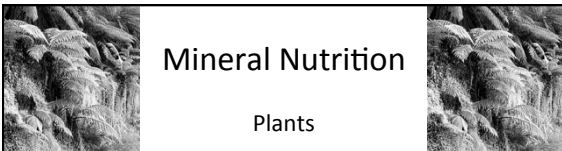


Questions

- What are the three mechanisms eukaryotes use to obtain nutrients?
 - Photosynthesis, Absorption, direct feeding
- What are fungi able to digest that makes them such unique decomposers?
 - Lignin
- What is the purpose of the microtriches of tapeworms?
 - Increased surface area

How Do Plants Get Minerals?

Mineral Nutrition



Mineral Nutrition

Plants

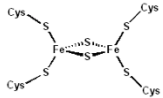
- What types of minerals do they need?
- How do they get minerals from the soil?
- How do they get minerals to the leaves?
- How do they “fix” nitrogen?

<http://upload.wikimedia.org/wikipedia/commons/thumb/3/3f/Fern02.jpg/220px-Fern02.jpg>

Essential Nutrients

Micronutrients

- (ppt)
- Used as enzyme cofactors
 - ferredoxin (PS I)

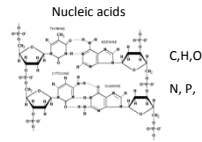


<http://en.wikipedia.org/wiki/Ferredoxin>

Essential Nutrients


Macronutrients

- Needed in large quantities
- Needed in macromolecules
 - Proteins, carbohydrates, nucleic acids, phospholipids, etc.



Element	Form Available to Plants	Functions	Average % Dry Weight*	Deficiency Symptoms
Obtained from CO₂ or H₂O				
Oxygen	O ₂ , H ₂ O	Electron acceptor in cellular respiration; major component of organic compounds	45	Usually affects roots—cells suffocate, leading to root rot and wilting
Carbon	CO ₂	Substrate for photosynthesis; major component of organic compounds	45	Slow growth (starvation)
Hydrogen	H ₂ O	Major component of organic compounds; electrical balance and establishment of electrochemical gradients	6	Slow growth due to cell death (desiccation)
*These percentages were obtained by drying vascular plants and then documenting what proportion of the waterless mass consists of various elements.				
Obtained from soil				
(a) Macronutrients				
Nitrogen	NO ₃ ⁻ (nitrate) NH ₄ ⁺ (ammonium ion)	Component of nucleic acids, proteins, hormones, and coenzymes	1.5	Failure to thrive; chlorosis (yellowing of leaves)
Potassium	K ⁺	Cofactor for many enzymes; necessary for osmotic adjustment in cells; required for synthesis of organic molecules	1.0	Chlorosis at margins of leaves or in mottled patterns; weak stems; short internodes
Calcium	Ca ²⁺	Regulatory functions; role in cell wall structure; stabilizes membranes; second messenger in signal transduction	0.5	Necrosis (small spots of dead cells) in meristems; deformation of young leaves; stunted, highly branched root system
Magnesium	Mg ²⁺	Chlorophyll component; activates many enzymes	0.2	Chlorosis between leaf veins; premature leaf drop
Phosphorus	H ₂ PO ₄ ⁻ (dihydrogen phosphate ion) HPO ₄ ²⁻ (hydrogen phosphate ion)	Component of ATP; nucleic acids, phospholipids, and several coenzymes	0.2	Stunted growth in young plants; dark green leaves with necrosis
Sulfur	SO ₄ ²⁻ (sulfate ion)	Component of protein and coenzymes	0.1	Stunted growth; chlorosis
*These percentages were obtained by drying vascular plants and then documenting what proportion of the waterless mass consists of various elements.				


Nitrogen-Phosphorus-Potassium
N – P – K



28-14-14

Net Weight: 25.00 Kg
Net Weight: 55.00 Kg

Arcad Fertilizers FZCO. UAE



18-24-6

(N) Nitrogen (P) Phosphorus (K) Potassium

http://www.lowes.com/rd_Fertilizer+Buying+Guide_543192375_

N – P – K


N=Shoots, P=Roots, K=Fruits

Nitrogen for proteins, and nucleic acids, chlorophyll

Phosphorus stimulates root growth, helps the plant set buds and flowers, improves vitality and increases seed size


Potassium promotes vigor, sturdy stems, deep roots encourages strong stems and well-developed flowers.

©How.com http://www.ahow.com/about_4902638_what_does_potassium_do_plants.html#x21oalDuIR



Mineral Nutrition

Plants



- What types of minerals do they need?
- **How do they get minerals from the soil?**
- How do they get minerals to the leaves?
- How do they “fix” nitrogen?

