جامعة الملك سعود
King Saud University

Biochemistry team 436

Purine degradation and Gout

- Color Index:

- Important.
- Extra Information.
- **Doctors slides.**

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Objectives:

By the end of the lecture. Students should be familiar with :

- Purine degradation pathway.
- Fate of uric acid in humans.
- Gout and hyperuricemia:
  - Biochemistry
  - Types
  - Treatment

Purine degradation pathway

- The major source of dietary nucleic acids (purines and pyrimidines) is meat.
- Purine and pyrimidine bases are absorbed by the intestine. (small intestine)
- The ingested bases are mostly degraded into different products by degradation pathways.
- These products are then excreted by the body (product for purine degradation = uric acid)
- Adenosine and guanosine (purines) are finally degraded to uric acid by purine degradation pathway.

Purine degradation pathway

للتوضيح: *من ٤٣٥*
1-Degradation of the nucleic acid into its building blocks "nucleotides"
2-Removal of phosphate group from the nucleotides by the enzyme "nucleotidase".
٣-تنفك النيوكليوسايدز إلى مكوناتها، سكر رايبوز + قواعد نيتروجينية (إما بيورين أو بيريميدين).
لاحظو ان البيورين هو اللي يعطي يوريك أسيد في نهاية المطاف وليس البيرميدينز!

1-Dietary DNA/RNA

- By **pancreatic nuclease**

2- Nucleotides

- By **nucleotidases**

3- Nucleosides

By nucleotidases

Remember:
Nucleoside= Nitrogenous base + Ribose
Nucleotide= Nitrogenous base + Ribose + PO_4

