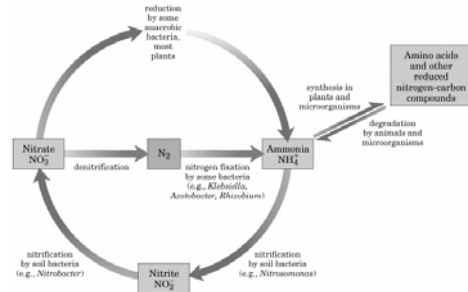


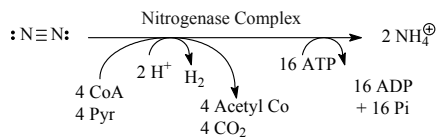
Anabolism of Nitrogen Compounds

Nitrogen Cycle

Fig. 22-1 Lehninger POB 3rd Ed.



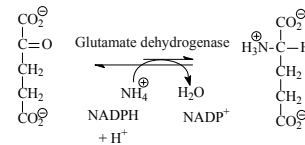
Nitrogenase is a Very Important Enzyme



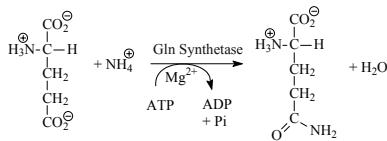
- Fe:S complexes as seen before
- Mo:Fe complexes
- Mg²⁺ cofactor
- doesn't occur in aerobic environment: leghemoglobin

Movement of NH₄⁺

- Just like catabolism, distribution is through Glu and Gln
- Glu not synthesized *de novo* in mammals, instead αKG is aminated *via* glutamate dehydrogenase, a mitochondrial enzyme.



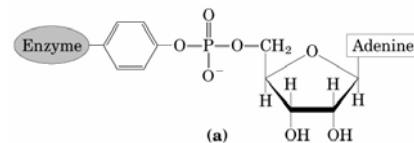
Glutamine Synthetase is Control Point for Nitrogen Anabolism



Heavily regulated: allosteric inhibition by carbamoyl phosphate, Trp, AMP, CTP, His, Gly, Ala, glucosamine-6-phosphate

2nd Mechanism of Glutamine Synthetase Regulation Unique: AMP Attached to Tyr

Fig. 22-7(a) Lehninger POB 3rd Ed.



- Adenylylated form is inactive form
- Cascade leads to adenylation as shown in 22-7(b)

Essential Amino Acids

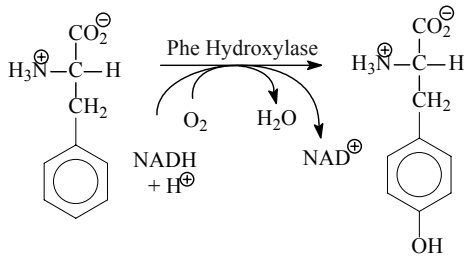
- PVT TIM HALL

Number of Enzymes Required to Synthesize Amino Acids

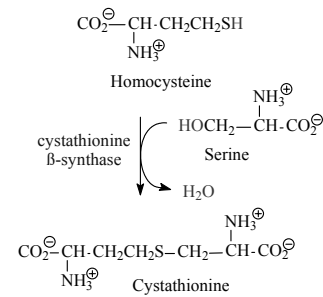
Table 30-2, Harper's ROB, 24th Ed.

