

# VACUOLE



PLANT CELLS ONLY

---

LARGEST ORGANELLE

VACUOLE

# VACUOLE



PLANT CELLS ONLY

---

LARGEST ORGANELLE

---

STORAGE ORGANELLE

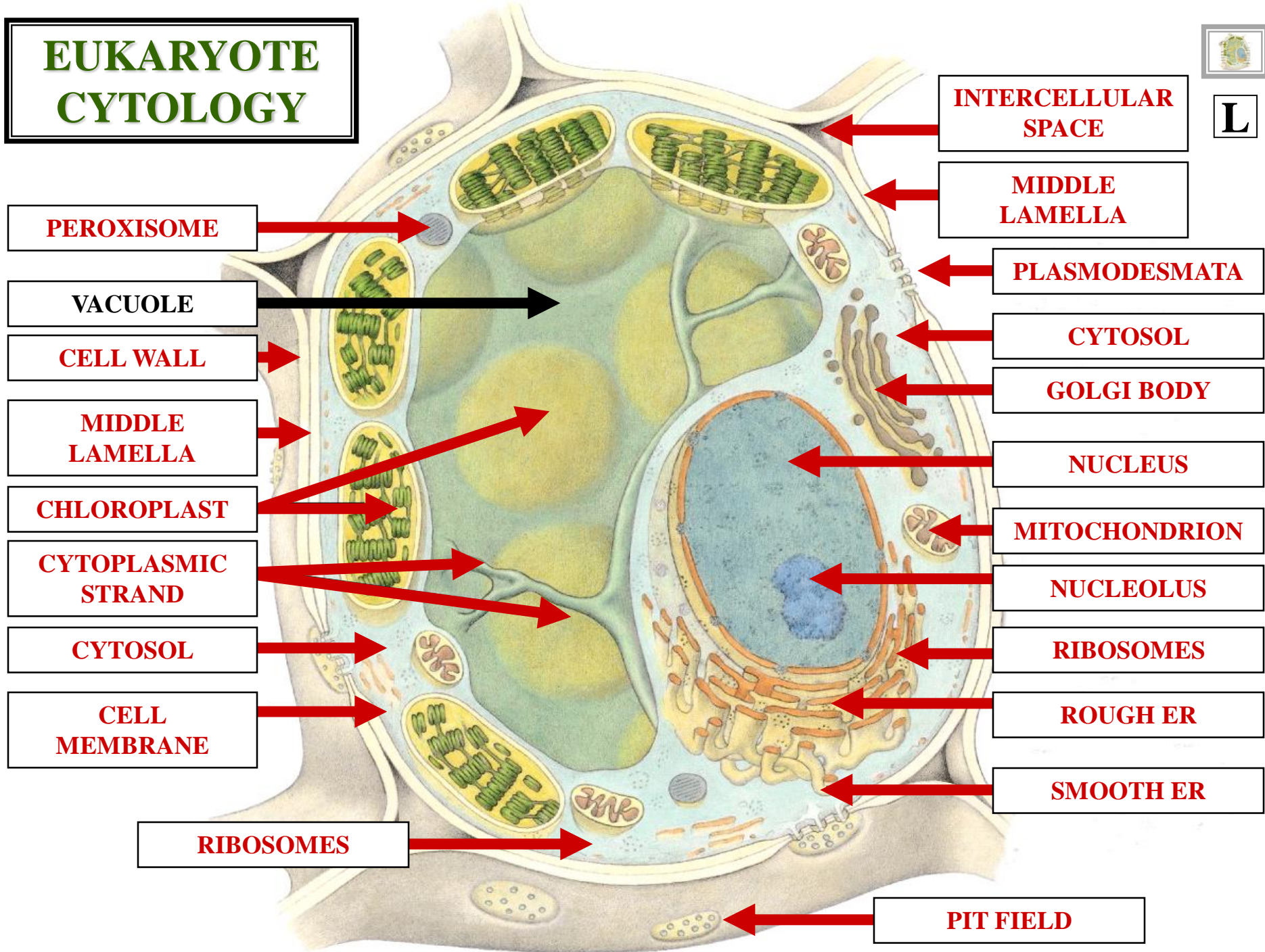
# VACUOLE



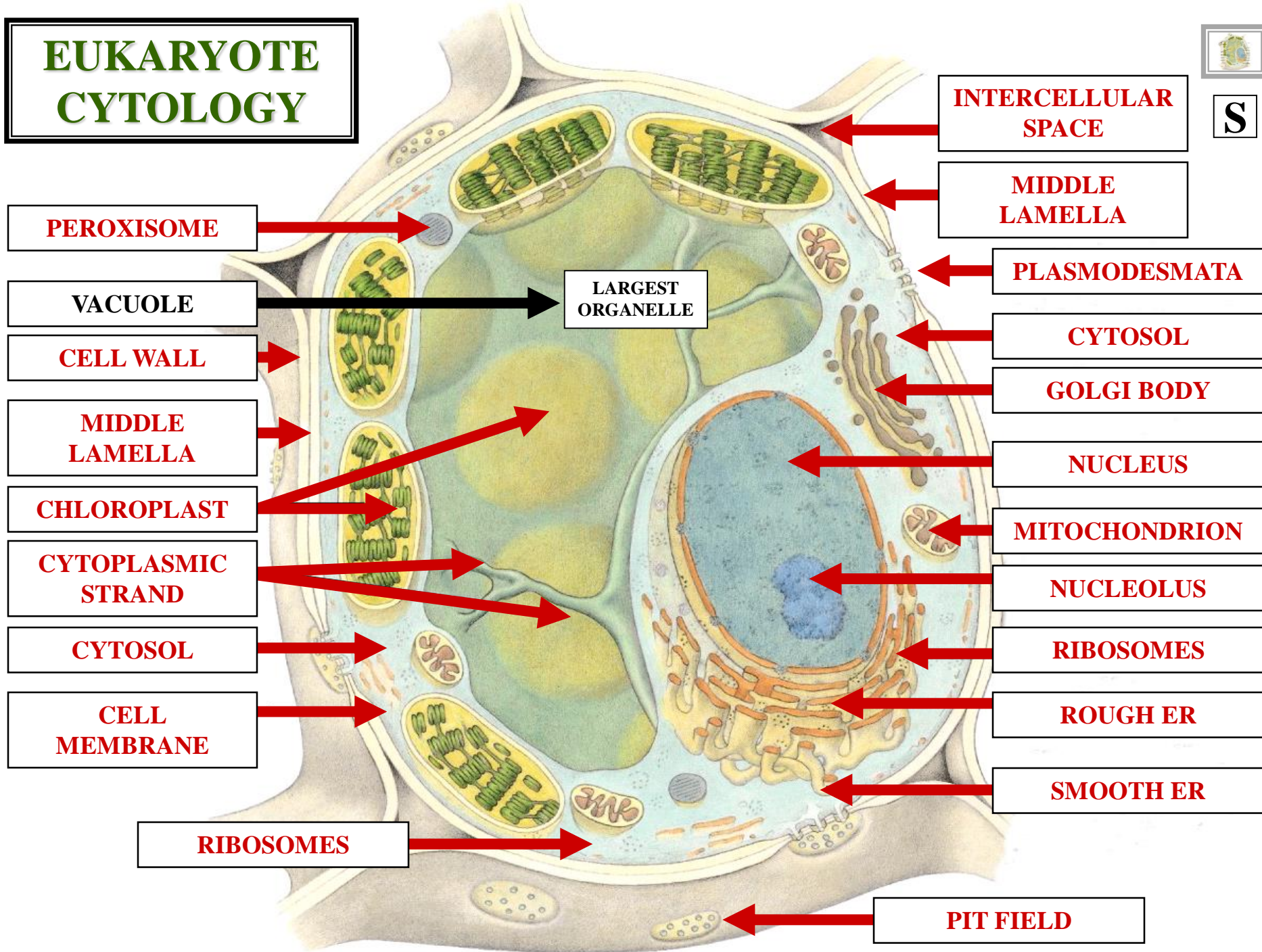
# PLANT CELLS ONLY



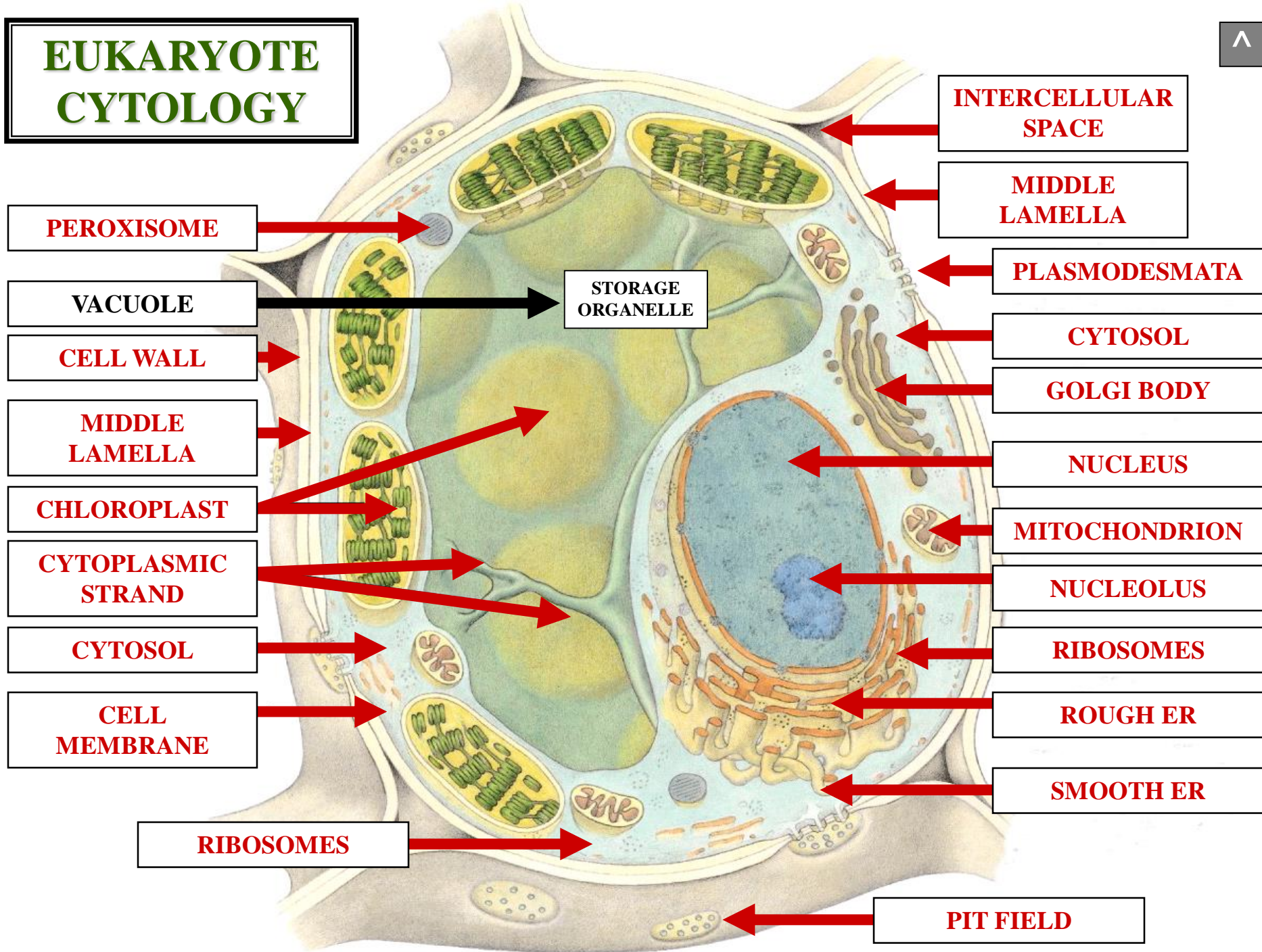
# EUKARYOTE CYTOLOGY



# EUKARYOTE CYTOLOGY

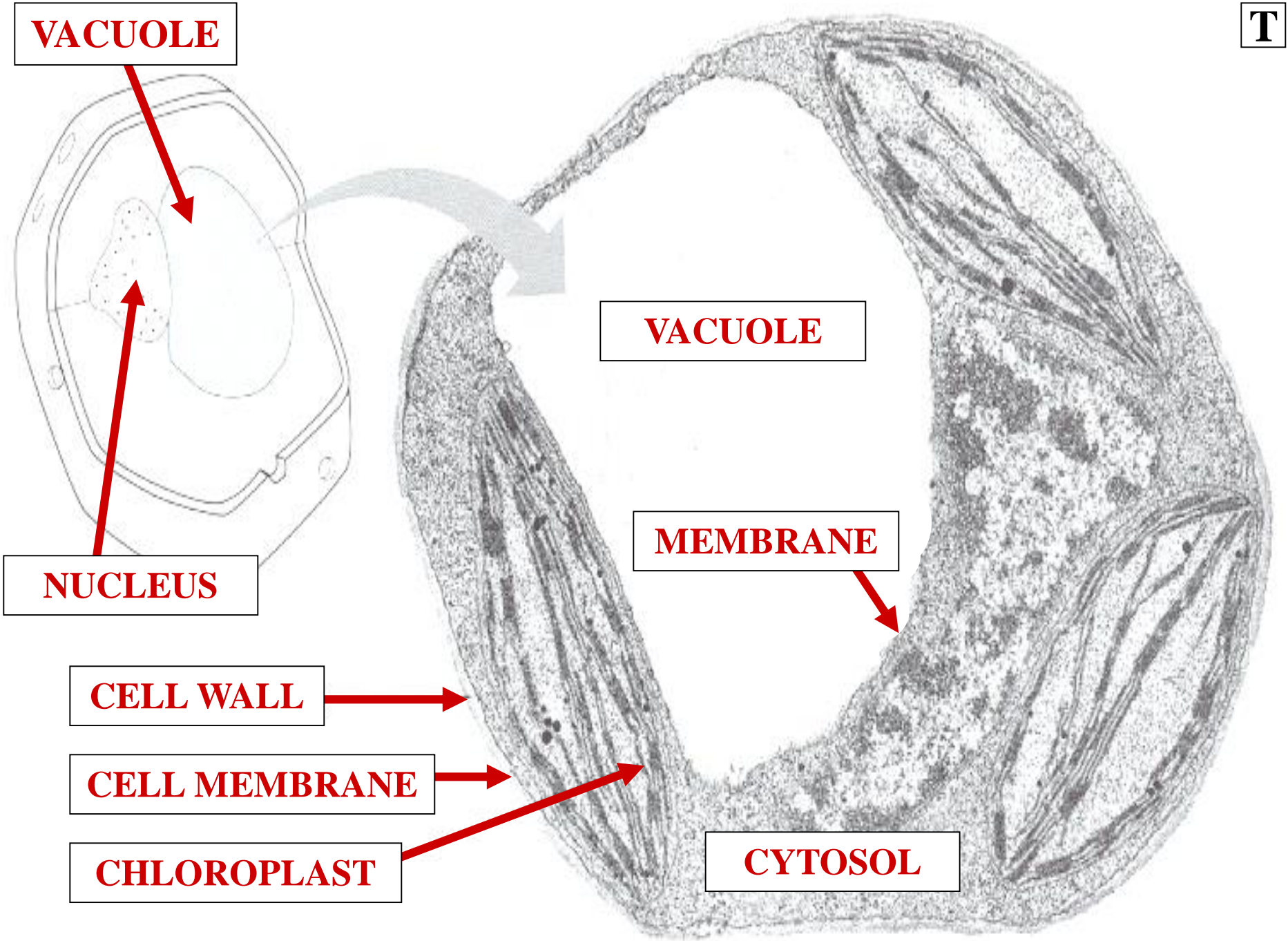


# EUKARYOTE CYTOLOGY





# VACUOLE ULTRASTRUCTURE



**VACUOLE**

**VACUOLE**

**NUCLEUS**

**MEMBRANE**

**CELL WALL**

**CELL MEMBRANE**

**CHLOROPLAST**

**CYTOSOL**



# **TONOPLAST MEMBRANE**



**TONOPLAST**

**VACUOLE MEMBRANE**

**TONOPLAST**



**T**

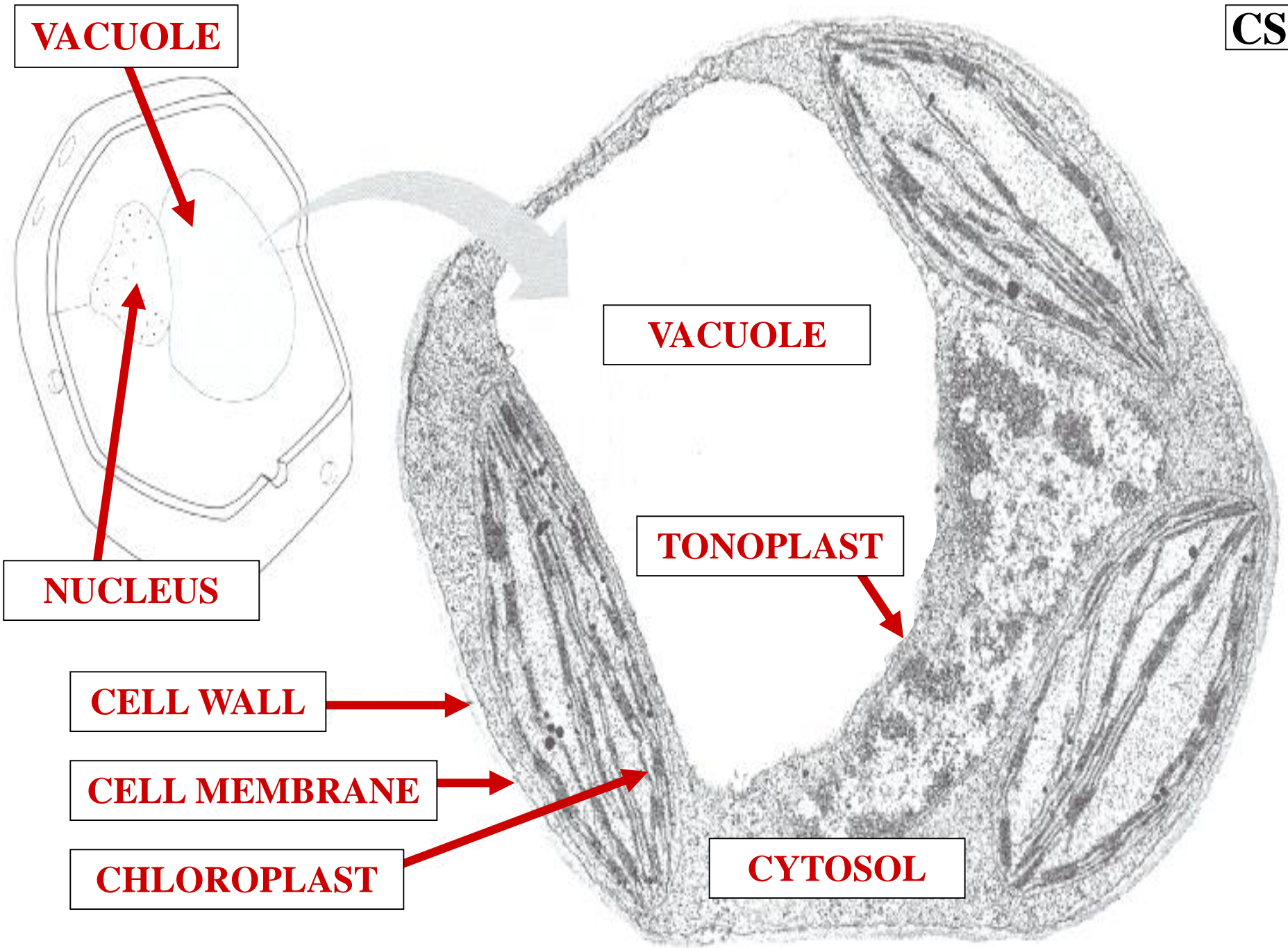
# **TONOPLAST**

**VACUOLE MEMBRANE**

**---**

**MEDIATES TRANSPORT  
INTO & OUT OF VACUOLE**

# **TONOPLAST**



**CELL SAP**



**CS**



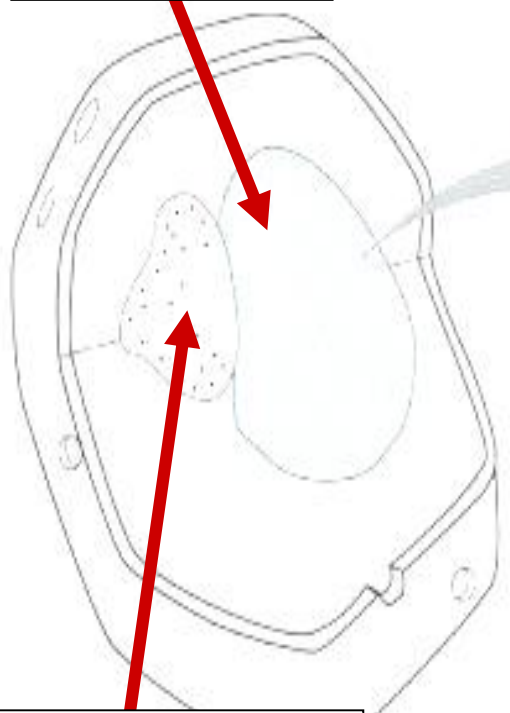
**CELL SAP**

**VACUOLE CONTENT**

**CELL SAP**



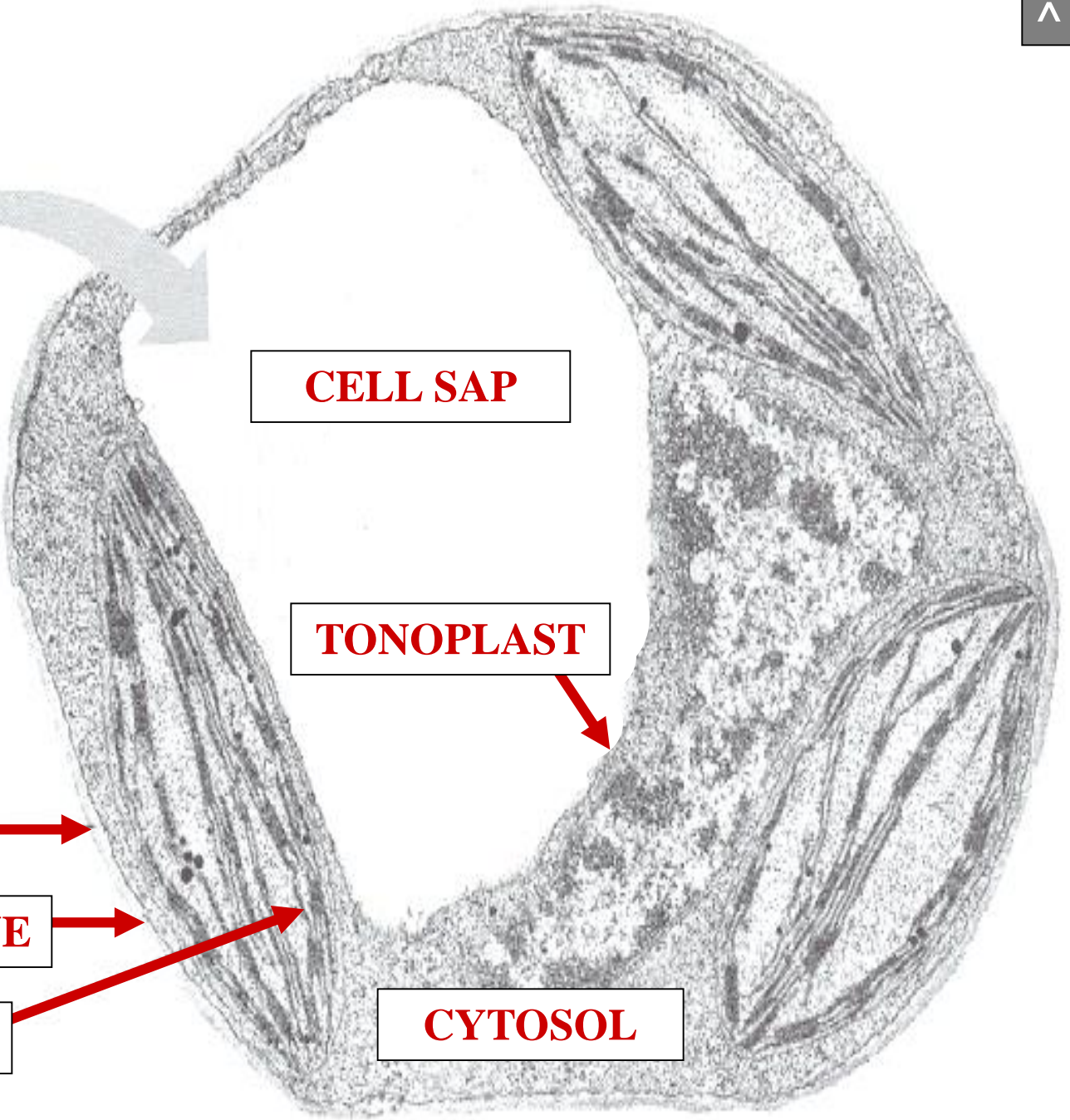
**VACUOLE**



**NUCLEUS**



**CELL SAP**



**TONOPLAST**



**CELL WALL**



**CELL MEMBRANE**



**CHLOROPLAST**

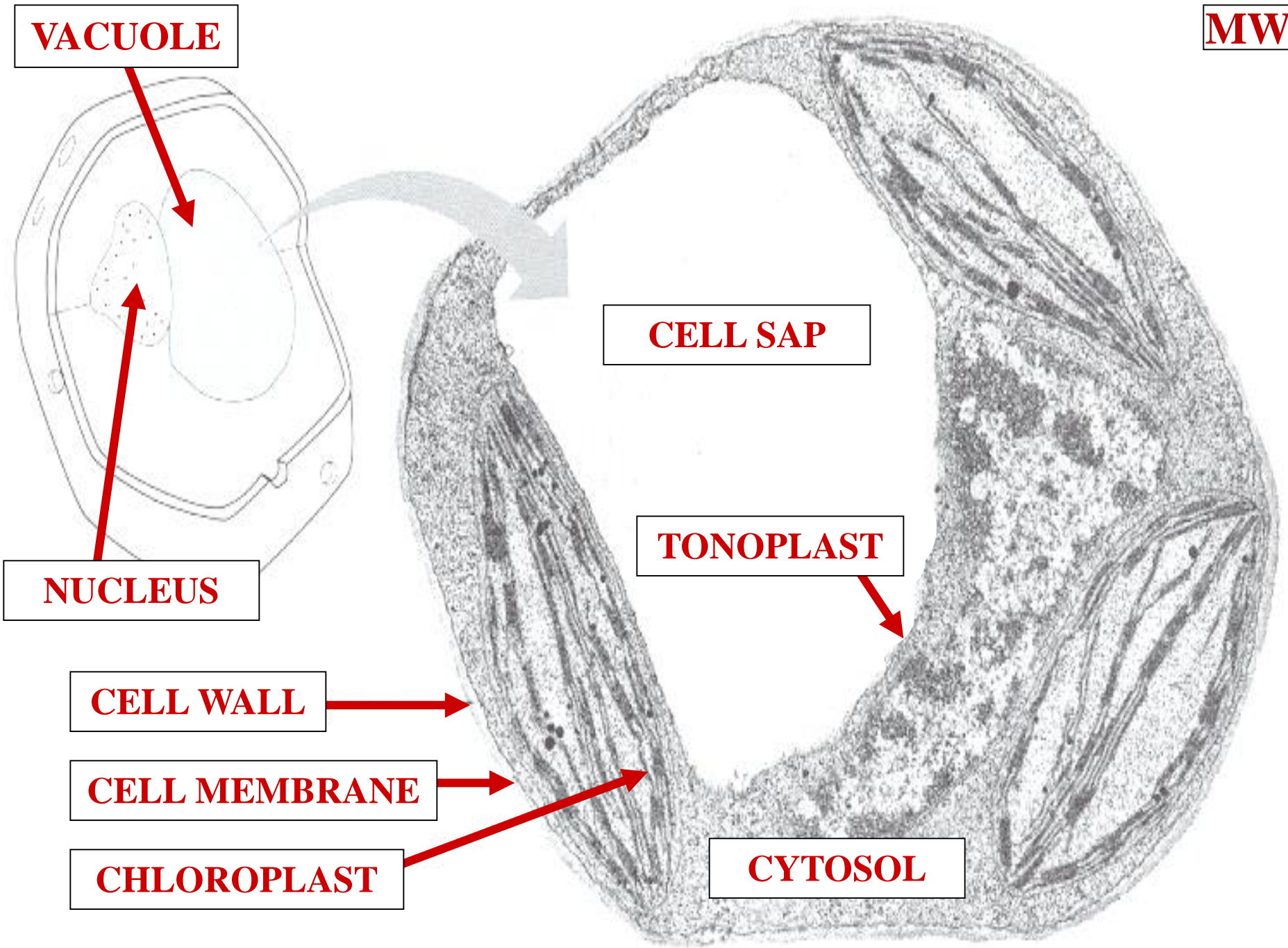


**CYTOSOL**

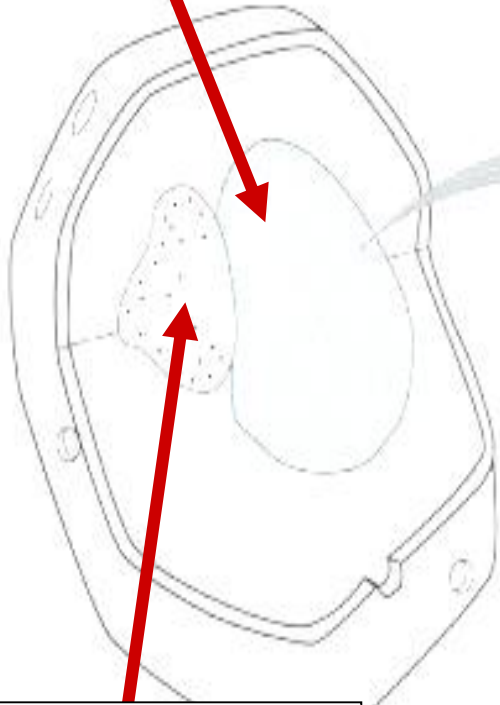


# CELL SAP CONTENT





**VACUOLE**



**NUCLEUS**

**CELL WALL**



**CELL MEMBRANE**



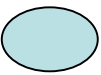
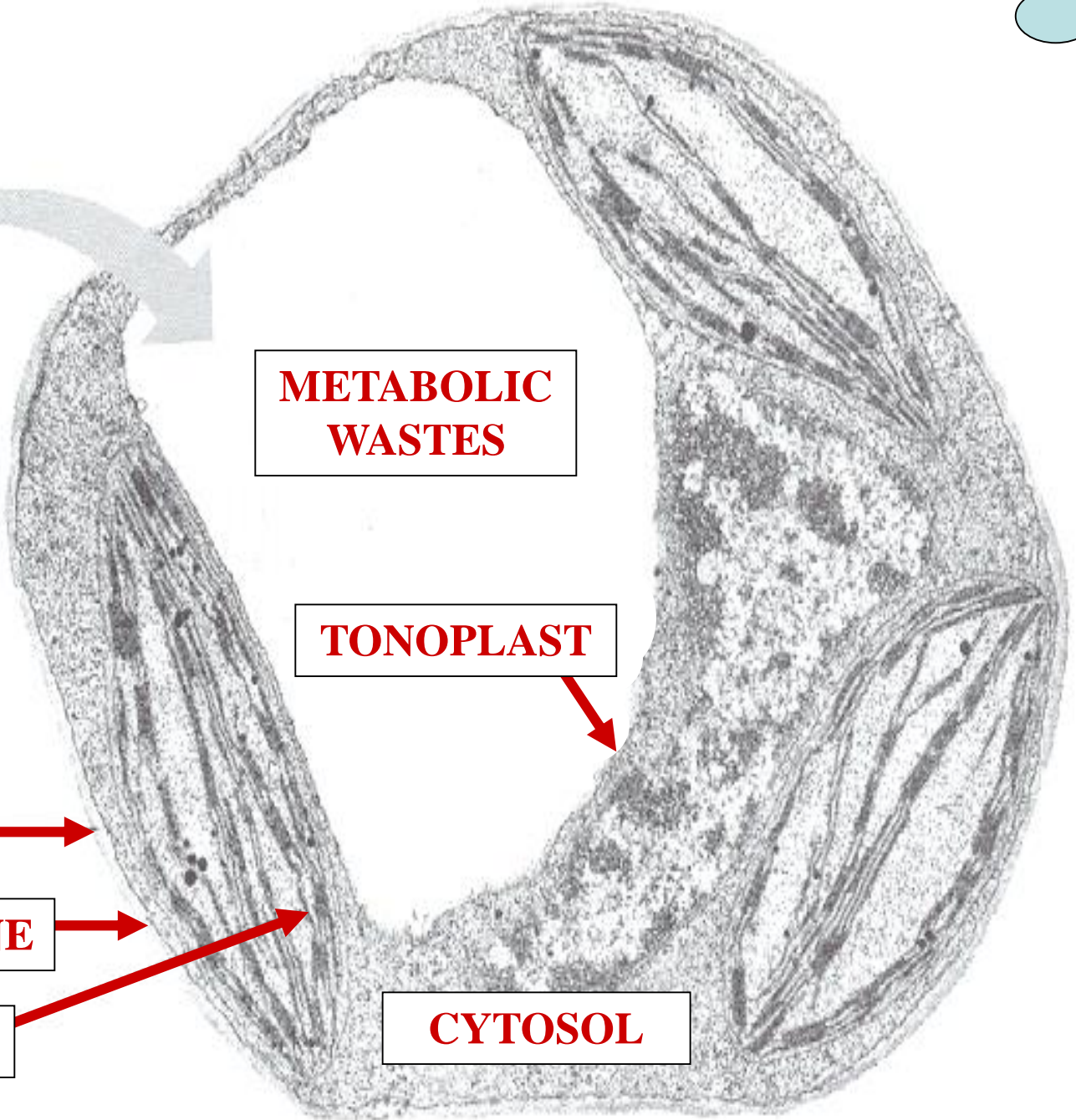
**CHLOROPLAST**

