Metabolism: Anabolism and Catabolism

Foundation block

Objectives:

- **Understand the concept of metabolic pathway**
- **Identify types & characters of metabolic pathways- anabolic and catabolic**
- **Identify ATP as the energy currency of cells**

color index:

- RED=important notes
- ORANGE=further explanation

Metabolsim: All the chemical reactions taking place inside a cell.

- energy consuming (anabolic) pathways

  Endergonic function

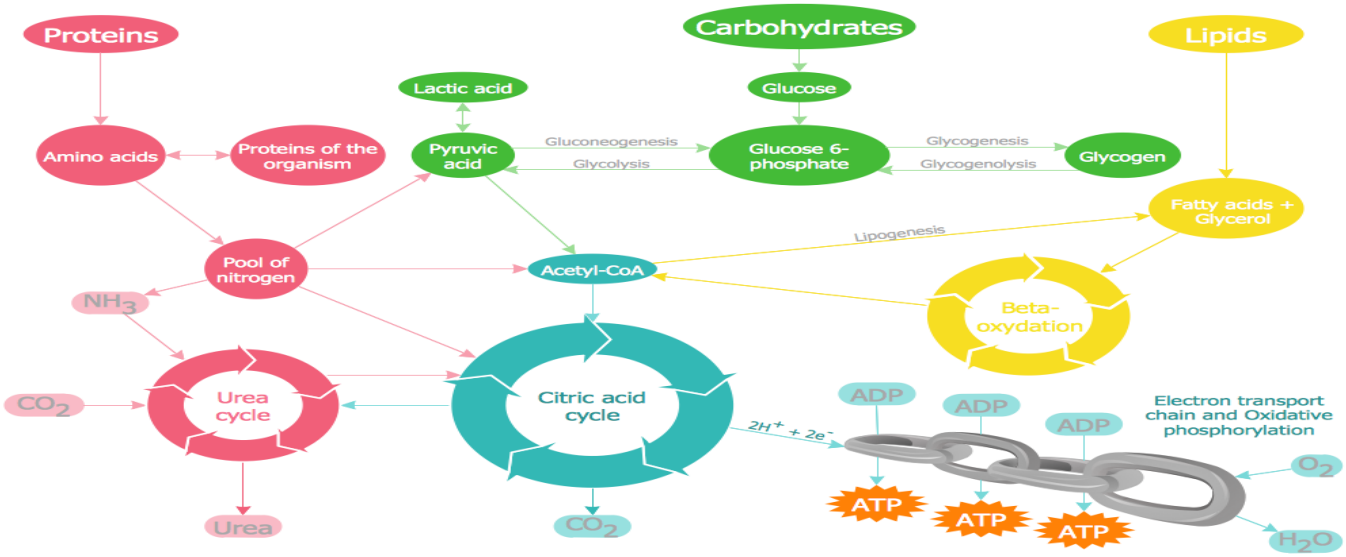
- energy producing (catabolic) pathways

  Exergonic function

• METABOLIC PATHWAY:

- Metabolic pathway is a series of chemical reactions "enzymes catalyze these reactions" for example: Gglycolysis is a metabolic pathway.
- Note that the product of the first reaction becomes subatrate for the seconde reaction.
- Sometimes we have different pathways intersect forming an intergrated and purposfule network of chemical reactions we call it

(Metabolic Map)



