

# MORPHIOLOGY



STUDY PLANT

EXTERNAL STRUCTURE

MORPHOLOGY



**MORPHOLOGY**

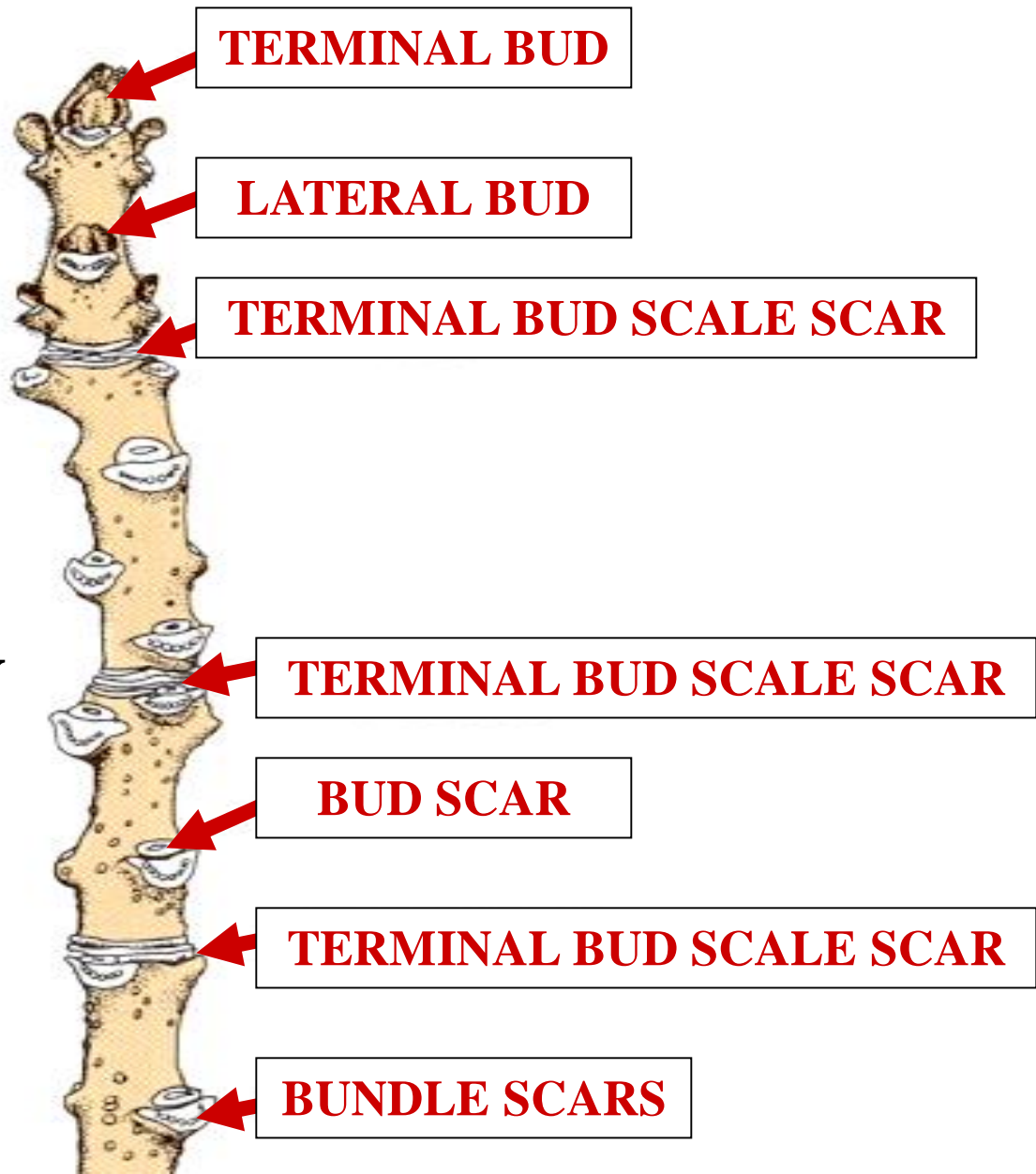
**STUDY**

**EXTERNAL**

**PLANT STRUCTURE**



# ANGIOSPERM TWIG MORPHOLOGY



# PHYLOGENY

# PHYLOGENY



# STUDY PLANT EVOLUTION

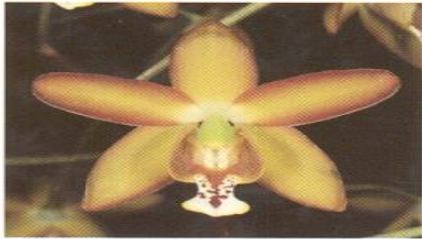
# PHYLOGENY

A large, close-up photograph of a white magnolia flower with green leaves, serving as the background for the text. The flower is in full bloom, showing its characteristic large, overlapping petals and a prominent, golden-brown stamen. The background is dark and out of focus, highlighting the flower and leaves.

**PHYLOGENY  
STUDY  
PLANT EVOLUTION**

# PLANT PHYLOGENY

^ T



# TRACHEOPHYTES

# TAXONOMY



# TAXONOMY



# STUDY PLANT CLASSIFICATION

# TAXONOMY



**TAXONOMY  
STUDY  
PLANT  
CLASSIFICATION**



Common potato



Eggplant



Habanero pepper



Tomato



Morning glory



Sweet potato



Maple



Sunflower



Pea



Corn



Grass



**PLANTAE**



**MAGNOLIOPHYTA**



**MAGNOLIOPSIDA**



**MAGNOLIALES**



**MAGNOLIACEAE**



**LIRIODENDRON**

**TULIP POPLAR**



**TULIPIFERA**

**TAXONOMIC CLASSIFICATION**





# PLANT DEFINITION



**PLANT DEFINITION**

**NO**

**COMMON DEFINITION**

**AMONGST BOTANISTS**

A close-up photograph of a white magnolia flower in full bloom, surrounded by dark green, glossy leaves. The background is dark and out of focus. The text is overlaid on the center of the flower.

**PLANT  
DEFINITION  
SUBJECTIVE**

# PLANT CLASS DEFINITION

**PLANT**





**PLANT**

**ORGANISM THAT  
POSSESSES PLASTIDS**

**PLANT**

# PLANT CELL

P

PLASTID

C.S.



**PLASTID**

# PLASTID

PLANT ORGANELLE  
ASSOCIATED WITH:

PLASTID

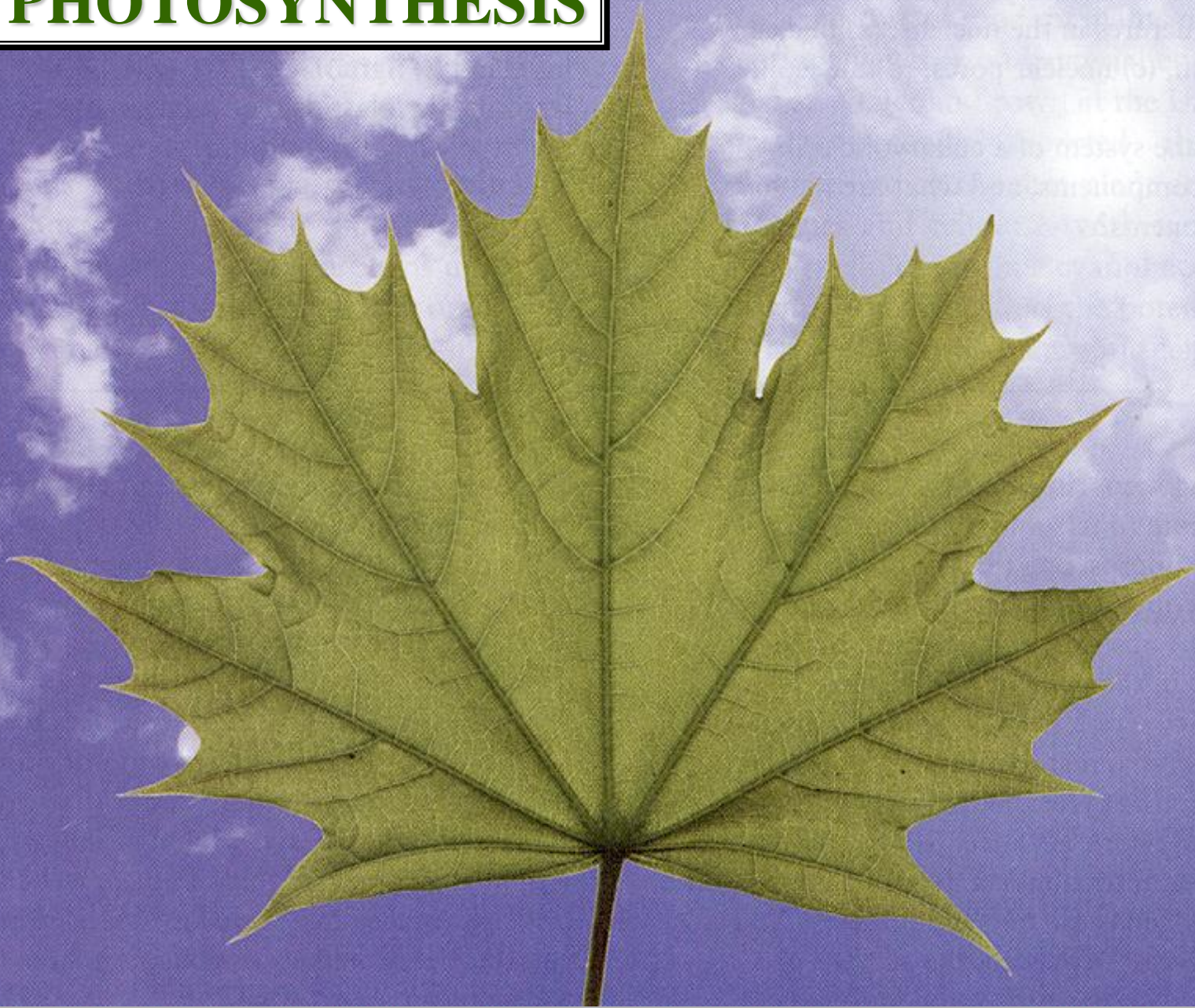


# **PLASTID**

**PLANT ORGANELLE  
ASSOCIATED WITH:  
PHOTOSYNTHESIS**

**PLASTID**

# PHOTOSYNTHESIS

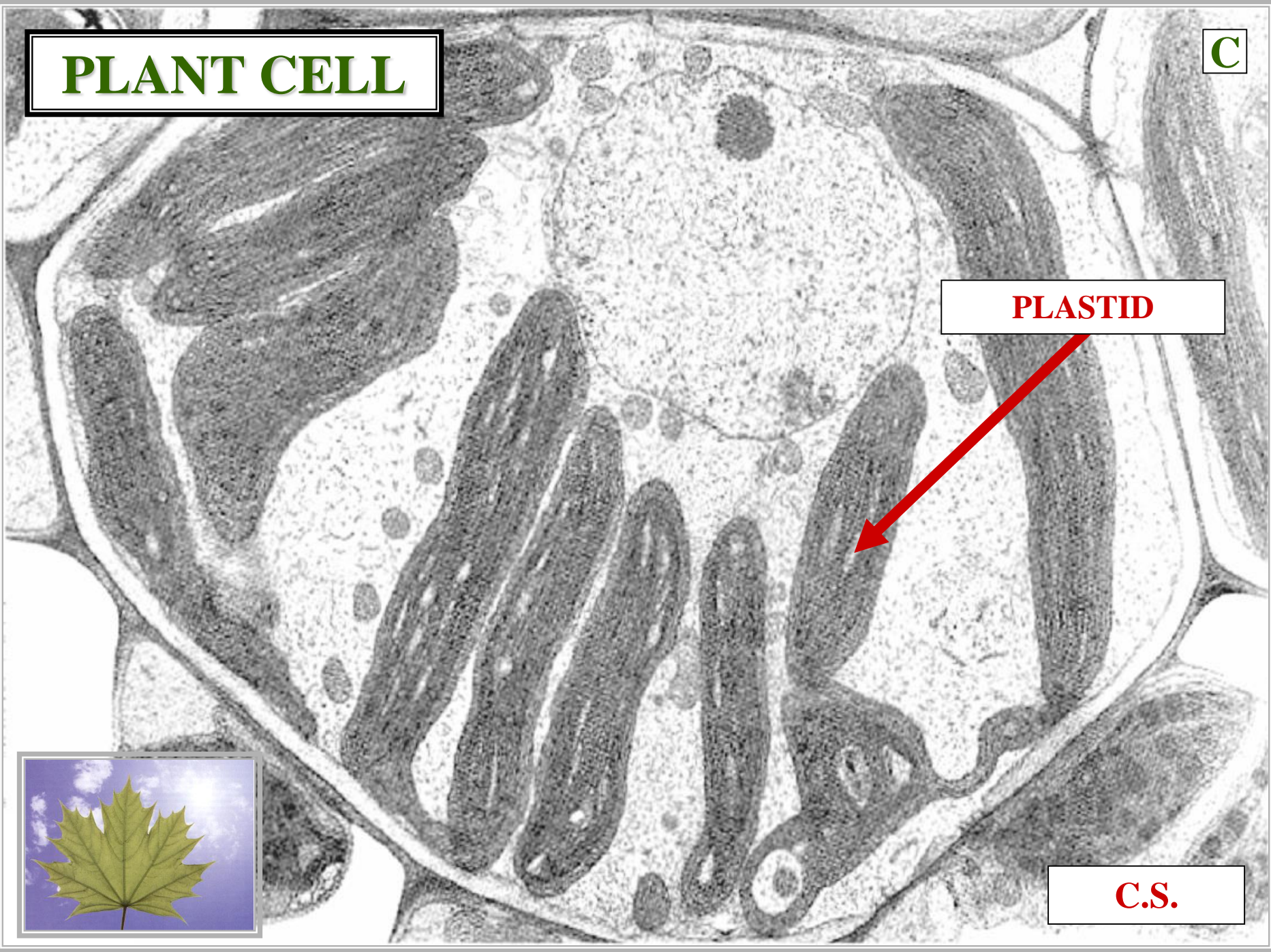


# PLANT CELL

C

PLASTID

C.S.

