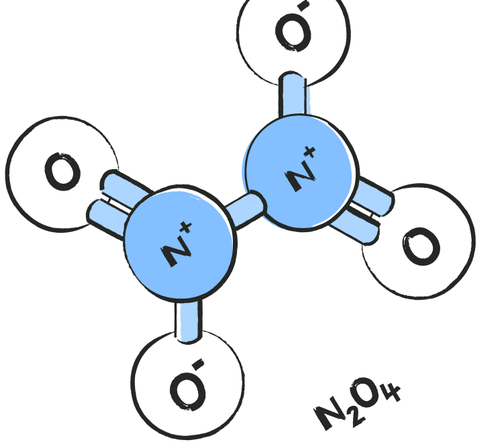
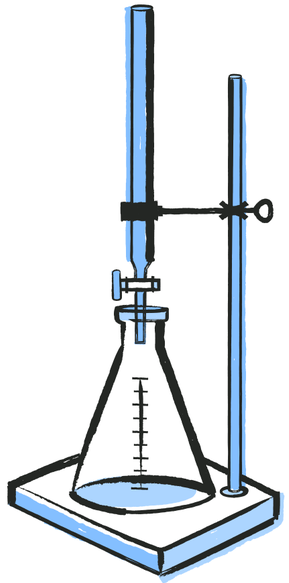
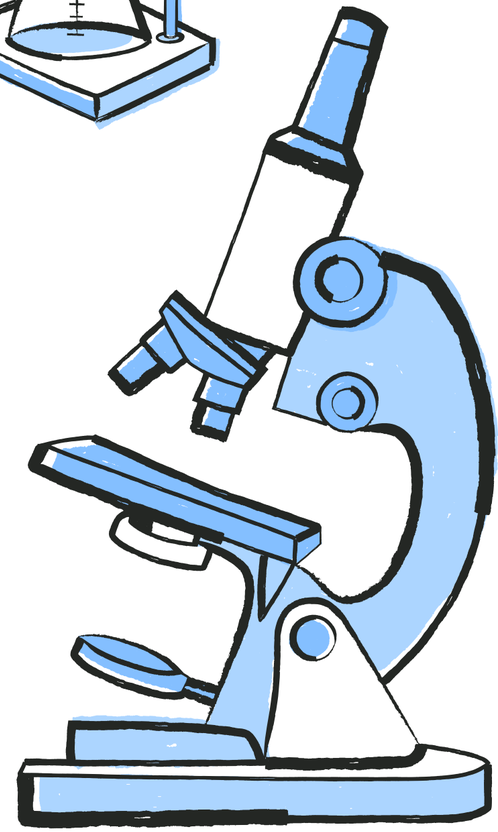