Essential	Nonessential
Phe 10	Ala 1
Val 1 (7 shared)	Asp 1
Trp 5 (8 shared)	Asn 1
Thr 6	Glu 1
Ile 8 (6 shared)	Gln 1
Met 5 (4 shared)	Pro 3
His 6	Ser 3
Arg 7	Gly 1
Lys 8	Cys 2
<u>Leu 3 (7 shared)</u>	<u>Tyr 1</u>
Total 59	Total 15

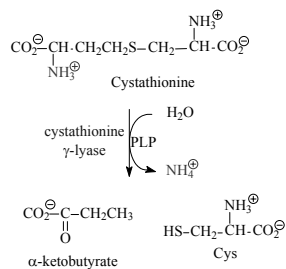
Semiessential Amino Acid



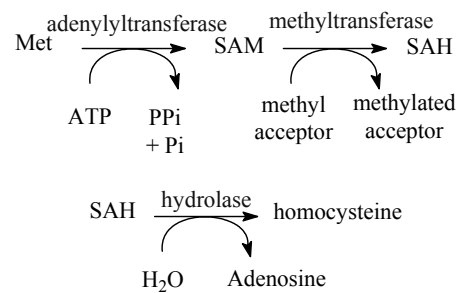
Cys Synthesis

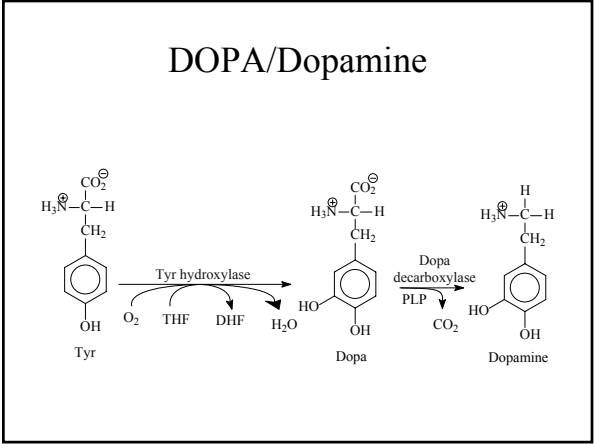
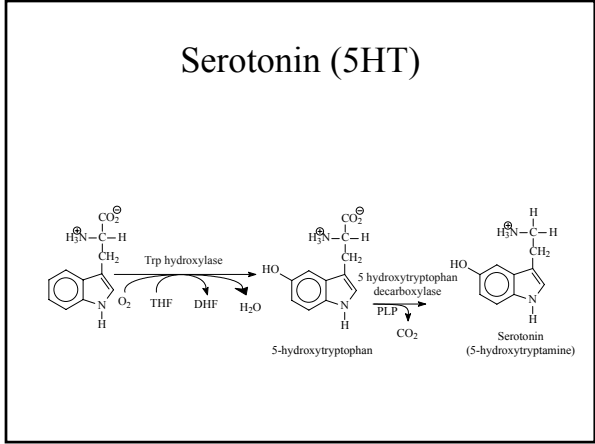
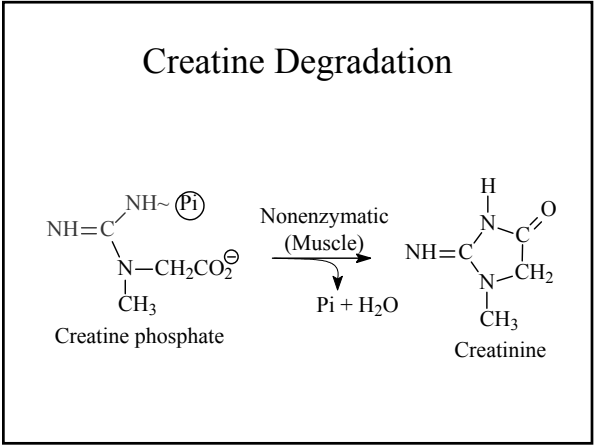
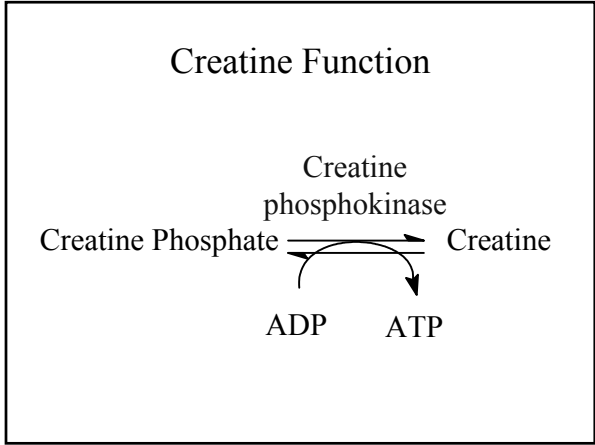
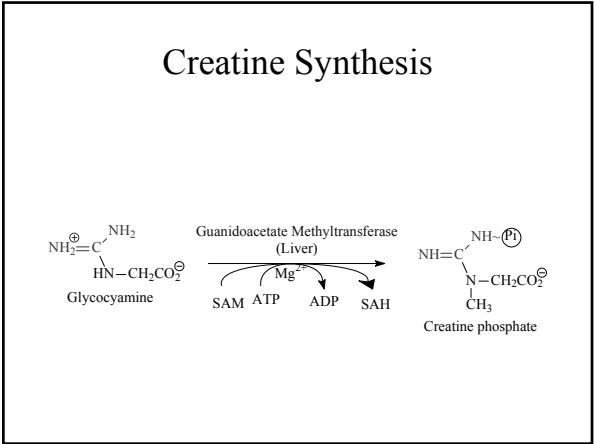
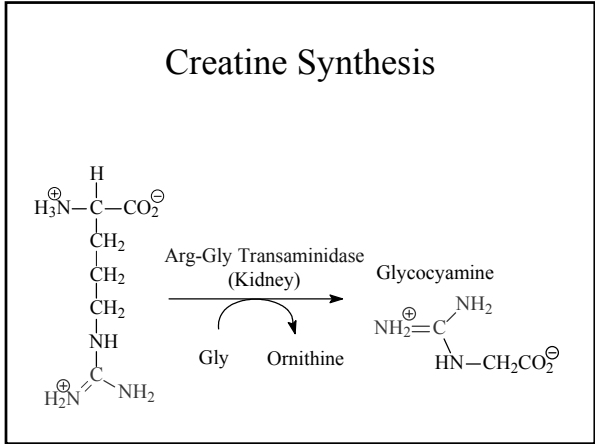