Metabolic Pathways

MAINLY

Catabolism

Energy-Yielding Nutrients → Energy-Poor Products

Anabolism

Precursor Molecules → Complex Molecules

Cycles

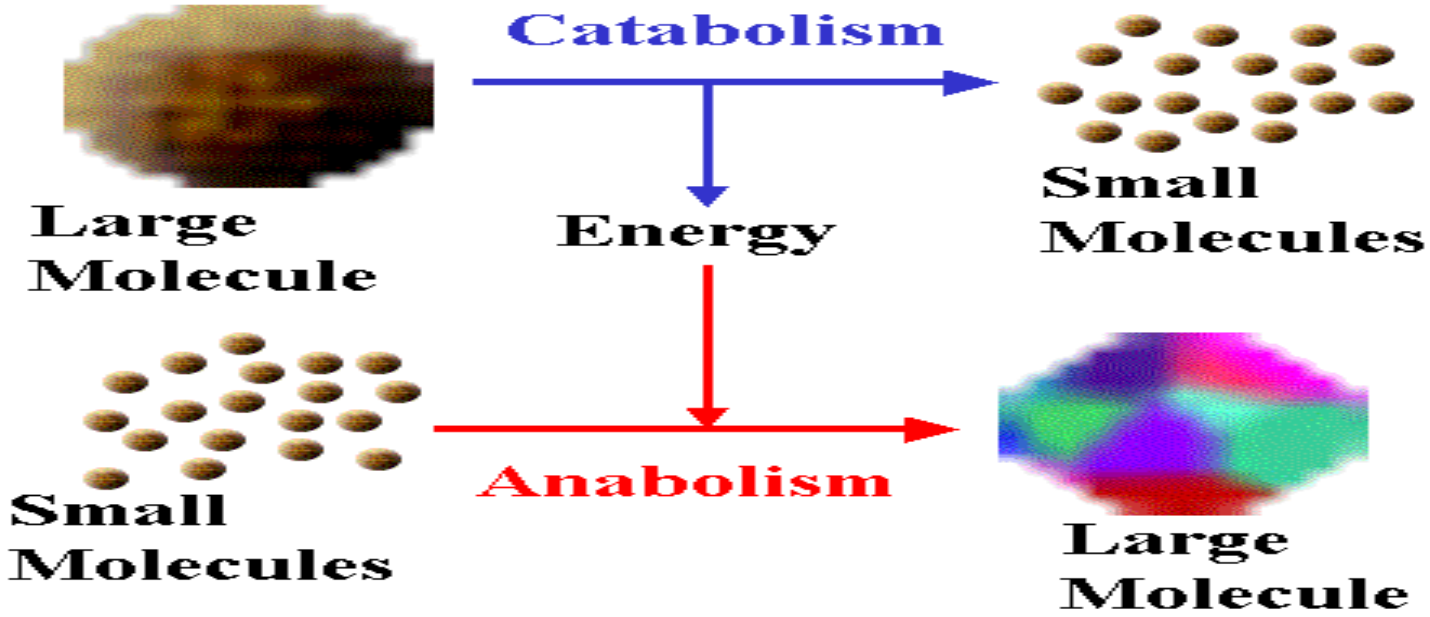
Pathways that regenerate a component

Amphibolic

Amphi=Dual 'ثنائي'

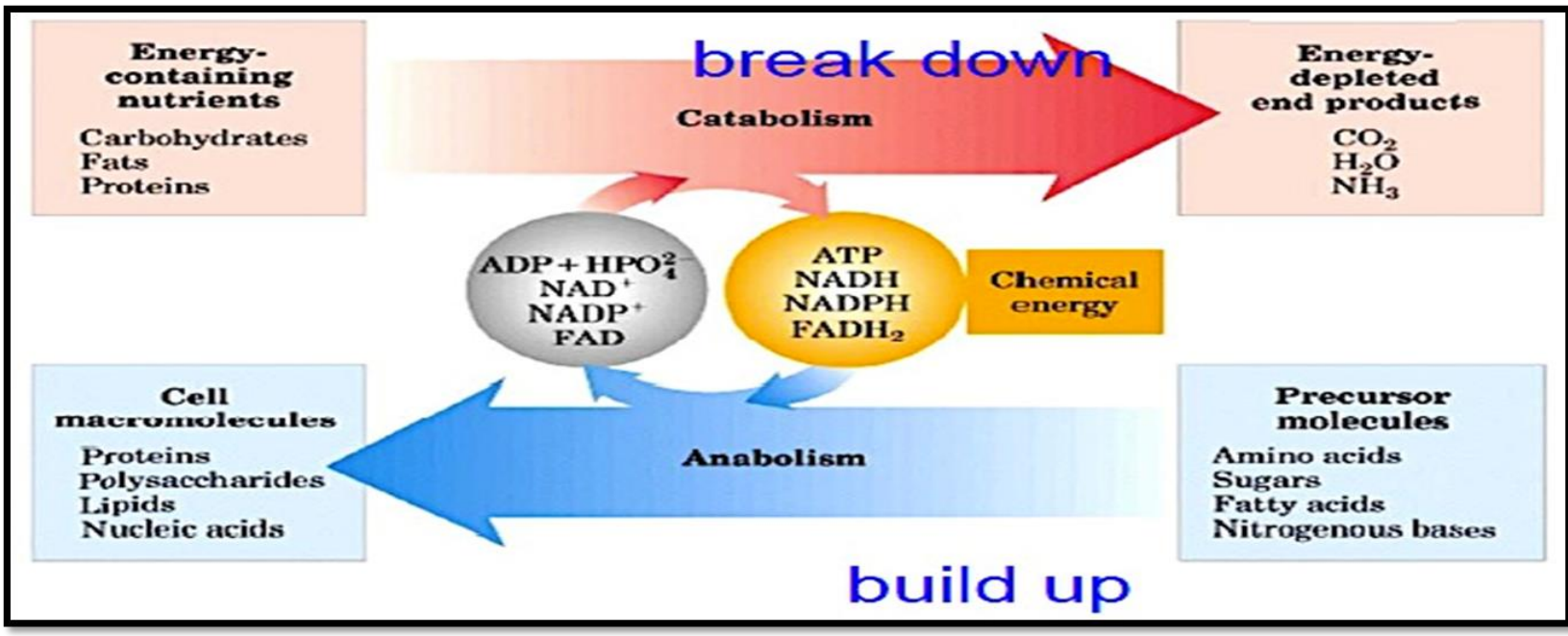
E.g.: -Krebs Cycle (mainly CATABOLIC cycle with ANABOLIC features).