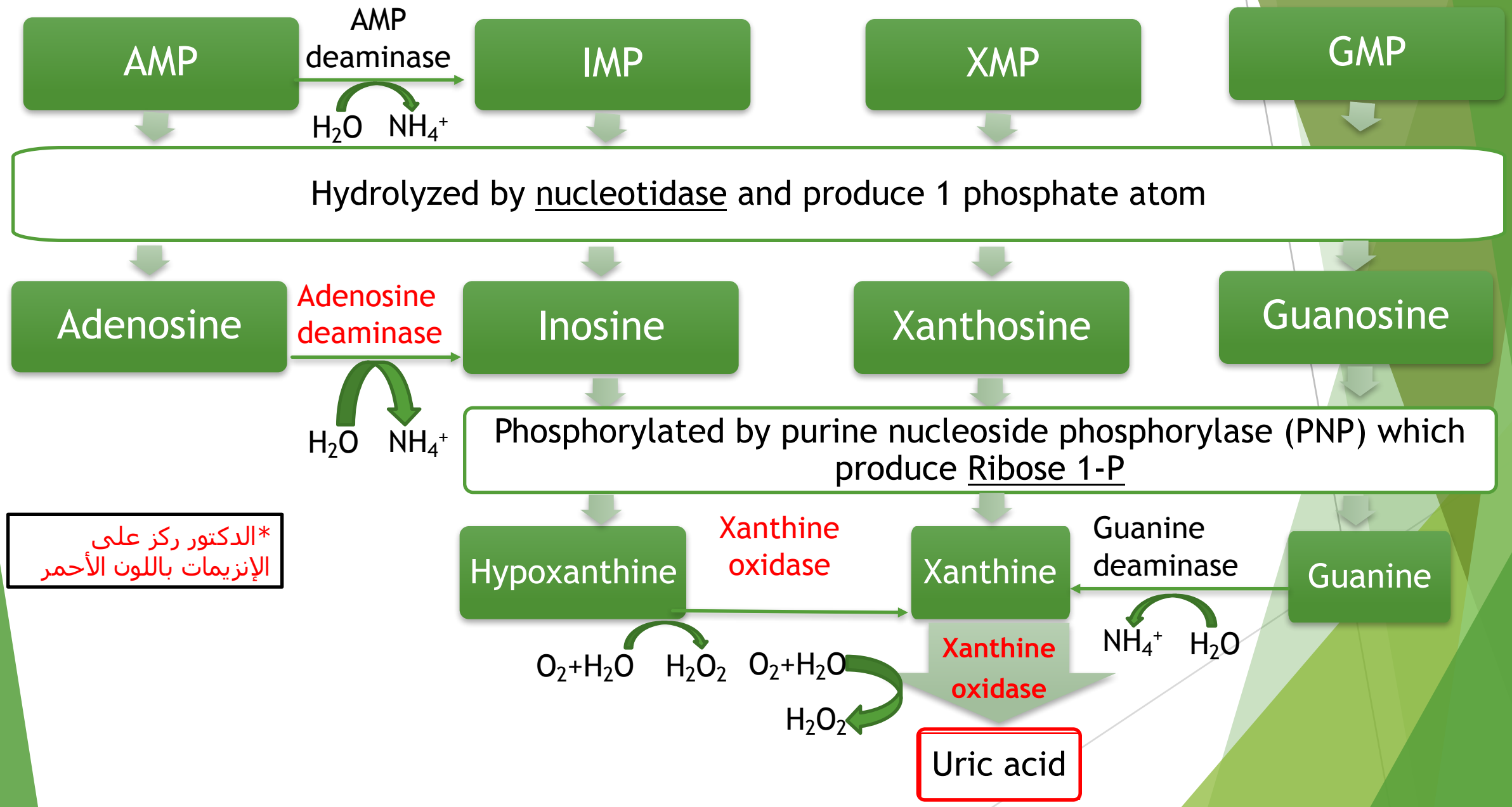
A-Free purine bases + ribose

- By purine degradation pathway
- Are converted to uric acid

B-Free pyrimidine bases + ribose

- By pyrimidine degradation pathway
- Are converted to Malonyl CoA

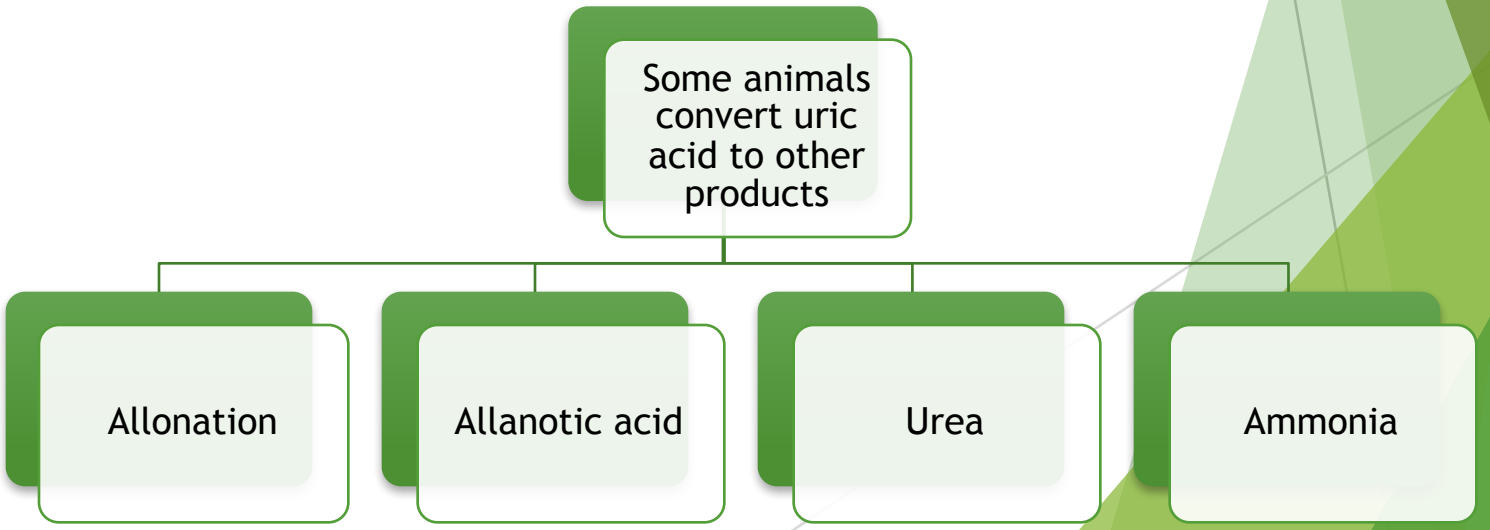
Major pathway of purine catabolism in animals



