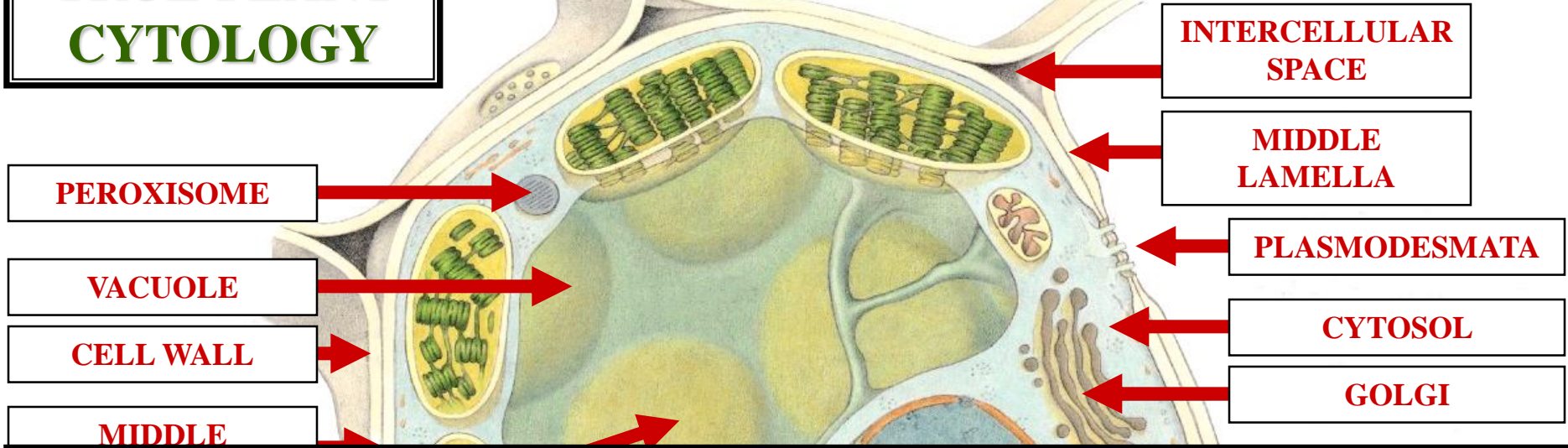
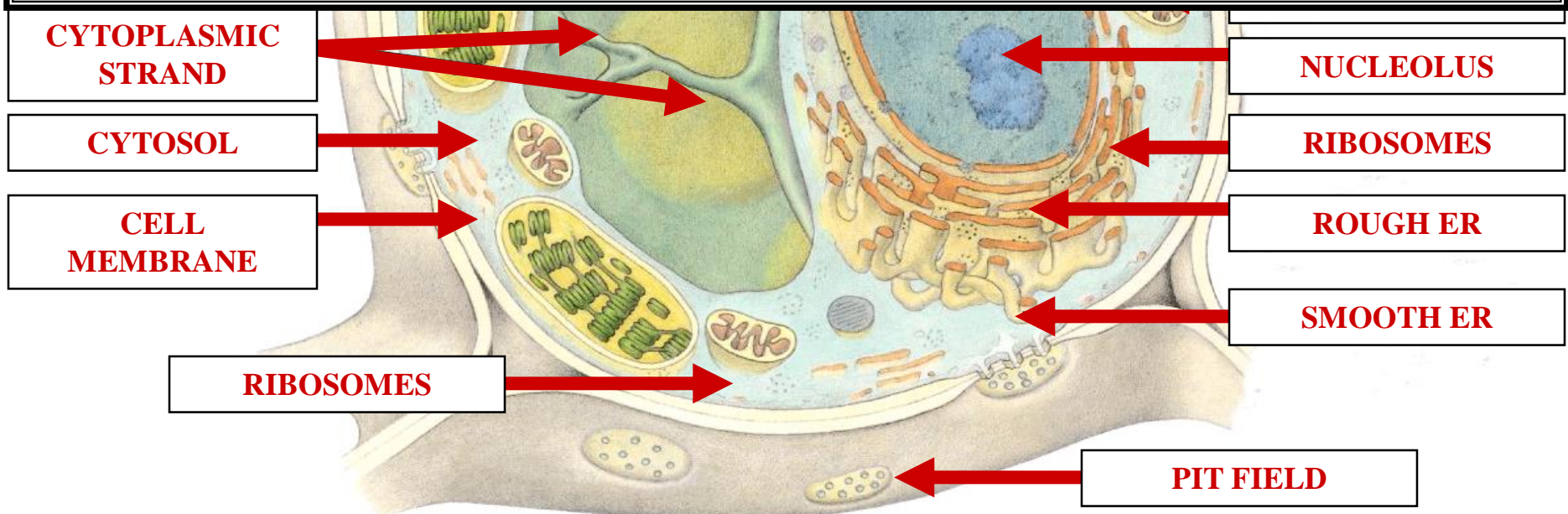


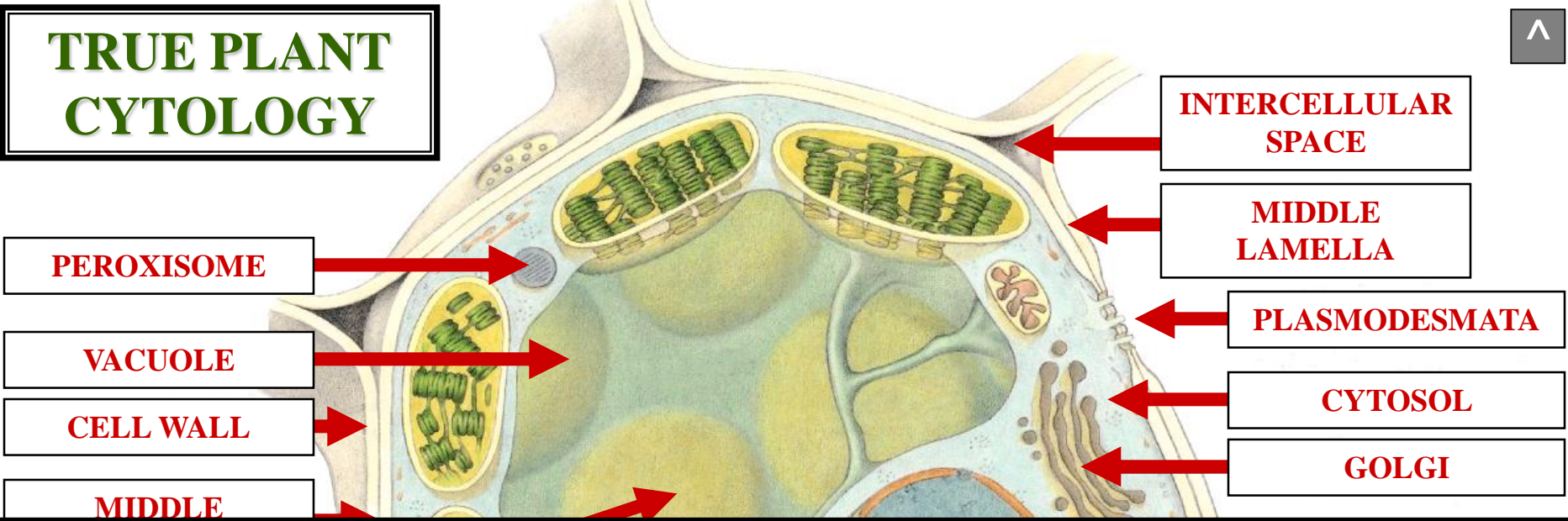
# TRUE PLANT CYTOLOGY



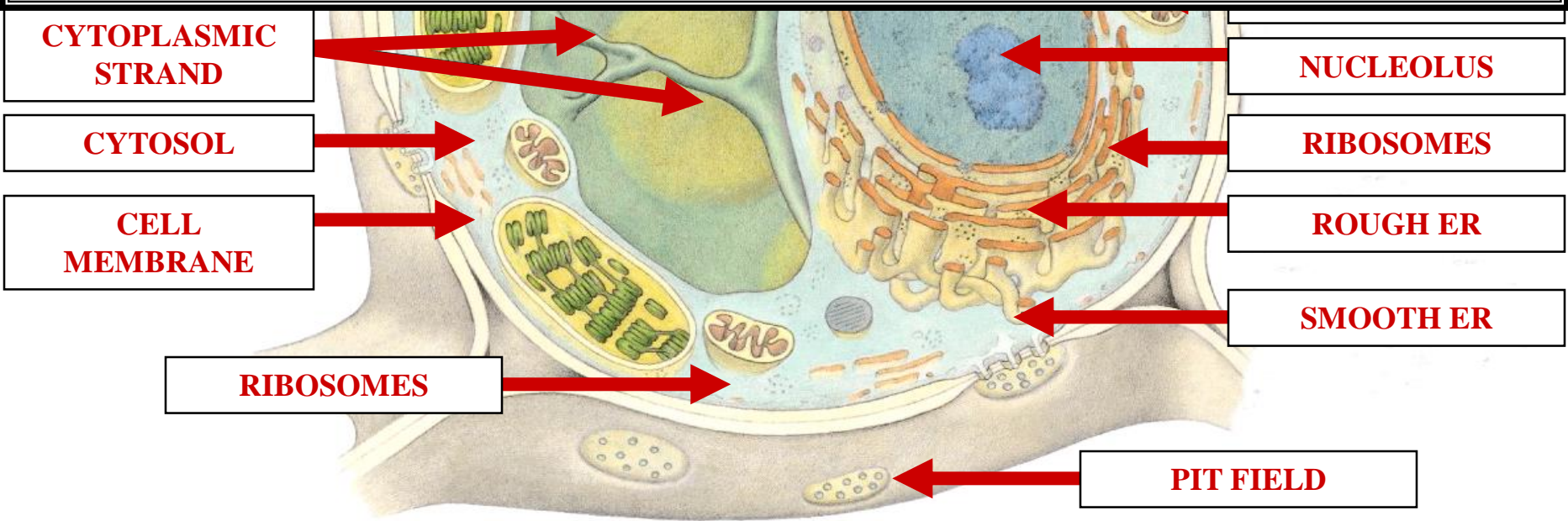
# SINGLE-MB ORGANELLES



# TRUE PLANT CYTOLOGY



# NON-MB ORGANELLE





# **NON-MEMBRANE BOUND ORGANELLE**

# RIBOSOME



# **RIBOSOMES**

# RIBOSOMES



DISTRIBUTED THROUGHOUT  
CYTOSOL

RIBOSOMES

# RIBOSOMES



**DISTRIBUTED THROUGHOUT  
CYTOSOL**

---

**ASSOCIATED WITH ER**

**RIBOSOMES**

# RIBOSOMES



**DISTRIBUTED THROUGHOUT  
CYTOSOL**

---

**ASSOCIATED WITH ER**

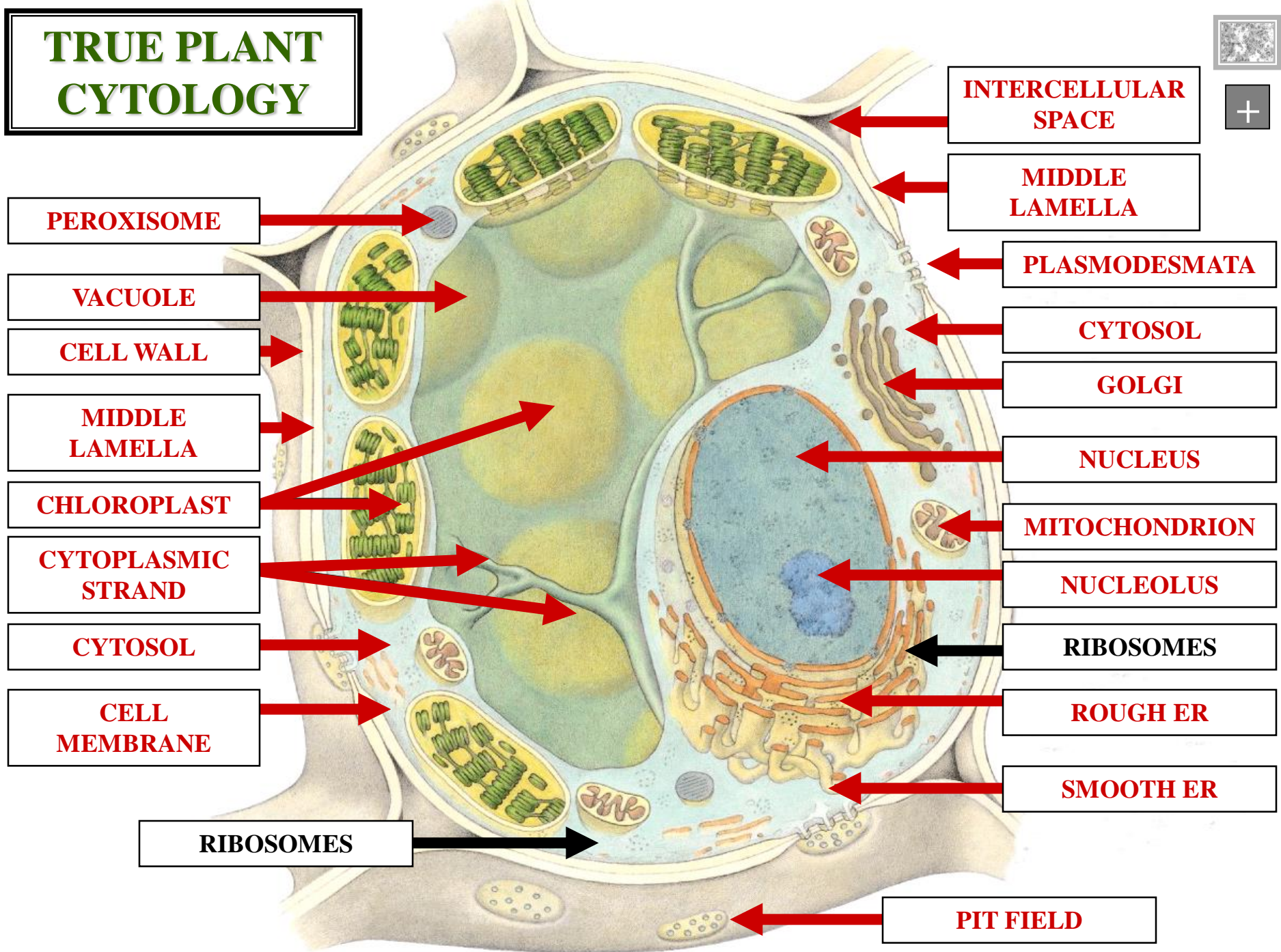
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**SITE: PROTEIN SYNTHESIS**

# RIBOSOMES

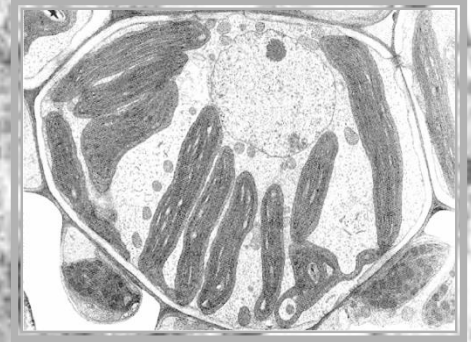


# TRUE PLANT CYTOLOGY



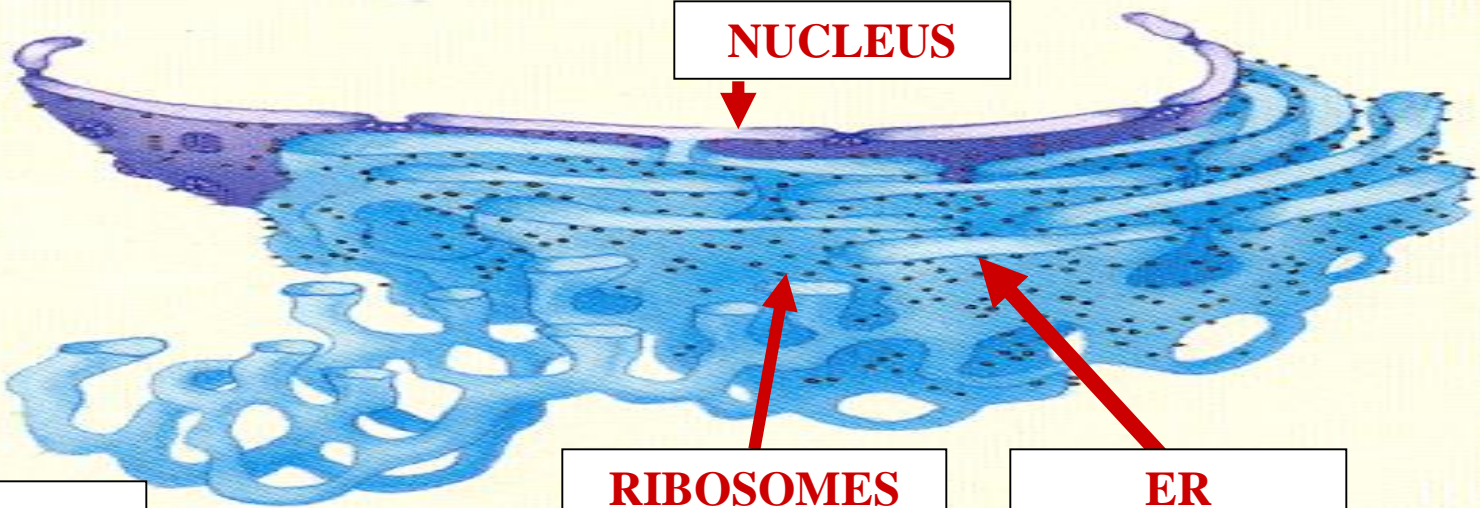
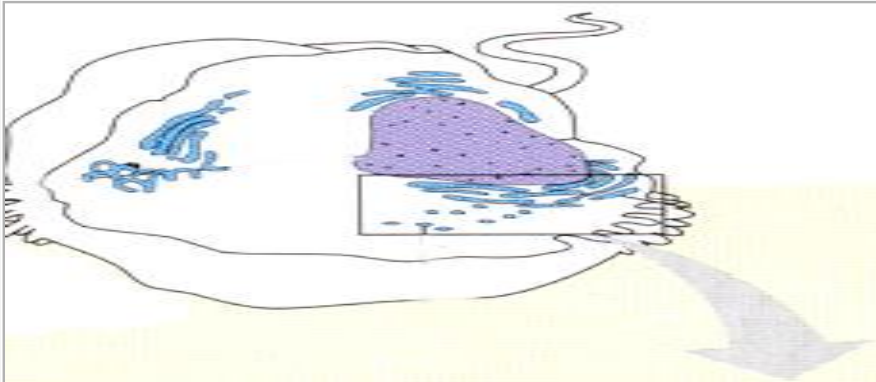
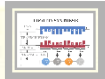
**RIBOSOMES**

