

Nitrogen cycle: Part II

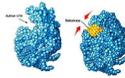
How nitrogen enters Earth's living systems .



1

The chemical bond which holds N₂ together is extremely difficult to break.

- **Nitrogen Fixation** is the name of the process of breaking that triple bond (it takes lots of energy to do this!)



Soil bacteria contain an enzyme called Nitrogenase which does this..

Lightning strikes create such strong electric fields that N₂ is physically torn apart.. The N atoms of which then readily combine with Oxygen to form NO_x






2

Many species of legumes have evolved a symbiotic relationship with the Nitrogen fixing bacteria.

This creates mutualistic relationship with the plant, producing ammonia in exchange for carbohydrates.




3

Nitrogen assimilation

Plants take nitrogen from the soil by absorption through their roots as:

- nitrate ions (NO₃⁻)
- nitrite ions (NO₂⁻)
- ammonium ions (NH₄⁺)

Amino Acid Structure

$$\begin{array}{c}
 \text{H} & \text{H} & \text{O} \\
 | & | & || \\
 \text{H}-\text{N} & -\text{C} & -\text{C}-\text{OH} \\
 \text{Amino Group} & \text{R} & \text{Carboxyl Group} \\
 & \text{Side Chain} &
 \end{array}$$



Animals absorb Nitrogen primarily through Amino Acids. (digesting proteins).

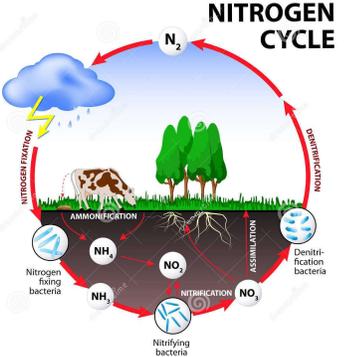
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Key Terms to understand

- Nitrogen Fixation
- Ammonification
- Nitrification
- Assimilation
- Denitrification.

Note: We'll discuss each of these in the next slides

NITROGEN CYCLE



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Utilization of various N sources is carefully regulated in all organisms.

Plants: It is usually the "limiting factor"

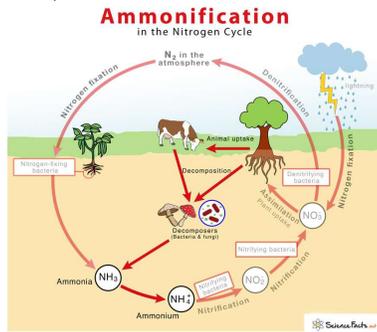
Animals: have various strategies for excreting excess

Note: Humans don't 'store' Nitrogen (or amino acids), we poop it out if we intake too much).



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Ammonification is a crucial part of the Nitrogen Cycle where decomposers (bacteria and fungi) break down amino acids, proteins, DNA, etc and convert it back into Ammonia and NH_4^+ ions (Ammonium).



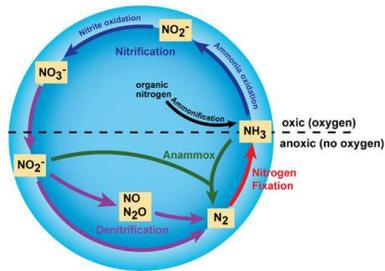
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Nitrification is a biological process where ammonia or ammonium (NH_3 or NH_4^+) is converted into nitrite (NO_2^-) and then nitrate (NO_3^-). This process, carried out by nitrifying bacteria, is a crucial step in the [nitrogen cycle](#), making nitrogen available to plants

Denitrification is a biological process where microorganisms convert nitrate (NO_3^-) into nitrogen gas (N_2) in the absence of oxygen. This process is a crucial part of the [nitrogen cycle](#), playing a vital role in nutrient cycling and water quality

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Note: The pathway taken depends on whether or not oxygen is present. Are we talking about a well oxygenated soil? Or are we talking about inside someone's intestines or at the bottom of a wet compost pit?



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