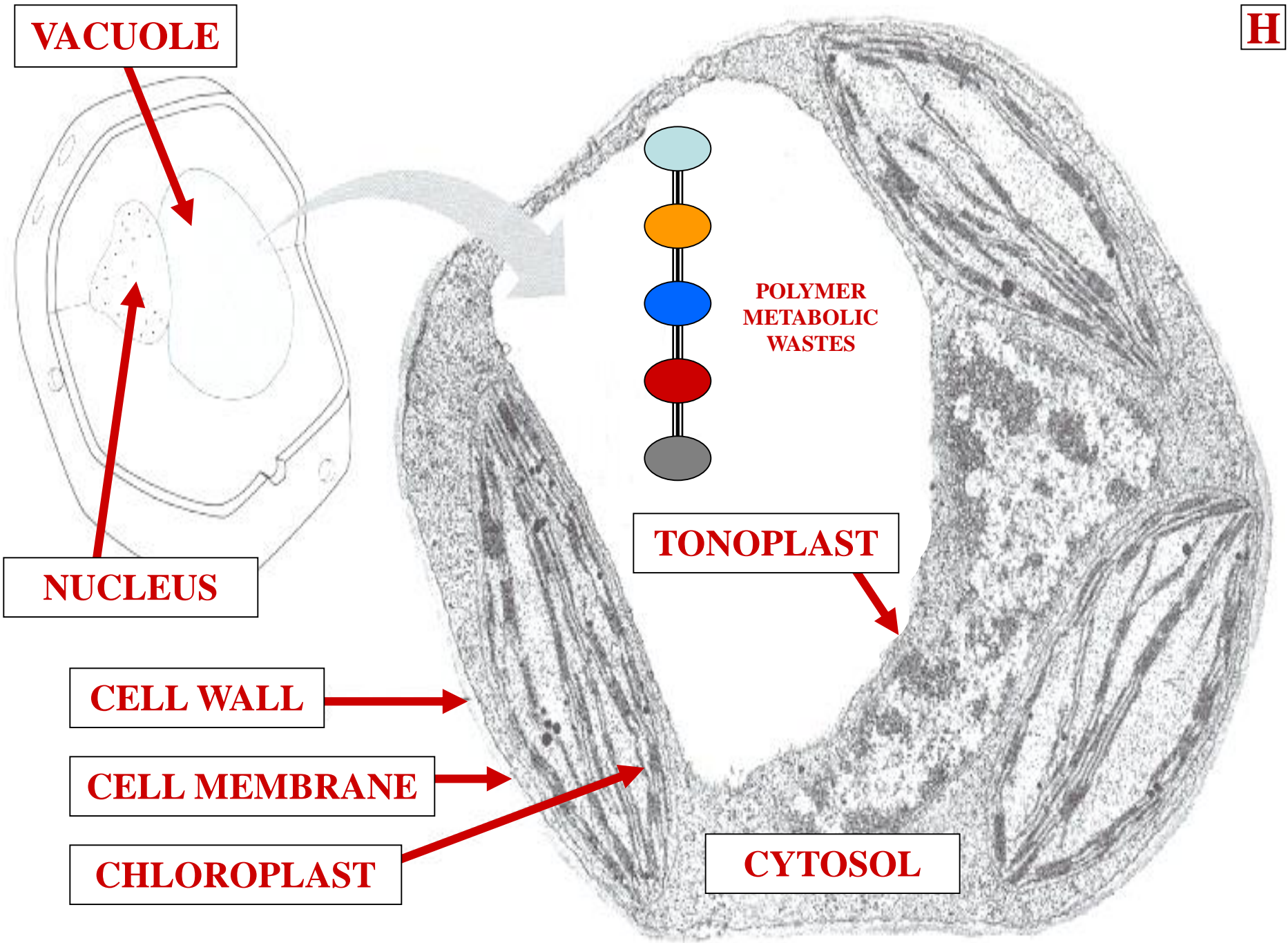


**CYTOSOL**

**METABOLIC WASTES**

**TONOPLAST**





**VACUOLE**

**NUCLEUS**

**CELL WALL**

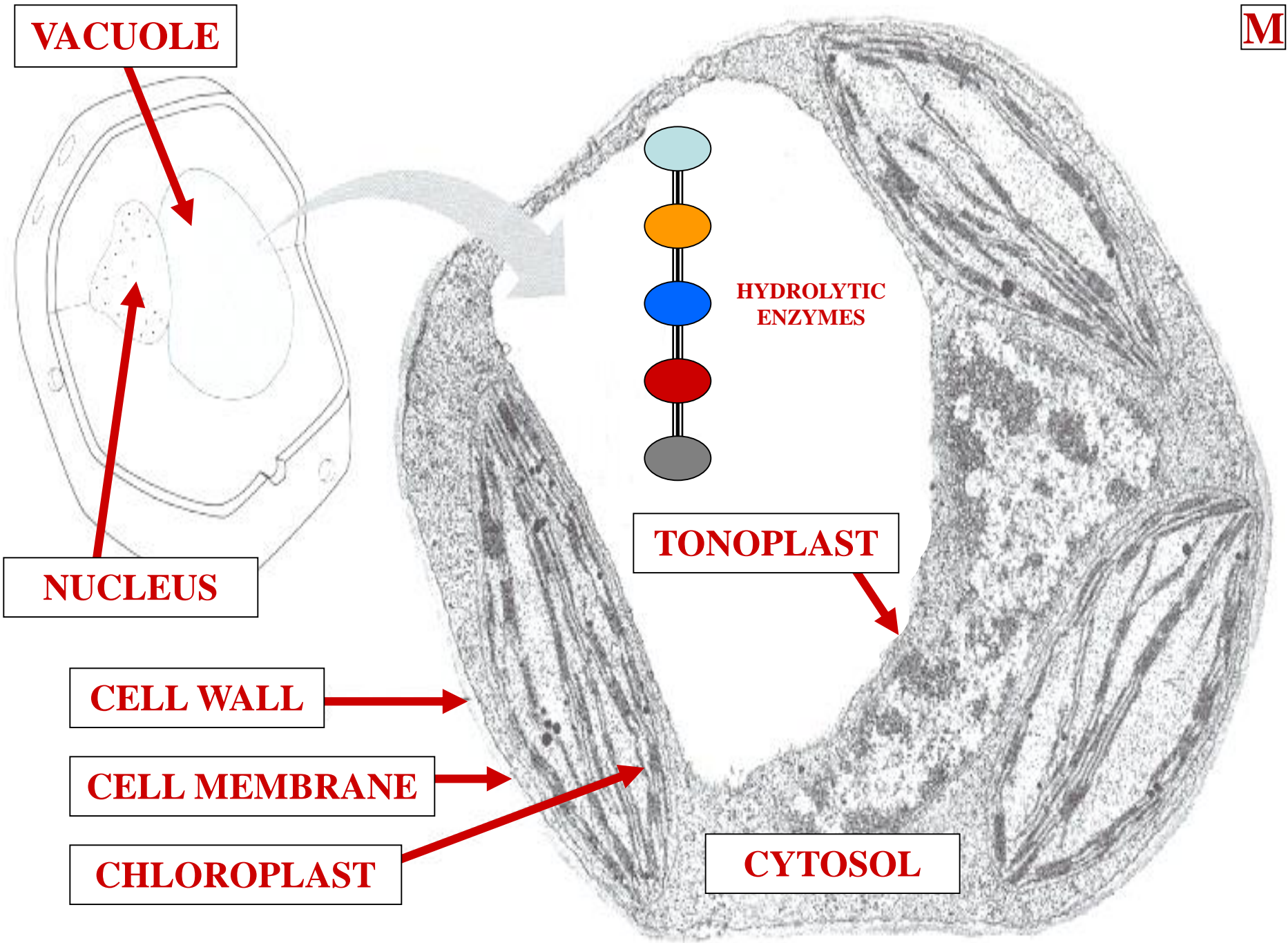
**CELL MEMBRANE**

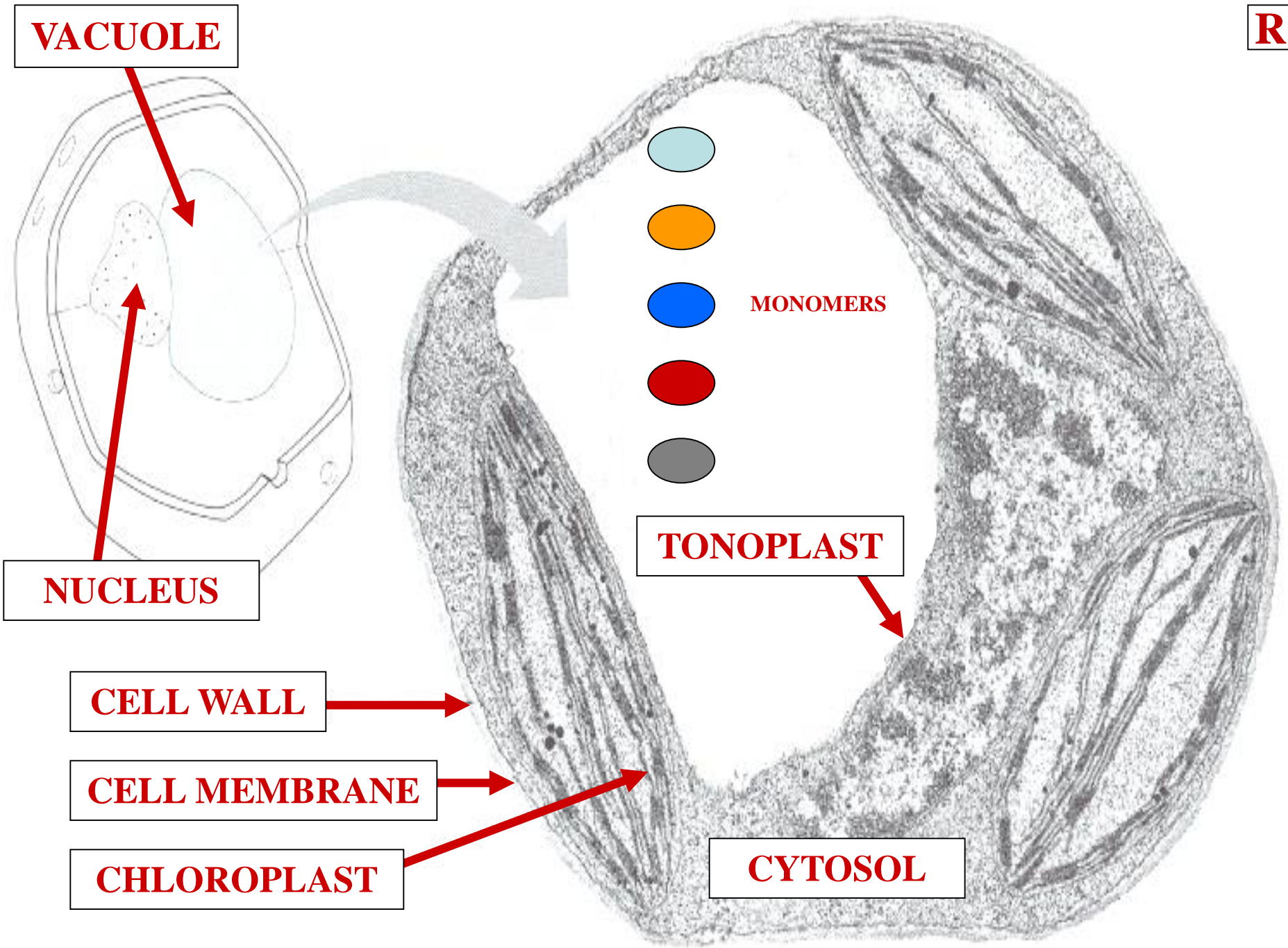
**CHLOROPLAST**

**TONOPLAST**

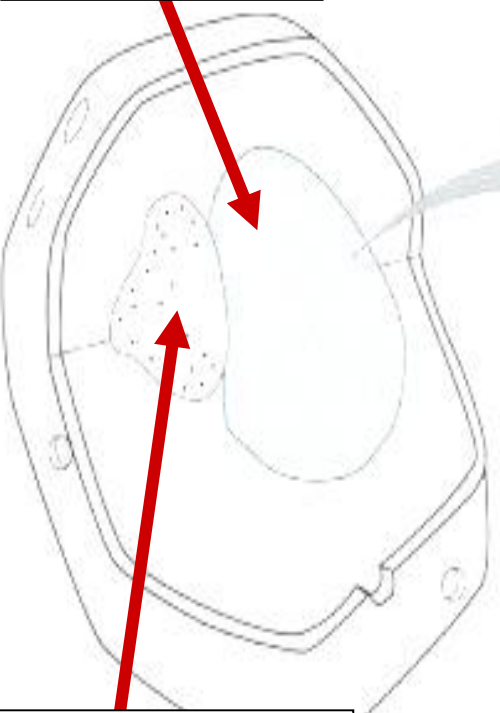
**CYTOSOL**

**POLYMER  
METABOLIC  
WASTES**





**VACUOLE**



**NUCLEUS**



**VACUOLE  
RECYCLES  
METABOLIC  
WASTES**

**TONOPLAST**



**CELL WALL**



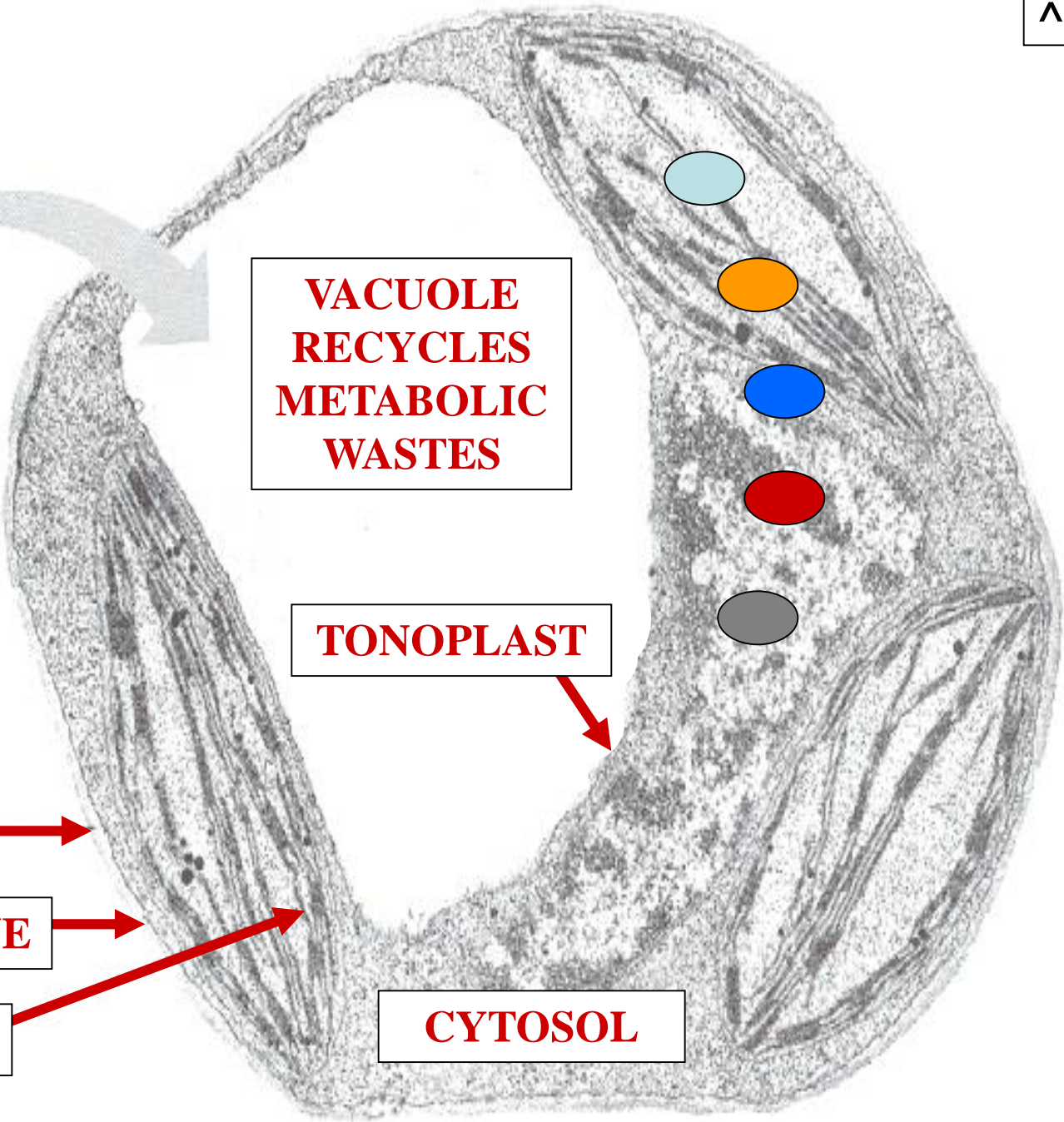
**CELL MEMBRANE**

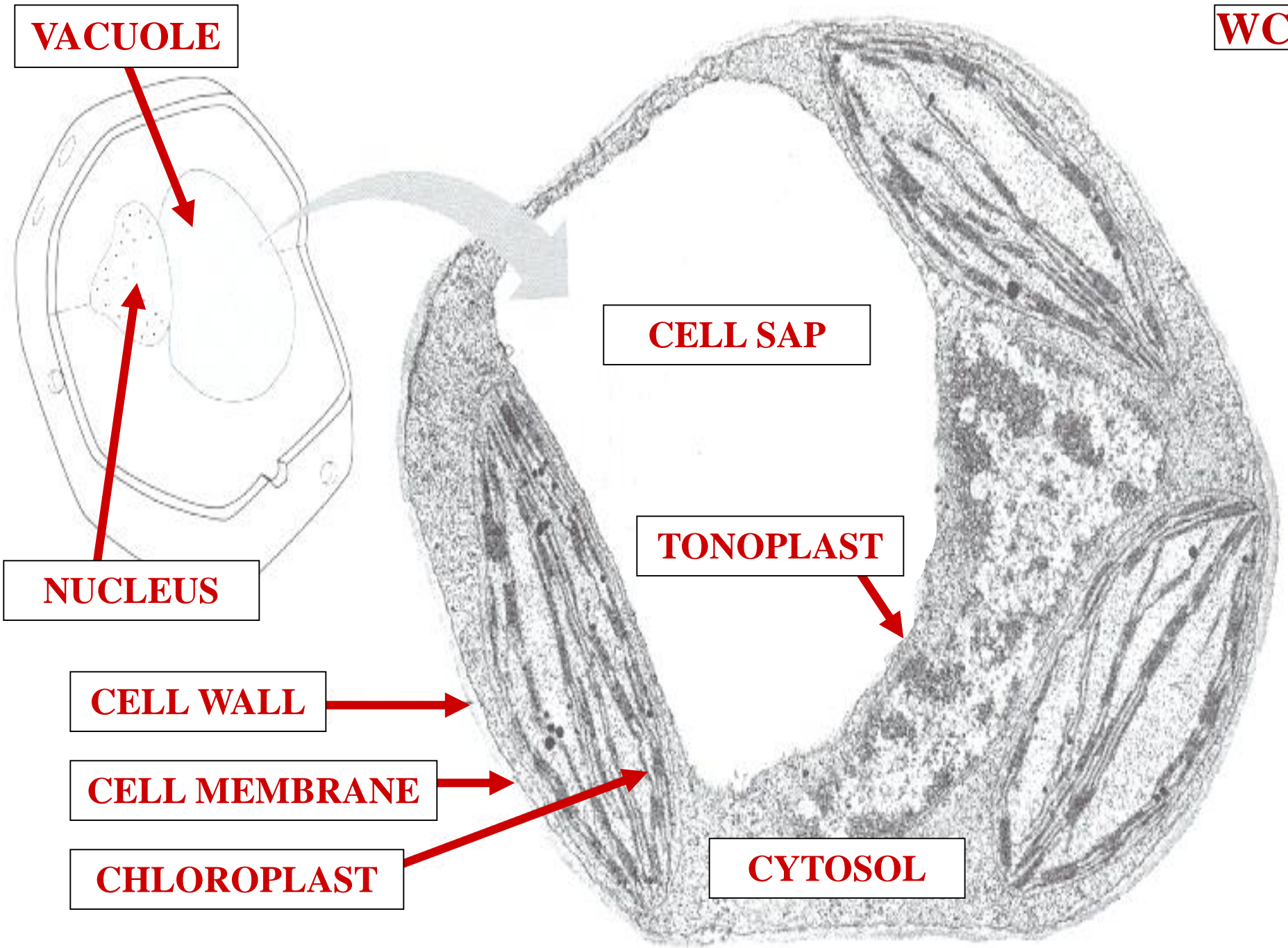


**CHLOROPLAST**



**CYTOSOL**





**VACUOLE**

**NUCLEUS**

**CELL WALL**

**CELL MEMBRANE**

**CHLOROPLAST**

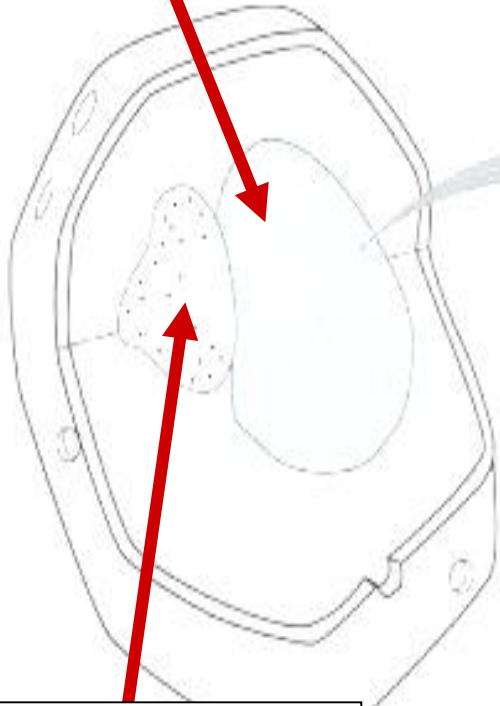
**CELL SAP**

**TONOPLAST**

**CYTOSOL**



**VACUOLE**



**NUCLEUS**



**WASTE  
CRYSTALS**

**TONOPLAST**



**CELL WALL**



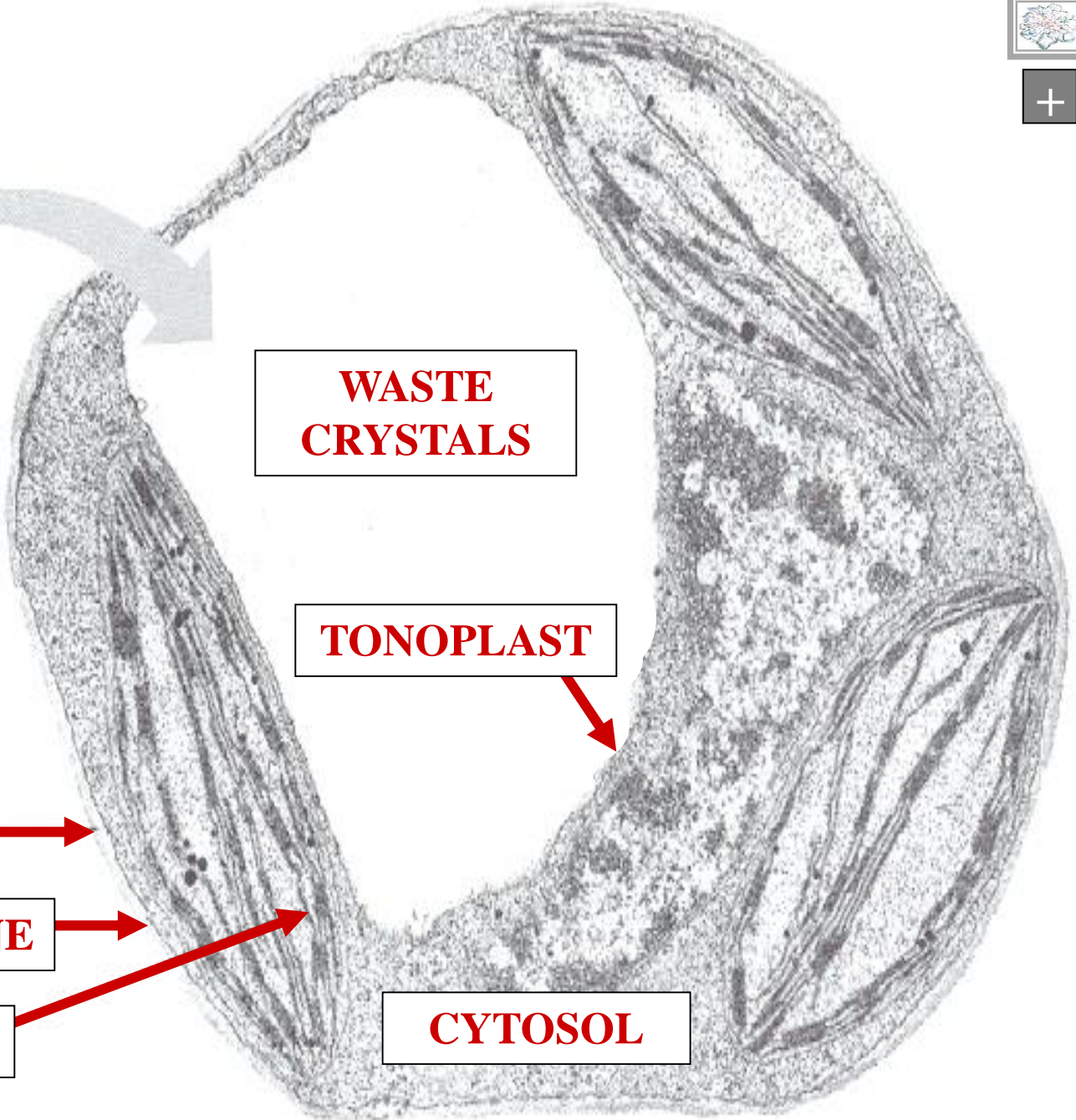