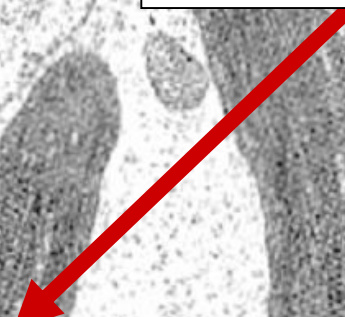


# PLANT CELL

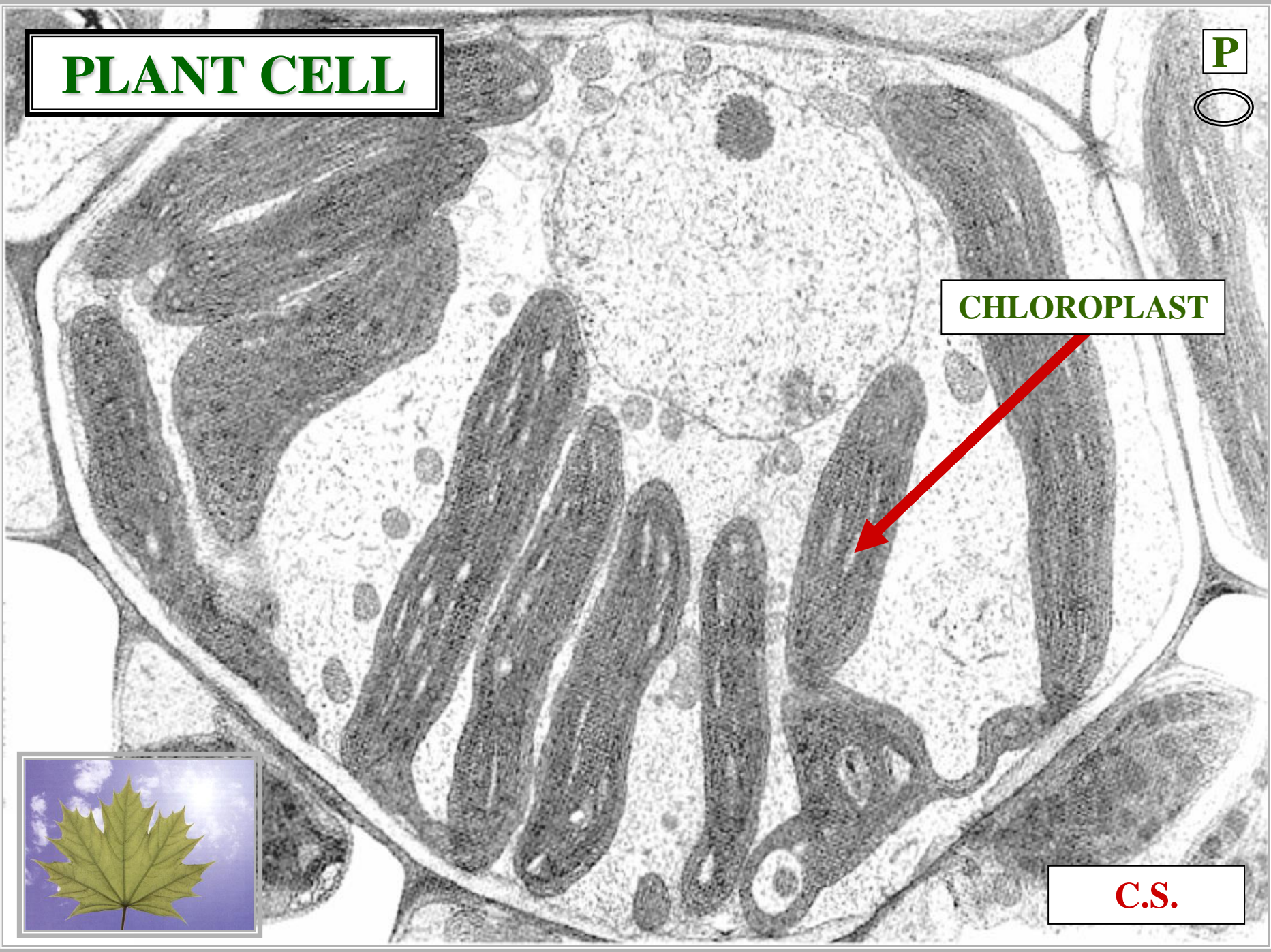
P



CHLOROPLAST



C.S.





# PHOTOSYNTHESIS



^  
P

WATER

CO<sub>2</sub>

**LIGHT ENERGY**

**PHOTO**

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID

ATP

DK RXT

STROMA

CHLOROPLAST

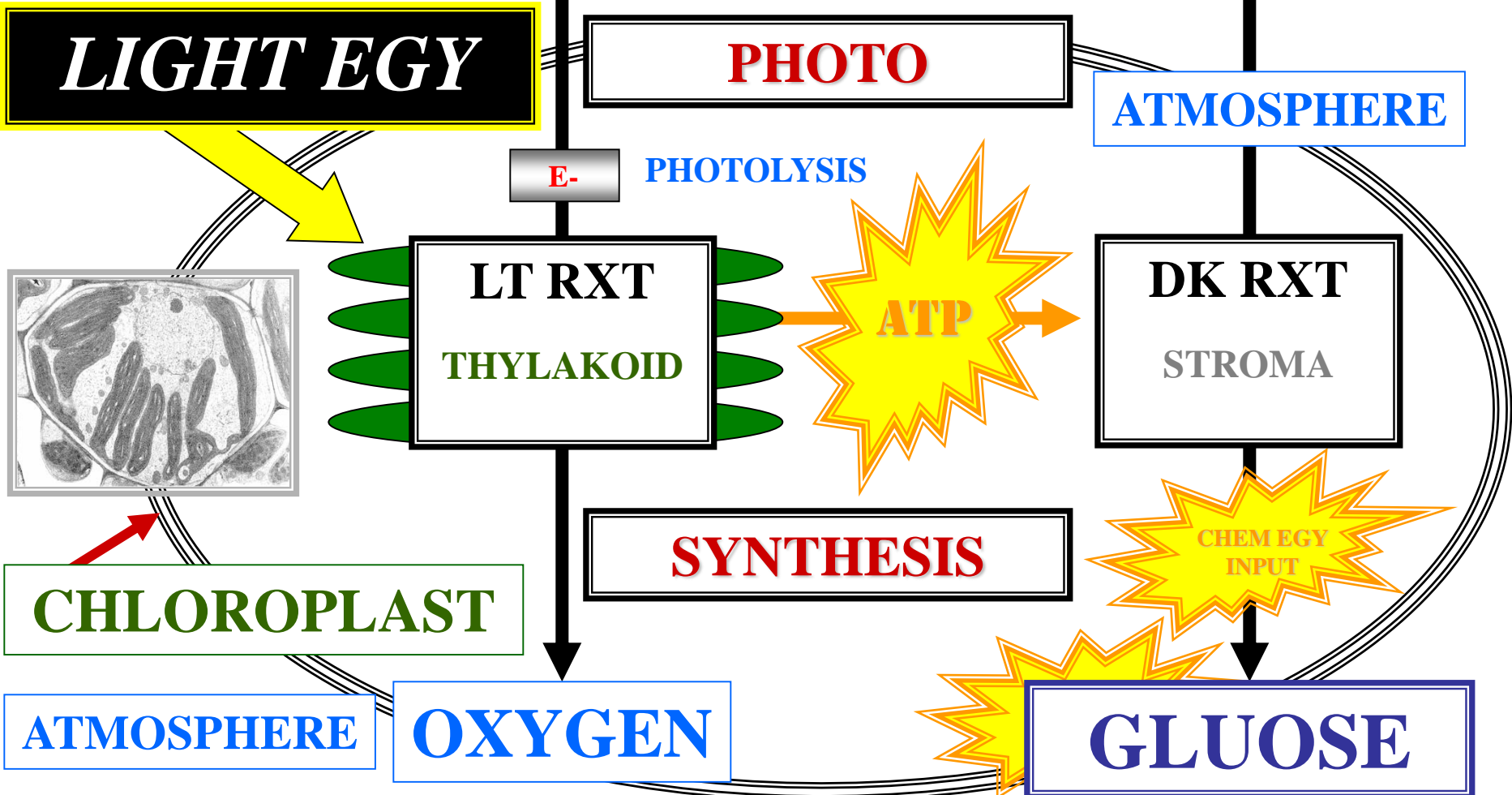
**SYNTHESIS**

CHEMICAL INPUT

ATMOSPHERE

OXYGEN

GLUCOSE



# PLASTID

PLANT ORGANELLE  
ASSOCIATED WITH:

