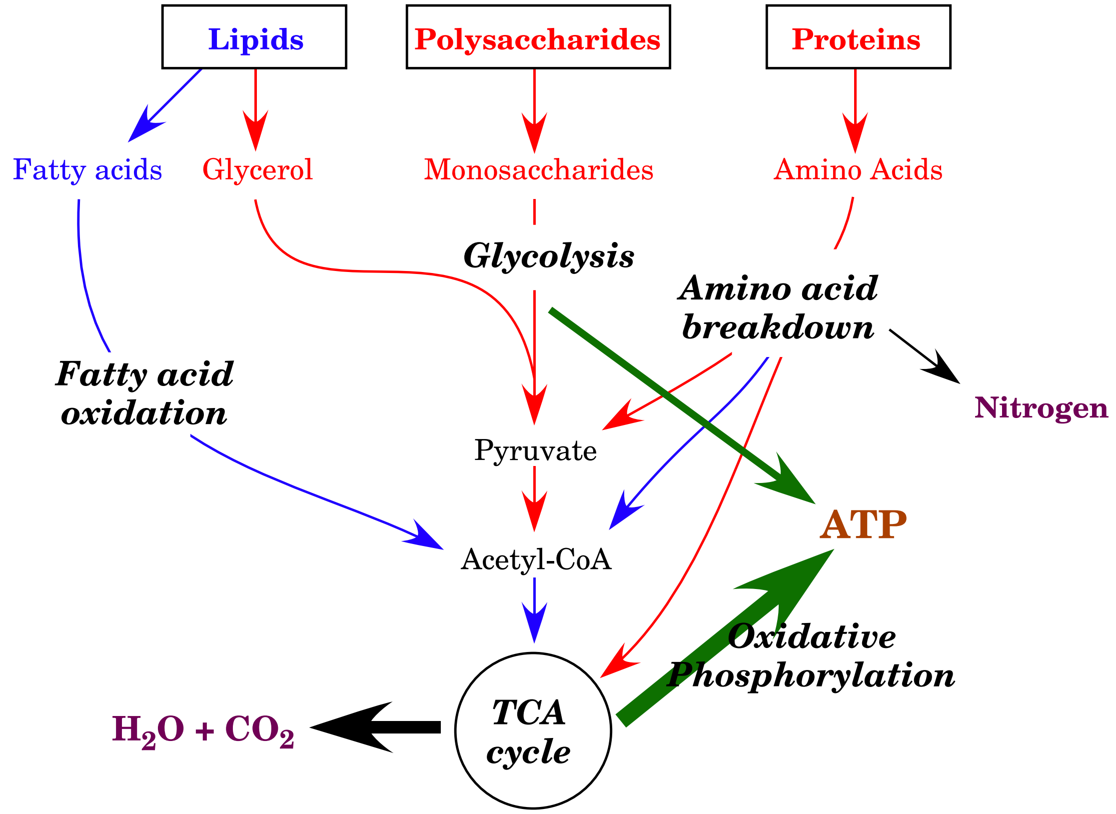
## Catabolic Processes



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