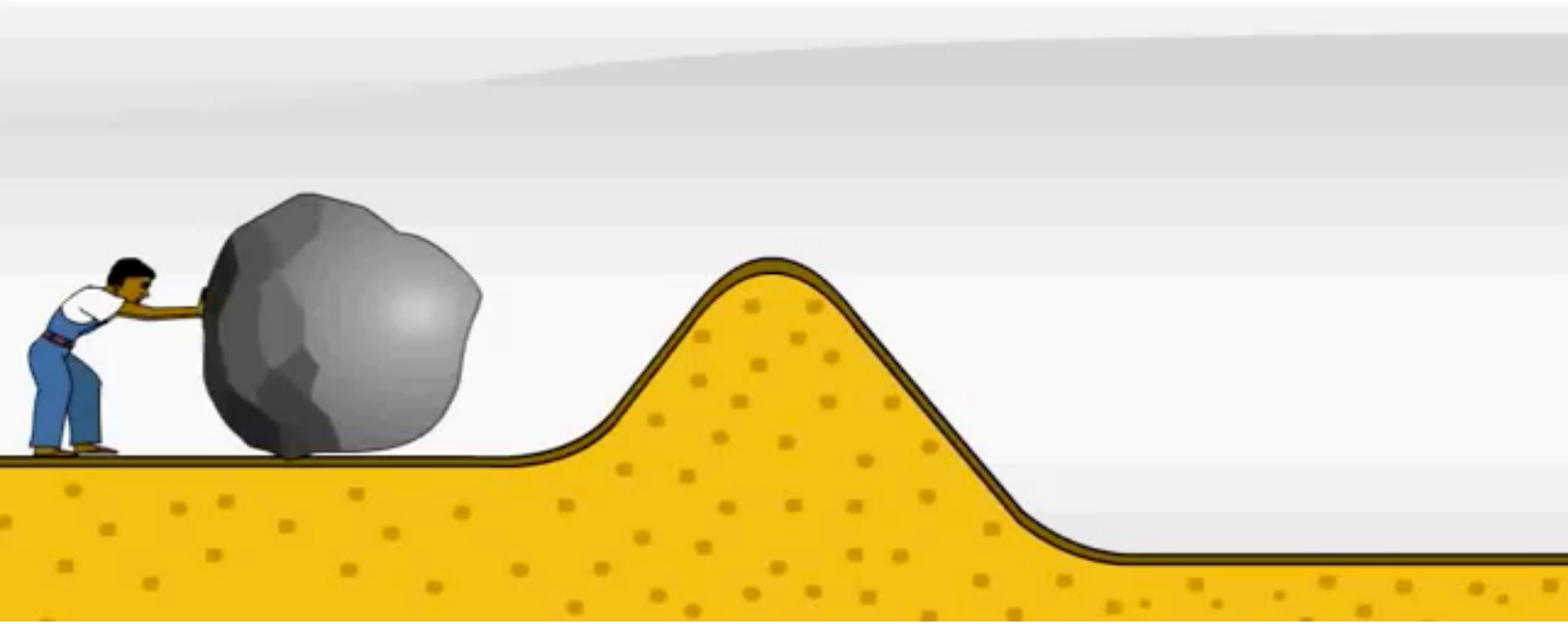
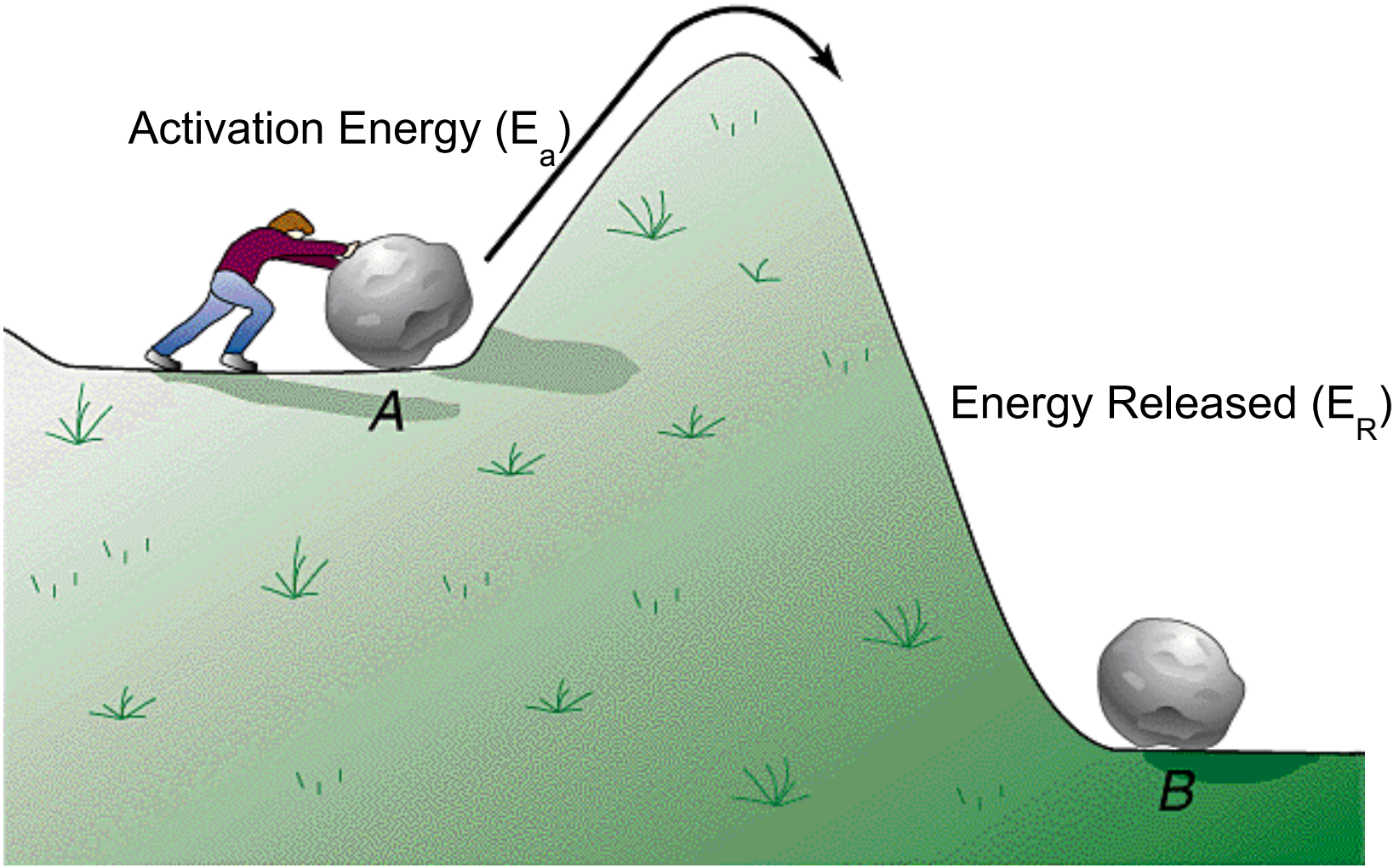
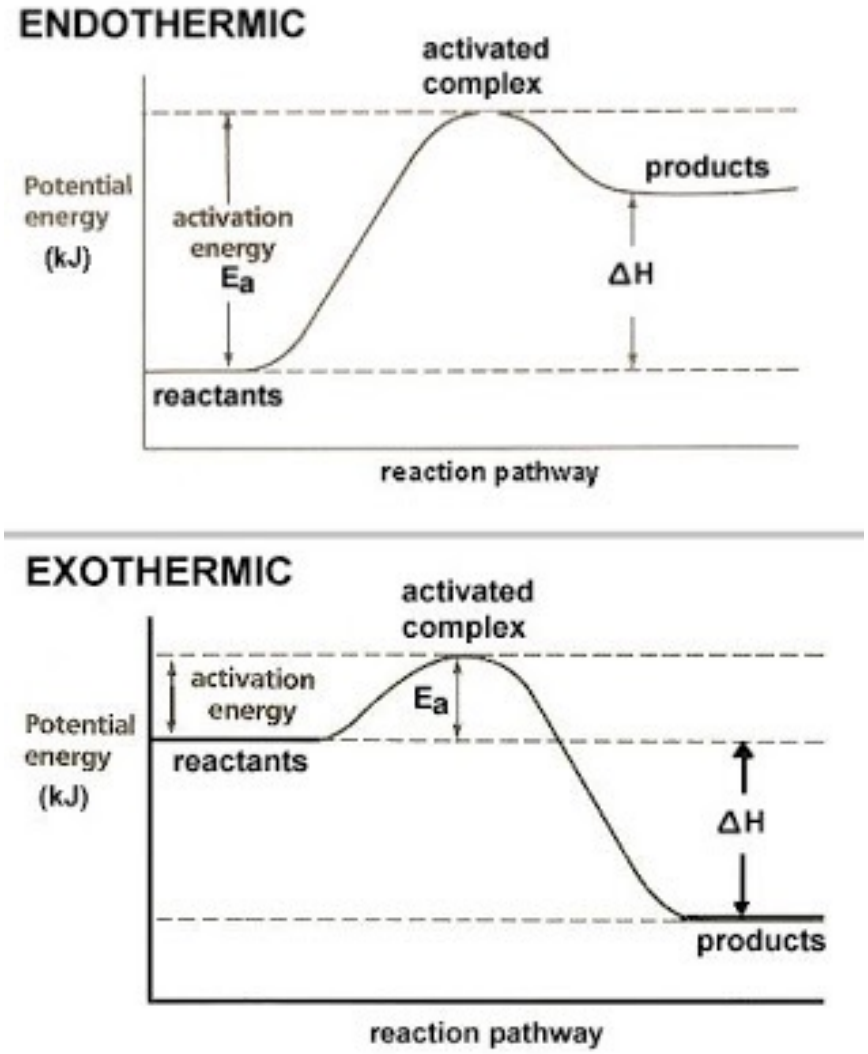
Activation Energy and Enzymes