PLASTID



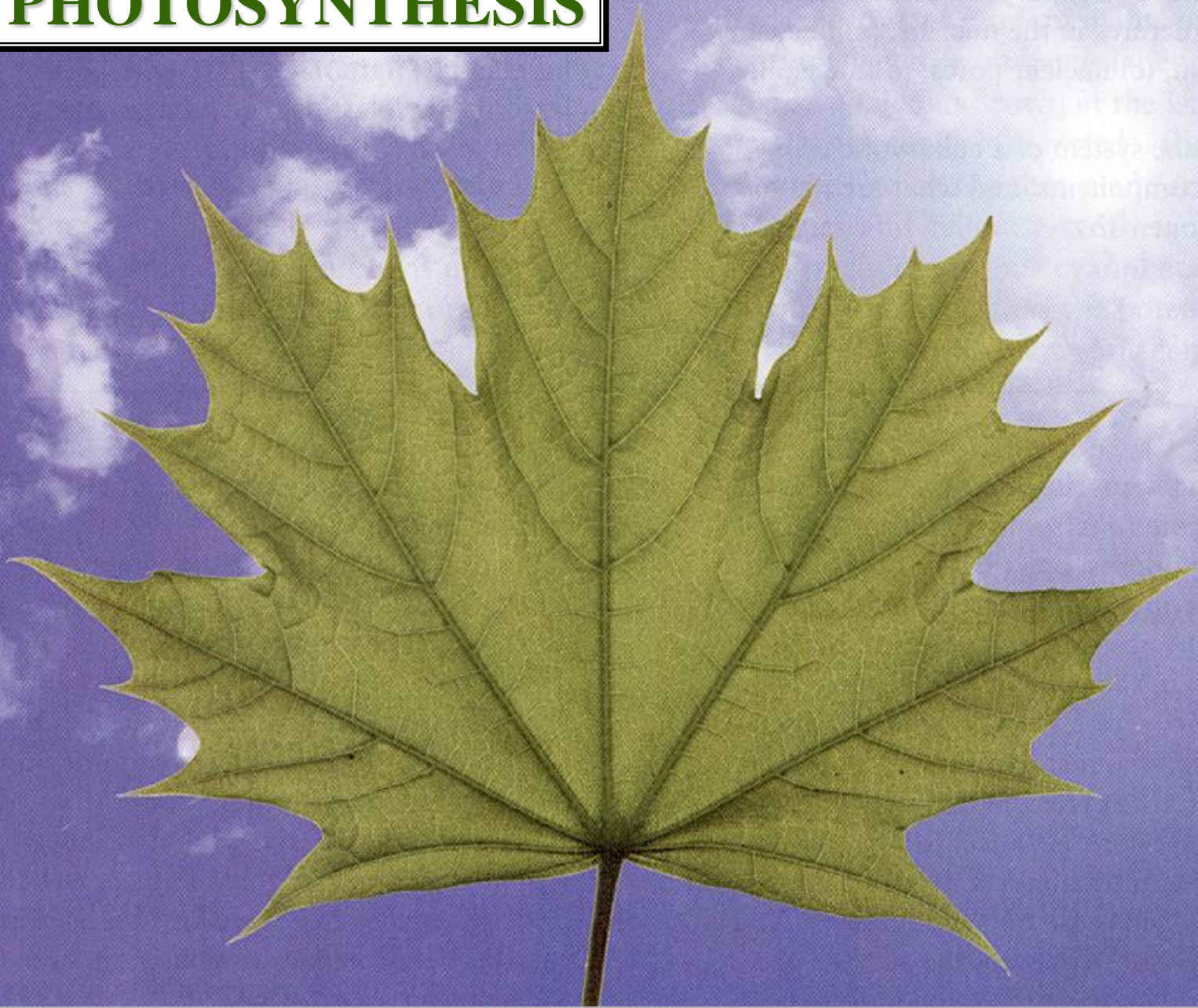
# **PLASTID**

**PLANT ORGANELLE  
ASSOCIATED WITH:  
STARCH STORAGE**

**PLASTID**

# PHOTOSYNTHESIS

P



# PHOTOSYNTHESIS

S



WATER

CO<sub>2</sub>

**LIGHT ENERGY**

**PHOTO**

ATMOSPHERE

**E-** PHOTOLYSIS



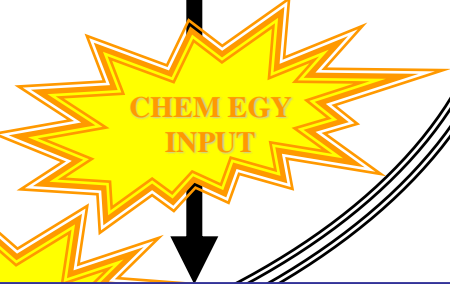
**LT RXT**  
**THYLAKOID**



**DK RXT**  
**STROMA**

**CHLOROPLAST**

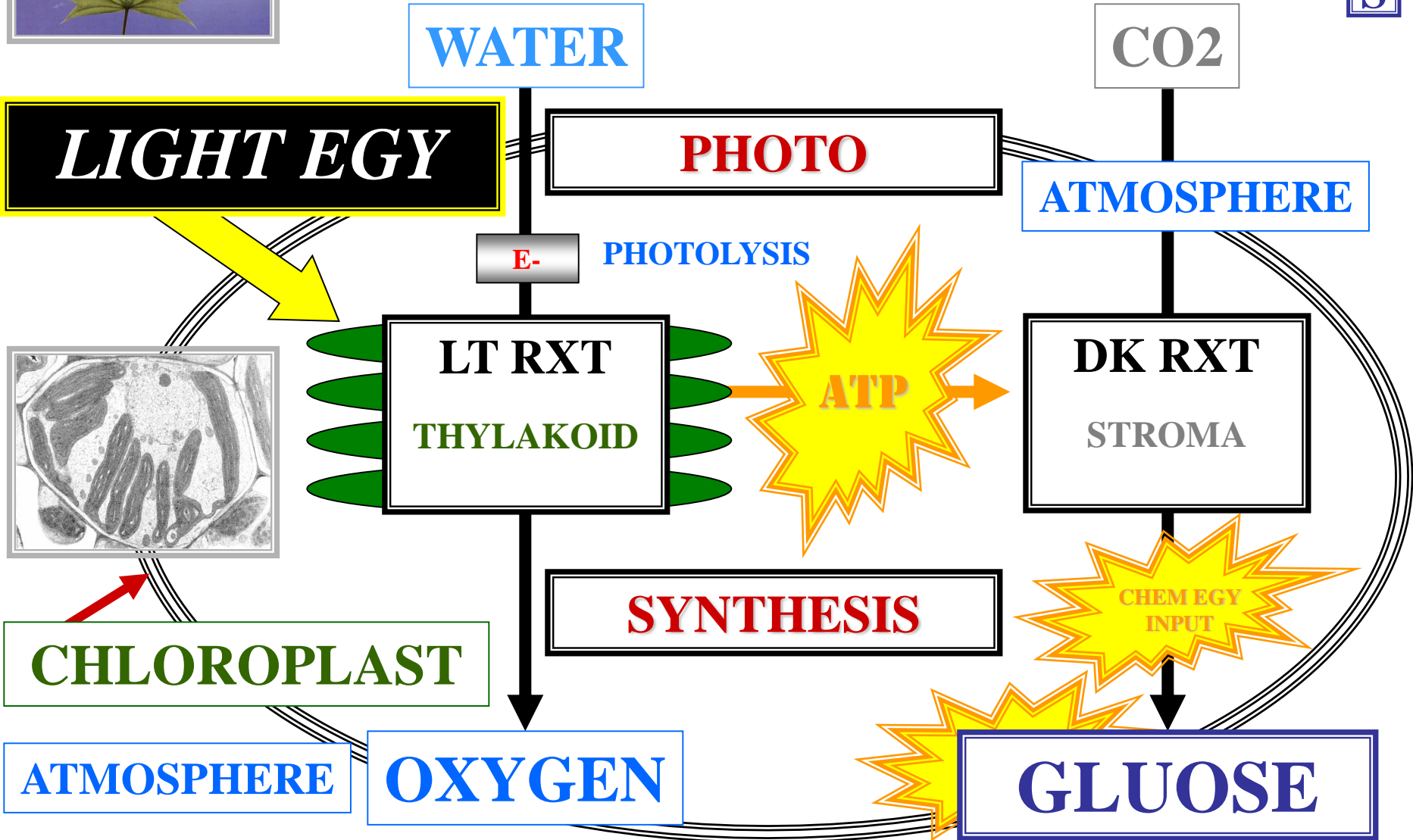
**SYNTHESIS**



ATMOSPHERE

**OXYGEN**

**GLUCOSE**



# PHOTOSYNTHESIS



WATER

CO<sub>2</sub>

**LIGHT ENERGY**

**PHOTO**

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT  
THYLAKOID

ATP

DK RXT  
STROMA

CHLOROPLAST

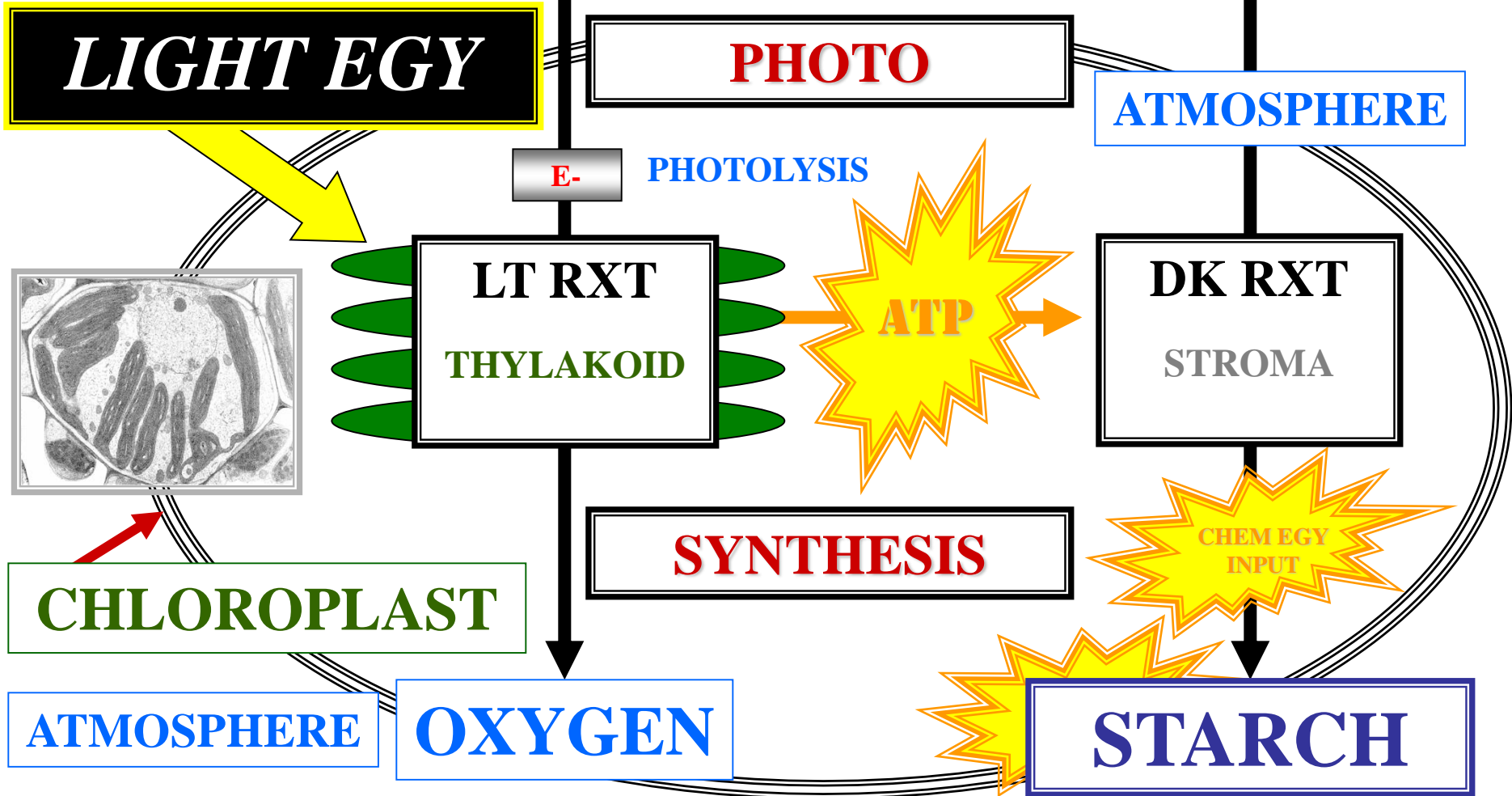
**SYNTHESIS**

CHEMICAL ENERGY INPUT

ATMOSPHERE

OXYGEN

STARCH



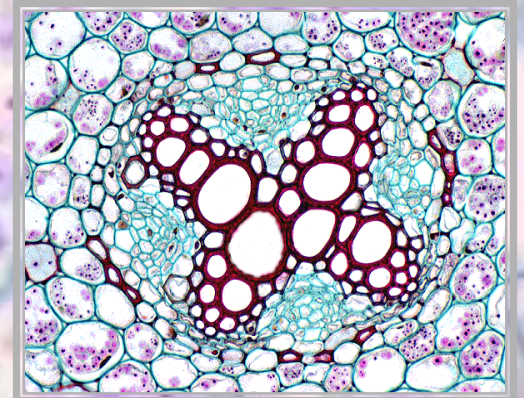
# STARCH STORAGE

P

STARCH GRAINS

ROOT

C.S.



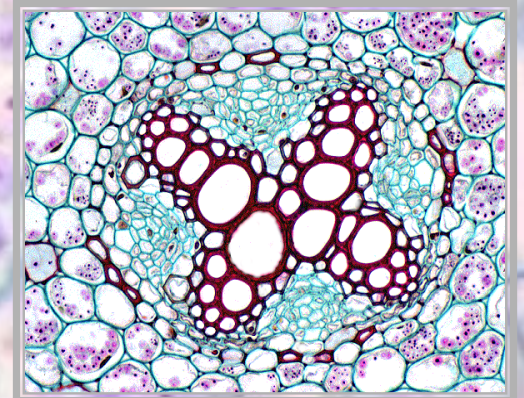
# STARCH STORAGE

L

PLASTIDS

ROOT

C.S.

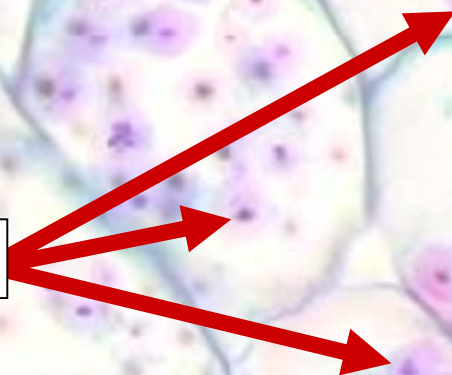




# STARCH STORAGE

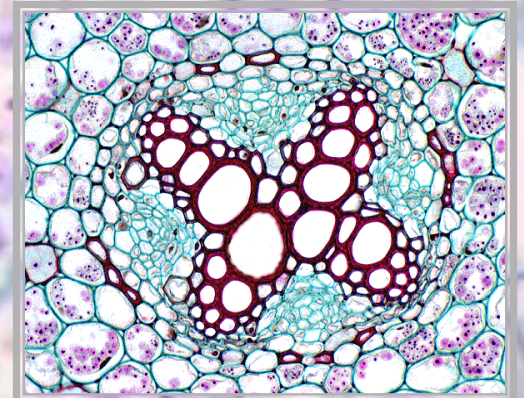


**LEUCOPLASTS**



**ROOT**

**C.S.**



**PLANT**

**ORGANISM THAT  
POSSESSES PLASTIDS**

**PLANT**

**TRUE PLANT**



**TRUE PLANT**

**POSSESSES**

**CHLOROPLASTS WITH:**

**TRUE PLANT**



**TRUE PLANT**

**POSSESSES**

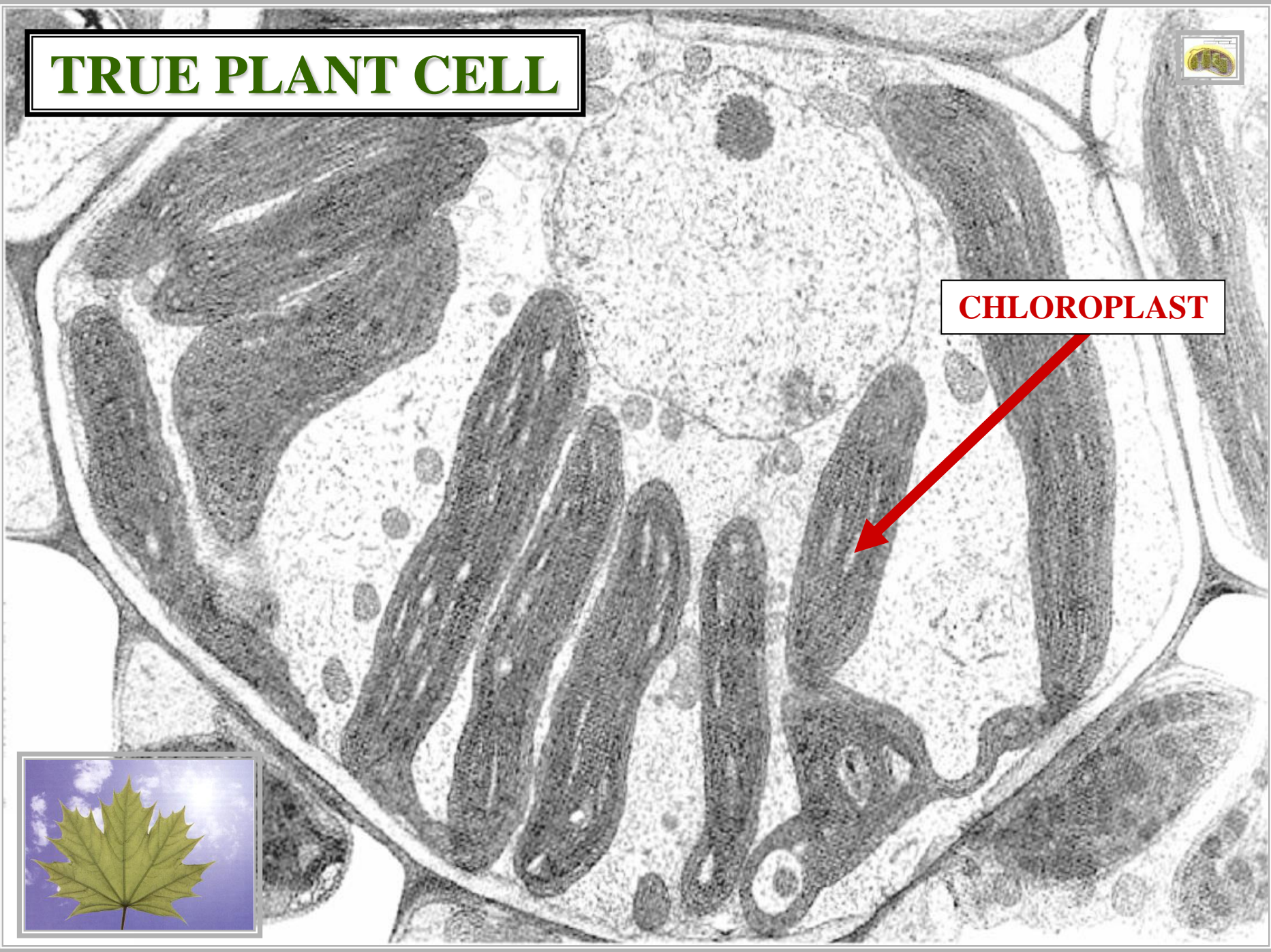
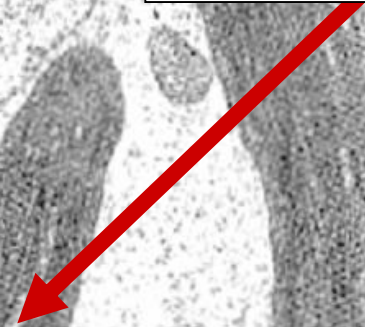
**CHLOROPLASTS WITH:  
DOUBLE MEMBRANE**

**TRUE PLANT**

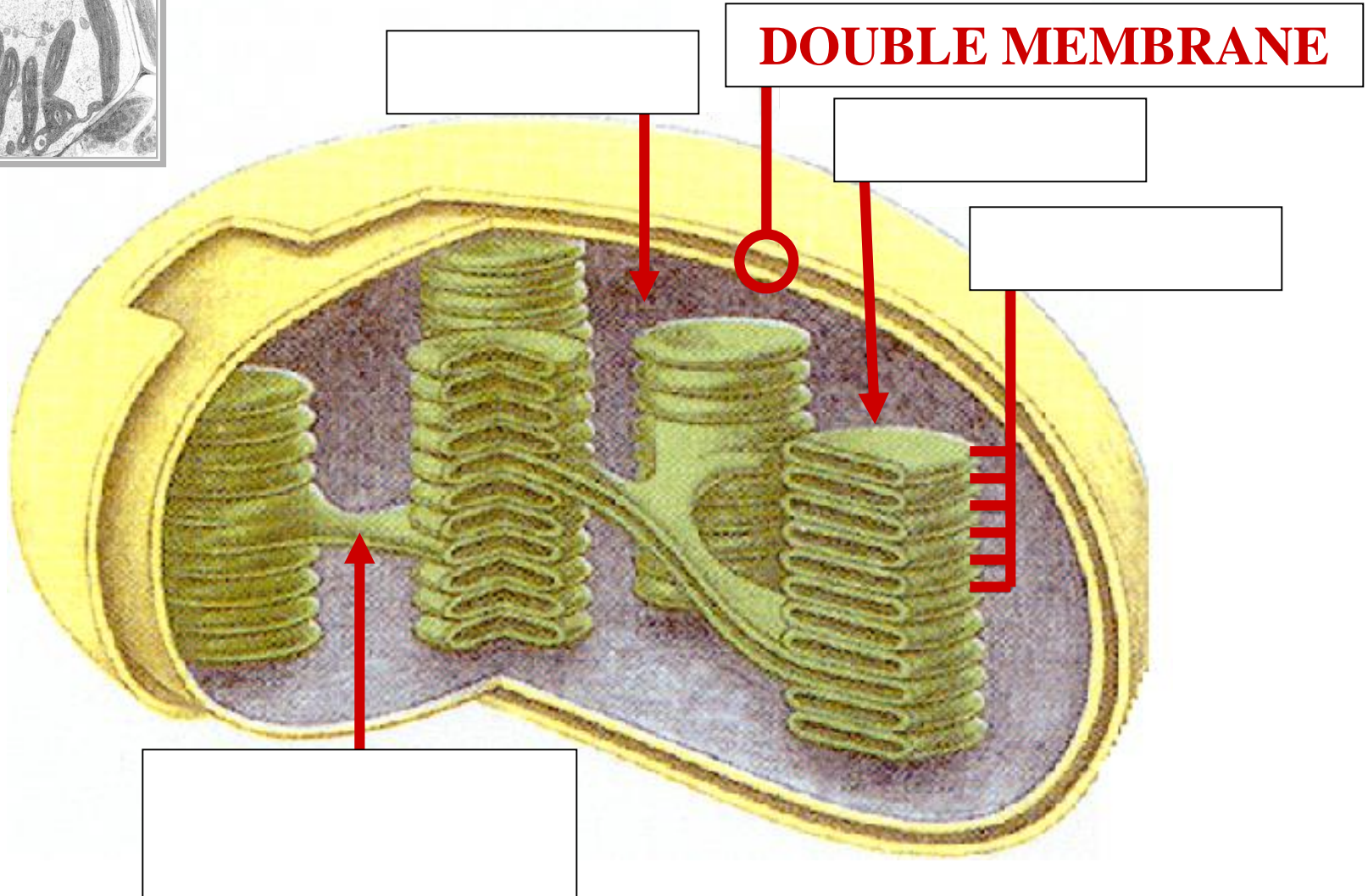
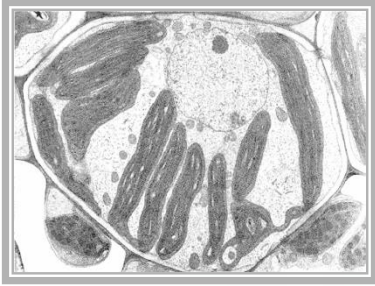
# TRUE PLANT CELL