**CYTOSOL**





# ENDOPLASMIC RETICULUM RIBOSOMES

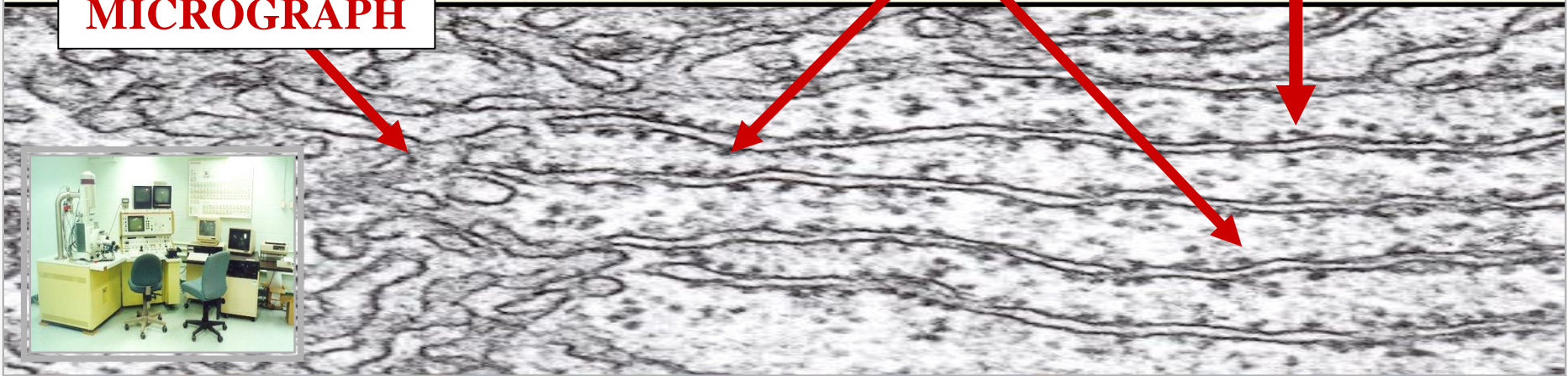


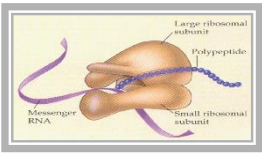
**NUCLEUS**

**RIBOSOMES**

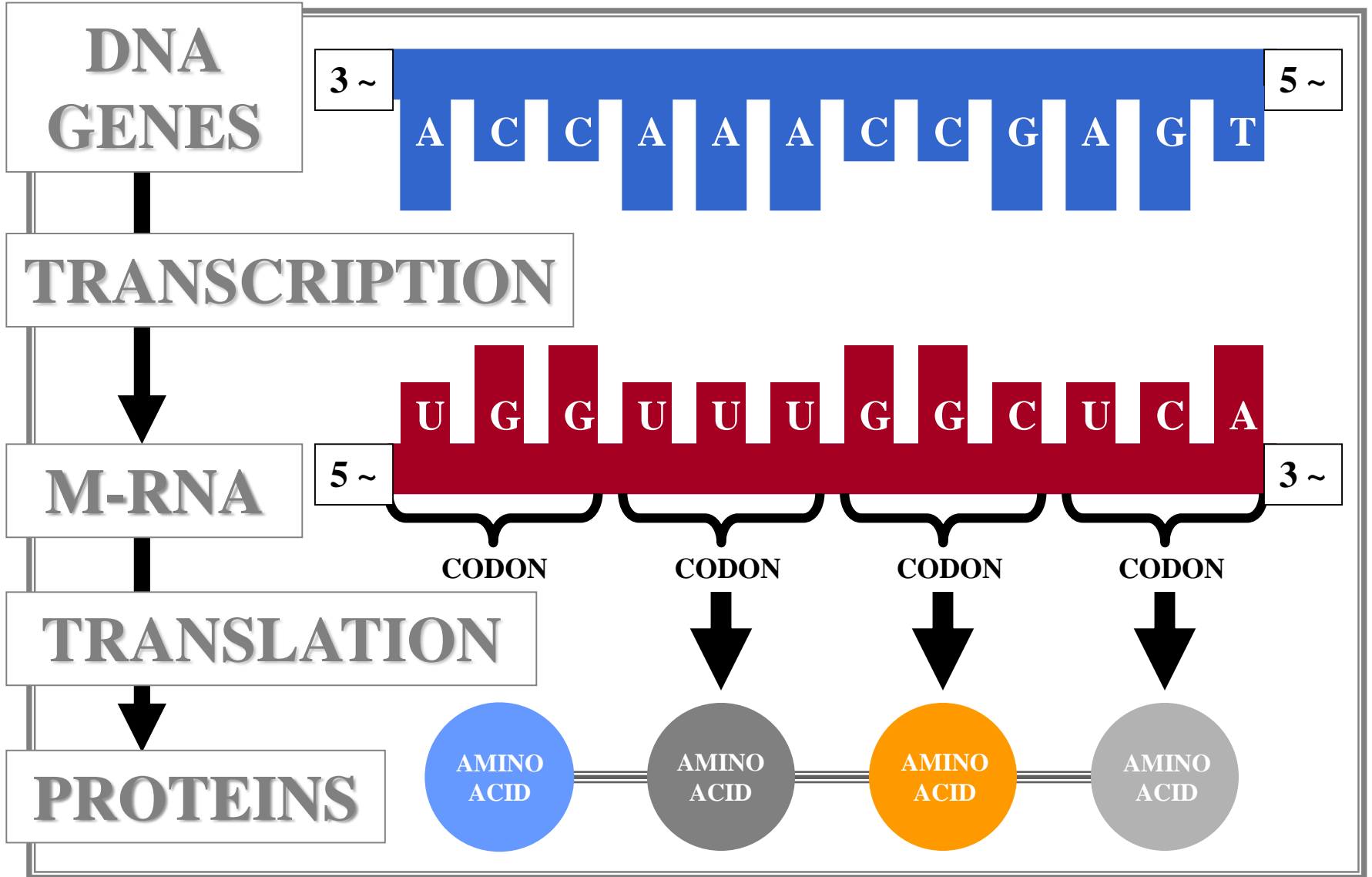
**ER**

**TEM  
MICROGRAPH**





# PROTEIN SYNTHESIS







# RIBOSOME COMPOSITION

# **RIBOSOME COMPOSITION**

**NUCLEIC ACID  
PROTEIN  
COMPLEX**

**RIBOSOME  
COMPOSITION**

# **RIBOSOME COMPOSITION**

P



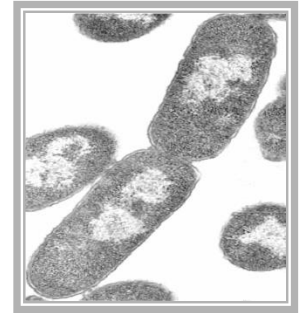
**RNA  
PROTEIN  
COMPLEX**

**RIBOSOME  
COMPOSITION**



**PROKARYOTE**

# PROKARYOTE RIBOSOME COMPOSITION



**PROKARYOTE**

**E**

**4**

**3 RNAs & 54 PROTEINS**

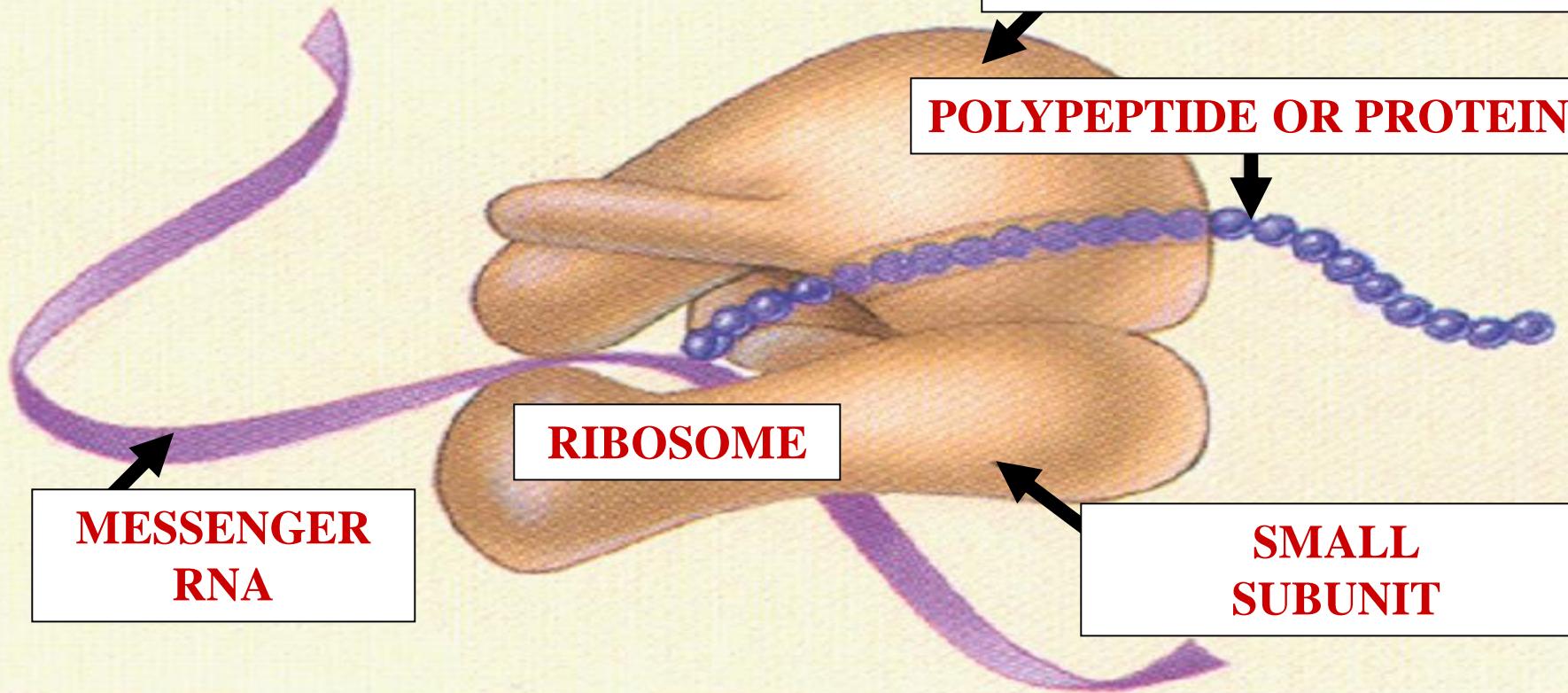
**LARGE  
SUBUNIT**

**POLYPEPTIDE OR PROTEIN**

**RIBOSOME**

**MESSENGER  
RNA**

**SMALL  
SUBUNIT**







**EUKARYOTE**

# EUKARYOTE RIBOSOME COMPOSITION



**EUKARYOTE**

**E**  
**L**

**4 RNAs & 73 PROTEINS**

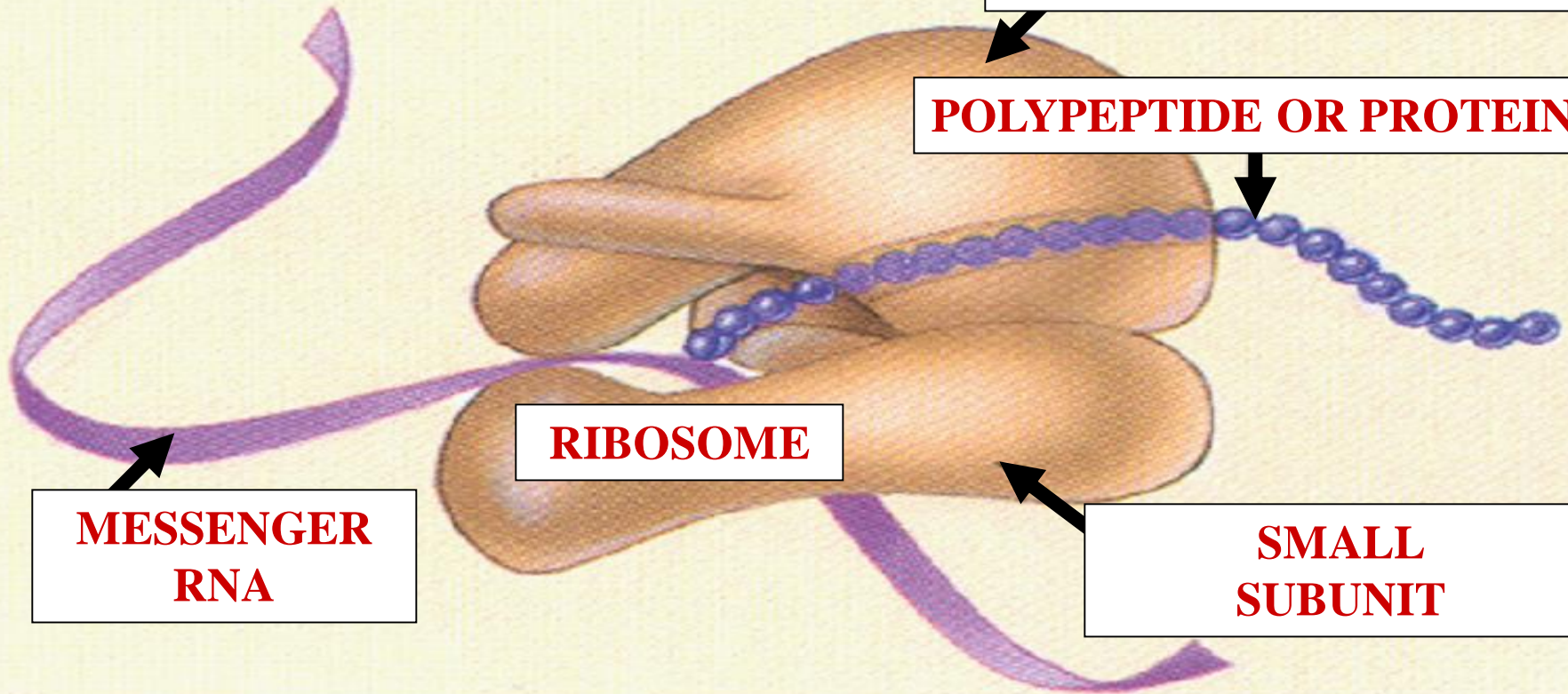
**LARGE  
SUBUNIT**

**POLYPEPTIDE OR PROTEIN**

**RIBOSOME**

**MESSENGER  
RNA**

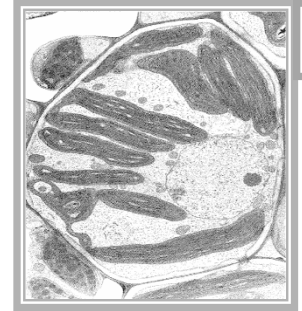
**SMALL  
SUBUNIT**





**EUKARYOTE**

# **EUKARYOTE RIBOSOME LARGER**



**EUKARYOTE**



**4 RNAs & 73 PROTEINS**

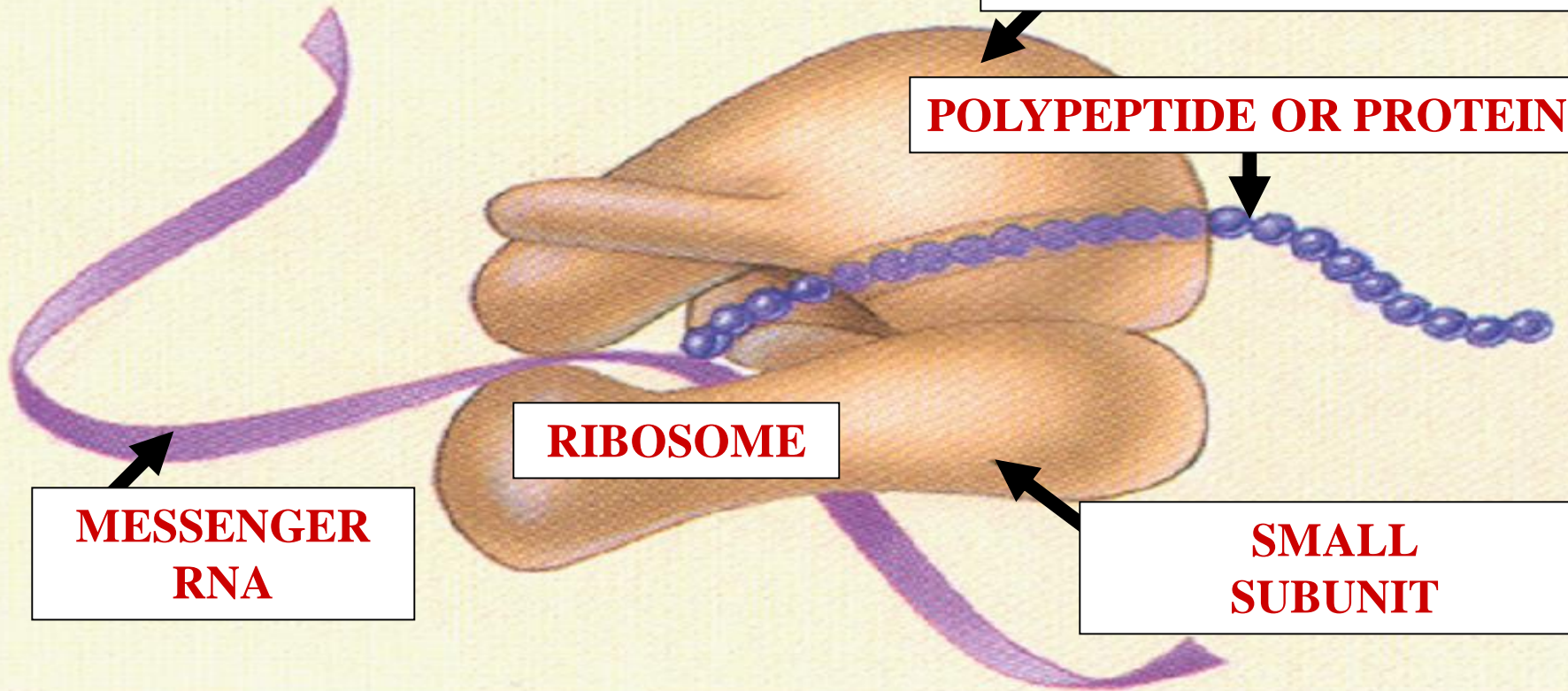
**LARGE  
SUBUNIT**

**POLYPEPTIDE OR PROTEIN**

**RIBOSOME**

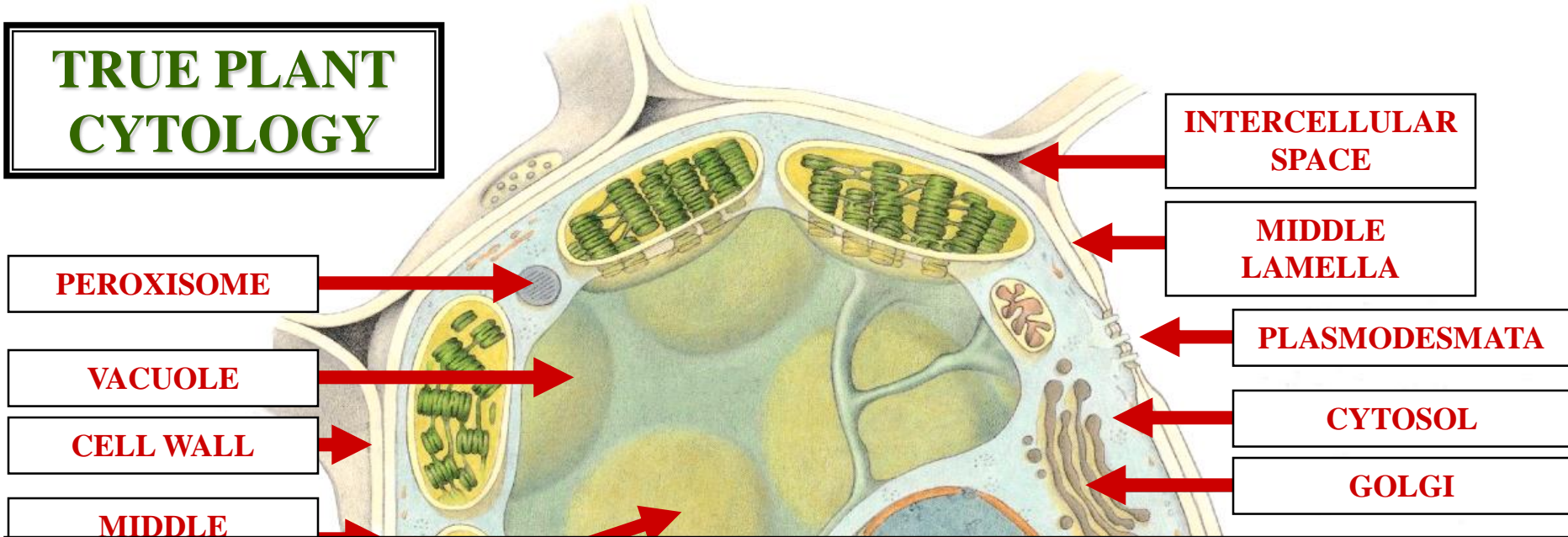
**MESSENGER  
RNA**

**SMALL  
SUBUNIT**

