



PRIMARY CELL WALL

**DERIVED DURING CELL GROWTH
HIGH PECTIN CONTENT
FLEXIBLE**

PRIMARY CELL WALL



PRIMARY CELL WALL

DERIVED DURING CELL GROWTH
HIGH PECTIN CONTENT
FLEXIBLE
ALWAYS PRESENT

PRIMARY CELL WALL

PRIMARY CELL WALL

P

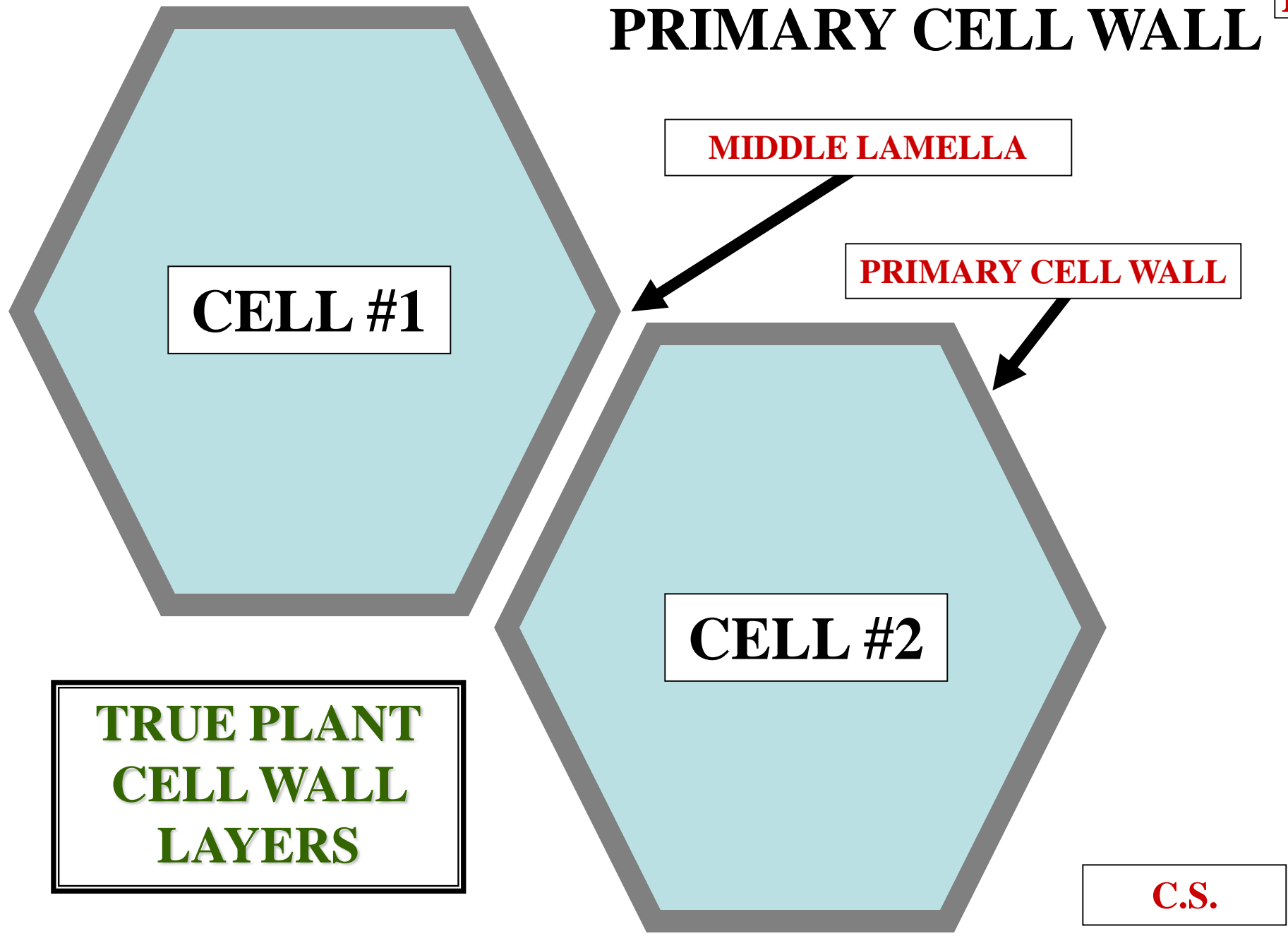
CELL #1

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

PRIMARY CELL WALL



CELL #1

MIDDLE LAMELLA

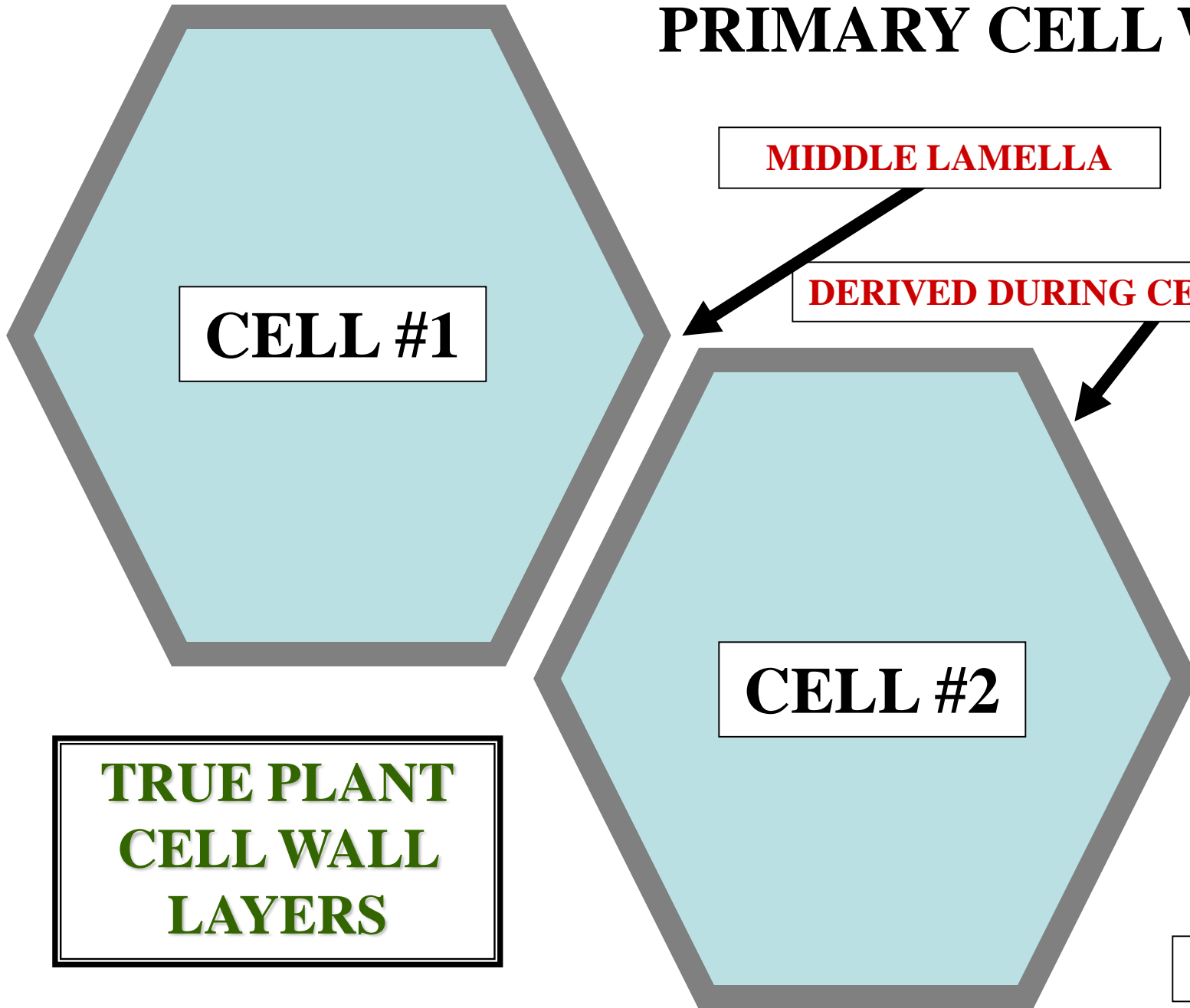
PRIMARY CELL WALL

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

PRIMARY CELL WALL ^H



MIDDLE LAMELLA

CELL #1

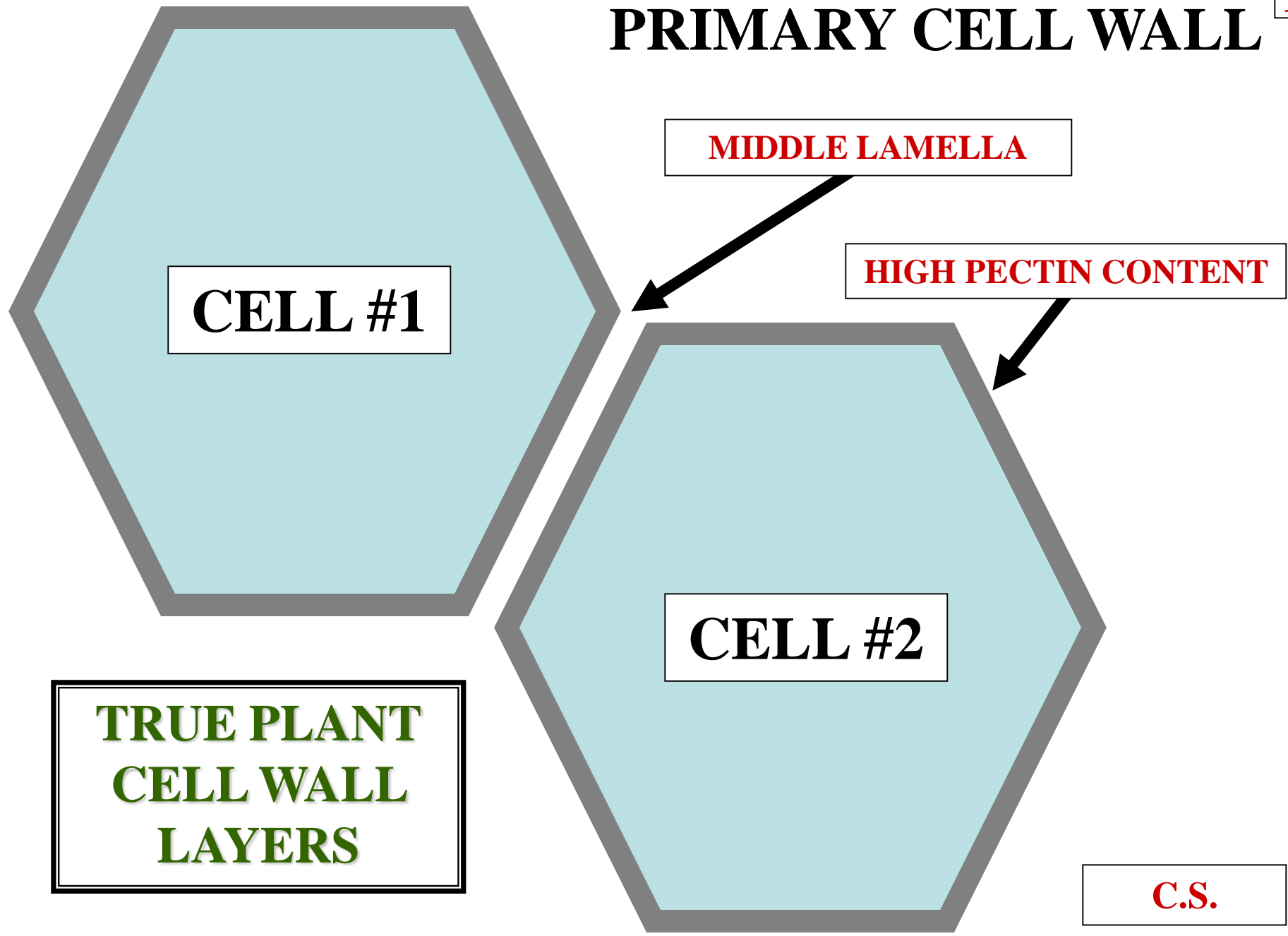