**CHLOROPLAST**



# TRUE PLANT CHLOROPLAST ULTRASTRUCTURE





**TRUE PLANT**

**POSSESSES**

**CHLOROPLASTS WITH:**

**TRUE PLANT**





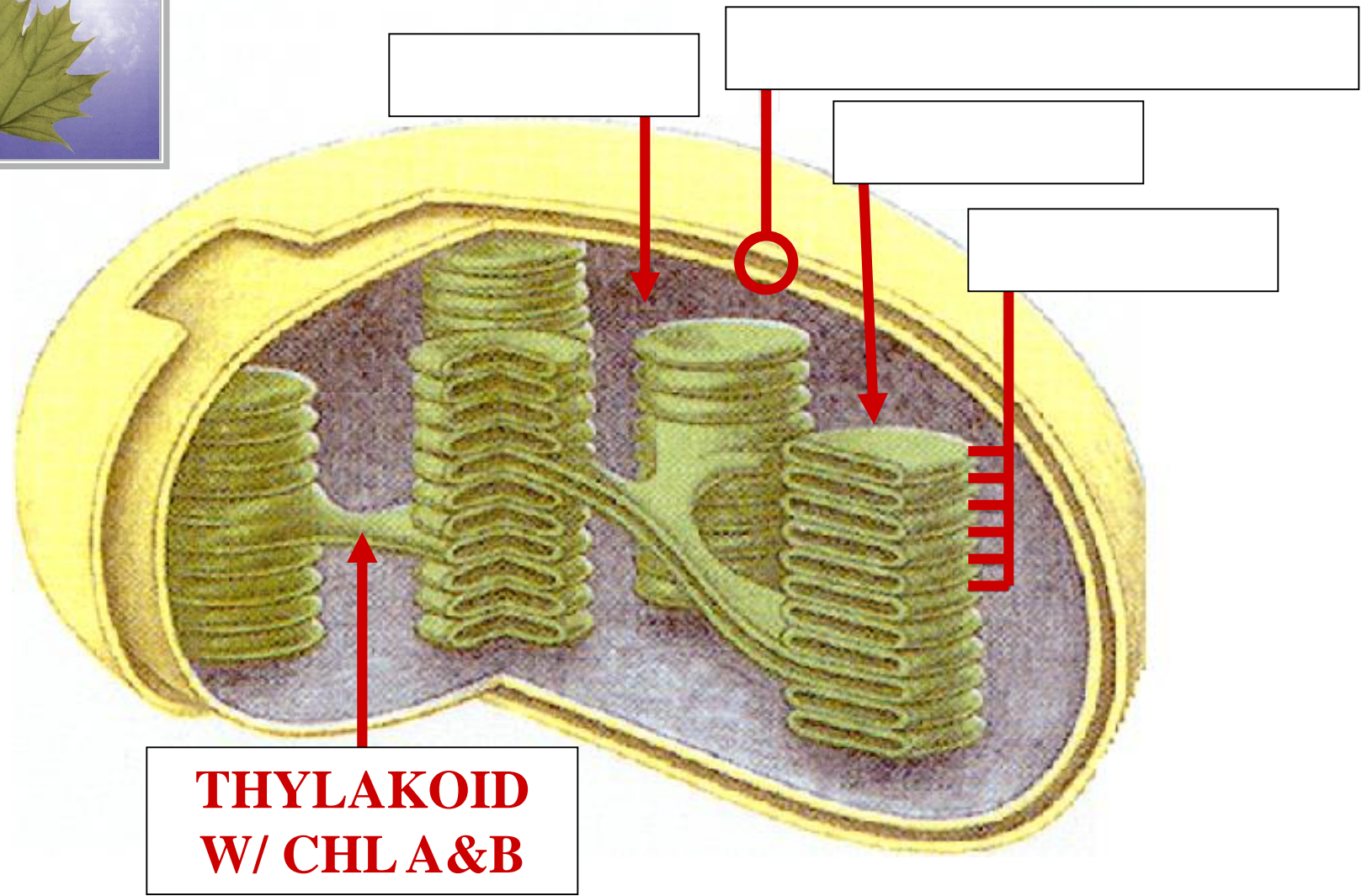
**TRUE PLANT**

**POSSESSES**

**CHLOROPLASTS WITH:  
CHLOROPHYLL A&B**

**TRUE PLANT**

# TRUE PLANT CHLOROPLAST ULTRASTRUCTURE





**TRUE PLANT**

**POSSESSES**

**CHLOROPLASTS WITH:**

**DOUBLE MEMBRANE**

**CHLOROPHYLL A&B**

**TRUE PLANT**



?



***MAGNOLIA***



**PLANT**



**TRUE PLANT**



# PLASTID EVOLUTION



# ENDOSYMBIOTIC THEORY

# **ENDOSYMBIOTIC THEORY**



**ENDOSYMBIOTIC  
THEORY**

**PLASTID  
EVOLUTION  
VIA  
SYMBIOSIS**

**ENDOSYMBIOTIC  
THEORY**

# SYMBIOSIS

# **SYMBIOSIS**



# **SYMBIOSIS**

**2 SPECIES**

**LIVING INTRICATE  
ASSOCIATION**

**SYMBIOSIS**





**LICHEN**

**LICHEN  
SYMBIOTIC  
RELATIONSHIP**

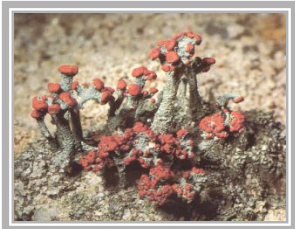
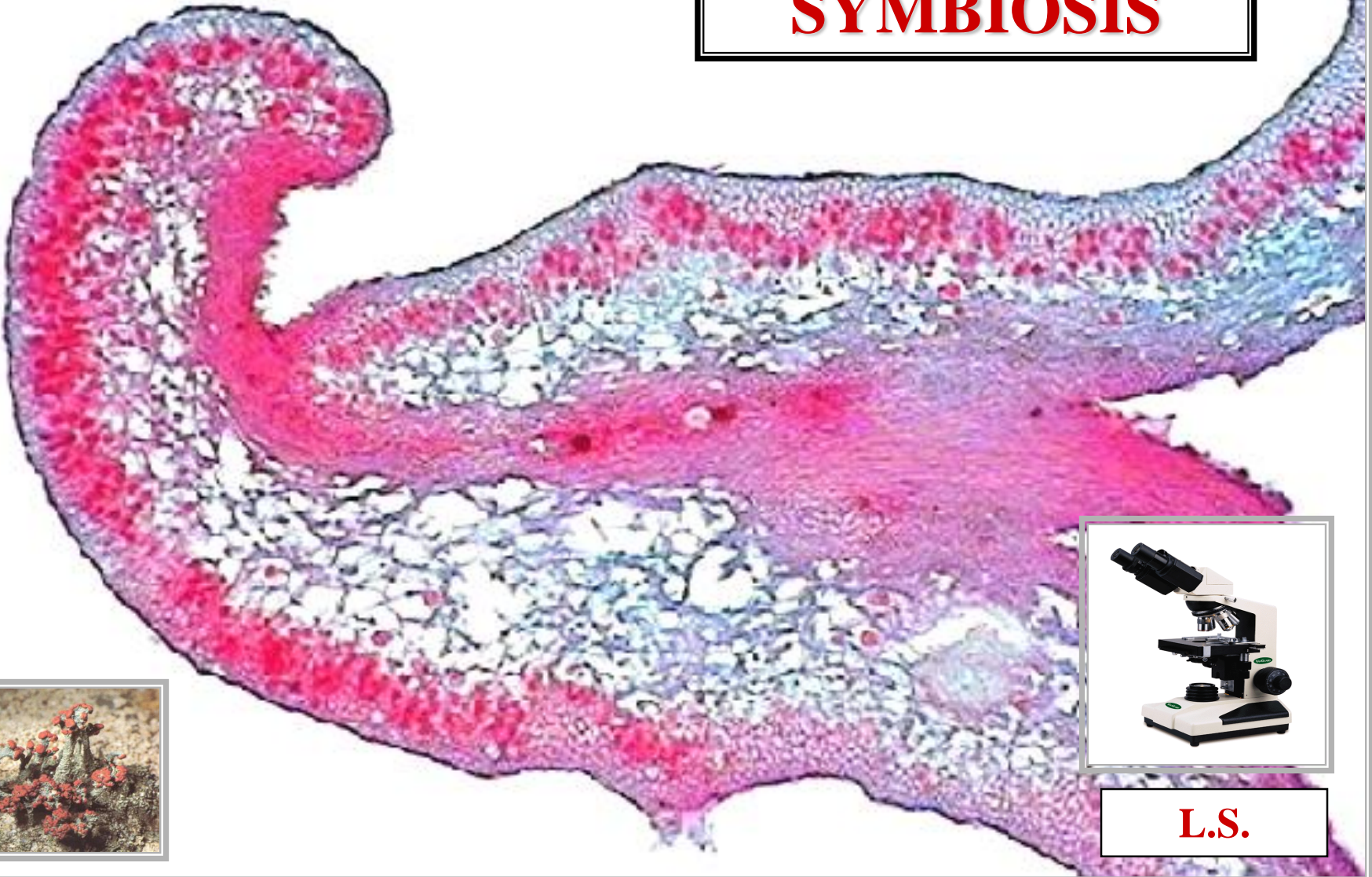




# LICHEN THALLUS

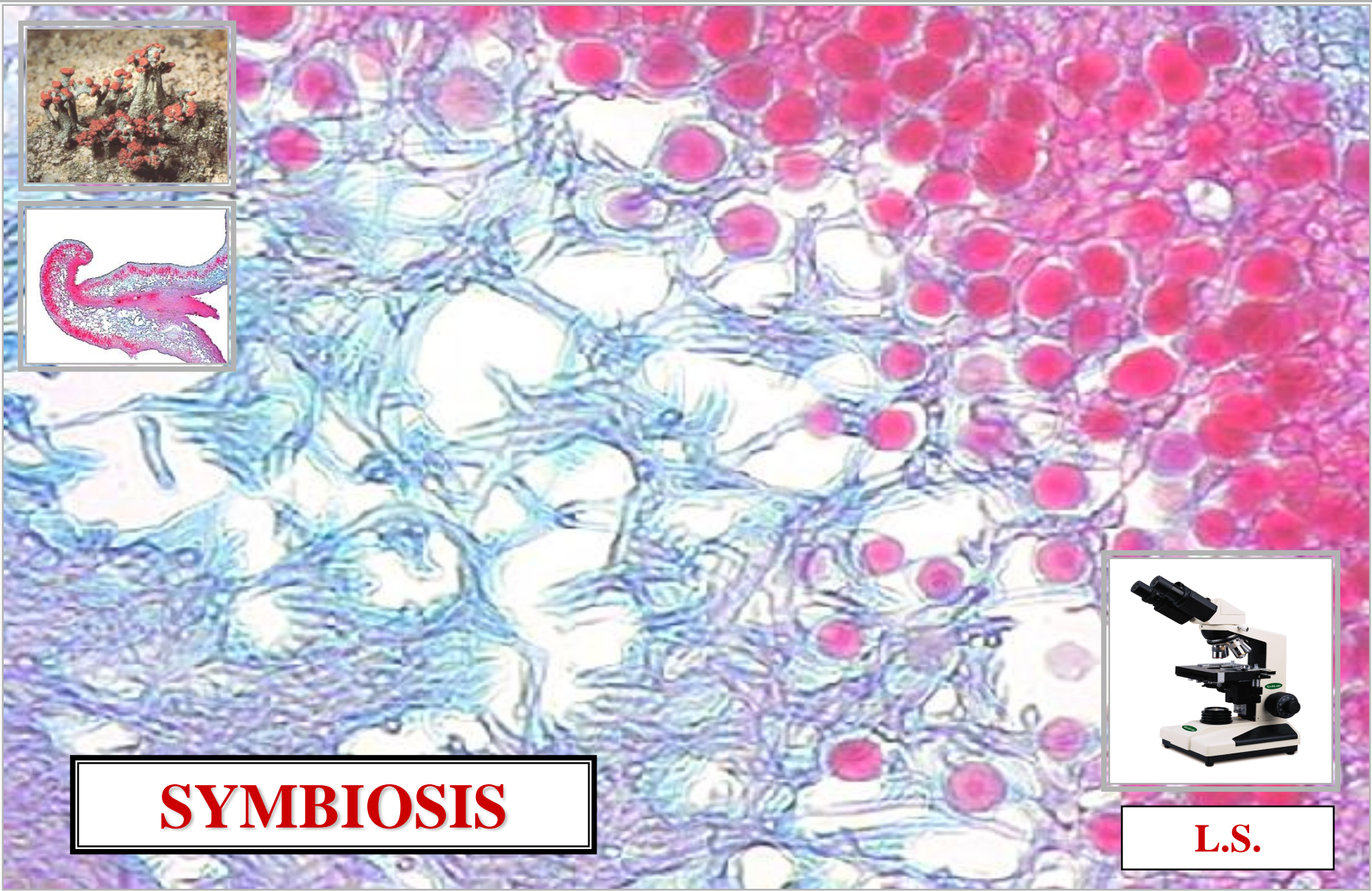
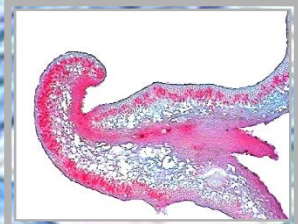
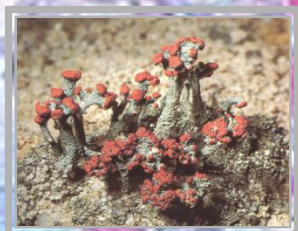


