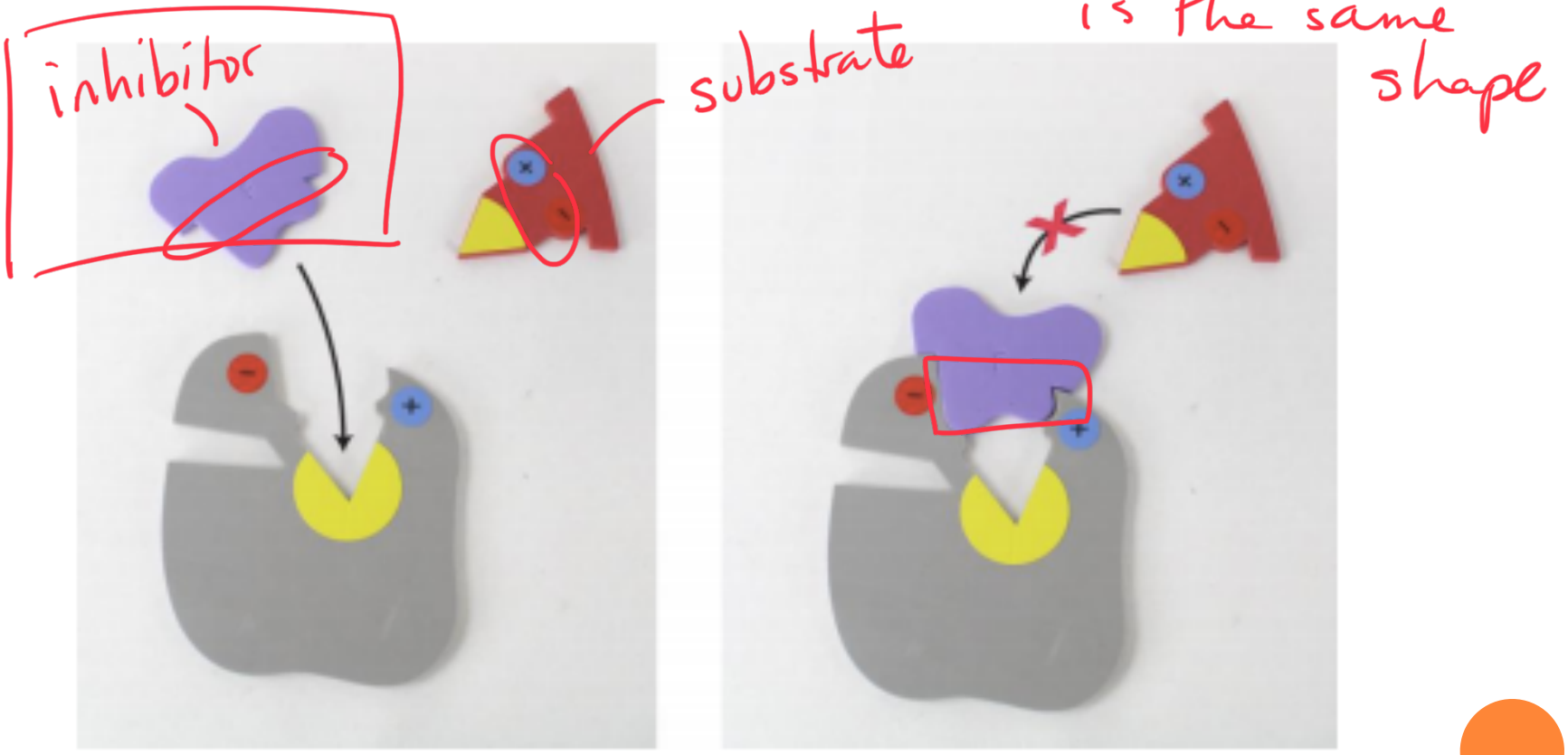
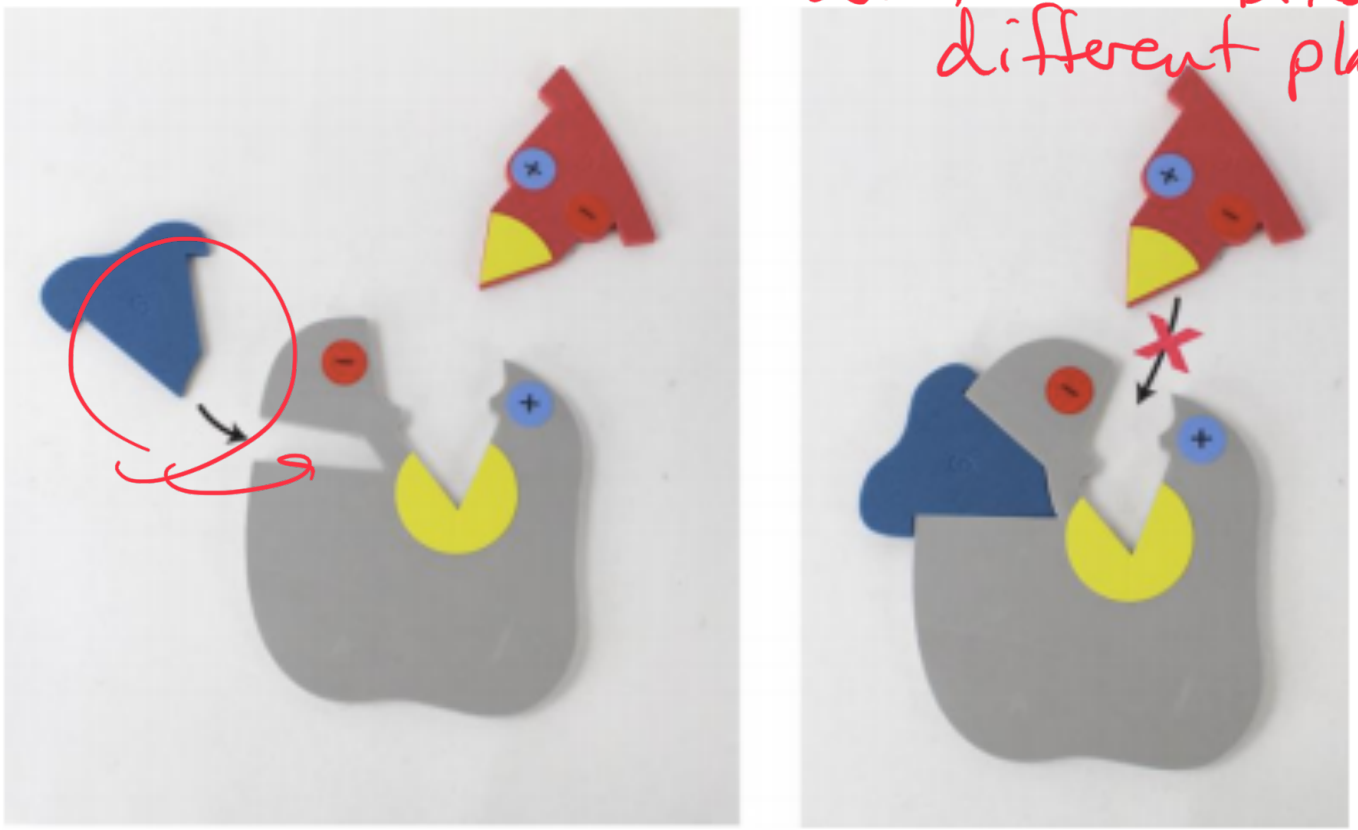
COMPETITIVE INHIBITION