**CELL MEMBRANE**



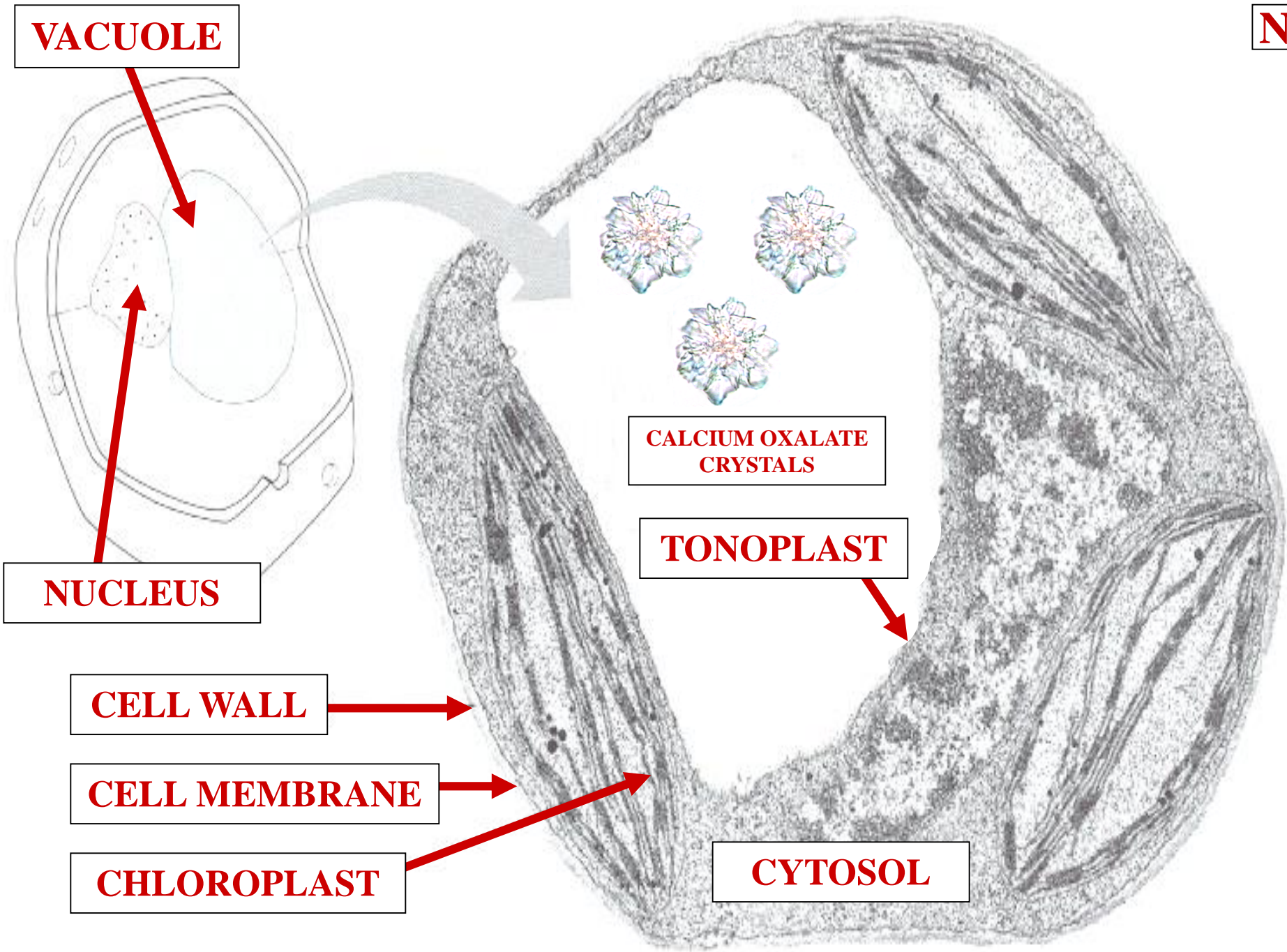
**CHLOROPLAST**



**CYTOSOL**







**VACUOLE**

**NUCLEUS**

**CELL WALL**

**CELL MEMBRANE**

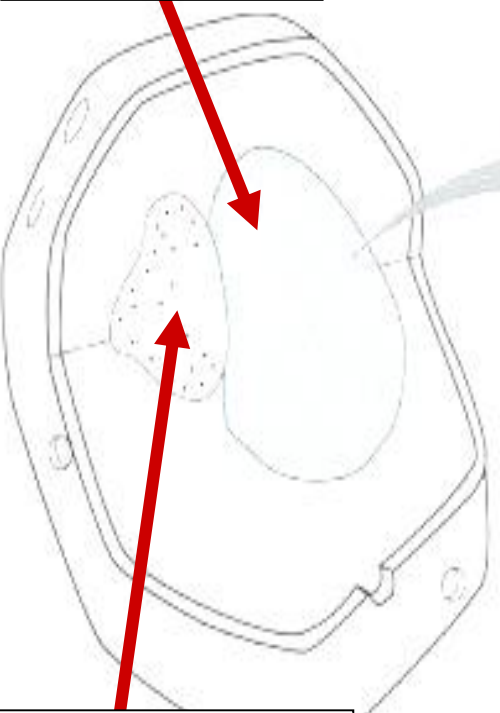
**CHLOROPLAST**

**CYTOSOL**

**CALCIUM OXALATE  
CRYSTALS**

**TONOPLAST**

**VACUOLE**



**NUCLEUS**

**CELL WALL**



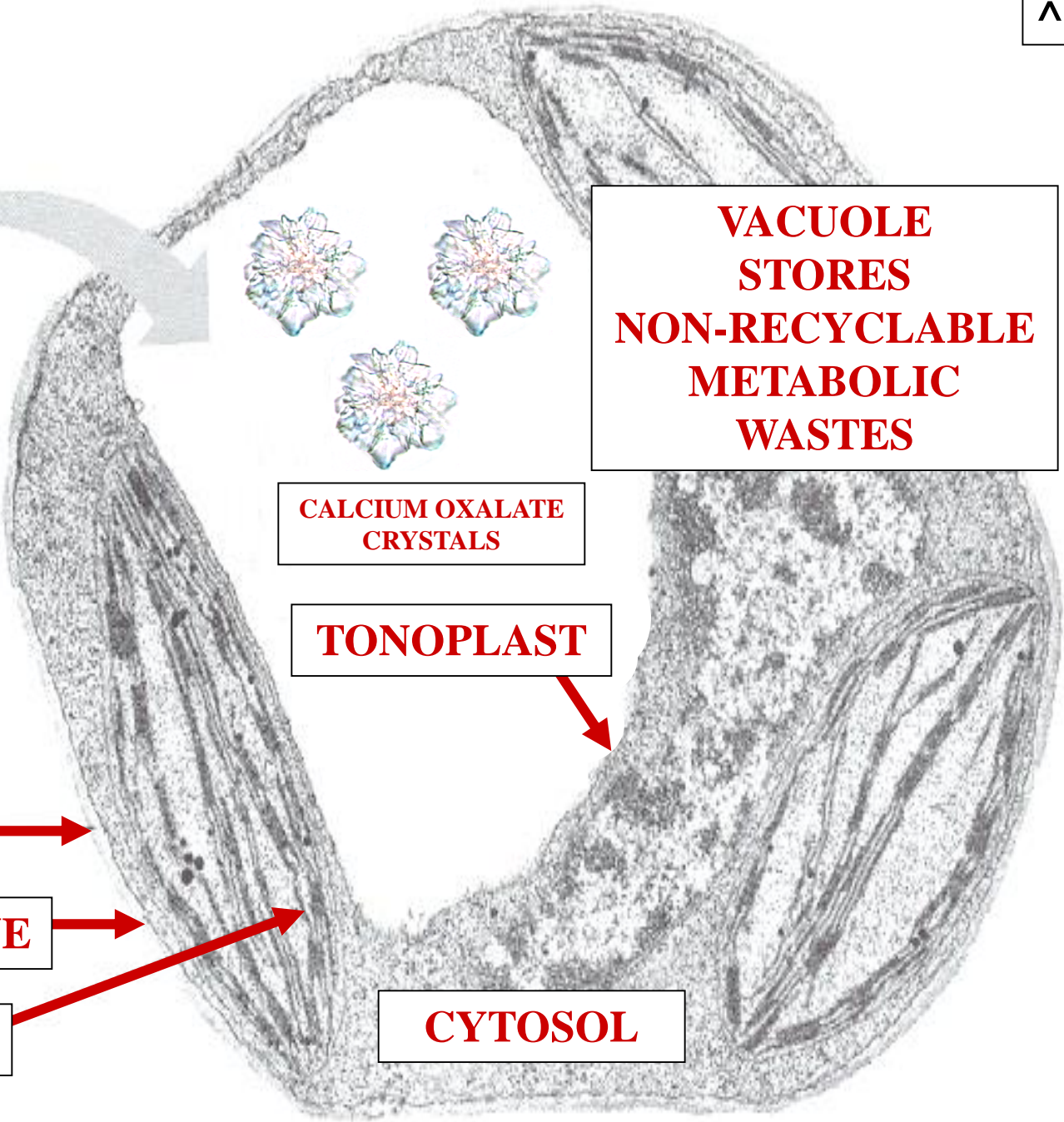
**CELL MEMBRANE**



**CHLOROPLAST**

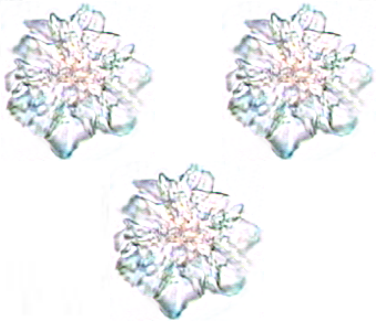


**CYTOSOL**



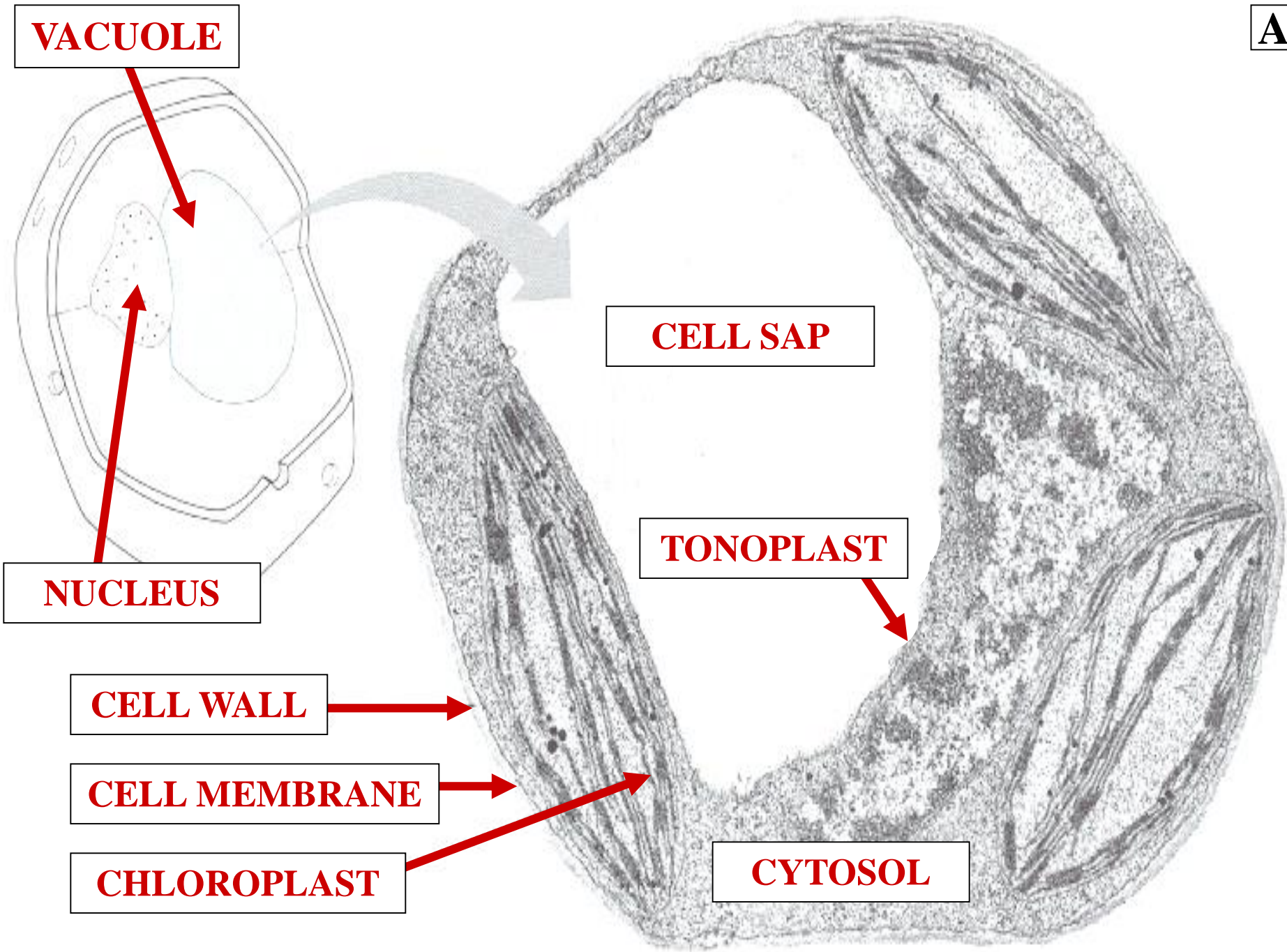
**VACUOLE  
STORES  
NON-RECYCLABLE  
METABOLIC  
WASTES**

**CALCIUM OXALATE  
CRYSTALS**



**TONOPLAST**





# ANTHOCYANINS



**ANTHOCYANINS**

**CELL SAP**

**BLUE & RED PIGMENTS**

**ANTHOCYANINS**

# ANTHOCYANINS



CELL SAP

BLUE & RED PIGMENTS

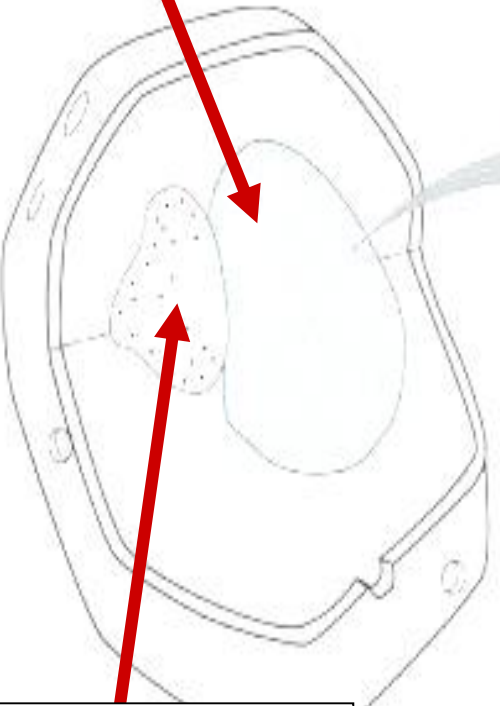
---

ATTRACT ANIMALS

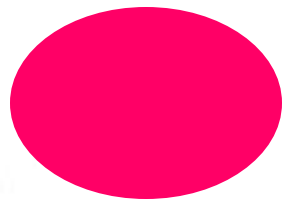
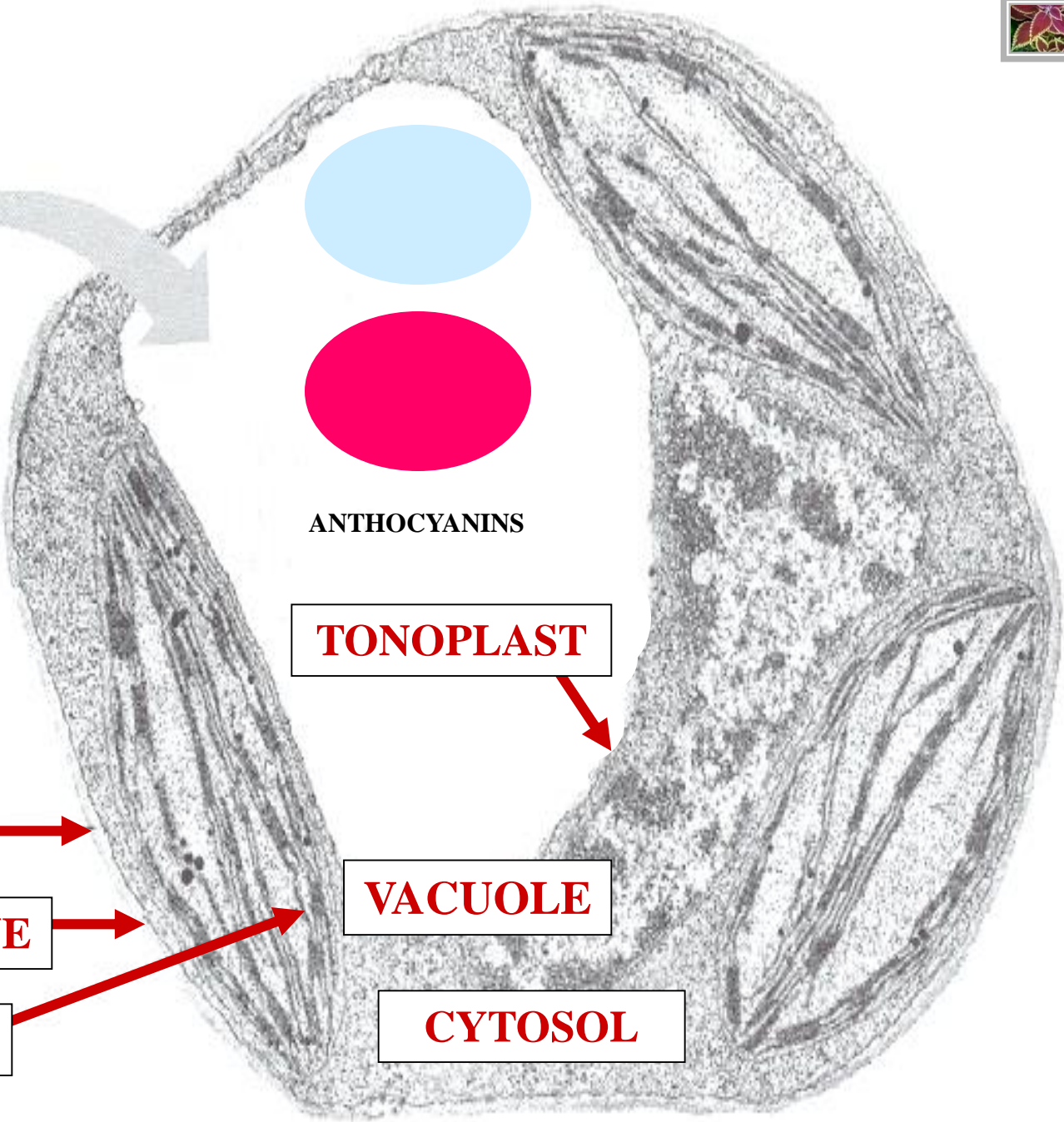
# ANTHOCYANINS