DERIVED DURING CELL GROWTH

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

PRIMARY CELL WALL



CELL #1

MIDDLE LAMELLA

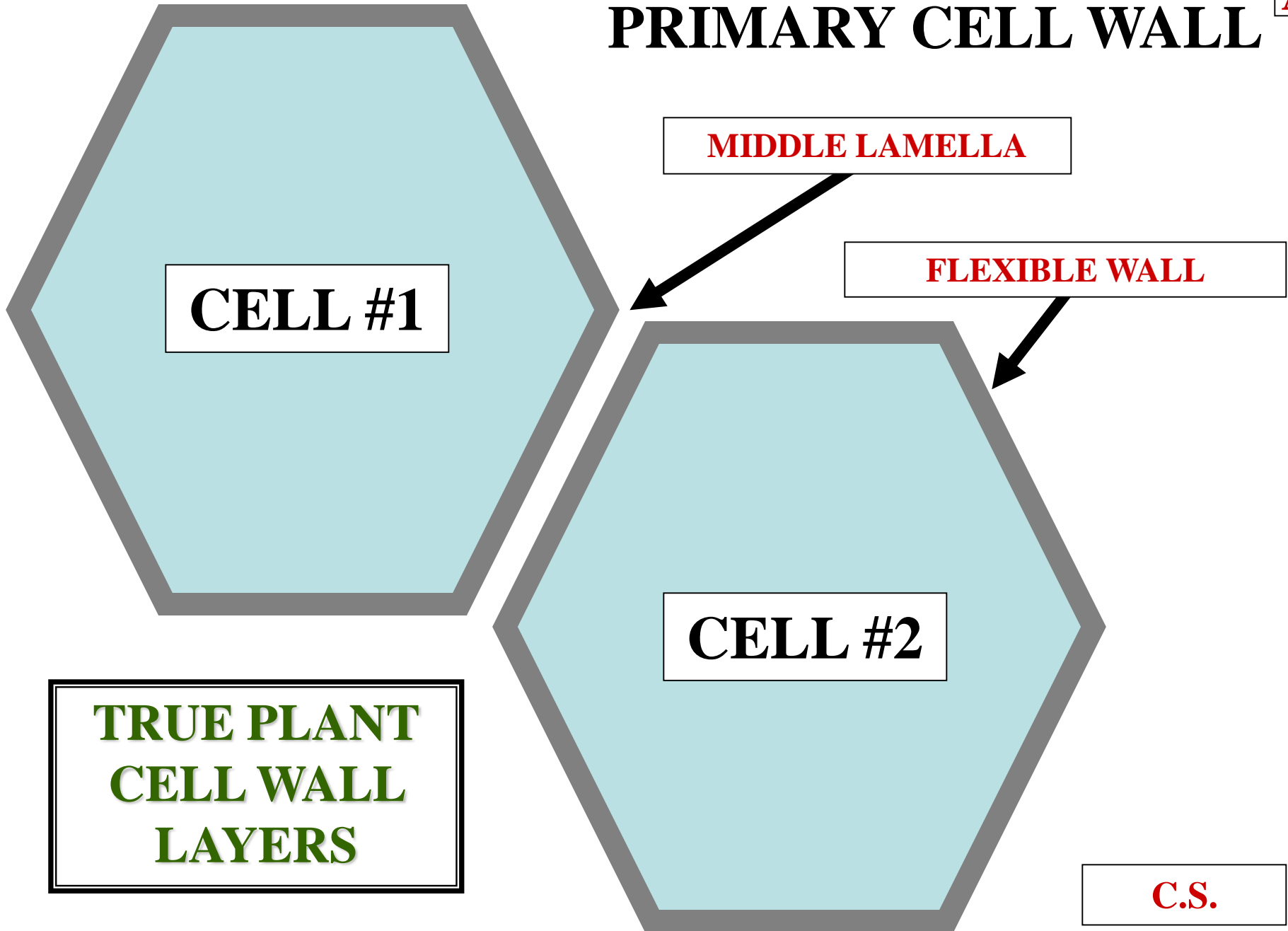
HIGH PECTIN CONTENT

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

PRIMARY CELL WALL



CELL #1

MIDDLE LAMELLA

FLEXIBLE WALL

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

PRIMARY CELL WALL

S

1

CELL #1

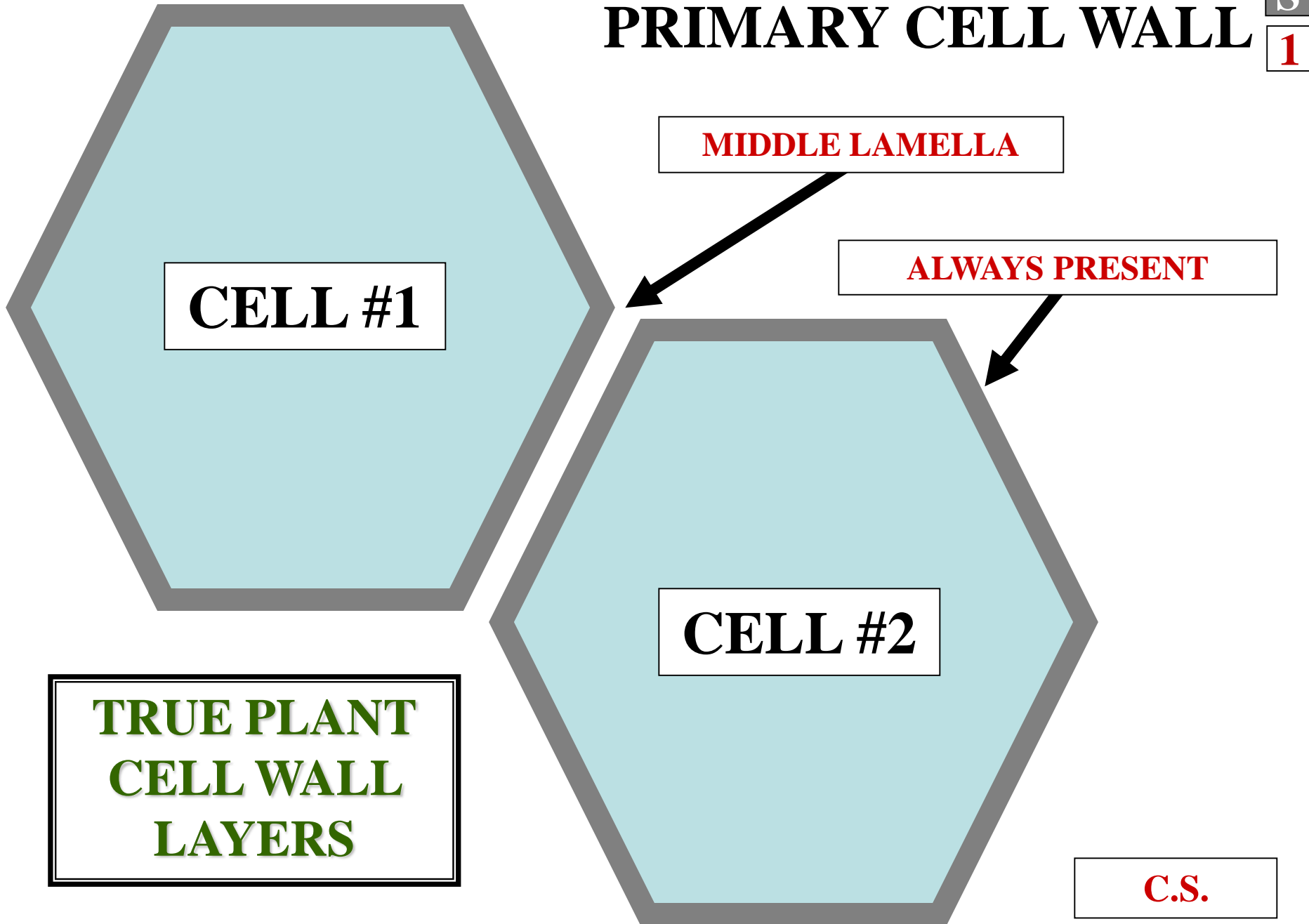
MIDDLE LAMELLA

ALWAYS PRESENT

CELL #2

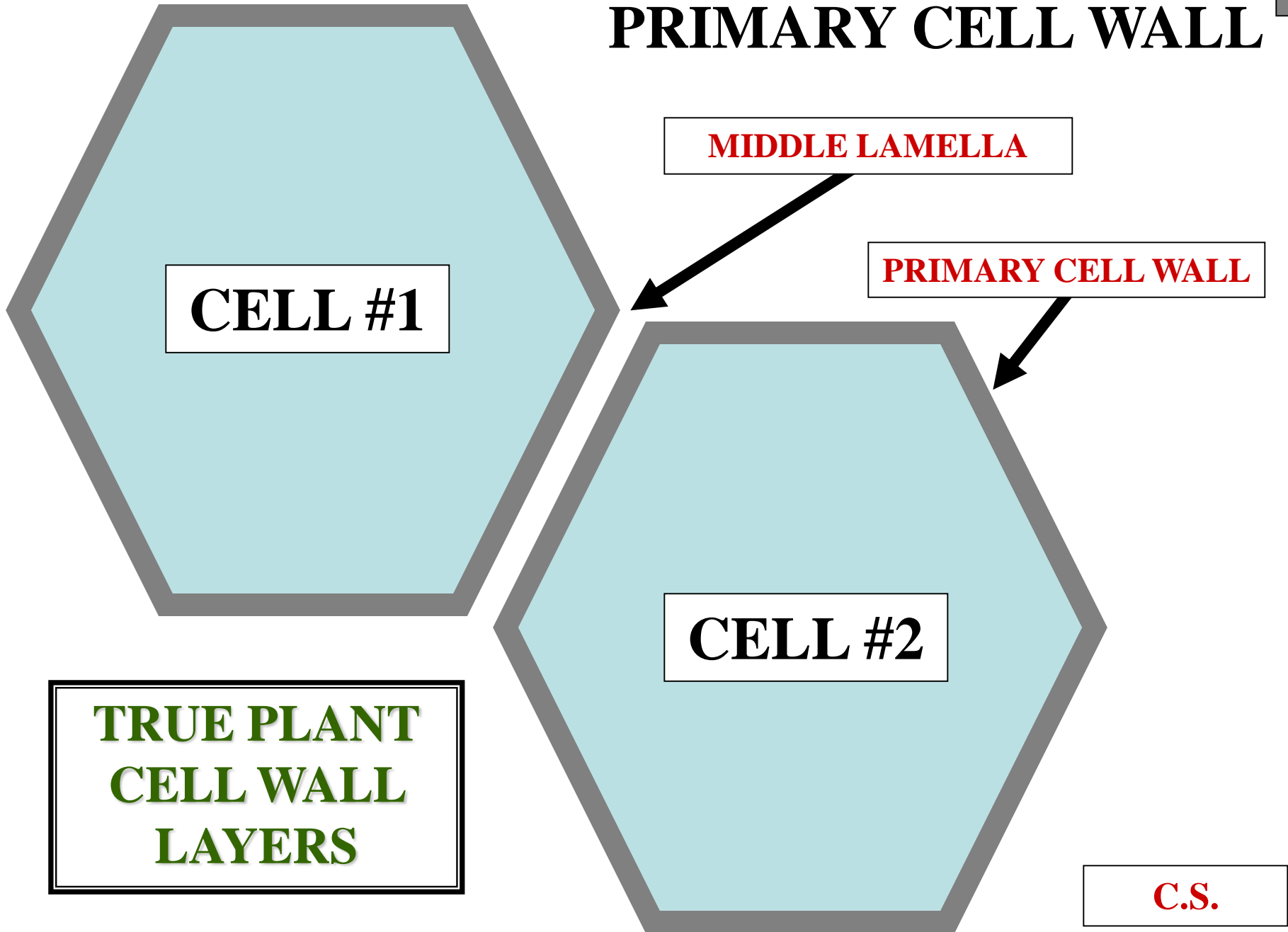
TRUE PLANT
CELL WALL
LAYERS

C.S.





