Lecture 13

Chemolithotrophic Organisms (cont.)

Exist @ interface of aerobic & anaerobic organisms

- Sulfur-oxidizers: H_2S, S^o, $S_2O_3^{2-} \rightarrow SO_4^{2-}$ $/ O_2, NO_3^-$
- Iron-oxidizers: $Fe(II) \rightarrow Fe(III)$ $/ O_2, NO_3^-$
  - → Only efficient @ acidic pH
- Methane-oxidizers: $CH_4 \rightarrow CO_2$ $/ O_2$

  (O_2, NO_3^- : e^- acceptors)

  (Methanotrophs) obligate methane oxidizers

Biogeochemical Cycles

e^- tower = model of the biosphere

$$CO_2 + H_2O \underset{\text{heterotrophs}}{\overset{\text{plants}}{\rightleftharpoons}} CH_2O + O_2$$

Carbon dominates all other biogeochemical cycles

START →

Coordination of metabolic reactions

Regulation:

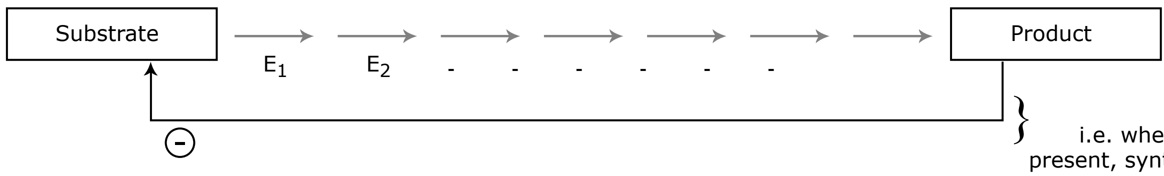
1. Enzyme activity
2. Enzyme level
3. Global control networks

1. Enzyme activity: controlled how?
   - o Specific proteases destroy enzymes (destruction)
   - o Activation: cleavage of inactive precursor
   - o Modification:
     - Covalent modification (example phosphorylation)
     - Reversible modification

   → Effector molecule (product) must bind possibly in addition to substrate.

   Allosteric enzymes → enzyme inhibition

   → Modified by feedback inhibition



i.e. when product is present, synthesis of product will not continue because product inhibits synthesis of more because no need for more

→ Typically at 1st enzyme in pathway

<u>Control of central metabolism</u>

- o Intermediates are allosteric <u>effectors</u>
  - → Example: phosphoenolpyruvate is allosteric effector for phosphofructokinase
- o ATP, NADH, NADPH – allosteric effectors because amounts present indicate cell energy status

Cells energy status:

$$\text{energy charge (EC)} = \frac{[ATP] + \frac{[ADP]}{2}}{[ATP] + [ADP] + [AMP]}$$ in cells, ~ 0.87-0.95

Generalization: if energy charge is high, cell will divert pathway towards more biosynthesis. If energy charge is low, cell will divert pathway towards fueling.

$$\text{Catabolic Reduction Charge} = \frac{[NADH]}{[NADH] + [NAD^+]}$$ ~ 0.3-07 (range)

$$\text{Anabolic Reduction Charge} = \frac{[NADPH]}{[NADPH] + [NADP^+]}$$ ~ 10 fold higher than CRC