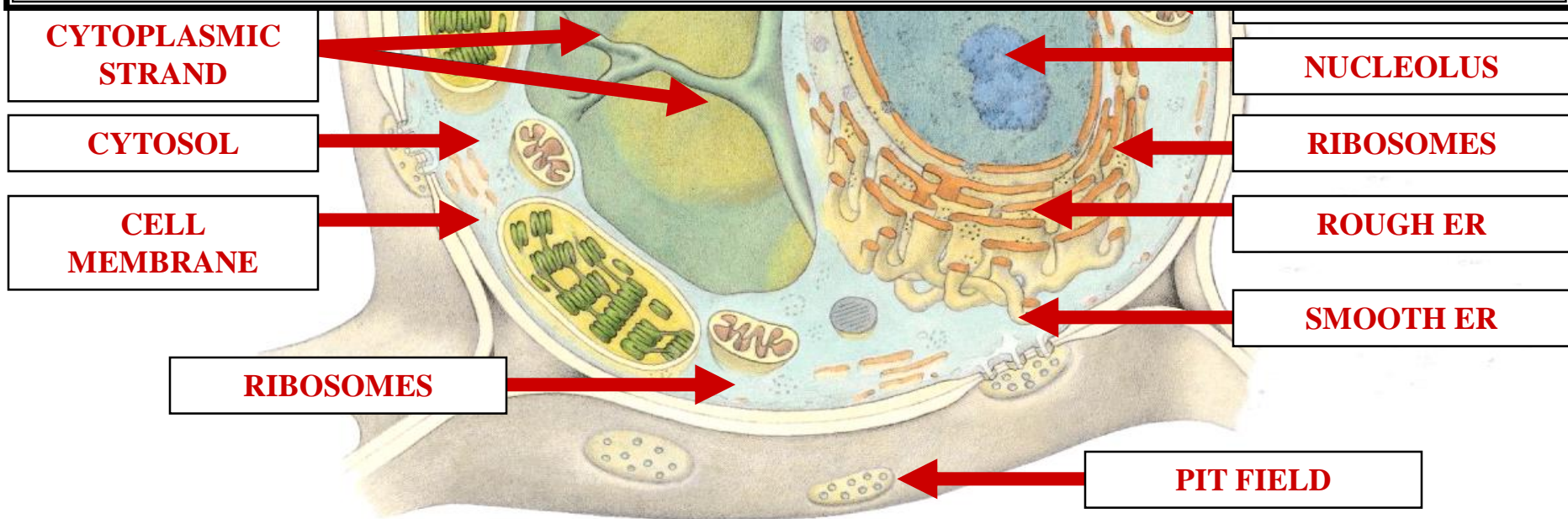




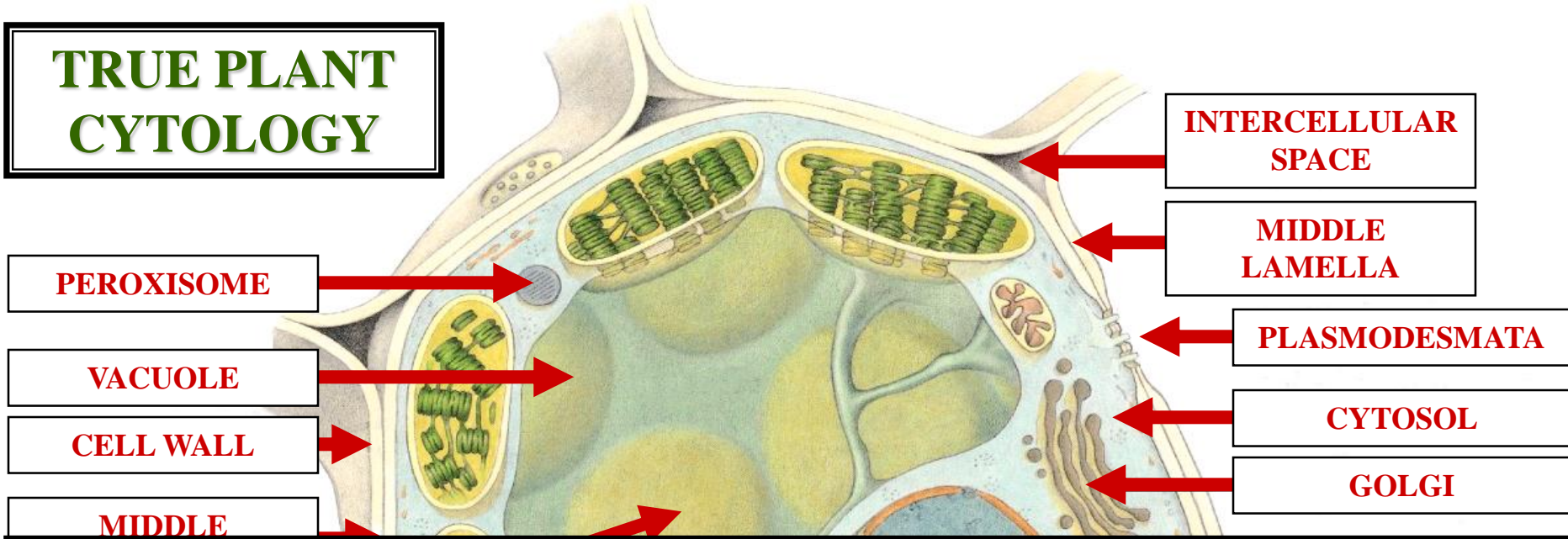
# TRUE PLANT CYTOLOGY



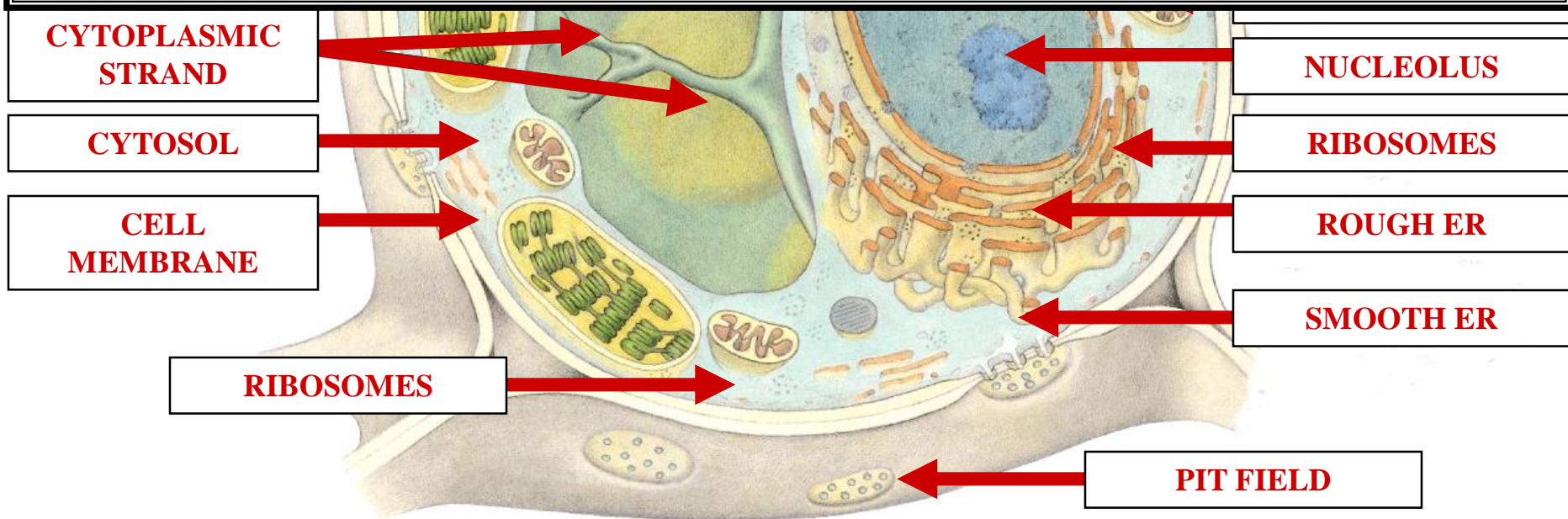
# SUMMARY



# TRUE PLANT CYTOLOGY

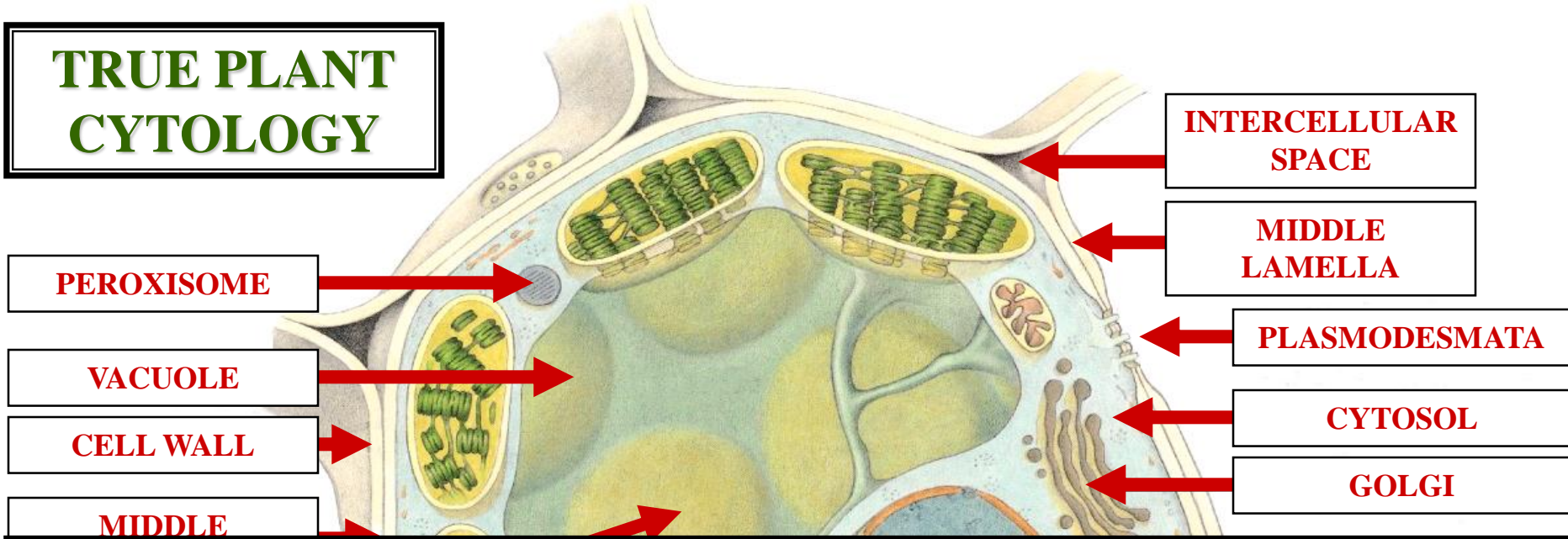


# DOUBLE-MB ORGANELLES

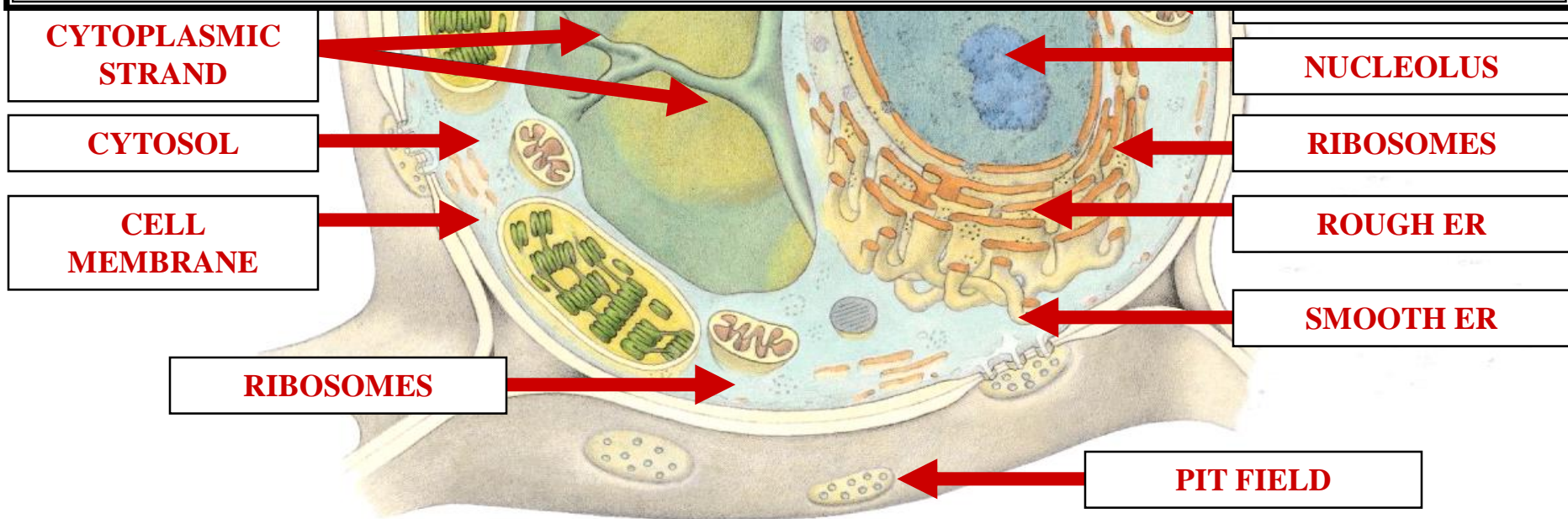




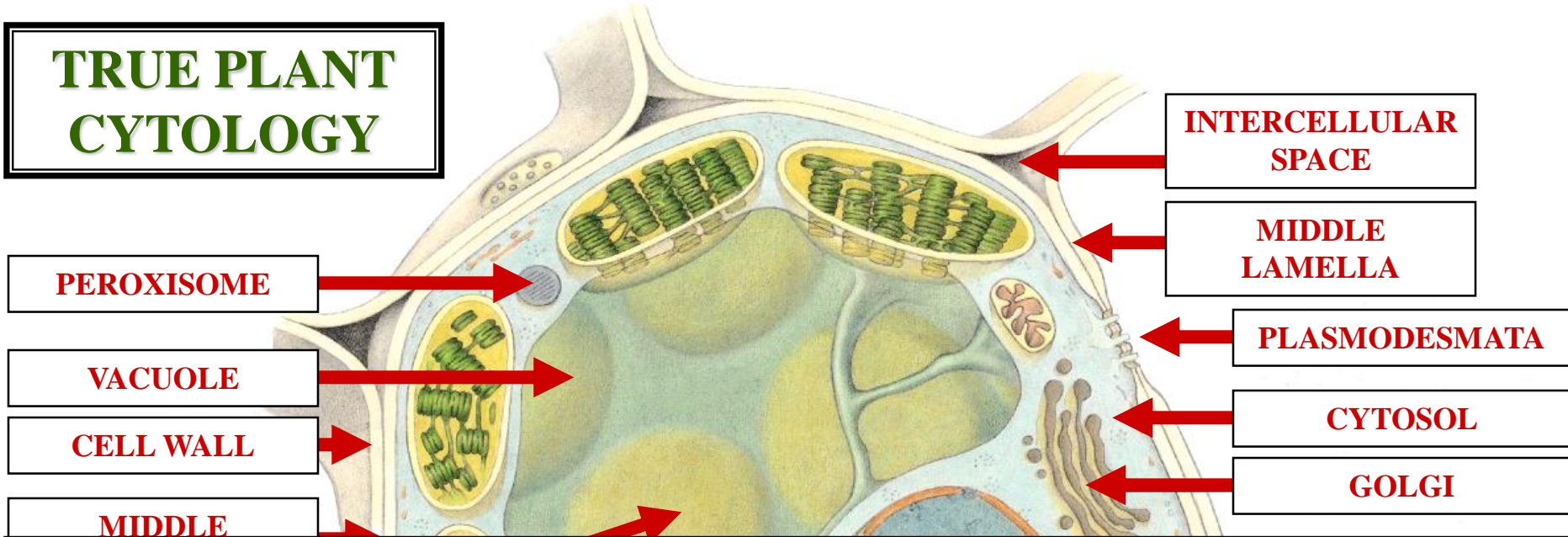
# TRUE PLANT CYTOLOGY



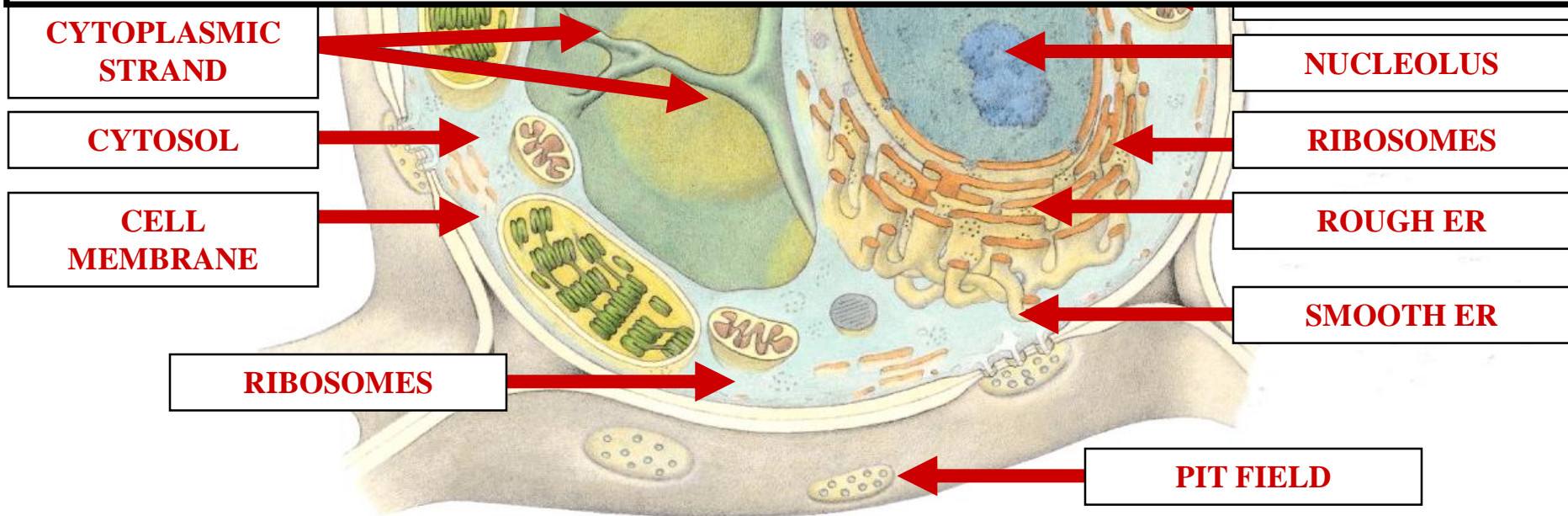
# SINGLE-MB ORGANELLES



# TRUE PLANT CYTOLOGY

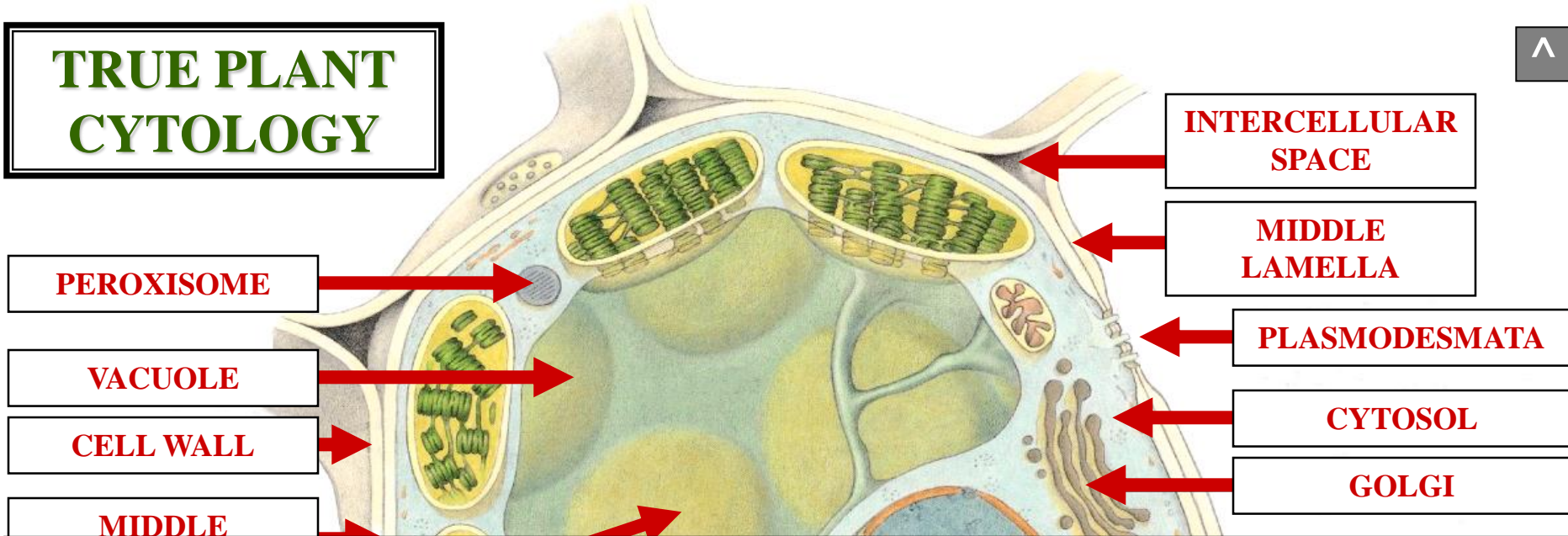


# NON-MB ORGANELLE

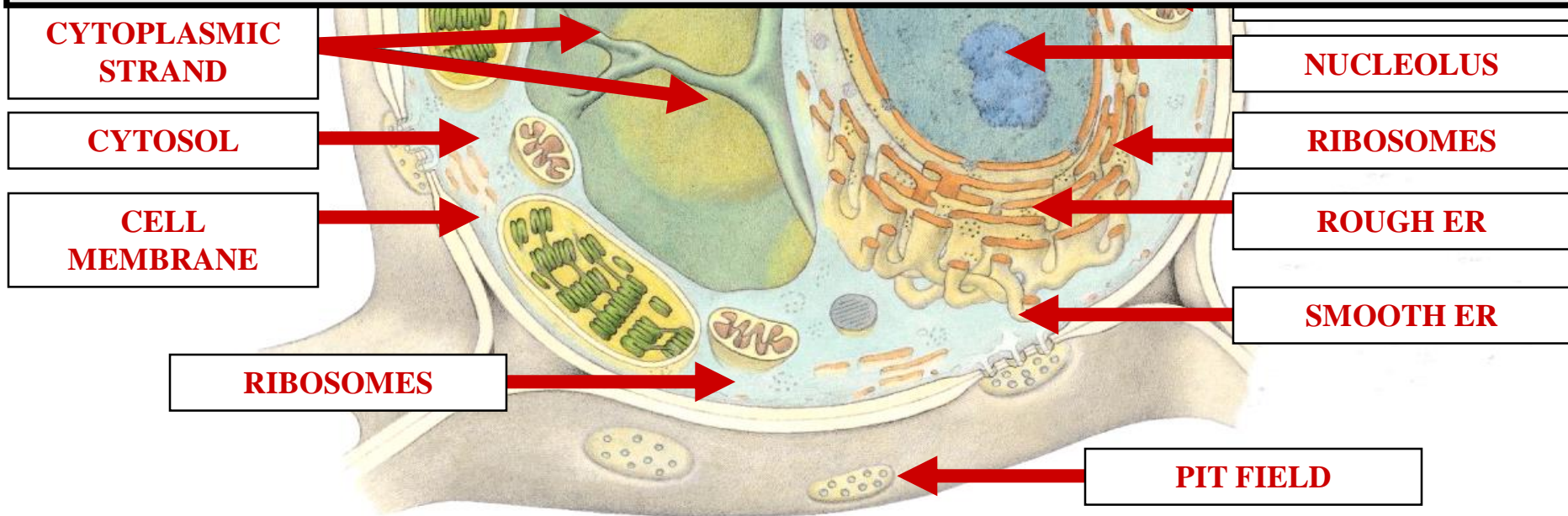




# TRUE PLANT CYTOLOGY



# 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**

**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**

**SITE**

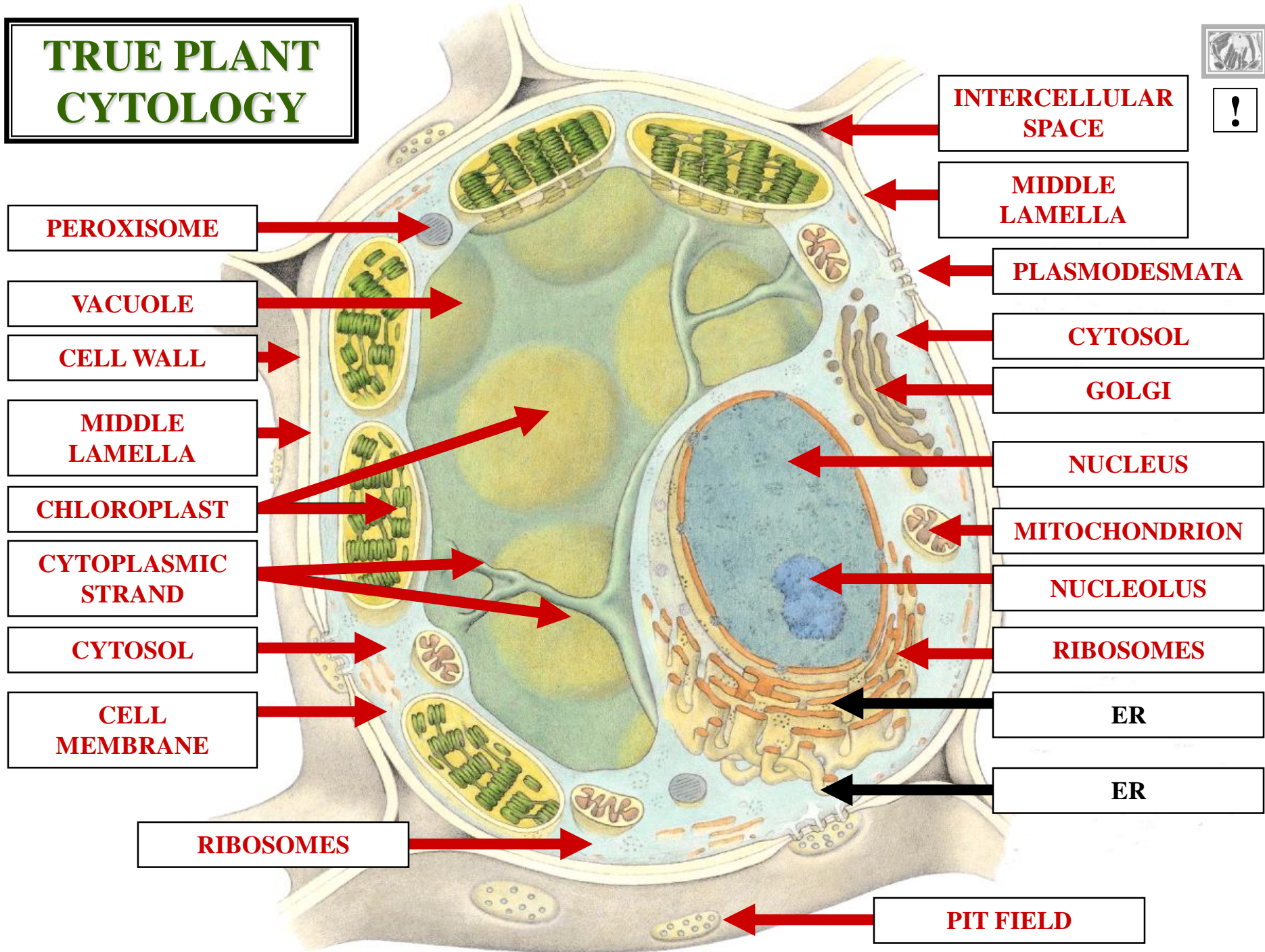
**ENZYME SYNTHESIS**

**AND**

**MEMBRANE SYNTHESIS**

# **ENDOPLASMIC RETICULUM**

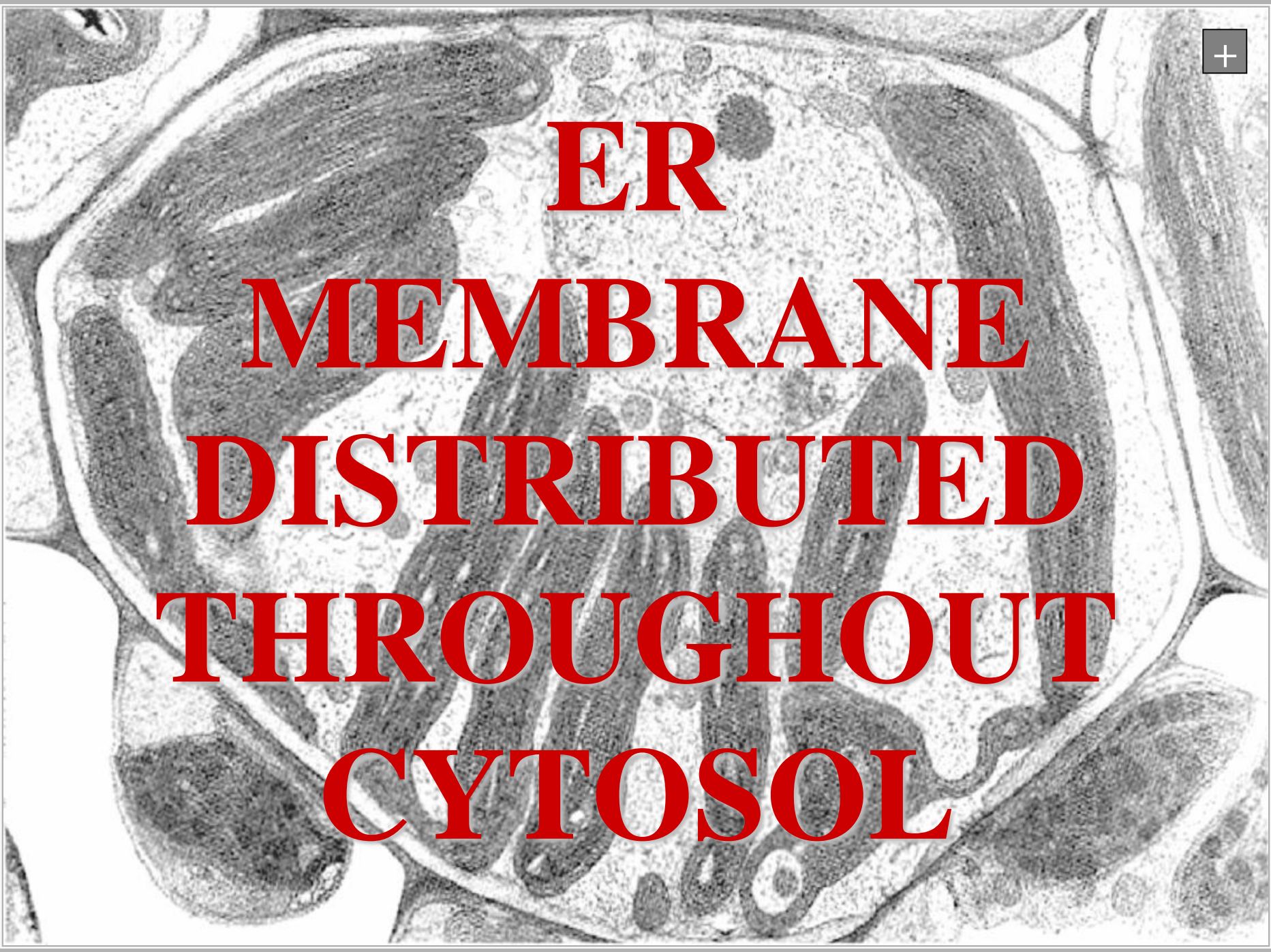
# TRUE PLANT CYTOLOGY







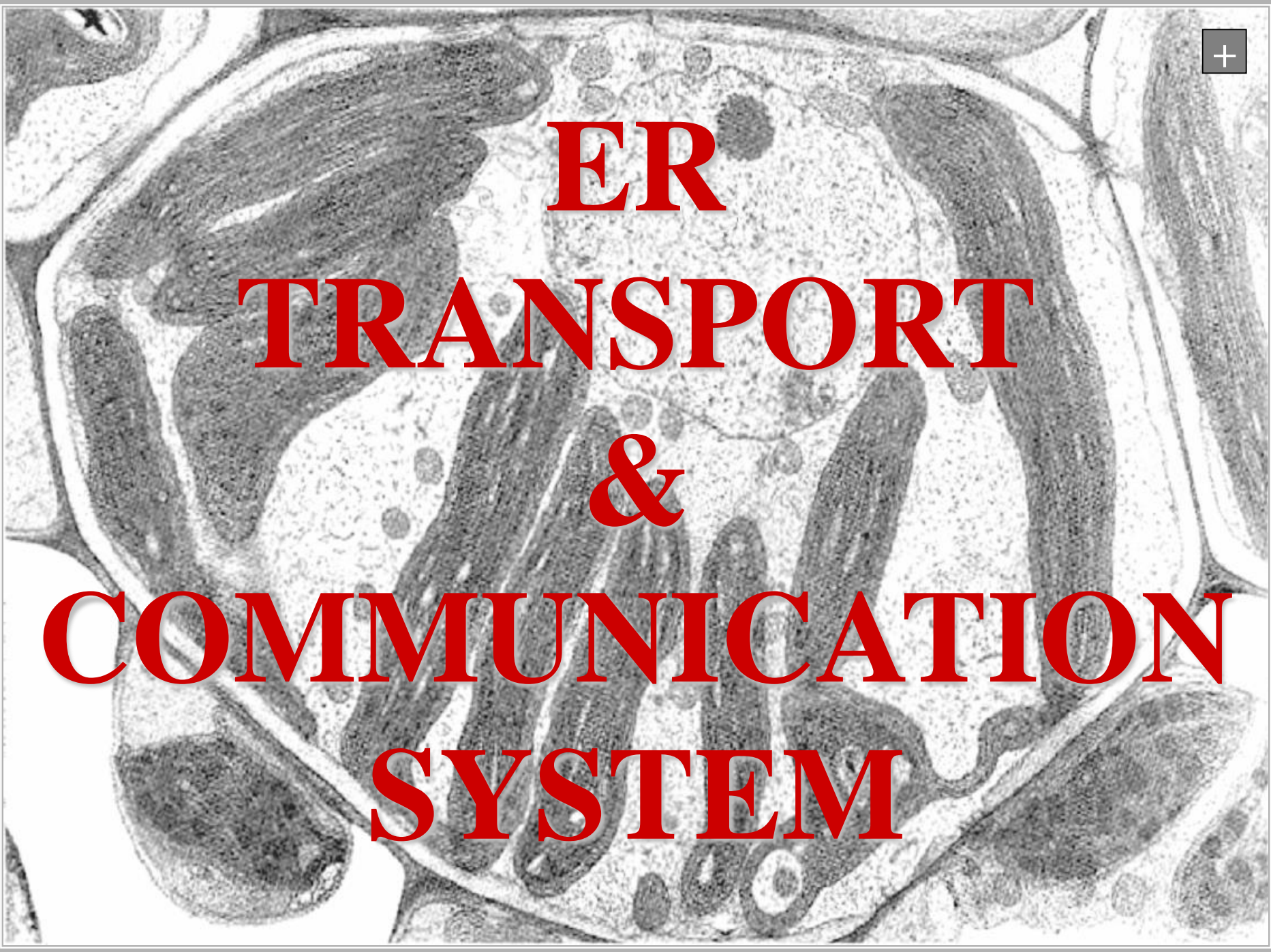
**ER**  
**MEMBRANE**  
**DISTRIBUTED**  
**THROUGHOUT**  
**CYTOSOL**







**ER  
TRANSPORT  
&  
COMMUNICATION  
SYSTEM**





An electron micrograph of a cell, likely a muscle cell, showing various organelles. The endoplasmic reticulum (ER) is visible as a network of membranes, and mitochondria are seen as elongated, striated structures. The text is overlaid in a large, bold, red serif font.