competitive Inhibitor → is an analog of the substrate – is the same shape

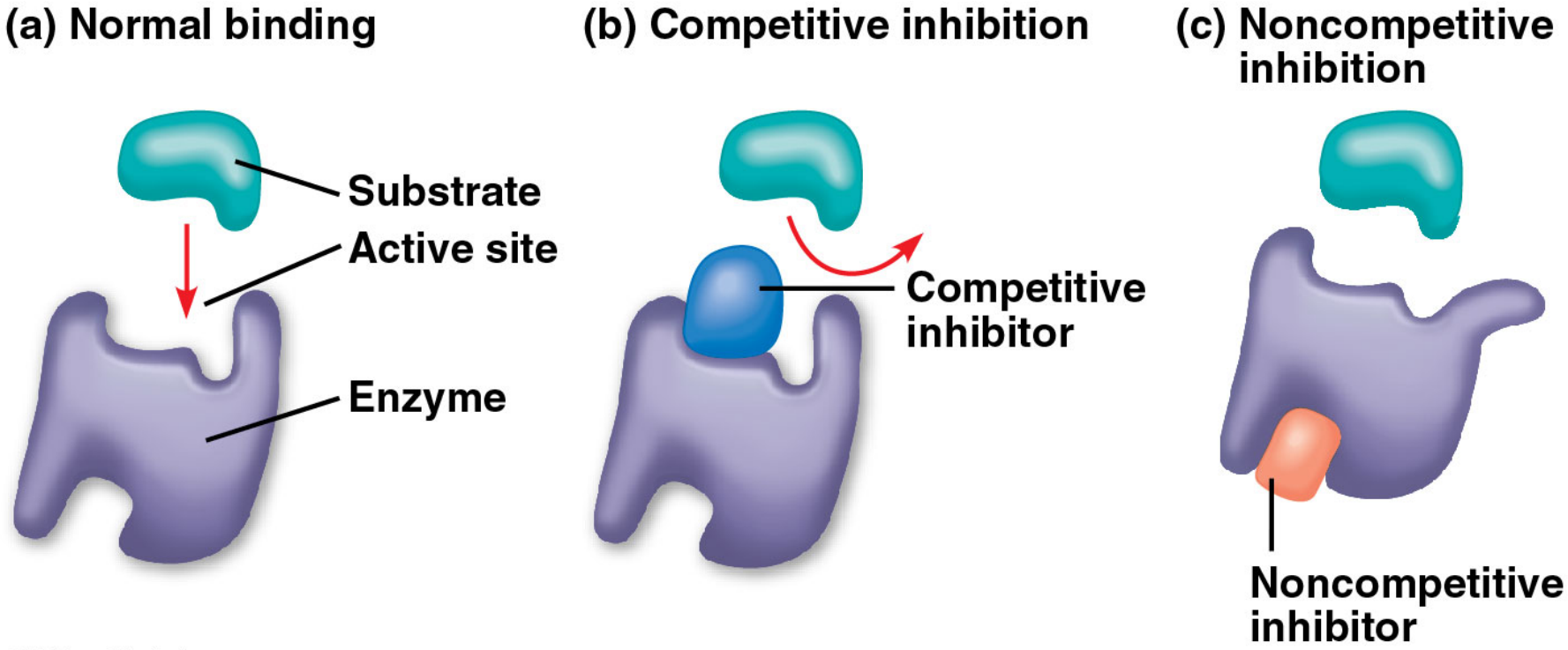


NONCOMPETITIVE INHIBITION

→ not same shape as substrate — bind to a different place



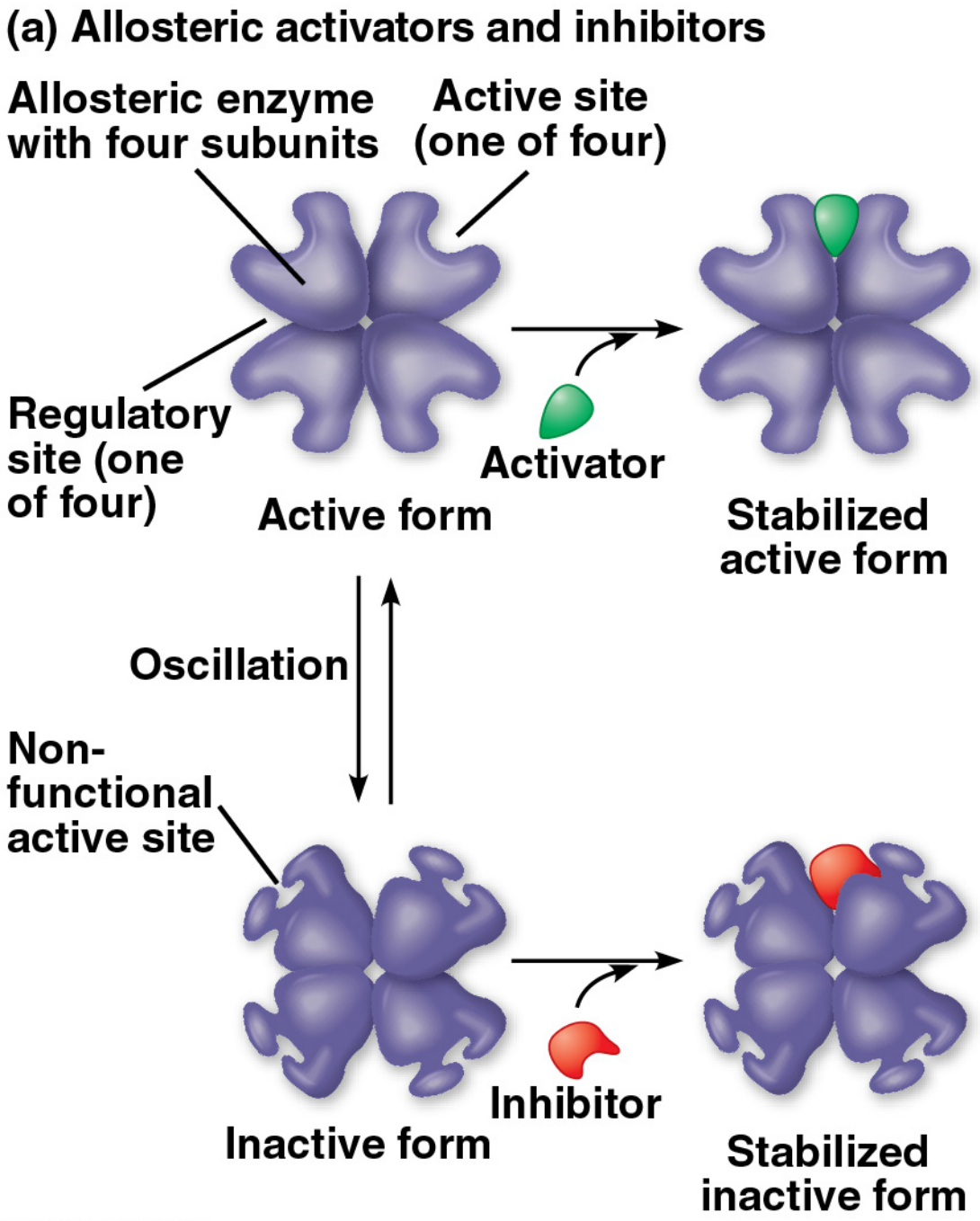
INHIBITION OF ENZYME ACTIVITY



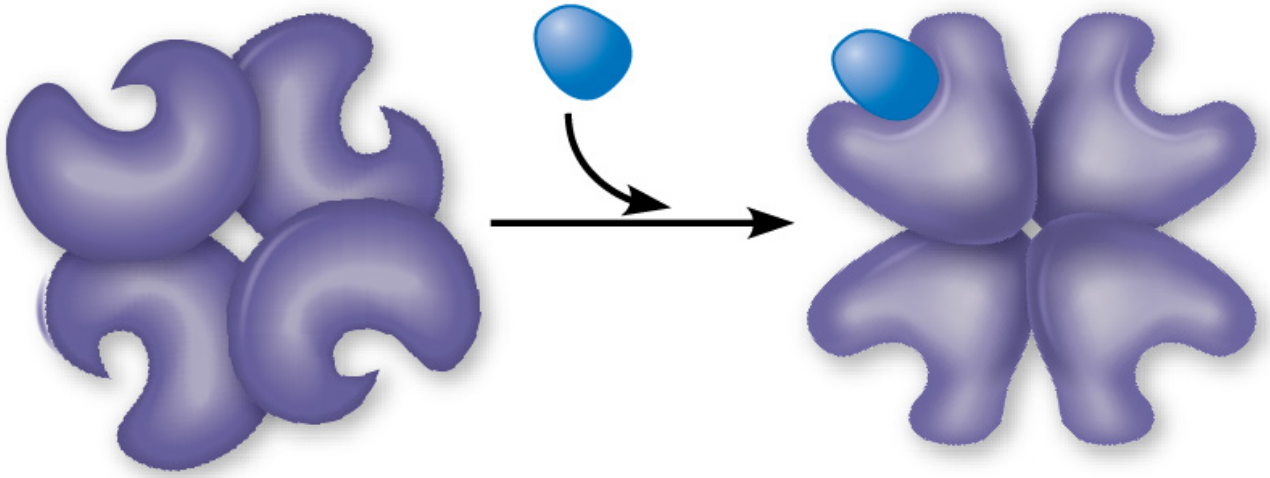
REGULATION OF ENZYME ACTIVITY

- To regulate metabolic pathways, the cell switches on/off the genes that encode specific enzymes
- **Allosteric regulation**: protein's function at one site is affected by binding of a **regulatory molecule** to a separate site (allosteric site)
  - Activator – stabilizes active site
  - Inhibitor – stabilizes inactive form
  - Cooperativity – one substrate triggers shape change in other active sites → increase catalytic activity

↳ interactions at sites other than the active site.