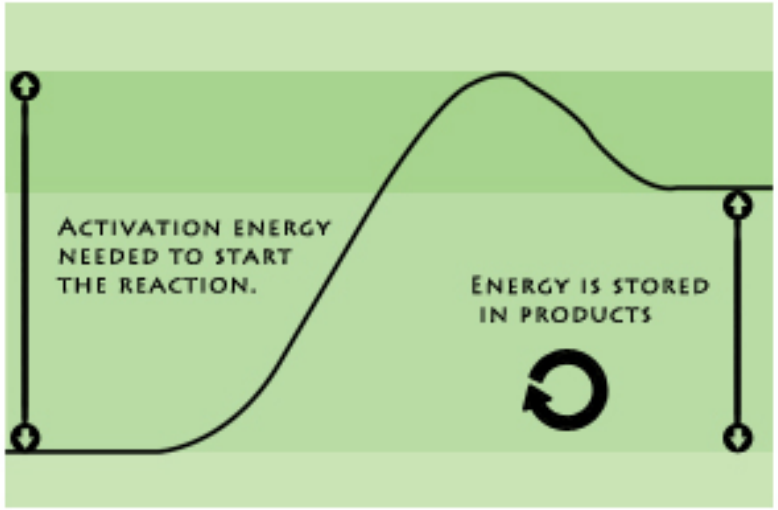



Activation Energy (E_a)
A
Energy Released (E_R)
B

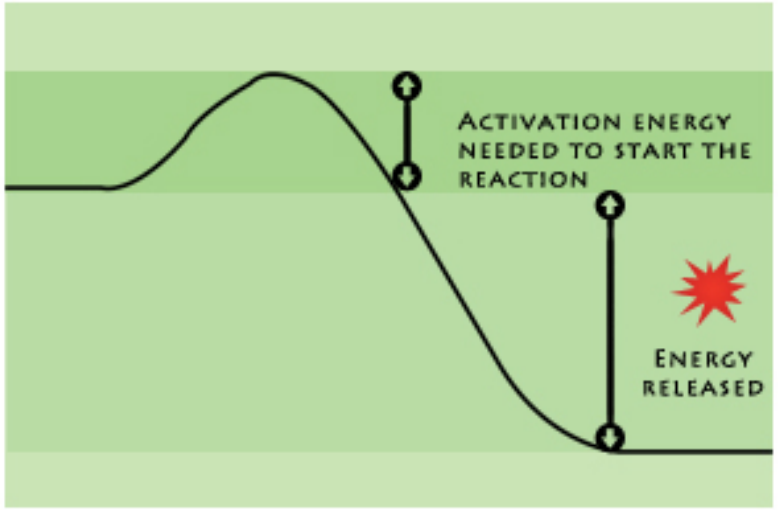
Activation Energy (E_a)



Endergonic



Exergonic



Exergonic vs Endergonic

In reactions

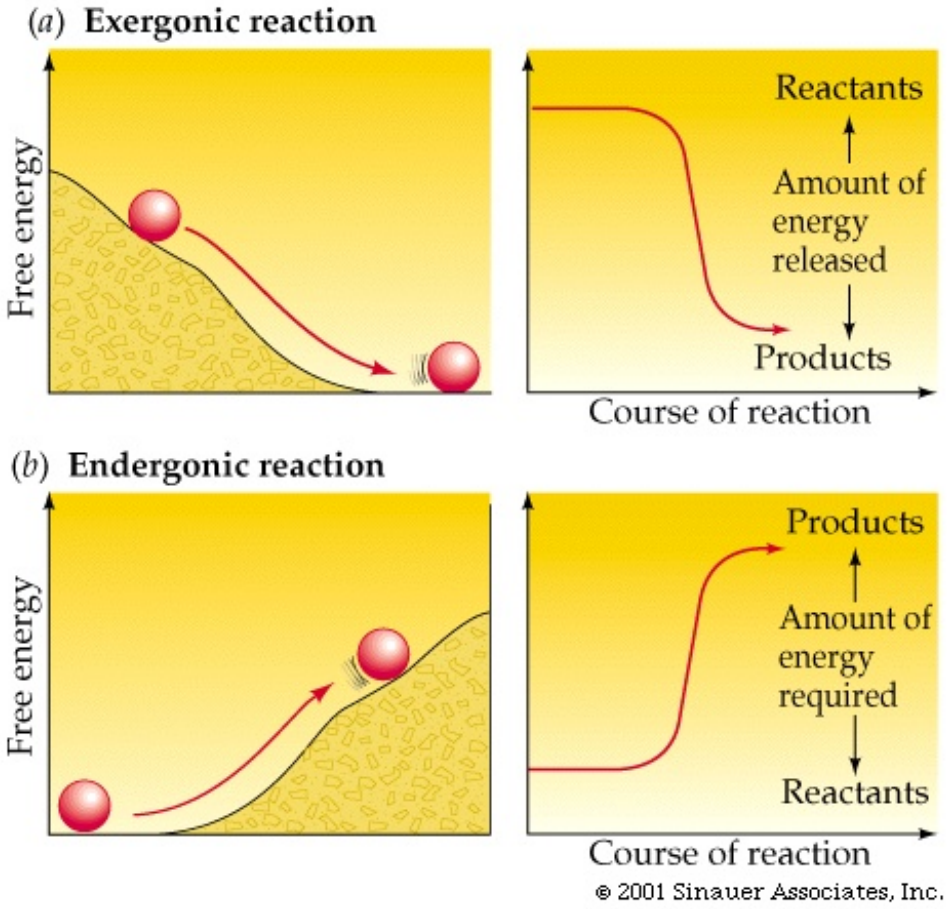
If products release more energy then the input of energy-> **Exergonic**