**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**

---

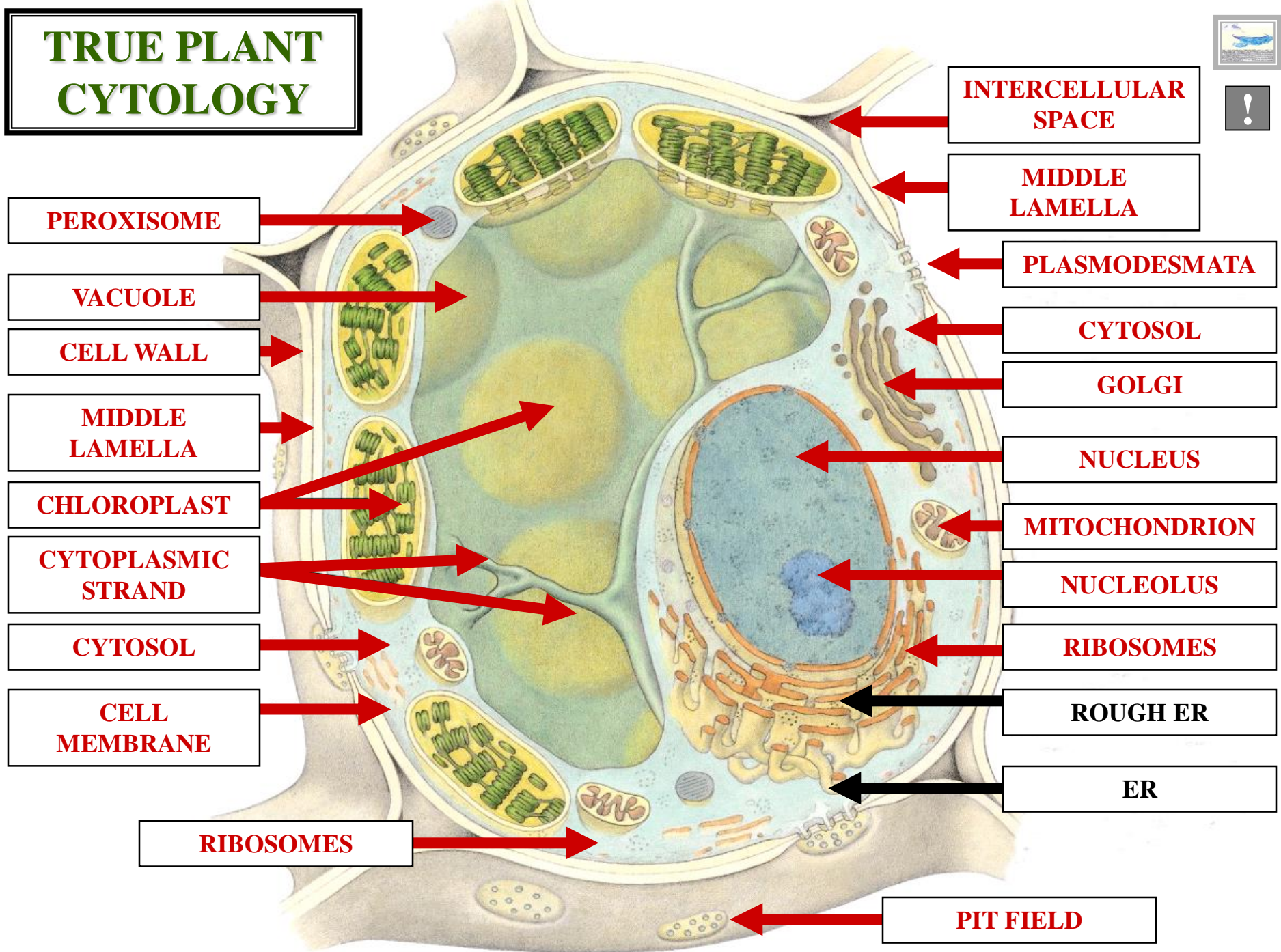
**CONFLUENT WITH NUCLEUS**

---

**SITE: ENZYME SYNTHESIS**

**ROUGH  
ENDOPLASMIC RETICULUM**

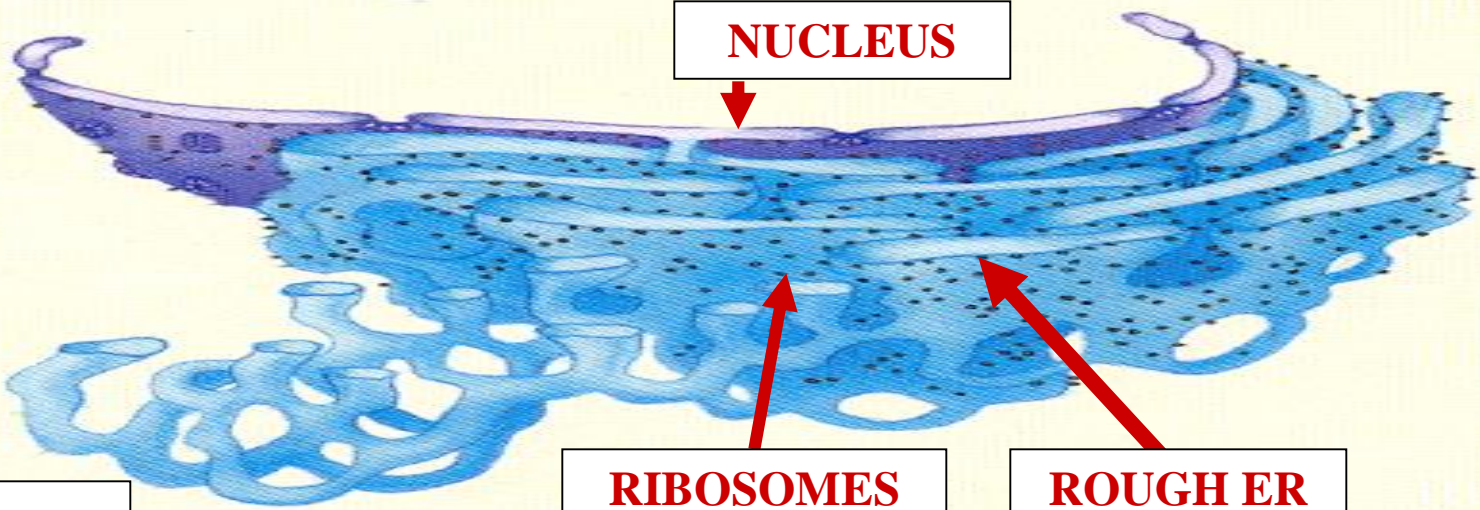
# TRUE PLANT CYTOLOGY





# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

C

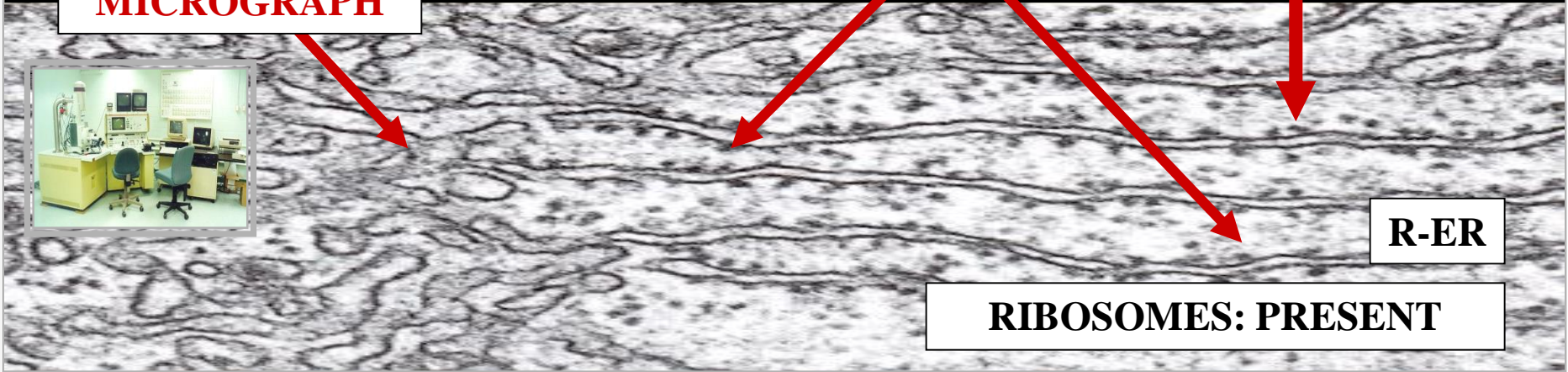


**NUCLEUS**

**RIBOSOMES**

**ROUGH ER**

**TEM  
MICROGRAPH**

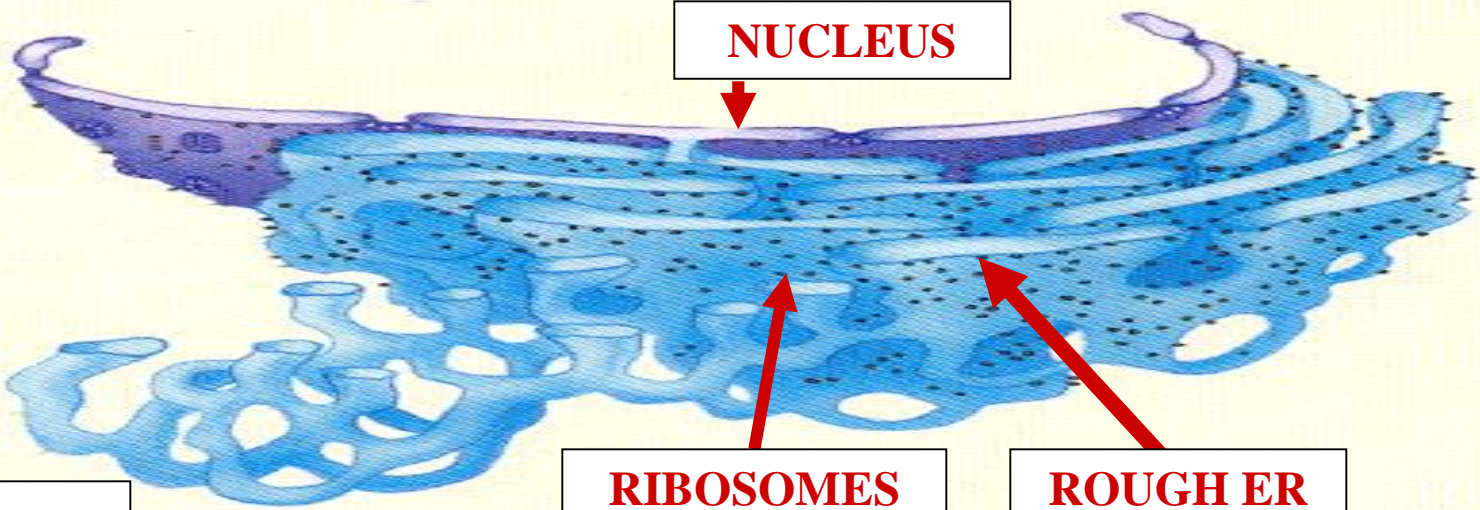


**R-ER**

**RIBOSOMES: PRESENT**

# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

S

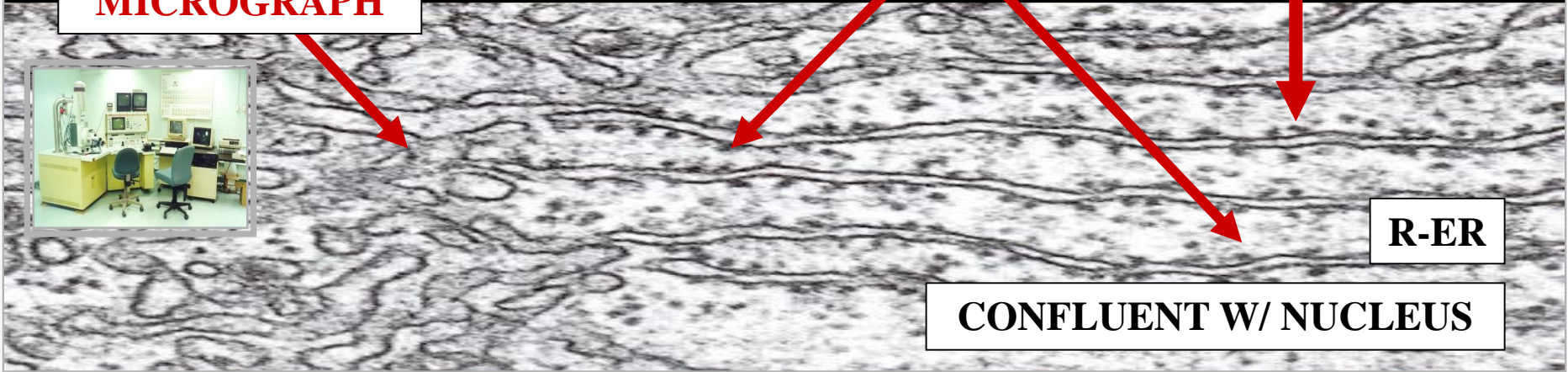


**NUCLEUS**

**RIBOSOMES**

**ROUGH ER**

**TEM  
MICROGRAPH**

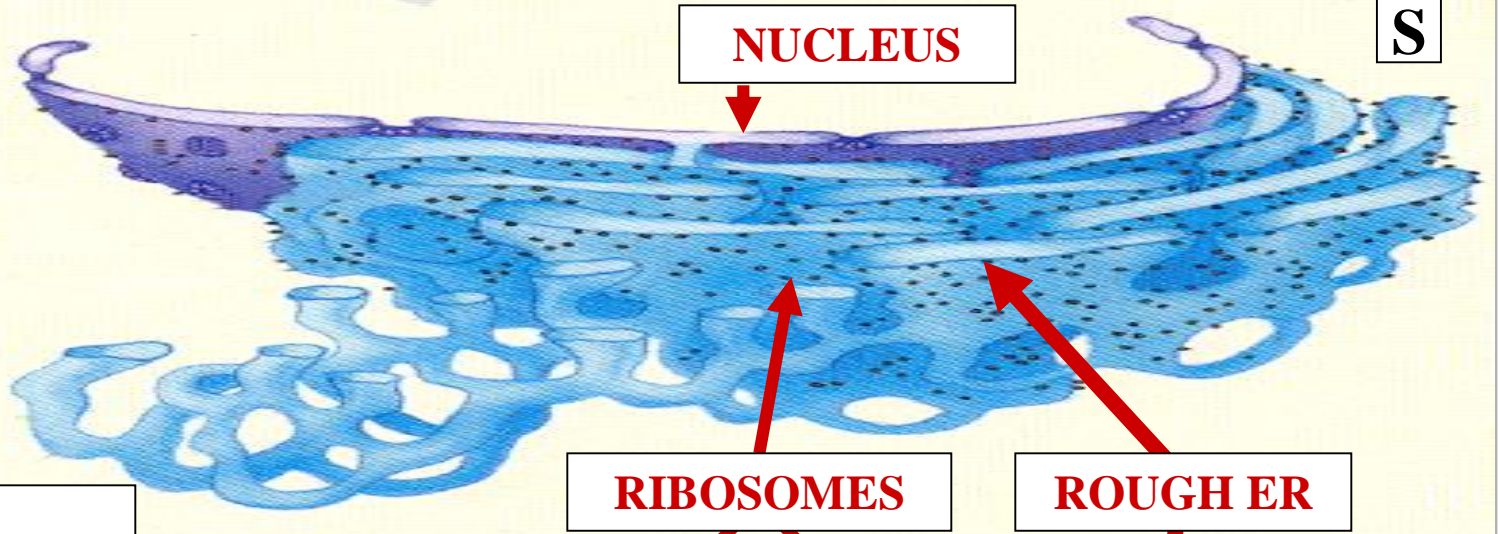
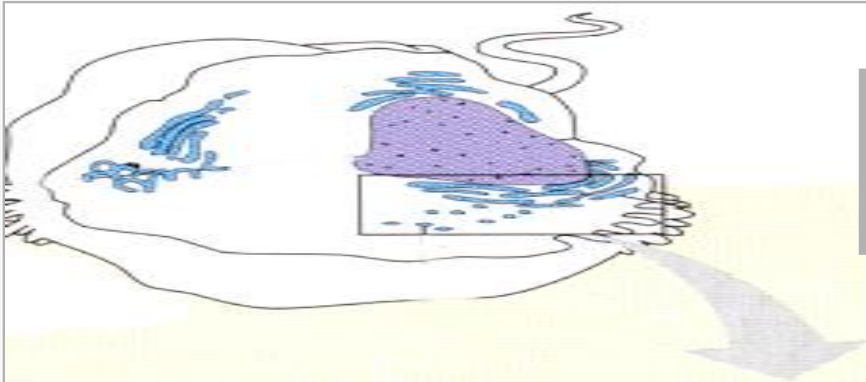


**R-ER**

**CONFLUENT W/ NUCLEUS**



# ENDOPLASMIC RETICULUM ULTRASTRUCTURE



^

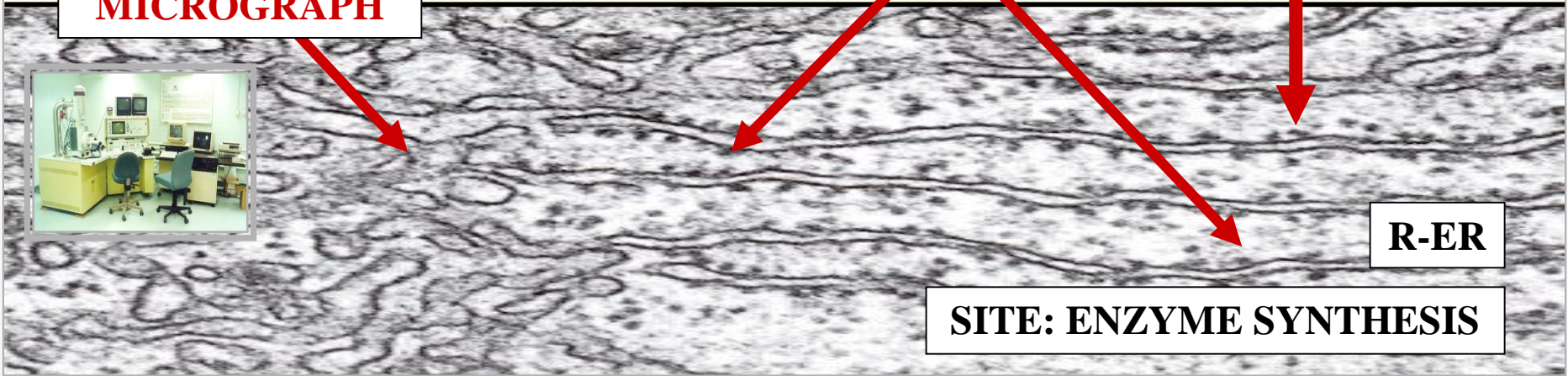
S

**NUCLEUS**

**RIBOSOMES**

**ROUGH ER**

**TEM  
MICROGRAPH**



**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**

---

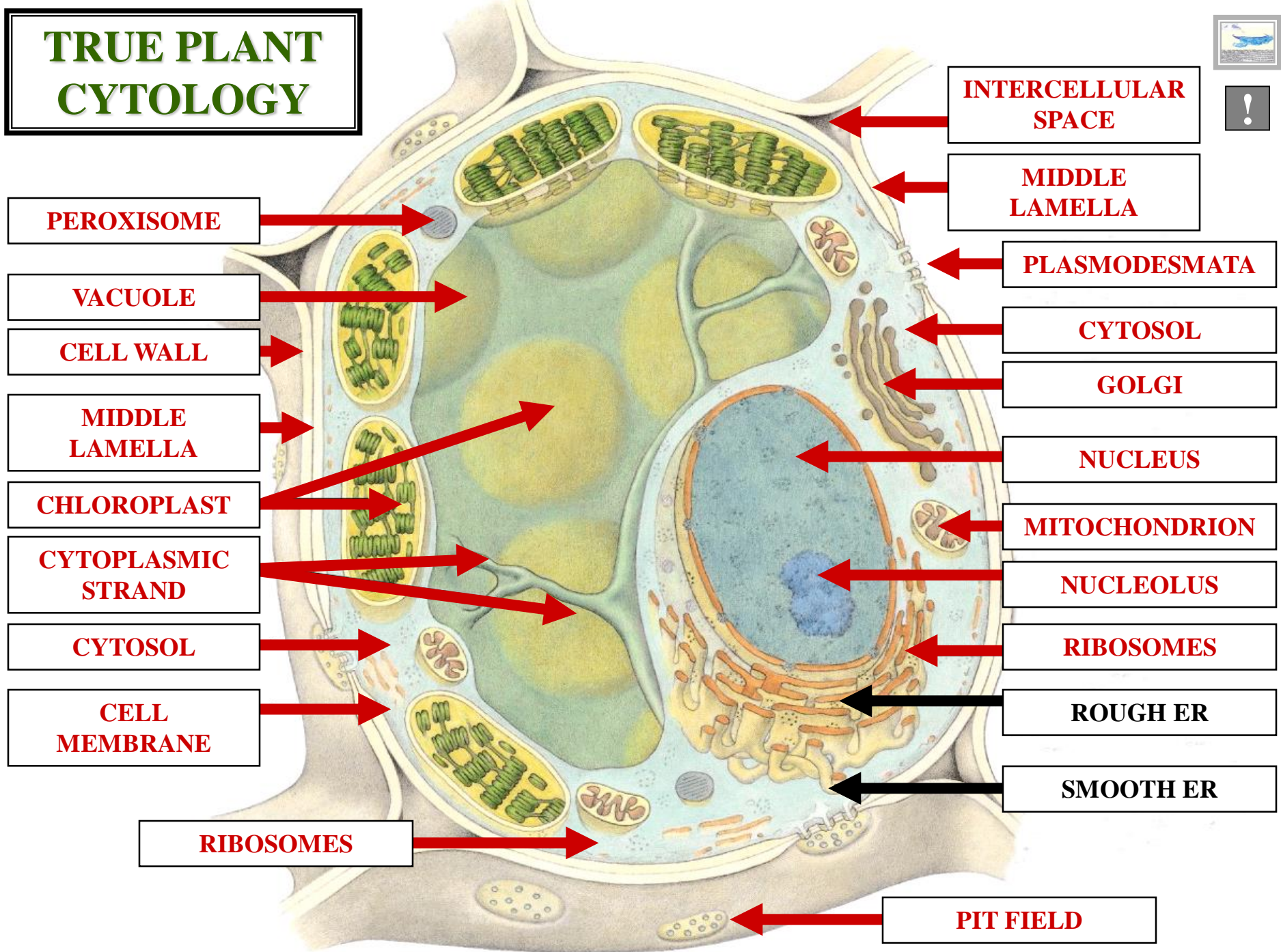
**CONFLUENT WITH R-ER**

---

**SITE: MEMBRANE SYNTHESIS**

**SMOOTH**  
**ENDOPLASMIC RETICULUM**

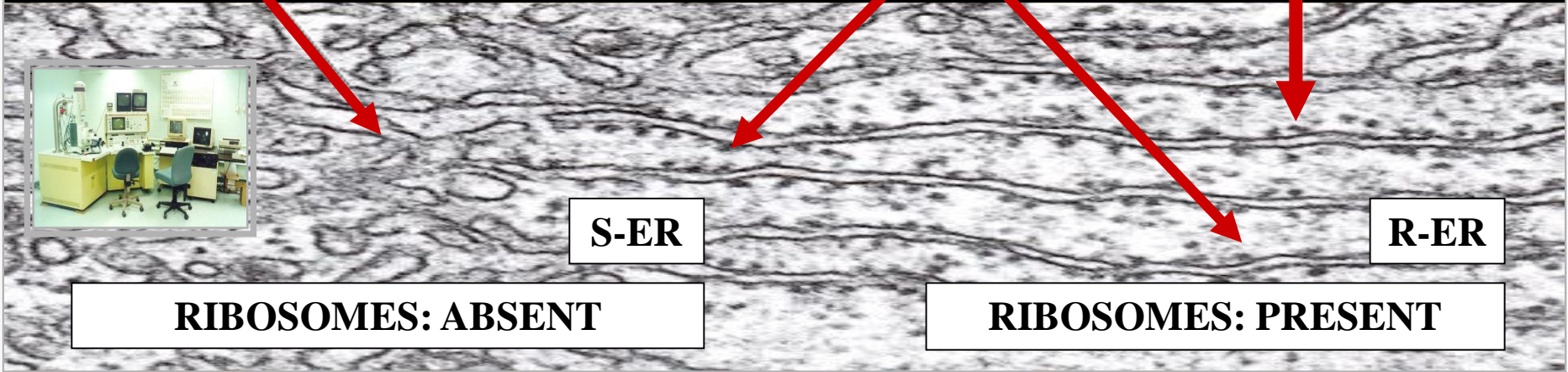
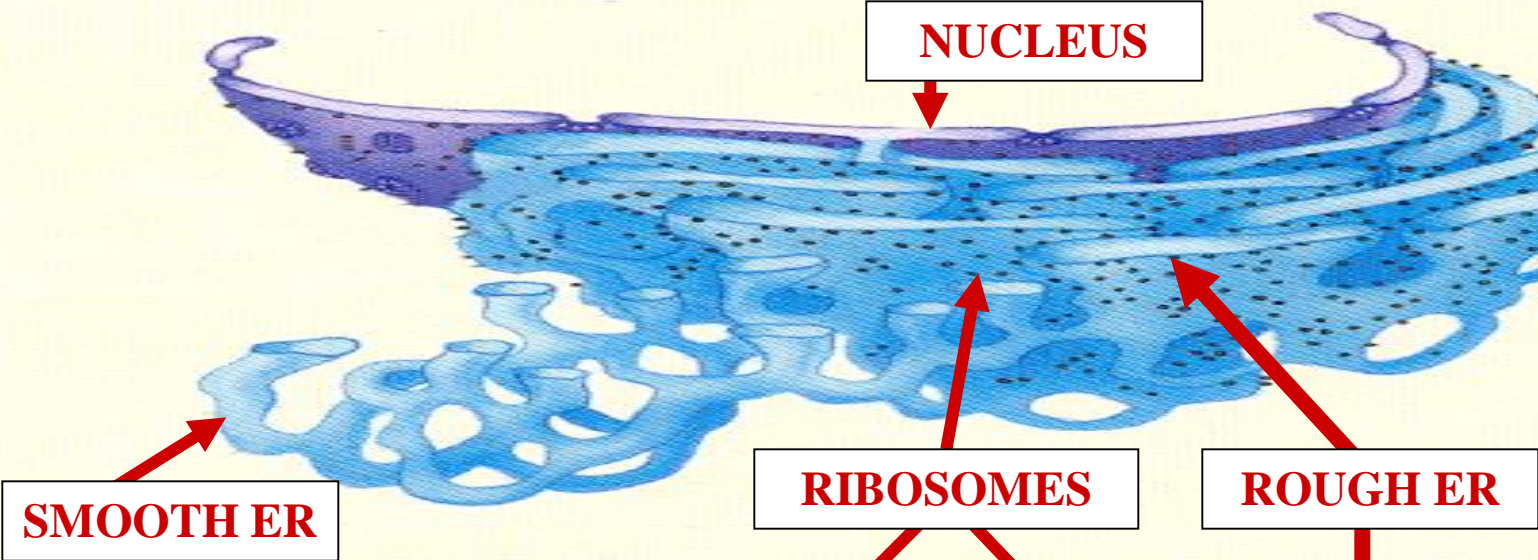
# TRUE PLANT CYTOLOGY





# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

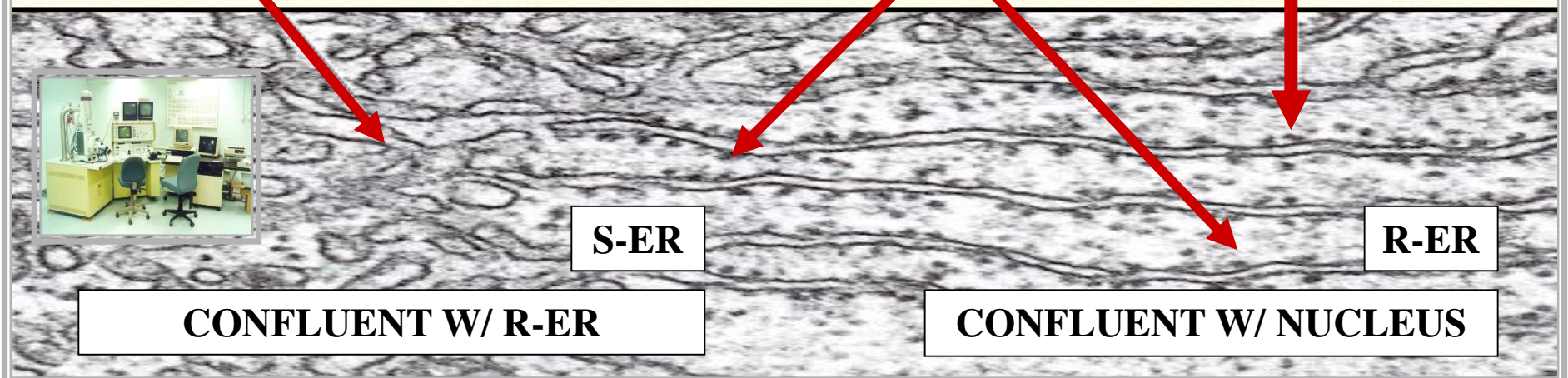
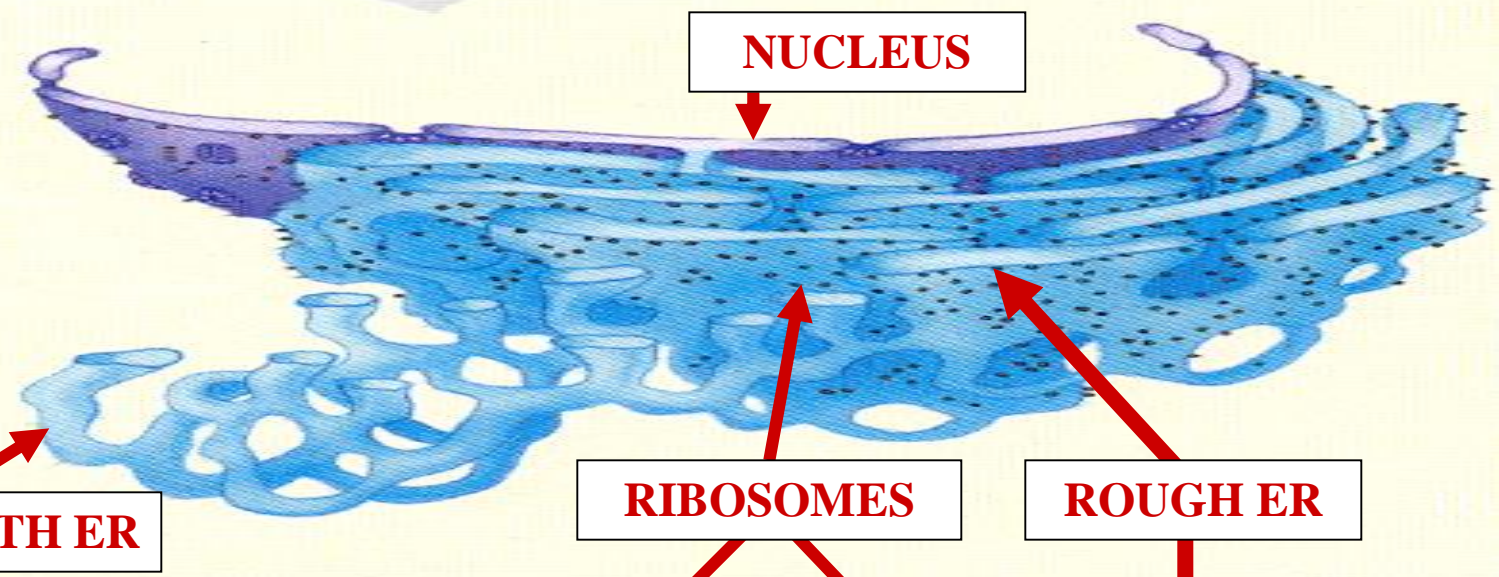
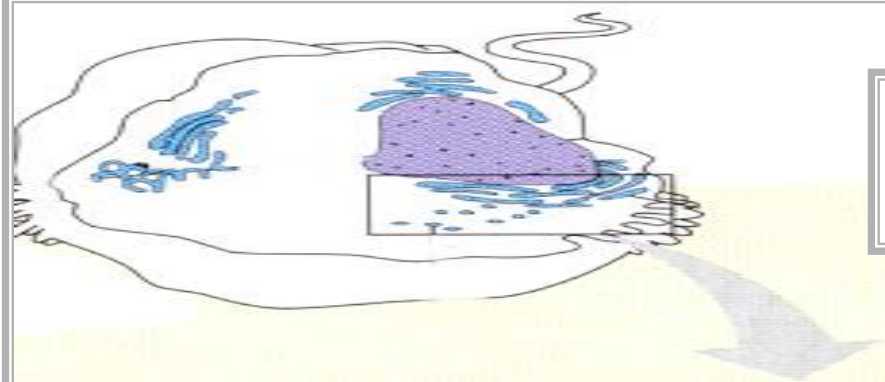
C





# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

S



**SMOOTH ER**

**NUCLEUS**

**RIBOSOMES**

**ROUGH ER**

**S-ER**

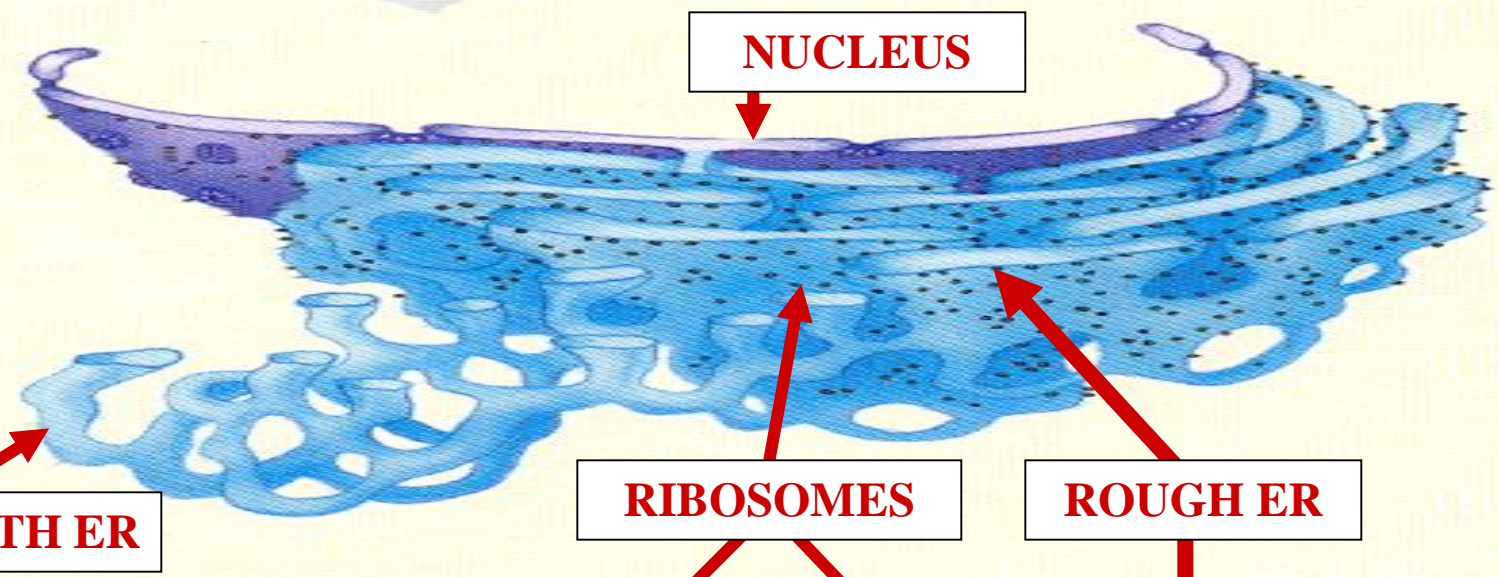
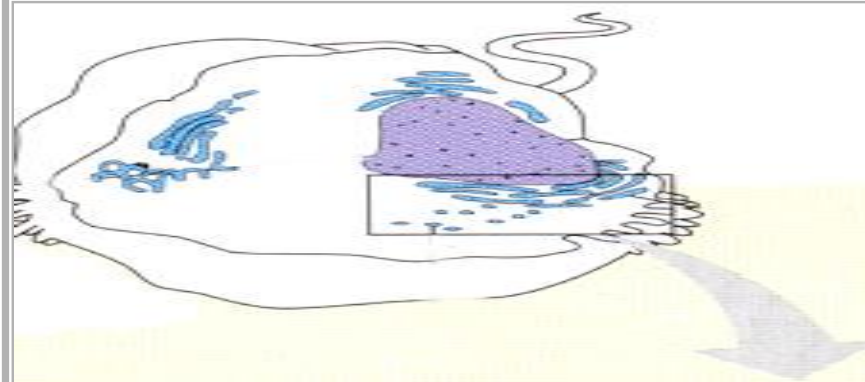
**R-ER**

**CONFLUENT W/ R-ER**

**CONFLUENT W/ NUCLEUS**

# ENDOPLASMIC RETICULUM ULTRASTRUCTURE

S



**NUCLEUS**

**SMOOTH ER**

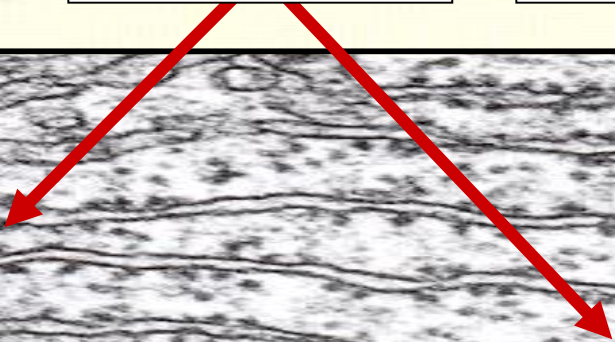
**RIBOSOMES**

**ROUGH ER**



**S-ER**

**SITE: MEMBRANE SYNTHESIS**

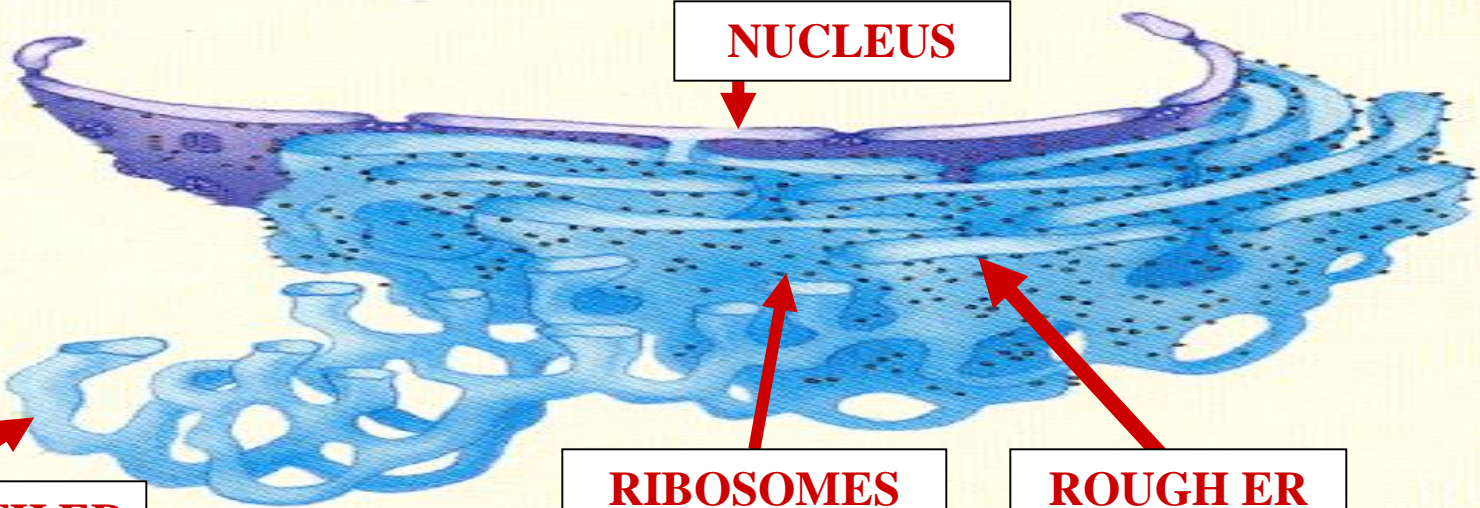
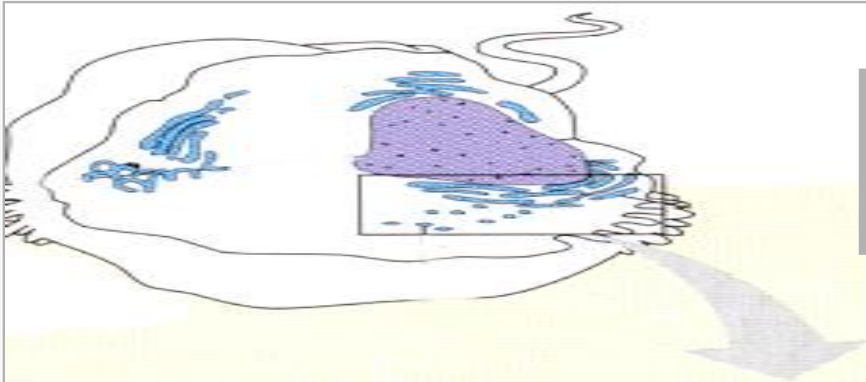


**R-ER**

**SITE: ENZYME SYNTHESIS**



# ENDOPLASMIC RETICULUM ULTRASTRUCTURE



**SMOOTH ER**

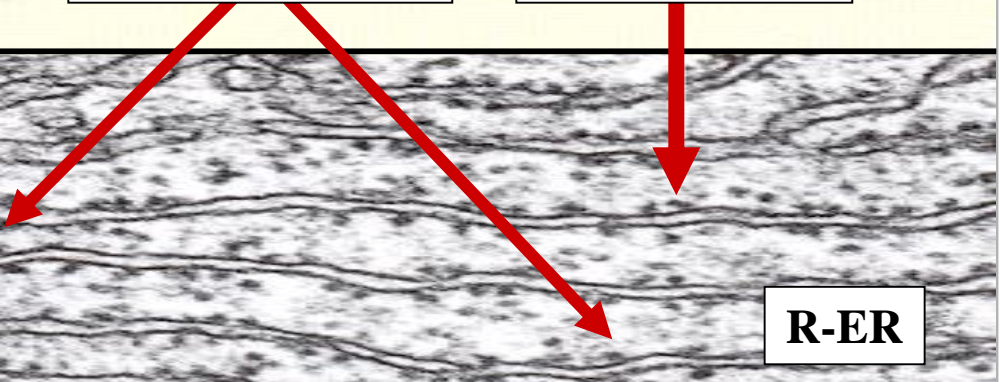
**RIBOSOMES**

**ROUGH ER**



**S-ER**

**RIBOSOMES: ABSENT**



**R-ER**

**RIBOSOMES: PRESENT**

# GOLGI

**GOLGI**



**GOLGI**



**ER DERIVED  
VESICLE ASSEMBLAGE**

**GOLGI**

**GOLGI**



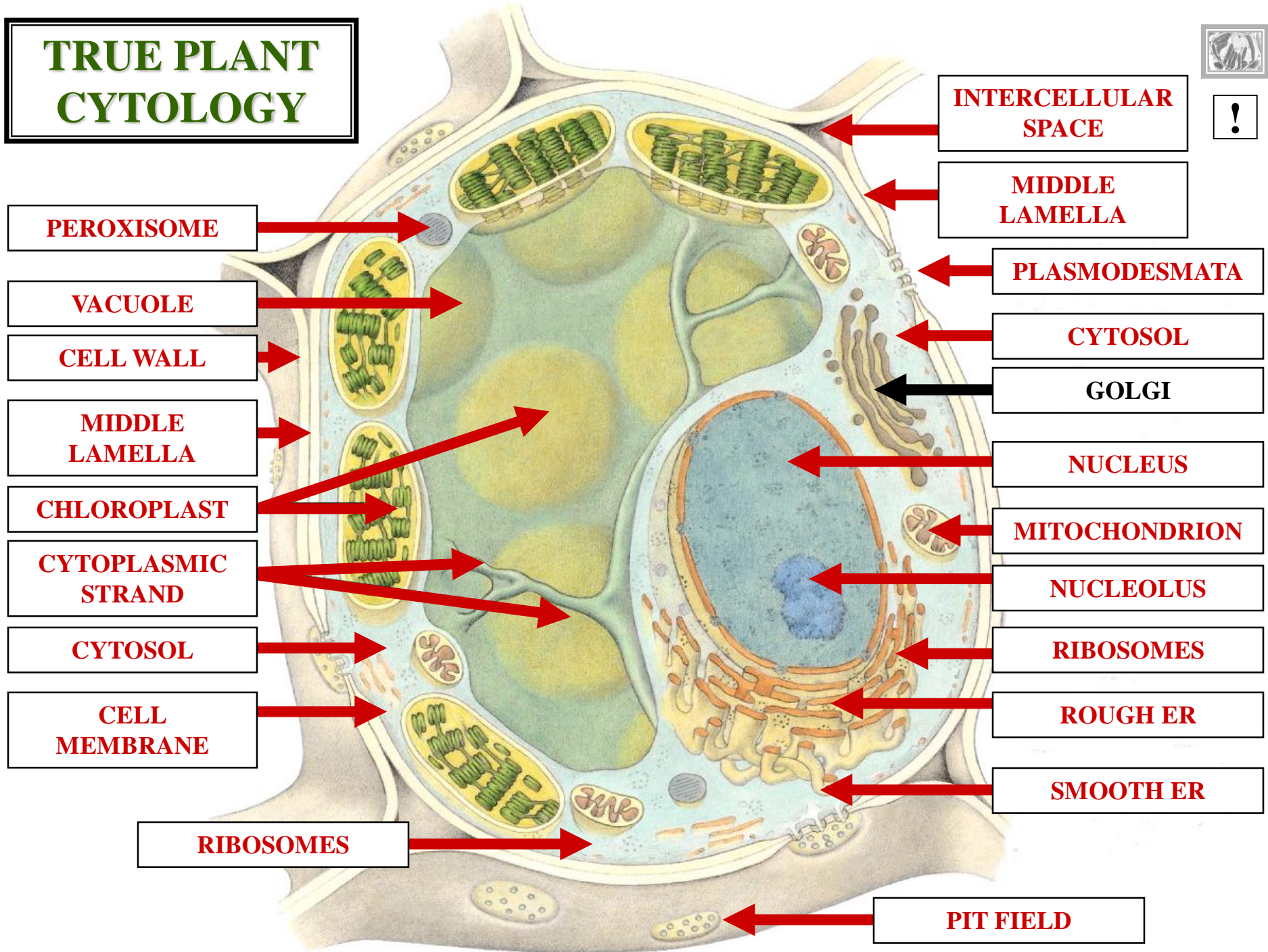
**ER DERIVED  
VESICLE ASSEMBLAGE**

---

**PACKAGING CENTER  
FOR CELL EXIT**

**GOLGI**

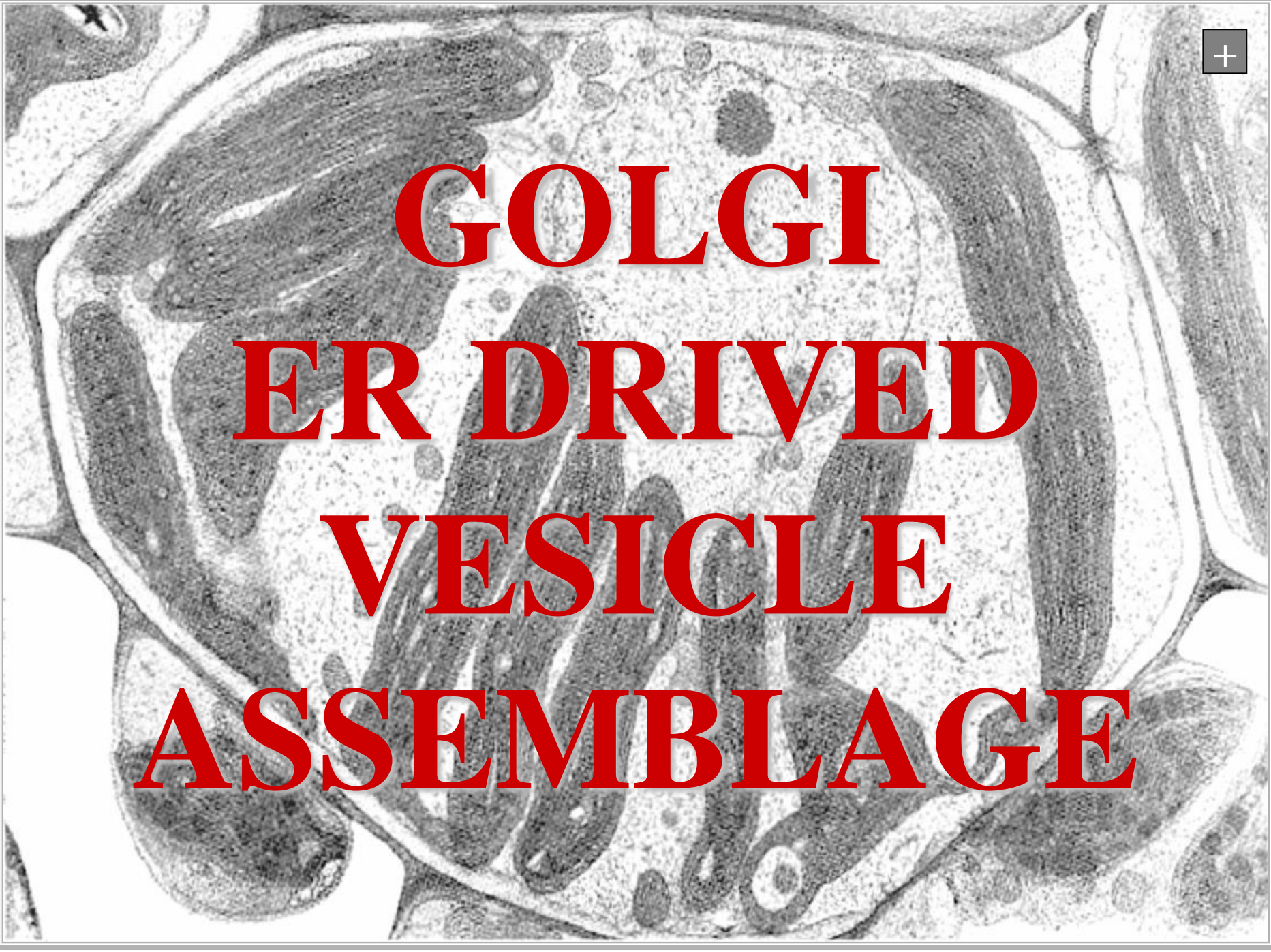
# TRUE PLANT CYTOLOGY








**GOLGI  
ER DRIVEN  
VESICLE  
ASSEMBLAGE**





An electron micrograph showing a cross-section of a Golgi apparatus. The structure is composed of several flattened, parallel membrane-bound sacs called cisternae, which are stacked together. The cisternae are separated by narrow spaces. The overall appearance is that of a series of interconnected, layered compartments. The text is overlaid in the center of the image.