Cys Synthesis

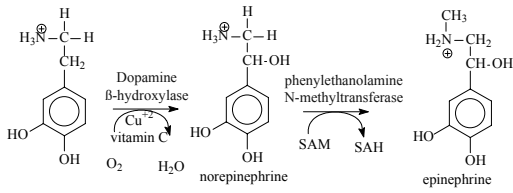


Cys Synthesis Homocysteine Generation

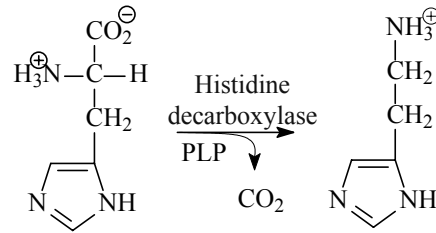




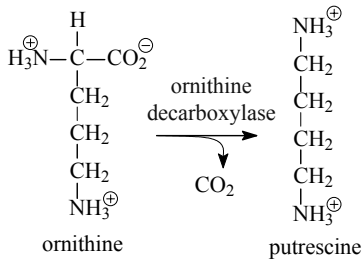
Epinephrine



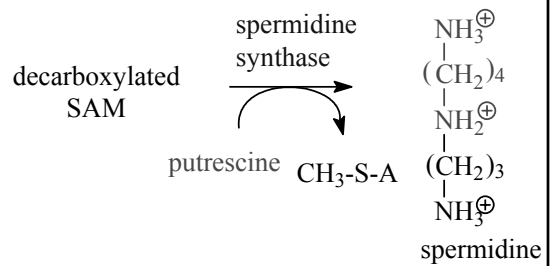
Histamine



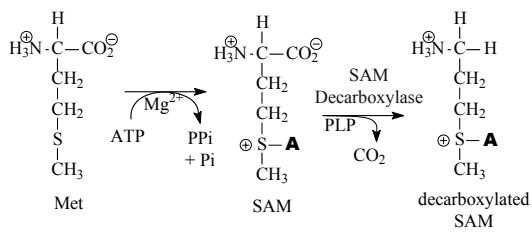
Polyamines



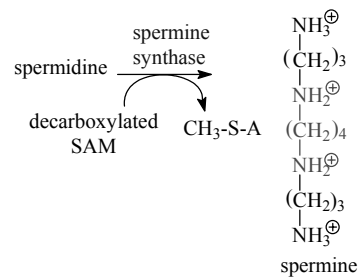
Polyamines



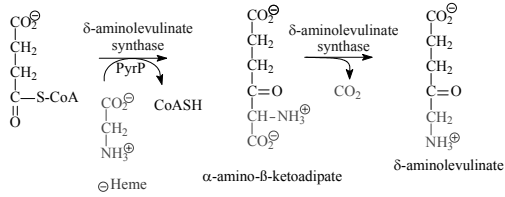
Polyamines



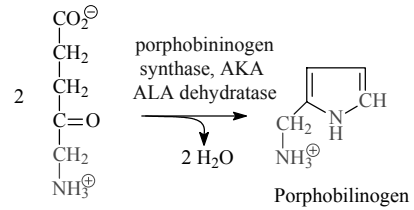
Polyamines



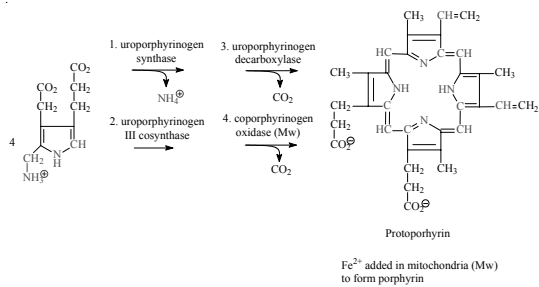
Heme Metabolism (Liver Mitochondria)



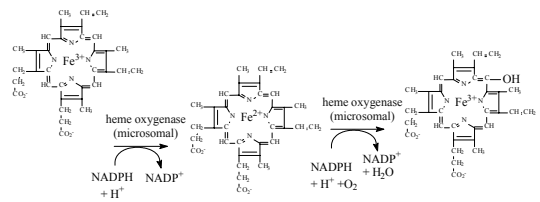
Heme Metabolism (Liver Cytoplasm)



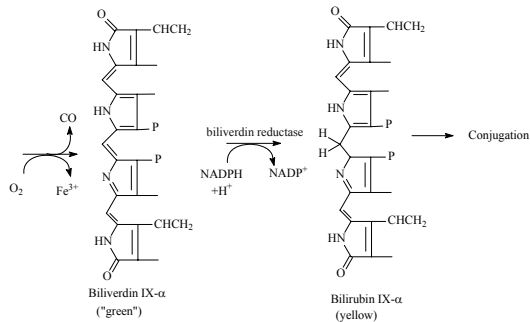
Heme Metabolism



Heme Metabolism



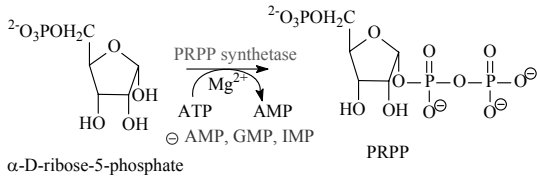
Heme Metabolism



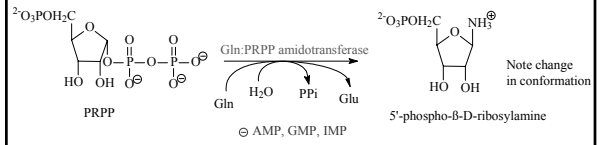
Conjugation

- Bilirubin diglucuronide
 - Glucuronic acid
 - Added in open chain form
 - Added to propyl groups
 - Increases water solubility