(energy to break bonds < energy released when new bonds form)

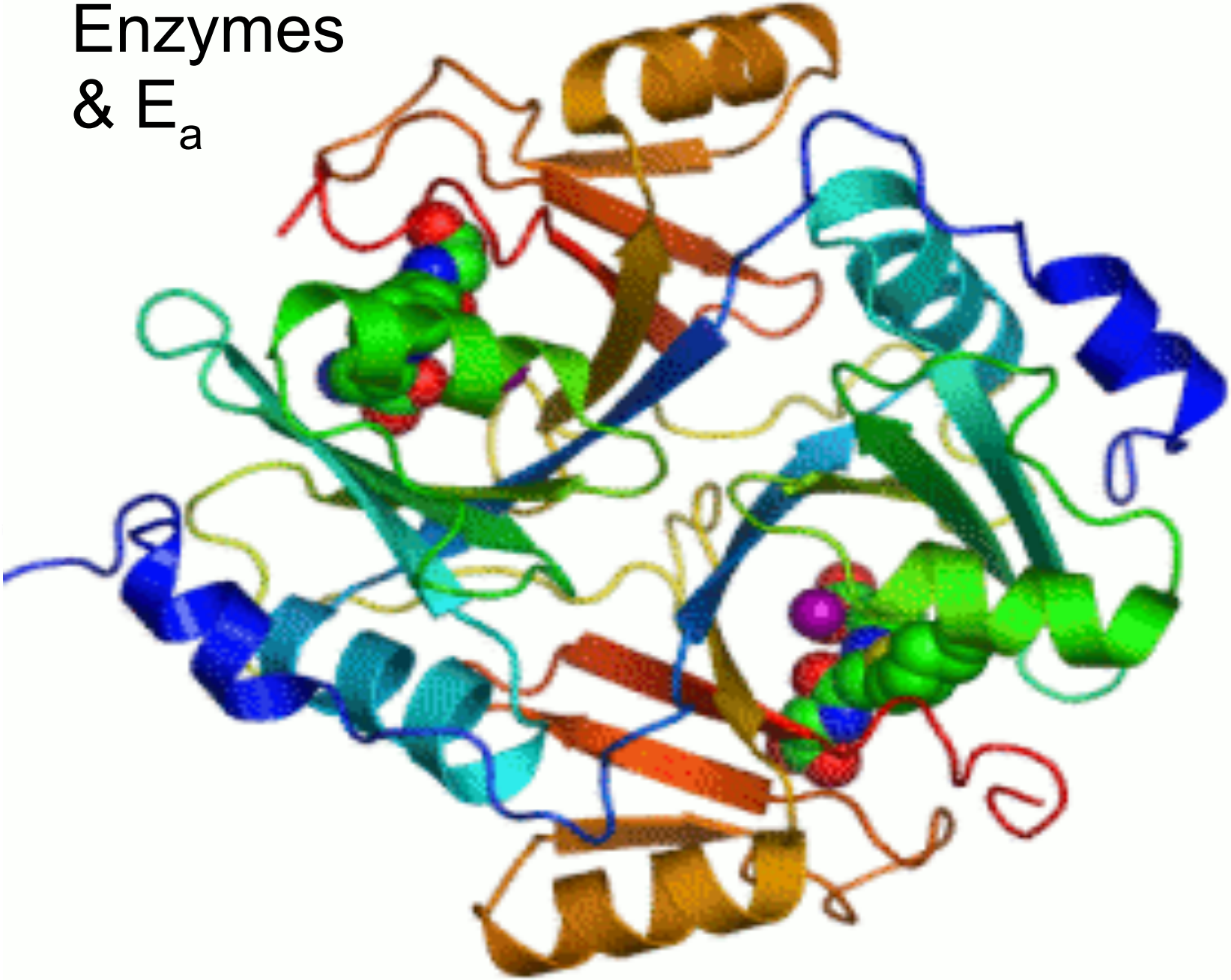
In reactions

If products release less energy then the input of energy-> **Endergonic**

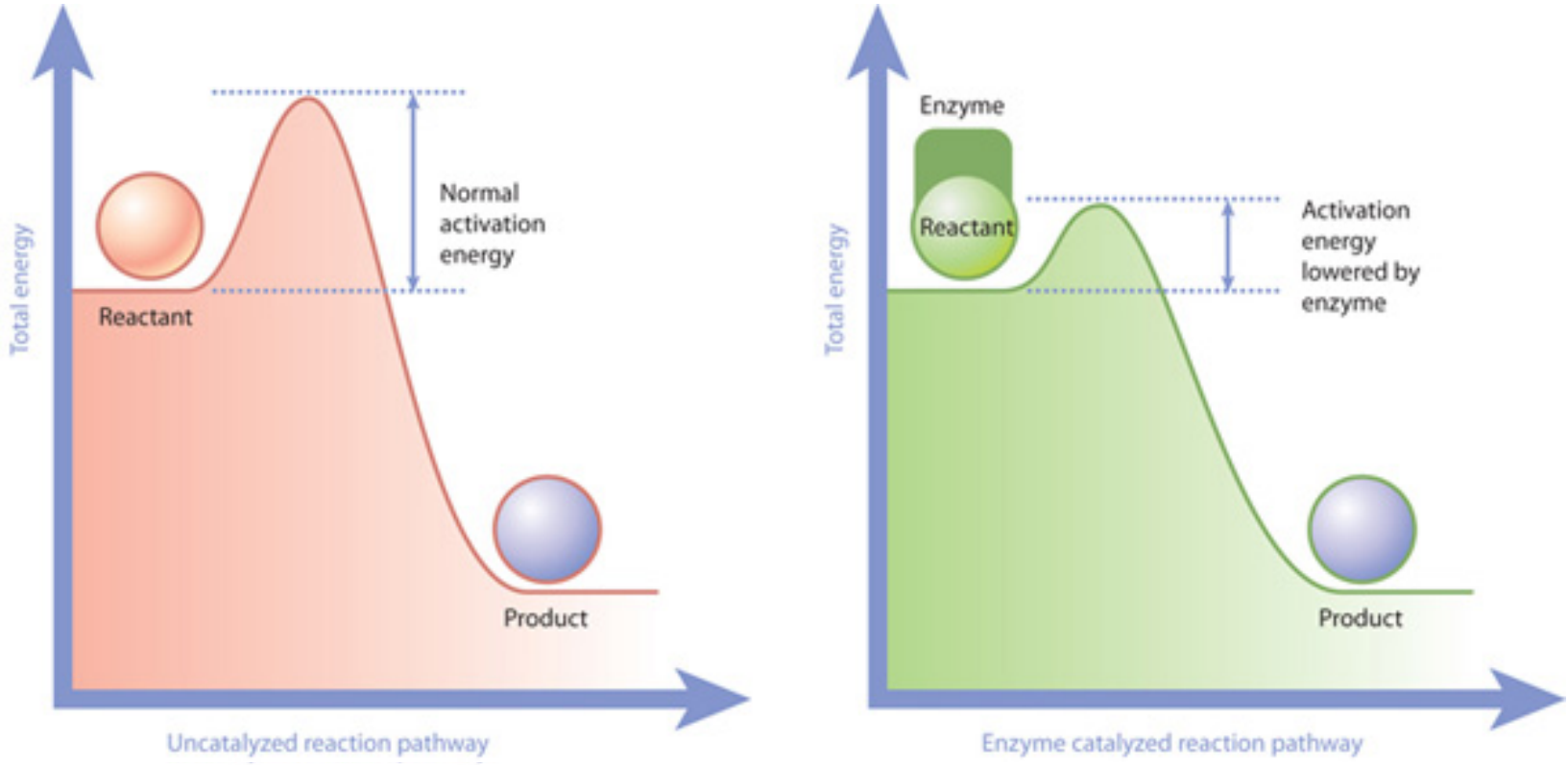
