

# Photosynthesis Webquest

## Introduction

Thanks to technology, scientists have discovered a way to reduce human beings down to a microscopic size for limited periods of time. This technology is predictably being used in the fields of medicine, computer science, and biology. Recently, the travel industry has also found ways to utilize the technology by offering adventure trips into areas previously unavailable to full-sized humans.

You and your team are travel agents working in a futuristic eco-tourism agency called “Micro-adventures,” whose mission is to educate the public about ecological issues through exciting vacation packages. You are developing a new vacation trip into the chloroplast of the plant cell. The first tour will be given to politicians, environmentalists, and journalists. What do you want these tourists to learn about photosynthesis?

## Tasks

Your eco-tourism travel agency is attempting to be the first to offer a tour to the chloroplast of a plant cell. The trip will allow visitors to study the internal structure of the chloroplast in the plant cell, witness the photosynthetic process in action, and learn more about how color is seen. Your task is to plan, develop, and promote a trip to the plant cell with the intention of highlighting the importance of plants to humans. By the end of the project, your group must:

- Create a map of the areas that visitors will see on the trip.
- Provide an itinerary of the trip which describes (in detail) the events and occurrences which will take place during each day of the tour.
- Write a script for a tour guide leading trips to the light and dark reactions.

## Process

### Task 1 – the structure of the chloroplast

1. Visit the following sites to learn about the form and function of the chloroplast

Links: Chloroplast pictures

<http://www.ualr.edu/~botany/chloroplast.jpg>

<http://www.bennetts.dircon.co.uk/NEW%20WEBSITE/Chloroplast%201.jpg>

<http://sps.k12.ar.us/massengale/images/chloroplast.jpg>

<http://www.rkm.com.au/CELL/Plant/plant-cell.html>

[\[art.com/image.asp?id=1319&search=1&pagename=Animal and Plant Cell\]\(http://www.science-art.com/image.asp?id=1319&search=1&pagename=Animal and Plant Cell\)](http://www.science-</a></p></div><div data-bbox=)

<http://sun.menloschool.org/~birchler/cells/plants/cytoplasm/p-cell.jpg>

<http://www.lclark.edu/~seavey/plant%20cell72-1.jpg>

Links: Chloroplast information

<http://www.cellsalive.com/cells/chloropl.htm>

<http://www.tvdsb.on.ca/westmin/science/sbioac/plants/chloro.htm>

<http://www.tiscali.co.uk/reference/encyclopaedia/hutchinson/m0006920.html>

2. Create a map of the areas that visitors will see on the trip. Your map should show where the chloroplast sits inside a plant cell, and how you will get there. Provide a map legend which gives close-up pictures of significant landmarks (stroma, thylakoids, grana, outer membranes, chlorophyll) and describe what visitors can expect to see at each location.

### Task 2 – The important steps of photosynthesis and events within the chloroplast

1. Read the following notes on how photosynthesis works

*In photosynthesis, the plant uses sunlight, water, and CO<sub>2</sub> to make glucose and oxygen. This is summarized in the formula for photosynthesis:*



*Another way of saying this is: Carbon dioxide (the air we exhale) and water are combined by the energy from sunlight to create glucose and oxygen. The plant gets the water and carbon dioxide from the environment, and then create glucose and oxygen which can be used by other organisms, such as people.*

*Photosynthesis takes place in two steps:*

*Step 1: The light reaction (happens on the thylakoid membrane).*

- *Sunlight is captured by chlorophyll*
- *The energy from sunlight is used to split water. The water is split into Oxygen and hydrogen.*
  - *The oxygen is released into the air for us to breath.*
  - *The hydrogen is further split into a proton (H<sup>+</sup>) and an electron.*
- *The electron is used to make ATP energy and NADP*
- *ATP, NADP, and H<sup>+</sup> are used in the dark reaction (the Calvin cycle)*

*Step 2: The Calvin cycle (happens in the stroma)*

- *The plant takes CO<sub>2</sub> out of the air*
- *The CO<sub>2</sub> is combined with H<sup>+</sup> to make sugar (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)*