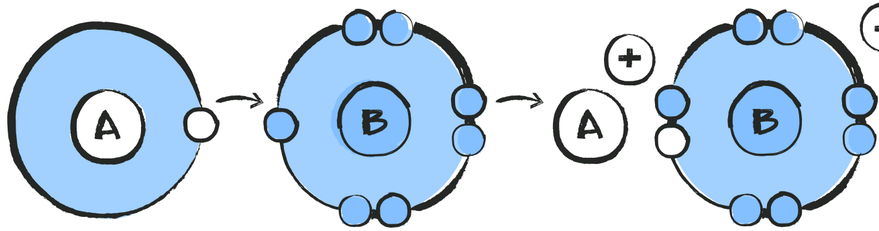


PURINES AND PYRIMIDINES ORIGINS SECOND STAGE



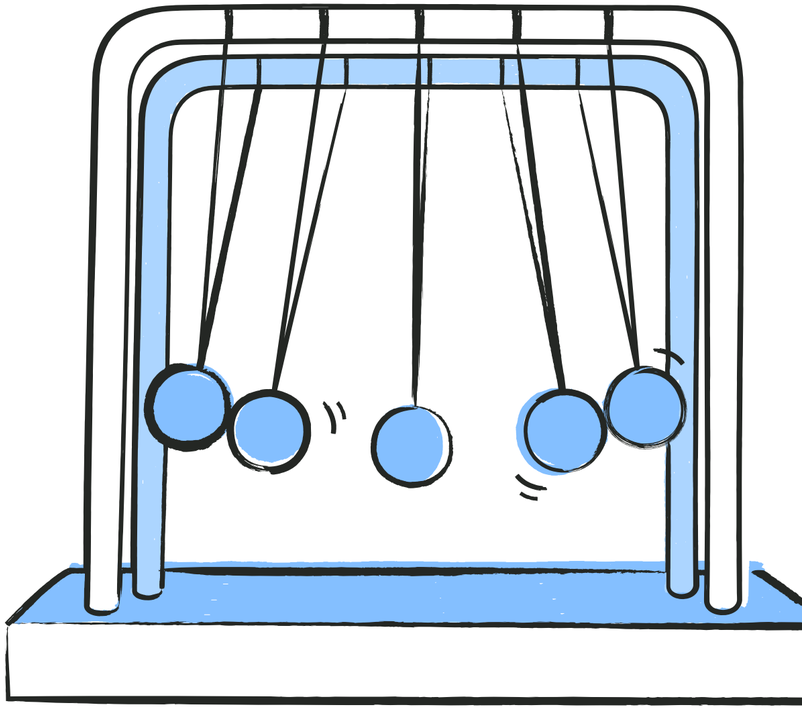
DR.RASHAD AL - TUUAMAH
MEDICAL BIOCHEMISTRY

INTRODUCTION TO PURINES AND PYRIMIDINES :



the terms PURINE and PYRIMIDINE have their origins in chemistry and biochemistry

specifically relating to the structure of nucleotides, which are the building blocks of

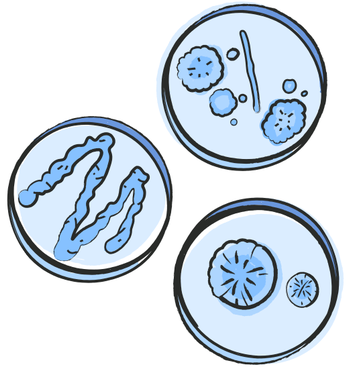


nucleic acids like DNA and RNA. in summary, PURINE and PYRIMIDINE originate from their

chemical structures and the historical context of their discovery, highlighting their

significance in the biochemistry of life.

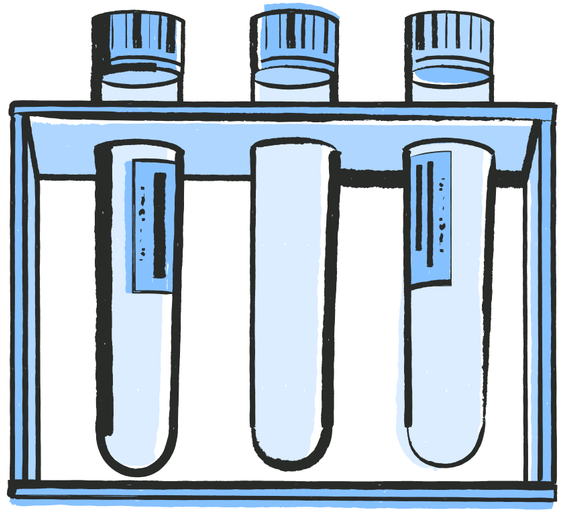
Origin of the Terms :



PURINE: the term PURINE comes from the words "pure" and "uric acid." the original compound, URIC ACID, was first identified as being derived from urine during the early 19th century.

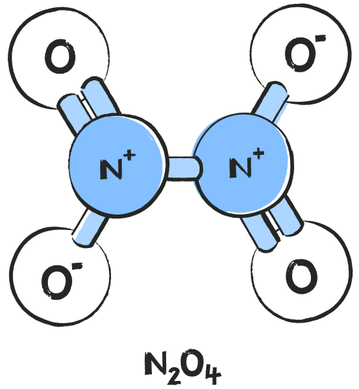
the structure was later determined to contain a fused double-ring system, leading to its classification as a PURINE.

PYRIMIDINE: the name PYRIMIDINE is derived from a combination of "PYRIDINE" (a six-membered nitrogen-containing ring structure) and "amine," indicating its nitrogen content.



PYRIMIDINES were identified as single-ring compounds that include key bases like CYTOSINE, THYMINE, and URACIL.