PRIMARY CELL WALL



CELL #1

MIDDLE LAMELLA

PRIMARY CELL WALL

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

SECONDARY CELL WALL

SECONDARY CELL WALL

SECONDARY CELL WALL



DERIVED AFTER CELL GROWTH

SECONDARY CELL WALL



SECONDARY CELL WALL

DERIVED AFTER CELL GROWTH
DEPOSITED INWARD OF ~1 WALL

SECONDARY CELL WALL

SECONDARY CELL WALL



DERIVED AFTER CELL GROWTH
DEPOSITED INWARD OF ~1 WALL
HIGH LIGNIN CONTENT

SECONDARY CELL WALL



SECONDARY CELL WALL

DERIVED AFTER CELL GROWTH
DEPOSITED INWARD OF ~1 WALL
HIGH LIGNIN CONTENT
RIGID

SECONDARY CELL WALL

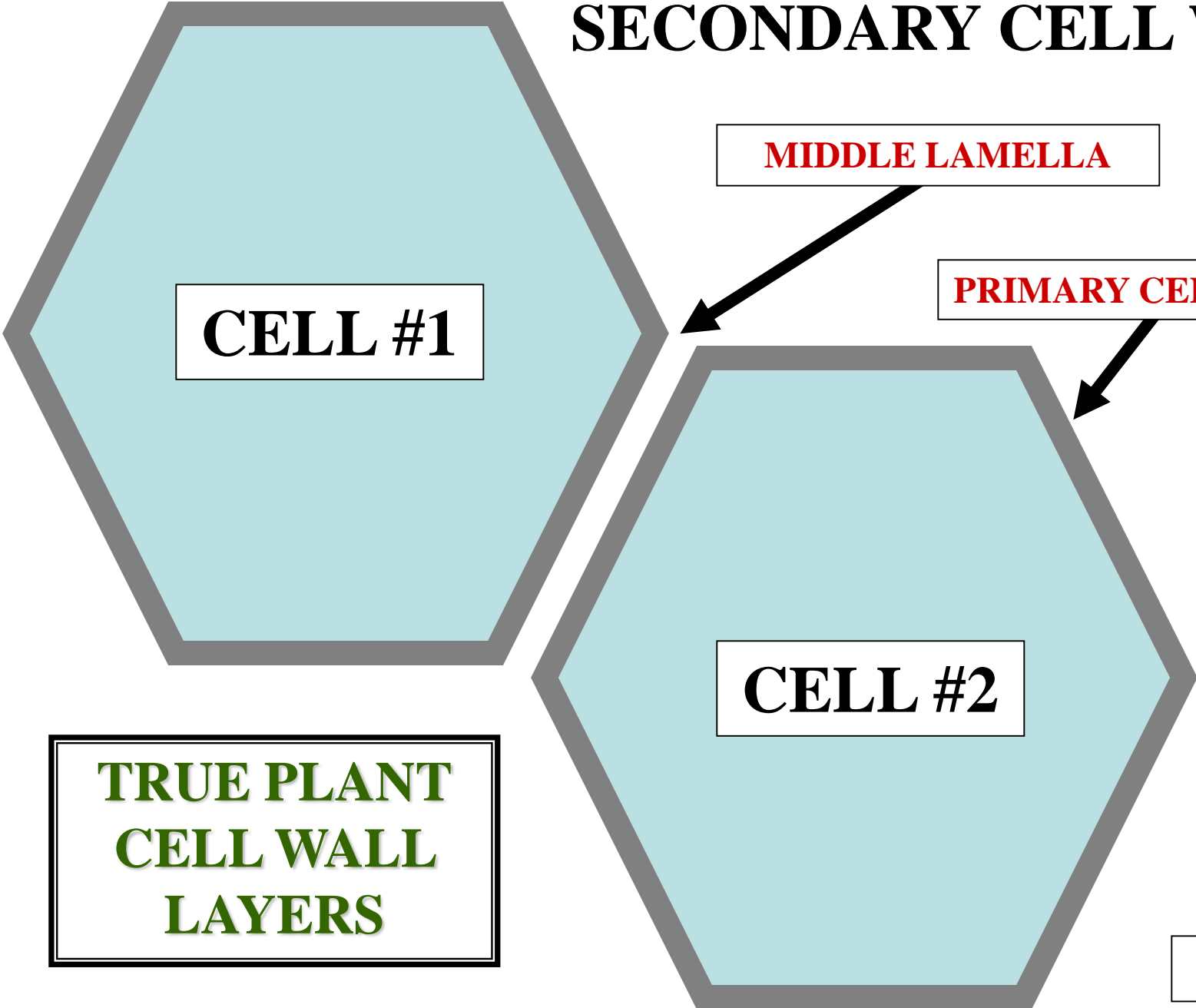
SECONDARY CELL WALL



DERIVED AFTER CELL GROWTH
DEPOSITED INWARD OF ~1 WALL
HIGH LIGNIN CONTENT
RIGID
PRESENT OR ABSENT

SECONDARY CELL WALL

SECONDARY CELL WALL



CELL #1

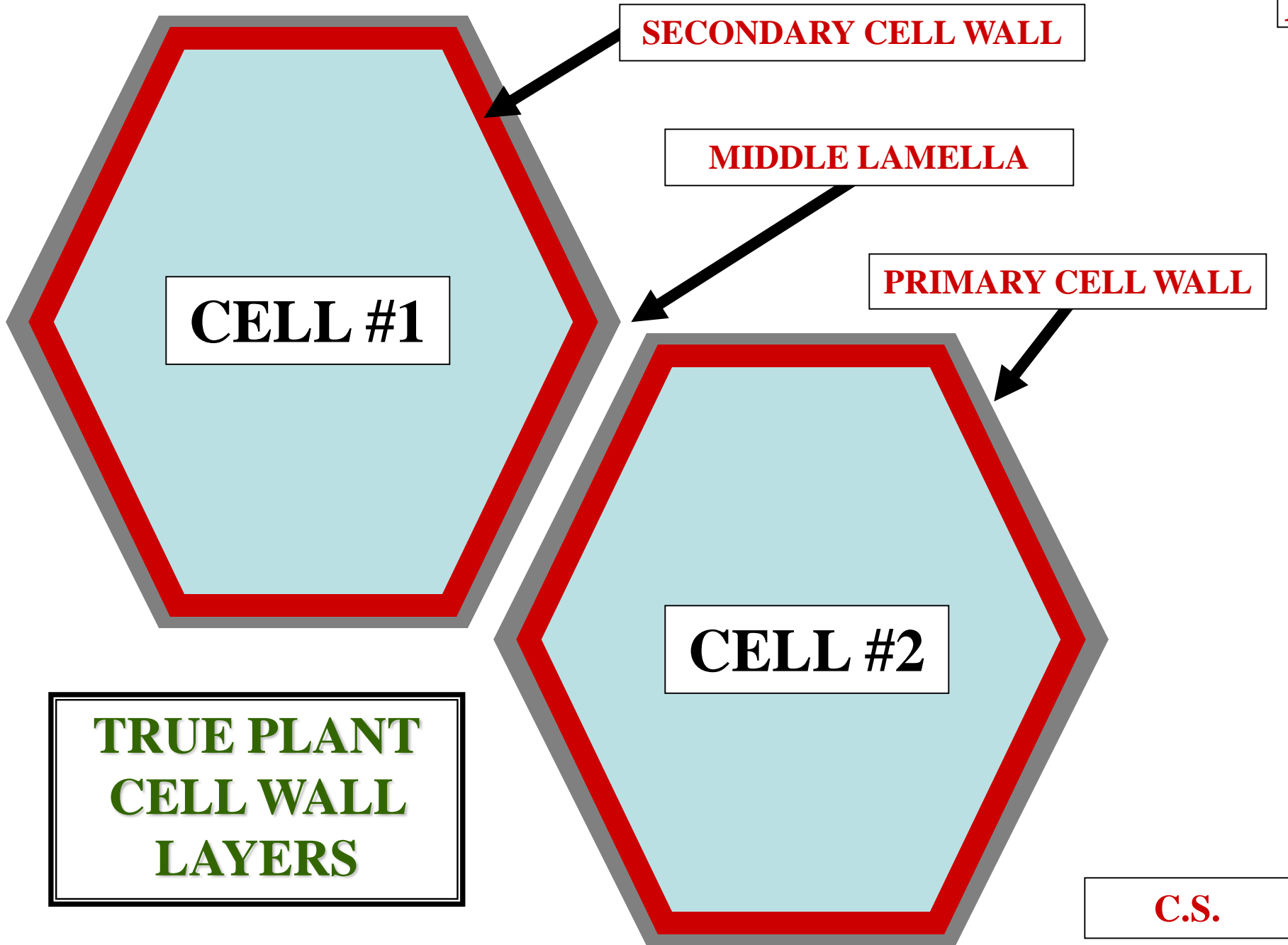
MIDDLE LAMELLA

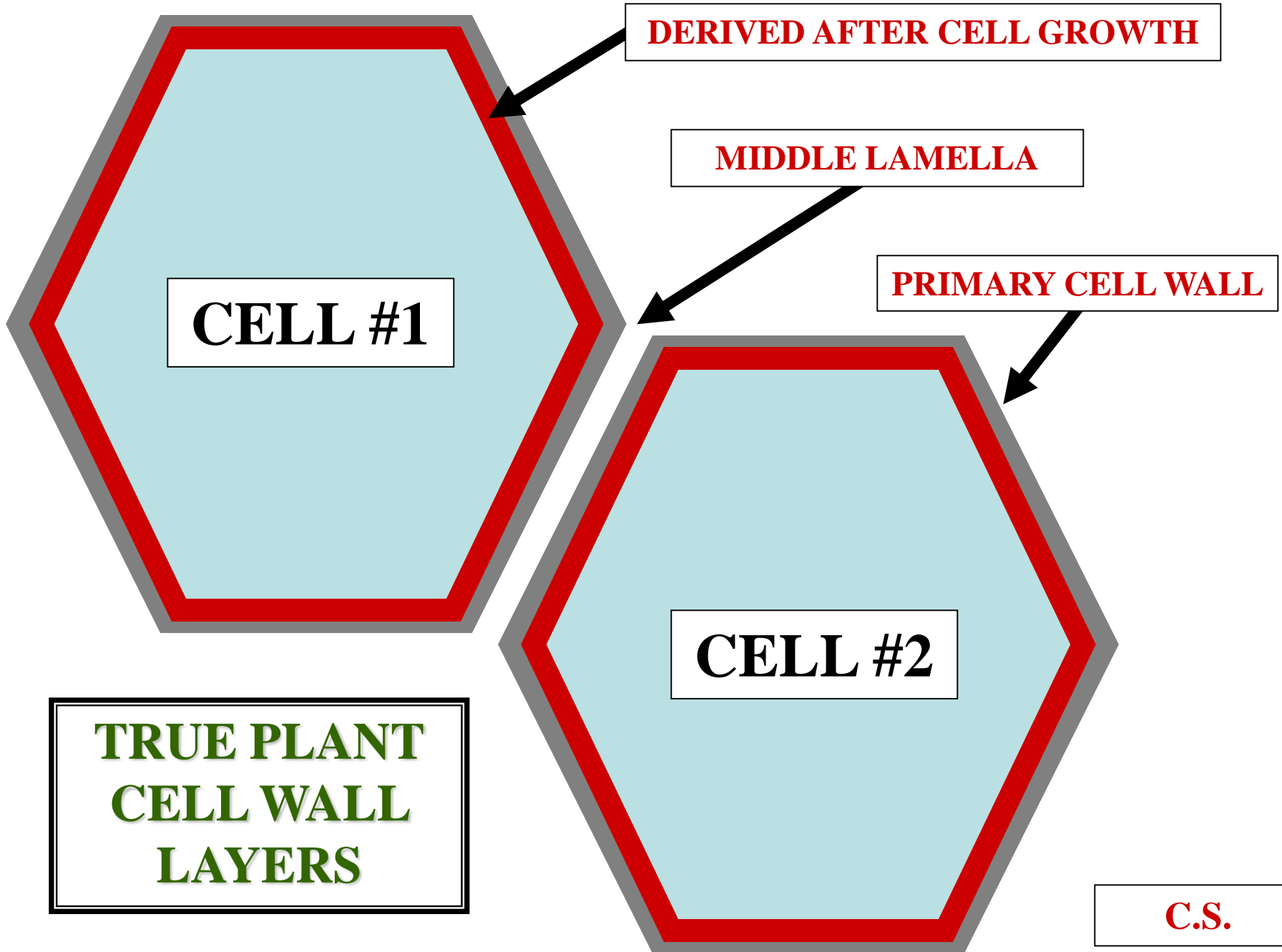
PRIMARY CELL WALL

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.





DERIVED AFTER CELL GROWTH

MIDDLE LAMELLA

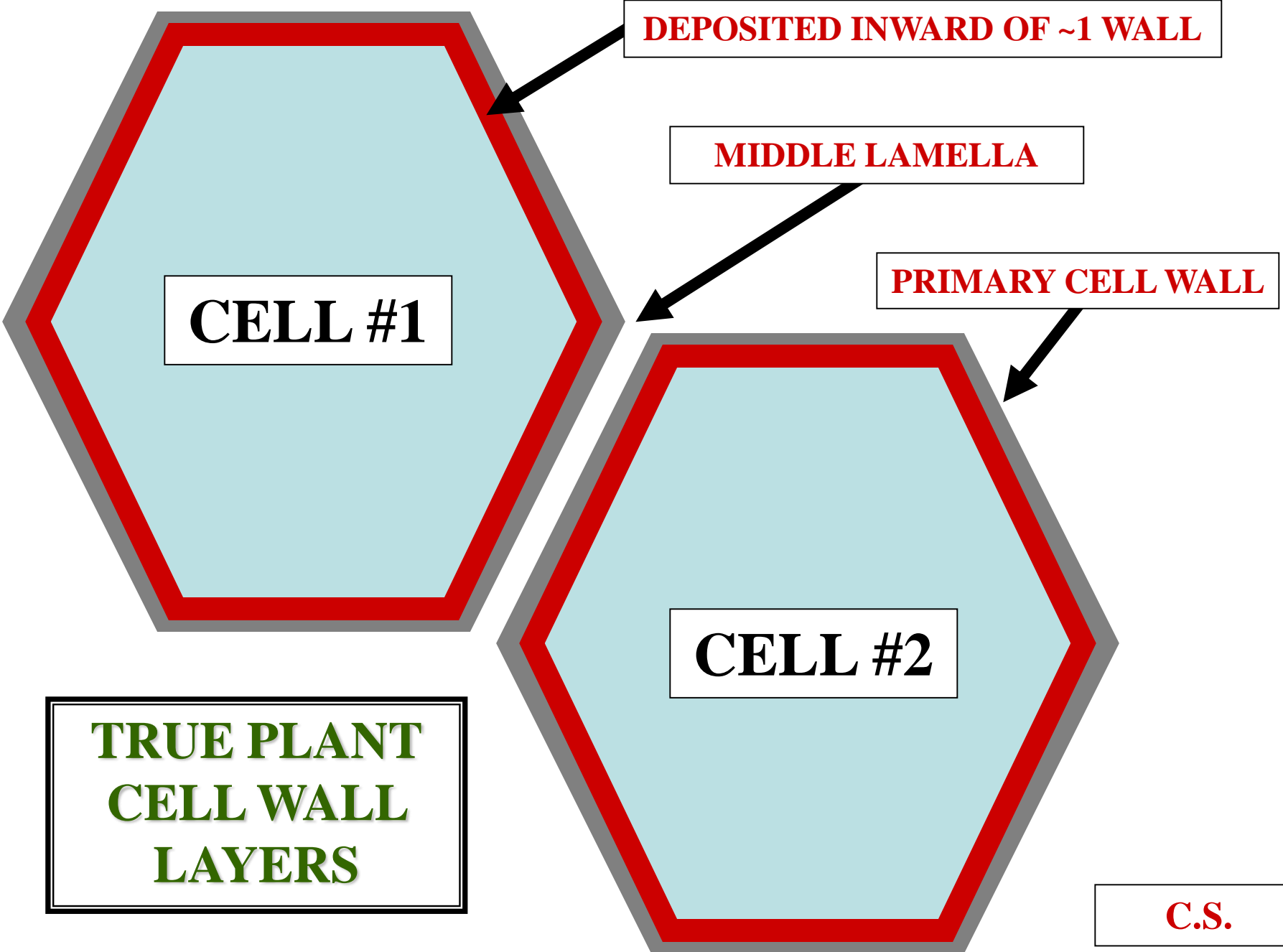
PRIMARY CELL WALL

CELL #1

CELL #2

TRUE PLANT
CELL WALL
LAYERS

C.S.