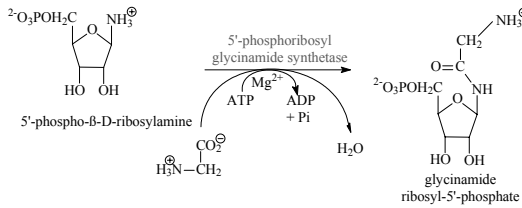
De novo Purine Synthesis



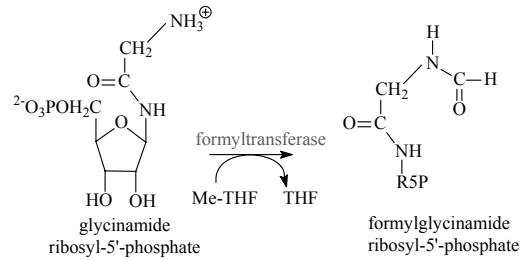
De novo Purine Synthesis



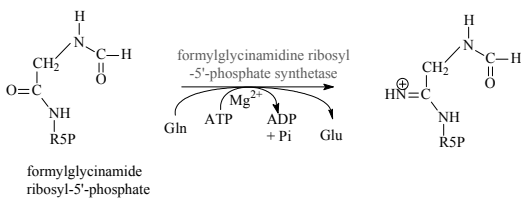
De novo Purine Synthesis



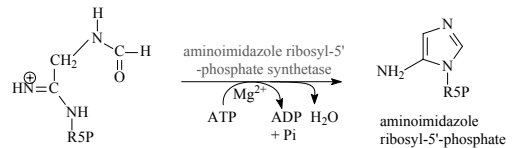
De novo Purine Synthesis



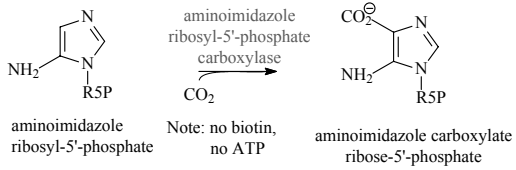
De novo Purine Synthesis



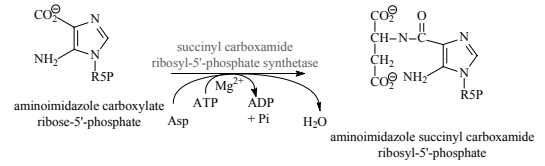
De novo Purine Synthesis



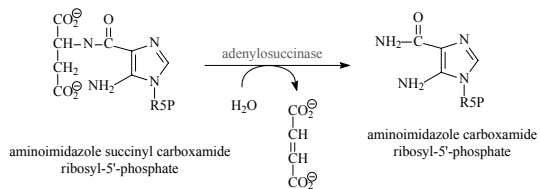
De novo Purine Synthesis



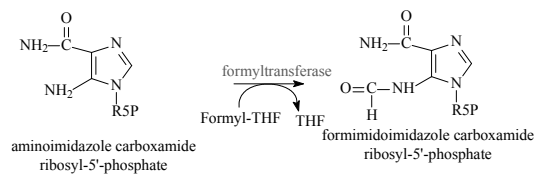
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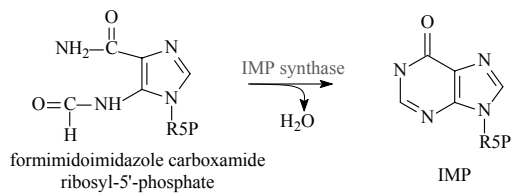
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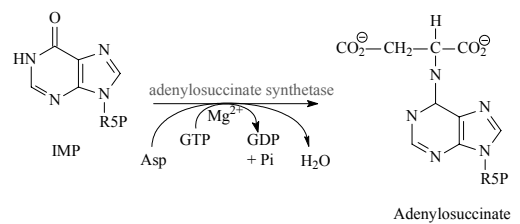
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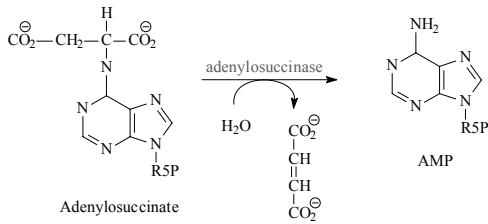
De novo Purine Synthesis