Importance in Biochemistry:

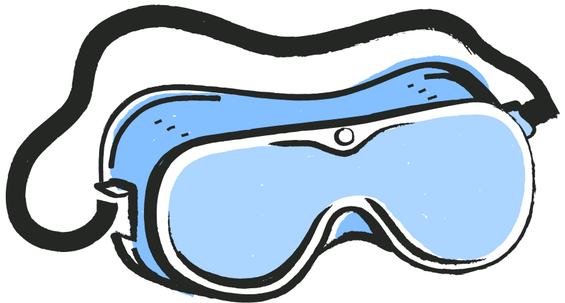


N_2O_4

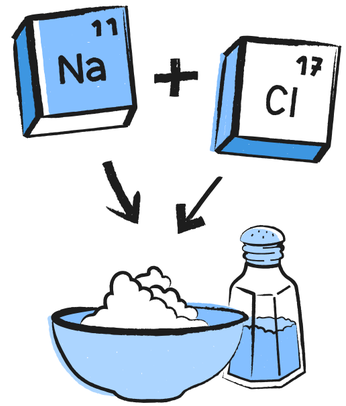
PURINES (ADENINE and GUANINE) and PYRIMIDINES play critical roles in the structure of nucleic acids and are

essential for various biological processes, including DNA replication and RNA transcription. their structural

properties, such as hydrogen bonding and base pairing, are crucial for the stability and functionality of genetic material.



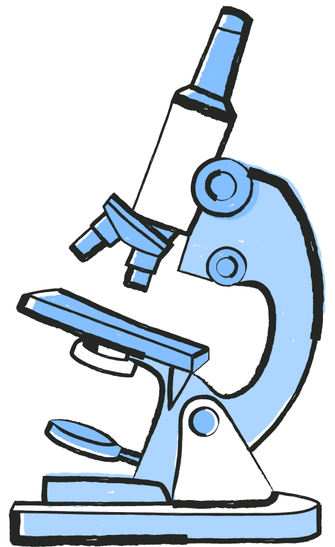
PYRIDINE: Etymology, Meaning, and Origin



PYRIDINE is a basic heterocyclic organic compound with the formula C_5H_5N.

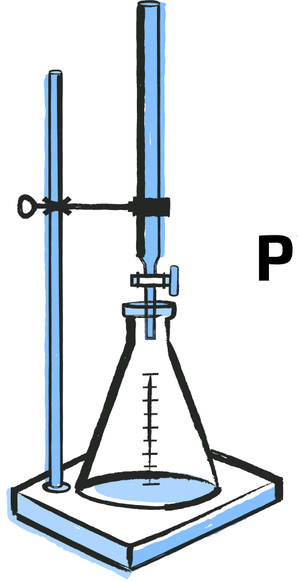
it consists of a six-membered ring containing five carbon atoms and one nitrogen atom.

the term PYRIDINE is derived from "pyr" meaning "fire" in greek, combined with the suffix "-idine," which is often used in chemistry to denote certain types of organic compounds.

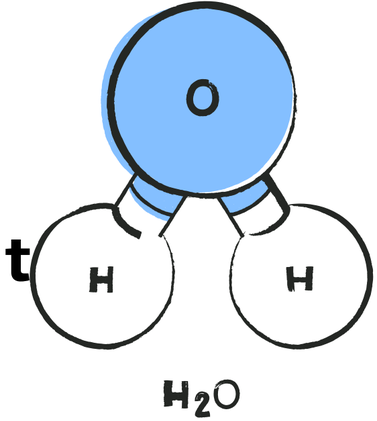


regarding its discovery, PYRIDINE was first isolated from coal tar in the 19th century.

and its name reflects its initial association with the more familiar "pyr" root, given its presence in substances like coal and its distinctive structure.



PROPERTIES AND USES OF PYRIDINE :

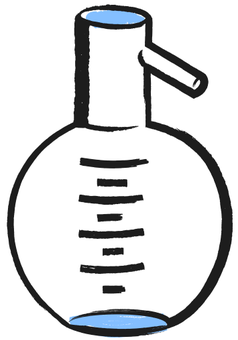


PYRIDINE is colorless, has a distinctive odor similar to that of rotten fish, and is highly polar.