-Part of it used for synthesis of glucose from amino acids.



Catabolism Vs. Anabolism

Anabolism	Catabolism
◆Simple to complex molecules	◆Complex to simple molecules
◆ENDERGONIC (absorption of energy)	◆EXERGONIC (release of energy)
◆Involves REDUCTION	◆Involves OXIDATION
◆Requires NADPH	◆Require NAD^+
◆DIVERGENT process	◆CONVERGENT process

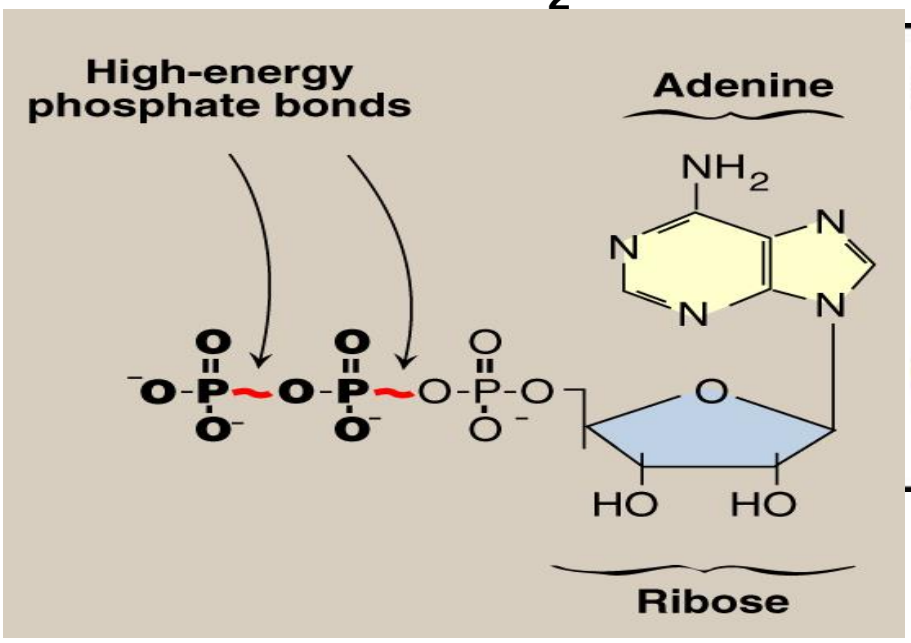


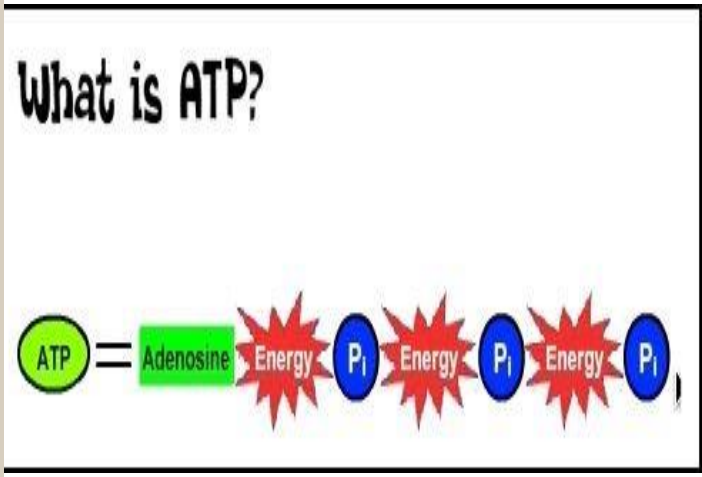
energy currency:ATP

- **ATP-ADP cycle** is the fundamental mode of energy exchange in biological systems.