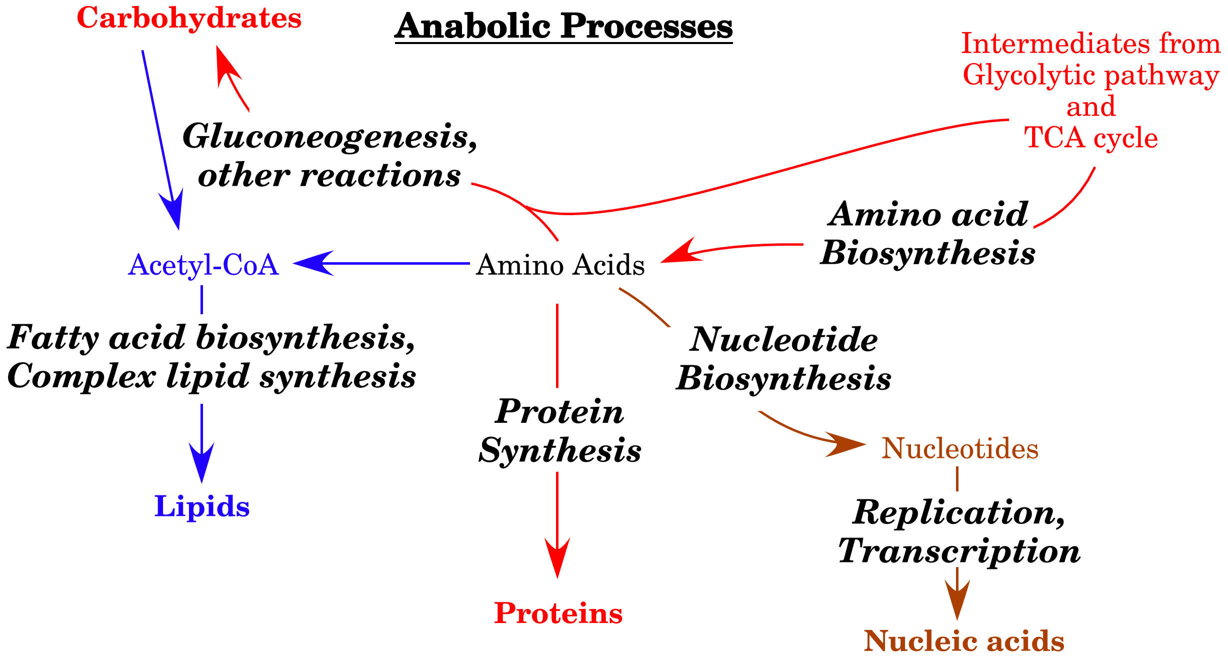
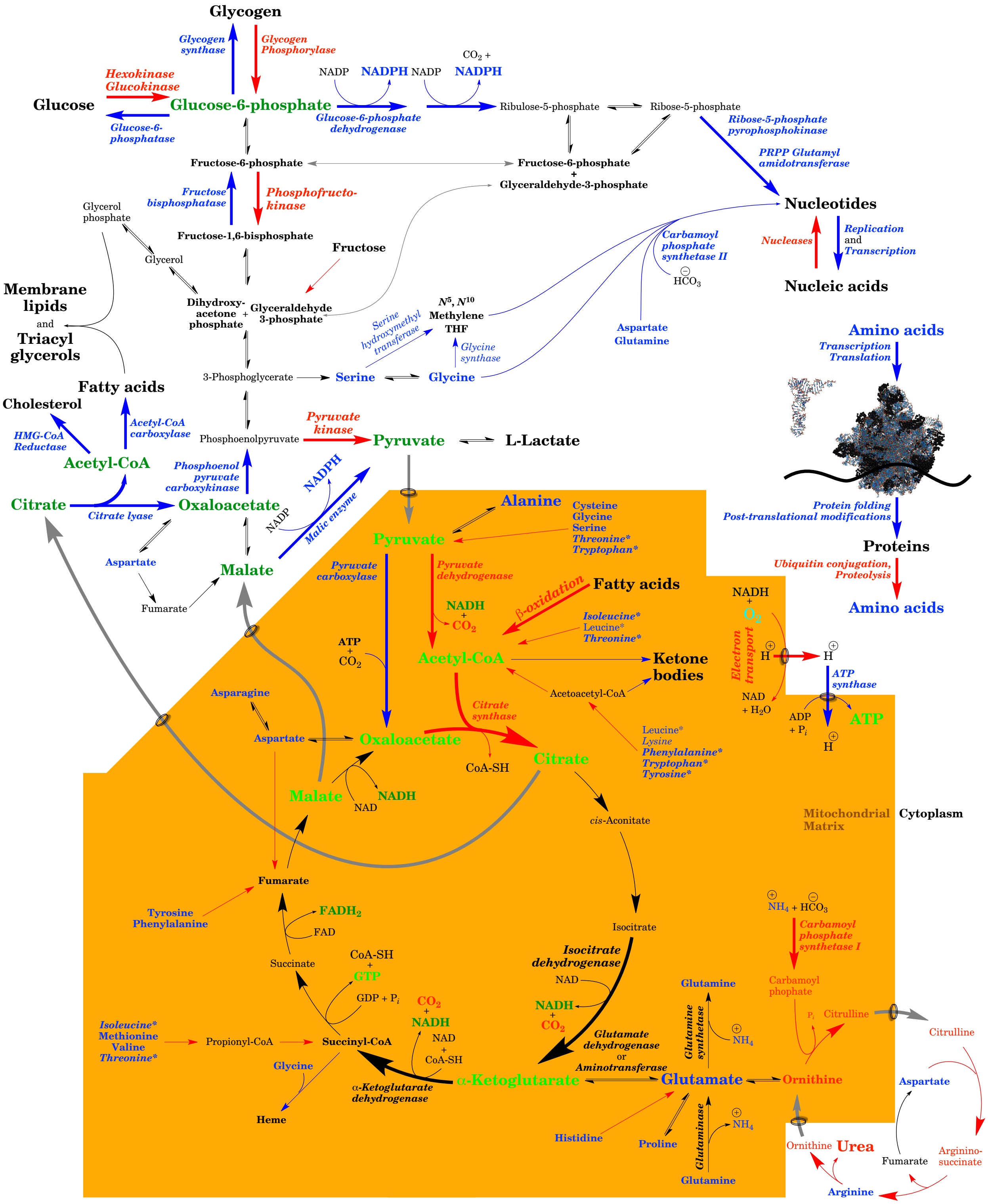
## Anabolic Processes