DEPOSITED INWARD OF ~1 WALL

MIDDLE LAMELLA

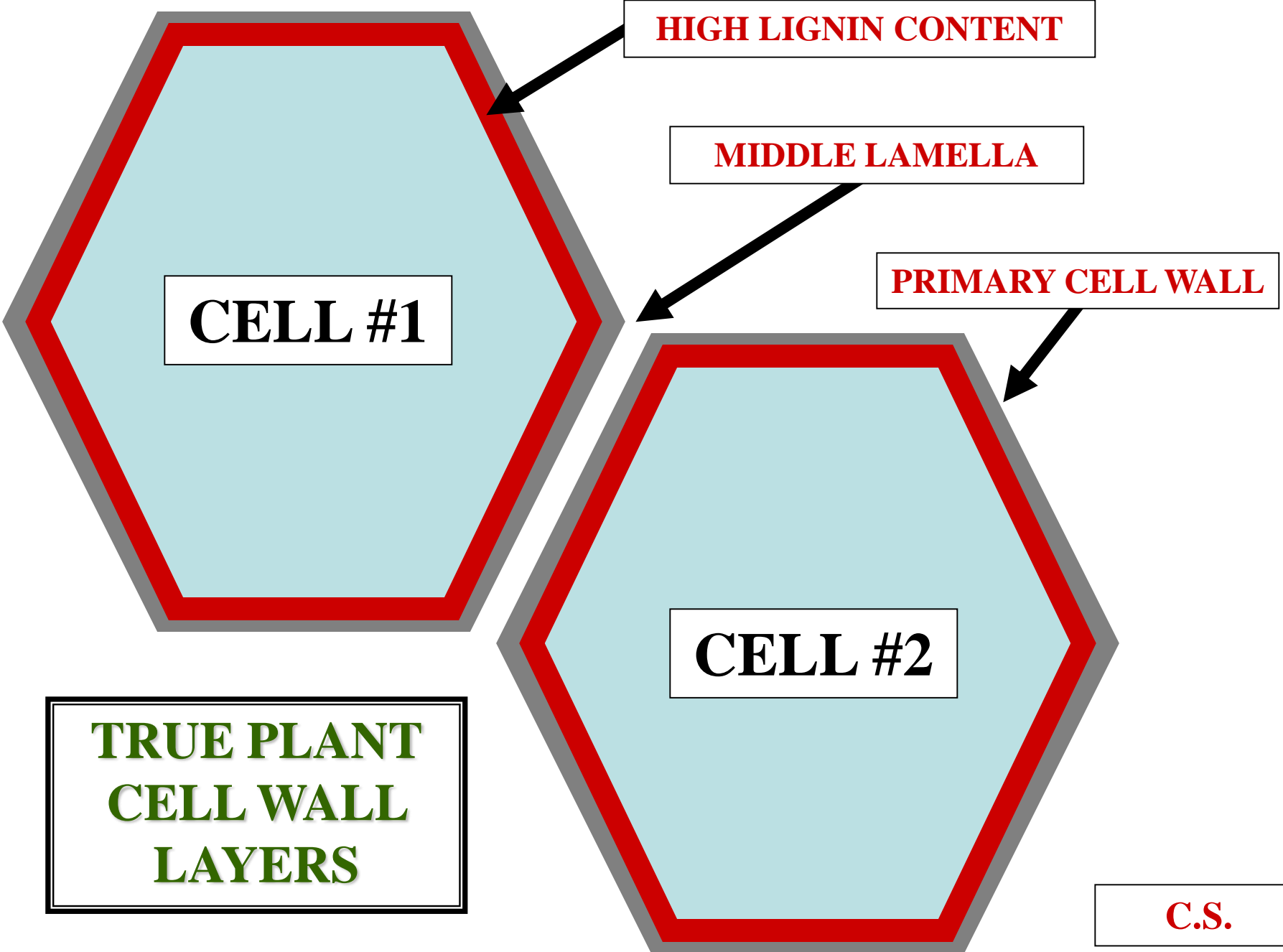
PRIMARY CELL WALL

CELL #1

CELL #2

TRUE PLANT
CELL WALL
LAYERS

C.S.



HIGH LIGNIN CONTENT

MIDDLE LAMELLA

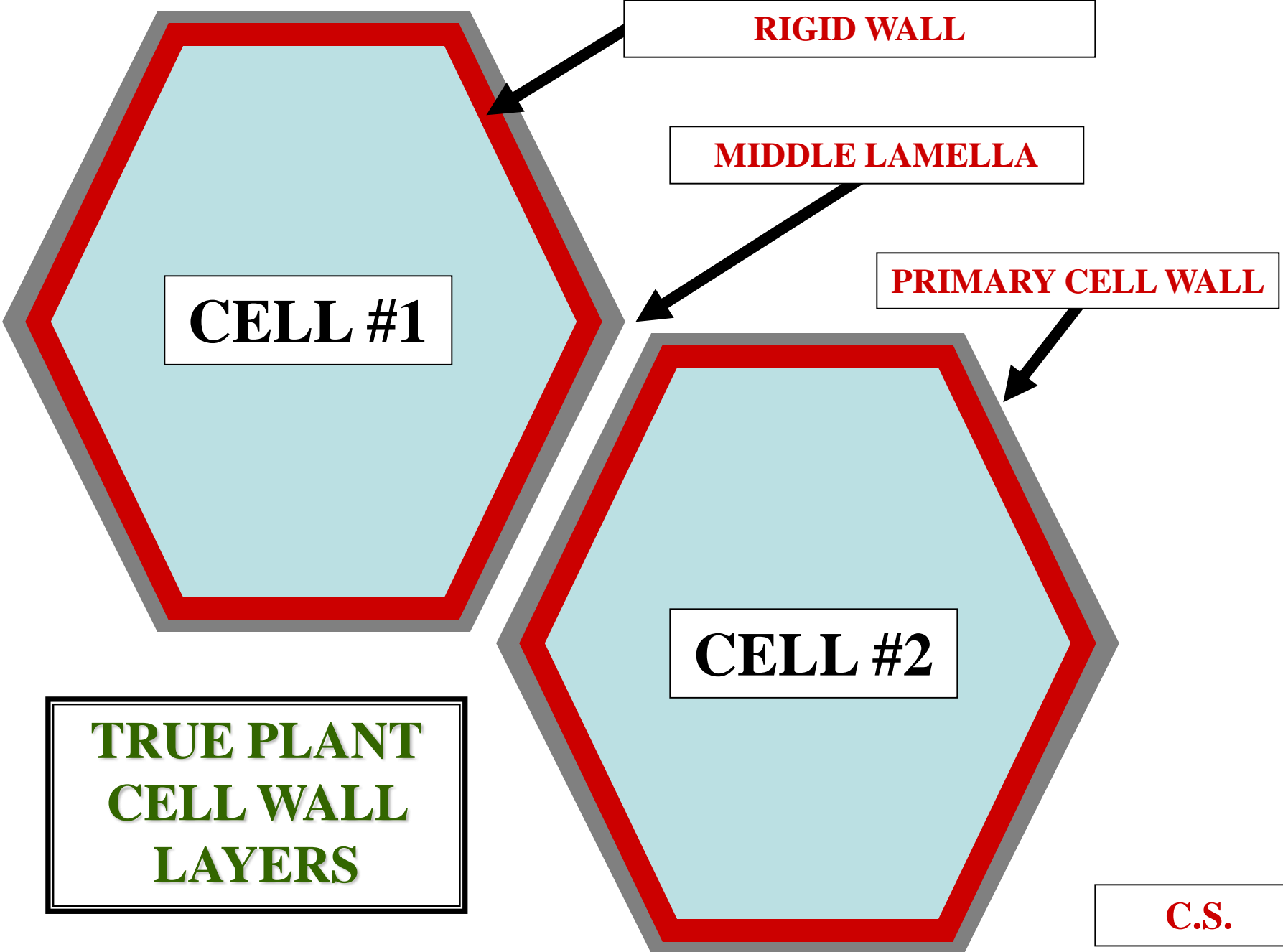
PRIMARY CELL WALL

CELL #1

CELL #2

TRUE PLANT
CELL WALL
LAYERS

C.S.



CELL #1

RIGID WALL

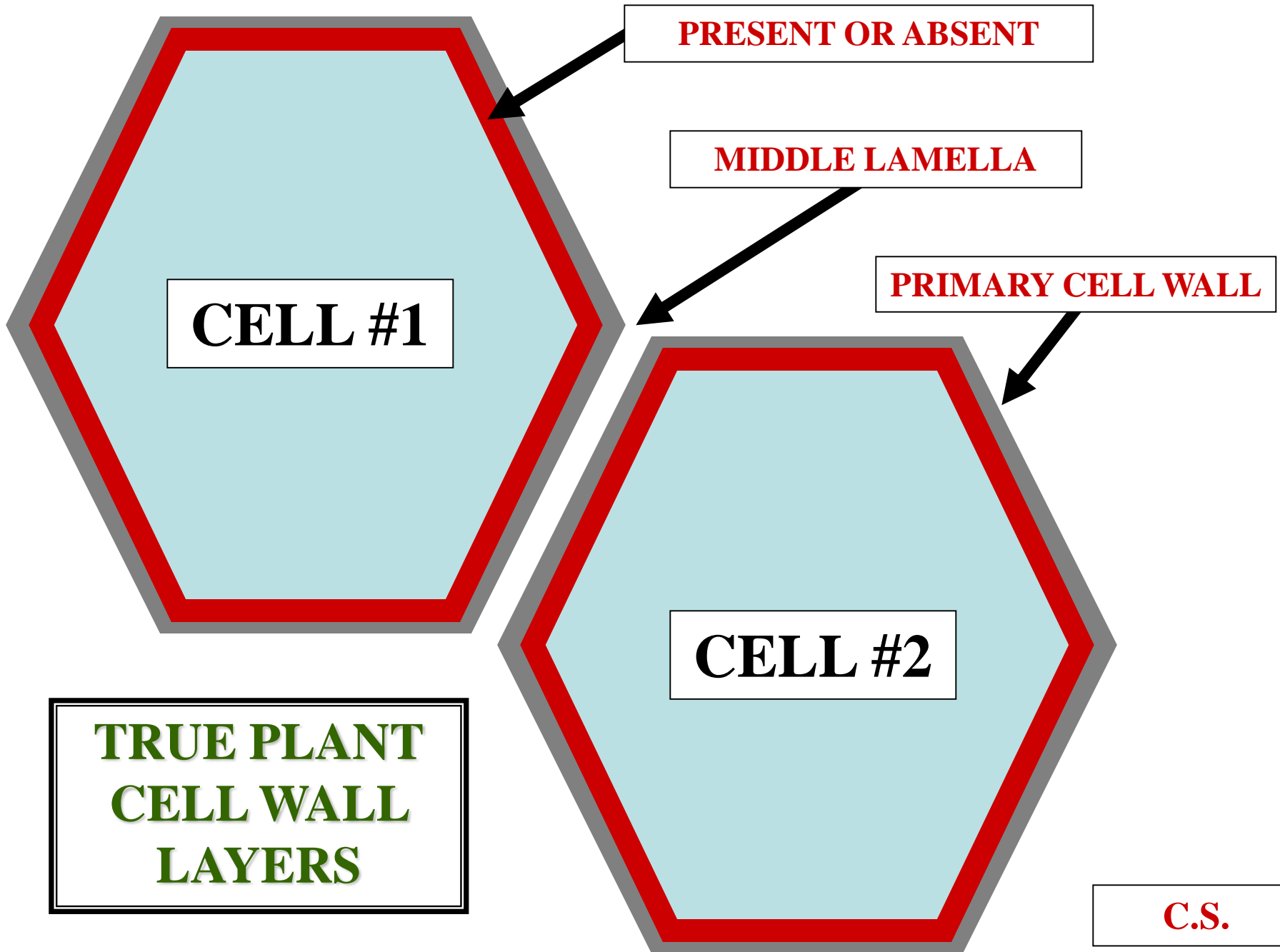
MIDDLE LAMELLA

PRIMARY CELL WALL

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.