**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS

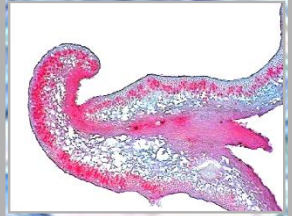


**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



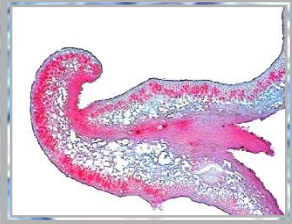
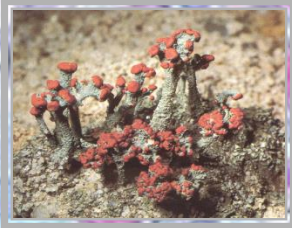
**FUNGUS SYMBIONT**

**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



**BACTERIA SYMBIONT**

**FUNGUS SYMBIONT**

**SYMBIOSIS**

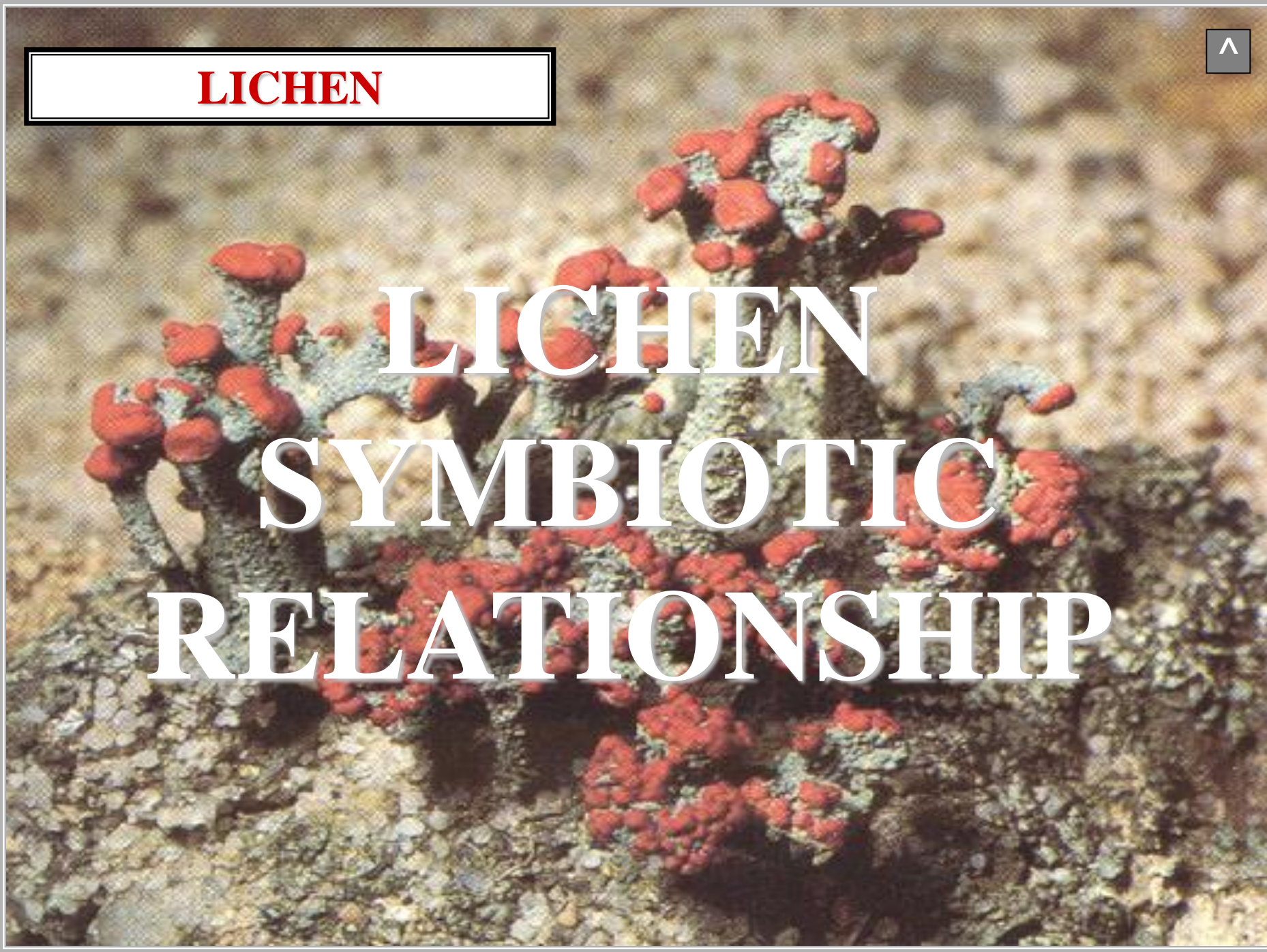


**L.S.**

**LICHEN**



**LICHEN  
SYMBIOTIC  
RELATIONSHIP**



# SYMBIOSIS TYPES

# **SYMBIOSIS TYPES**

**PARASITISM**

**SYMBIOSIS TYPES**

# **SYMBIOSIS TYPES**

**PARASITISM**

**COMMENSALISM**

**SYMBIOSIS TYPES**



# **SYMBIOSIS TYPES**

**PARASITISM**

**COMMENSALISM**

**MUTUALISM**

# **SYMBIOSIS TYPES**

# PARASITISM



**SYMBIOSIS**  
**PARASITISM**

**ONE SPECIES BENEFITS**  
**ONE SPECIES ADVERSELY**  
**AFFECTED**

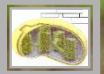
**SYMBIOSIS**  
**PARASITISM**

# INDIAN PIPE

F

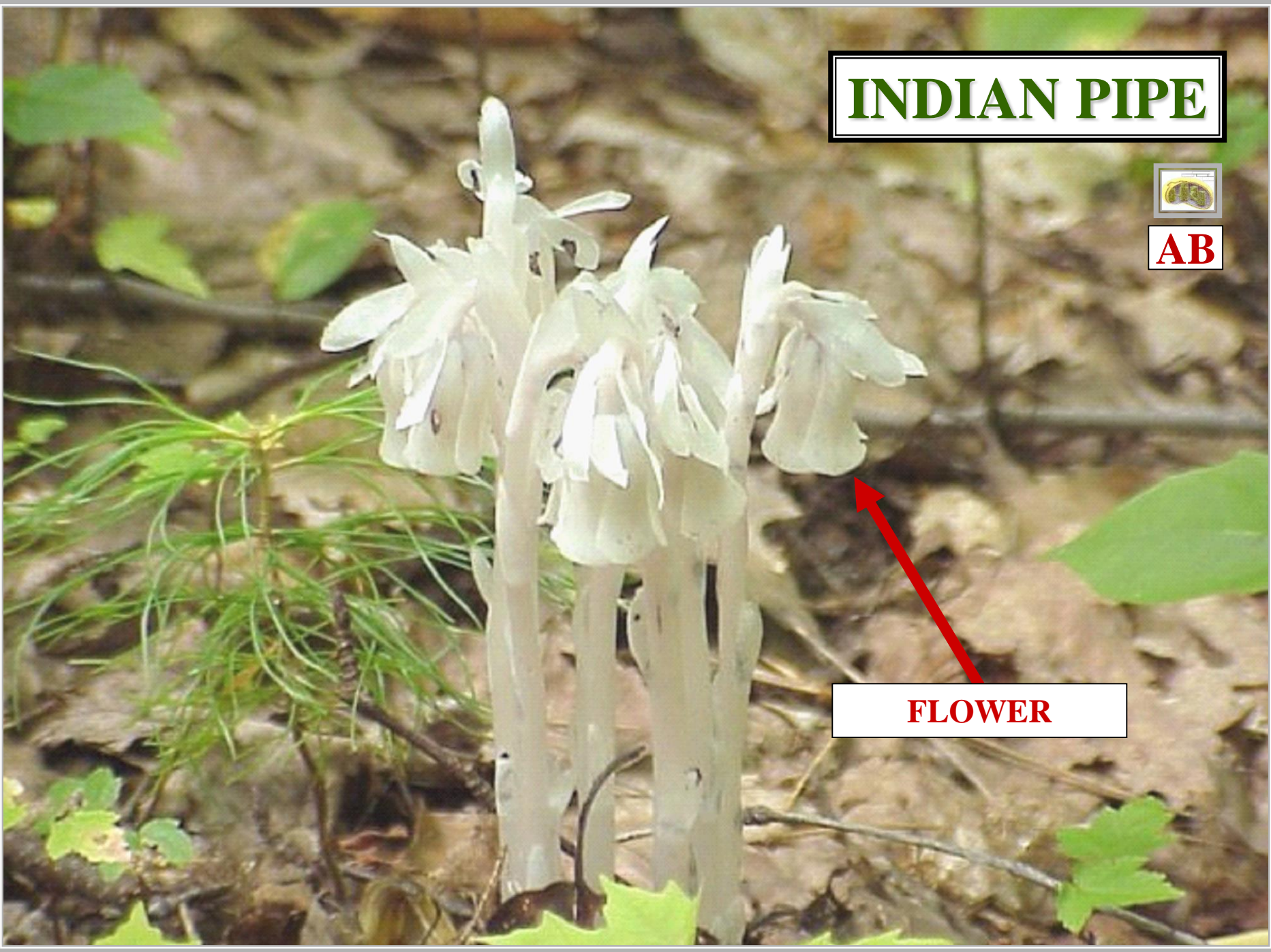


# INDIAN PIPE



**AB**

**FLOWER**



# INDIAN PIPE

P

AB



CHLOROPLASTS ABSENT

# INDIAN PIPE

N



**PHOTOSYNTHESIS ABSENT**

A photograph of an Indian Pipe (Monotropa hypopitys) plant. The plant is a pale, translucent white color with several upright stems and clusters of bell-shaped flowers. It is growing in a forest floor covered with brown, fallen leaves. To the left of the plant, there is a small, green, needle-like plant. The background is a soft-focus forest floor with more leaves and twigs.

**INDIAN PIPE**

**P**

**NON-PSYN PLANT**



A photograph of an Indian Pipe (Monotropa hypopitys) plant. The plant is a pale, translucent white color with several upright stems. Each stem has a cluster of bell-shaped flowers at the top. The plant is growing in a forest setting with a ground covered in brown, fallen leaves. Some green leaves of other plants are visible in the background and foreground. The overall scene is a close-up of the plant in its natural habitat.

# INDIAN PIPE

^

# PARASITISM

# COMMENSALISM



# **SYMBIOSIS**

# **COMMENSALISM**

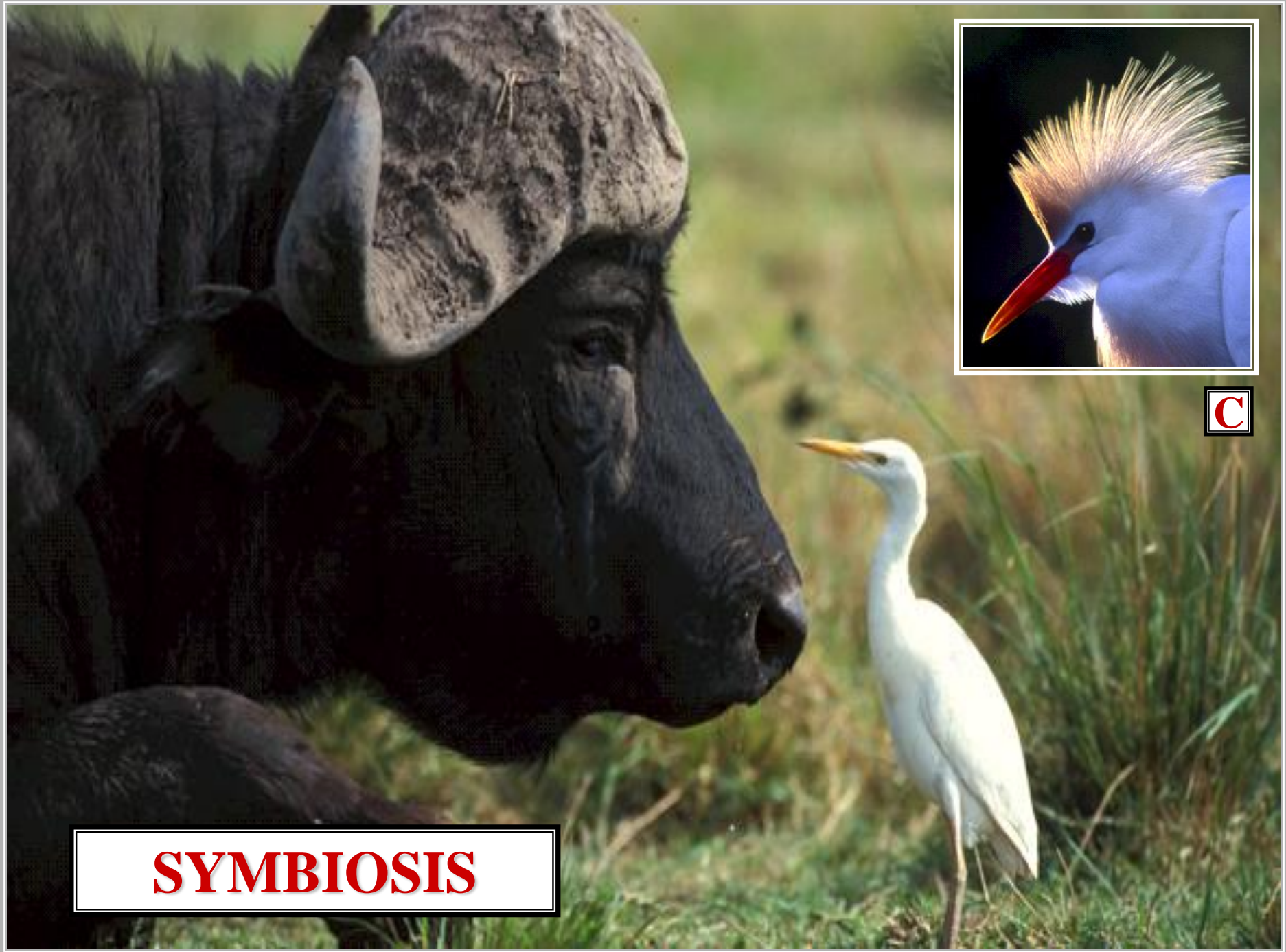
**ONE SPECIES BENEFITS**  
**ONE SPECIES UNAFFECTED**

