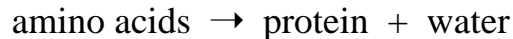


# Biochemistry: The Chemistry of Living Things & Viruses

What must living things do to stay alive?

1. Make catalysts that enhance the rates of “favorable” processes. (This includes both chemical and physical processes.) *Example: To digest lactose, we need an enzyme that breaks lactose into glucose & galactose.*
2. Extract chemical energy from the surroundings to drive inherently unfavorable processes toward product formation. Actually done by running a modified process that is thermodynamically favorable.

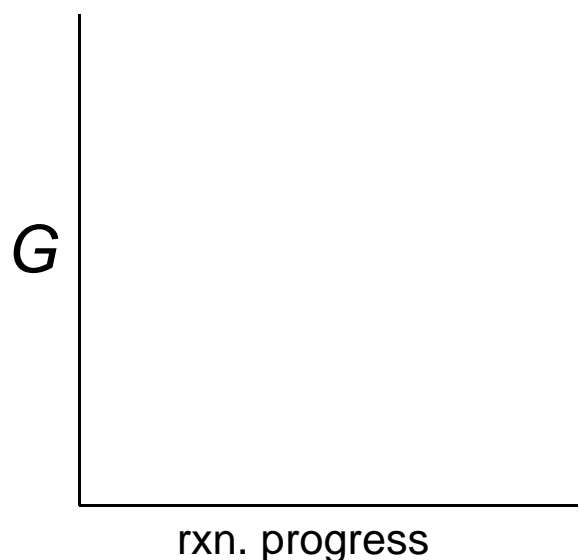
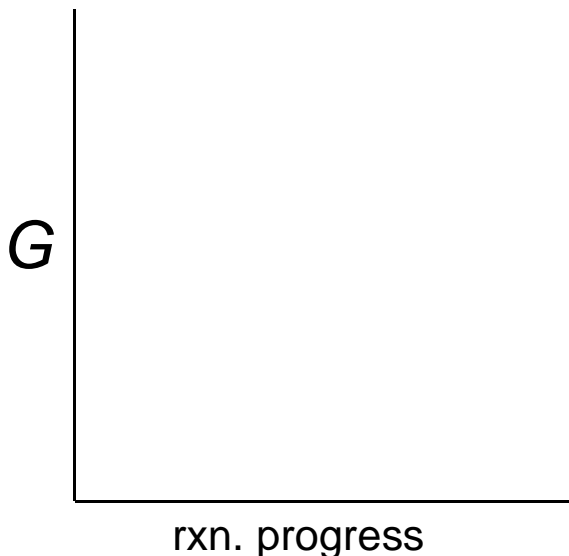
*Example: synthesis of macromolecules (proteins, nucleic acids), proteins (see next p):*  
a) *How would this look starting from “free” amino acids?*



b) *How do we actually make our proteins (not from “free” amino acids)?*



3. Extract materials from the environment that can be used to build catalysts (see above) and genetic material (see below).



4. Store (& express) information (genetic material) to run processes described in #1 & 2 above in a form with *appropriate* stability. *Appropriate*:
  - a) stable enough to pass through generations (example: avoid cancer)
  - b) pliable enough to change with environment (medical example: emergence of antibiotic resistant bacteria)
  
5. Requirement for boundaries (membranes)
  - a) Concentration effects on rates. Membranes let you concentrate things.
  - b) Defense issues. View membranes like walls of a fort. Troy & Horse?
  - c) Boundaries within boundaries?
  
6. Many specialty functions
  - a) environmental sensors (example: \_\_\_\_\_)
  - b) communication (example: \_\_\_\_\_)
  - c) attack and defense (example: \_\_\_\_\_)
  - d) mobility (example: \_\_\_\_\_)
  - e) light emission (example: \_\_\_\_\_)
  - f) others
  
7. Four main categories of biomolecules
  - a) protein
  - b) carbohydrate
  - c) lipid
  - d) nucleic acid