**VACUOLE**



**NUCLEUS**



**ANTHOCYANINS**

**TONOPLAST**



**VACUOLE**

**CYTOSOL**

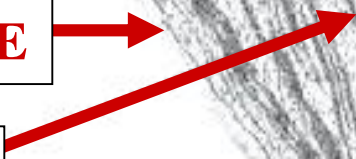
**CELL WALL**

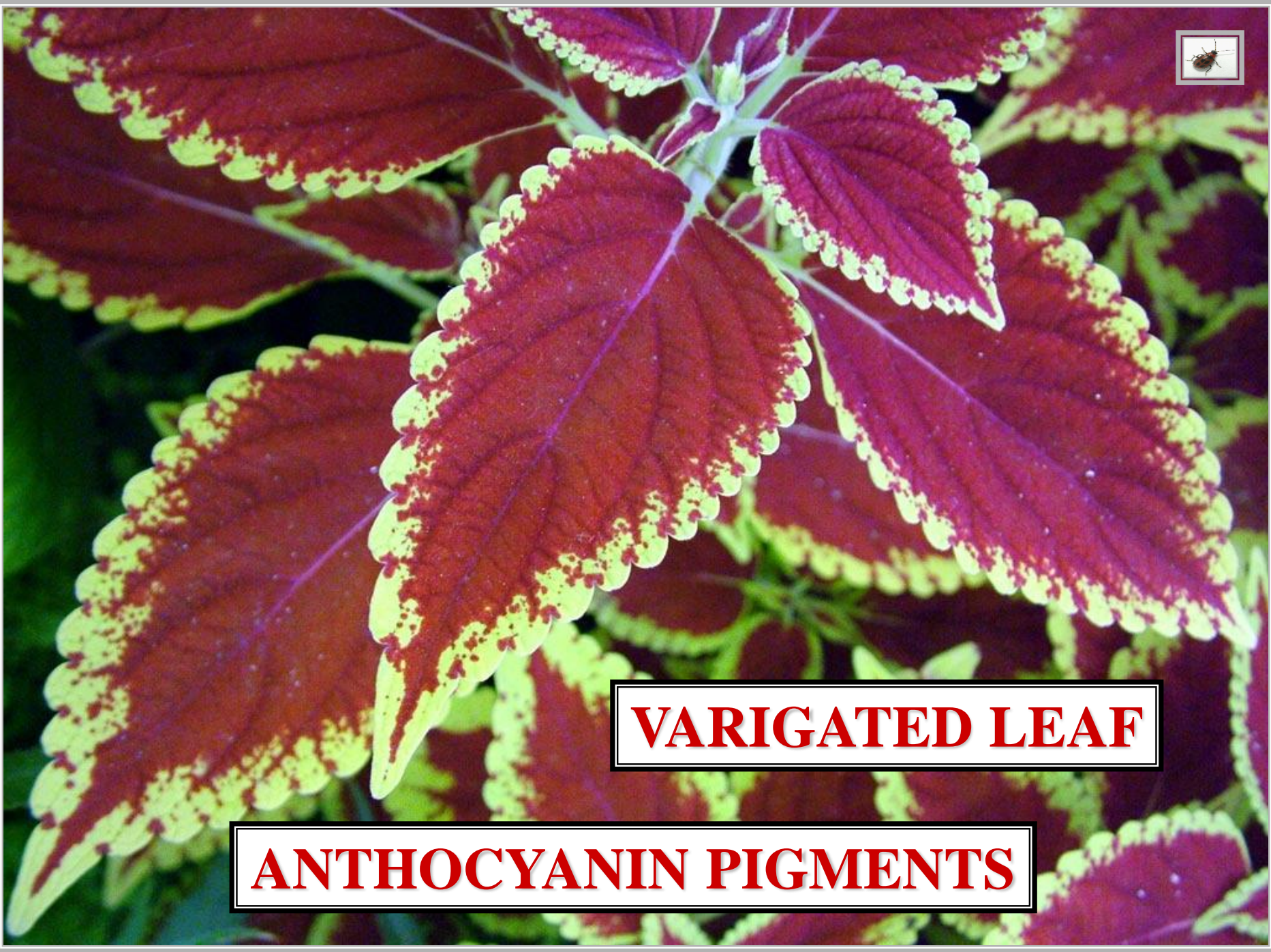


**CELL MEMBRANE**



**CHLOROPLAST**





**VARIGATED LEAF**

**ANTHOCYANIN PIGMENTS**

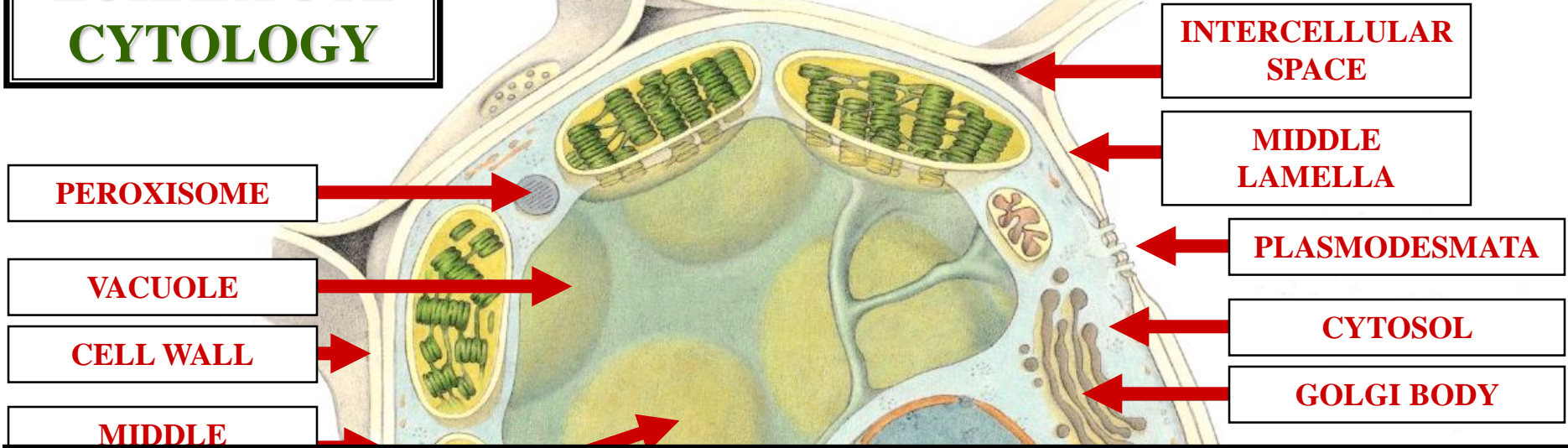




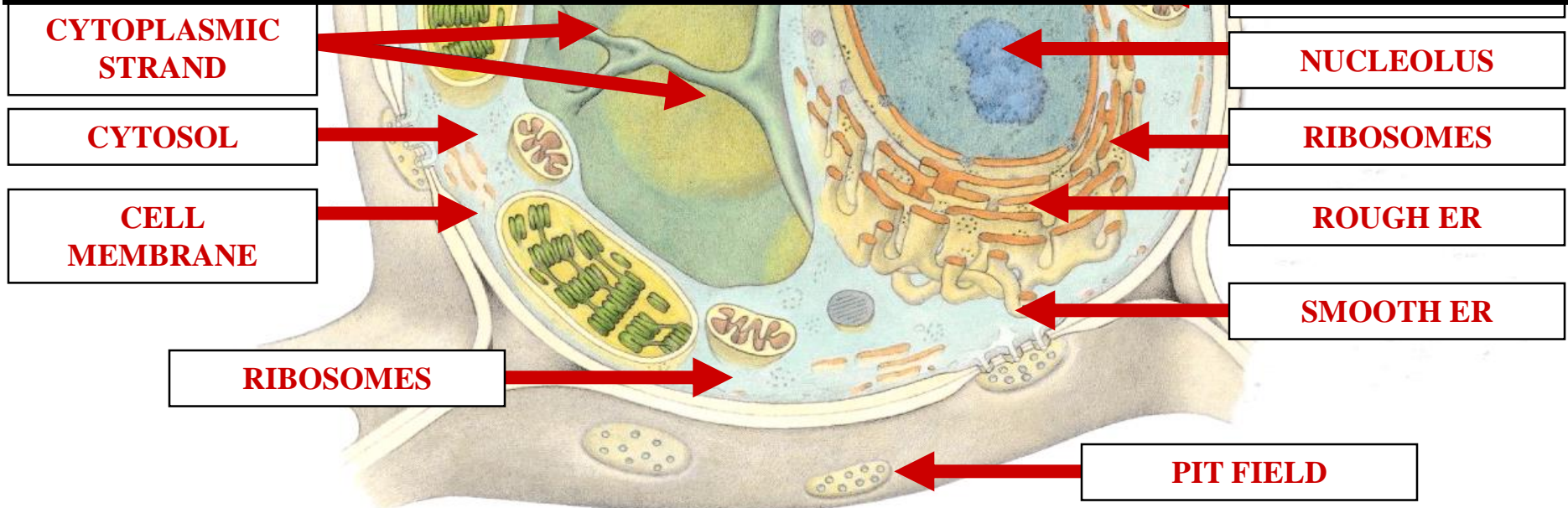
**VARIGATED LEAF**

**ANTHOCYANIN PIGMENTS**

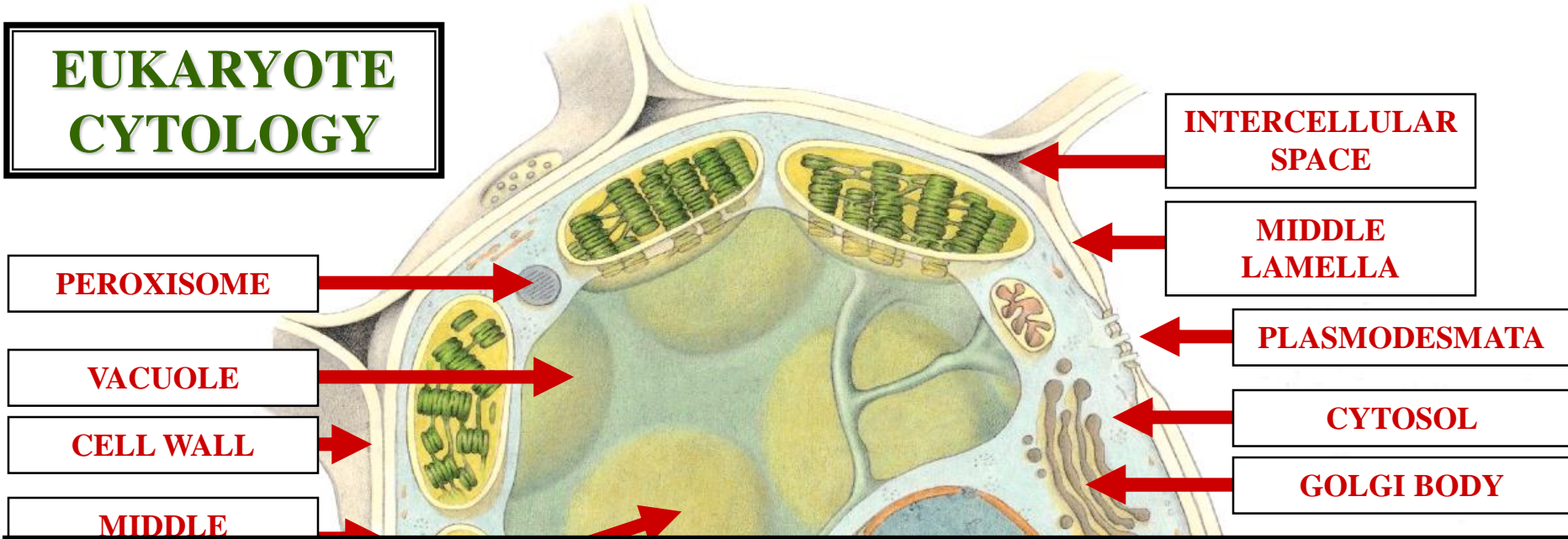
# EUKARYOTE CYTOLOGY



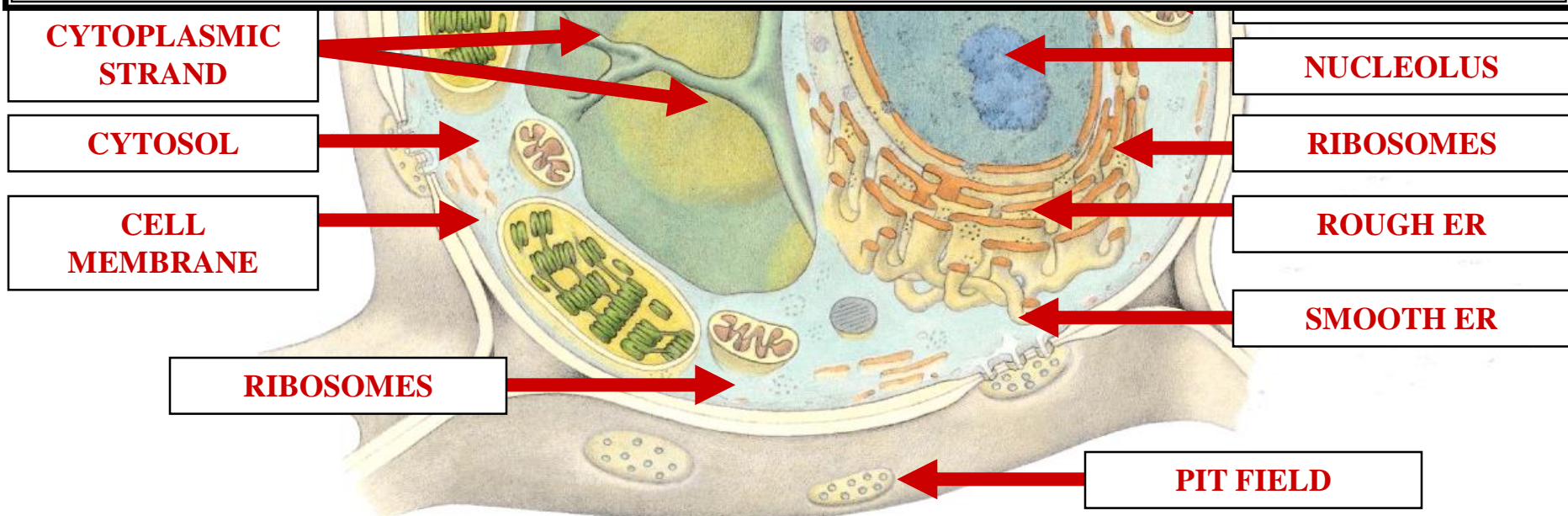
# SUMMARY



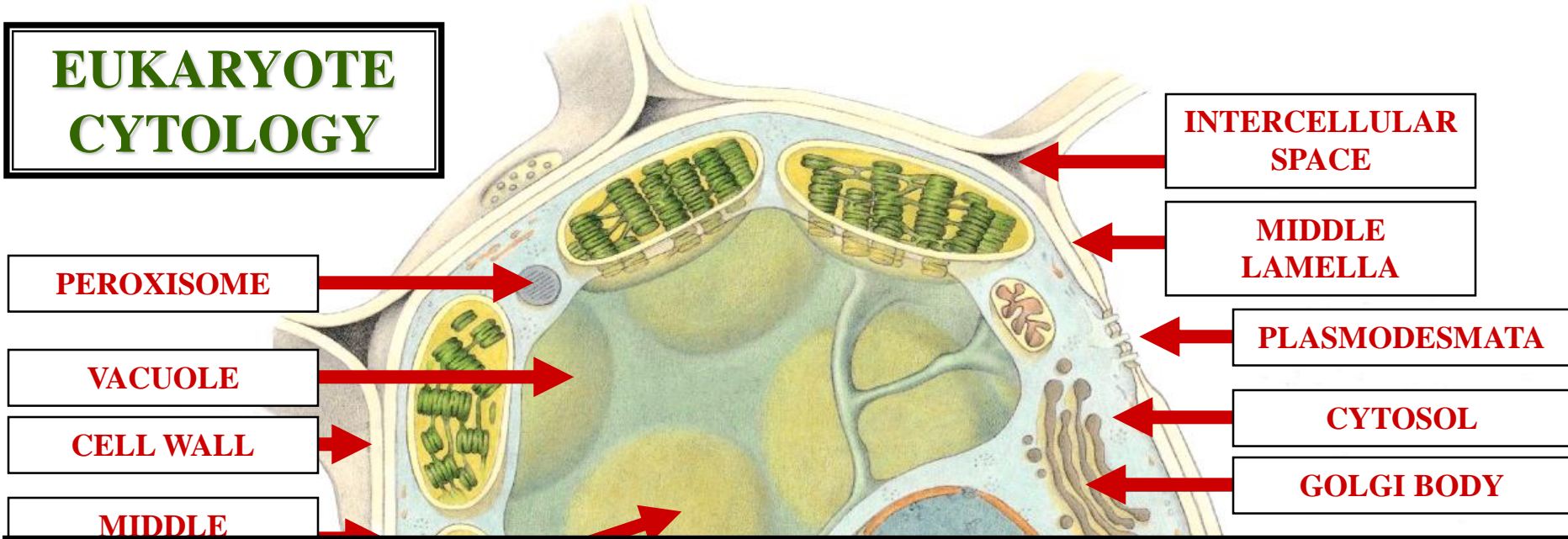
# EUKARYOTE CYTOLOGY



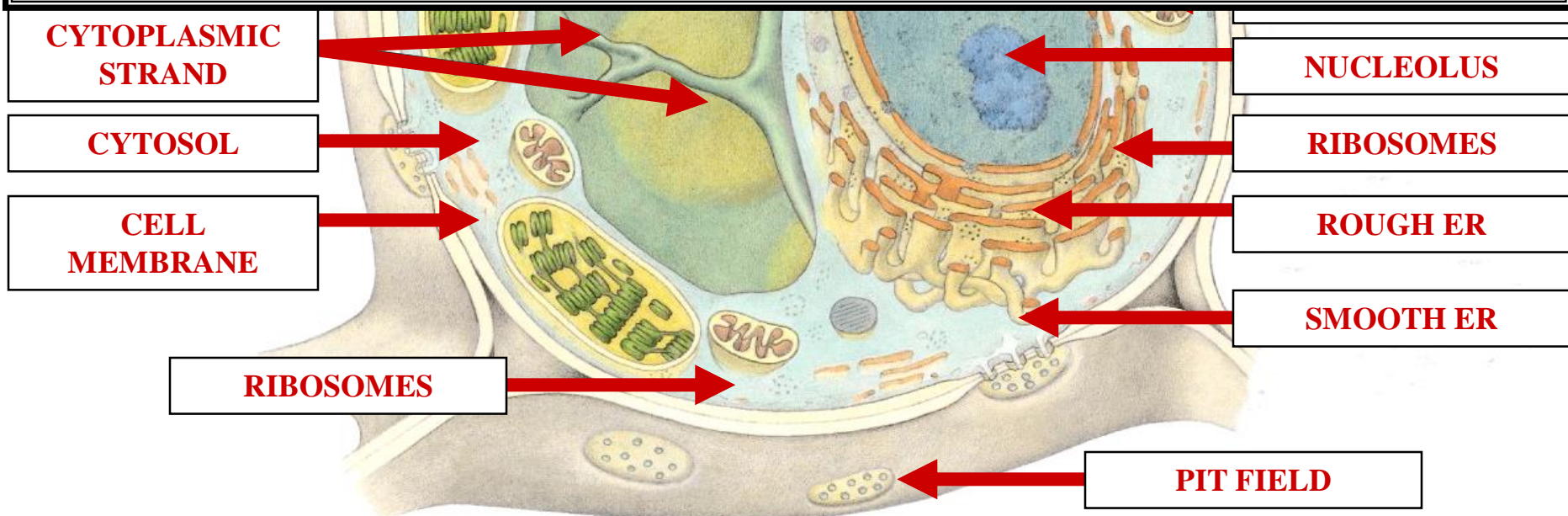
# DOUBLE-MB ORGANELLES



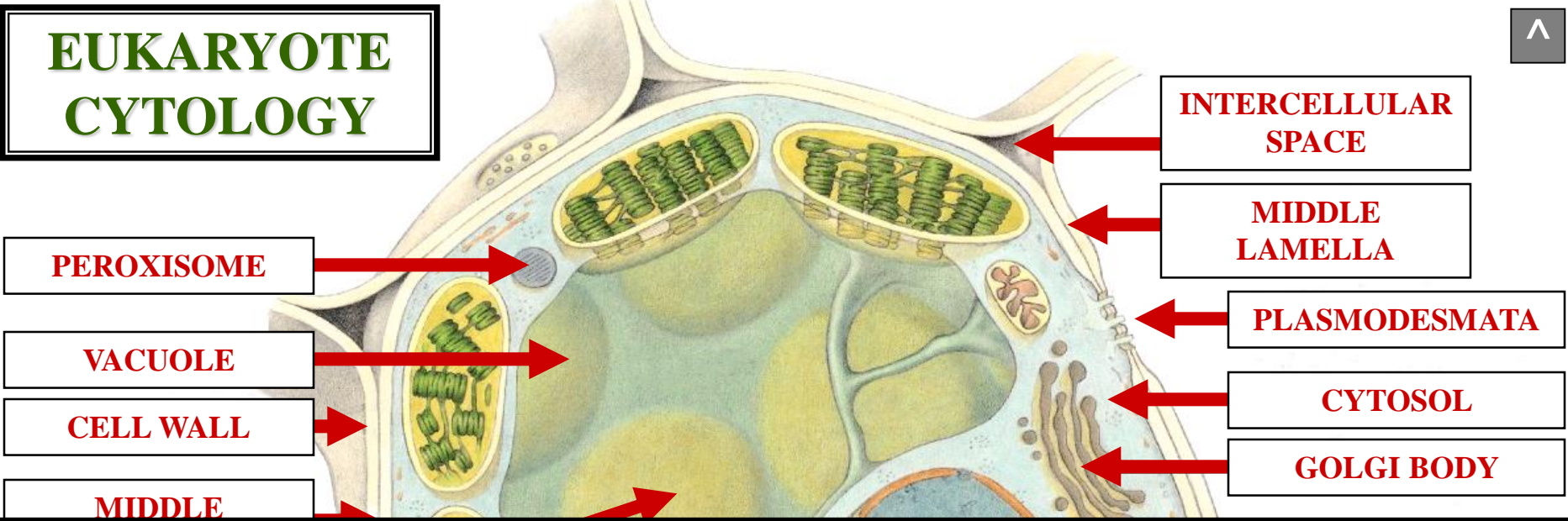
# EUKARYOTE CYTOLOGY



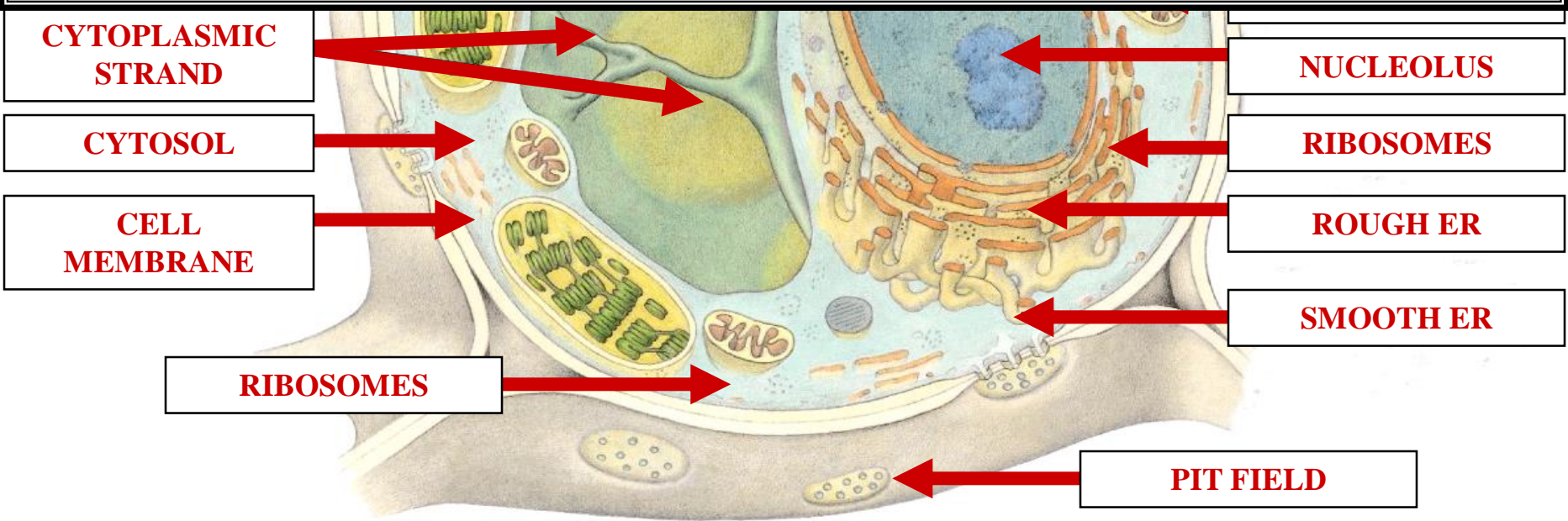
# SINGLE-MB ORGANELLE



# EUKARYOTE CYTOLOGY



# NON-MB ORGANELLE





# **NON-MEMBRANE BOUND ORGANELLE**

# RIBOSOME

**RIBOSOME**



# **RIBOSOME**



**DISTRIBUTED THROUGHOUT  
CYTOSOL**

**RIBOSOME**

# **RIBOSOME**



**DISTRIBUTED THROUGHOUT  
CYTOSOL**

---

**ASSOCIATED WITH  
ENDOPLASMIC RETICULUM**

**RIBOSOME**

# RIBOSOME



**DISTRIBUTED THROUGHOUT  
CYTOSOL**

---

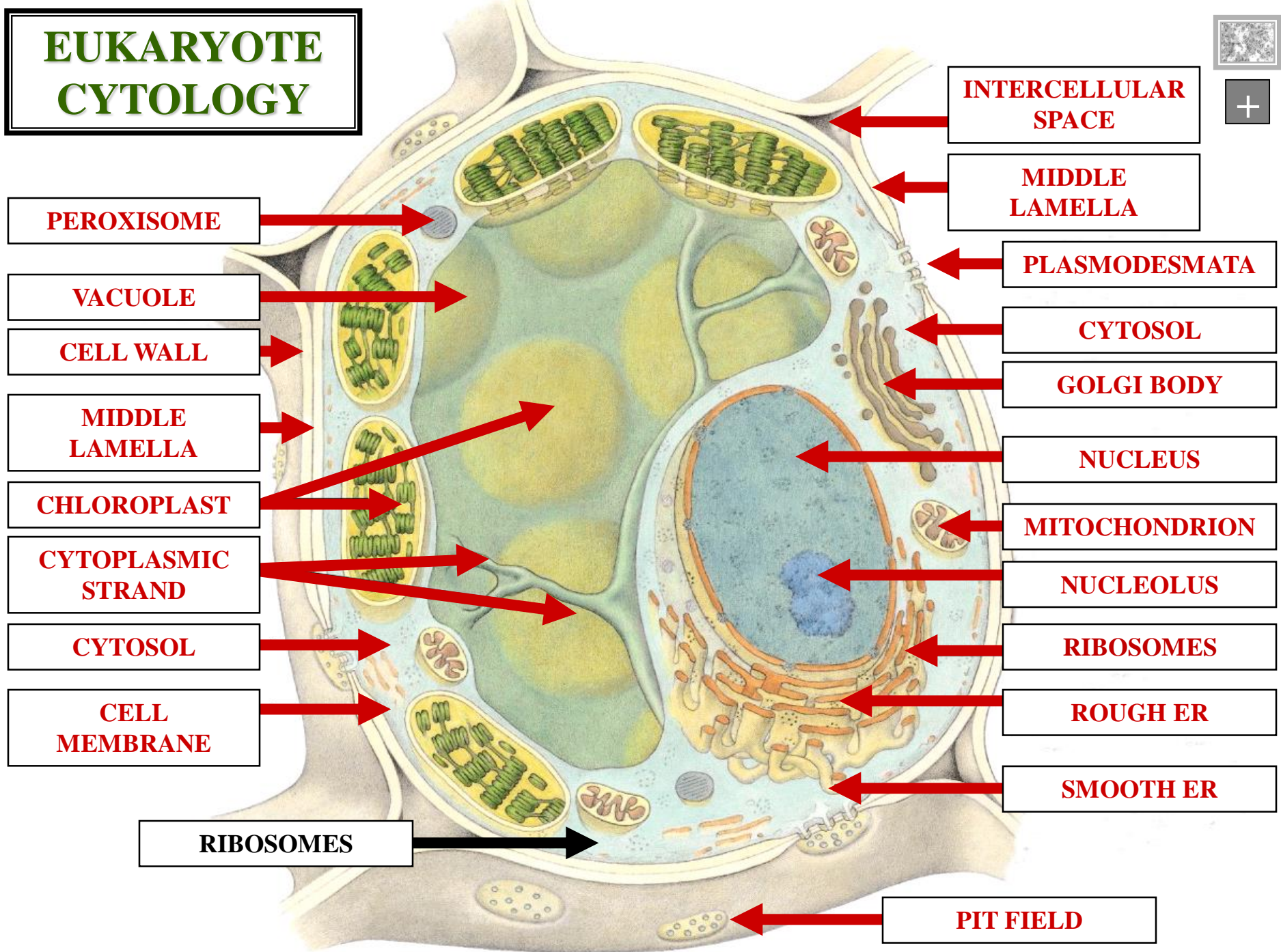
**ASSOCIATED WITH ER**

---

**SITE: PROTEIN SYNTHESIS**

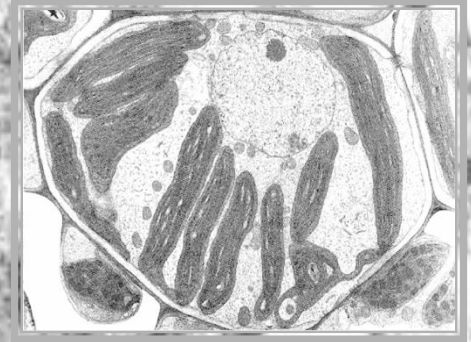
# RIBOSOME

# EUKARYOTE CYTOLOGY

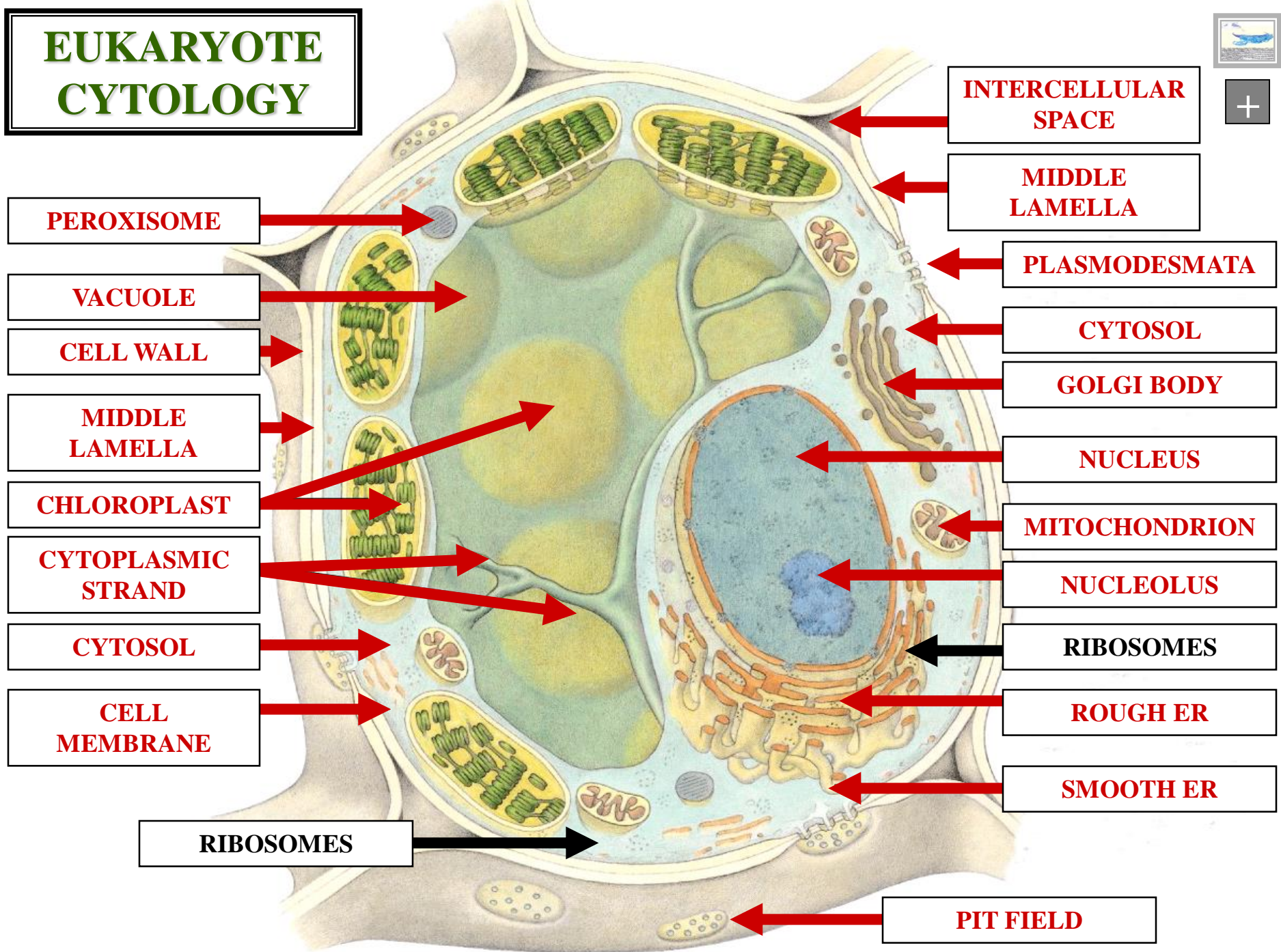


**RIBOSOMES**

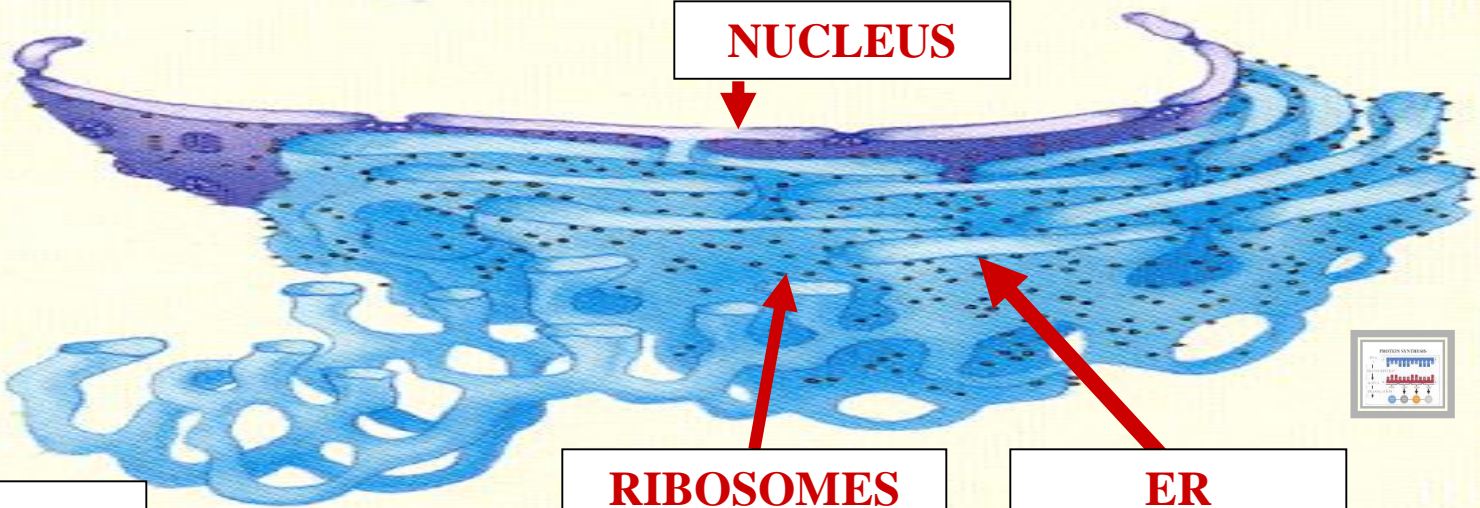
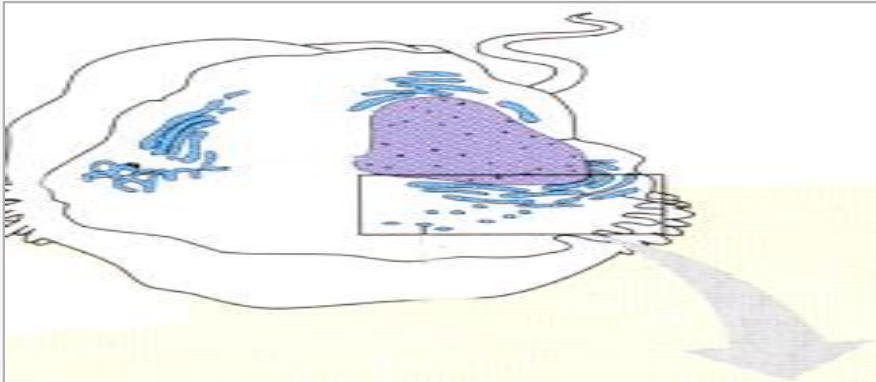
**CYTOSOL**



# EUKARYOTE CYTOLOGY



# ENDOPLASMIC RETICULUM RIBOSOMES

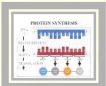
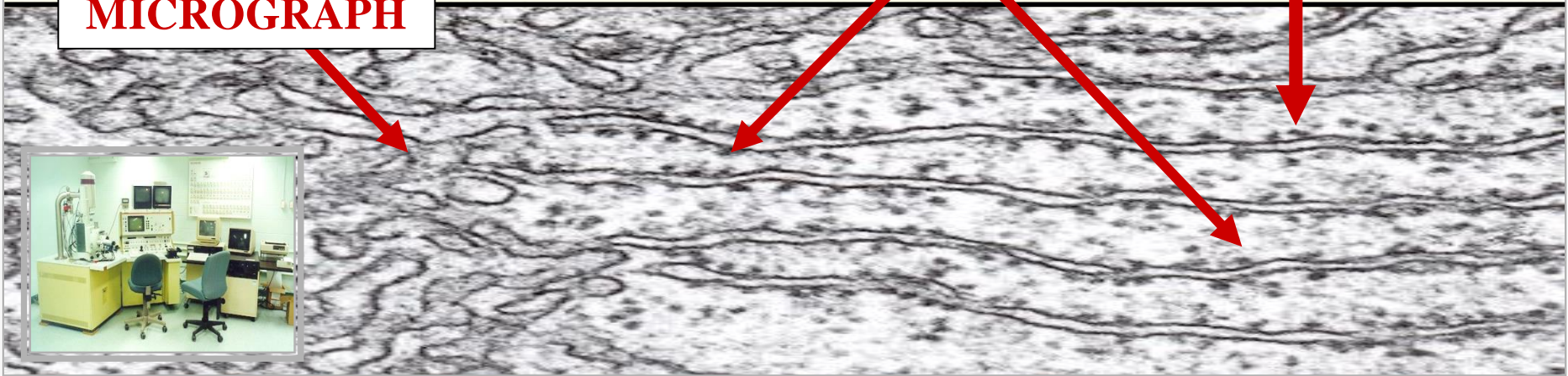