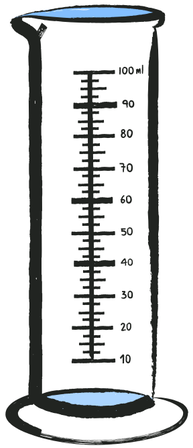
as for its uses, PYRIDINE is used as a solvent, in the synthesis of various chemicals, and as a precursor to agrochemicals, pharmaceuticals, and dyes.

in summary, PYRIDINE refers to a nitrogen-containing ring compound, named for its chemical structure and historical context.

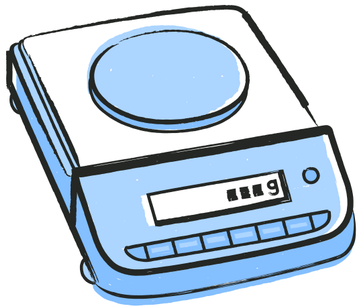
its unique properties make it significant in various industrial and research applications.



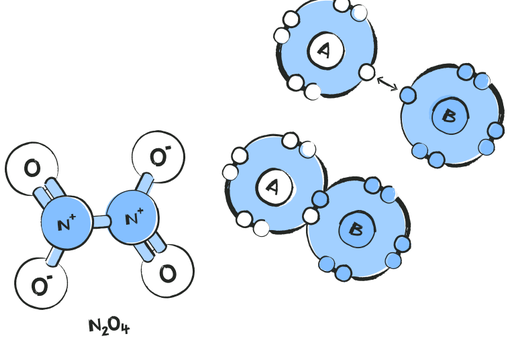
Relationship Between URIC ACID, PURINES, AND PYRIMIDINES:



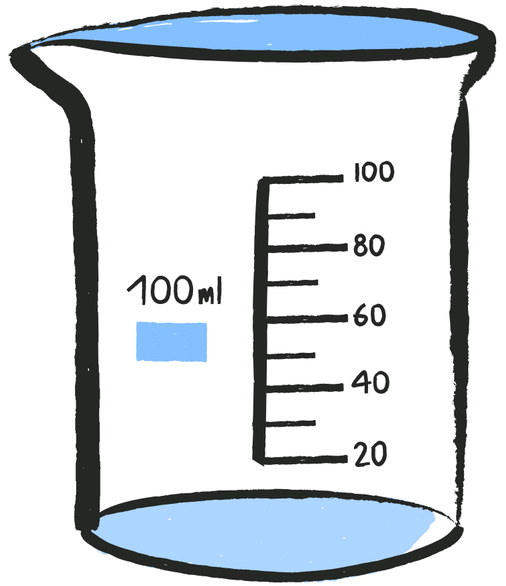
the relationship between URIC ACID, PURINES, and PYRIMIDINES is rooted in the metabolism of nucleic acids, which are essential components of all living cells.



PURINES: by definition, PURINES are nitrogenous bases that have a double-ring structure.



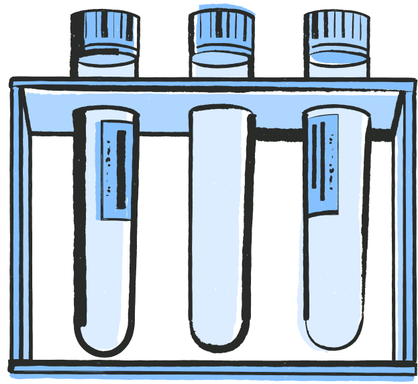
the primary PURINES are ADENINE and GUANINE. their role is being key components of nucleotides, which make up DNA and RNA.



PYRIMIDINES: by definition, PYRIMIDINES are nitrogenous bases with a single-ring structure.

the main PYRIMIDINES are CYTOSINE, THYMINE (found in DNA), and URACIL (found in RNA). like PURINES, they are essential for the formation of nucleotides.