(energy to break bonds > energy released when new bonds form)



Enzymes & E_a



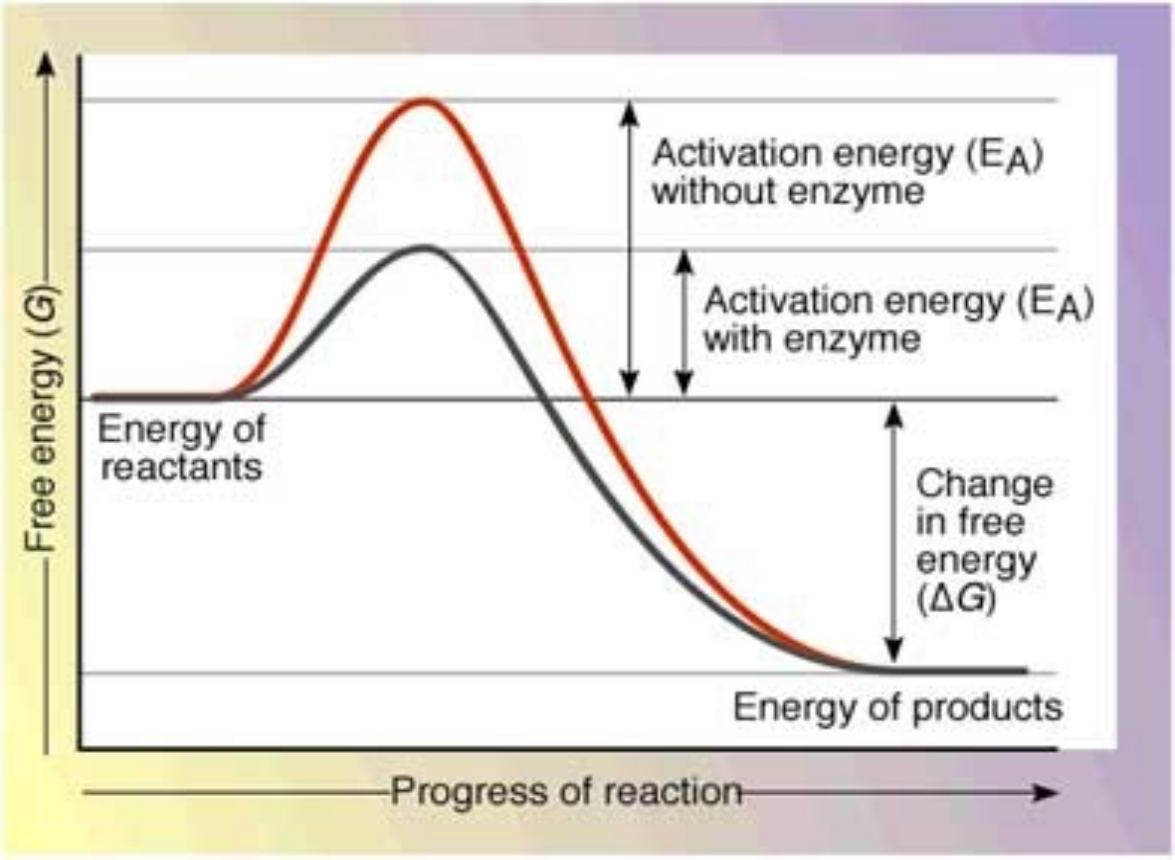
How is E_a Overcome?



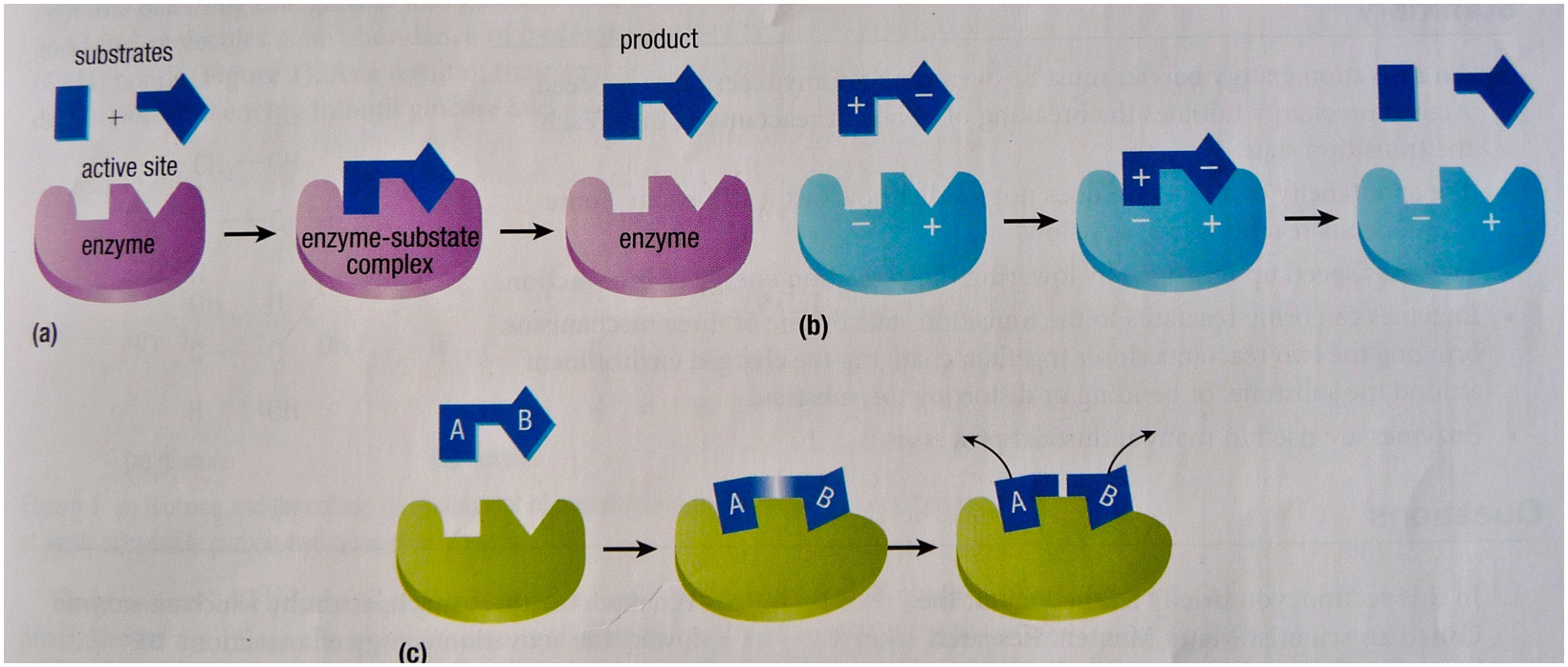
How is E_a Overcome?