**NUCLEUS**

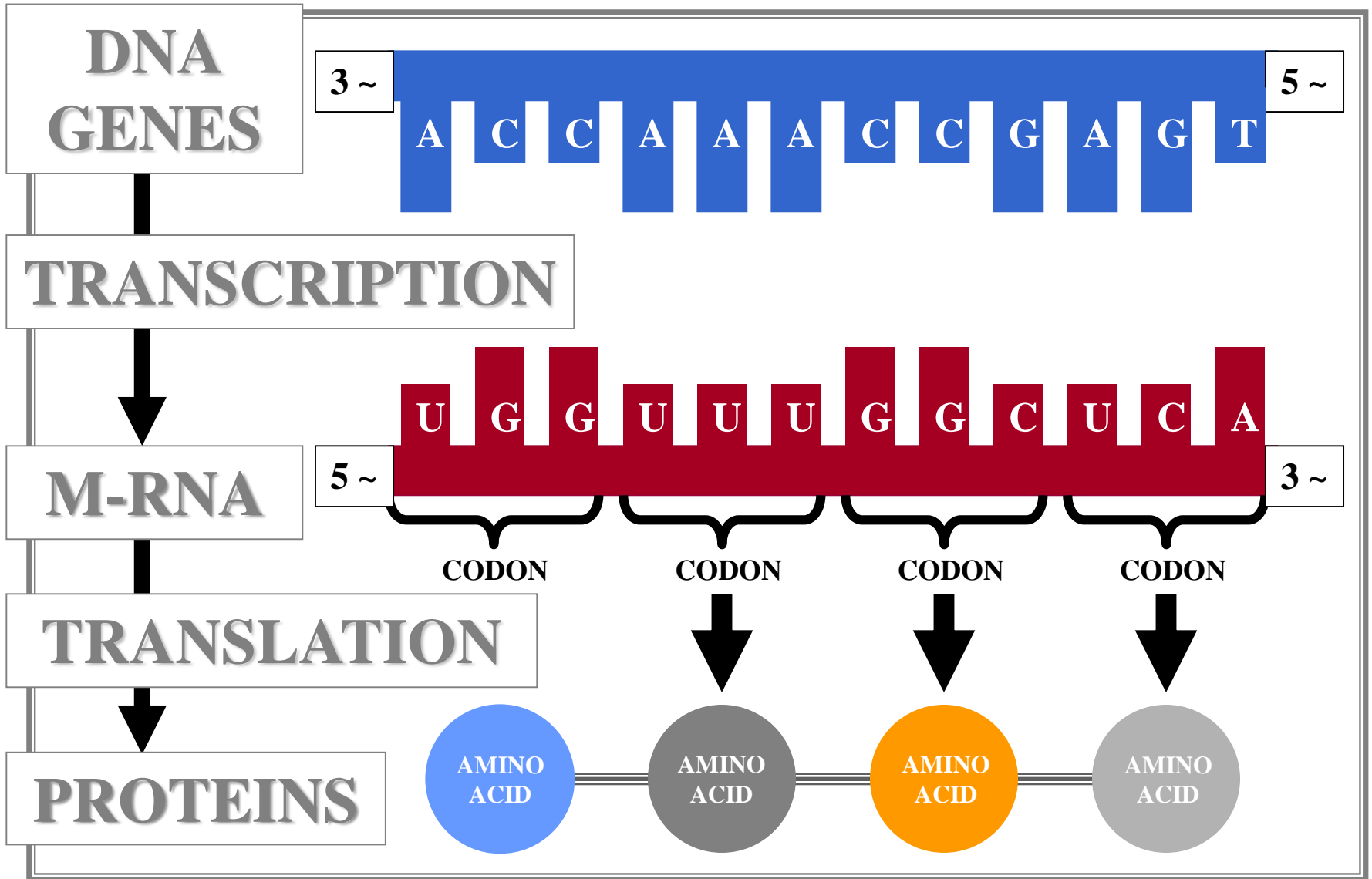
**RIBOSOMES**

**ER**

**TEM  
MICROGRAPH**



# PROTEIN SYNTHESIS







# RIBOSOME COMPOSITION

# **RIBOSOME COMPOSITION**



**NUCLEIC ACID  
PROTEIN  
COMPLEX**

**RIBOSOME  
COMPOSITION**

# **RIBOSOME COMPOSITION**

**P**



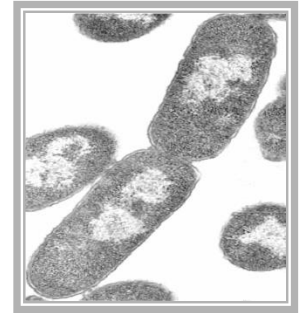
**RNA  
PROTEIN  
COMPLEX**

# **RIBOSOME COMPOSITION**



**PROKARYOTE**

# PROKARYOTE RIBOSOME COMPOSITION



**PROKARYOTE**

**E**

**4**

**3 RNAs & 54 PROTEINS**

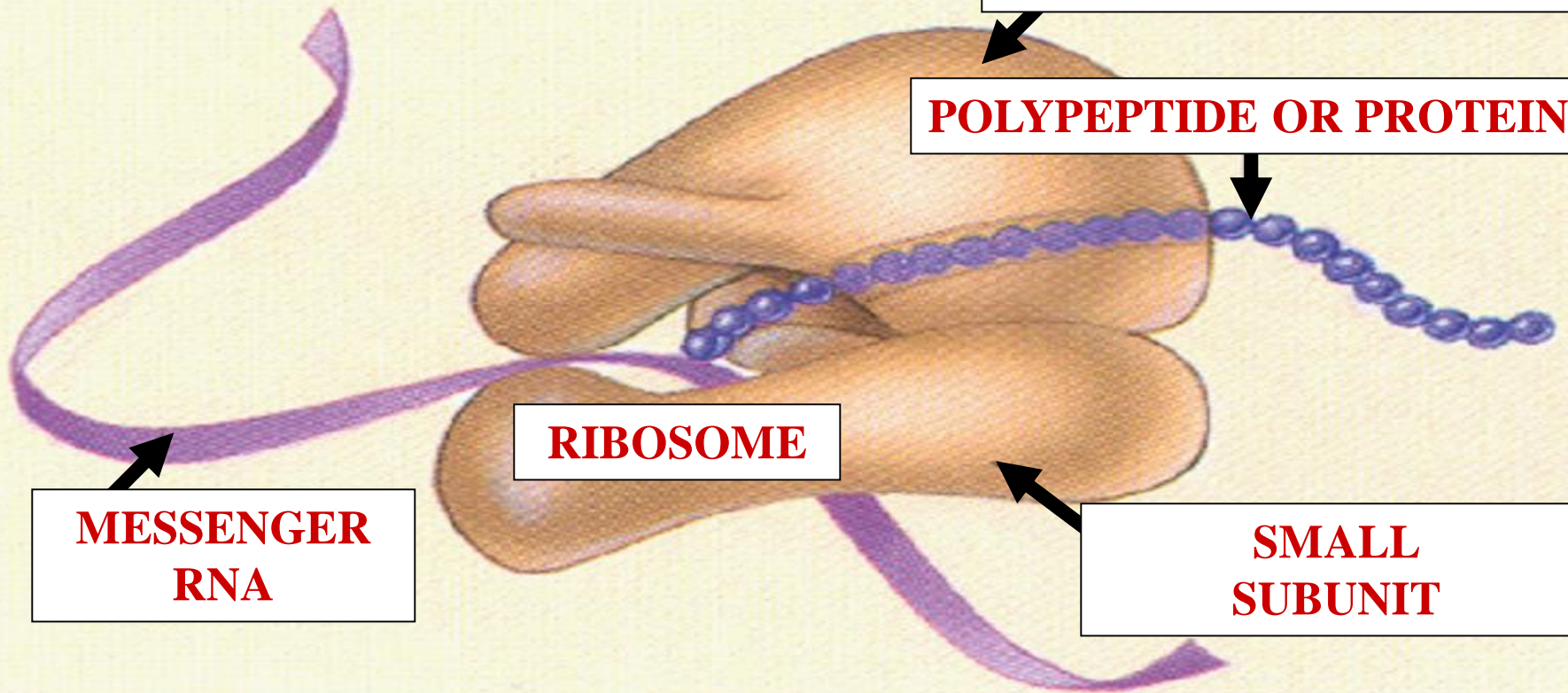
**LARGE  
SUBUNIT**

**POLYPEPTIDE OR PROTEIN**

**RIBOSOME**

**MESSENGER  
RNA**

**SMALL  
SUBUNIT**





**EUKARYOTE**

# EUKARYOTE RIBOSOME COMPOSITION



**EUKARYOTE**

**E**  
**L**

**4 RNAs & 73 PROTEINS**

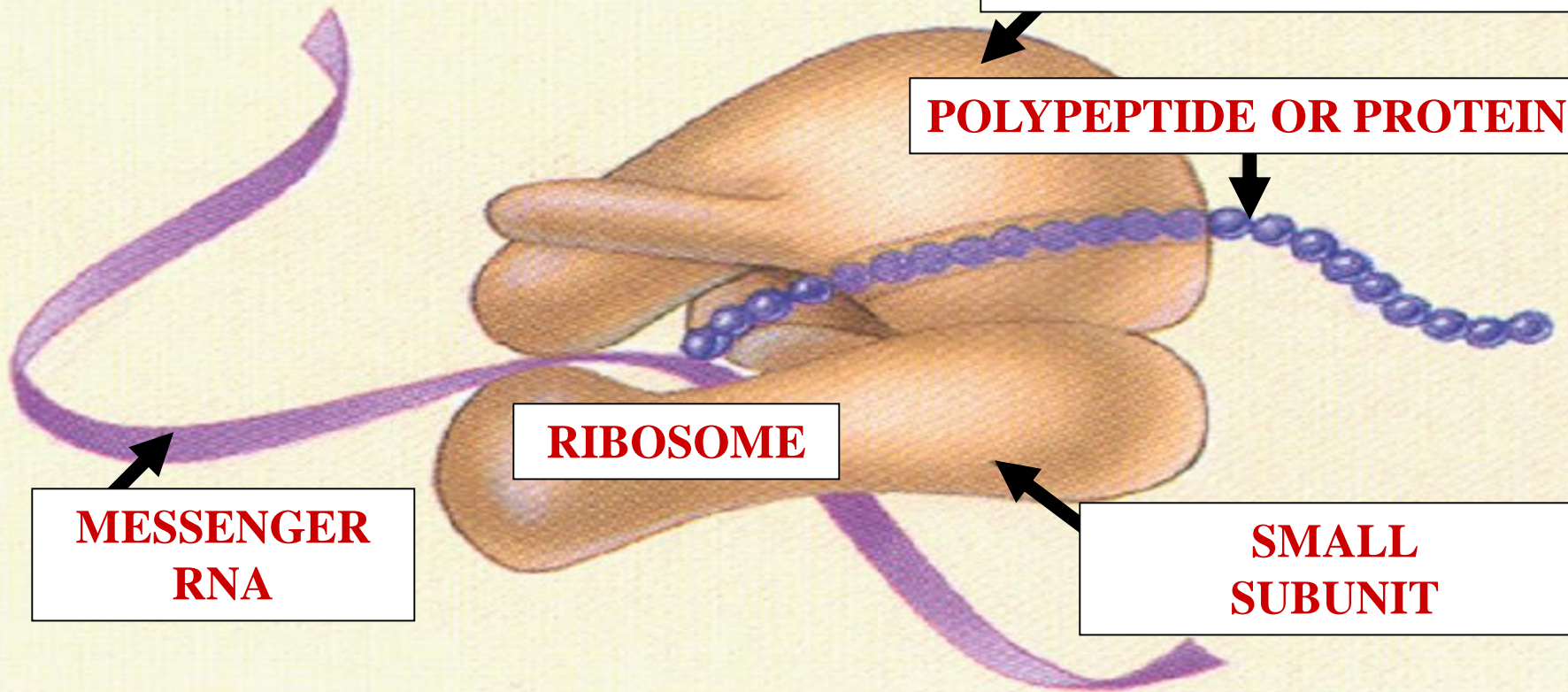
**LARGE  
SUBUNIT**

**POLYPEPTIDE OR PROTEIN**

**RIBOSOME**

**MESSENGER  
RNA**

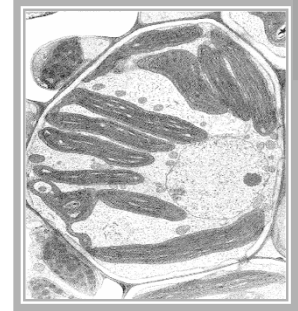
**SMALL  
SUBUNIT**





**EUKARYOTE**

# **EUKARYOTE RIBOSOME LARGER**



**EUKARYOTE**



**4 RNAs & 73 PROTEINS**

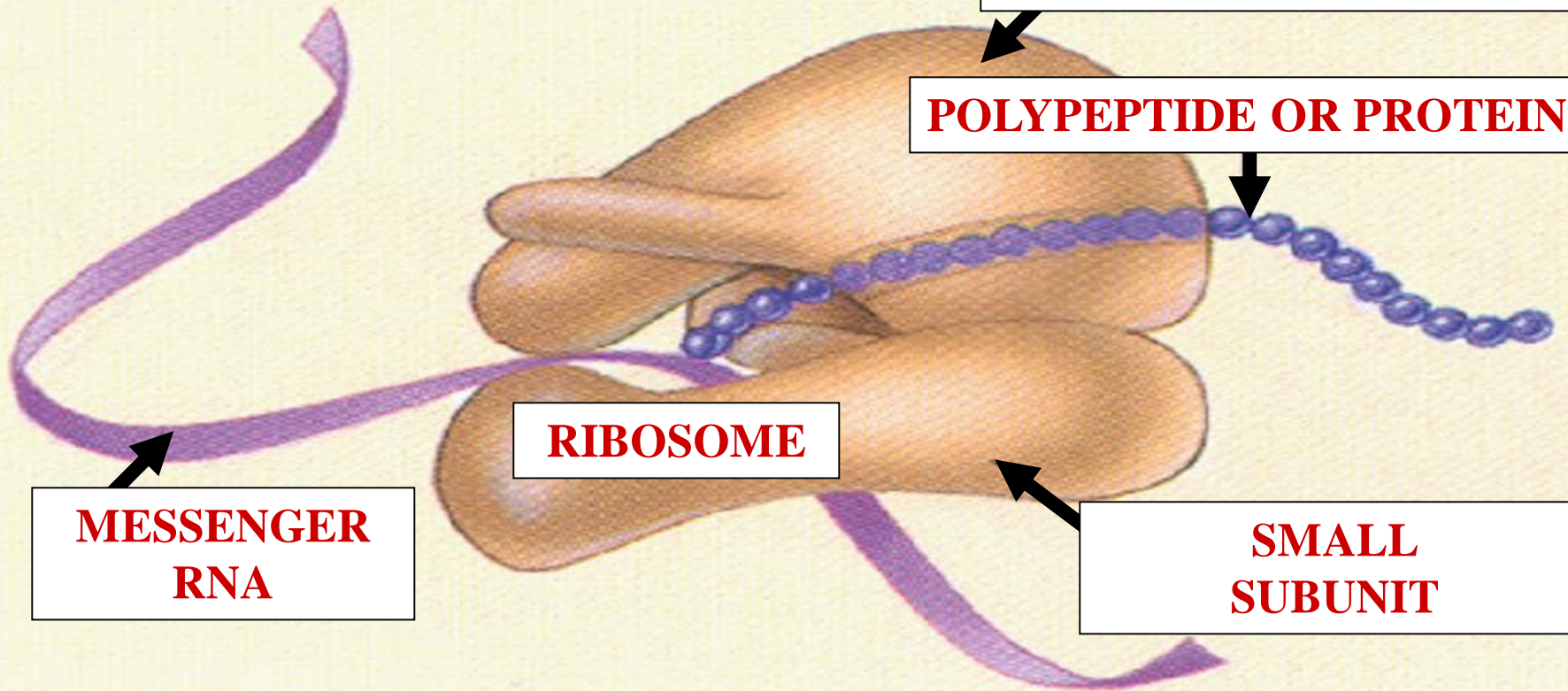
**LARGE  
SUBUNIT**

**POLYPEPTIDE OR PROTEIN**

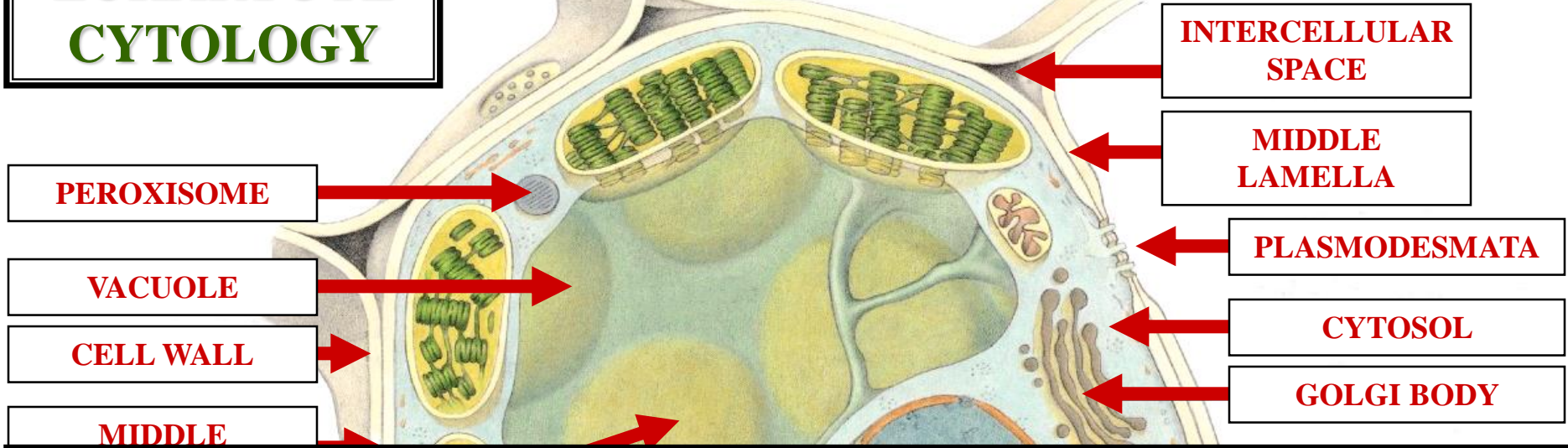
**RIBOSOME**

**MESSENGER  
RNA**

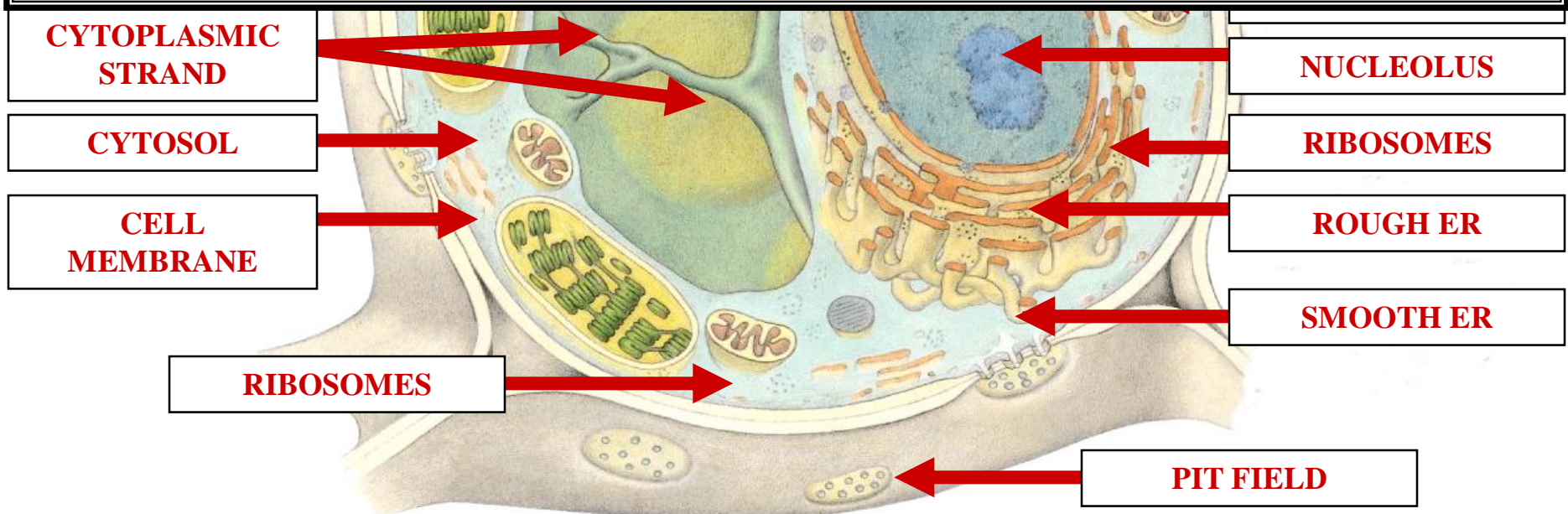
**SMALL  
SUBUNIT**



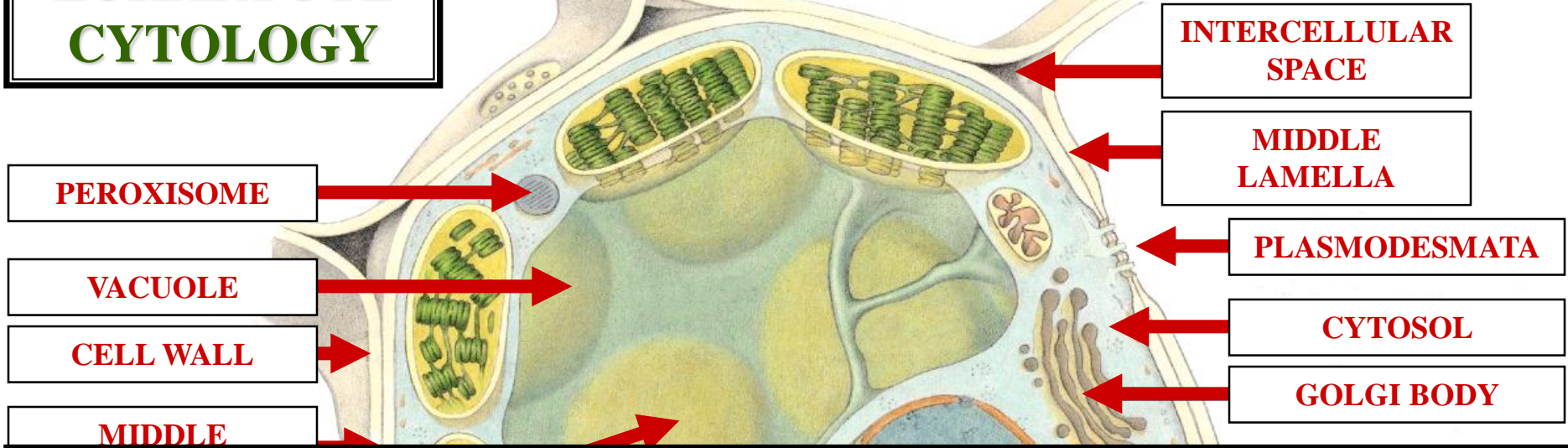
# EUKARYOTE CYTOLOGY



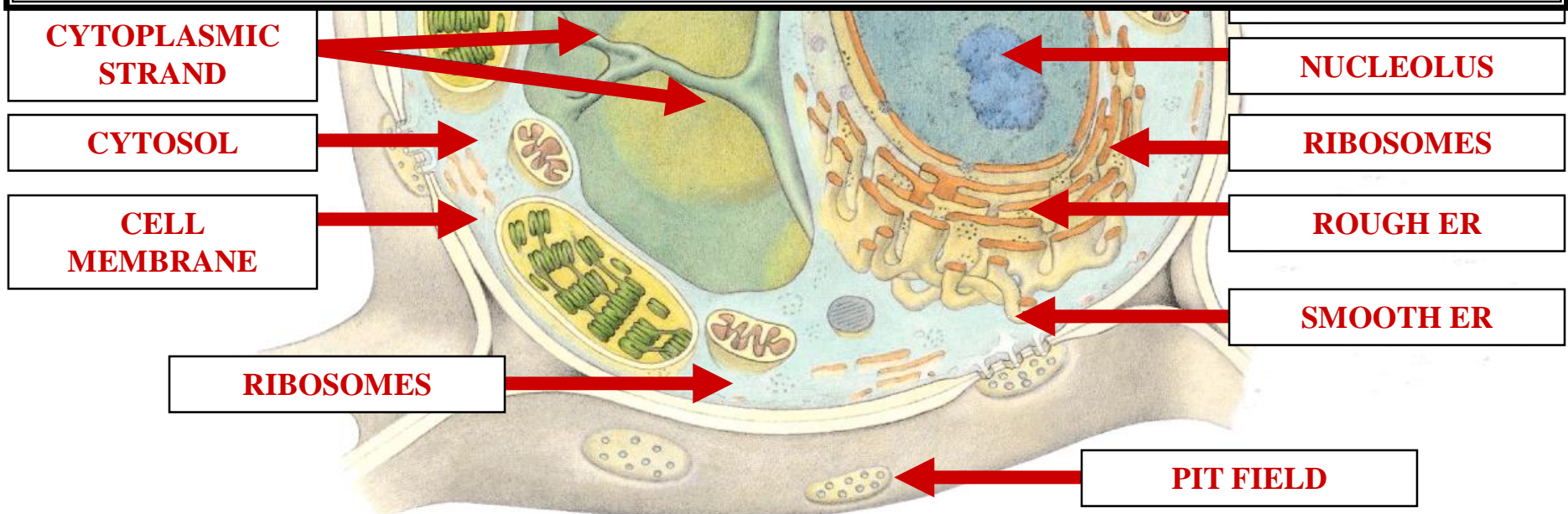
# SUMMARY



# EUKARYOTE CYTOLOGY

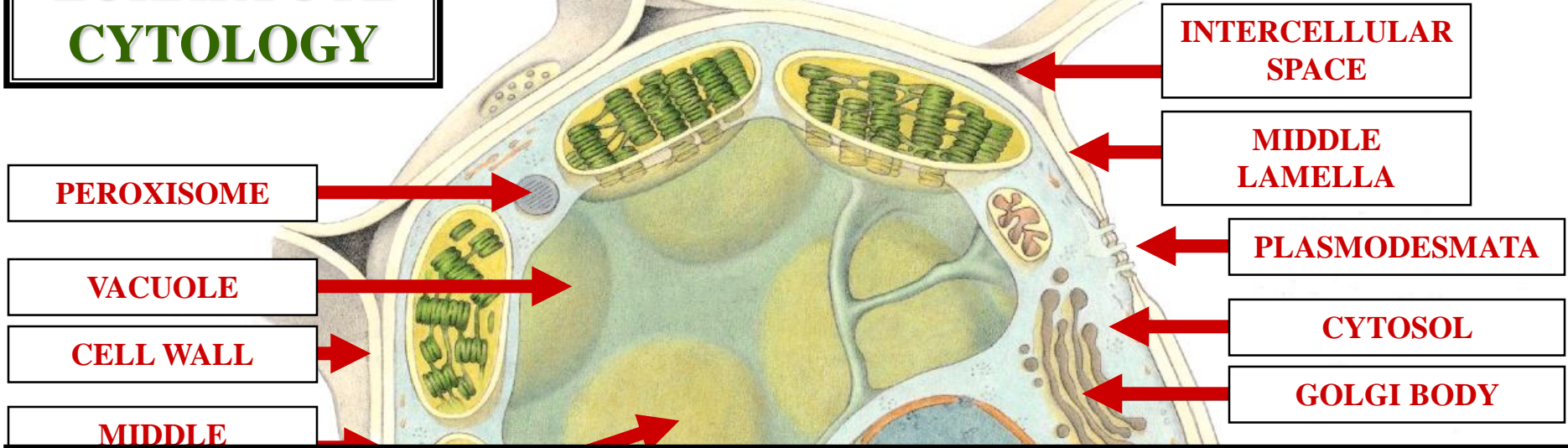