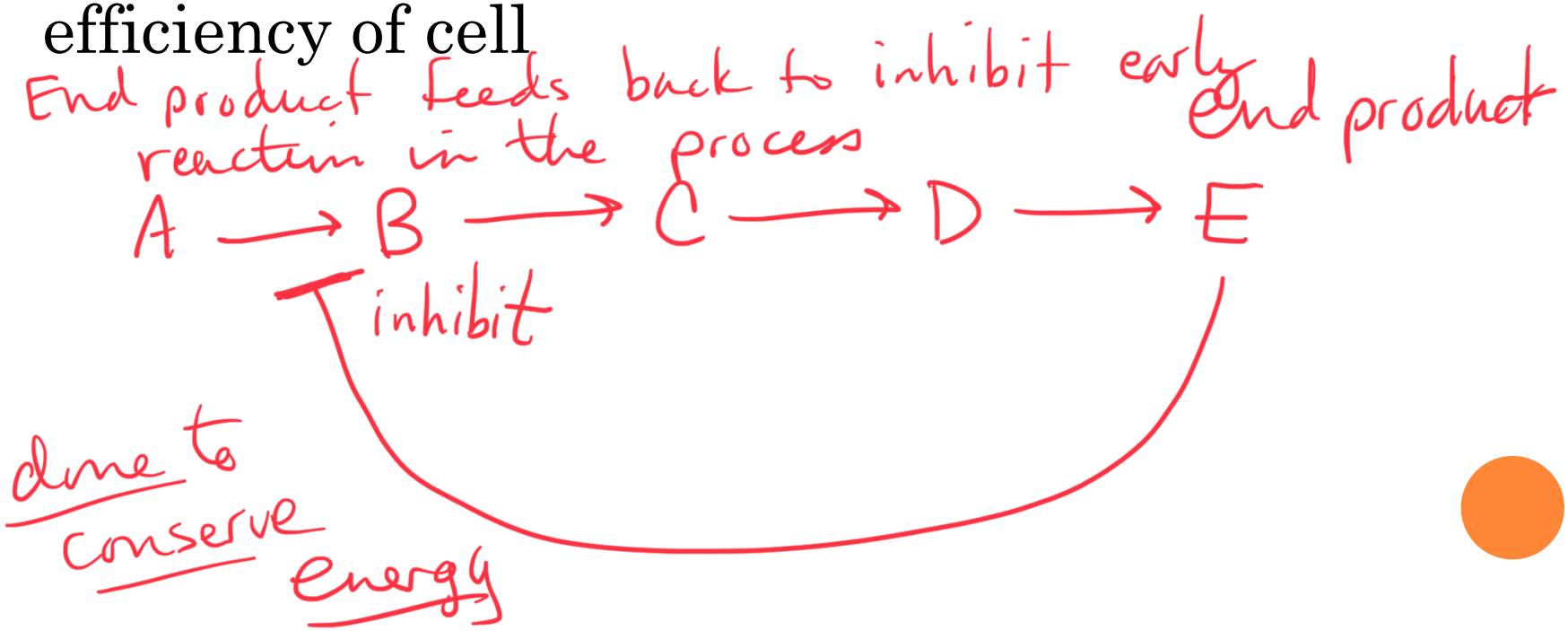


(b) Cooperativity: another type of allosteric activation

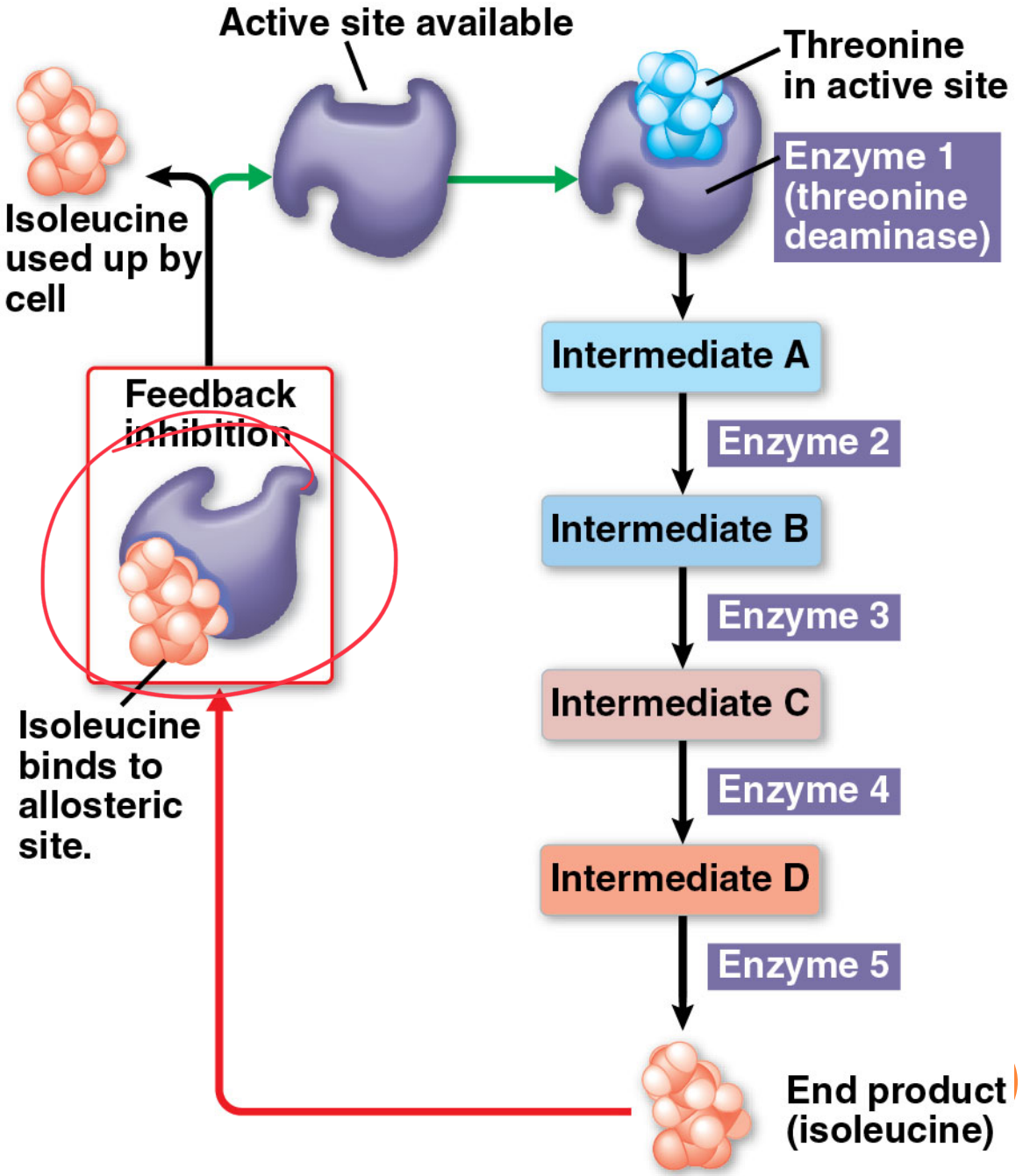


FEEDBACK INHIBITION

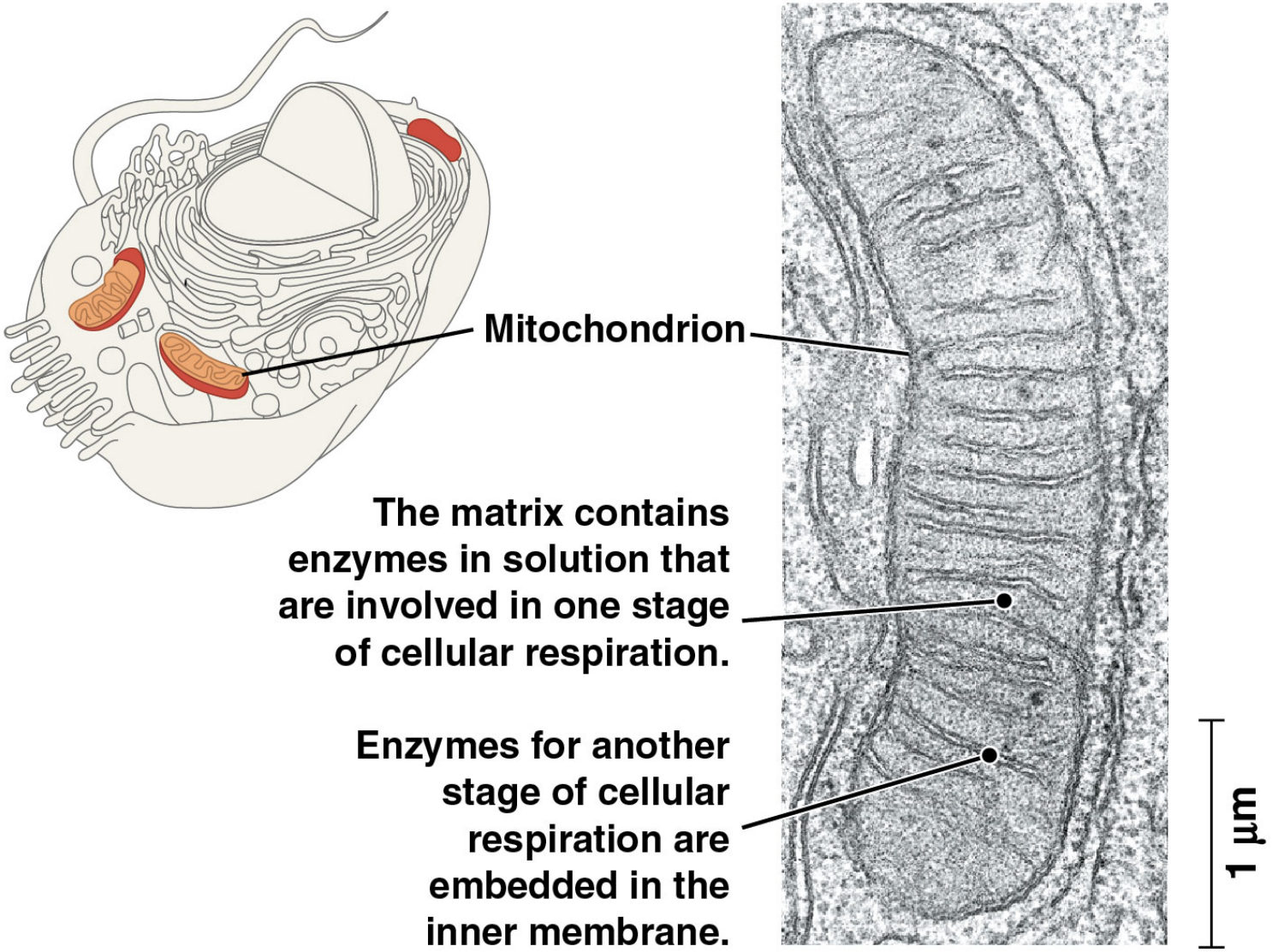
- End product of a metabolic pathway shuts down pathway by binding to the allosteric site of an enzyme
- Prevent wasting chemical resources, increase efficiency of cell



FEEDBACK INHIBITION



ORGANIZATION OF ENZYMES WITHIN A CELL



Cellular Respiration

Respiration O_2 in → CO_2 out

Chapter 7: Respiration

In open systems, cells require E to perform work (chemical, transport, mechanical)