# Major Metabolic Pathways

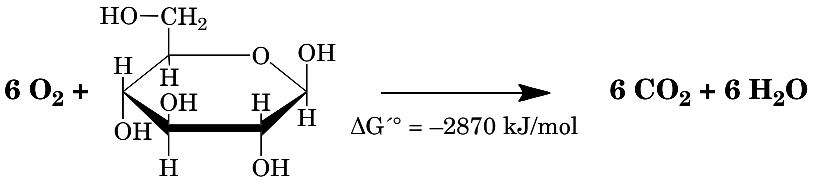


## Organisms

### Equilibrium

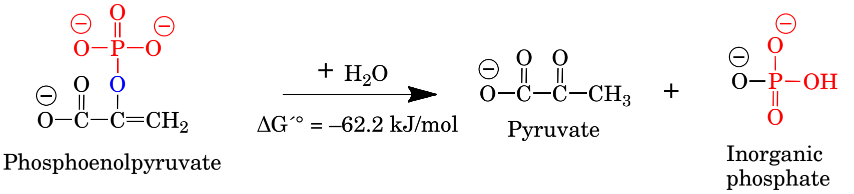
### Homeostasis

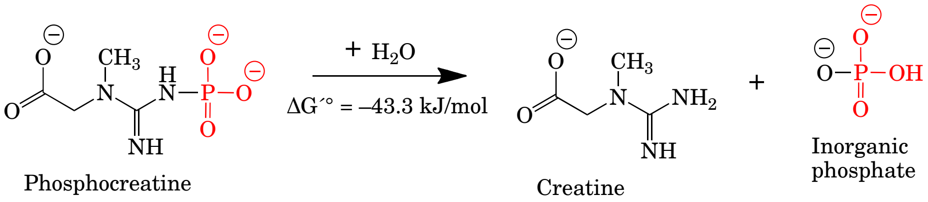
## Bioenergetics

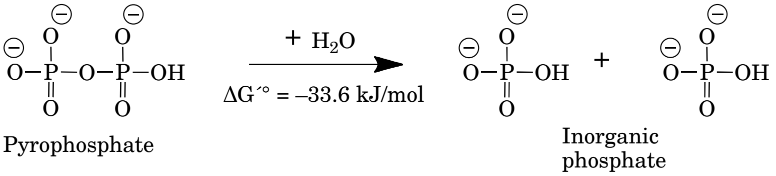


