ARC Centre of Excellence for Integrative Legume Research

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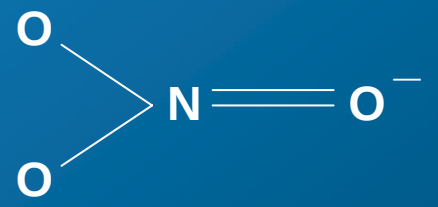
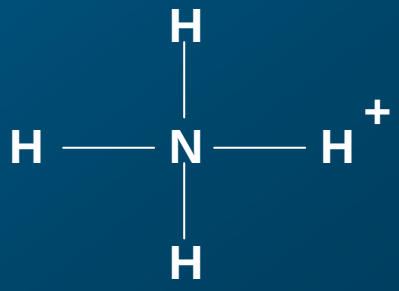


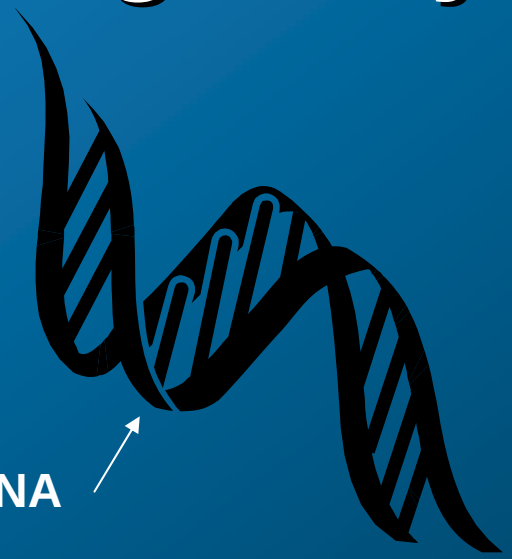
Legumes and the Nitrogen Cycle



Lisette Pregelj – Education & Outreach Manager

Legumes & the Nitrogen Cycle

- Nitrogen is essential for life
- It is one of the ingredients of proteins and nucleic acids (DNA)
- Nitrogen is needed also for growth
- Nitrogen is very abundant on Earth
- 78% of the atmosphere is nitrogen!



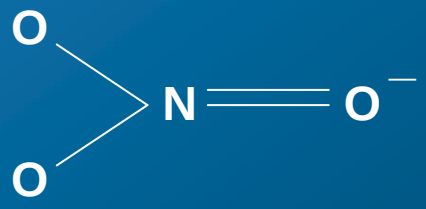
Soybean seedlings

Legumes & the Nitrogen Cycle

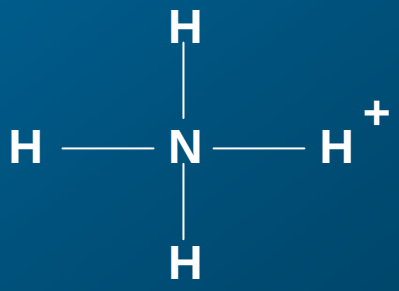
- Despite nitrogen's abundance, there is a lack of usable nitrogen
- This limits growth and productivity of plants and animals
- Most forms of life cannot use nitrogen gas directly from the atmosphere

Except….

- Plants can use nitrogen from the atmosphere that has been ‘fixed’
- ‘fixed’ nitrogen has been converted from nitrogen gas into a useable form
- ‘fixed’ nitrogen is either nitrate or ammonium



Nitrate NO_3^-



Ammonium NH_4^+

Plant Roots

- Plants have special transporters on their roots
- These transporters take up ‘fixed’ nitrogen
- ‘fixed’ nitrogen is then moved to other parts of the plant to make proteins for growth or DNA

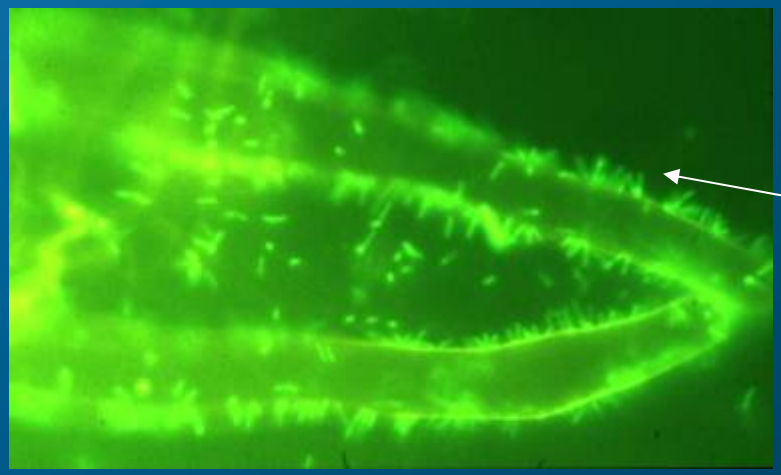
Animal Food



- **Animals obtain their ‘fixed’ nitrogen by eating plants or by eating other animals who have eaten plants**
- **Herbivores eat only plants**
- **Carnivores eat only other animals**

‘Fixed’ Nitrogen

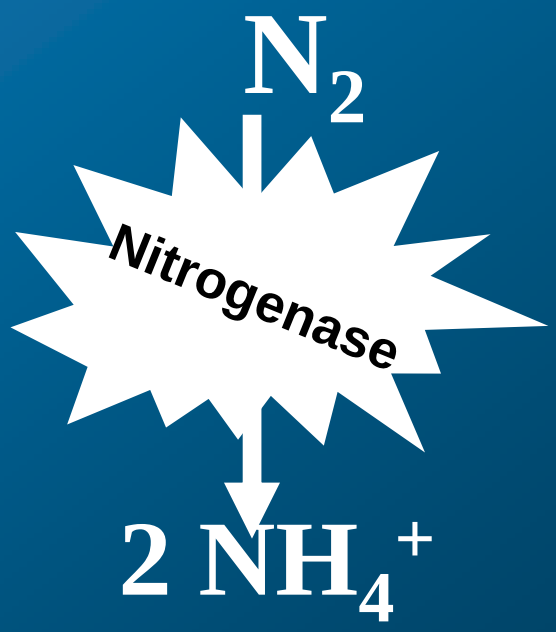
- Ammonium and nitrate are fixed by special bacteria through decomposition
- Some of these bacteria are called *Rhizobia*
- *Rhizobia* live freely in soil or:
- *Rhizobia* live inside plants in a symbiotic relationship



Rhizobia **near a Legume root**

Nitrogenase

- **Nitrogenase is an enzyme (protein) that *Rhizobia* have**
- **Allows them to convert atmospheric nitrogen (N_2) into ammonium (NH_4^+)**



Rhizobia

Plants with *Rhizobia*

Plants without *Rhizobia*

‘Fixed’ Nitrogen

- Nitrogen is also ‘fixed’ by animal and plant decay
- When animals or plants die, bacteria convert their tissue into ammonia
- Ammonia is then released into the soil
- Lightning strikes can also fix nitrogen

CILR

- University of Queensland
- Australian National University
- University of Melbourne
- University of Newcastle

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Contact Us
HQ: University of Queensland
Tel: 3365 3550
Email: director.CILR@uq.edu.au
lisette.pregelj@uq.edu.au

Visit Our Website!
www.cilr.uq.edu.au