**GOLGI  
PACKAGING  
CENTER  
CELL EXIT**



# GOLGI ULTRASTRUCTURE

**ER**

# GOLGI ULTRASTRUCTURE

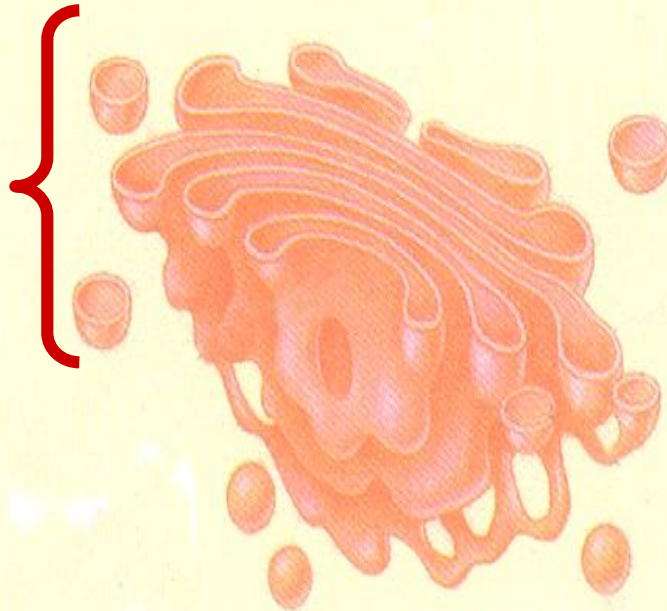


**GOLGI**

**GOLGI**



**GOLGI**



1  $\mu$ m



**CM**

# GOLGI ULTRASTRUCTURE



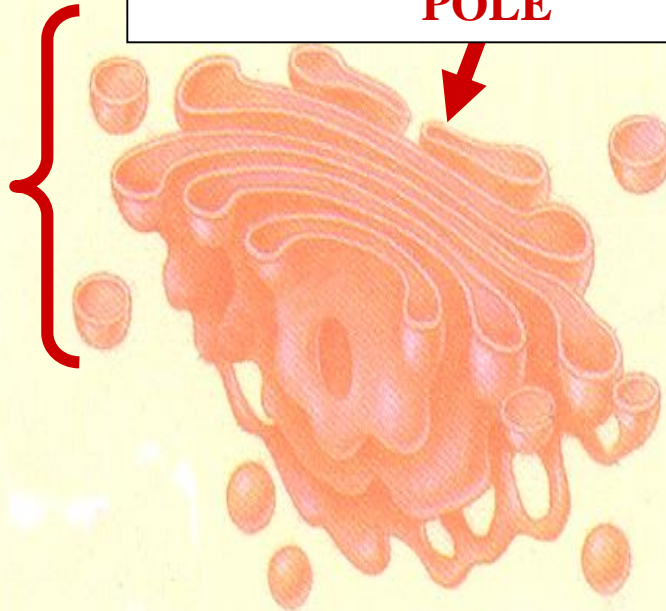
**GOLGI**

**GOLGI**



**GOLGI  
ENDOPLASMIC RETICULUM  
POLE**

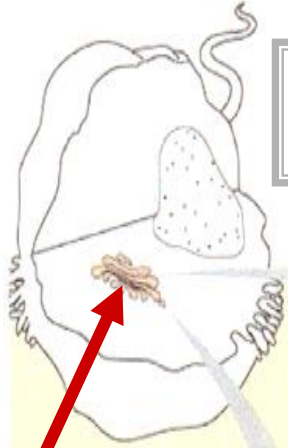
**GOLGI**





**EG**

# **GOLGI ULTRASTRUCTURE**



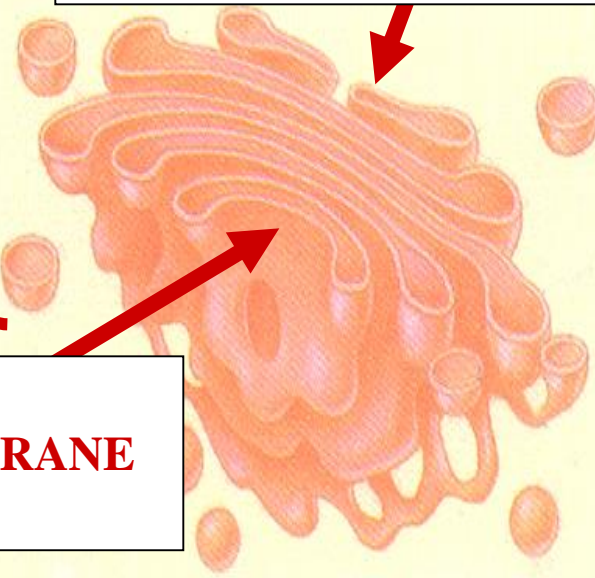
**GOLGI**

**GOLGI**



**GOLGI  
ENDOPLASMIC RETICULUM  
POLE**

**GOLGI**



**GOLGI  
CELL MEMBRANE  
POLE**

1 μm

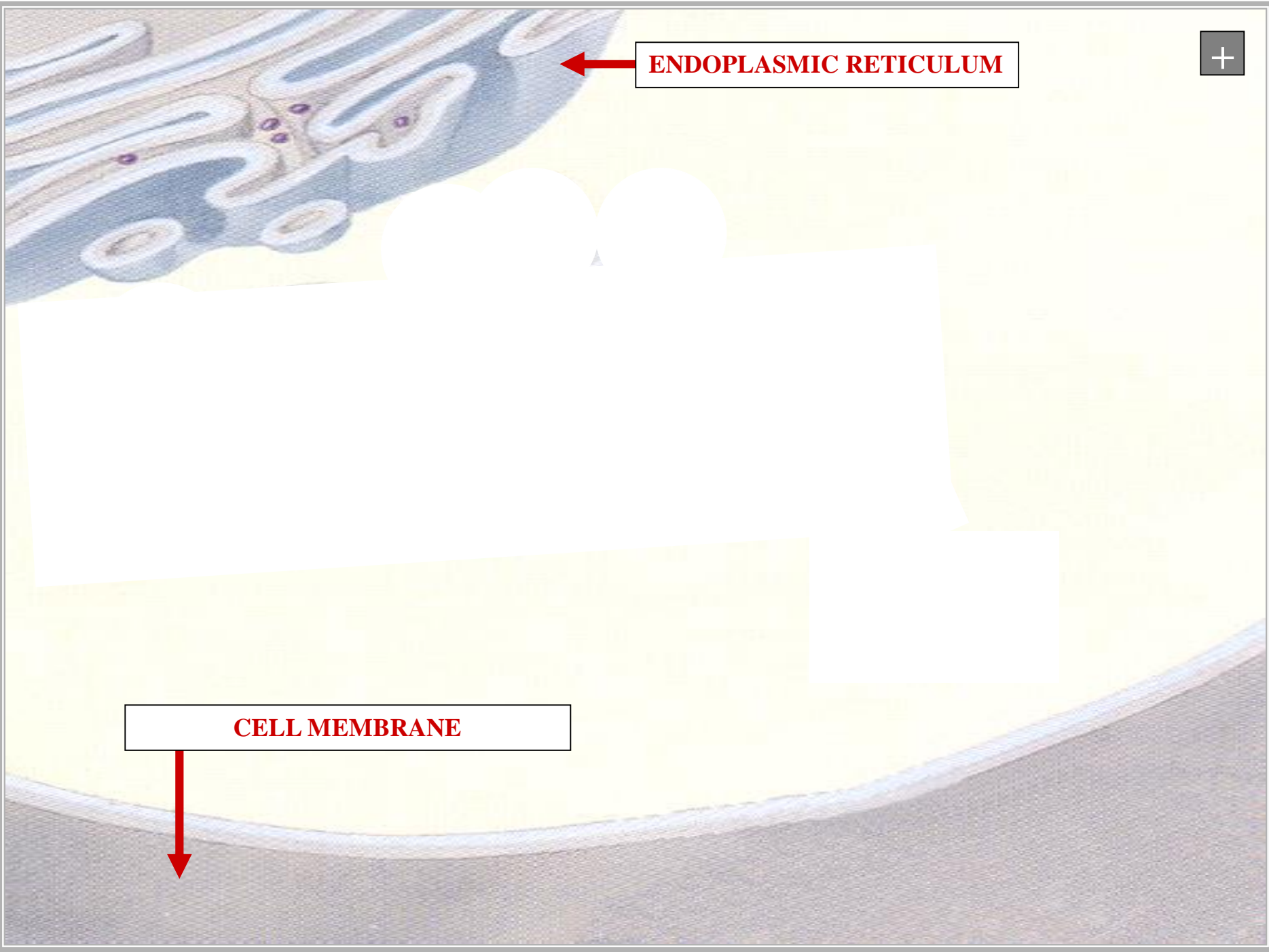


**GOLGI  
PACKAGING CENTER  
CELL EXIT  
EXAMPLE**



**ENDOPLASMIC RETICULUM**

**CELL MEMBRANE**





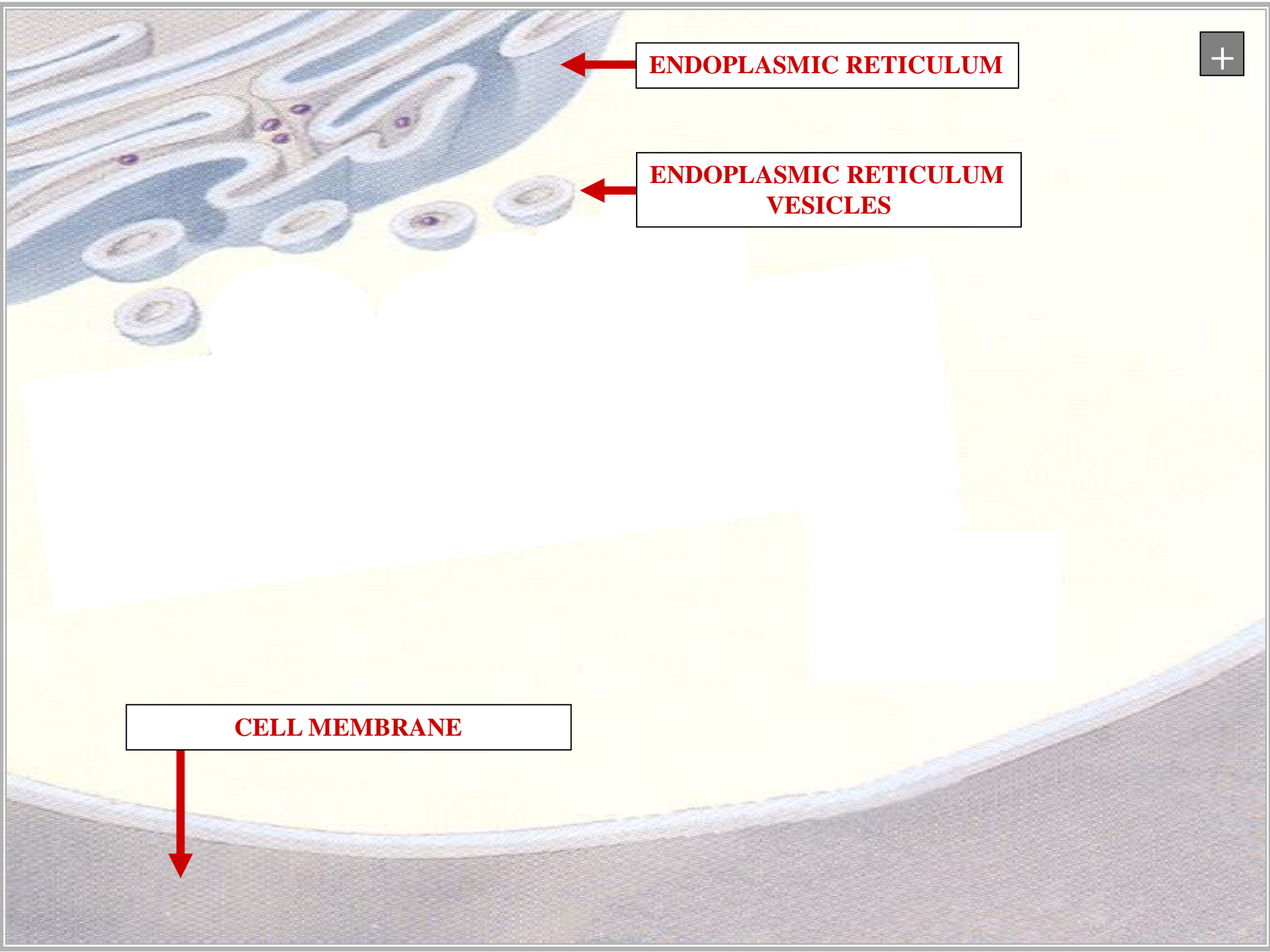
**ENDOPLASMIC RETICULUM**



**ENDOPLASMIC RETICULUM  
VESICLES**



**CELL MEMBRANE**







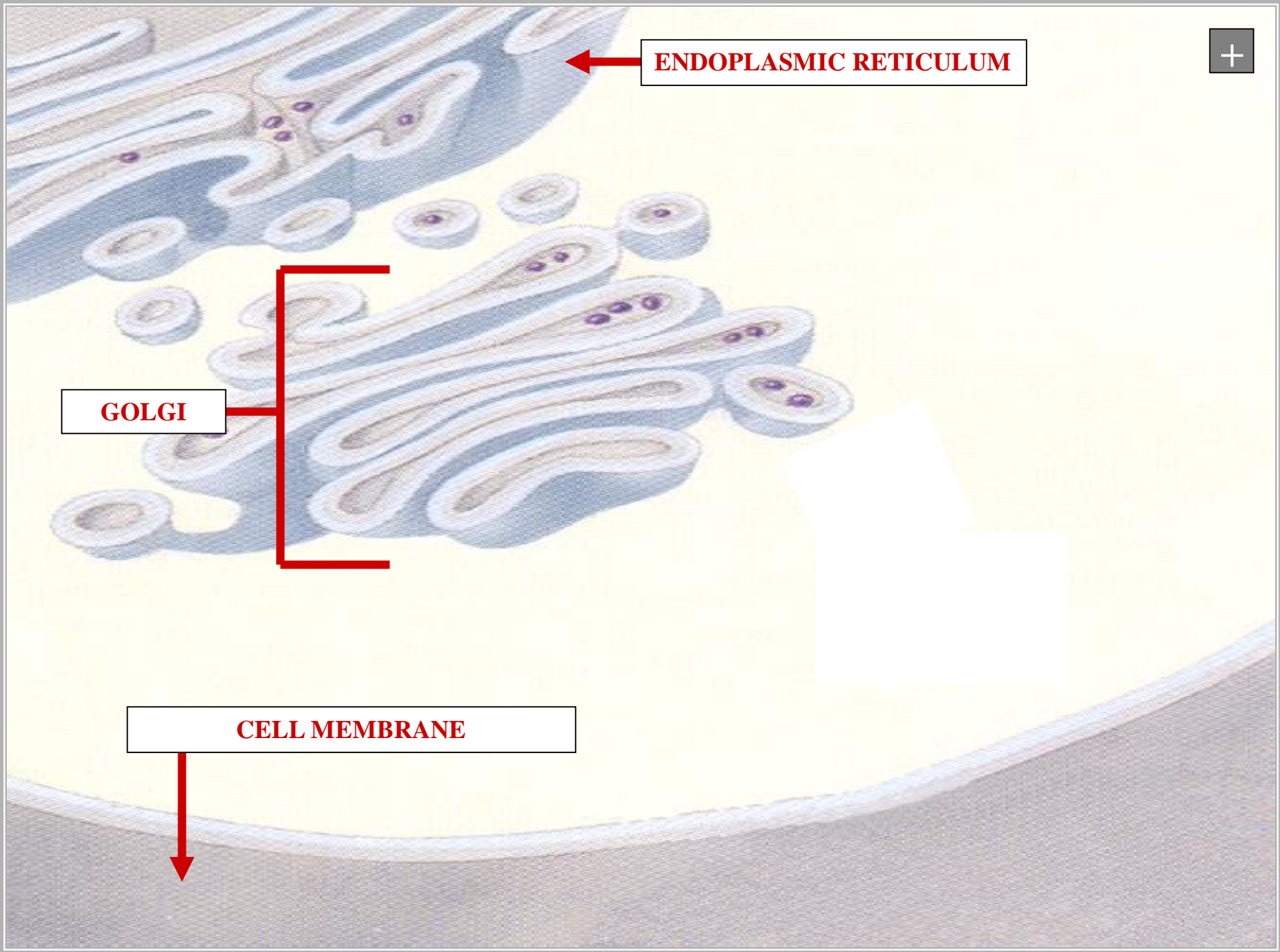
**ENDOPLASMIC RETICULUM**



**GOLGI**



**CELL MEMBRANE**





**ENDOPLASMIC RETICULUM**



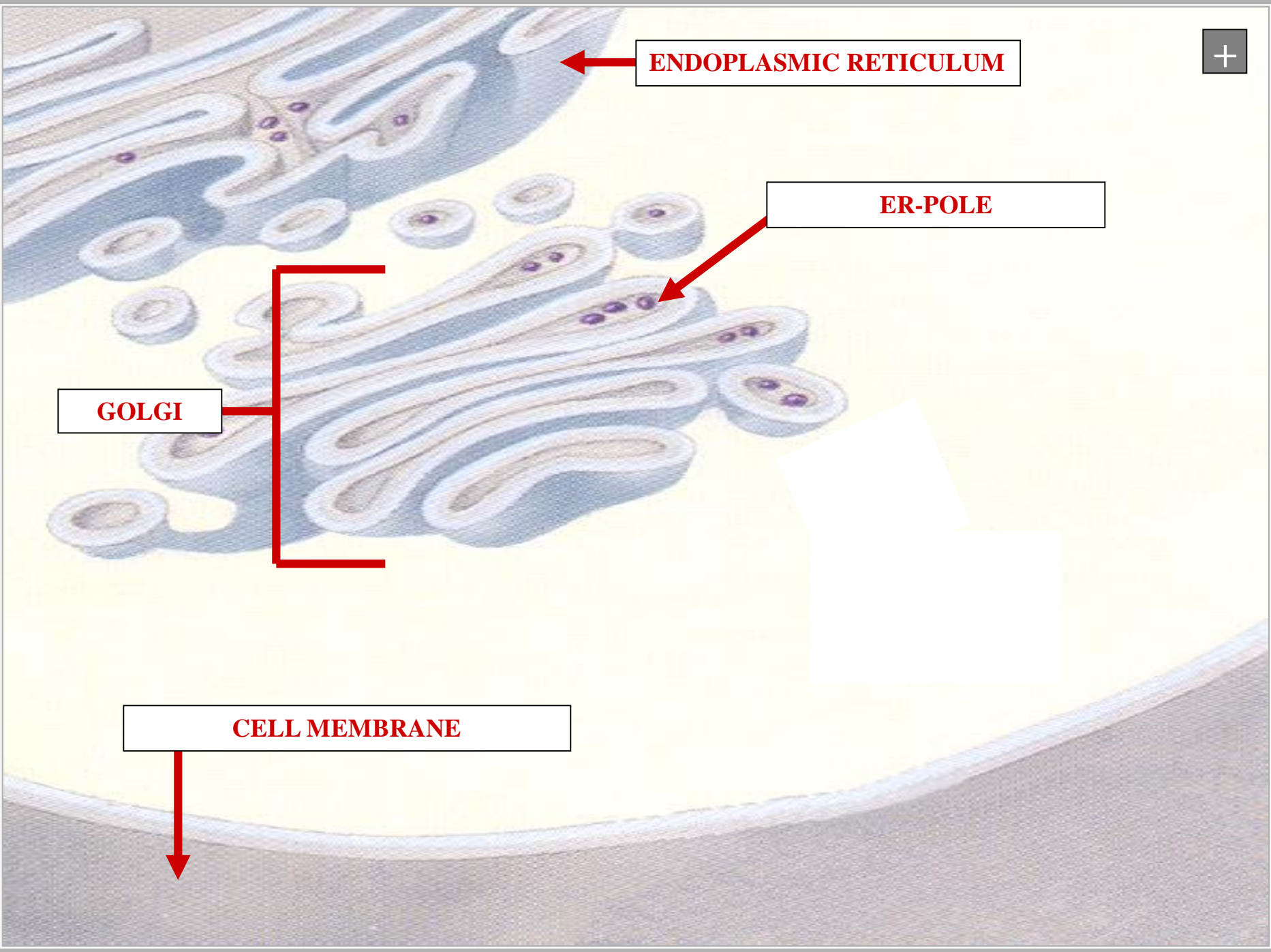
**ER-POLE**



**GOLGI**



**CELL MEMBRANE**







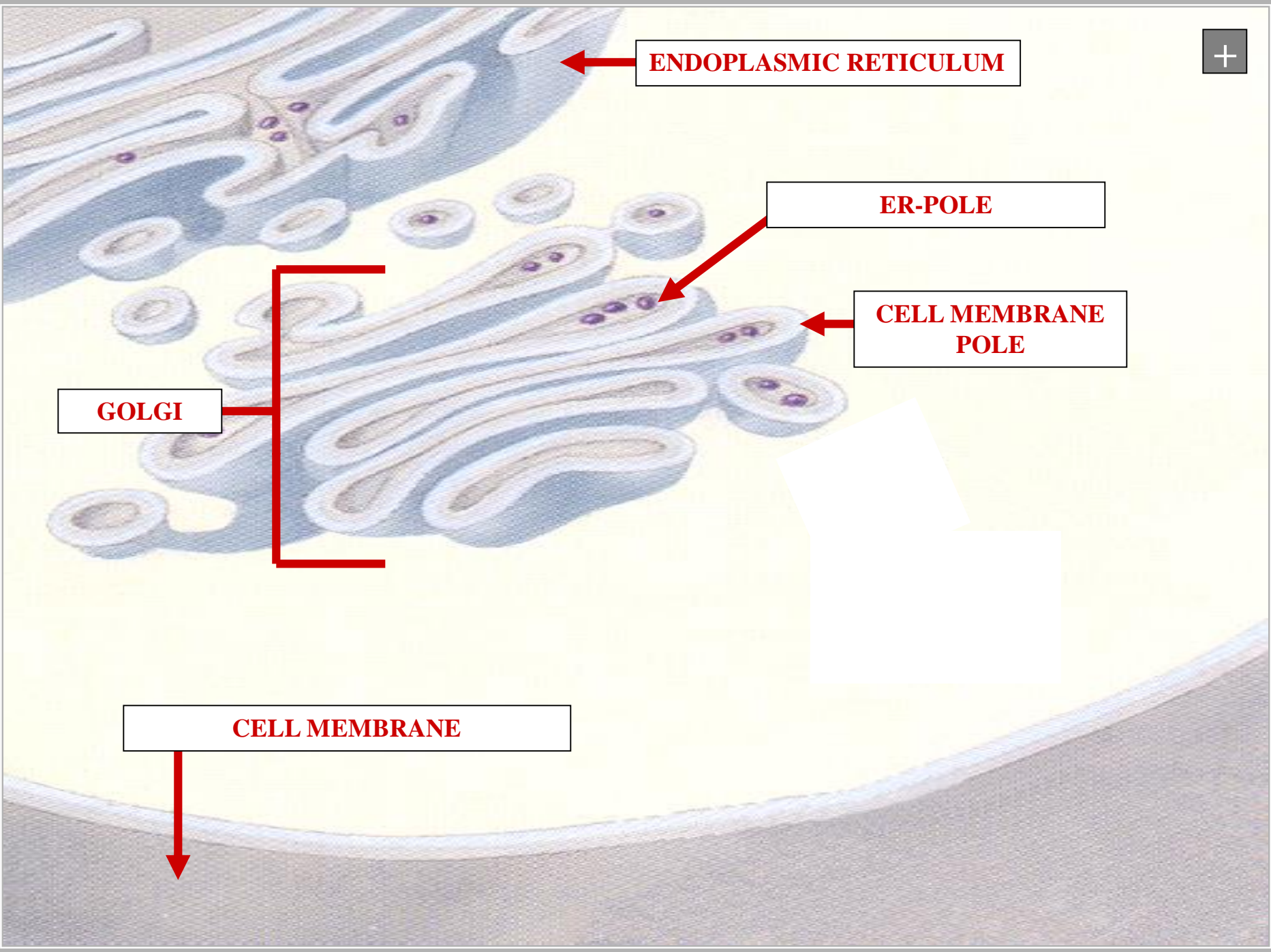
**ENDOPLASMIC RETICULUM**

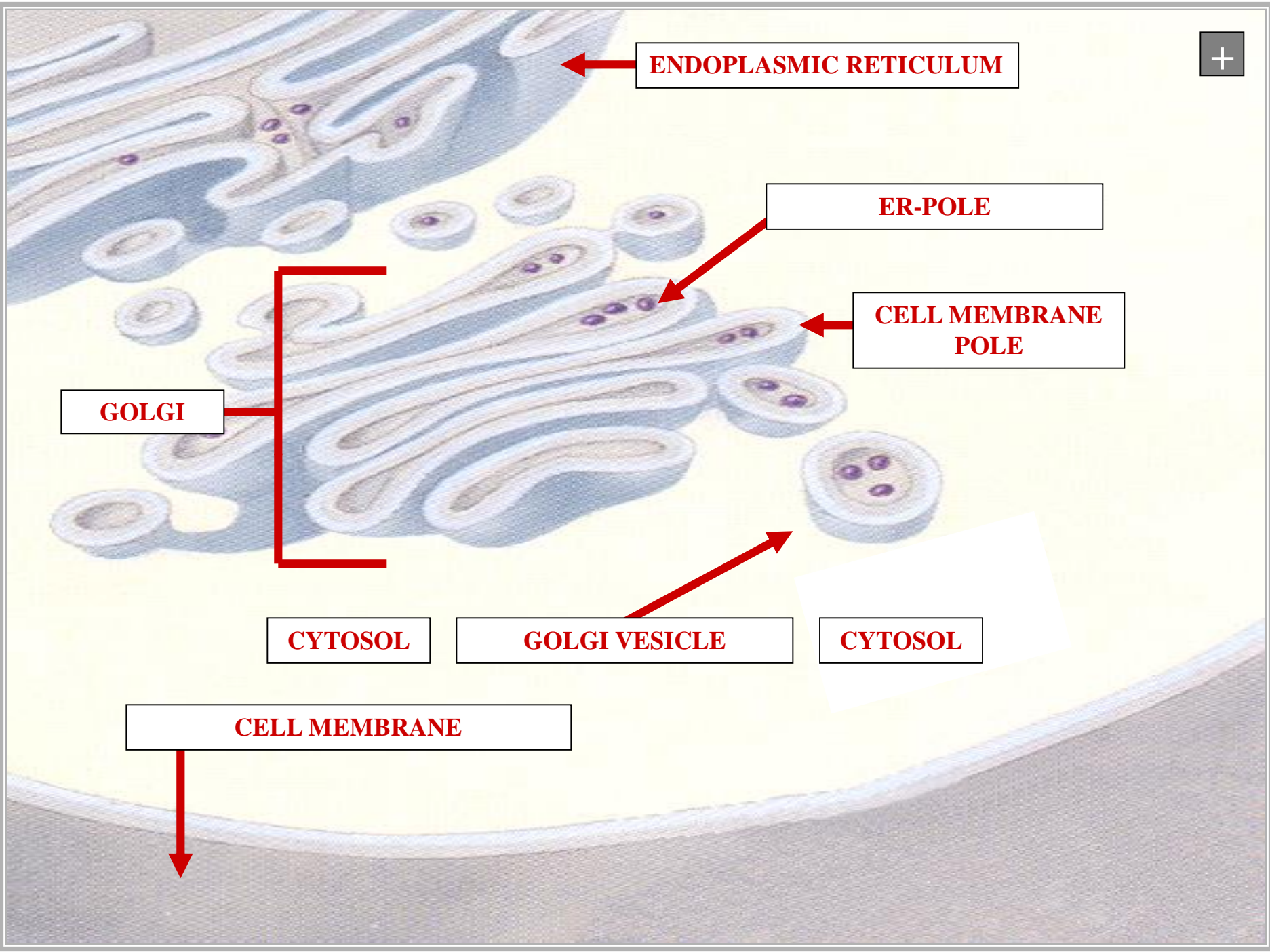
**ER-POLE**

**CELL MEMBRANE  
POLE**

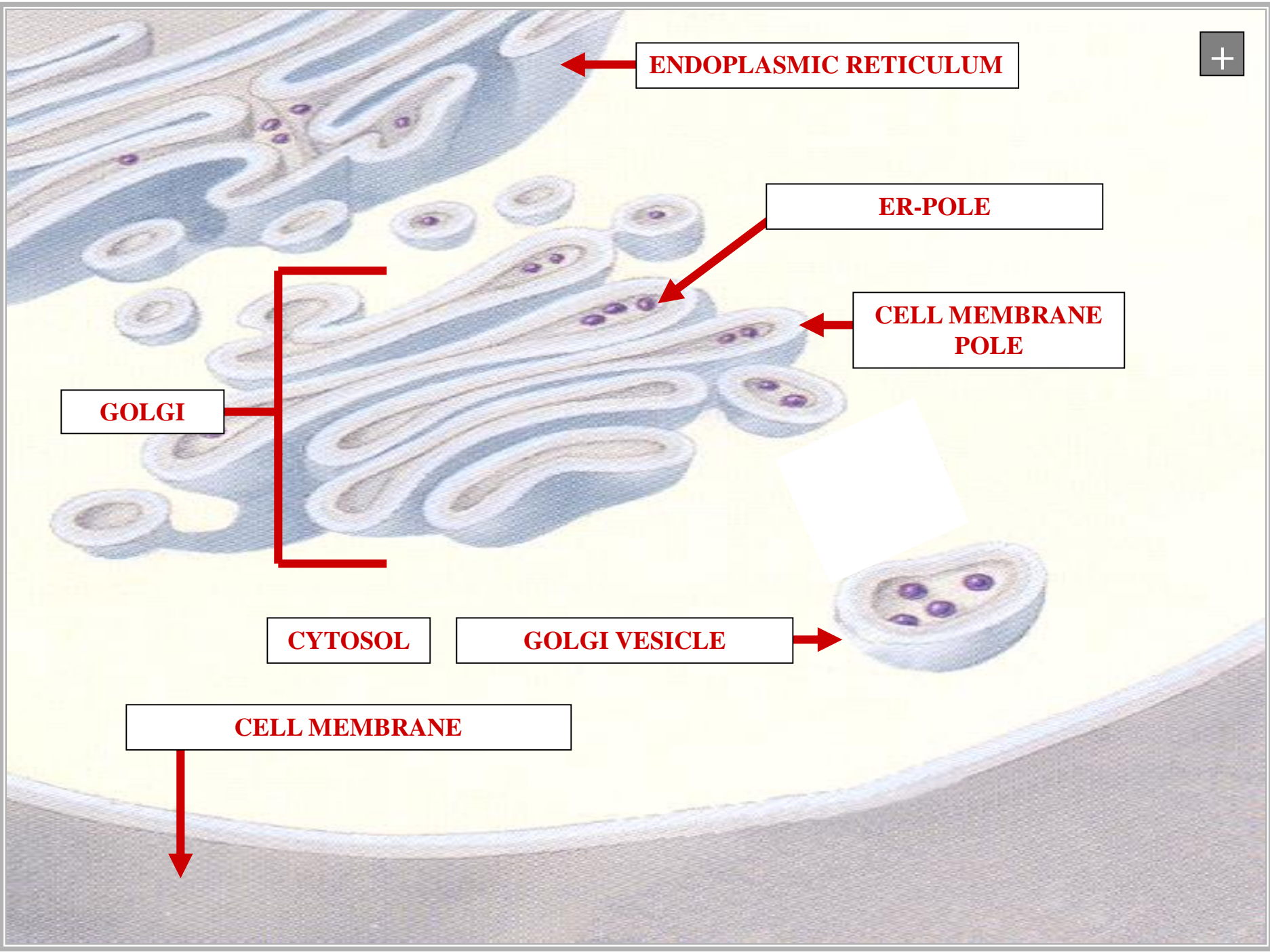
**GOLGI**

**CELL MEMBRANE**









**ENDOPLASMIC RETICULUM**

**ER-POLE**

**CELL MEMBRANE  
POLE**

**GOLGI**

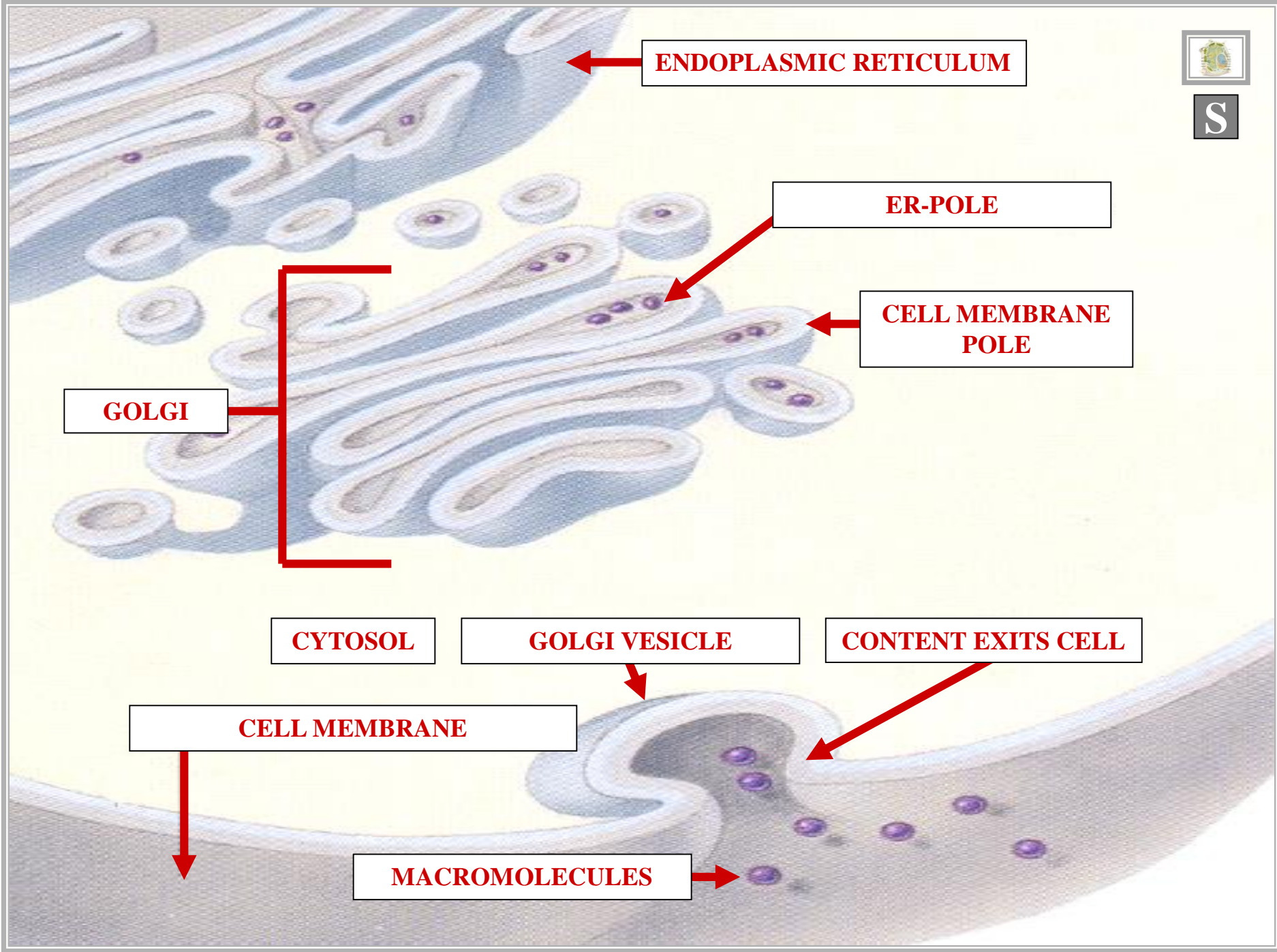
**CYTOSOL**

**GOLGI VESICLE**

**CELL MEMBRANE**

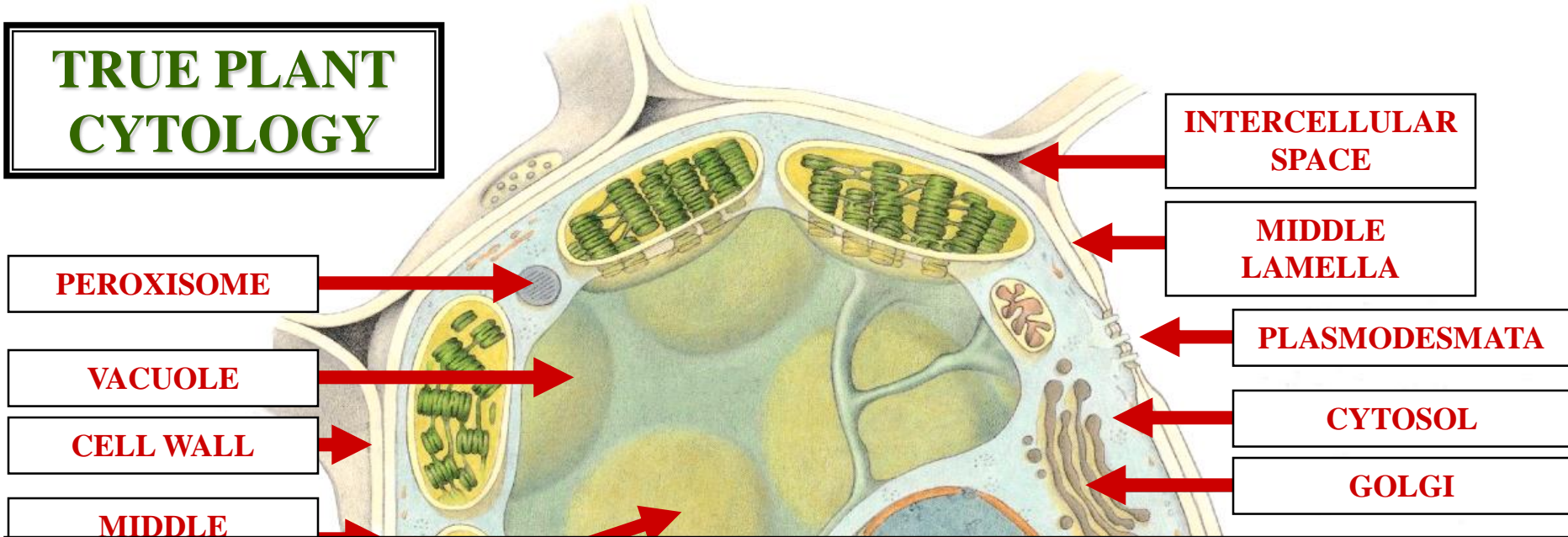


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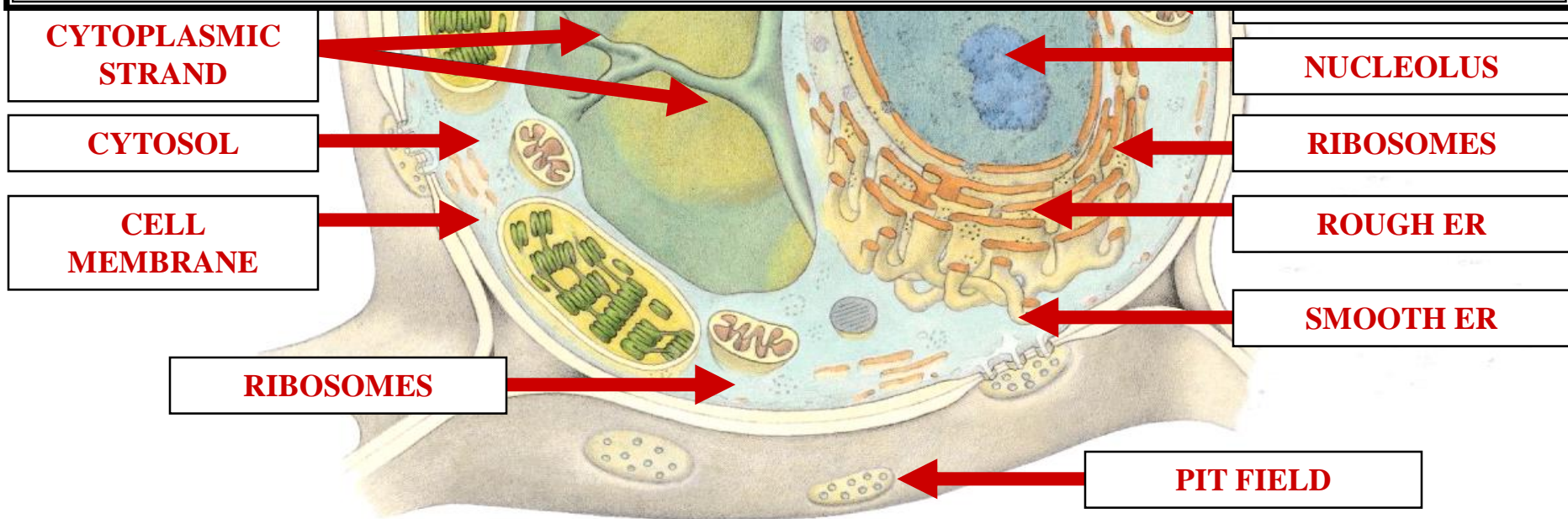