# DOUBLE-MB ORGANELLES

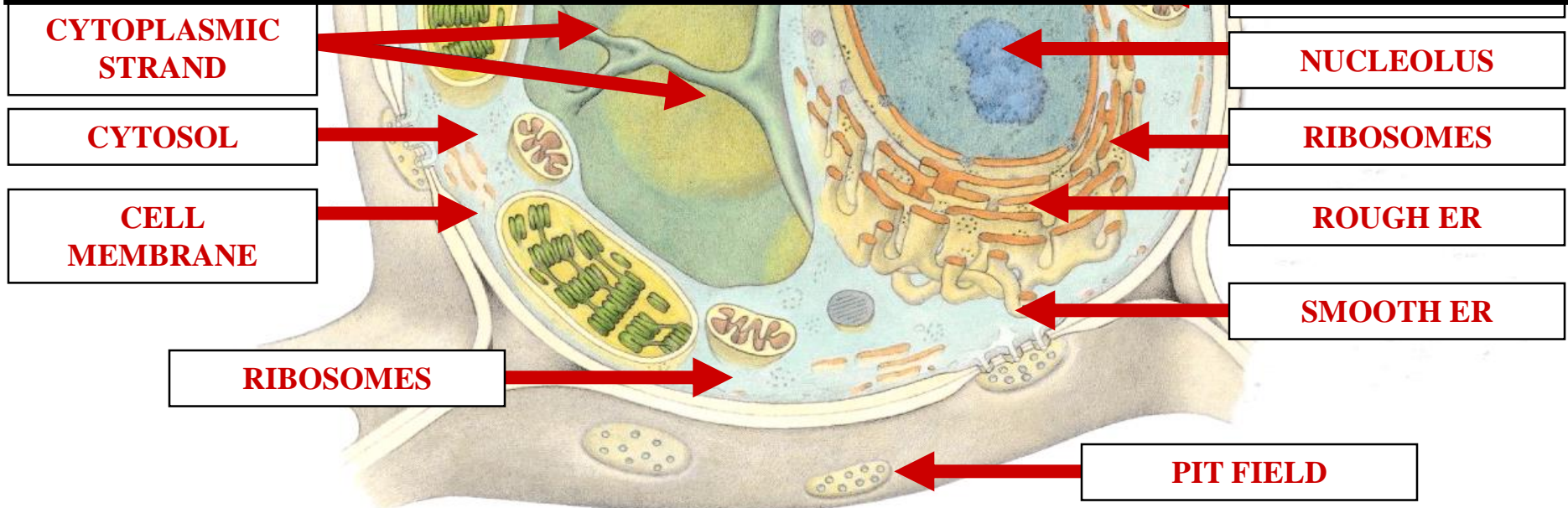




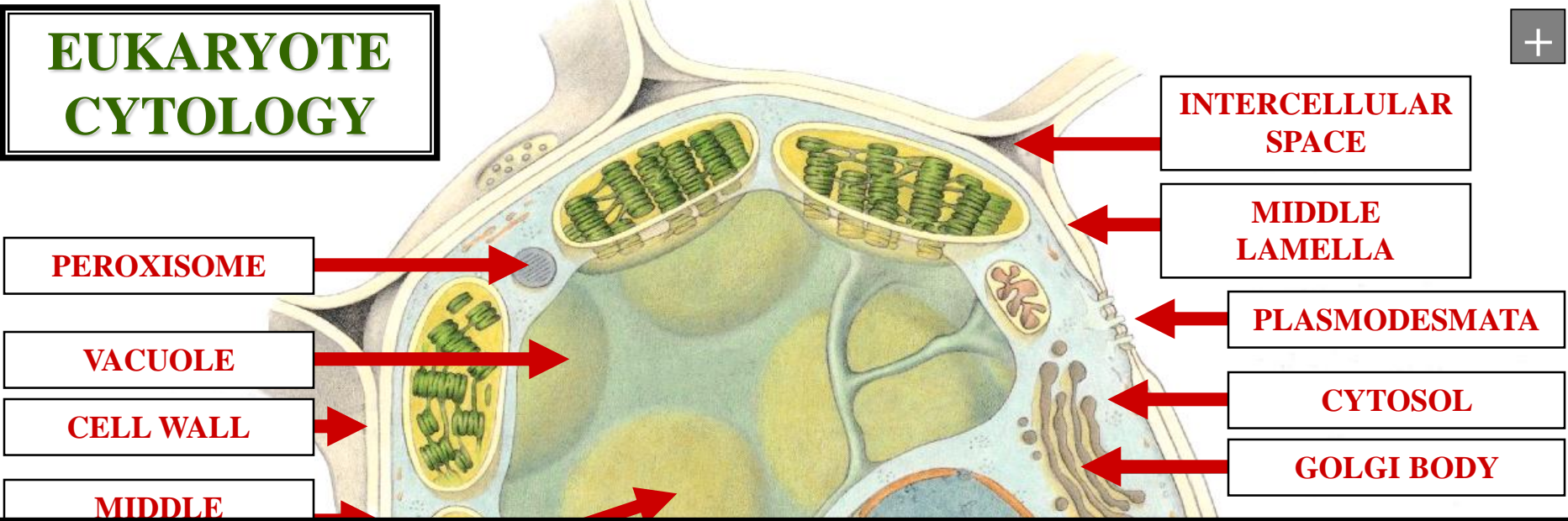
# EUKARYOTE CYTOLOGY



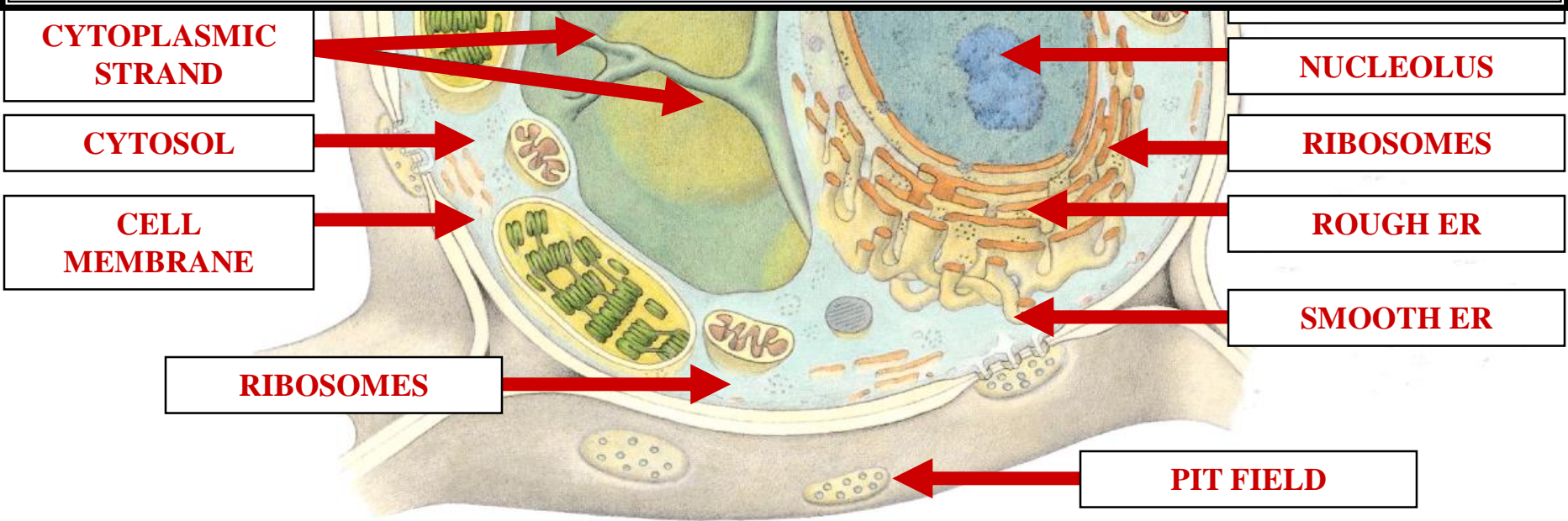
# SINGLE-MB ORGANELLE



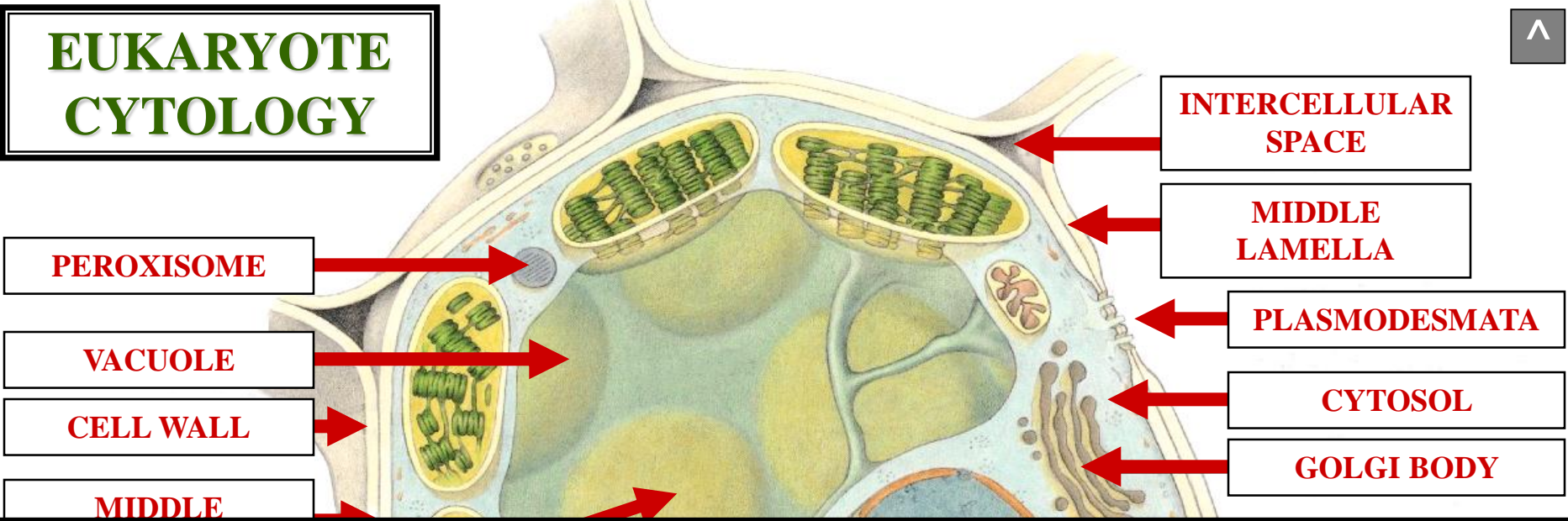
# EUKARYOTE CYTOLOGY



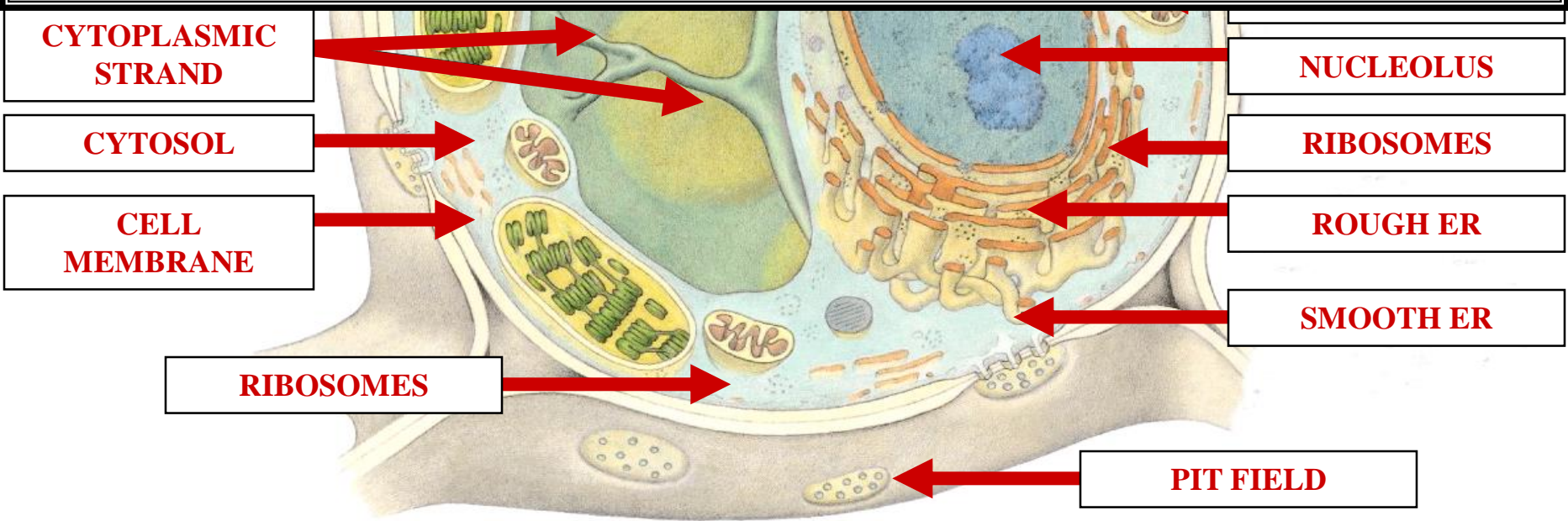
# NON-MB ORGANELLE



# EUKARYOTE CYTOLOGY



# ENDO-MEMBRANE SYSTEM





# ENDO-MEMBRANE SYSTEM

# ENDO-MEMBRANE SYSTEM COMPONENTS

# **ENDO-MEMBRANE SYSTEM COMPONENTS**

**ENDOPLASMIC RETICULUM**

**ENDO-MEMBRANE SYSTEM  
COMPONENTS**

# **ENDO-MEMBRANE SYSTEM**

## **COMPONENTS**

**ENDOPLASMIC RETICULUM**  
**GOLGI BODY**

**ENDO-MEMBRANE SYSTEM**  
**COMPONENTS**

# ENDOPLASMIC RETICULUM ER



**ENDOPLASMIC  
RETICULUM  
ER**



# ENDOPLASMIC RETICULUM

MEMBRANE DISTRIBUTED  
THROUGHOUT CYTOSOL

ENDOPLASMIC RETICULUM



# ENDOPLASMIC RETICULUM

## TRANSPORT AND COMMUNICATION SYSTEM

# ENDOPLASMIC RETICULUM

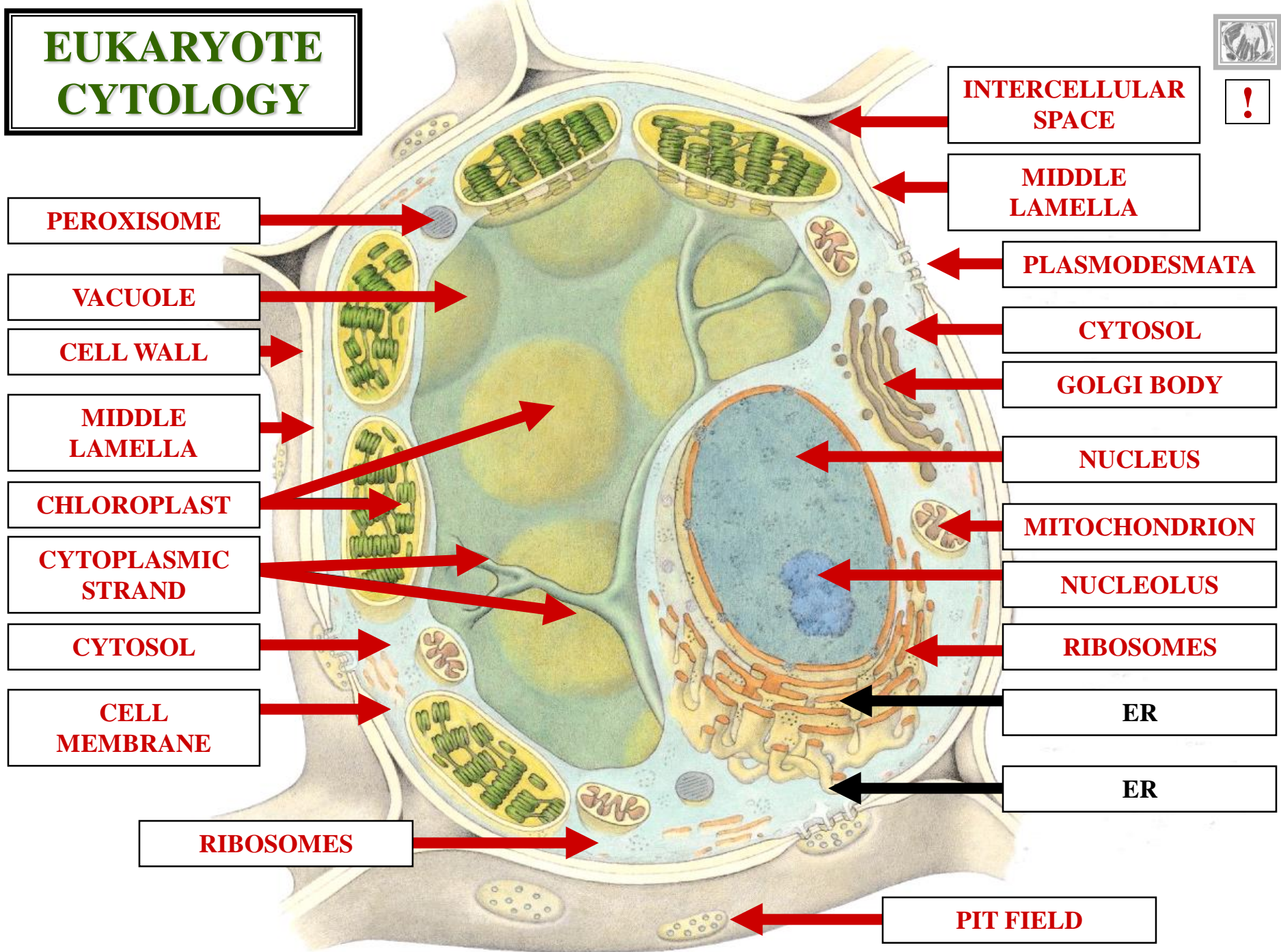


# **ENDOPLASMIC RETICULUM**

## **ENZYME SYNTHESIS AND MEMBRANE SYNTHESIS**

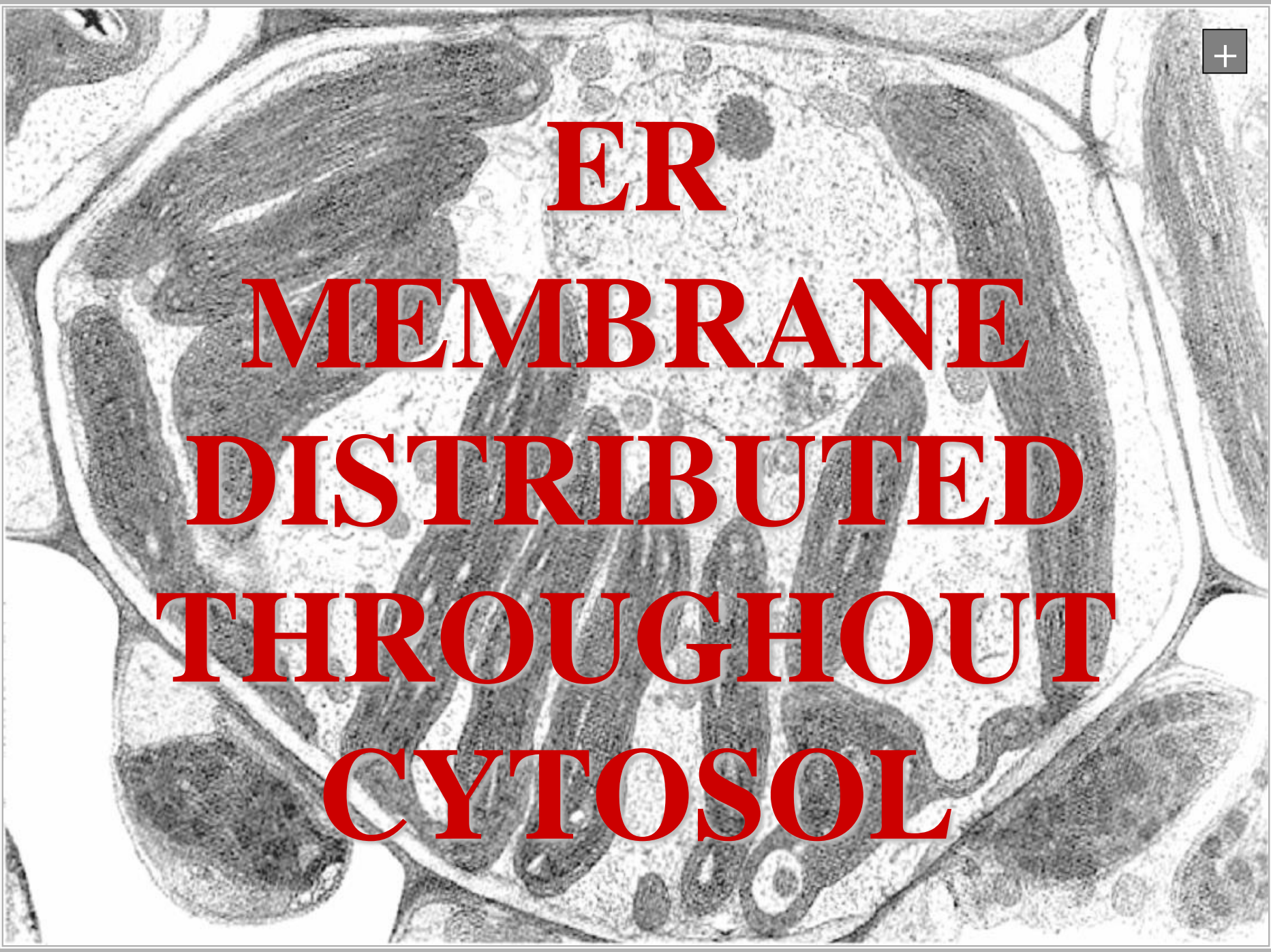
# **ENDOPLASMIC RETICULUM**

# EUKARYOTE CYTOLOGY



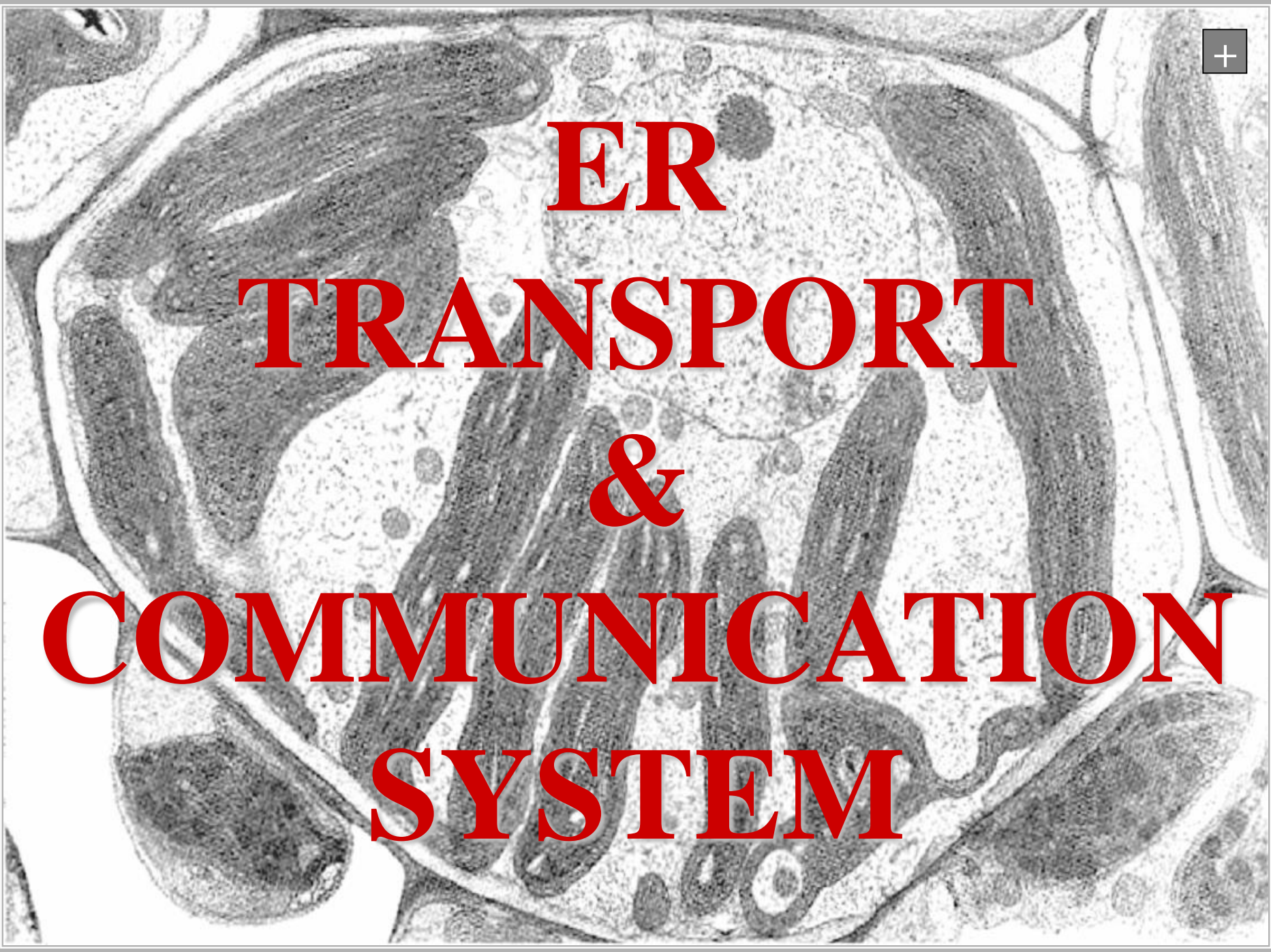


**ER**  
**MEMBRANE**  
**DISTRIBUTED**  
**THROUGHOUT**  
**CYTOSOL**



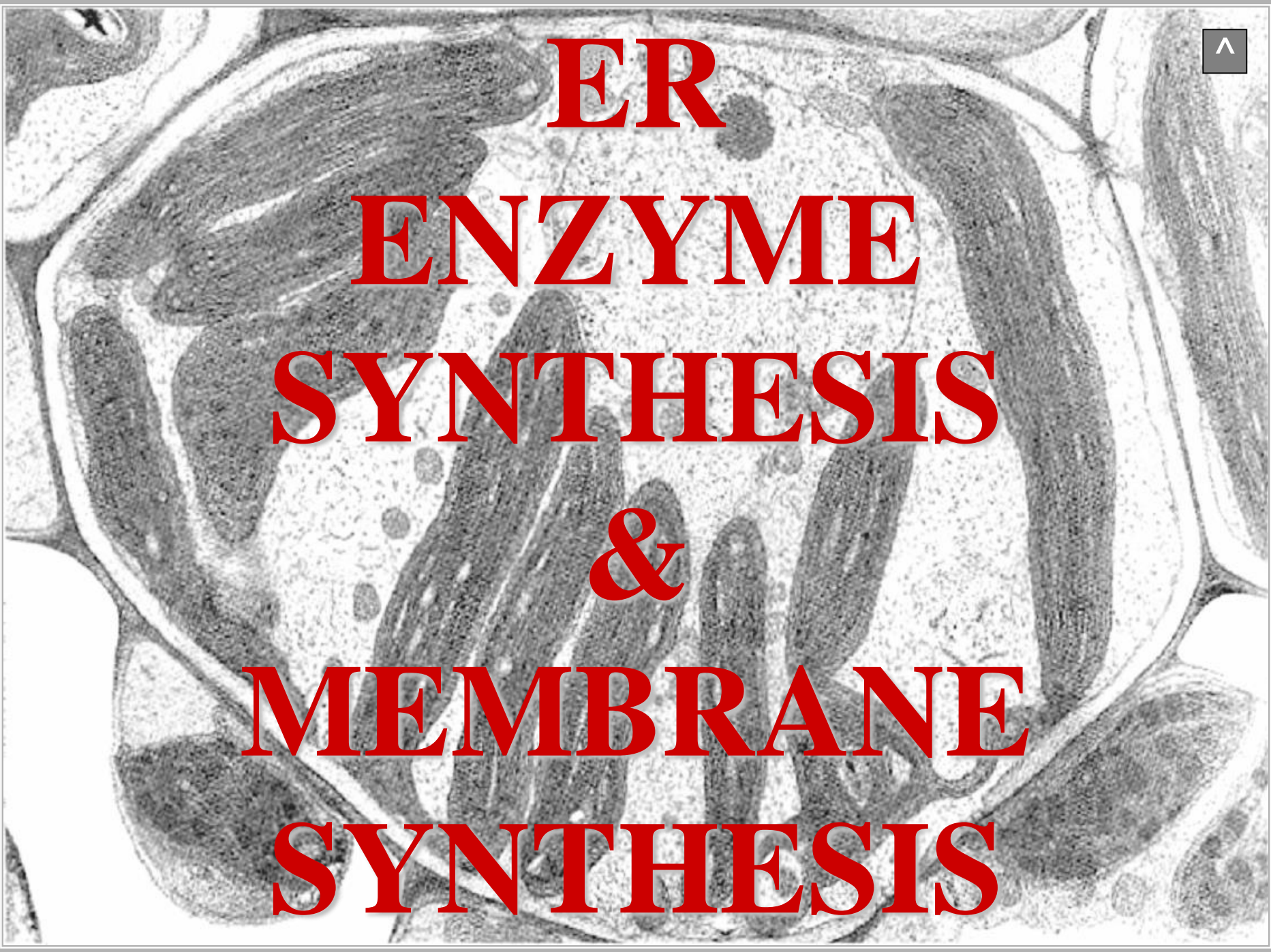


**ER  
TRANSPORT  
&  
COMMUNICATION  
SYSTEM**