# **SYMBIOSIS**

# **COMMENSALISM**

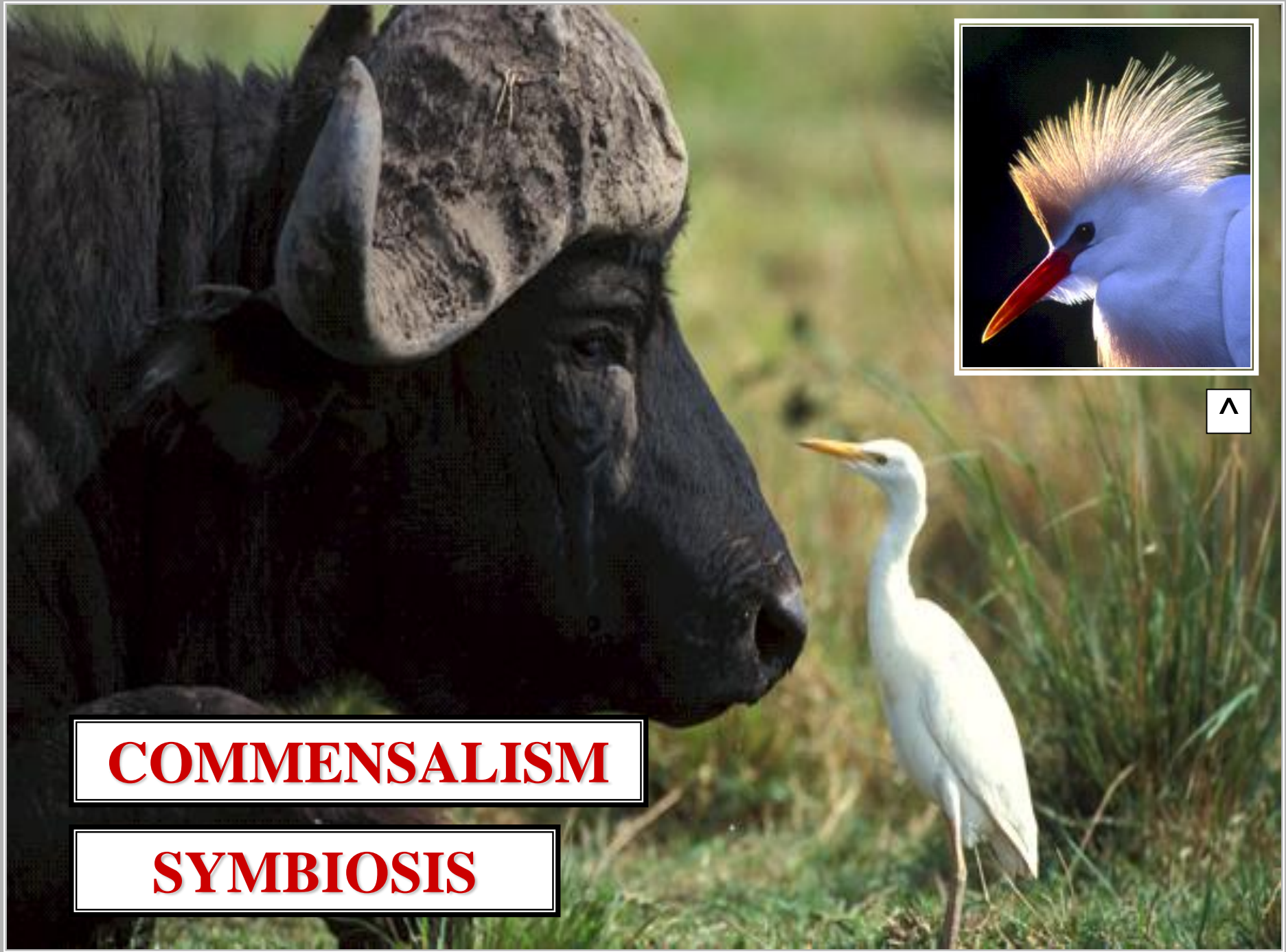
# AFRICAN SAVANNA





C

**SYMBIOSIS**



**COMMENSALISM**

**SYMBIOSIS**

**MUTUALISM**

# **SYMBIOSIS TYPES**



## **MUTUALISM**

**BOTH/TWO SPECIES**

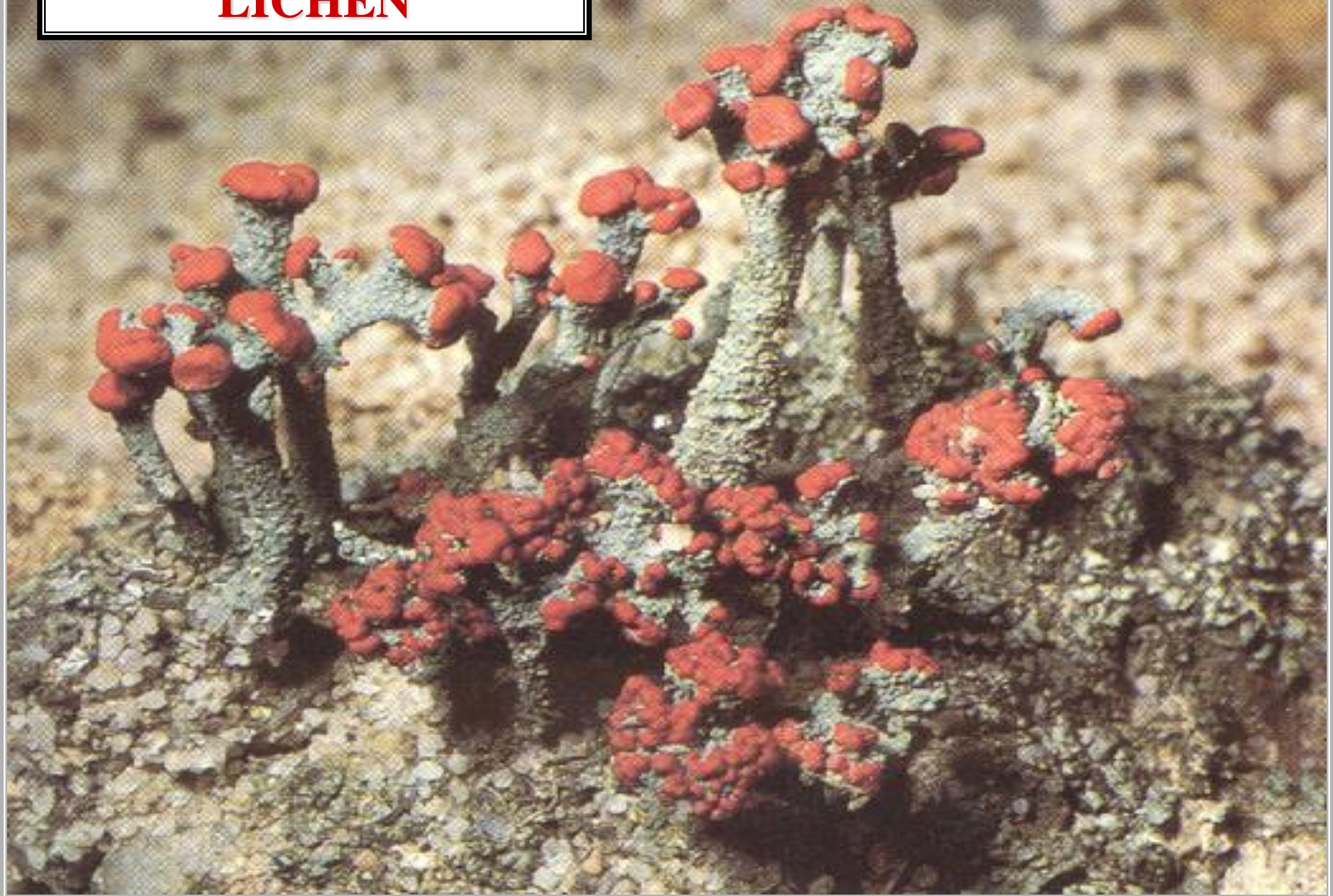
**BENEFIT**

# **SYMBIOSIS TYPES**

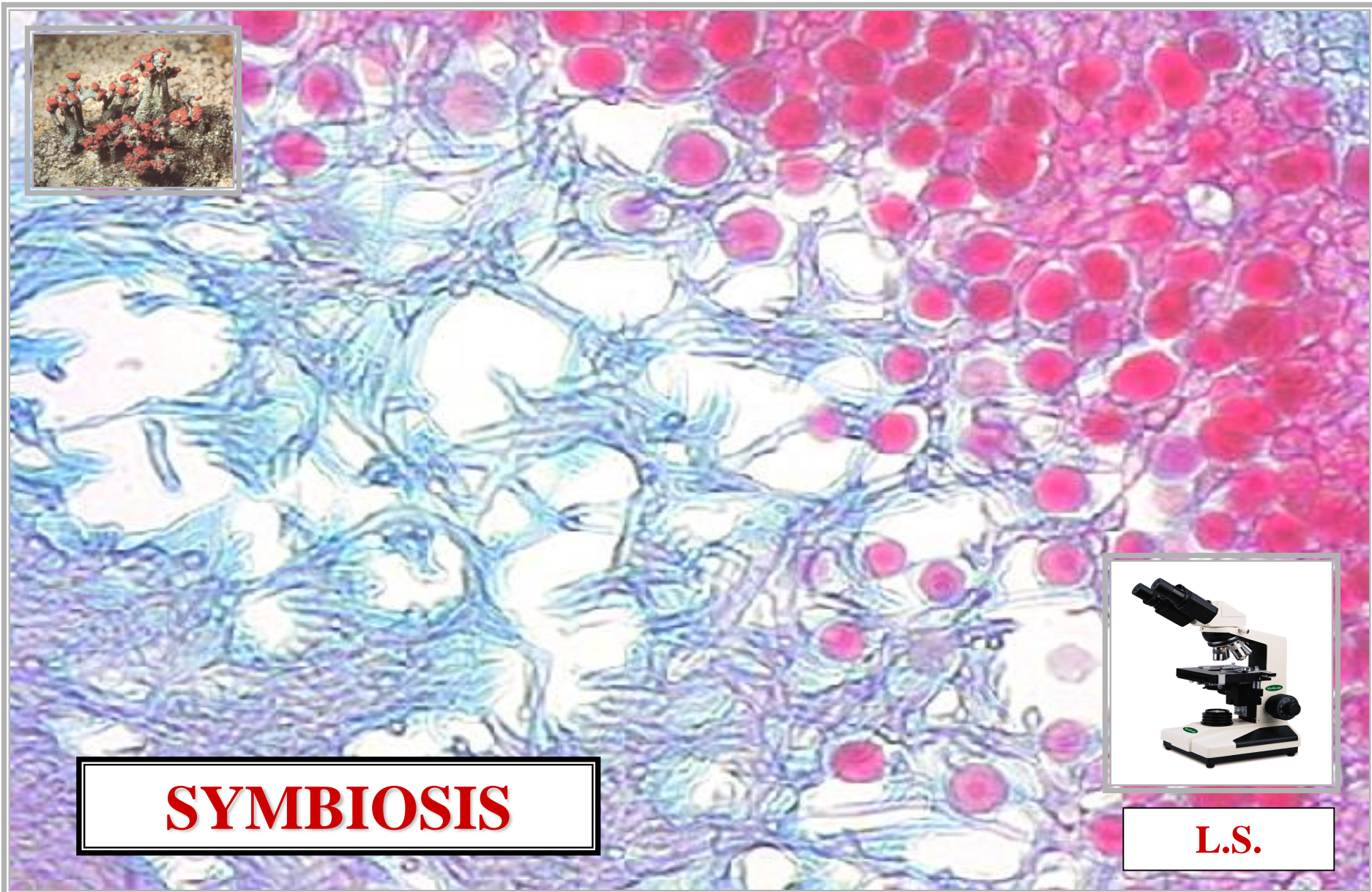
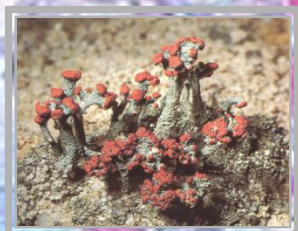
## **MUTUALISM**



# LICHEN



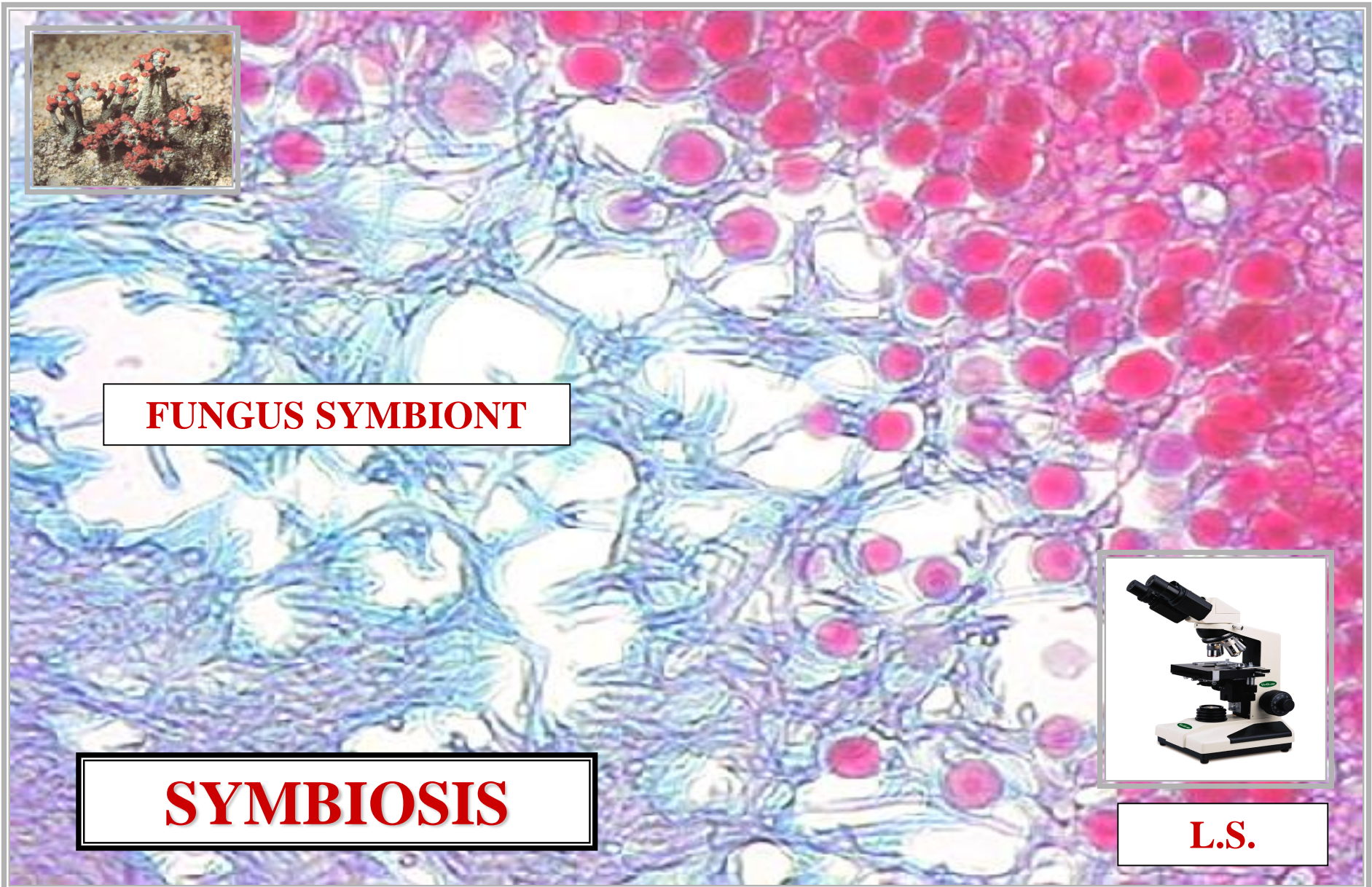
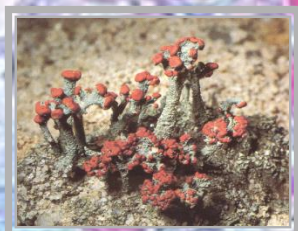
# LICHEN THALLUS