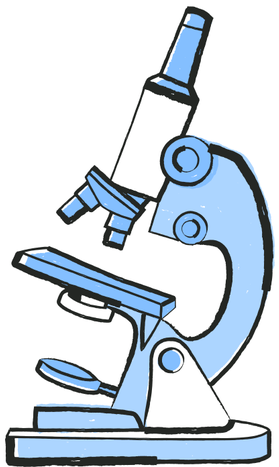
URIC ACID and Metabolic Pathways:



URIC ACID is the final product of PURINE metabolism in humans and many other

organisms. when PURINES are broken down in the body, they go through a series of enzymatic

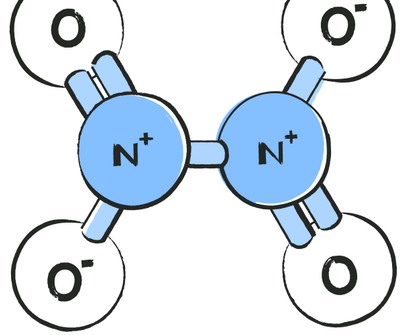
reactions that ultimately lead to the formation of URIC ACID. URIC ACID is primarily excreted



through urine, and its levels in the blood can be an important indicator of metabolic health.

high levels of URIC ACID can lead to conditions like gout, where URIC ACID crystals accumulate in joints.

In summary of the relationship, when PURINES are metabolized, they are broken down to form URIC ACID.

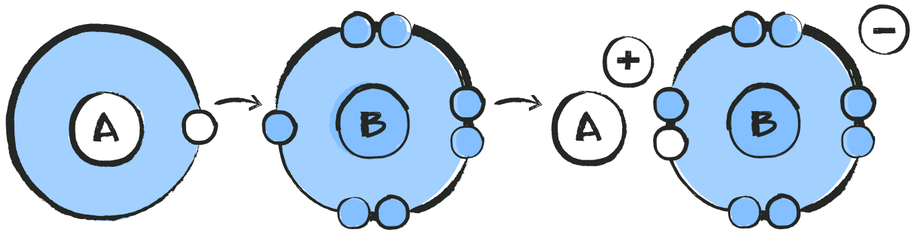


N_2O_4

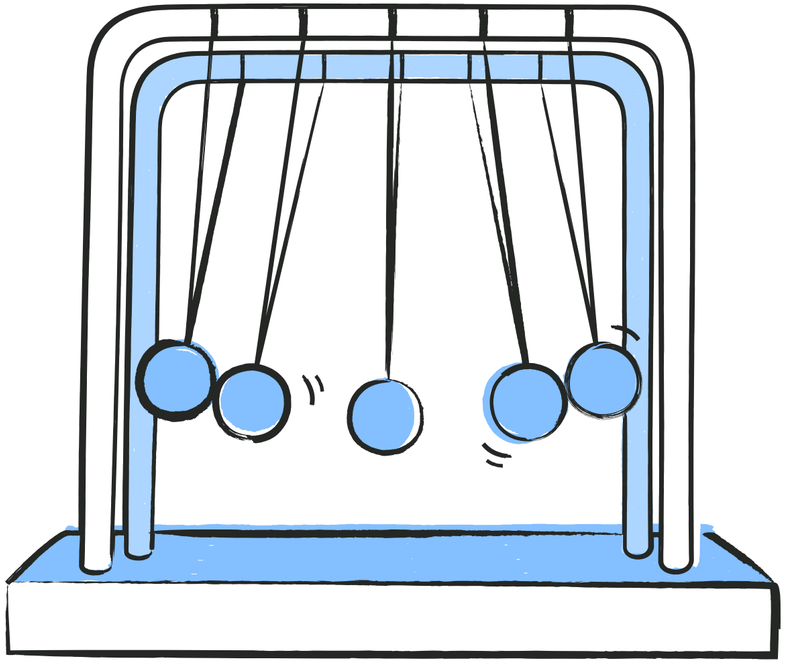
monitoring URIC ACID levels can give insights into PURINE metabolism and help diagnose certain conditions related to metabolic disorders.

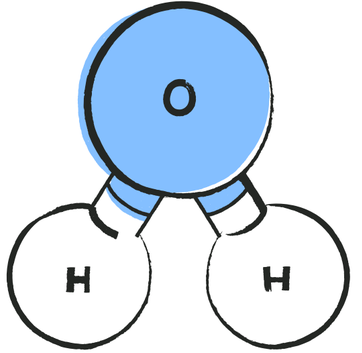
PURINES directly relate to the production of URIC ACID upon their metabolism, while PYRIMIDINES have a separate metabolic pathway and do not produce URIC ACID.