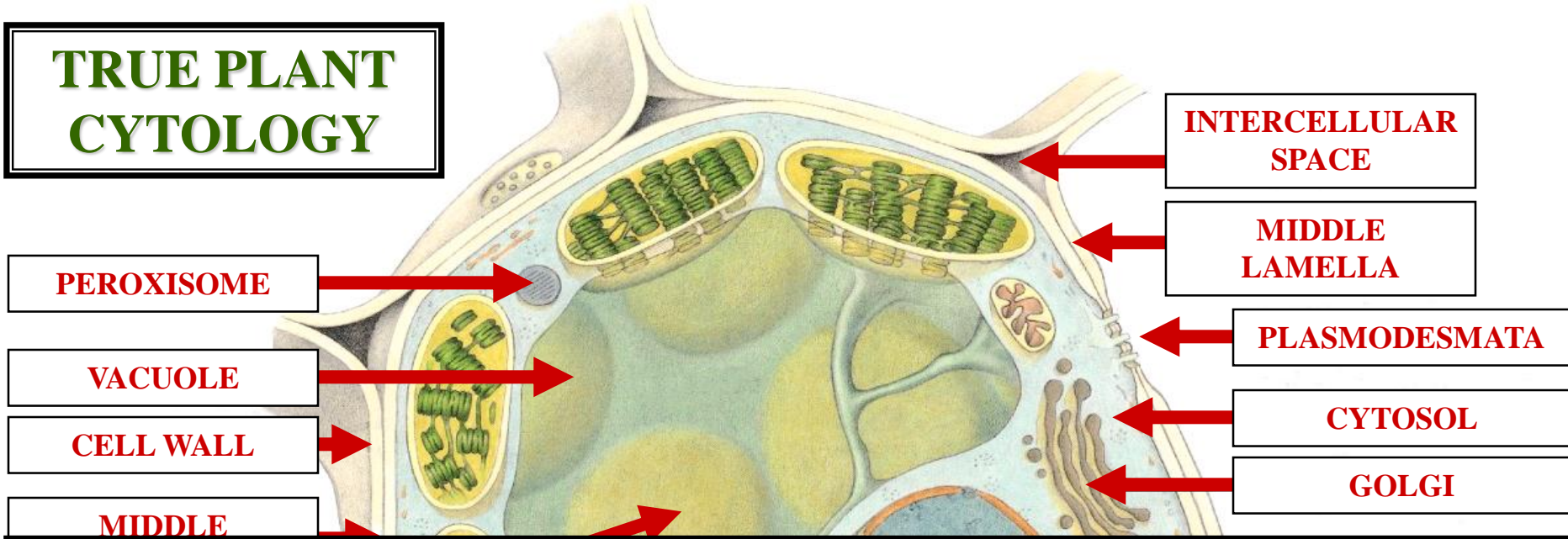
# TRUE PLANT CYTOLOGY



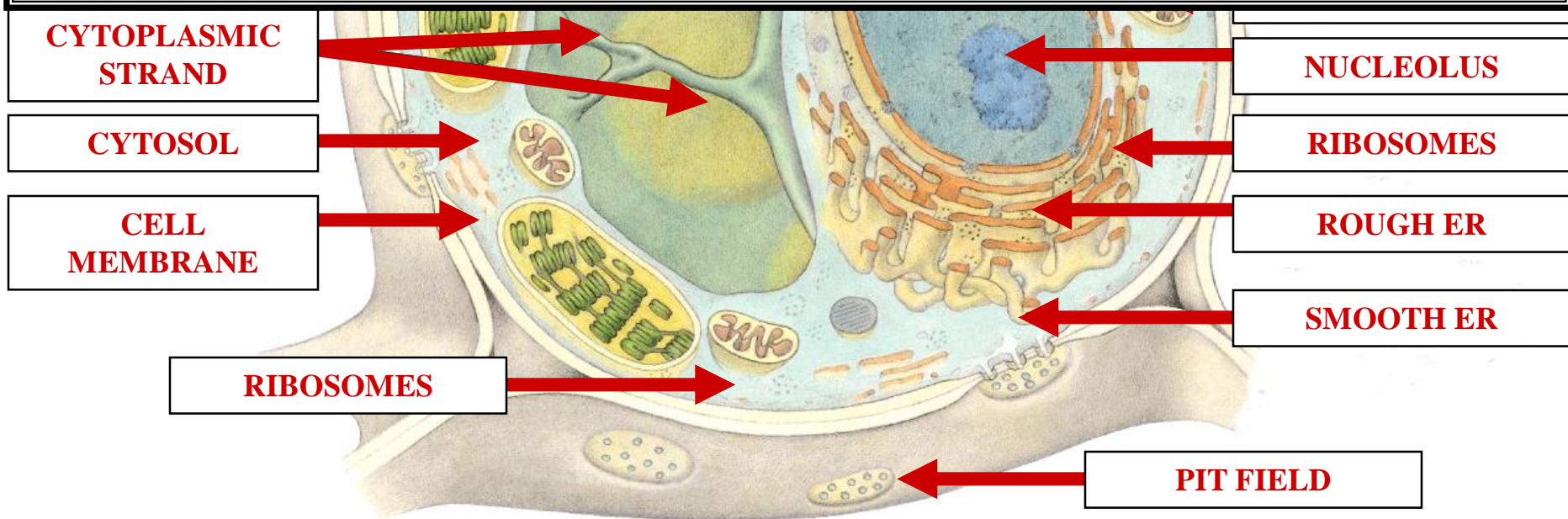
# SUMMARY



# TRUE PLANT CYTOLOGY

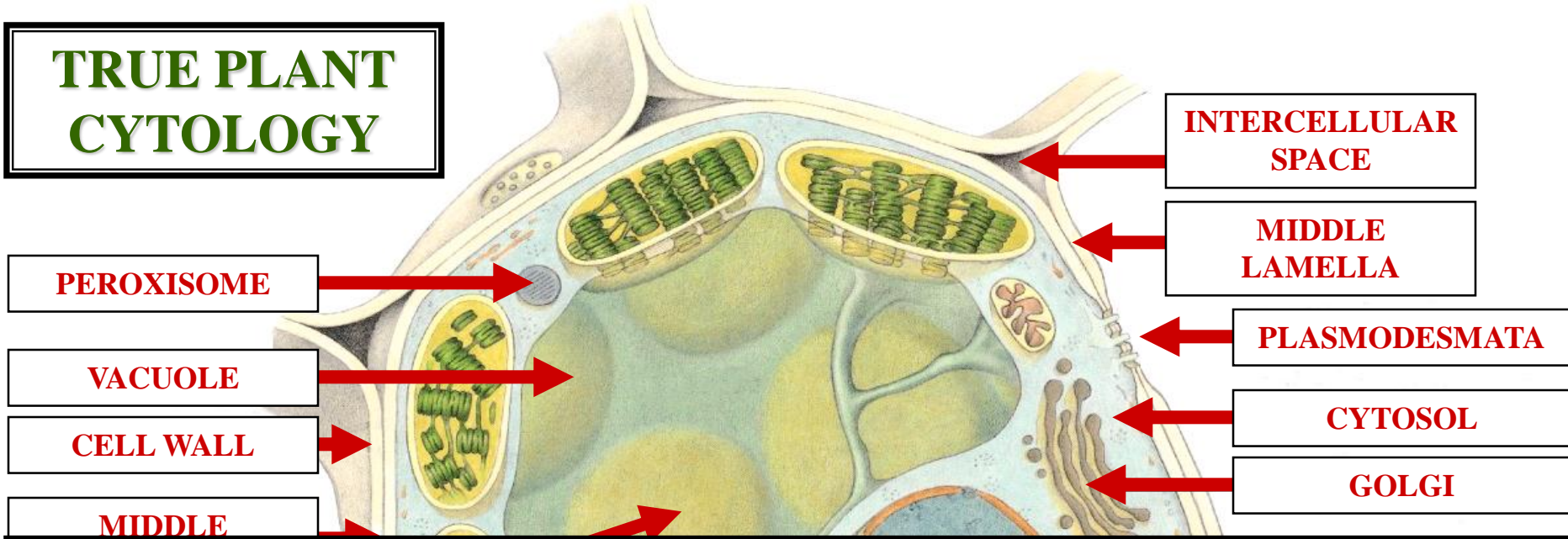


# DOUBLE-MB ORGANELLES

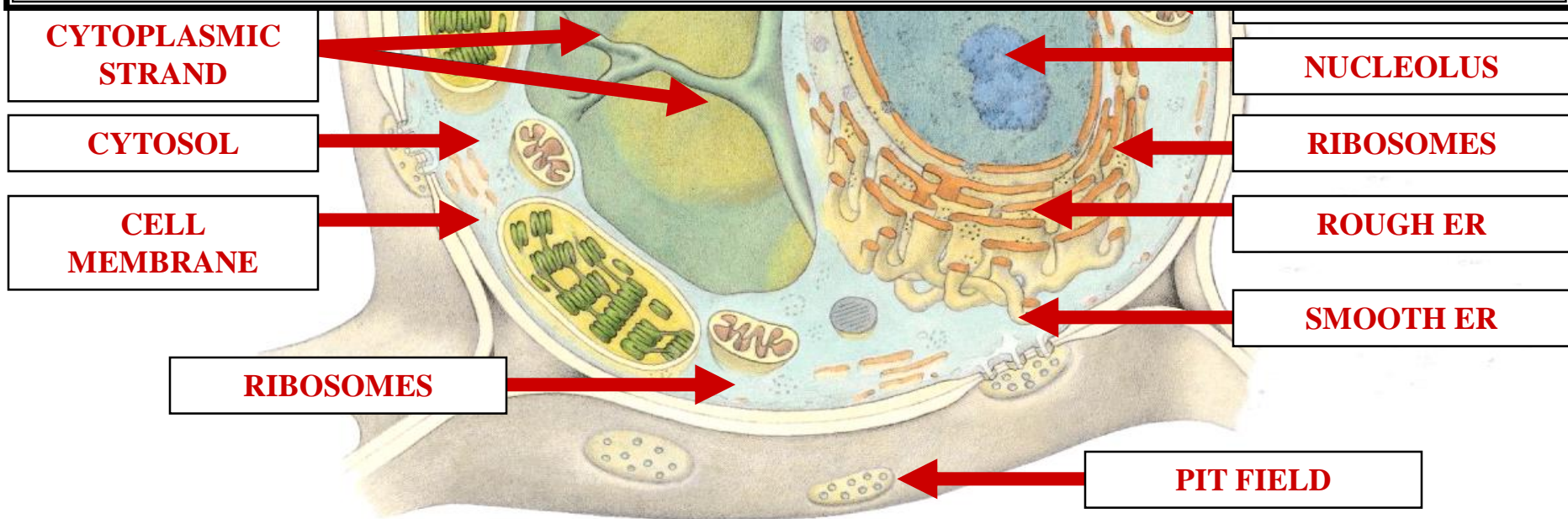




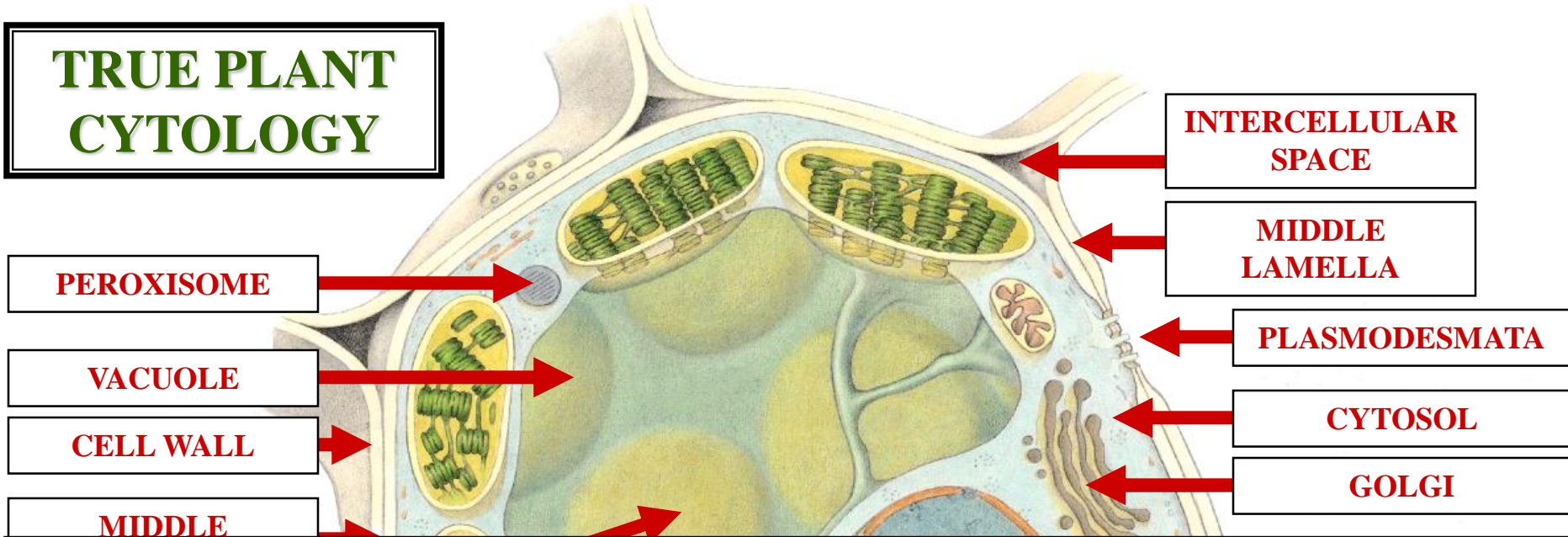
# TRUE PLANT CYTOLOGY



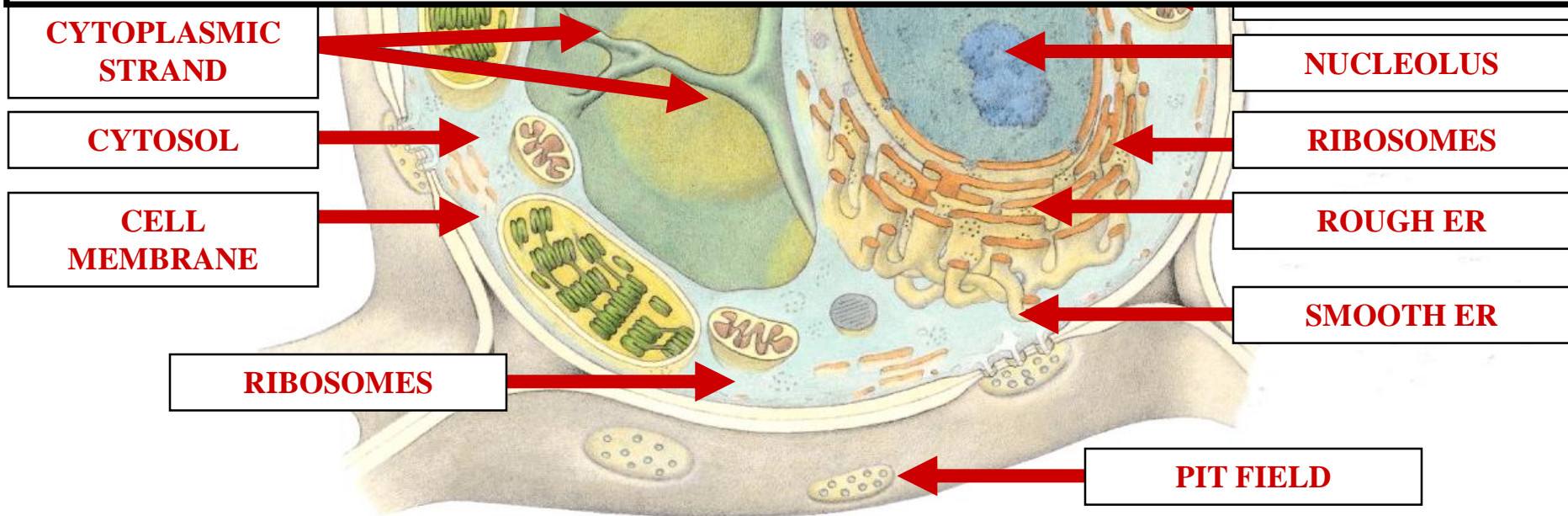
# SINGLE-MB ORGANELLES



# TRUE PLANT CYTOLOGY

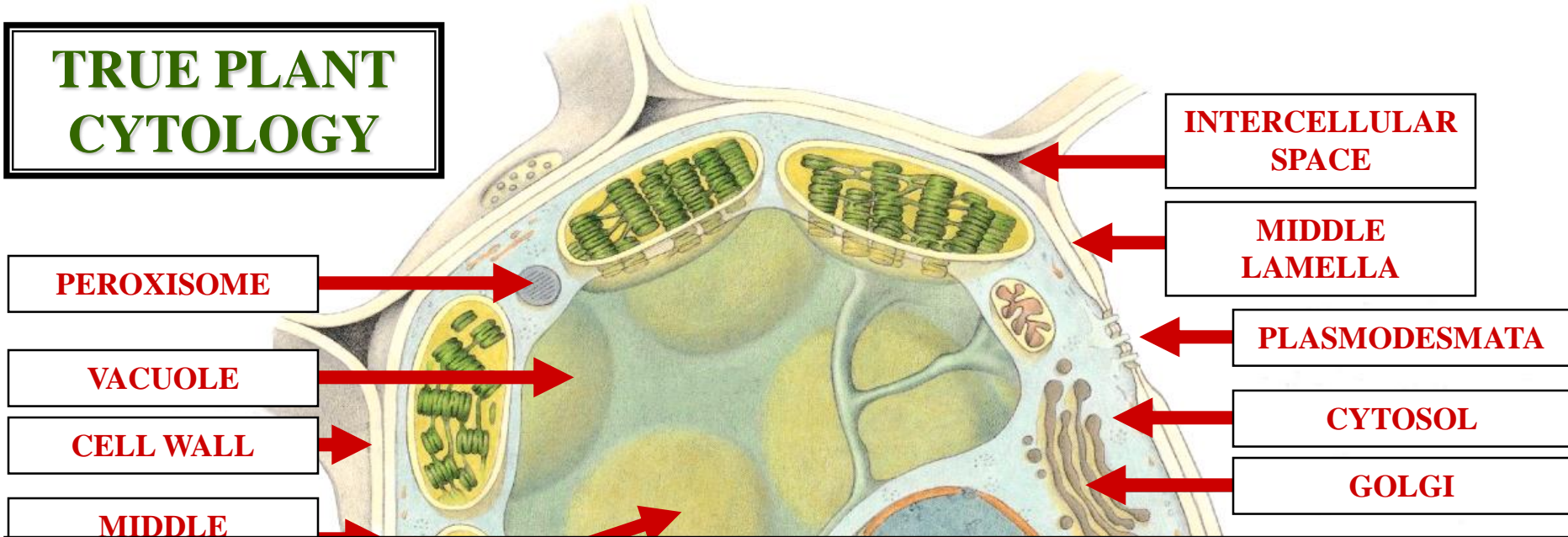


# NON-MB ORGANELLE

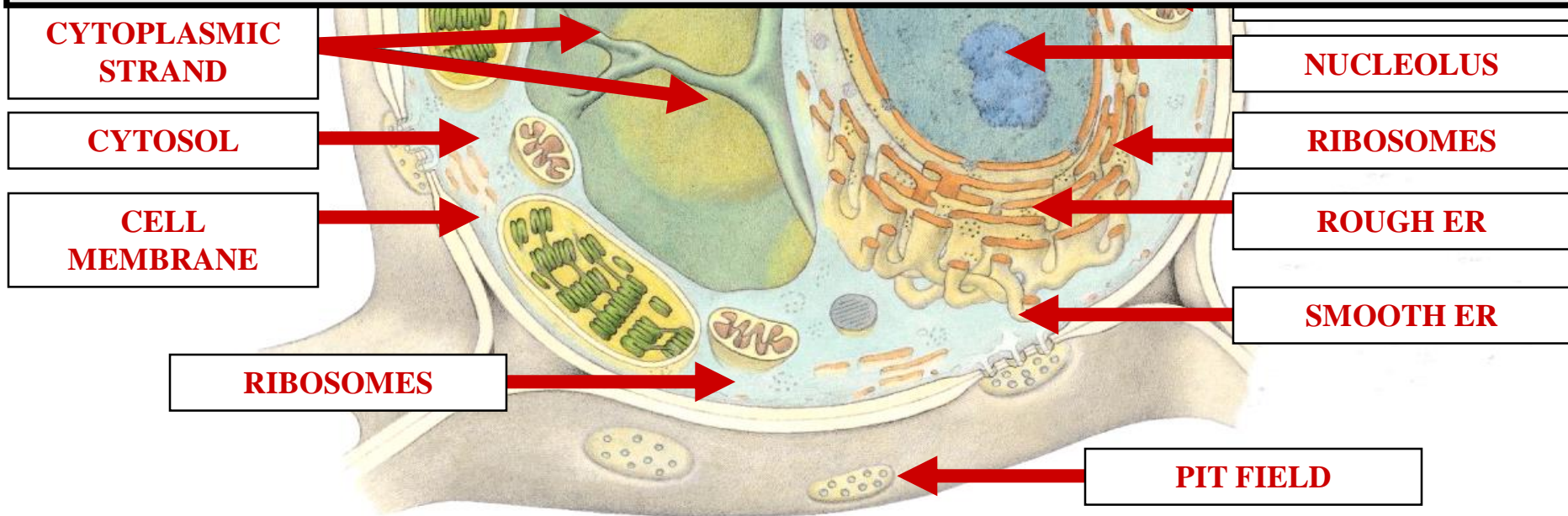




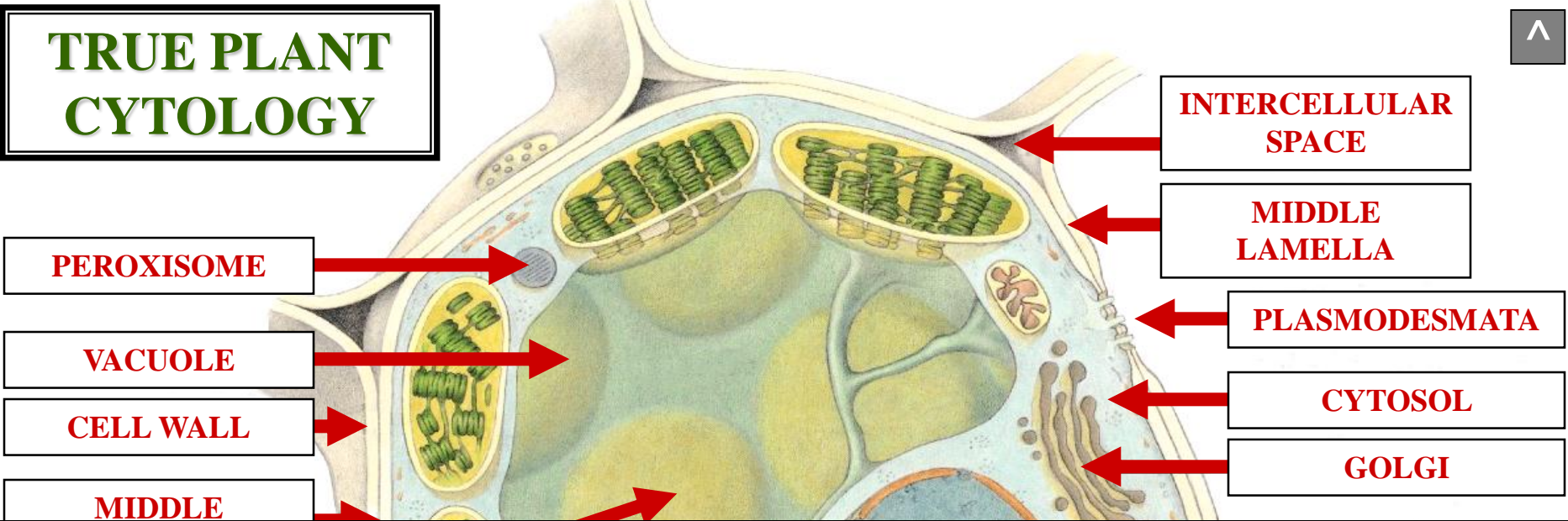
# TRUE PLANT CYTOLOGY



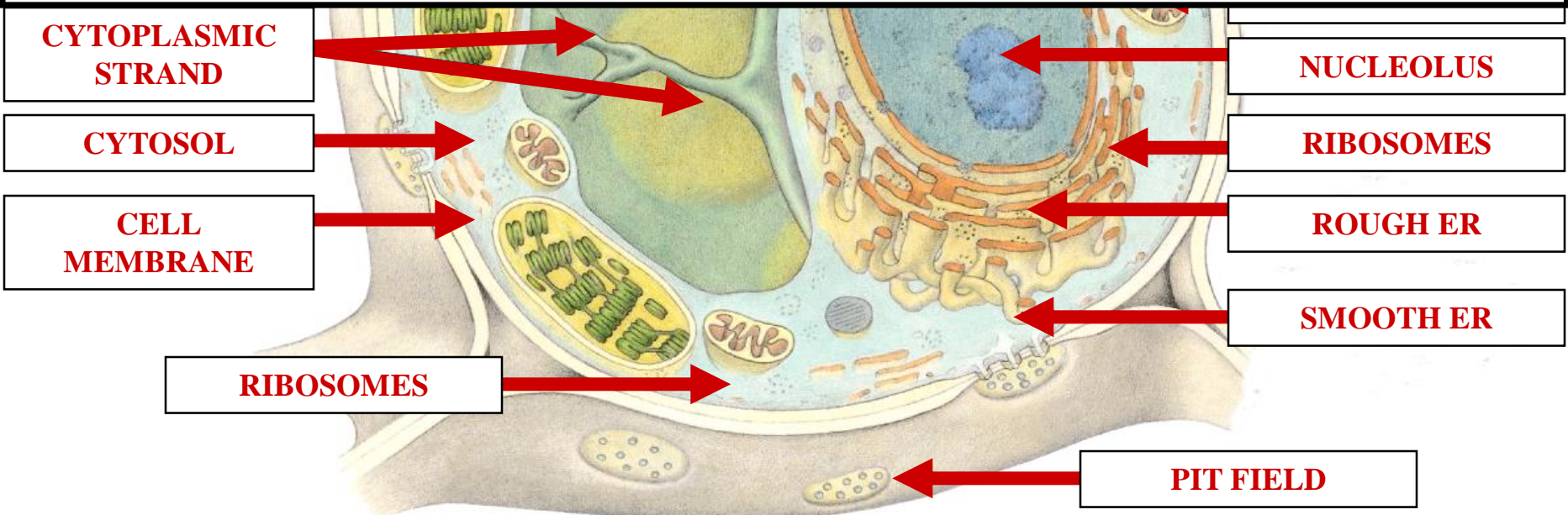
# ENDO-MEMBRANE SYSTEM



# TRUE PLANT CYTOLOGY



# MISCELLANEOUS CYTOLOGY







# MISCELLANEOUS CYTOLOGY

# CYTOSKELETON

# CYTOSKELETON



# CYTOSKELETON

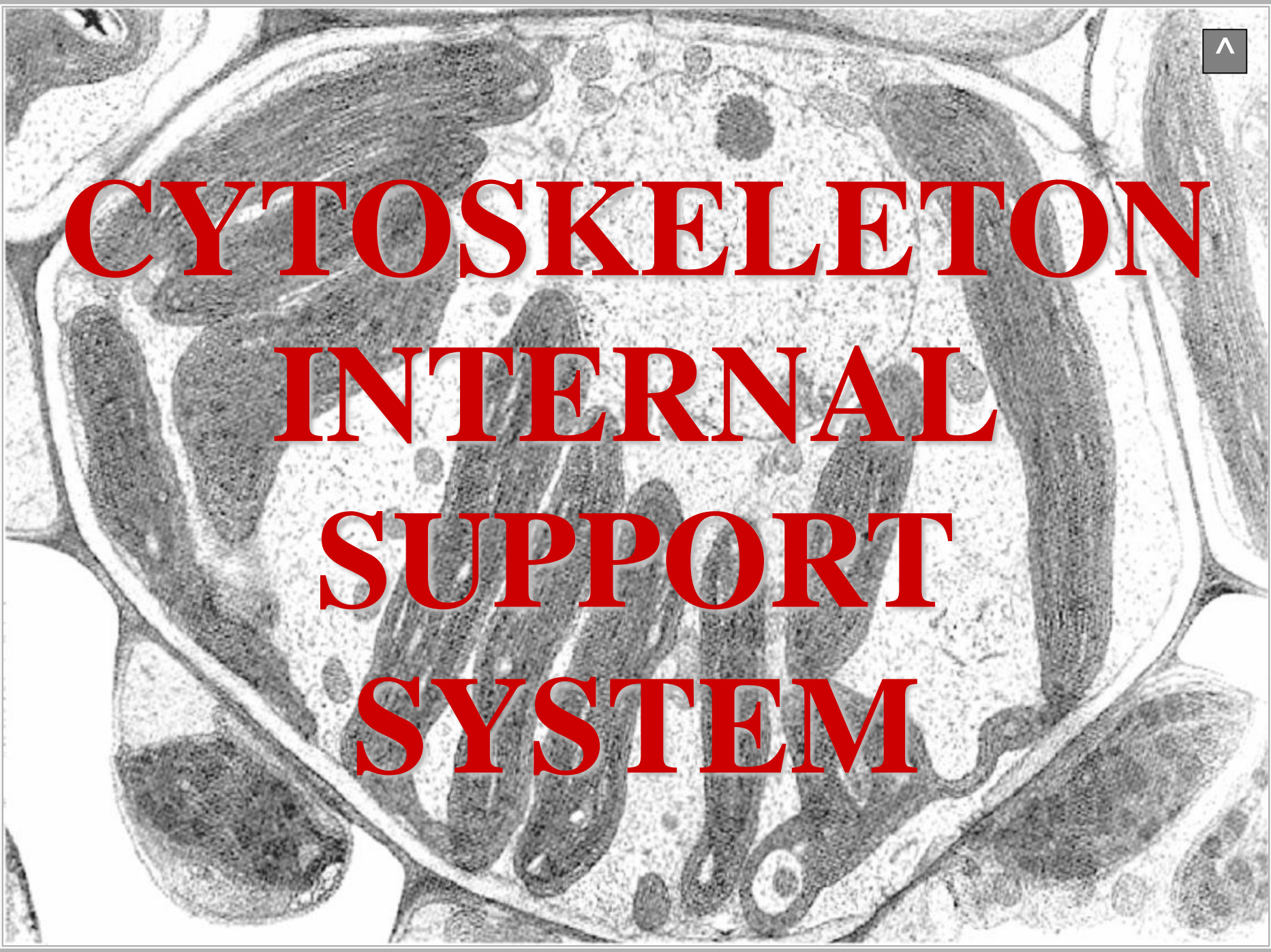


CELL INTERNAL  
STRUCTURAL  
SUPPORT SYSTEM

CYTOSKELETON



**CYTOSKELETON  
INTERNAL  
SUPPORT  
SYSTEM**



# CYTOSKELETON COMPONENTS

# **CYTOSKELETON COMPONENTS**

**MICROFILAMENTS**

# **CYTOSKELETON COMPONENTS**



# **CYTOSKELETON COMPONENTS**

**MICROFILAMENTS  
MICROTUBULES**

**CYTOSKELETON  
COMPONENTS**