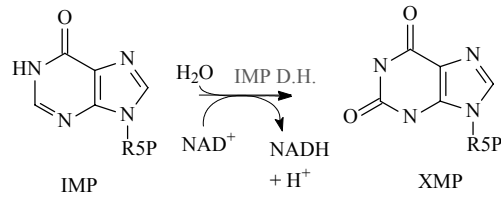
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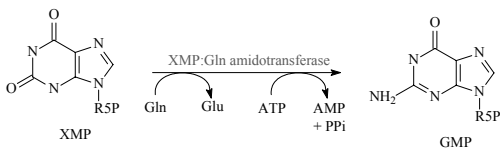
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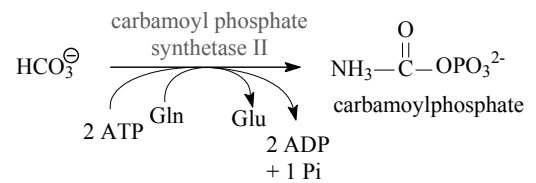
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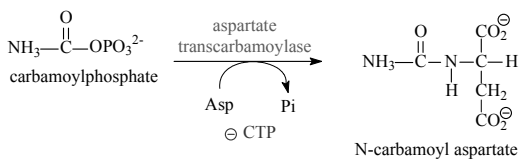
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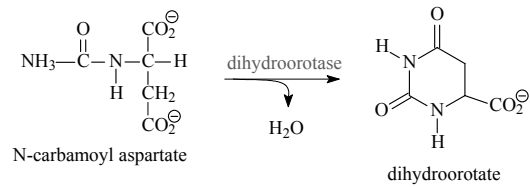
De novo Pyrimidine Synthesis



