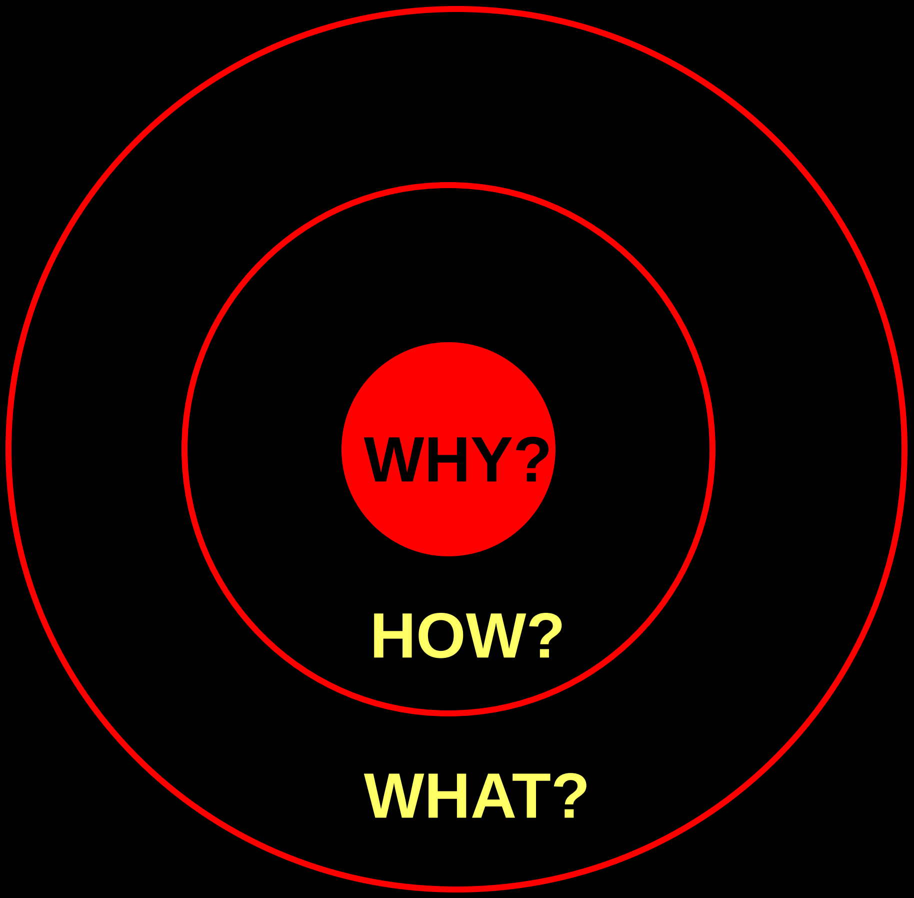

Glucose
Glucose
Alanine
Palmitate
Pyruvate
Ketone bodies
Pyruvate
Oxaloacetate
Acetyl-CoA
CO_2
In Brain


Glucose
Glucose
Alanine
Palmitate
Pyruvate
Ketone bodies
Pyruvate
Oxaloacetate
Acetyl-CoA
2CO2
In Skeletal Muscle


ob
db
ob
db
ob
db
ob
db

Glucose-6-phosphatase activity relies on multiple components.




WHY?
HOW?
WHAT?