- enzymes lower the activation energy
- increasing the likelihood of a reaction occurring
- since enzymes are substrate specific, reactions are controlled.

Enzymes and E_a



How do Enzymes lower E_a.



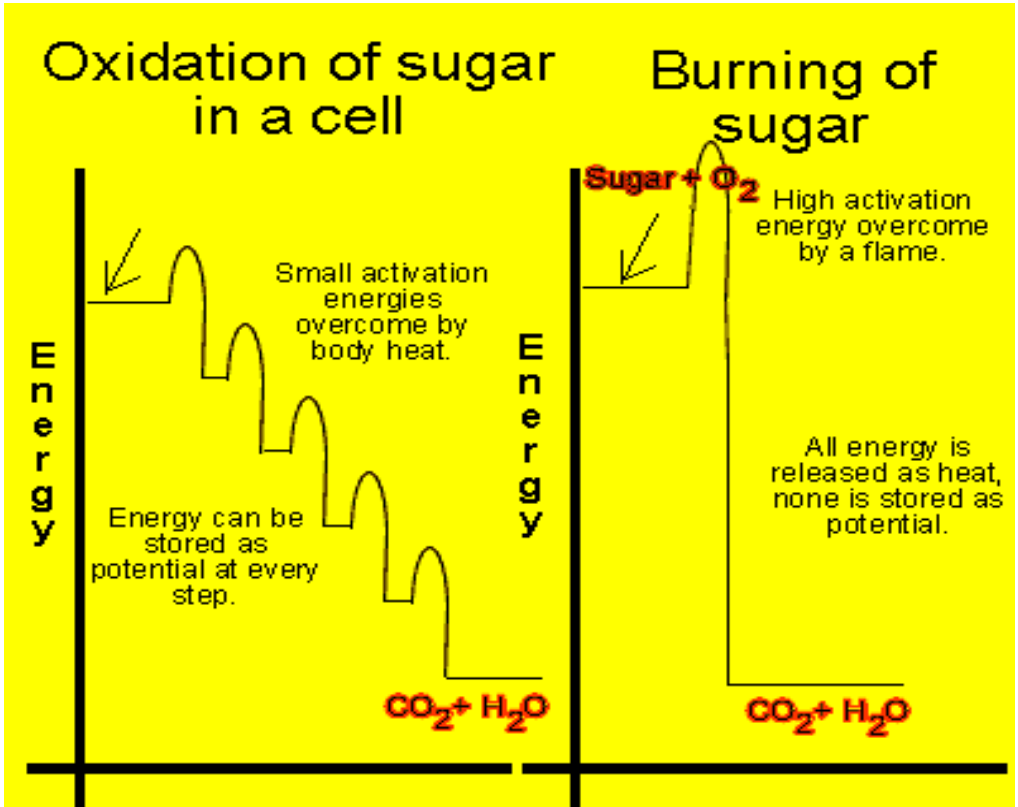
How do Enzymes lower E_a.

- » enzymes bring substrate in close proximity with proper orientation
- » enzymes create an environment to favourable for substrates to react
- » enzymes place strains on existing bonds

Metabolic Pathways and Enzymes revisited

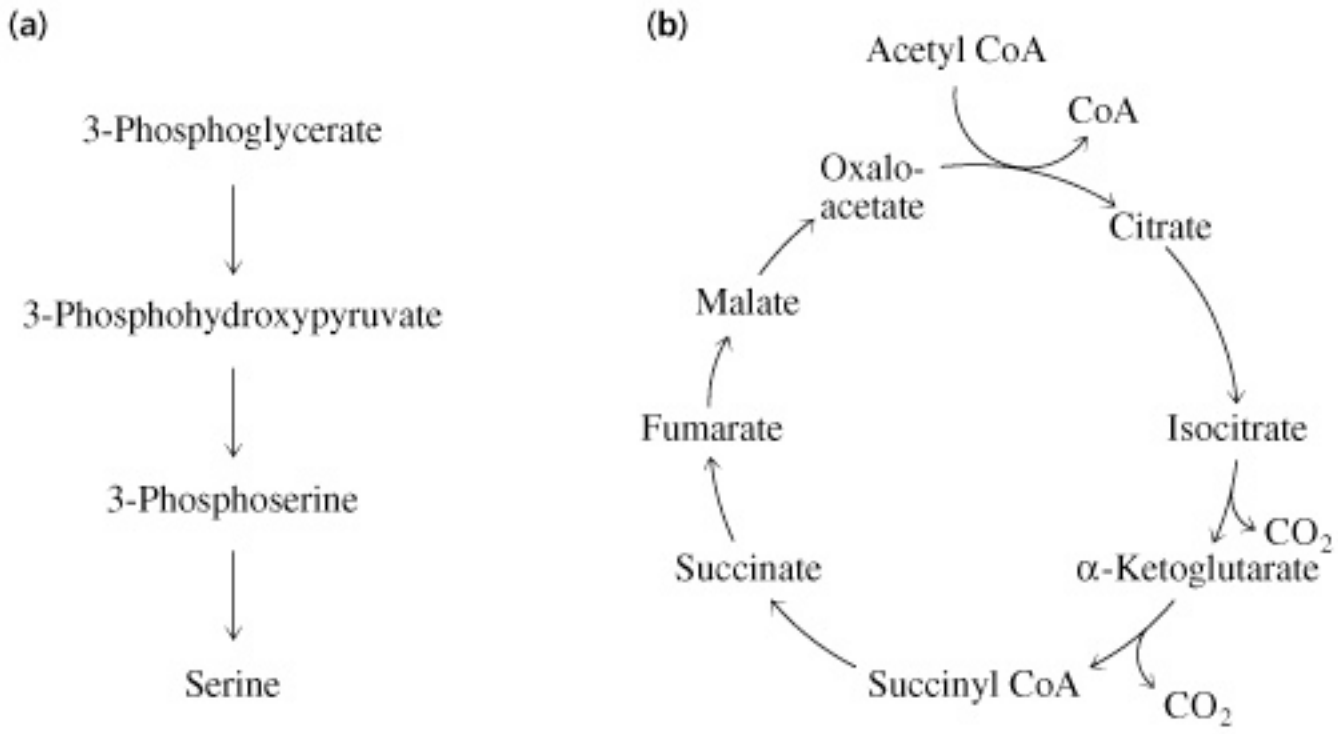
Metabolic Pathways

- ‘Metabolism’ termed by Schwann referring to chemical changes in cells
- Chemical changes occur in incremental steps that are enzyme driven