PRESENT OR ABSENT

MIDDLE LAMELLA

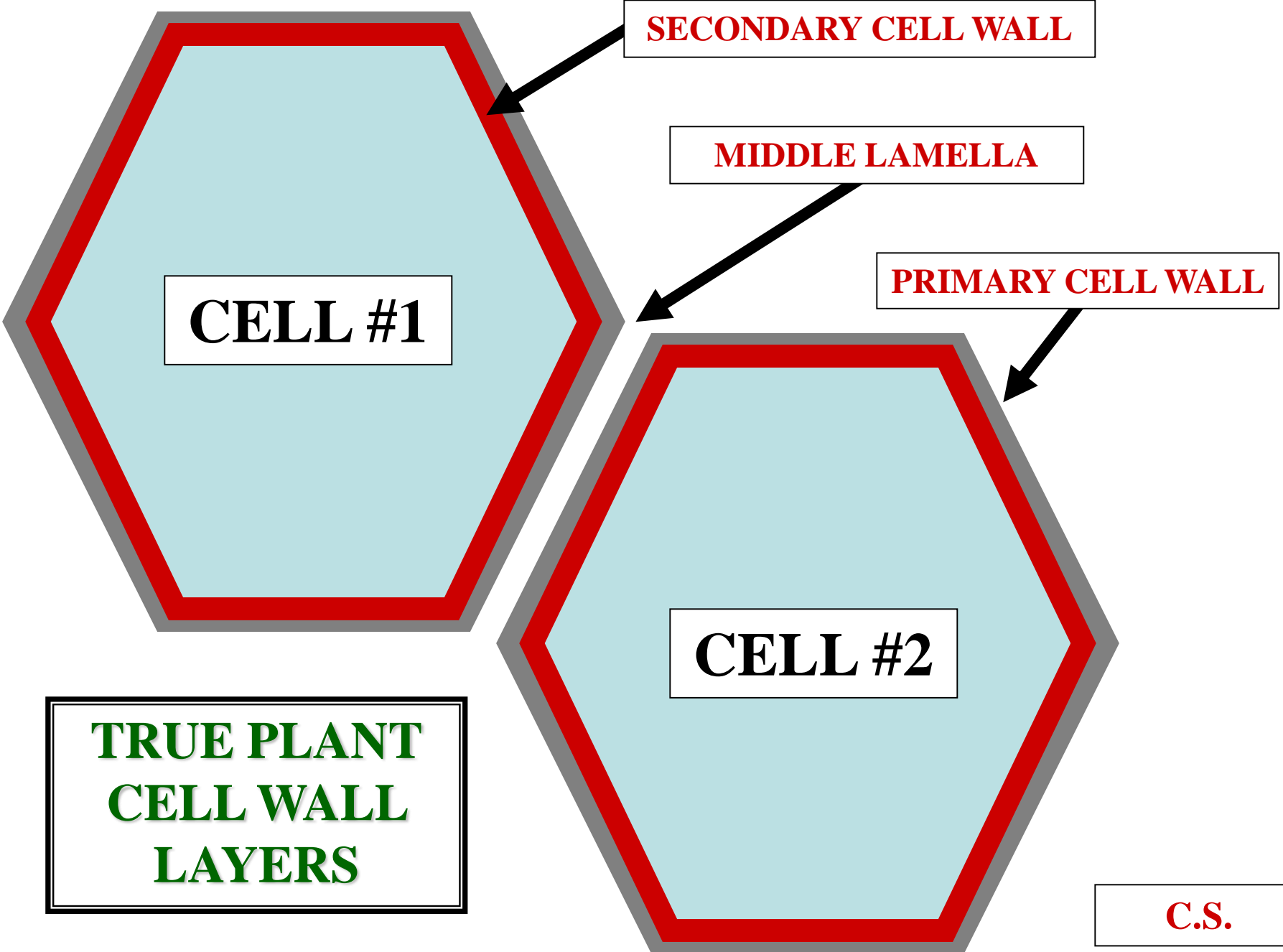
PRIMARY CELL WALL

CELL #1

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.



SECONDARY CELL WALL

MIDDLE LAMELLA

PRIMARY CELL WALL

CELL #1

CELL #2

**TRUE PLANT
CELL WALL
LAYERS**

C.S.

PLASMODESMATA

PLASMODESMATA



PLASMODESMATA

**PRIMARY WALL CONDUITS
BETWEEN ADJACENT CELLS**

PLASMODESMATA



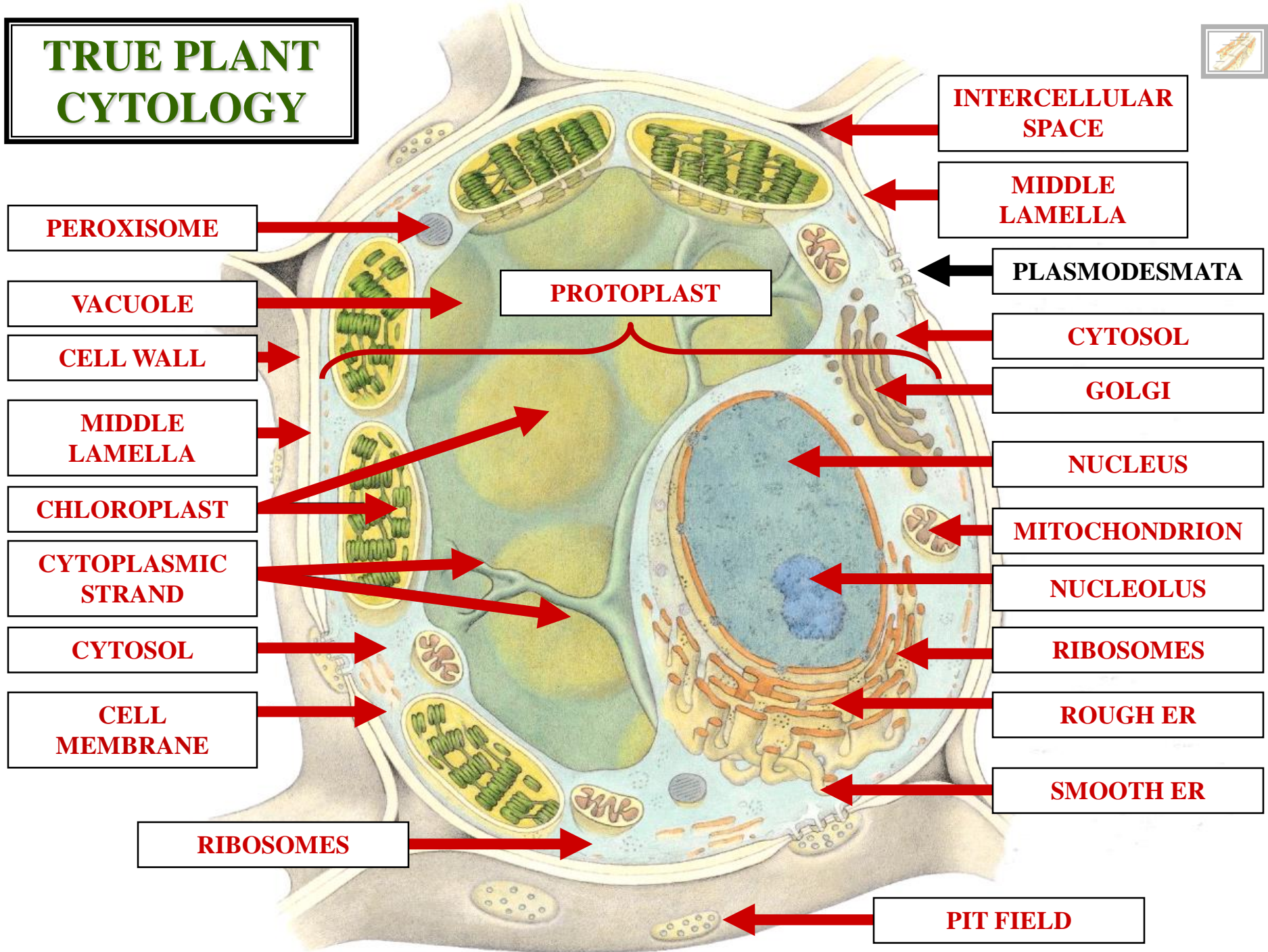
PLASMODESMATA

**PRIMARY WALL CONDUITS
BETWEEN ADJACENT CELLS**

**INTERCELLULAR
COMMUNICATION**

PLASMODESMATA

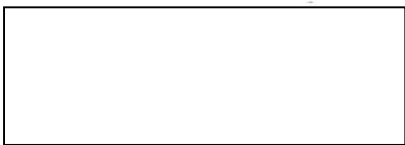
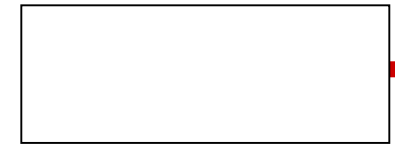
TRUE PLANT CYTOLOGY