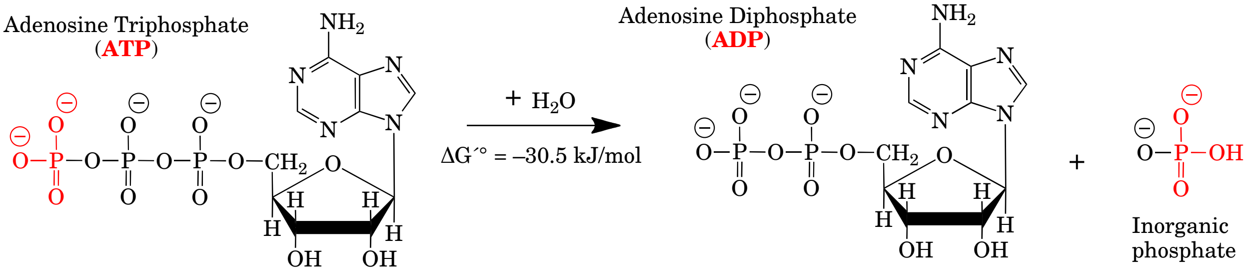
Glucose

## Energetic Molecules

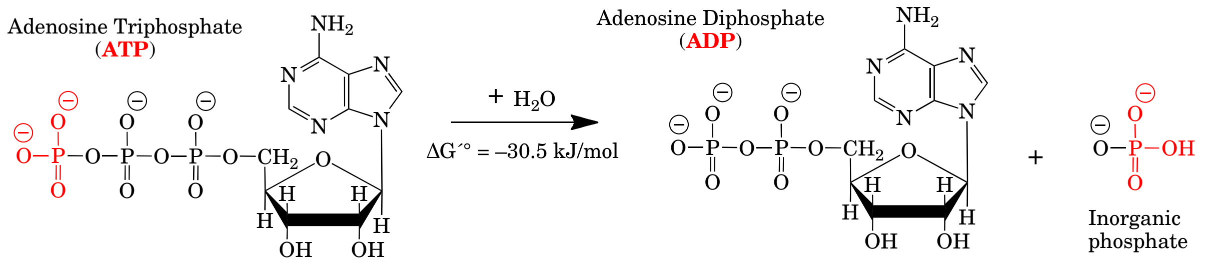


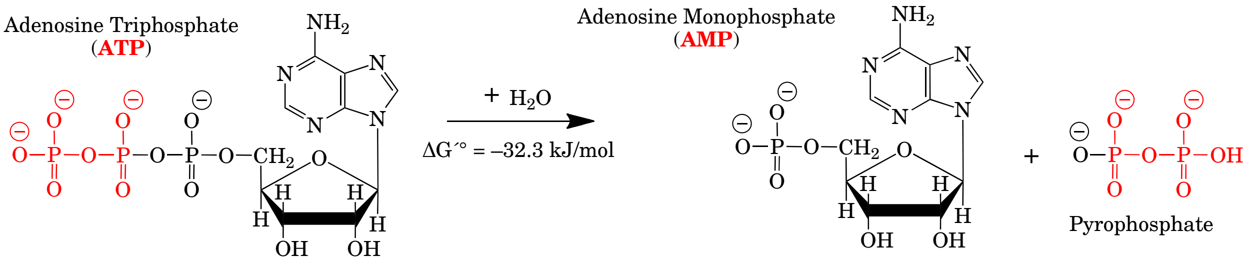


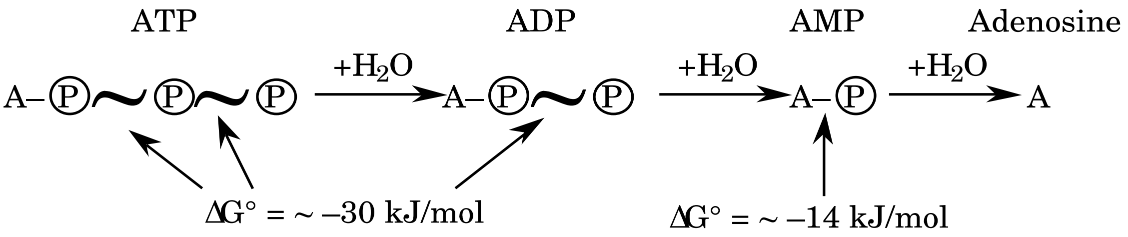




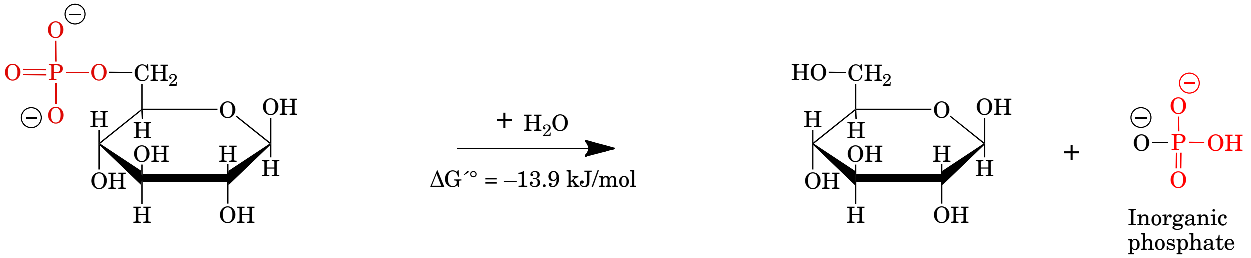
# ATP and "High Energy Phosphate"