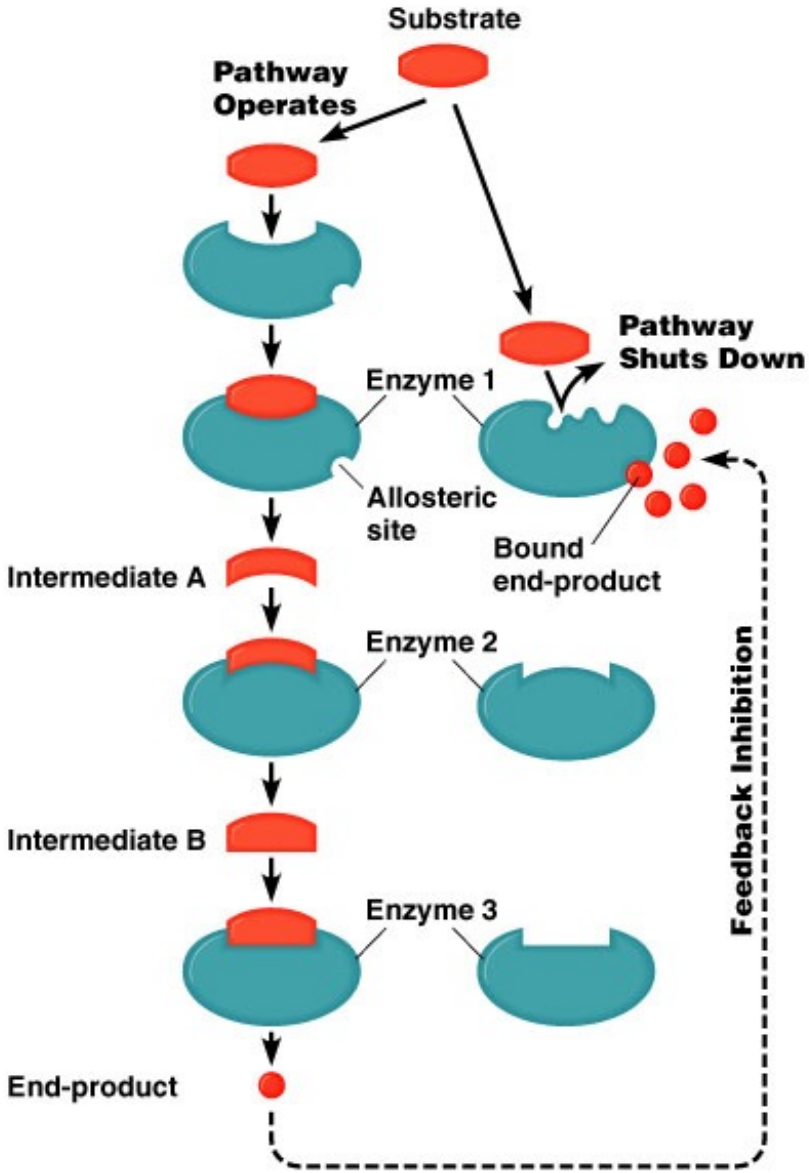
Pathways

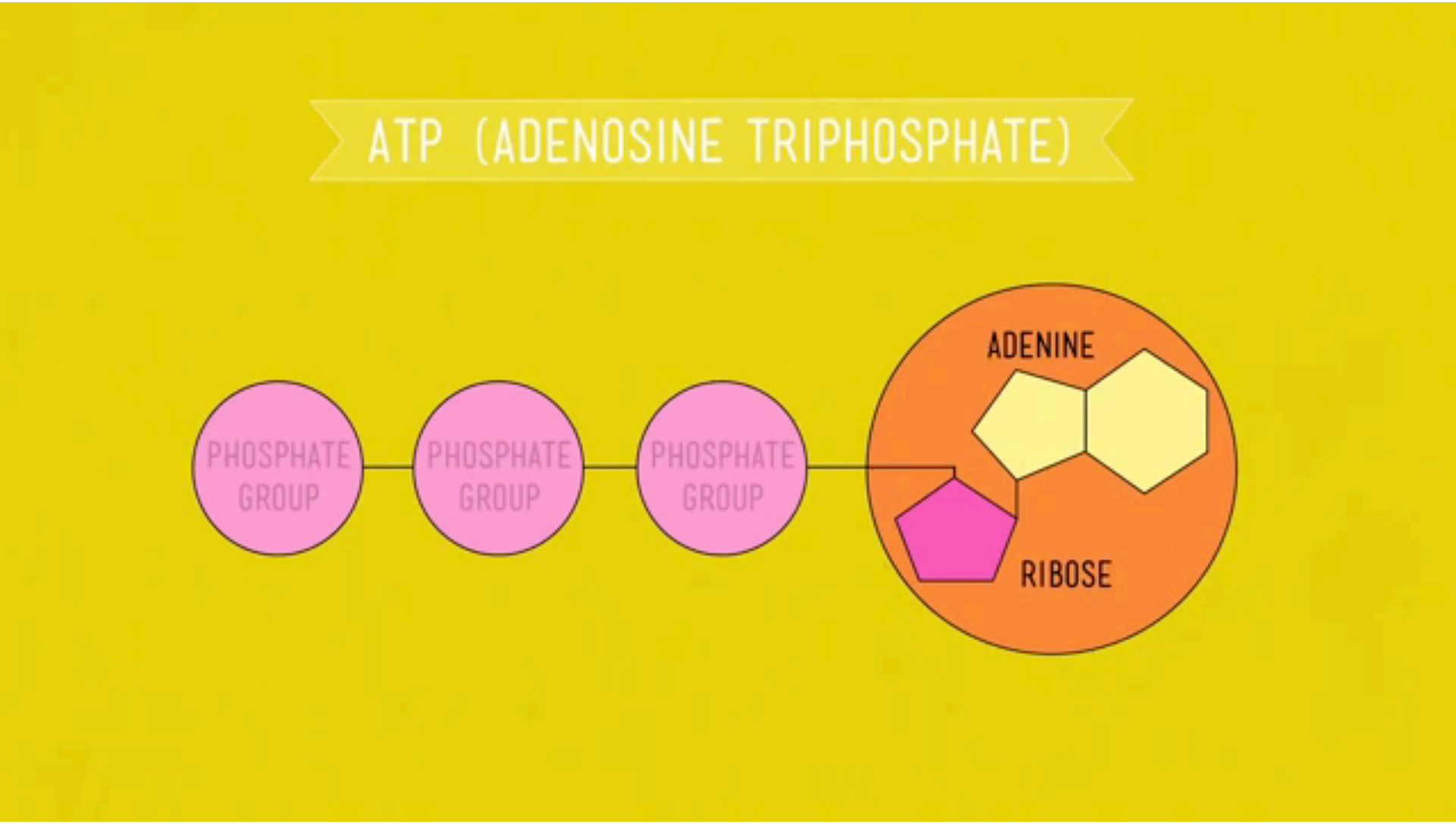
» Some are linear while other can be cycles