CELL #1

**PRIMARY
CELL WALL**

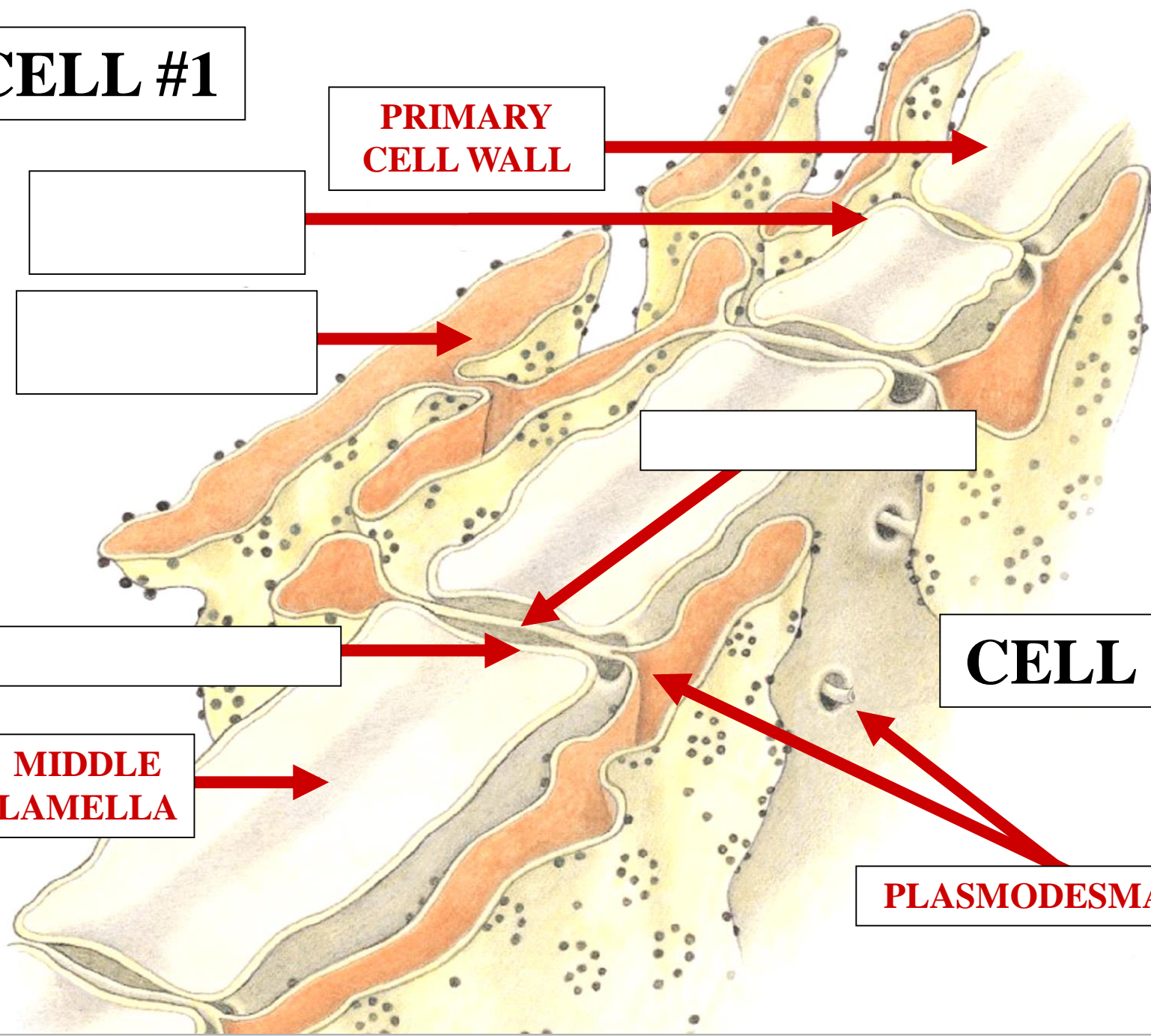
I



CELL #2

**MIDDLE
LAMELLA**

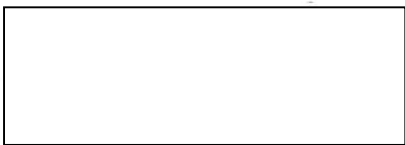
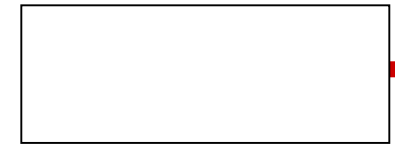
PLASMODESMATA



CELL #1



PRIMARY CELL WALL

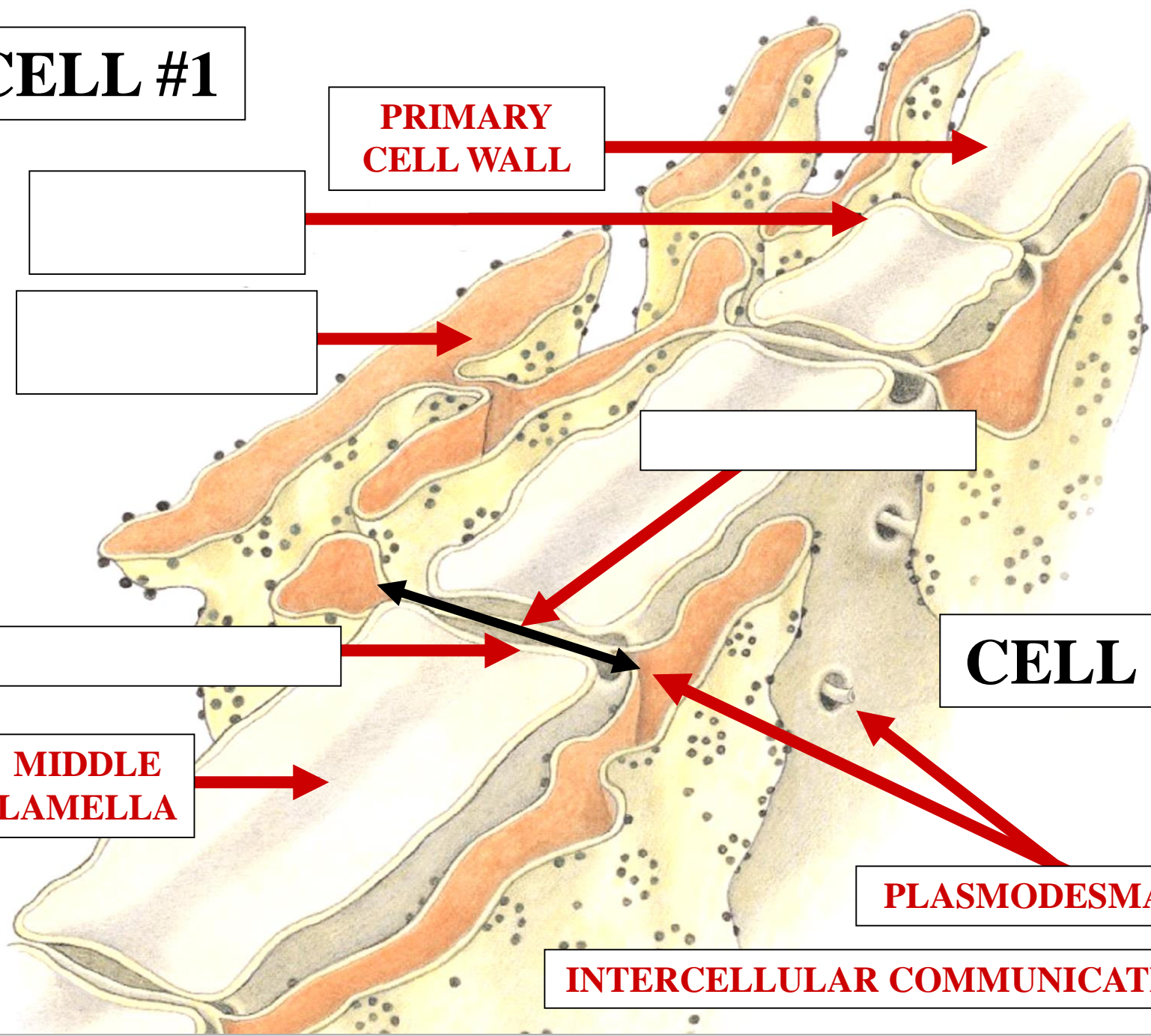


MIDDLE LAMELLA

CELL #2

PLASMODESMATA

INTERCELLULAR COMMUNICATION

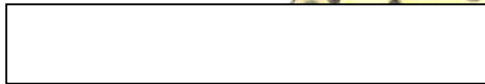
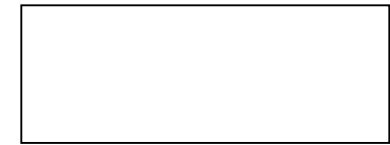