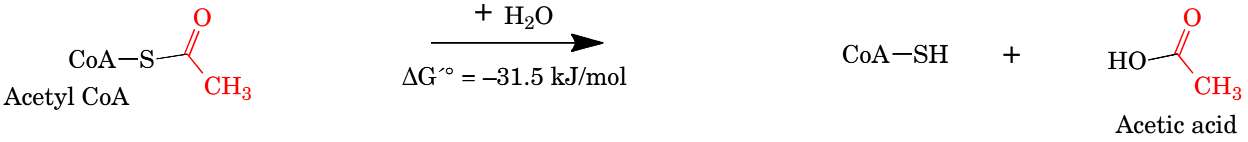




# "Low Energy Phosphate"



## Other Energetic Molecules



$$\text{NADH} + {}^{1}\!/_{2}\,\text{O}_2 \xrightarrow[\Delta G'^{\circ} = -220\ \text{kJ/mol}]{} \text{NAD} + \text{H}_2\text{O}$$

## Redox Processes

$$\Delta G'^{\circ} = -n\mathscr{F}\Delta E'^{\circ}$$

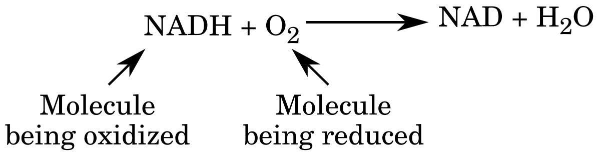
$n$ = number of electrons

$\mathscr{F}$ = Faraday constant = (96485 Joules/(V•mol)

$\Delta E^{\circ\prime}$ = Reduction potential difference

Nernst equation

$$\Delta E \;=\; \Delta E'^{\circ} - \frac{\text{RT}}{n\mathscr{F}}\ln\left(\frac{[\text{Products}]}{[\text{Reactants}]}\right)$$



$E^{\circ\prime}$ (Volts)

$\text{NAD} + 2\,\text{e}^- \longrightarrow \text{NADH}$ –0.315 V

${}^{1}\!/_{2}\,\text{O}_2 + 2\,\text{e}^- \longrightarrow \text{H}_2\text{O}$ +0.815 V

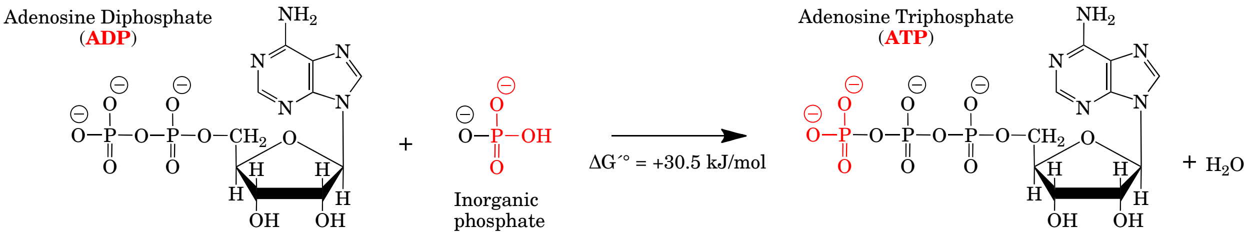
$$\Delta G'^{\circ} = -n\mathscr{F}\Delta E'^{\circ} = -n\mathscr{F}(E'^{\circ}_{\text{reduced}} - E'^{\circ}_{\text{oxidized}}) = -(2)(96485)[0.815 - (-0.315)] = -218.1\ \text{kJ/mol}$$

## Membrane Energetics

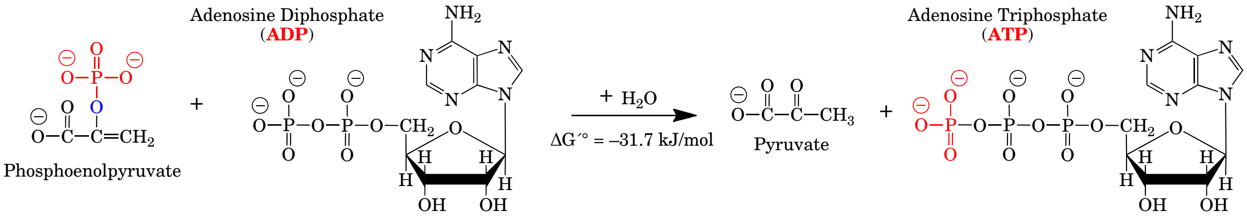
For **entering** a compartment

$$\Delta G = RT\ln\left(\frac{C_{in}}{C_{out}}\right) + Z\mathscr{F}\Delta\Psi$$

## Oxidative Phosphorylation and Photo-phosphorylation



## Substrate-Level Phosphorylation



## ATP Buffers