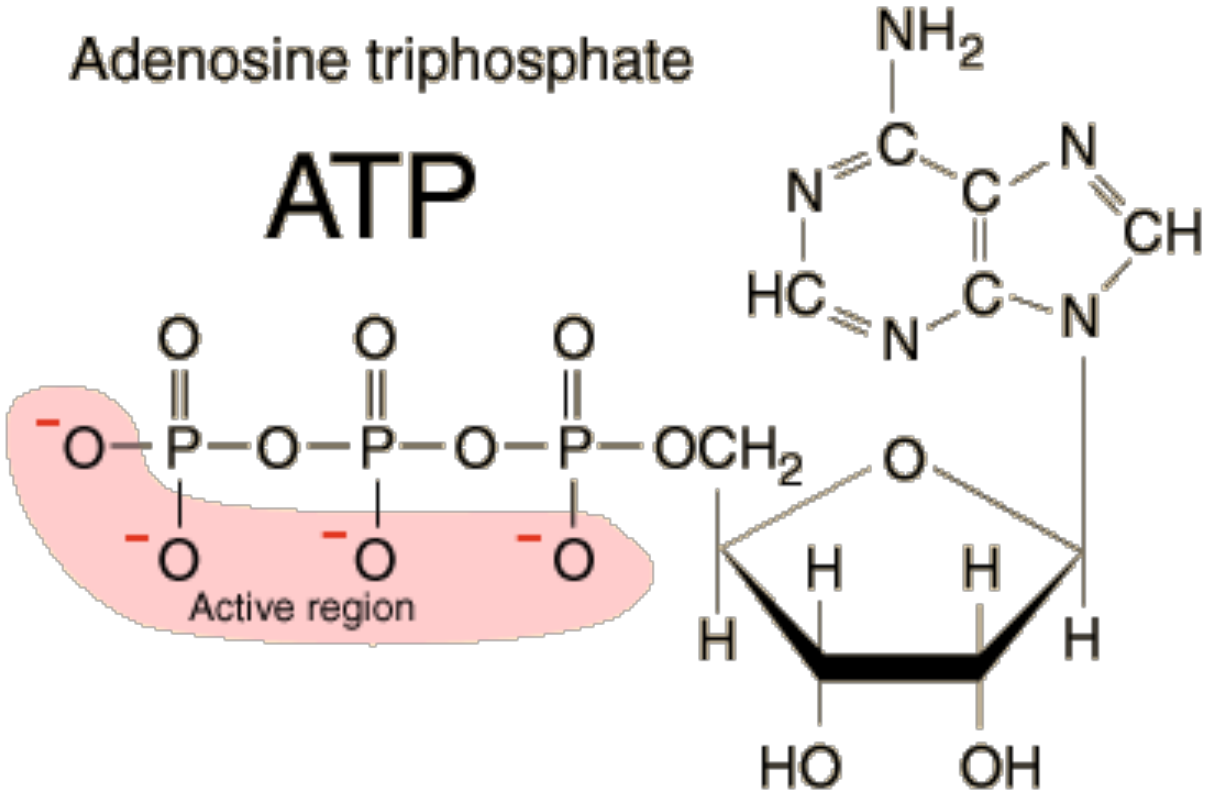
Pathways are regulated Feedback Inhibition

- often used to regulate multi-step metabolic pathways
- A product of a pathway acts as an allosteric inhibitor of the first enzyme of the pathway