**SYMBIOSIS**

**L.S.**

# LICHEN THALLUS



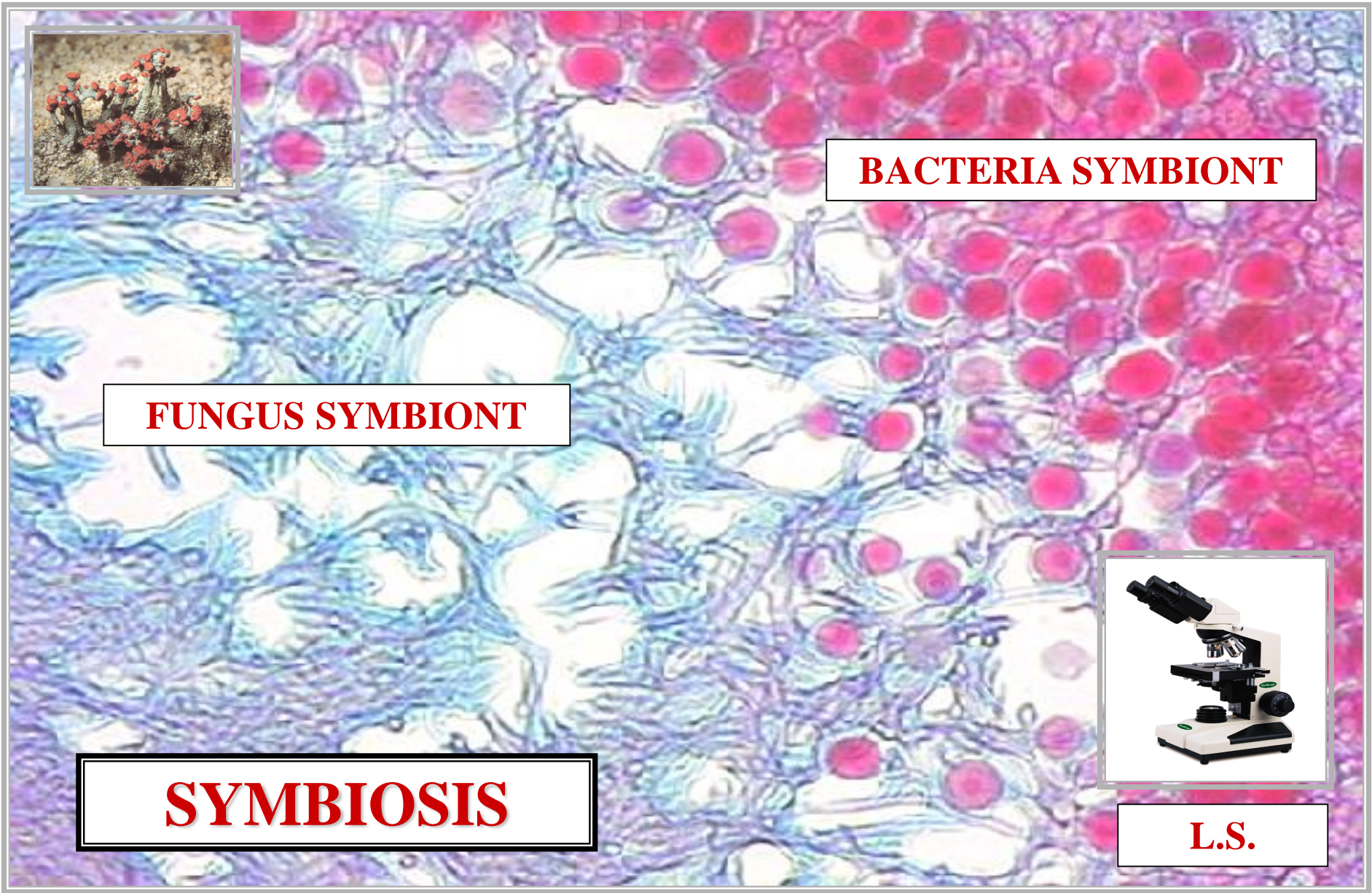
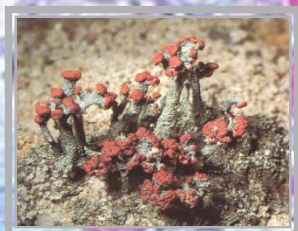
**FUNGUS SYMBIONT**

**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



**BACTERIA SYMBIONT**

**FUNGUS SYMBIONT**

**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



**BACTERIA SYMBIONT**  
**PHOTOSYNTHETIC**

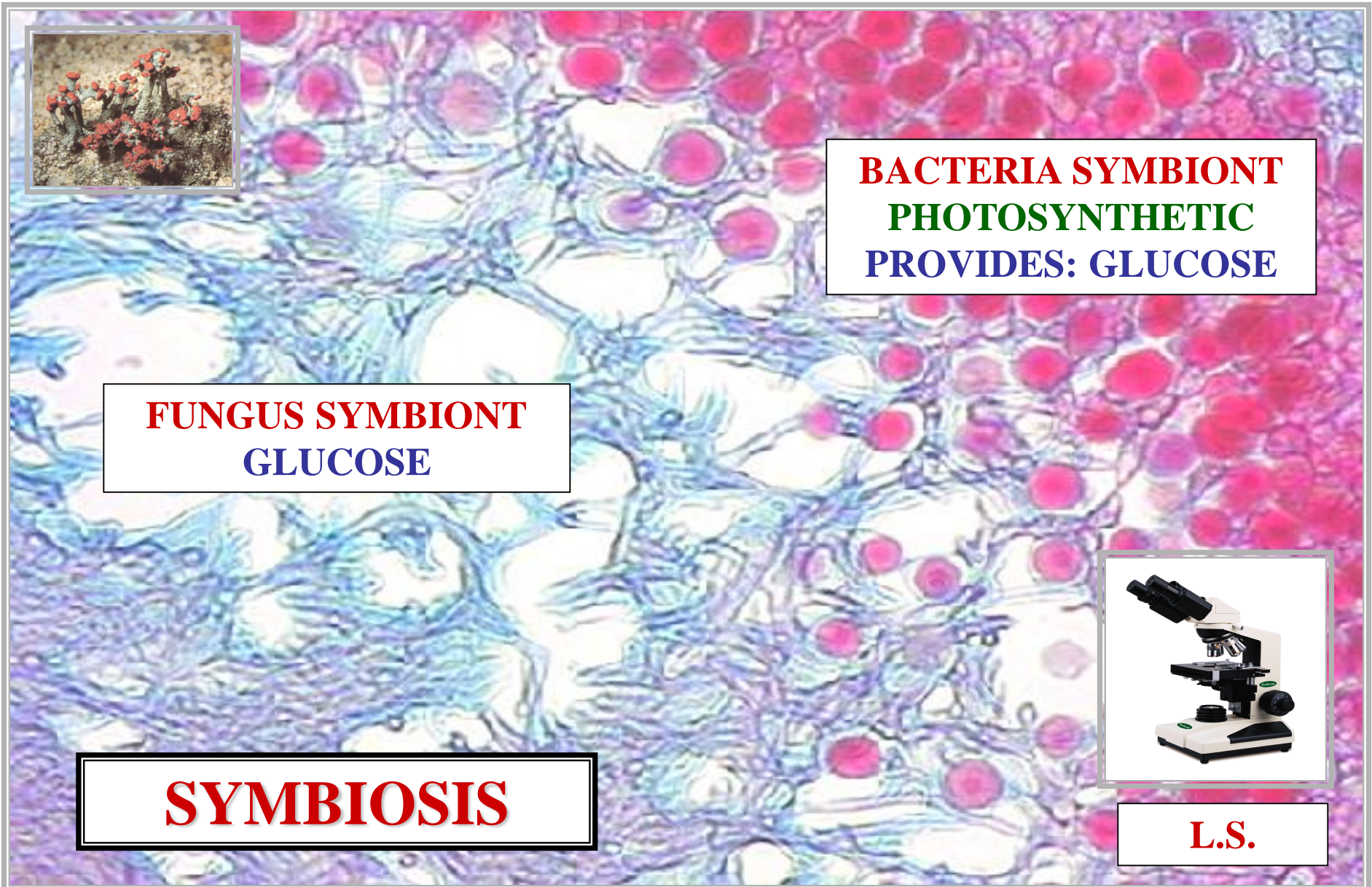
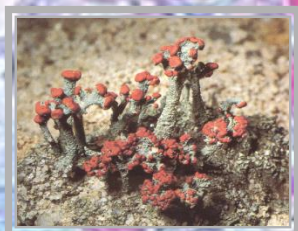
**FUNGUS SYMBIONT**