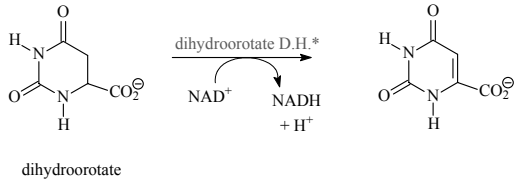
De novo Pyrimidine Synthesis



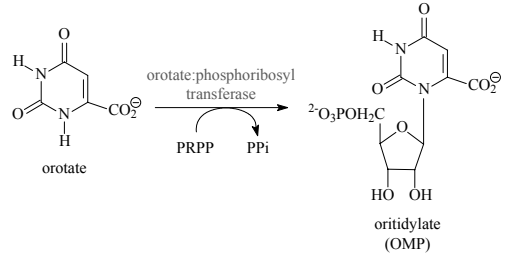
De novo Pyrimidine Synthesis



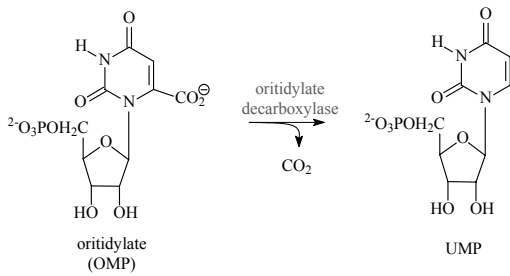
De novo Pyrimidine Synthesis



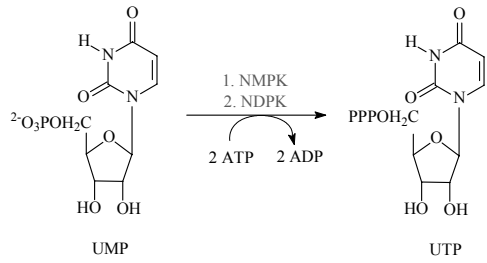
De novo Pyrimidine Synthesis



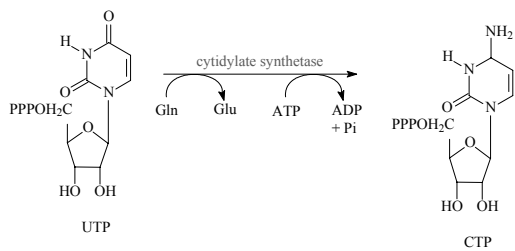
De novo Pyrimidine Synthesis



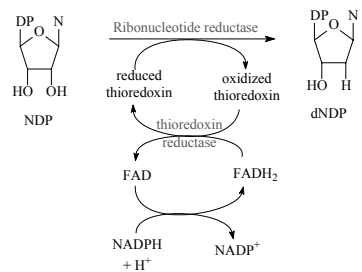
De novo Pyrimidine Synthesis



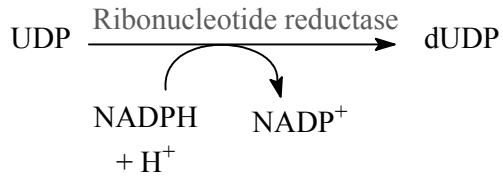
De novo Pyrimidine Synthesis



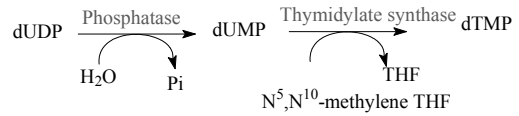
Loose Ends: Ribonucleotide Reductase



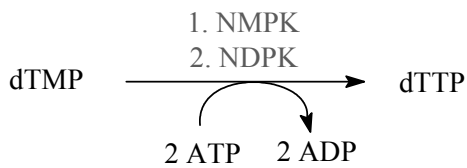
Loose Ends: T Synthesis



Loose Ends: T Synthesis



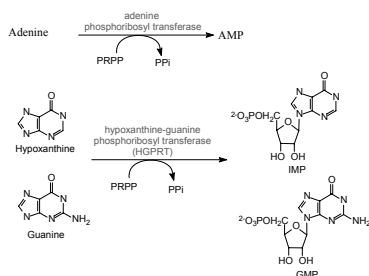
Loose Ends: T Synthesis



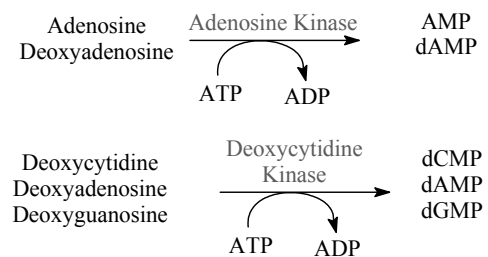
Summary of Nucleotide Synthesis

- Purines built up on ribose
 - PRPP synthetase key step
 - 13 enzyme activities on 3 polypeptides (to IMP)
- Pyrimidine rings built, then ribose added
 - Carbamoyl phosphate synthetase II key step
 - Multifunctional enzyme (mammals): all but dihydroorotate DH (CAD)
- Salvage is important—rapid turnover of mRNA

Purine Salvage Occurs by Two Mechanisms: From Bases



Purine Salvage Occurs by Two Mechanisms: From Nucleosides



Pyrimidine Synthetic Enzyme Gene Expression is Also Regulated

- Multifunctional protein (dihydroorotate dehydrogenase separate)
- coordinate repression and derepression (will talk about later)