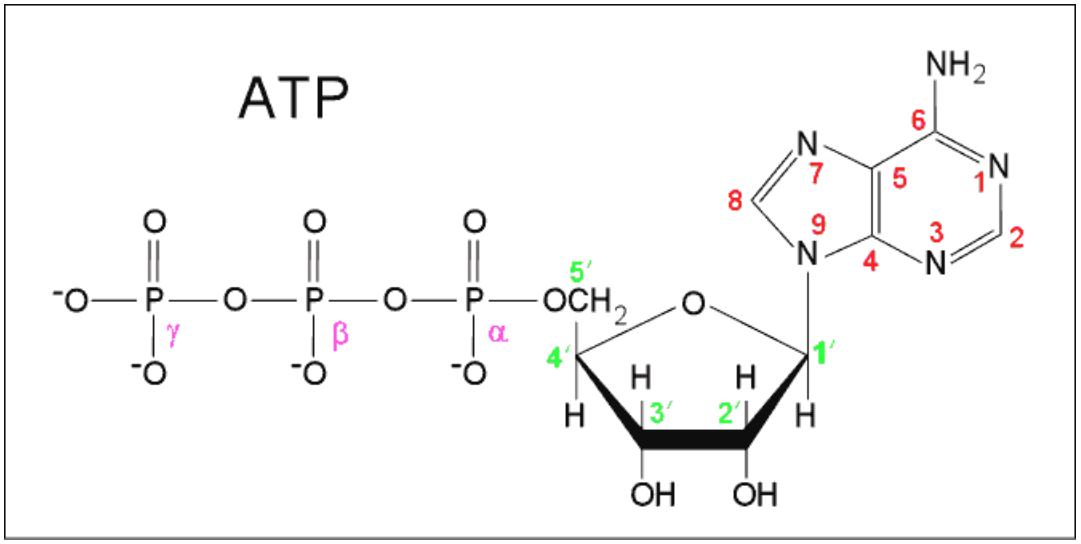

ATP (ADENOSINE TRIPHOSPHATE)
PHOSPHATE GROUP
PHOSPHATE GROUP
PHOSPHATE GROUP
ADENINE
RIBOSE

Structure of ATP



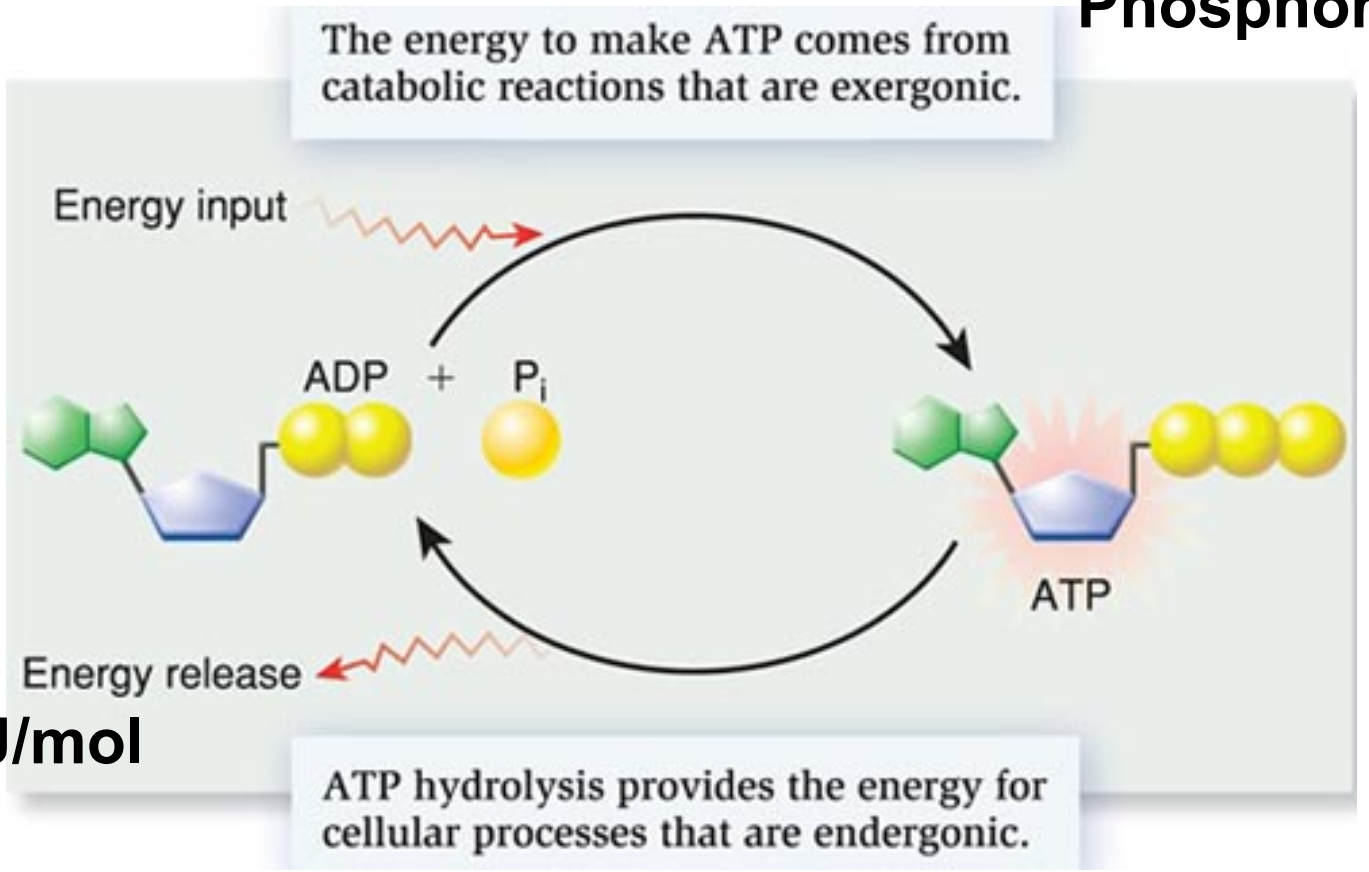
Adenosine Triphosphate

- All cells in every living organism use the same energy carrier (ATP) for almost all Energy-requiring actions.



ATP cycle

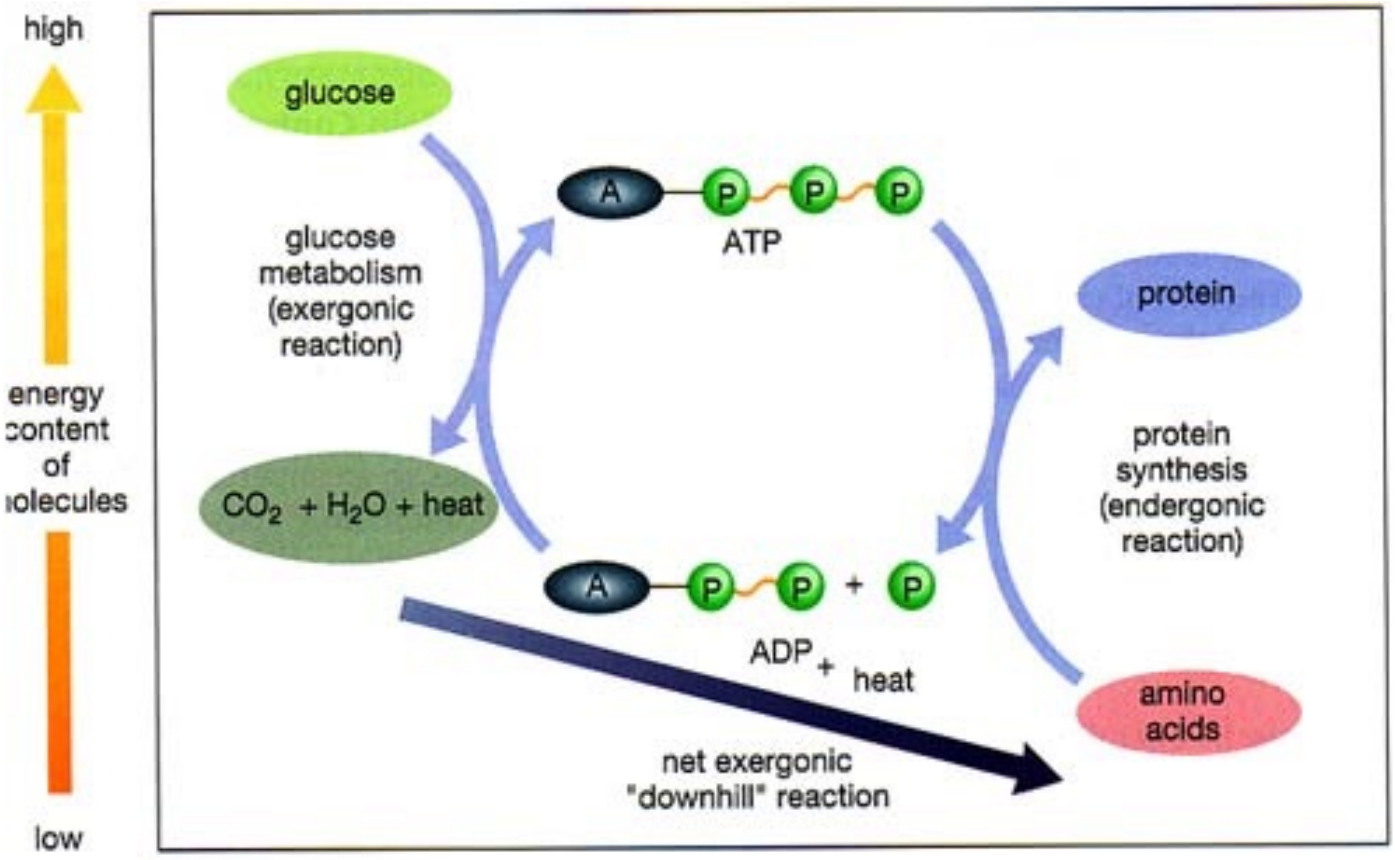
Phosphorylation



ΔE= 30kJ/mol

Hydrolysis

Energy Coupling



For reactions to work in cells, and exergonic reaction is required release energy to power an endergonic reaction. This is **COUPLING**.

Why do cells use ATP?

- Why not use other energy-rich molecules directly?

-manageable amount of Energy

-“universal” - is able to couple with many different endergonic reactions

-usable in single reaction (unlike heat that will affect multiple reactions at once)