# **MICROFILAMENTS**



# **CYTOSKELETON MICROFILAMENTS**

**SOLID ACTIN FILAMENTS**

# **CYTOSKELETON MICROFILAMENTS**



# **CYTOSKELETON MICROFILAMENTS**

**SOLID ACTIN FILAMENTS**

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**FOUND THROUGHOUT CYTOSOL**

# **CYTOSKELETON MICROFILAMENTS**





# **CYTOSKELETON MICROFILAMENTS**

**SOLID ACTIN FILAMENTS**

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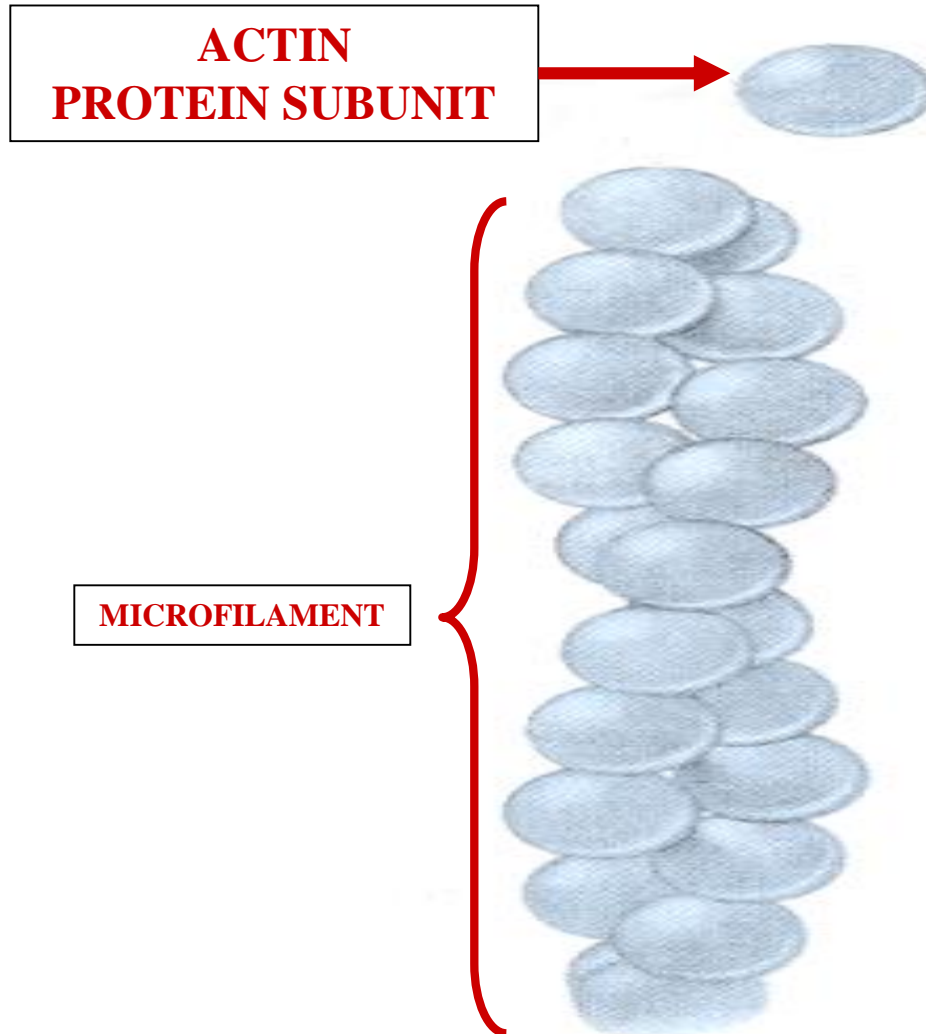
**FOUND THROUGHOUT CYTOSOL**

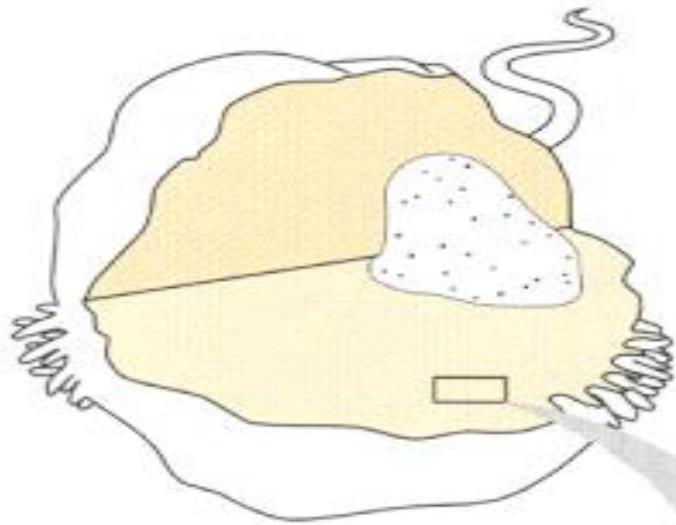
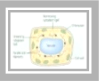
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**INDUCE CYCLOSIS**

# **CYTOSKELETON MICROFILAMENTS**

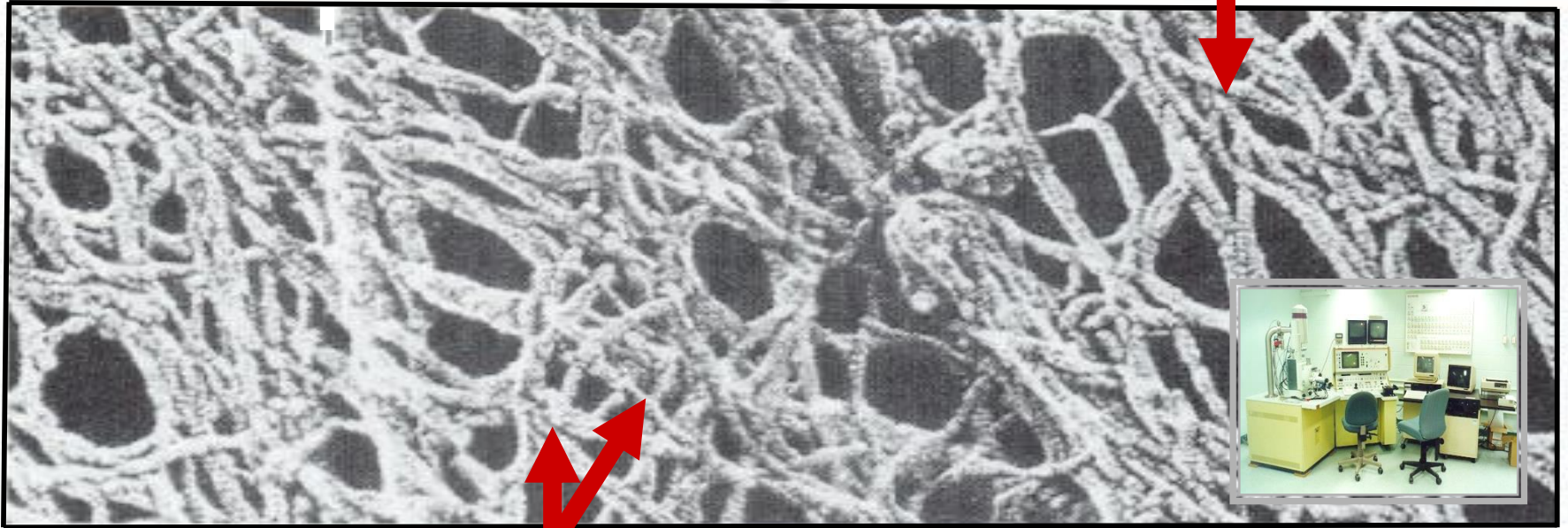
# MICROFILAMENT COMPOSITION





# CYTOSKELETON ULTRASTRUCTURE

**CYTOSOL**



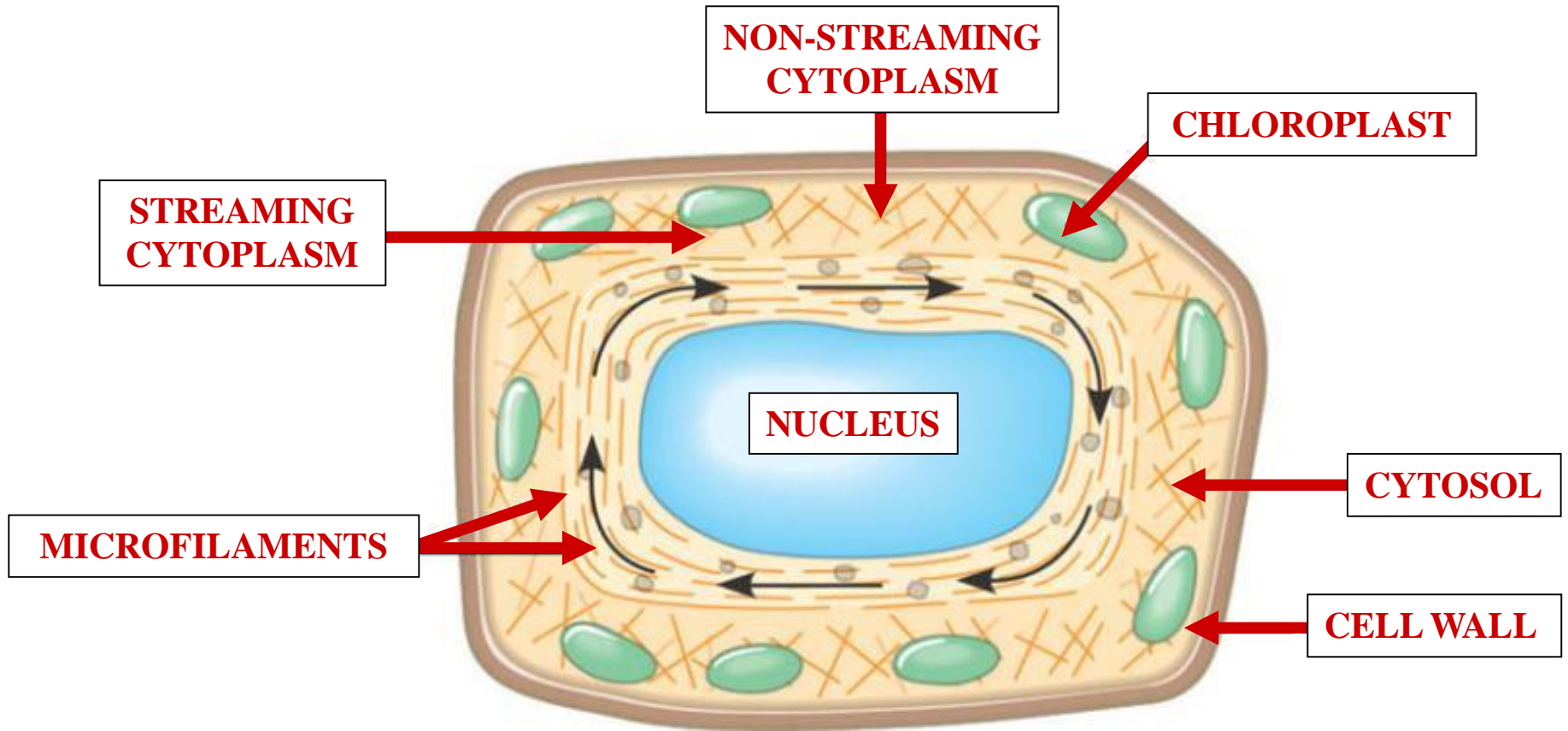
**MICROFILAMENTS**



# CYTOPLASMIC STREAMING



M



**CYTOPLASMIC STREAMING = CYCLOSIS**



An electron micrograph showing a cross-section of a cell. The cytoplasm is filled with various organelles, including mitochondria and endoplasmic reticulum. The text is overlaid on the image, describing cytoplasmic streaming. The text is in a bold, red, italicized serif font.

*CYTOPLASMIC  
STREAMING  
EQUALLY MIXES  
METABOLITES*



***EFFICIENT  
CELL  
METABOLISM***