**ER**  
**ENZYME**  
**SYNTHESIS**  
**&**  
**MEMBRANE**  
**SYNTHESIS**







# ENDOPLASMIC RETICULUM

# ULTRASTRUCTURE

**ENDOPLASMIC  
RETICULUM  
ULTRASTRUCTURE  
COMPONENTS**

**ENDOPLASMIC RETICULUM  
ULTRASTRUCTURE  
COMPONENTS**

**ROUGH ER**

**ENDOPLASMIC RETICULUM  
ULTRASTRUCTURE  
COMPONENTS**

**ENDOPLASMIC RETICULUM** R  
**ULTRASTRUCTURE**  
**COMPONENTS**

**ROUGH ER**  
**SMOOTH ER**

**ENDOPLASMIC RETICULUM**  
**ULTRASTRUCTURE**  
**COMPONENTS**

**ROUGH ER**



**ROUGH**

**ENDOPLASMIC RETICULUM**

**RIBOSOMES: PRESENT**

**ROUGH**

**ENDOPLASMIC RETICULUM**



**ROUGH**

**ENDOPLASMIC RETICULUM**

**RIBOSOMES: PRESENT**

**---**

**CONFLUENT WITH NUCLEUS**

**ROUGH**

**ENDOPLASMIC RETICULUM**



**ROUGH  
ENDOPLASMIC RETICULUM**

**RIBOSOMES: PRESENT**

---

**CONFLUENT WITH NUCLEUS**

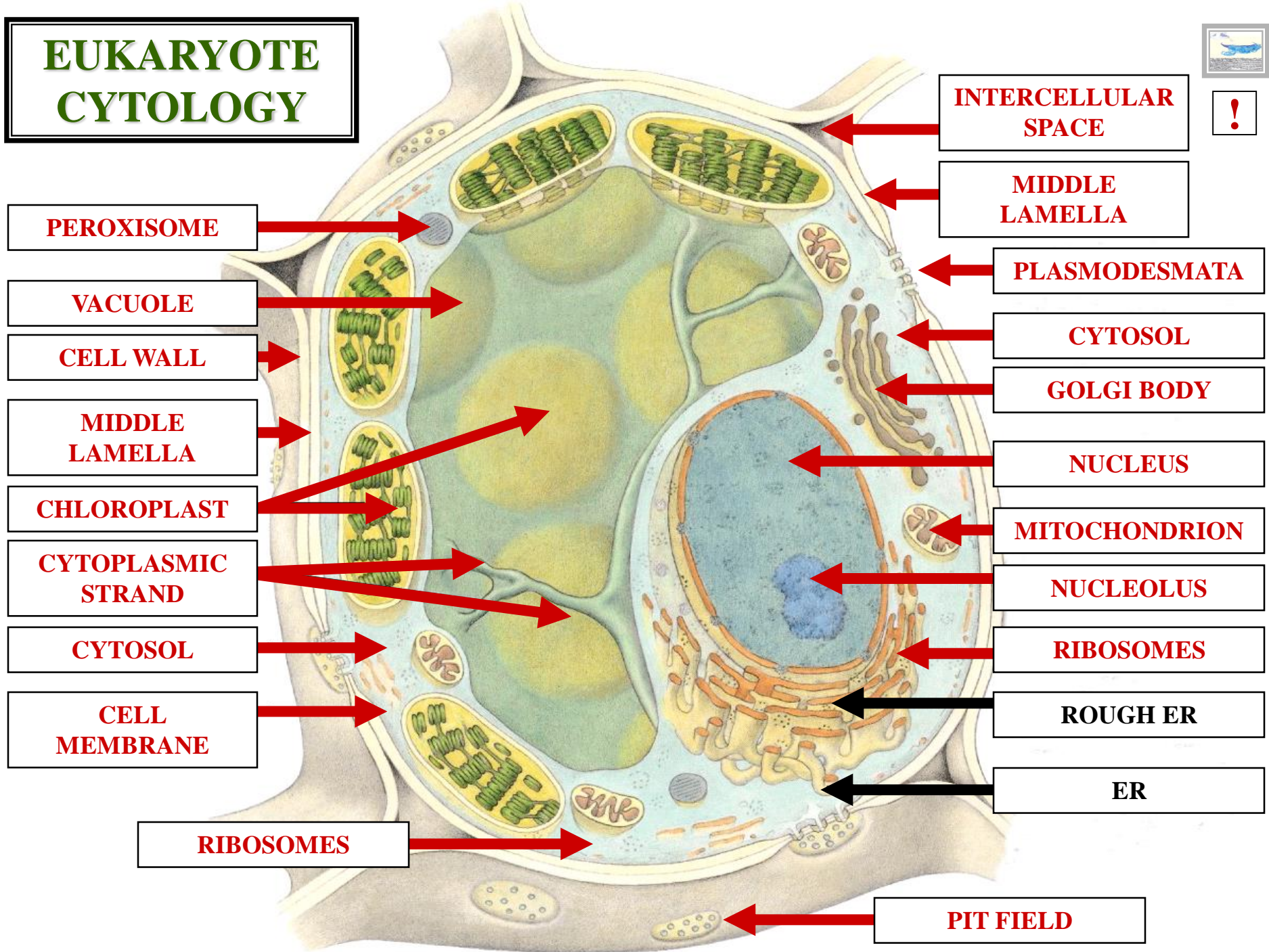
---

**SITE: ENZYME SYNTHESIS**

**ROUGH  
ENDOPLASMIC RETICULUM**

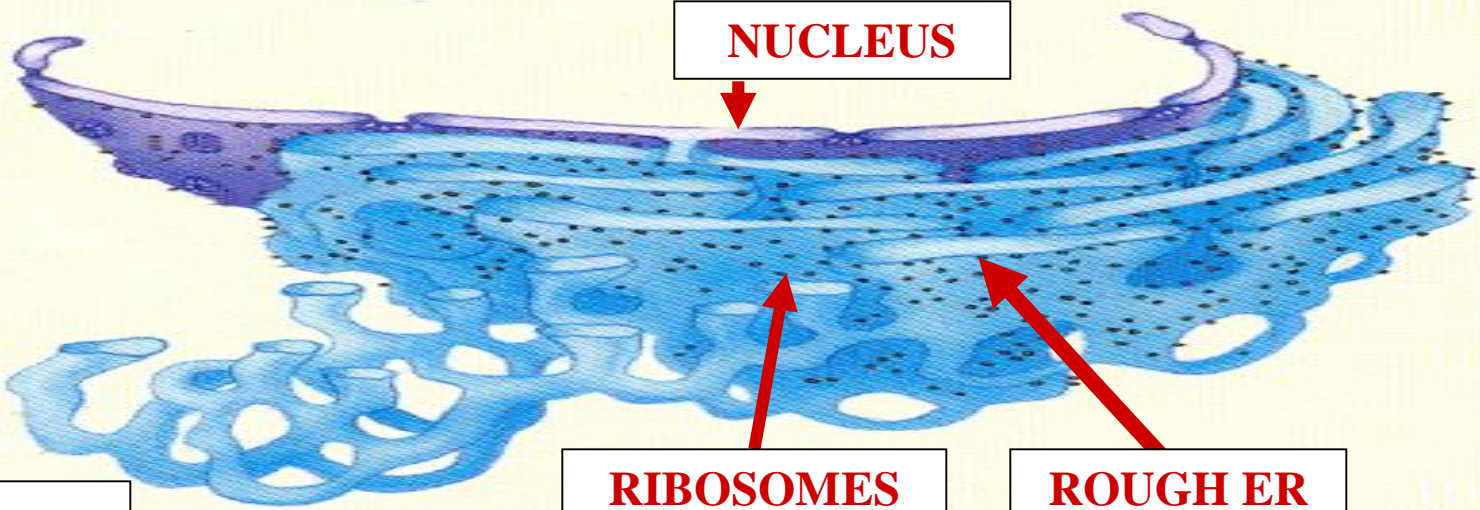


# EUKARYOTE CYTOLOGY



# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

C

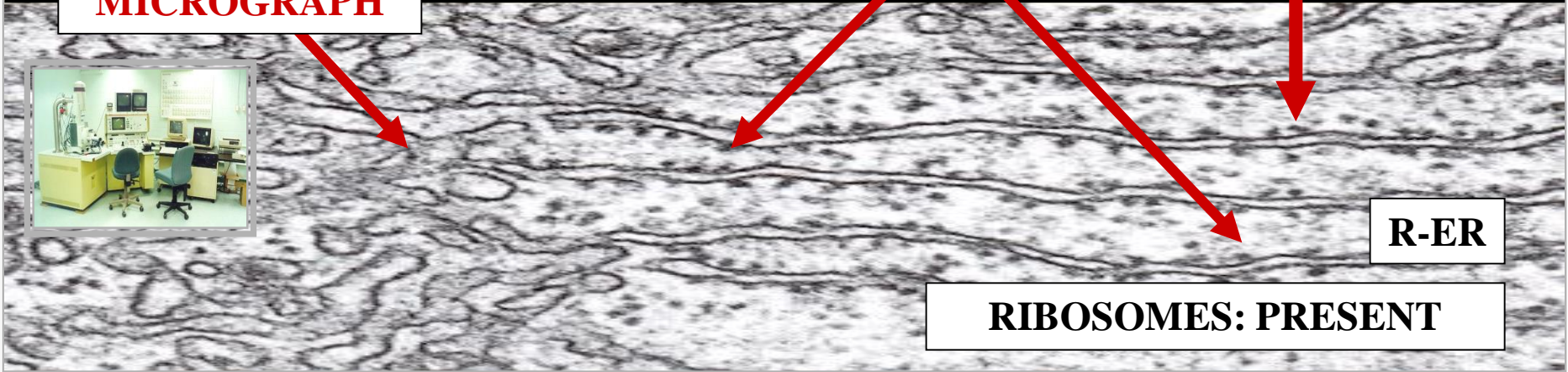


**NUCLEUS**

**RIBOSOMES**

**ROUGH ER**

**TEM  
MICROGRAPH**

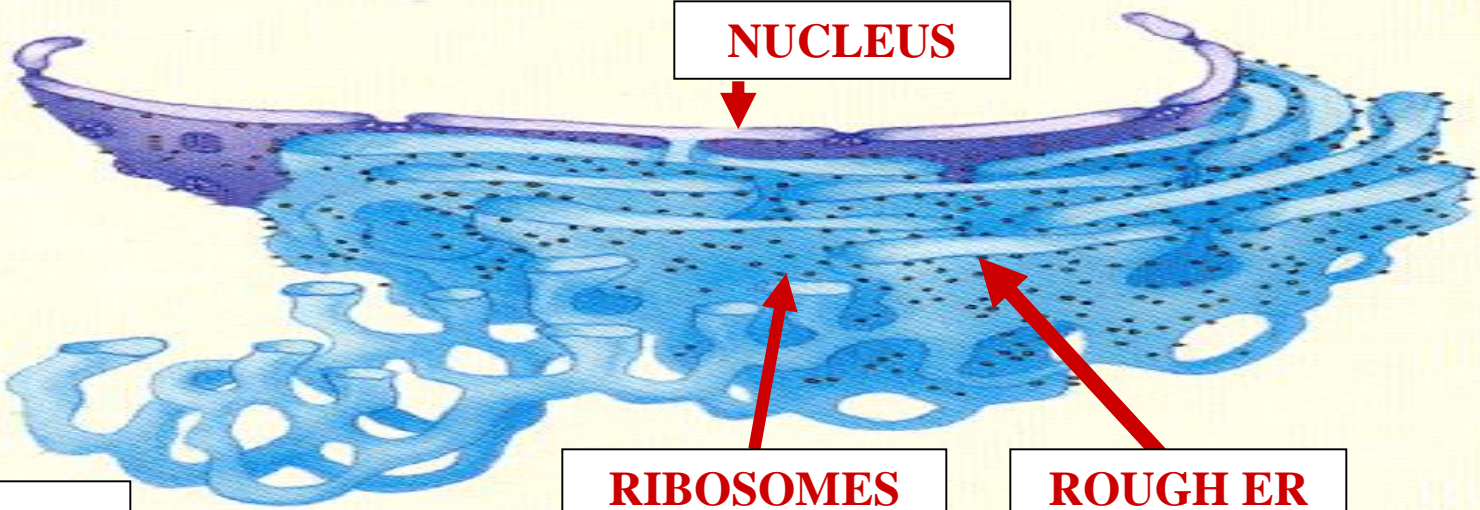


**R-ER**

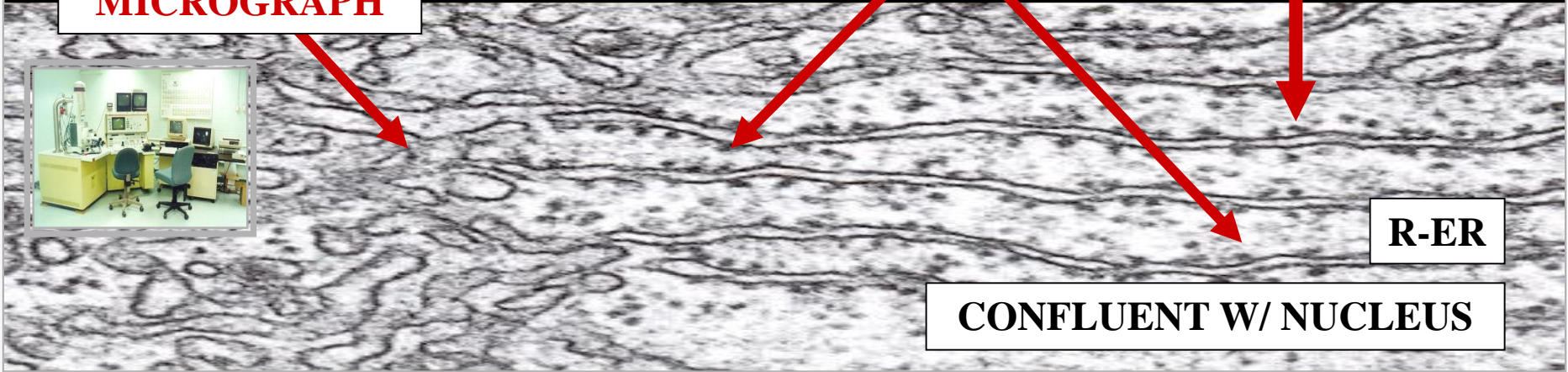
**RIBOSOMES: PRESENT**

# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

S



**TEM  
MICROGRAPH**



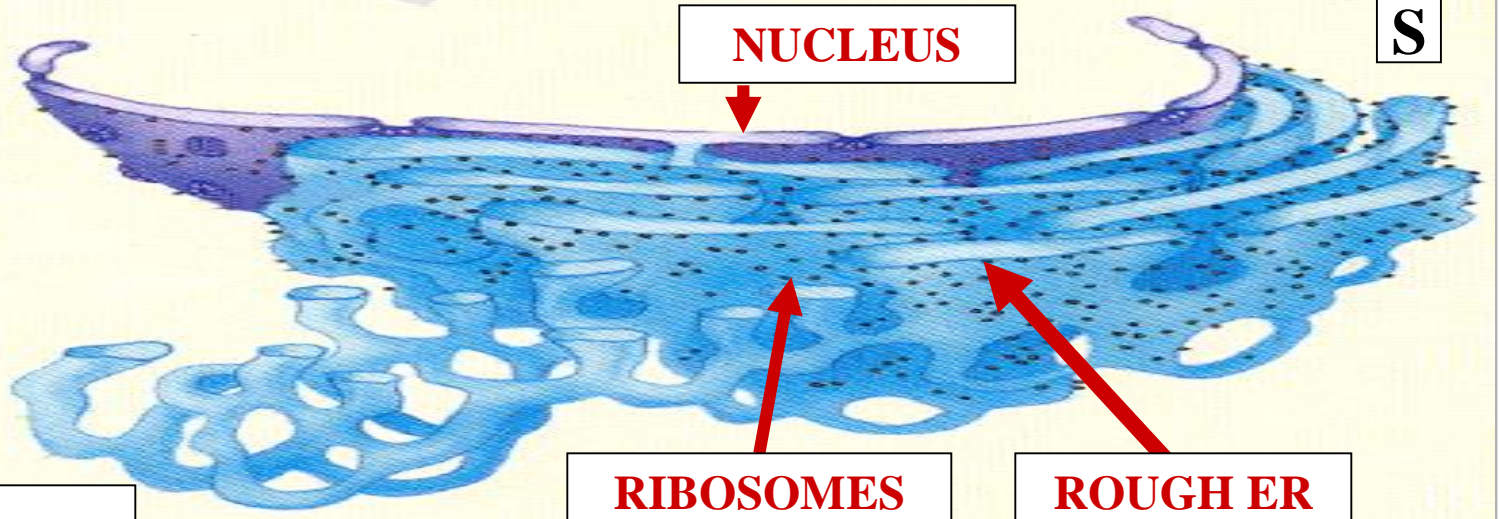
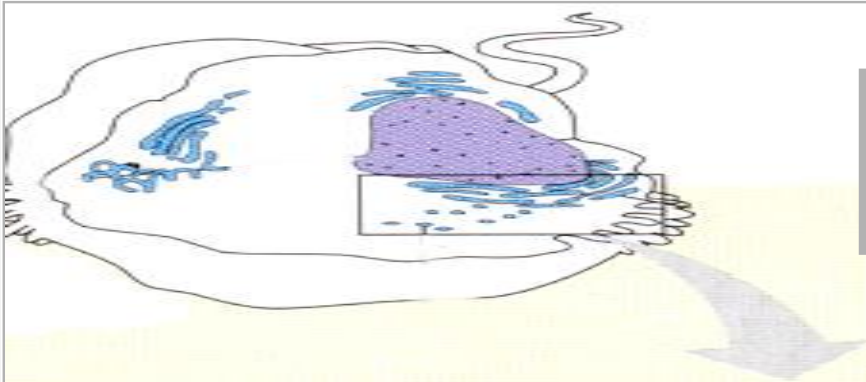
**RIBOSOMES**