METABOLISM OF PYRIMIDINES:



PYRIMIDINES, unlike PURINES, follow a different metabolic pathway and do not contribute to the formation of URIC ACID. PYRIMIDINES include the bases CYTOSINE THYMINE, and URACIL.



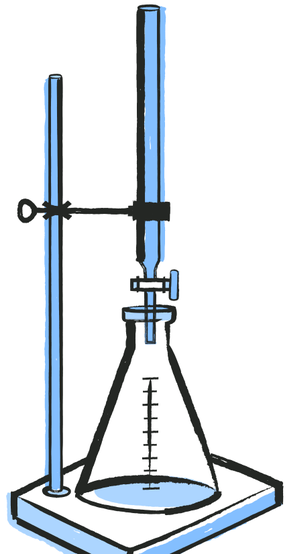


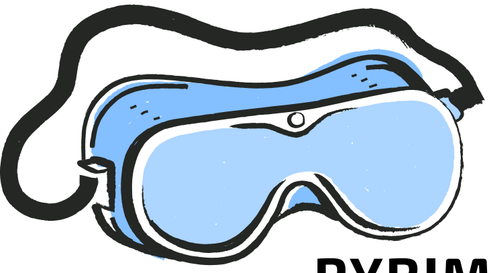
H_2O

Pathway:

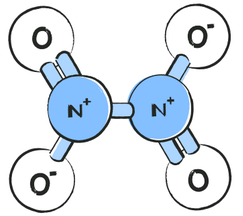
PYRIMIDINES are broken down into smaller molecules such as BETA-ALANINE, BETA-AMINOISOBUTYRIC ACID, and AMMONIA. these products can enter various metabolic pathways.

the degradation of PYRIMIDINES does not lead to the production of URIC ACID; instead, they are converted into substances that can be utilized in different biosynthetic processes or excreted.





Precursor to Nucleotides and Clinical Relevance:



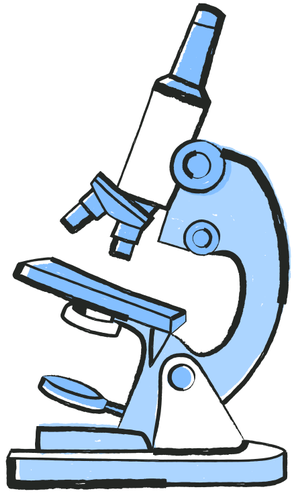
N_2O_4

PYRIMIDINES are synthesized into nucleotides (like CMP, UMP, and TMP) in a series of enzymatic reactions.

these nucleotides are essential for nucleic acid synthesis. regarding clinical and biological relevance, PYRIMIDINES are key players in the structural integrity of nucleic acids. they form part of the genetic code that carries the information for building proteins.

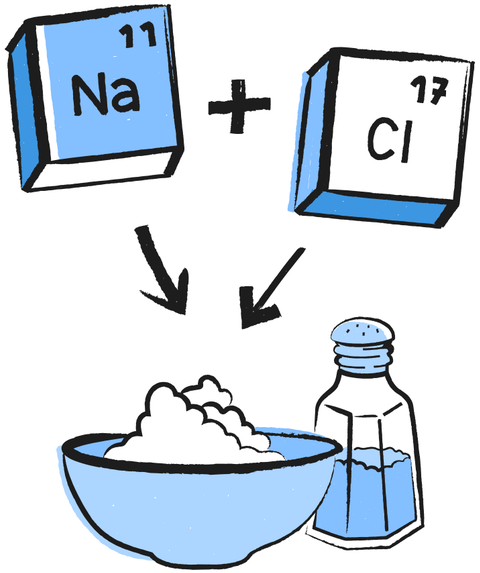
since PYRIMIDINES do not lead to URIC ACID production, conditions involving elevated URIC ACID (like gout) are primarily concerned with PURINE metabolism, not PYRIMIDINE metabolism.

Final Summary :



in summary, while PURINES are metabolized to produce URIC ACID

PYRIMIDINES break down into different metabolites without contributing to URIC ACID levels.



this distinction is important for understanding various metabolic disorders and the roles different nucleobases play in cellular processes.

thank you!