Energy

E flows into ecosystem as Sunlight

↓

Autotrophs transform it into chemical E

O_2 released as byproduct

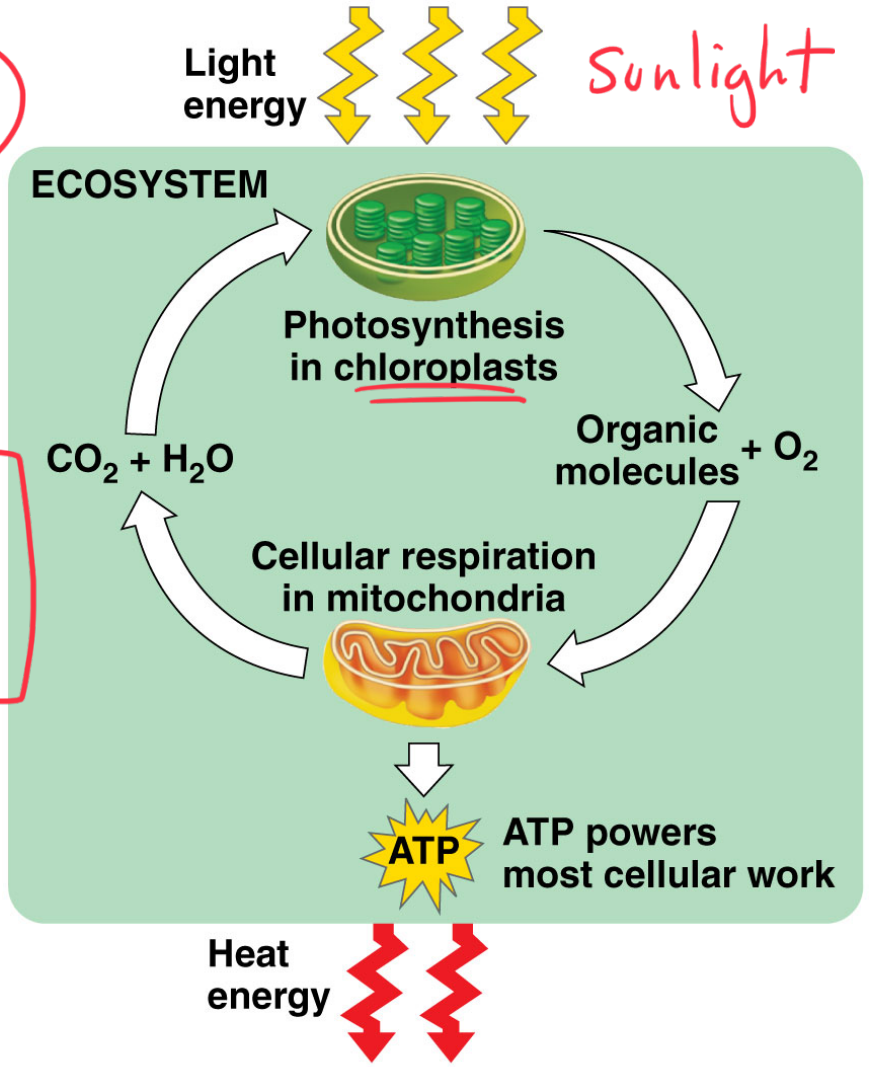
↓

Cells use some of chemical E in organic molecules to make ATP

↓

E leaves as heat

↓



Review

Release energy $-\Delta G$ exergonic

Big → small

Spontaneous

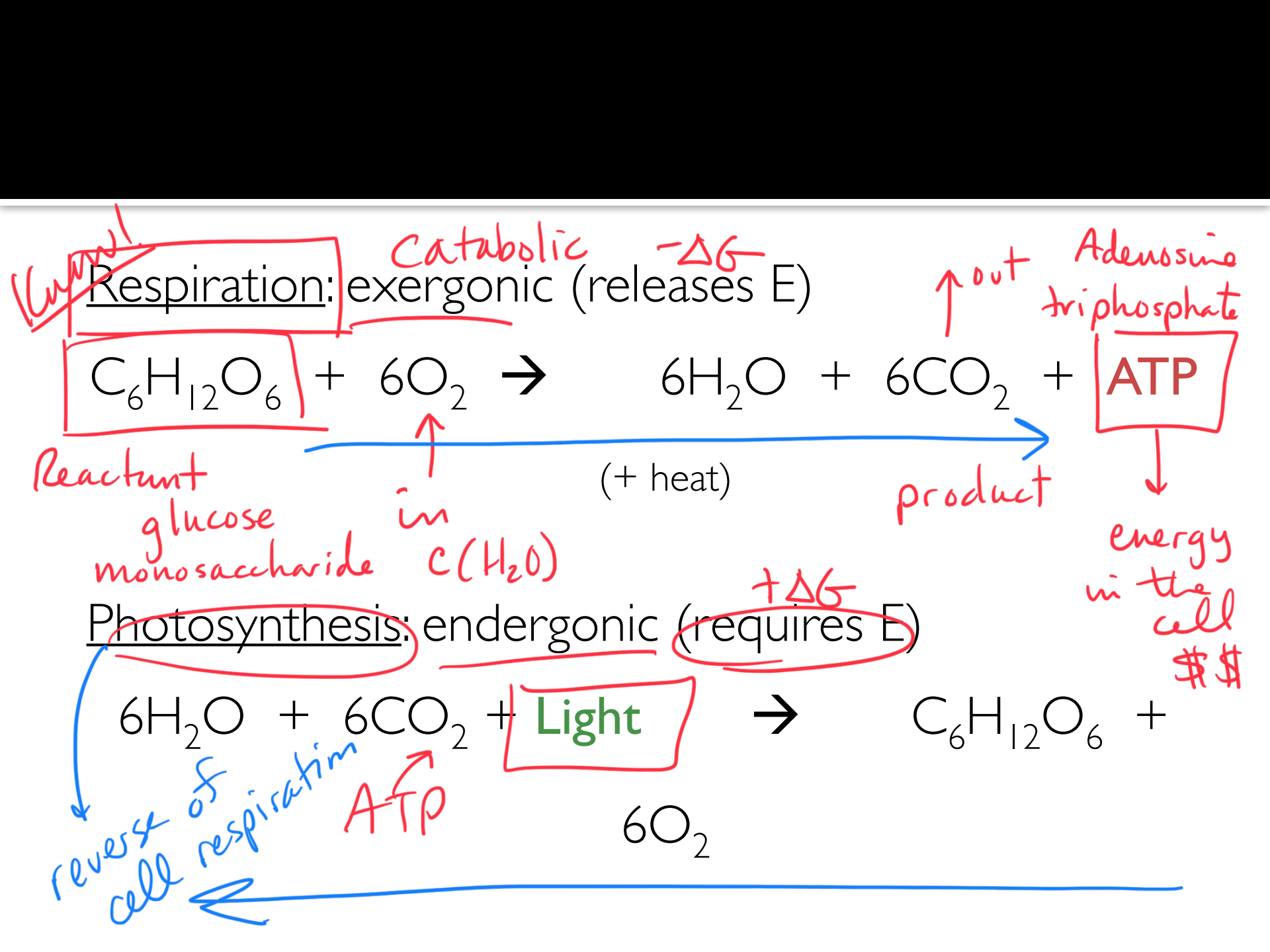
Complex organic molecules

Catabolic Pathway

Simpler waste products with less E

Some E used to do work and dissipated as heat

Gibbs Free energy →


Respiration: exergonic (releases E)
catabolic
−ΔG
out
Adenosine triphosphate
$C_6H_{12}O_6$ + $6O_2$ → $6H_2O$ + $6CO_2$ + ATP
(+ heat)
Reactant
glucose monosaccharide
in
$C(H_2O)$
product
energy in the cell
$$
Photosynthesis: endergonic (requires E)
+ΔG
$6H_2O$ + $6CO_2$ + Light → $C_6H_{12}O_6$ + $6O_2$
ATP
reverse of cell respiration

Redox Reactions

transfers of electrons (oxidation-reduction)

$NH_3 + NH_3 \rightarrow N_2H_6$ rocket fuel

reduced

Most of ATP we get is from redox reactions

oxidation (donor) lose e-

$Xe^- + Y \rightarrow X + Ye^-$

reduction (acceptor) gain e-

OIL oxidation is Loss of an electron

RIG reduction is gain of electrons

- Oxidation = lose e- (loss of energy)
- Reduction = gain e- (gain energy)