Fate of uric acid in humans

- In humans, primates, birds and reptiles the final product of purine degradation is uric acid, which is then excreted in the urine.
- Uric acid is less soluble in water.
- Reptiles, insects and birds excrete uric acid as a paste of crystals to save water.
- Humans excrete uric acid in the urine, they do not have enzymes to further degrade uric acid.
- Excessive production of uric acid causes deposition of uric acid crystals in the joints leading to:

a. Gout.
b. Hyperuricemia.



Fate of uric acid in Animals

Uric acid

- Primates
- Birds
- Reptiles

Urate oxidase

Allonation

- Other mammals

Allonationase

Allonatioc Acid

- Teleost fish

Allonatiocase

Urea

- Cartilaginous fish

Ureaase

Ammonia

- Invertebrates

Degradation of uric acid to ammonia in some animals, doctor said only read names ***girls*

Gout

- Gout is a disease due to high levels of uric acid in body fluids.
- 7.0 mg/dL and above
- Uric acid accumulates because of:

a. **Overproduction**

b. **Underexcretion**

- Painful arthritic joint inflammation due to deposits of insoluble sodium urate crystals (especially big toe).
- Affects 3 per 1000 people.
- Sodium urate crystals accumulate in kidneys, ureter and joints leading to chronic gouty arthritis.

Sodium urate crystals in urine

Swollen joints

Gout

- Inaccurately associated with overtreating and drinking.
- **Alcohol** used to be contaminated with **lead** during manufacture and storage, and lead decreases excretion of uric acid from kidneys causing hyperuricemia and gout.
- Excessive meat consumption increases uric acid production in some individuals.
- There are two main causes of gout:

a. Overproduction of uric acid. b. Underexcretion of uric acid.

Primary gout

- Due to overproduction of uric acid.
- Genetic abnormality in the enzymes of purine degradation.
- Excessive production and degradation of purine bases (adenine, guanine, hypoxanthine)

Secondary hyperuricemia

- Underexcretion of uric acid due to chronic renal disease.
- A variety of disorders and lifestyles cause it.
- -Chemotherapy
  -Excessive alcohol intake
- Excessive consumption of purine-rich food such as meat.
- **It does not always cause gout (not always followed by gout)**

Treatment

Analgesic, anti-inflammatory drugs	**To reduce pain and inflammation**
Uricoseric acid	To increase uric acid excretion
Xanthine oxidase inhibitor (rate limiting enzyme) • Febuxostat • Allopurinol	To reduce uric acid production

Videos

- Gout: treatment, causes, massage therapy, prevention:

https://www.youtube.com/watch?v=QOa7TLnwFXs&spfreload=10

- Gout treatment tips and advice:

https://www.youtube.com/watch?v=btuhyPTwD7Q

- Recall:

https://www.youtube.com/watch?v=MA-ouz1LtpM

- Gout:

https://www.youtube.com/watch?v=1O3F-b8FfDY

Quiz

- https://www.onlinequizcreator.com/purine-degradation-and-gout/quiz-239407

Girls team members:

1-هبة الناصر.

2- زينة الكاف

3-ابتسام المطيري

4- بشرى قوقندي

5-ربى برناوي

6- سمية الغامدي

Boys team members:

1- محمد المهوس.

-Team leaders:

رانيا العيسى.

عبدالله المانع.

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Reference :

Lippincott's Illustrated Reviews Biochemistry: Unit II, Chapter 11, Pages 125 - 136.