<http://upload.wikimedia.org/wikipedia/commons/thumb/3/3f/Ferns02.jpg/220px-Ferns02.jpg>

Getting Minerals from the Soil

Obtained from soil				
(a) Macrominerals				
Nitrogen	NO ₃ ⁻ (nitrate) NH ₄ ⁺ (ammonium ion)	Component of nucleic acids, proteins, hormones, and coenzymes	1.5	Failure to thrive; chlorosis (yellowing of leaves)
Potassium	K ⁺	Cofactor for many enzymes; necessary for osmotic adjustment in cells; required for synthesis of organic molecules	1.0	Chlorosis at margins of leaves or in mottled pattern; weak stems; short internodes
Calcium	Ca ²⁺	Regulatory functions; role in cell wall structure; stabilizes membranes; second messenger in signal transduction	0.5	Necrosis (small spots of dead cells) in meristems; deformation of young leaves; stunted, highly branched root system
Magnesium	Mg ²⁺	Chlorophyll component; activates many enzymes	0.2	Chlorosis between leaf veins; premature leaf drop
Phosphorus	H ₂ PO ₄ ⁻ (dihydrogen phosphate ion) HPO ₄ ²⁻ (hydrogen phosphate ion)	Component of ATP nucleic acids, phospholipids, and several coenzymes	0.2	Stunted growth in young plants; dark green leaves with necrosis
Sulfur	SO ₄ ²⁻ (sulfate ion)	Component of protein and coenzymes	0.1	Stunted growth; chlorosis

*These percentages were obtained by drying whole plants and then documenting what proportion of the waterless mass consists of various elements.
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Nutrients and availability

<u>Cation</u>	<u>Anion</u>
(+) charge mineral	(-) charged mineral
Bound to soil (-)	dissolves in water

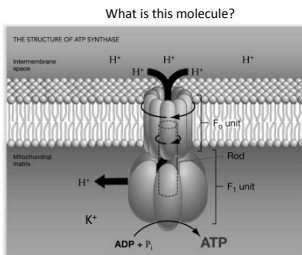


The plant's dilemma:

How to import molecules against a concentration gradient

How to import both positive and negative molecules

Importing molecules against a concentration gradient



What is this molecule?

What if we changed the direction of the reaction?

Creates a positive charge outside the root hair (-200 mV)

Encourages positive molecules to enter the roots

Nutrient transport

1. Establish an charge difference

2. Positively charged ions pass with the help of channel proteins

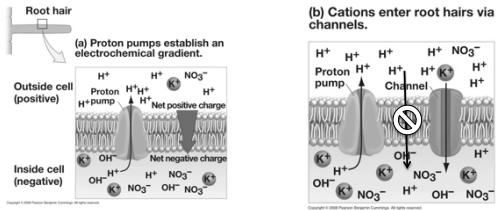
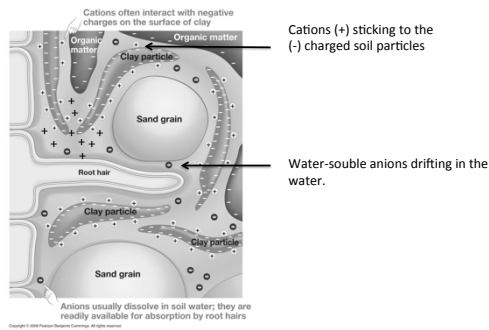
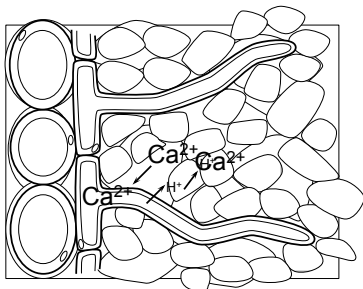


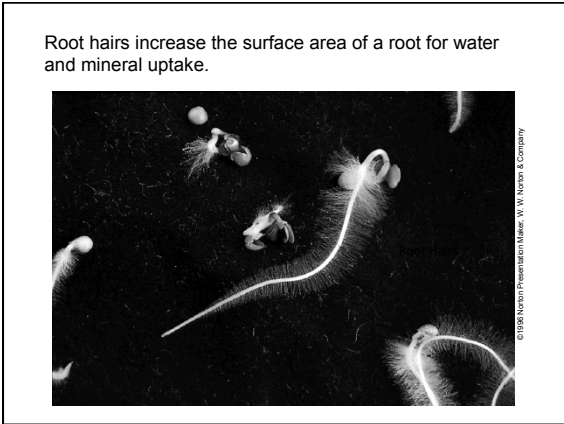
Figure 38.10 pg 845

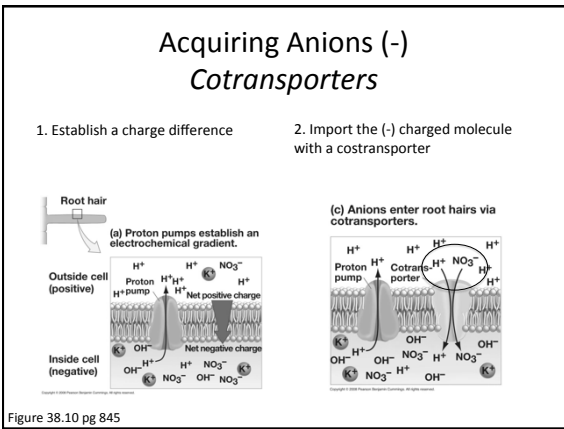
Minerals in the Soil



Root hairs are responsible for **cation exchange**







10 minutes

- Describe how the plant gets cations from the soil.
- Describe how plants get anions from the soil.
- Explain one of these concepts to your neighbor and they will describe the other to you.