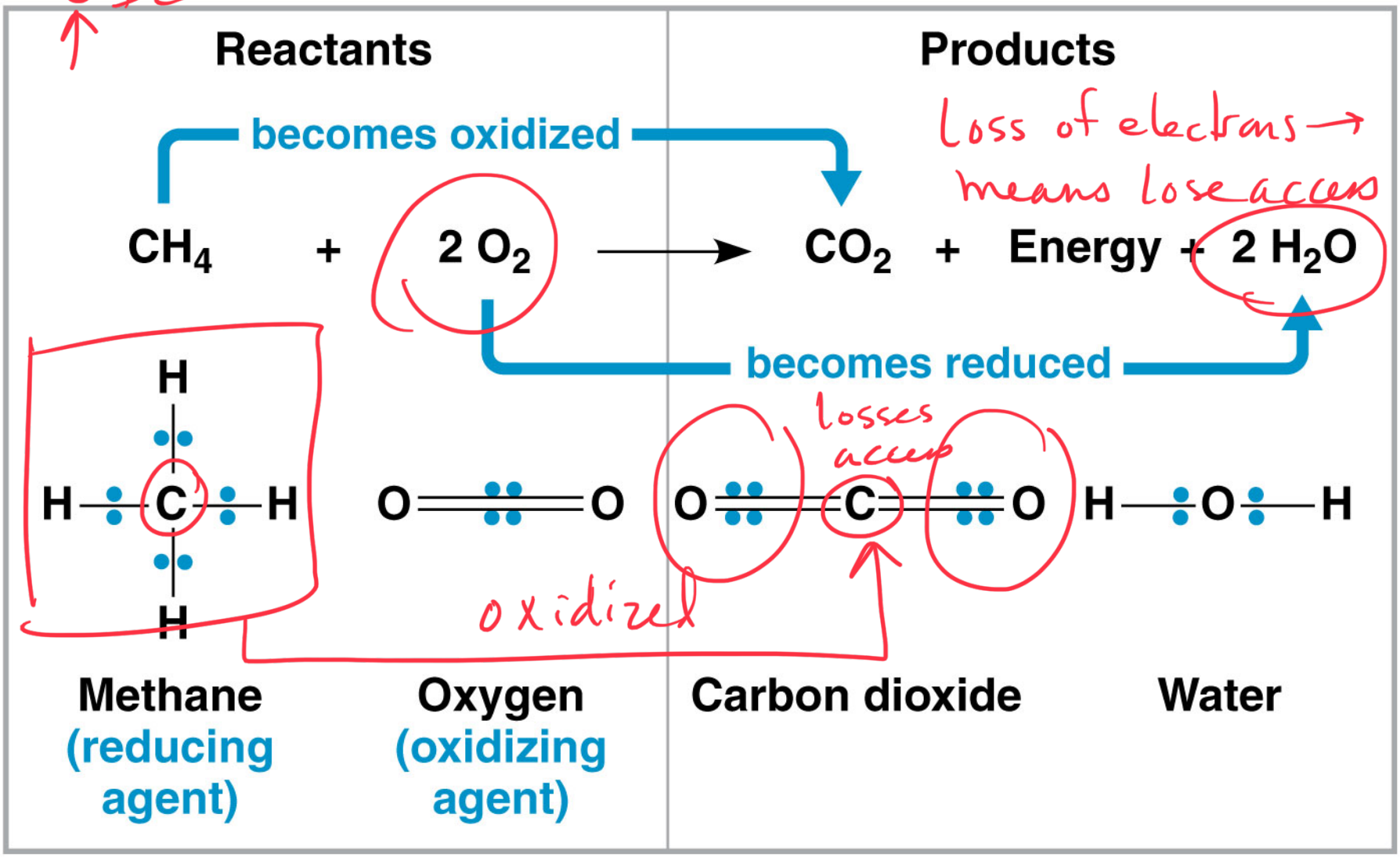
OiLRiG or ~~LeoGer~~

oxidation

$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2 +$ ATP

reduction

OIL RIG

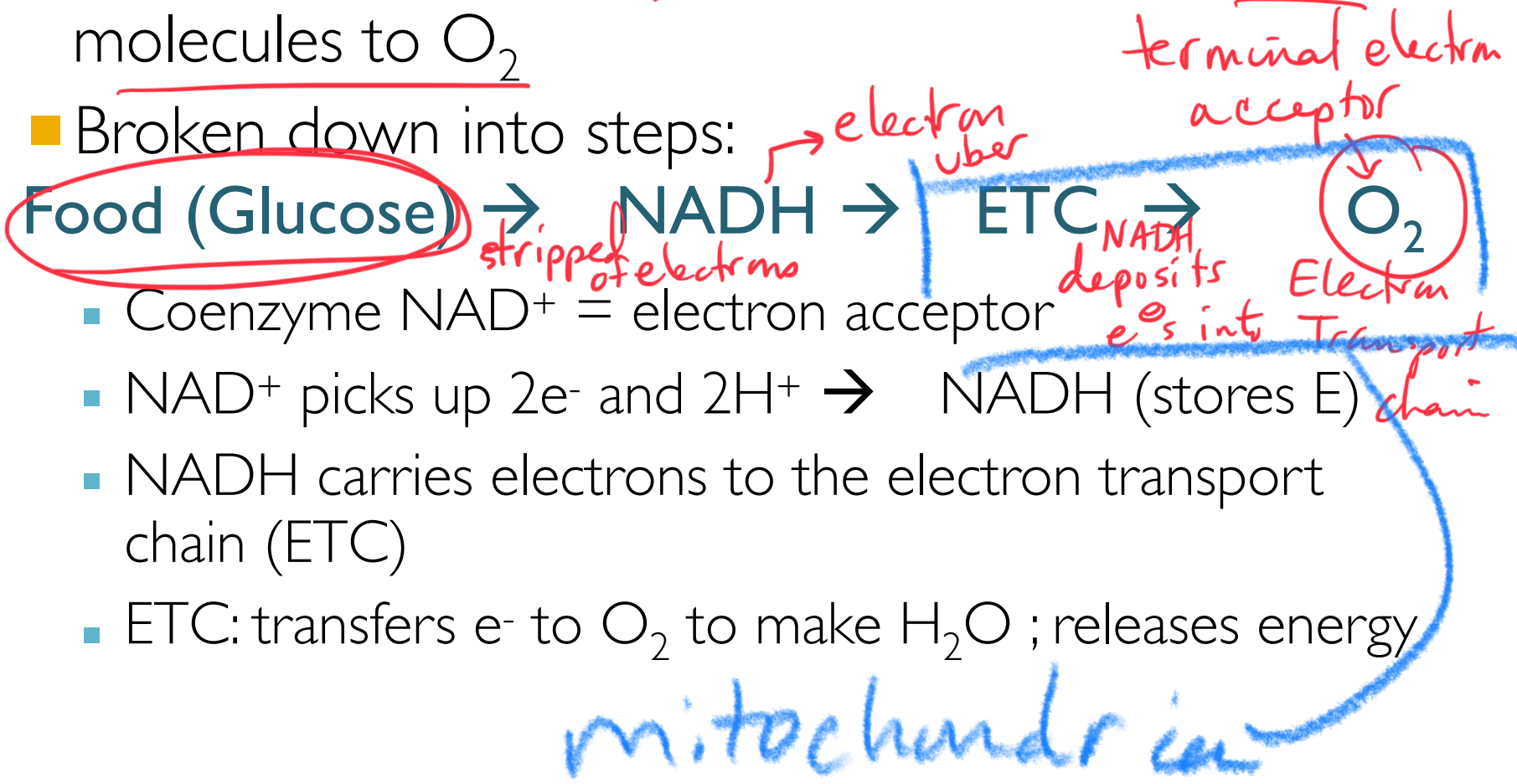


Energy Harvest

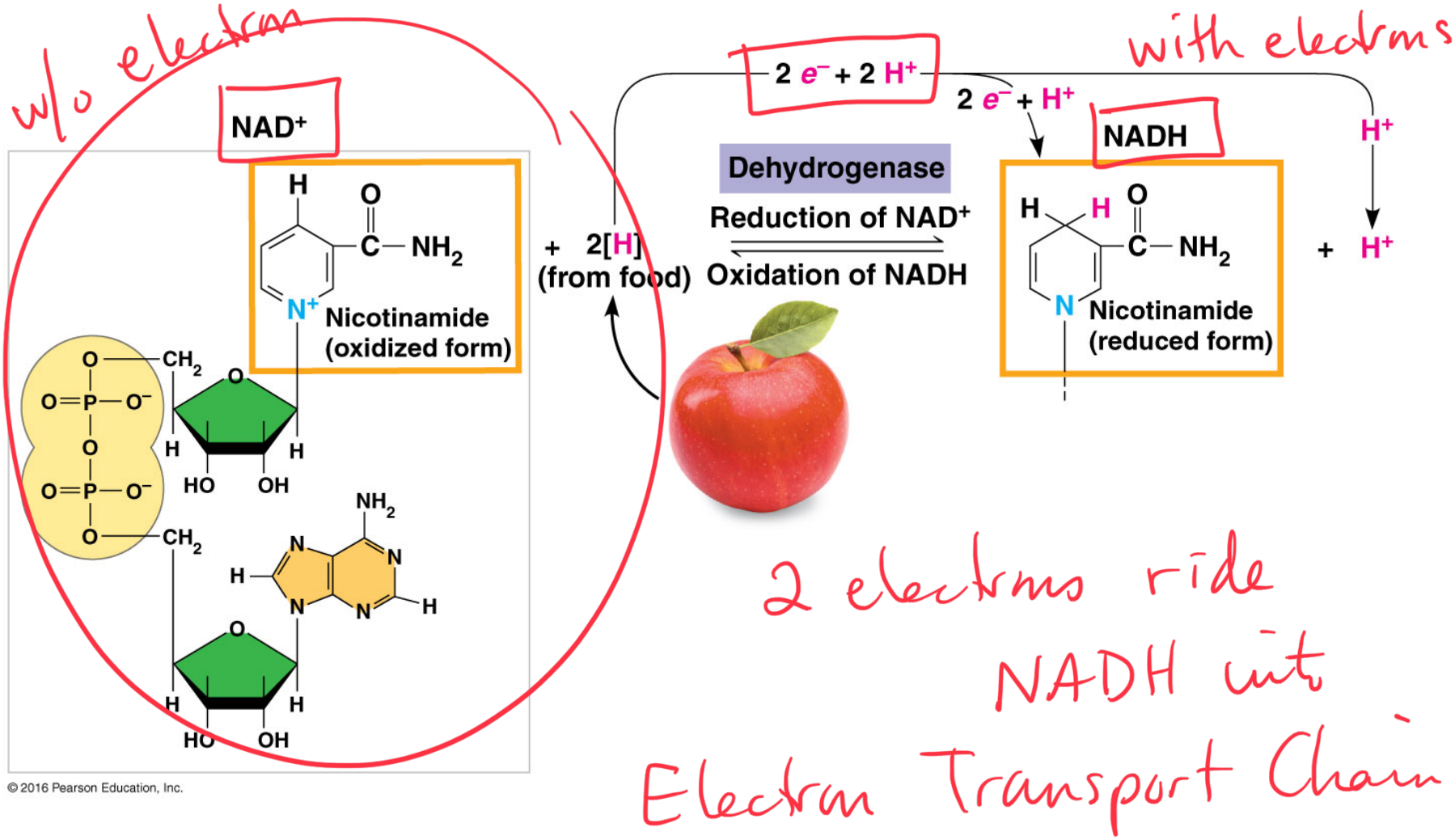
- Energy is released as electrons "fall" from organic molecules to O_2
- Broken down into steps:

Food (Glucose) → NADH → ETC → O_2

  - Coenzyme NAD^+ = electron acceptor
  - NAD^+ picks up $2e^-$ and $2H^+$ → NADH (stores E)
  - NADH carries electrons to the electron transport chain (ETC)
  - ETC: transfers e^- to O_2 to make H_2O ; releases energy



NAD^+ as an electron shuttle



Electron Transport Chain