when H_2O is added to ATP in a process called (hydrolysis) the bound between 2 phosphate group will break realising one phosphate molecule turning it to ADP.

$$ATP + H_2O \longrightarrow ADP + P_i$$





Δ G° -7.3 kcal/mol/bond

NOTE: Electron transport and ATP synthesis are tightly coupled processes

- oxidation/reduction

Oxidation:

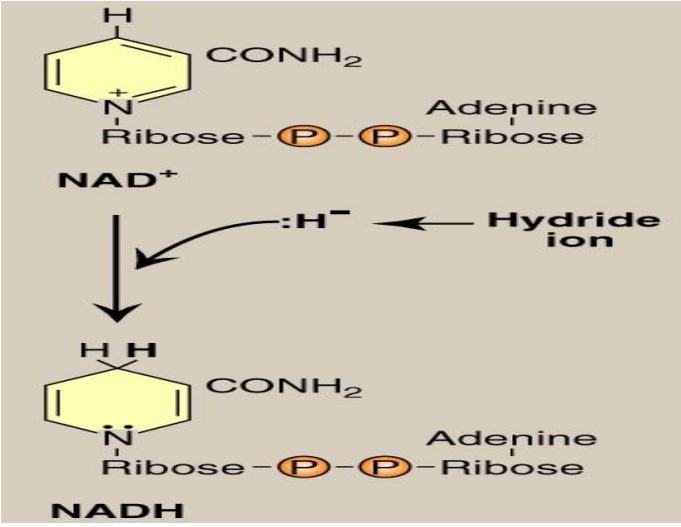
Loss of hydrogen

Loss of electrons

Reduction:

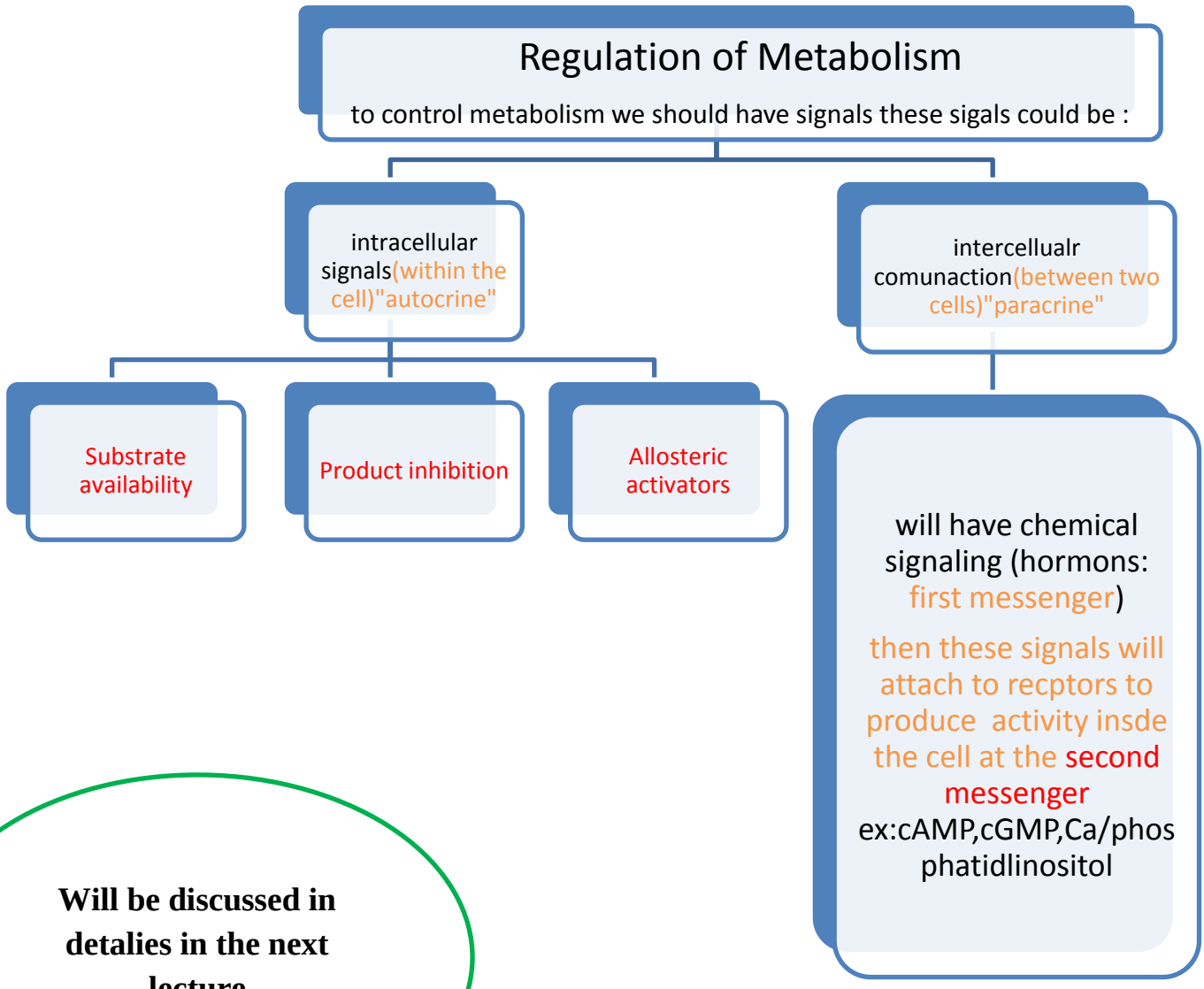
Gain of hydrogen

Gain of electrons



* when NAD^+ is reduced (gains hydrogen) it'll become NADH

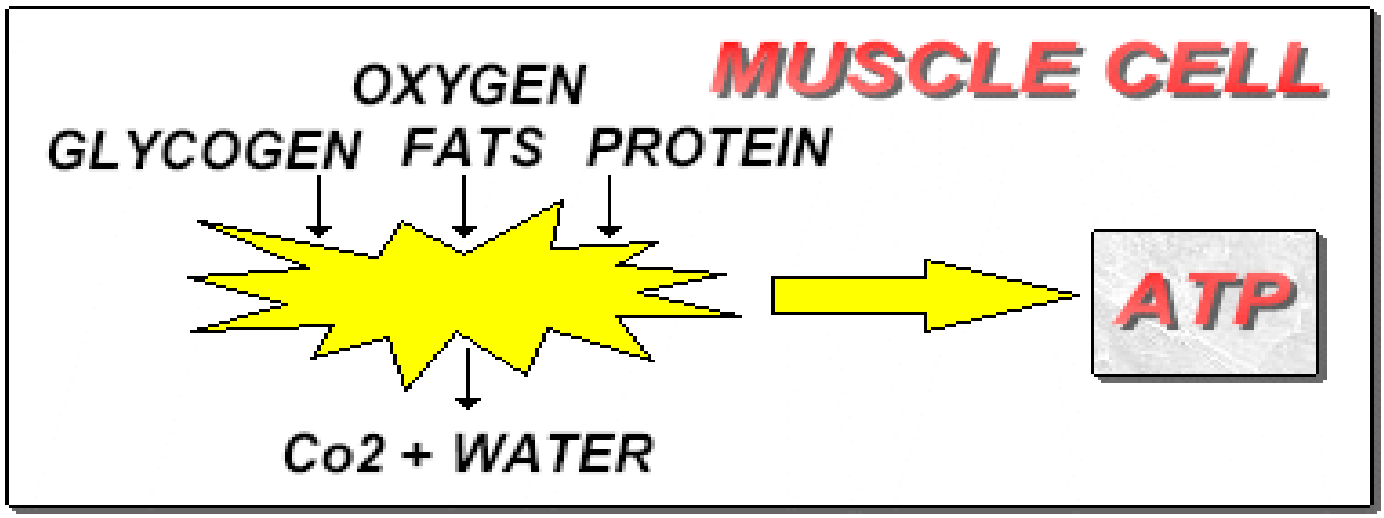
Loss of electrons is oxidation
Gain of electrons is reduction



Will be discussed in detalies in the next lecture

Metabolic Fuel

- they are substances used for energy production.carbohydrates and lipid (mainly),proteins (little extent)
- carbohydrates (broken down to glucose) and it's the major metabolic fuel.
- lipids (broken down to fatty acids)
- protein (broken down to amino acids) least used.



We can conclude that: Metabolic pathways are tightly regulated and highly integrated.

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