2. Provide an itinerary of the trip (in list form which shows what will happen during each day of the trip) which describes (in detail) the events and occurrences which will take place during each day of the tour (sunlight being captured by chlorophyll, sunlight energy being used to split water, oxygen going into the atmosphere, ATP, NADP, and H<sup>+</sup> going from the thylakoid membrane into the stroma, CO<sub>2</sub> combining with H<sup>+</sup> to make sugar). Your itinerary should also include meals, scenic drives, hotel stays, and general sight-seeing recommendation

Links: Sample itineraries:

<http://www.greywhale.com/itinerar.htm>

<http://www.islandexpeditions.com/pdf-docs/Paradise%20Islands.pdf>

<http://www.thaifoodandtravel.com/travel/itinso.html>

### Task 3 – Understanding the photosynthetic process and reactions

1. Study your notes along with the information from the following sites:

Links: Photosynthesis information

<http://www.sciencemadesimple.com/leaves.html>

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookPS.html>

<http://www2.worldbook.com/features/earth/assets/earlydevelop.jpg>

Links: Light Reaction and dark reaction (Calvin cycle)

<http://biology.clc.uc.edu/courses/bio104/photosyn.htm>

<http://ghs.gresham.k12.or.us/science/ps/sci/soph/energy/intbio/photo/rxns.htm>

<http://ghs.gresham.k12.or.us/science/ps/sci/soph/energy/photosyn/lightrxns.htm> (look at steps 1 and 2)

[http://en.wikipedia.org/wiki/Dark\\_reaction](http://en.wikipedia.org/wiki/Dark_reaction) (in particular, read Calvin cycle and light-independent reaction)

2. Write a script for a tour guide who is leading a group through the thylakoid membrane during the light reaction, and then through the stroma during the dark reaction. The script should sound like a tour guide speaking rather than like a set of biology notes, and should be at least two pages typed.

Links: the importance of photosynthesis

<http://www.infoplease.com/ce6/sci/A0860379.html>

<http://photoscience.la.asu.edu/photosyn/study.html>

<http://www.britannica.com/eb/article-9108553>

Links: photosynthesis and rainforests

<http://rainforests.mongabay.com/0401.htm>

[http://www.savetherainforest.org/savetherainforest\\_007.htm](http://www.savetherainforest.org/savetherainforest_007.htm)

<http://www.elbosquenuuevo.org/tropical-rainforests.php>

<http://www.geography.learnontheinternet.co.uk/topics/rainforest.html#future>

<http://www.spectacle.org/196/rich1.html>

Links: Writing a persuasive essay

[http://www.natick.k12.ma.us/schools/wilson/webquest/norton/internet\\_webquest/esaydesc.html](http://www.natick.k12.ma.us/schools/wilson/webquest/norton/internet_webquest/esaydesc.html)

<http://www.infoplease.com/homework/writingskills7.html>

## Evaluation

	Beginning 1	Developing 2	Accomplished 3	Exemplary 4	Score
Tour Map	Messy , structures not shown or labeled, poor or absent drawing of	Average appearance, not all structures present or labeled, events	Attractive appearance, most structures present and labeled, most events listed,	Creative and attractive, all structures present and labeled, all events listed,	

	plant cell, no description of events seen at each site	seen not listed, poor plant cell	plant cell diagram complete	correct diagram of plant cell	
Itinerary	Absent, too short, no descriptions, not realistic, incomplete, uncreative	Not all processes mentioned, does not resemble a real itinerary, not very creative	Most events mentioned, somewhat realistic and authentic in appearance, somewhat creative in design	Very creative with all processes mentioned in correct sequence, very realistic in appearance and design	
Tour Guide Script	Absent, incorrect, or incomplete; very short without descriptions of processes; does not resemble tour guide script	Not very descriptive, sounds more like a rehash of notes than tour guide script, somewhat inaccurate or incomplete	Sounds conversational rather than like the notes, most processes described correctly and completely	Very creative, sounds like a tour guide script rather than a rehash of notes, accurate and complete description of processes	

## Conclusion

Congratulations! You have completed your first tours and all participants agree that the trip was an overwhelming success. Hopefully, you have gained a better understanding of the importance of plants in creating food and enriching our atmosphere with increased oxygen and decreased carbon dioxide.