**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



**BACTERIA SYMBIONT**  
**PHOTOSYNTHETIC**  
**PROVIDES: GLUCOSE**

**FUNGUS SYMBIONT**  
**GLUCOSE**

**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



**BACTERIA SYMBIONT**  
**PHOTOSYNTHETIC**  
**PROVIDES: GLUCOSE**  
**SECURITY**

**FUNGUS SYMBIONT**  
**GLUCOSE**  
**PROVIDES: SECURITY**

**SYMBIOSIS**



**L.S.**

# LICHEN THALLUS



**BACTERIA SYMBIONT**  
**PHOTOSYNTHETIC**  
**PROVIDES: GLUCOSE**  
**SECURITY**

**FUNGUS SYMBIONT**  
**GLUCOSE**  
**PROVIDES: SECURITY**

**MUTUALISM**

**SYMBIOSIS**



**L.S.**



# ENDOSYMBIOSIS

# ENDOSYMBIOSIS



# **ENDOSYMBIOSIS**

**ONE SPECIES  
LIVING WITHIN  
SECOND HOST SPECIES**

**ENDOSYMBIOSIS**

# PLANT CELL

P

CHLOROPLASTS

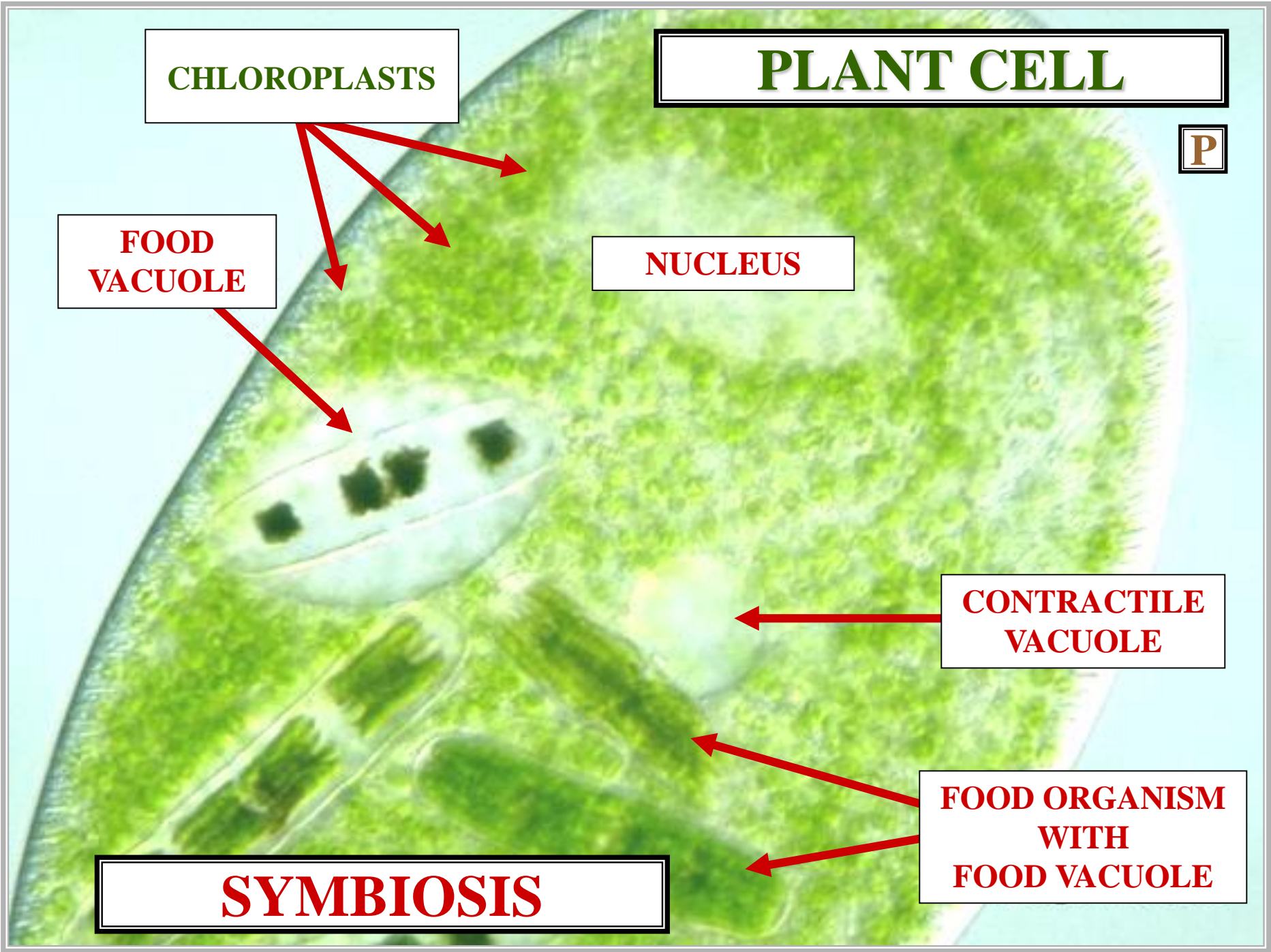
FOOD  
VACUOLE

NUCLEUS

CONTRACTILE  
VACUOLE

FOOD ORGANISM  
WITH  
FOOD VACUOLE

SYMBIOSIS



# PROTOZOAN

G

CHLOROPLASTS

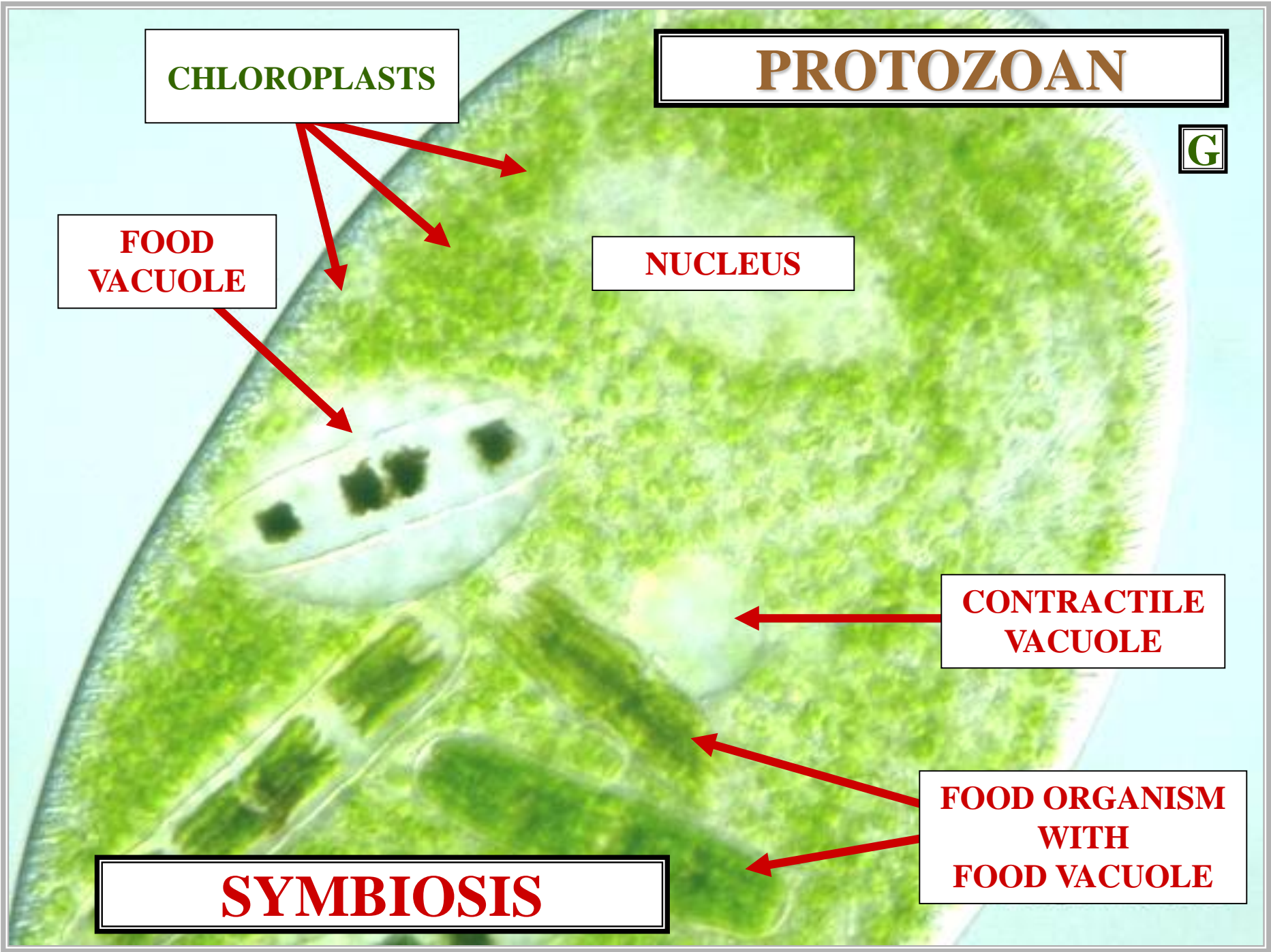
FOOD  
VACUOLE

NUCLEUS

CONTRACTILE  
VACUOLE

FOOD ORGANISM  
WITH  
FOOD VACUOLE

SYMBIOSIS



**SYMBIOTIC  
GREEN ALGAE**

**PROTOZOAN**

**E**

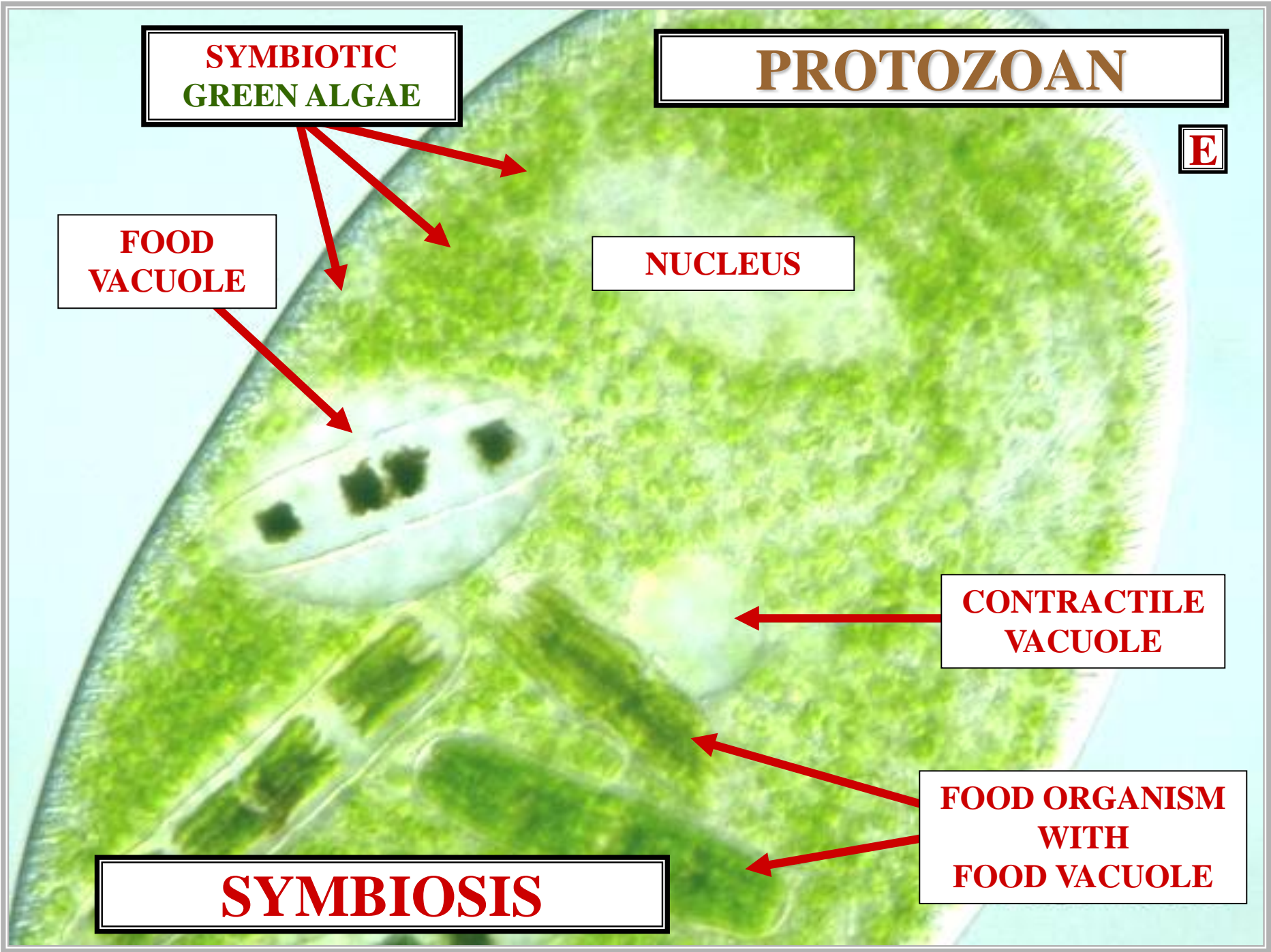
**FOOD  
VACUOLE**

**NUCLEUS**

**CONTRACTILE  
VACUOLE**

**FOOD ORGANISM  
WITH  
FOOD VACUOLE**

**SYMBIOSIS**



# PROTOZOAN

**ENDOSYMBIOTIC  
GREEN ALGAE**

**FOOD  
VACUOLE**

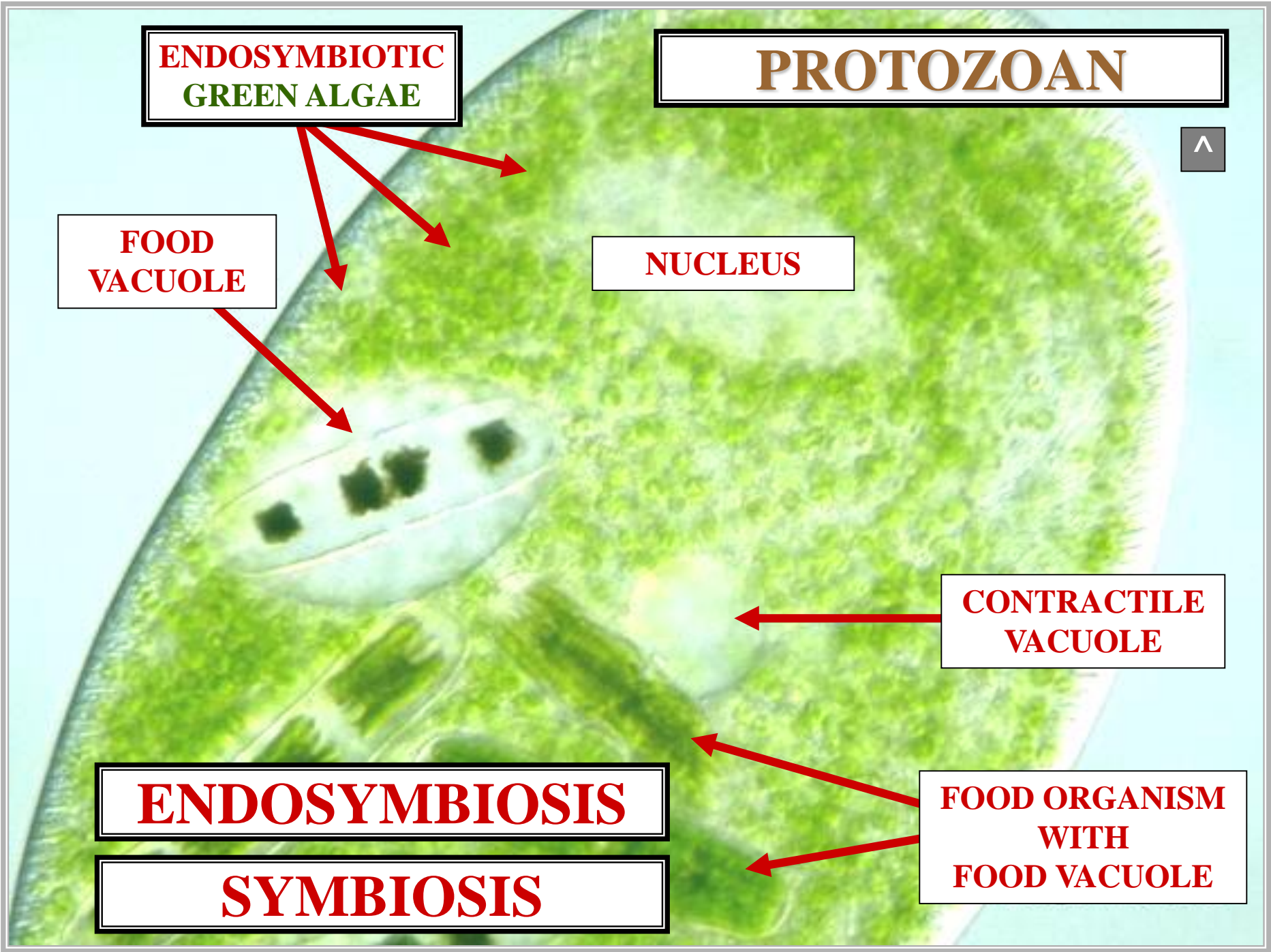
**NUCLEUS**

**CONTRACTILE  
VACUOLE**

**ENDOSYMBIOSIS**

**SYMBIOSIS**

**FOOD ORGANISM  
WITH  
FOOD VACUOLE**





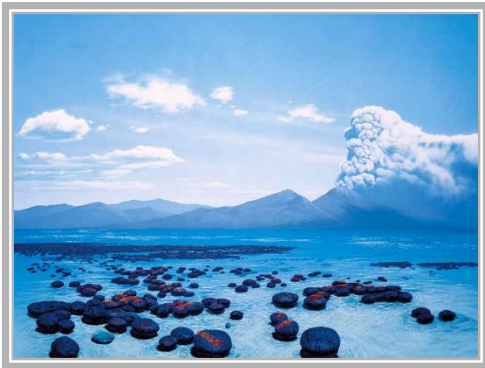
**PLASTID  
EVOLUTION  
HYPOTHETICAL  
SCENARIO**



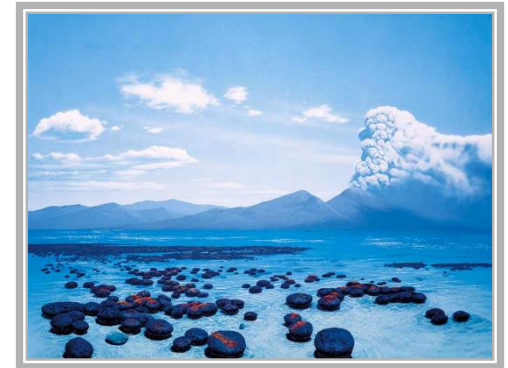
**HETEROTROPHIC  
HOST CELL**  
**DNA W\ HISTONE PROTEINS**  
**LARGE RIBOSOMES**

**AUTOTROPHIC  
PROKARYOTE**  
**DNA W\OUT HISTONE PROTEINS**  
**SMALL RIBOSOMES**

**HETEROTROPHIC  
HOST CELL  
DNA W\ HISTONE PROTEINS  
LARGE RIBOSOMES**

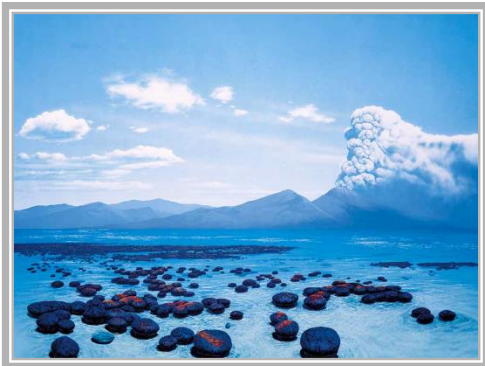


**AUTOTROPHIC  
PROKARYOTE  
DNA W\OUT HISTONE PROTEINS  
SMALL RIBOSOMES**



**HETEROTROPH & AUTOTROPH: SAME HABITAT**

**HETEROTROPHIC  
HOST CELL  
DNA W\ HISTONE PROTEINS  
LARGE RIBOSOMES**



**AUTOTROPHIC  
PROKARYOTE**

**PHOTOSYNTHESIS**

**GLUCOSE**



**HETEROTROPHIC  
HOST CELL**

**CONSUMES OTHER ORGANISMS  
CONSUMES AUTOTROPH**