**ROUGH ER**

**R-ER**

**CONFLUENT W/ NUCLEUS**

# ENDOPLASMIC RETICULUM ULTRASTRUCTURE



**TEM  
MICROGRAPH**

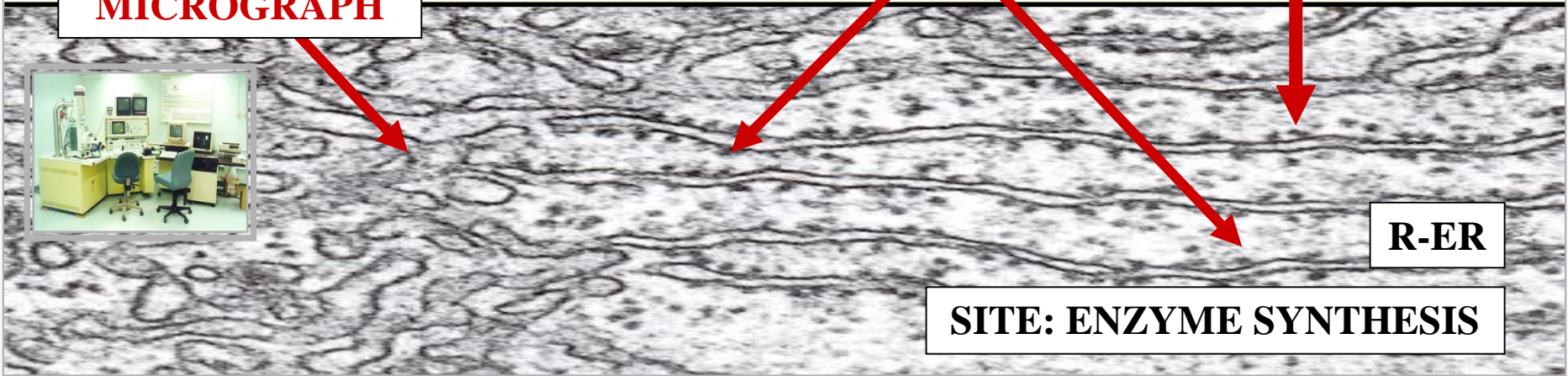


**RIBOSOMES**

**ROUGH ER**

**R-ER**

**SITE: ENZYME SYNTHESIS**



**SMOOTHER**



**SMOOTH**

**ENDOPLASMIC RETICULUM**

**RIBOSOMES: ABSENT**

**SMOOTH**

**ENDOPLASMIC RETICULUM**



**SMOOTH  
ENDOPLASMIC RETICULUM**

**RIBOSOMES: ABSENT**

**---**

**CONFLUENT WITH R-ER**

**SMOOTH  
ENDOPLASMIC RETICULUM**



**SMOOTH  
ENDOPLASMIC RETICULUM**

**RIBOSOMES: ABSENT**

---

**CONFLUENT WITH R-ER**

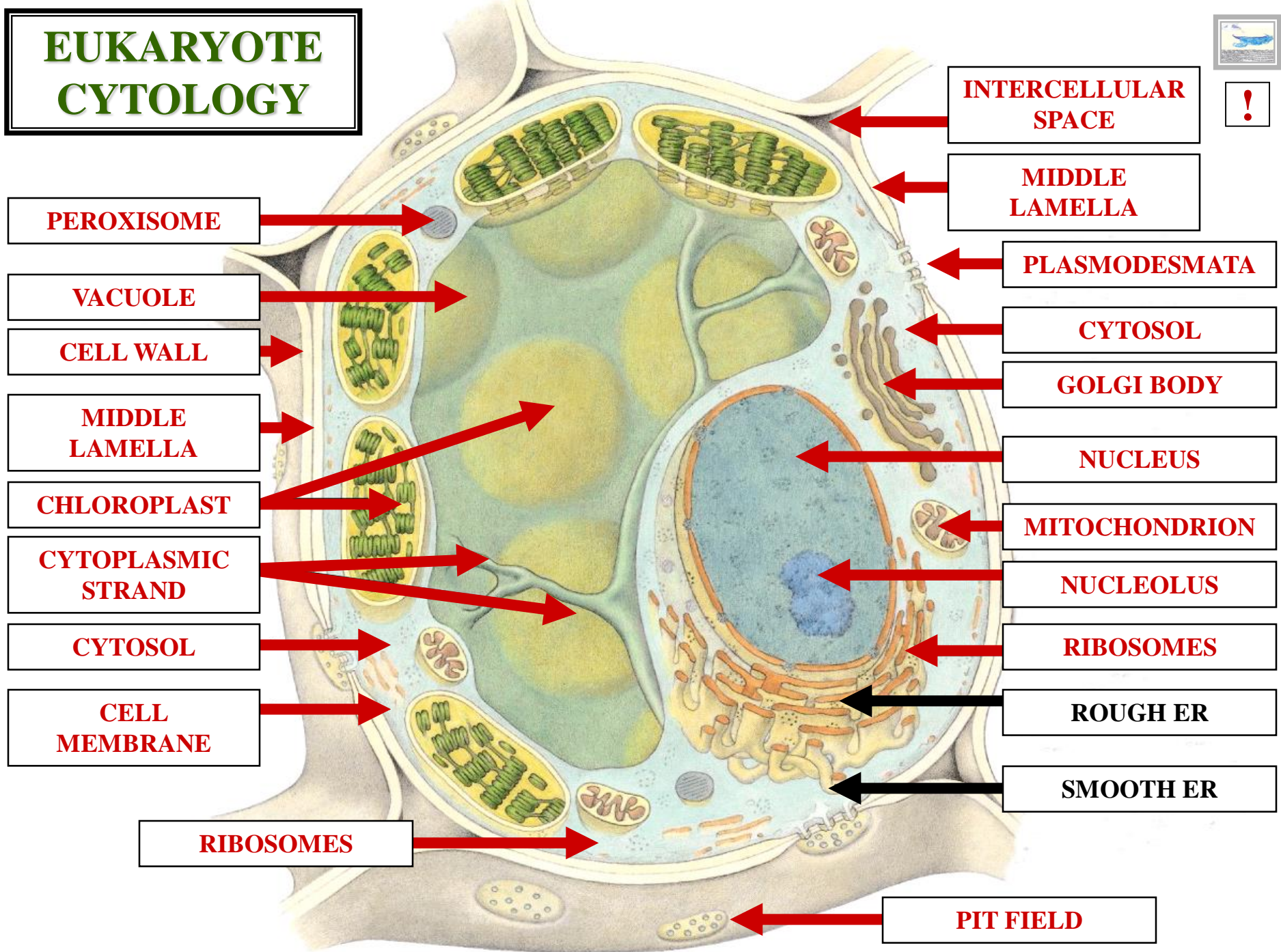
---

**SITE: MEMBRANE SYNTHESIS**

**SMOOTH  
ENDOPLASMIC RETICULUM**

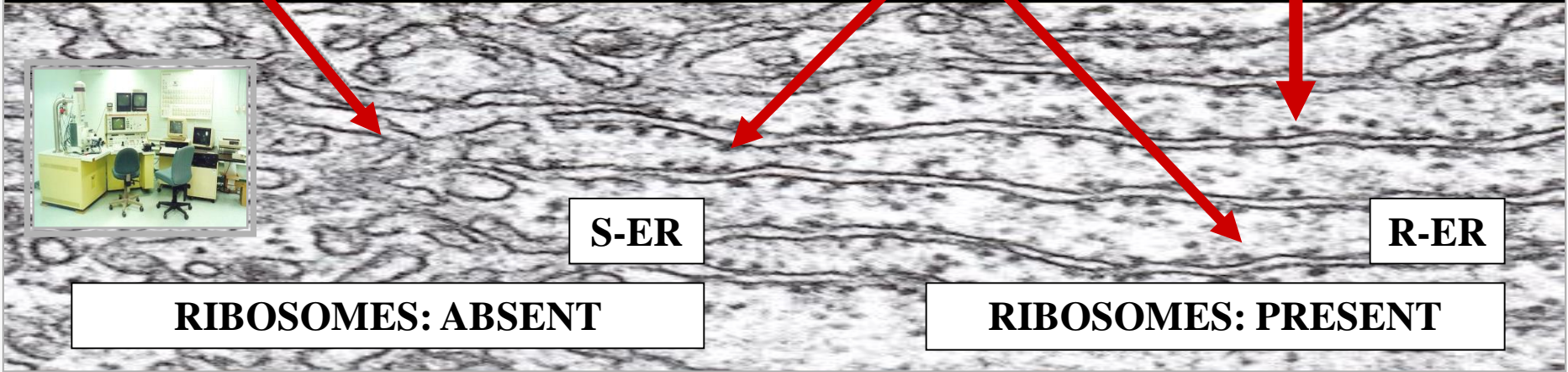
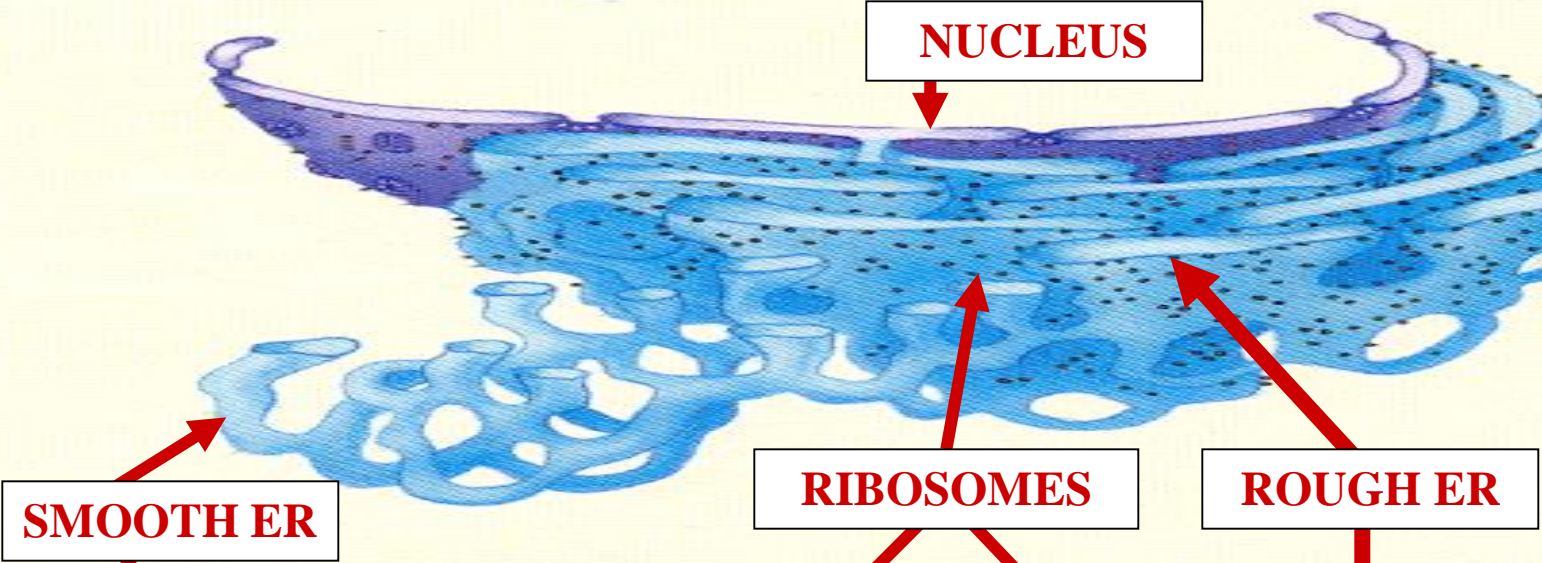


# EUKARYOTE CYTOLOGY



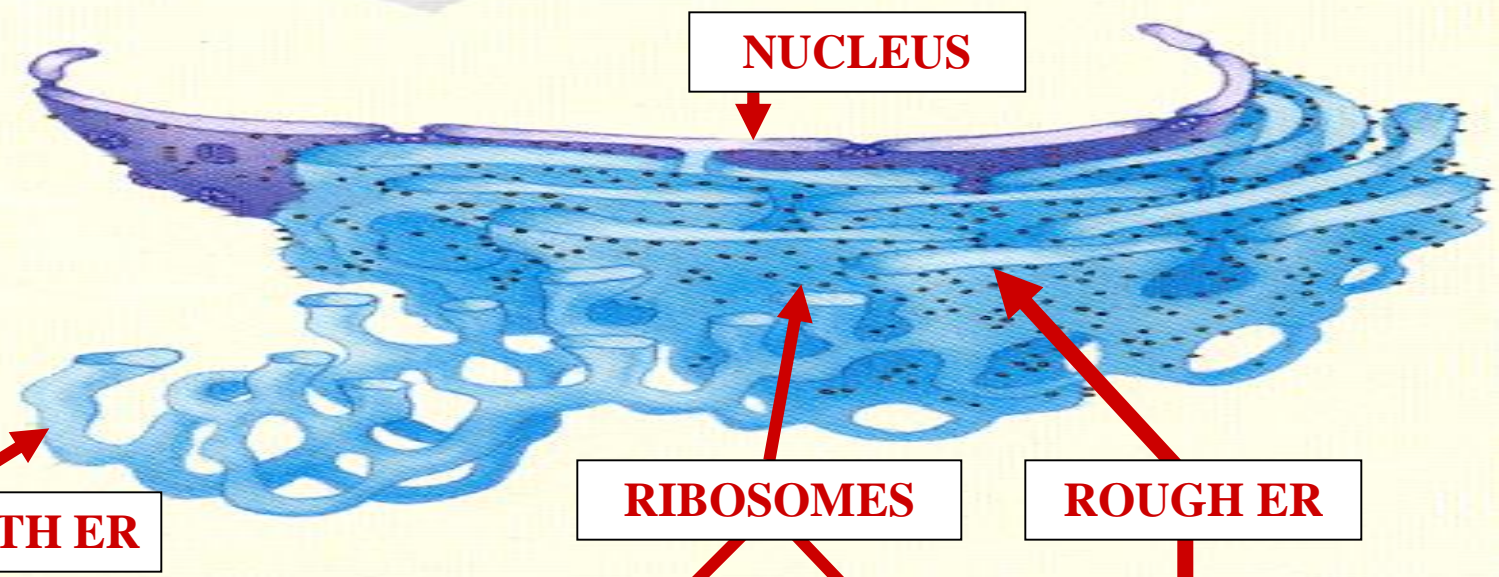
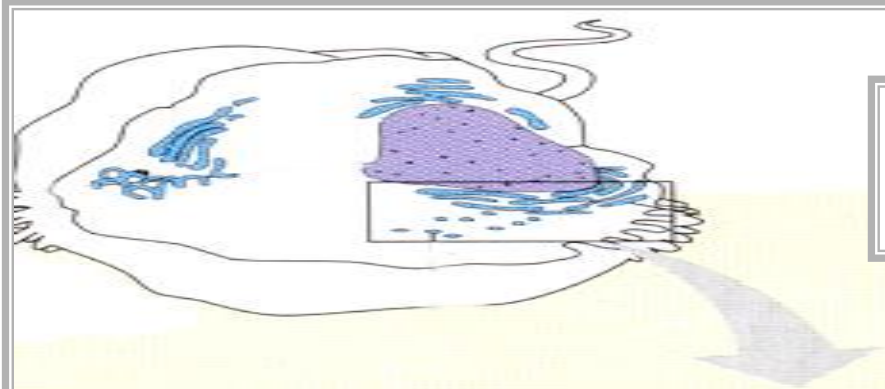
# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

C



# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

S



**NUCLEUS**

**SMOOTH ER**

**RIBOSOMES**

**ROUGH ER**



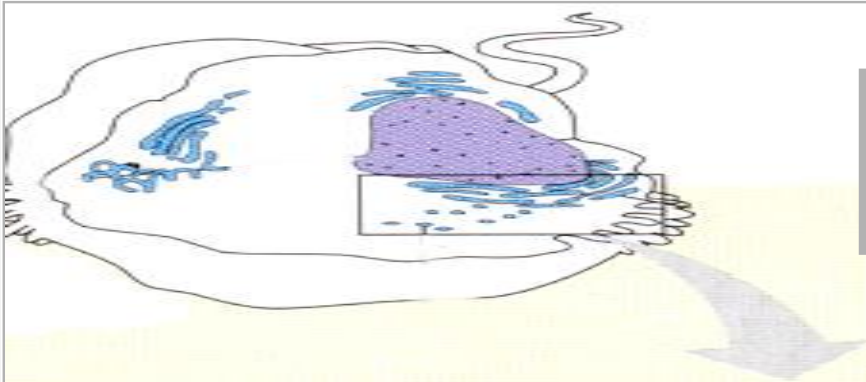
**S-ER**

**R-ER**

**CONFLUENT W/ R-ER**

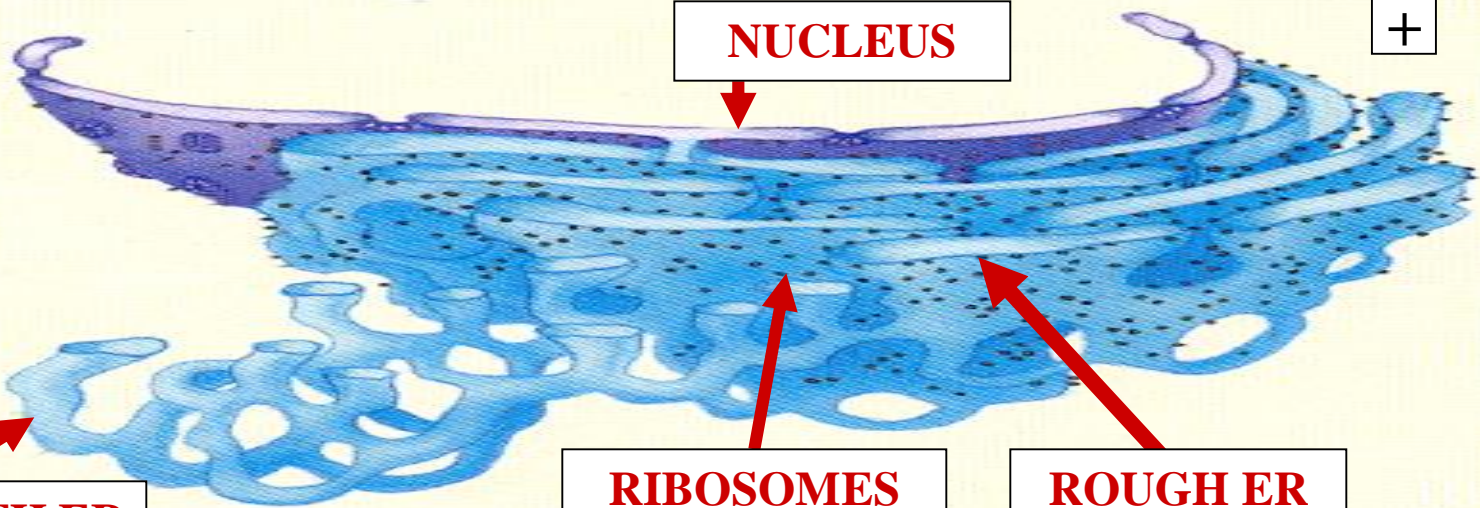
**CONFLUENT W/ NUCLEUS**

# ENDOPLASMIC RETICULUM ULTRASTRUCTURE



\$

+

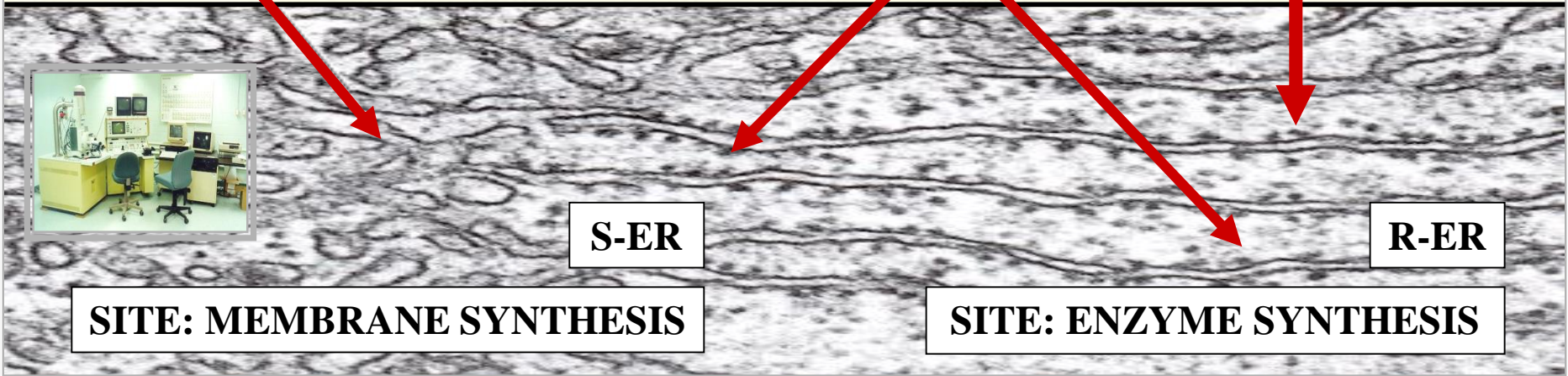


**NUCLEUS**

**SMOOTH ER**

**RIBOSOMES**

**ROUGH ER**



**S-ER**

**R-ER**

**SITE: MEMBRANE SYNTHESIS**

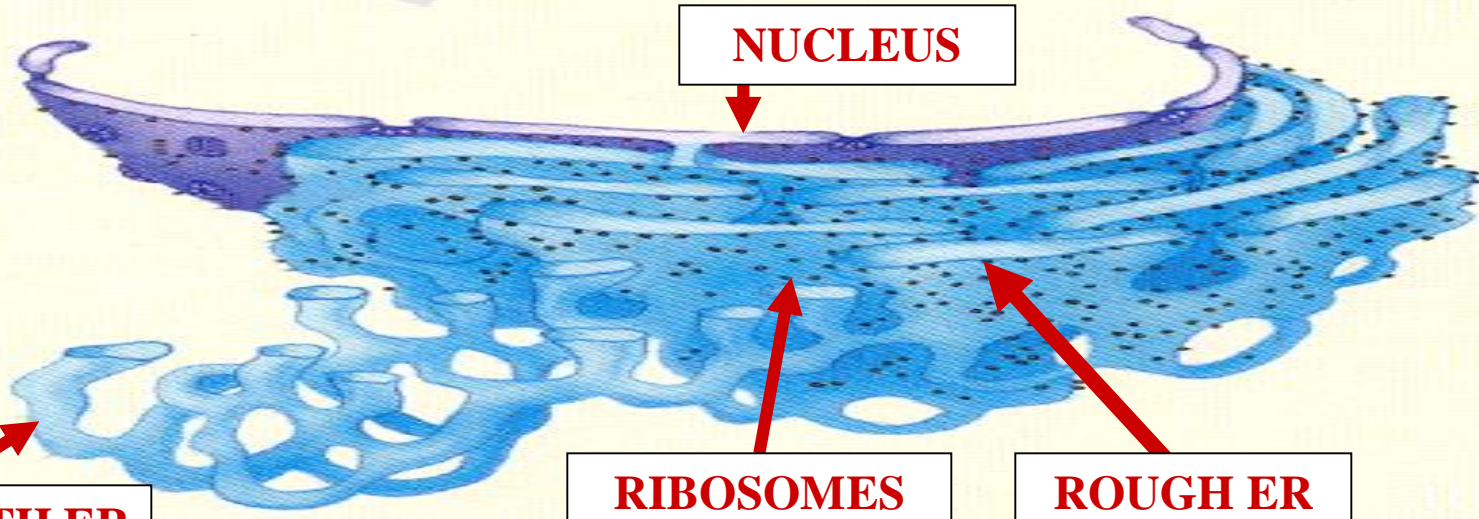
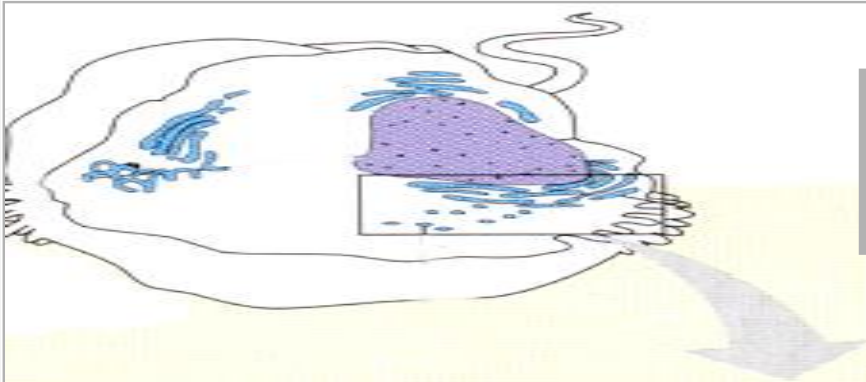
**SITE: ENZYME SYNTHESIS**





# **ENDOPLASMIC RETICULUM ULTRASTRUCTURE SUMMARY**

# ENDOPLASMIC RETICULUM ULTRASTRUCTURE



**SMOOTH ER**

**RIBOSOMES**

**ROUGH ER**



**S-ER**

**R-ER**

**RIBOSOMES: ABSENT**

**RIBOSOMES: PRESENT**

# GOLGI BODY

# **GOLGI BODY**



**GOLGI BODY**



**ER DRIVED  
VESICLE ASSEMBLAGE**

**GOLGI BODY**

**GOLGI BODY**



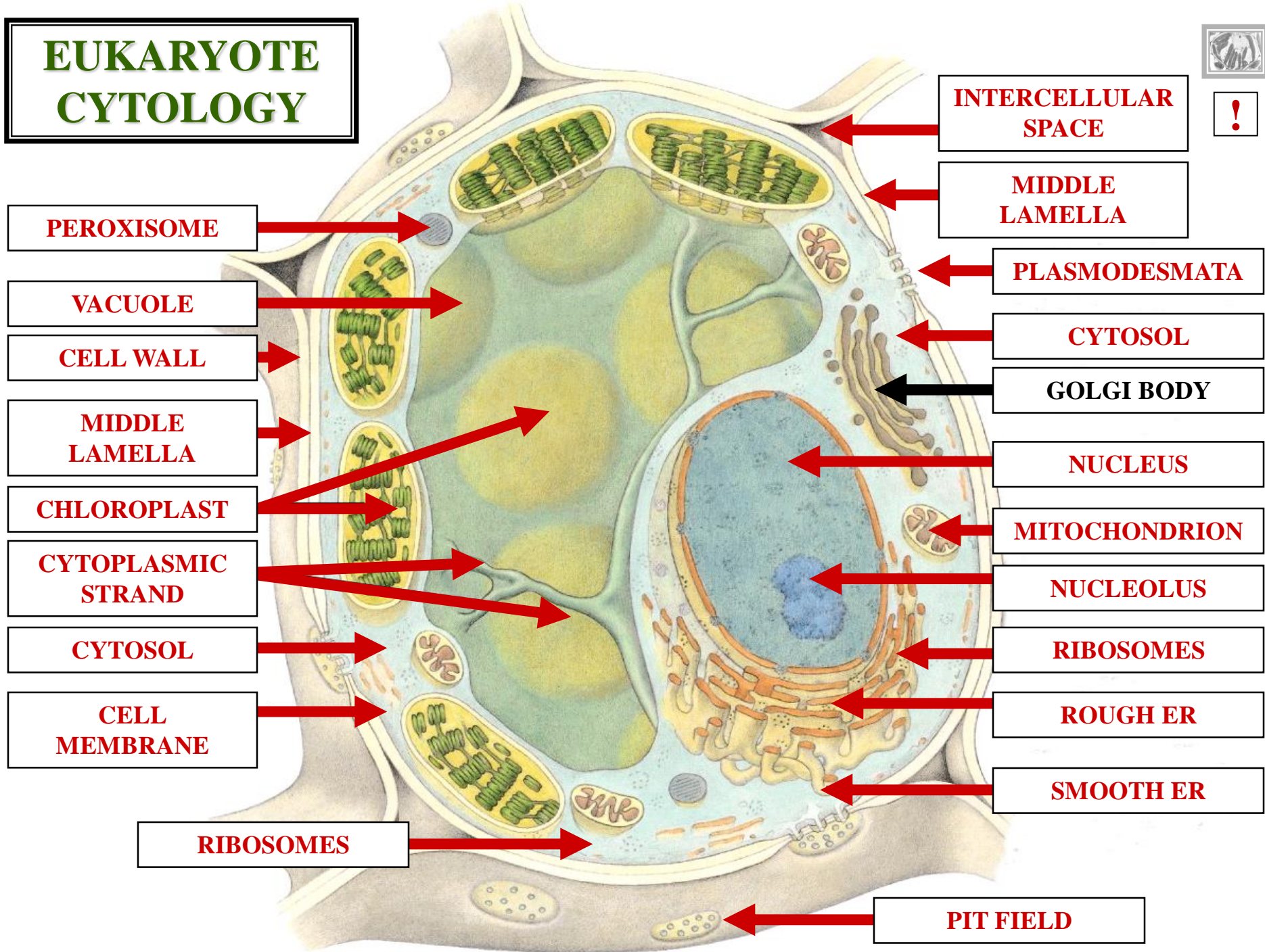
**ENERGICALLY DRIVEN  
VESICLE ASSEMBLAGE**

---

**PACKAGING CENTER  
FOR CELL EXIT**

**GOLGI BODY**

# EUKARYOTE CYTOLOGY





**GOLGI BODY  
ER DRIVEN  
VESICLE  
ASSEMBLAGE**