PLASMODESMATA ULTRASTRUCTURE

CELL #1

**PRIMARY
CELL WALL**



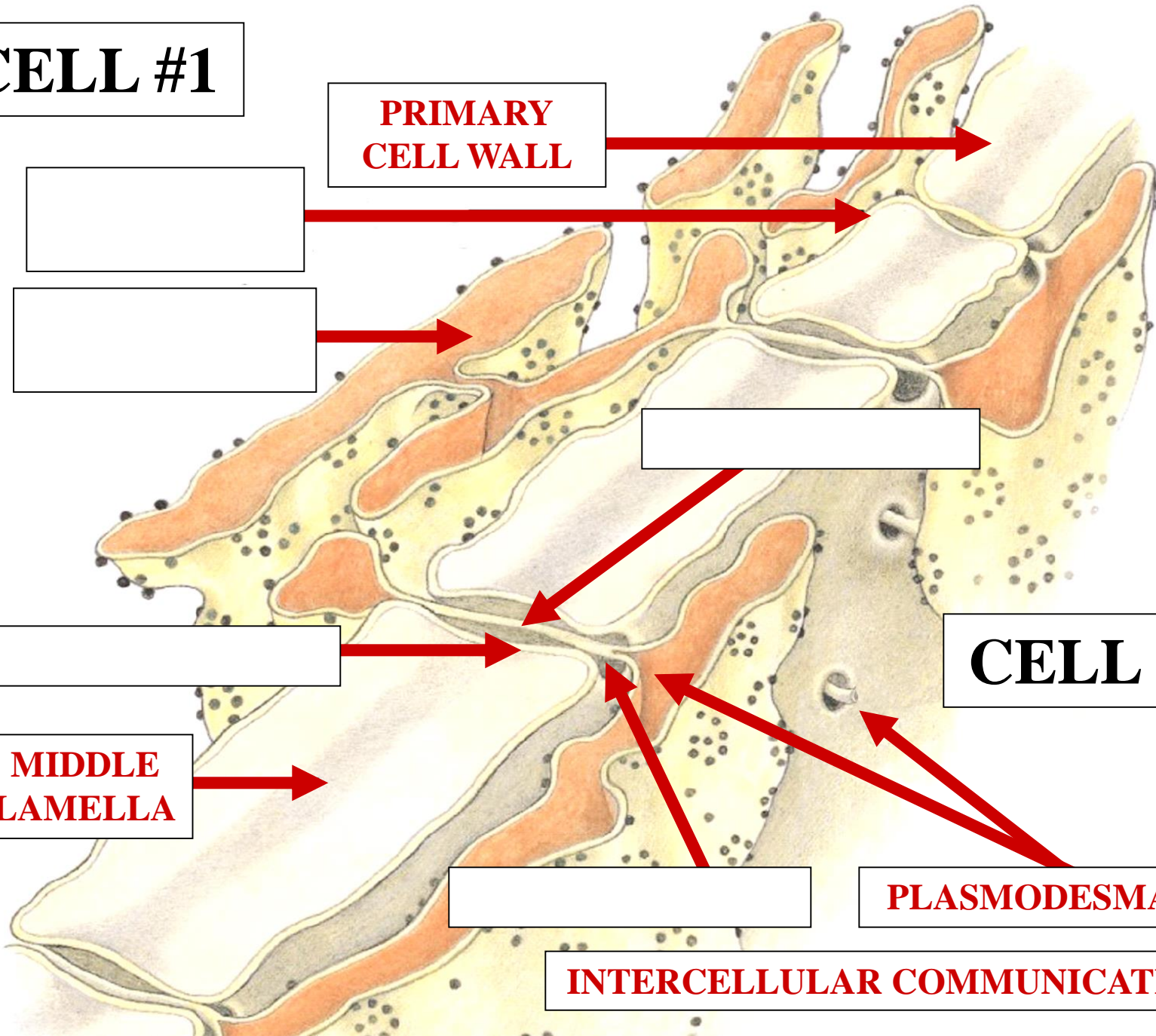
**MIDDLE
LAMELLA**

CELL #2



PLASMODESMATA

INTERCELLULAR COMMUNICATION



CELL #1

**PRIMARY
CELL WALL**

[]

[]

CELL MEMBRANE

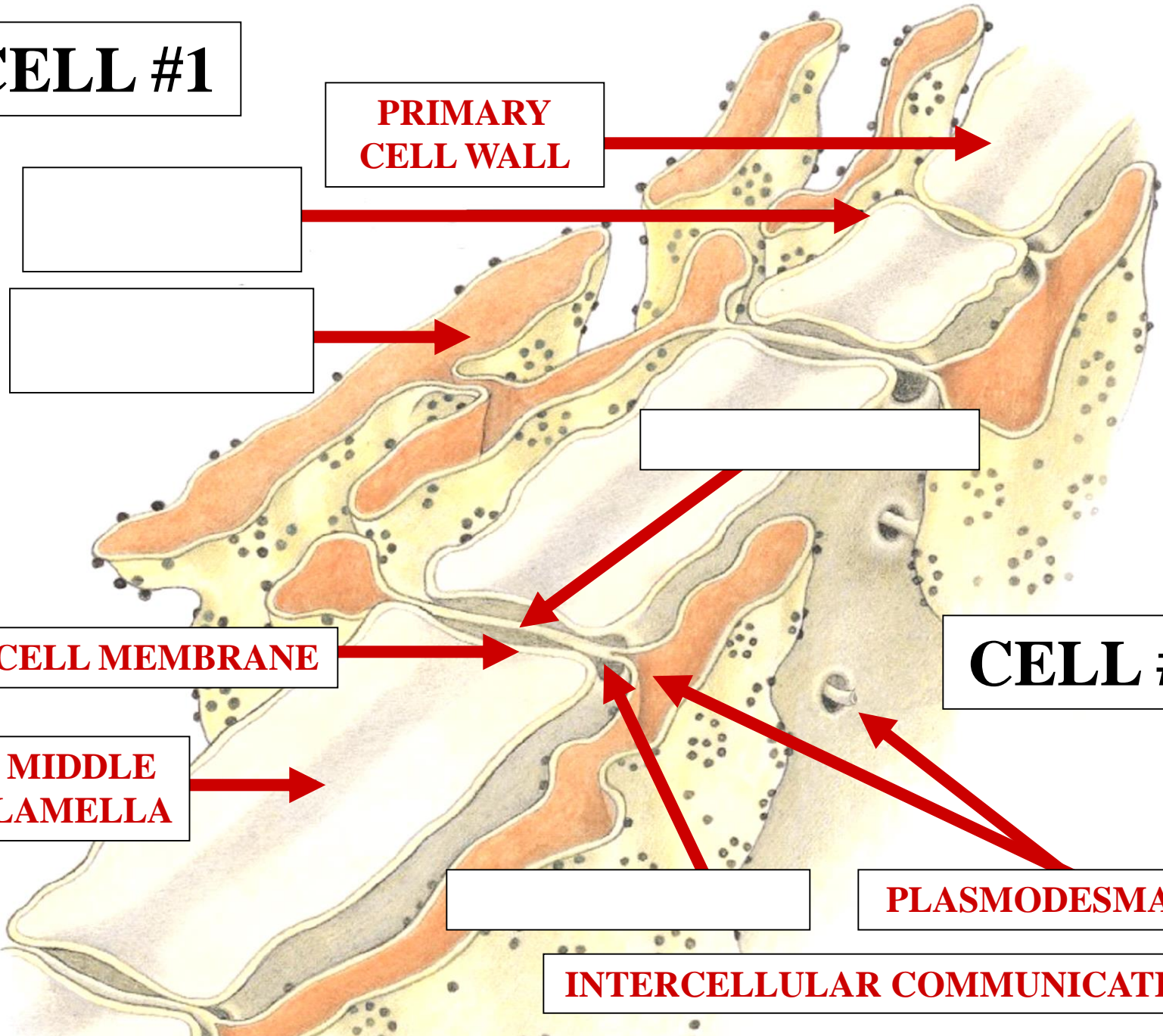
**MIDDLE
LAMELLA**

CELL #2

[]

PLASMODESMATA

INTERCELLULAR COMMUNICATION



CELL #1

D

**PRIMARY
CELL WALL**

[]

[]

DESMOTUBULE

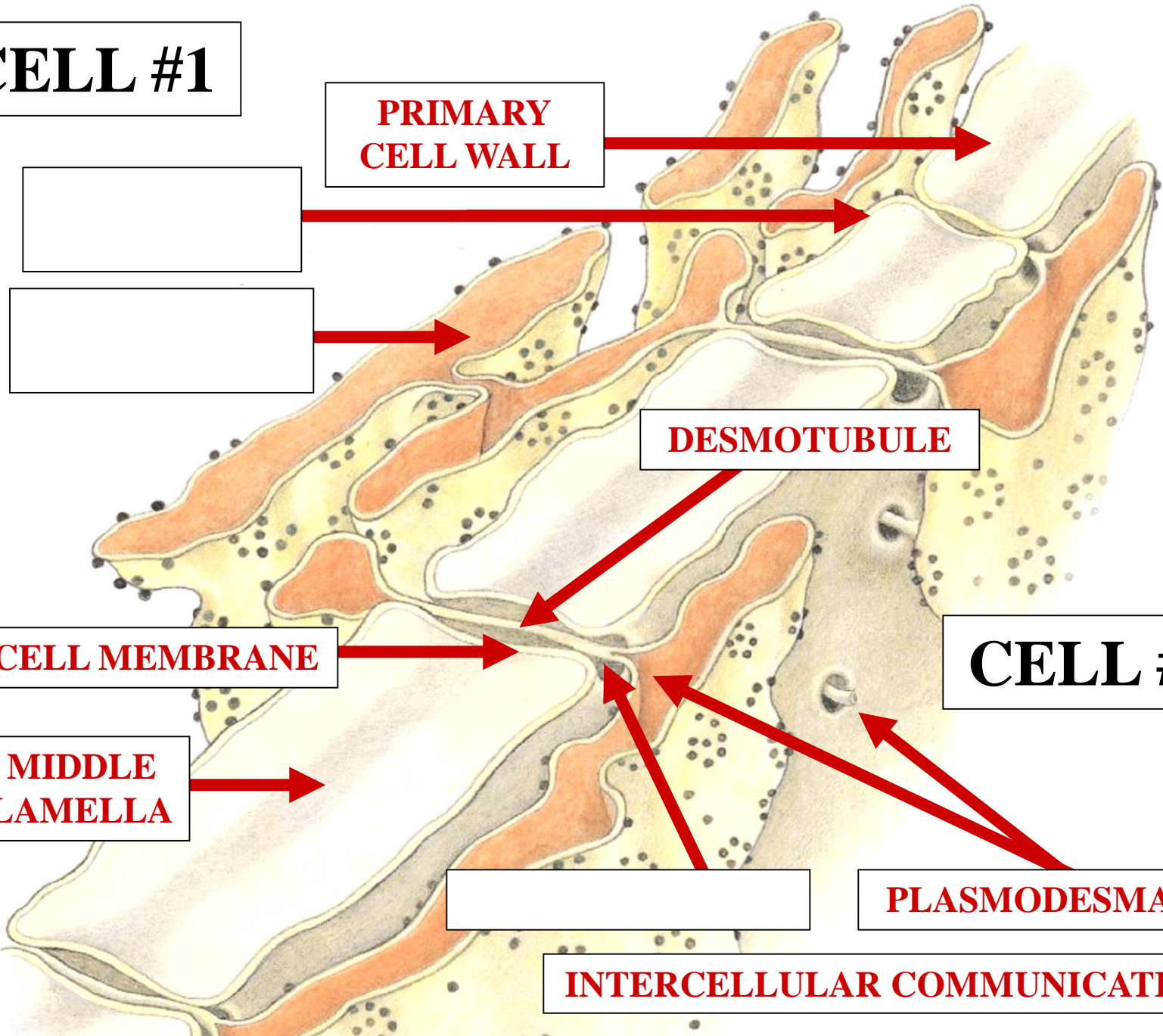
CELL MEMBRANE

CELL #2

**MIDDLE
LAMELLA**

PLASMODESMATA

INTERCELLULAR COMMUNICATION



DESMOTUBULE

**PLASMODESMATA
DESMOTUBULE**



**ENDOPLASMIC RETICULUM
TUBULE**

**PLASMODESMATA
DESMOTUBULE**

CELL #1

!
ER

**PRIMARY
CELL WALL**

FLEXIBLE WALL

DESMOTUBULE

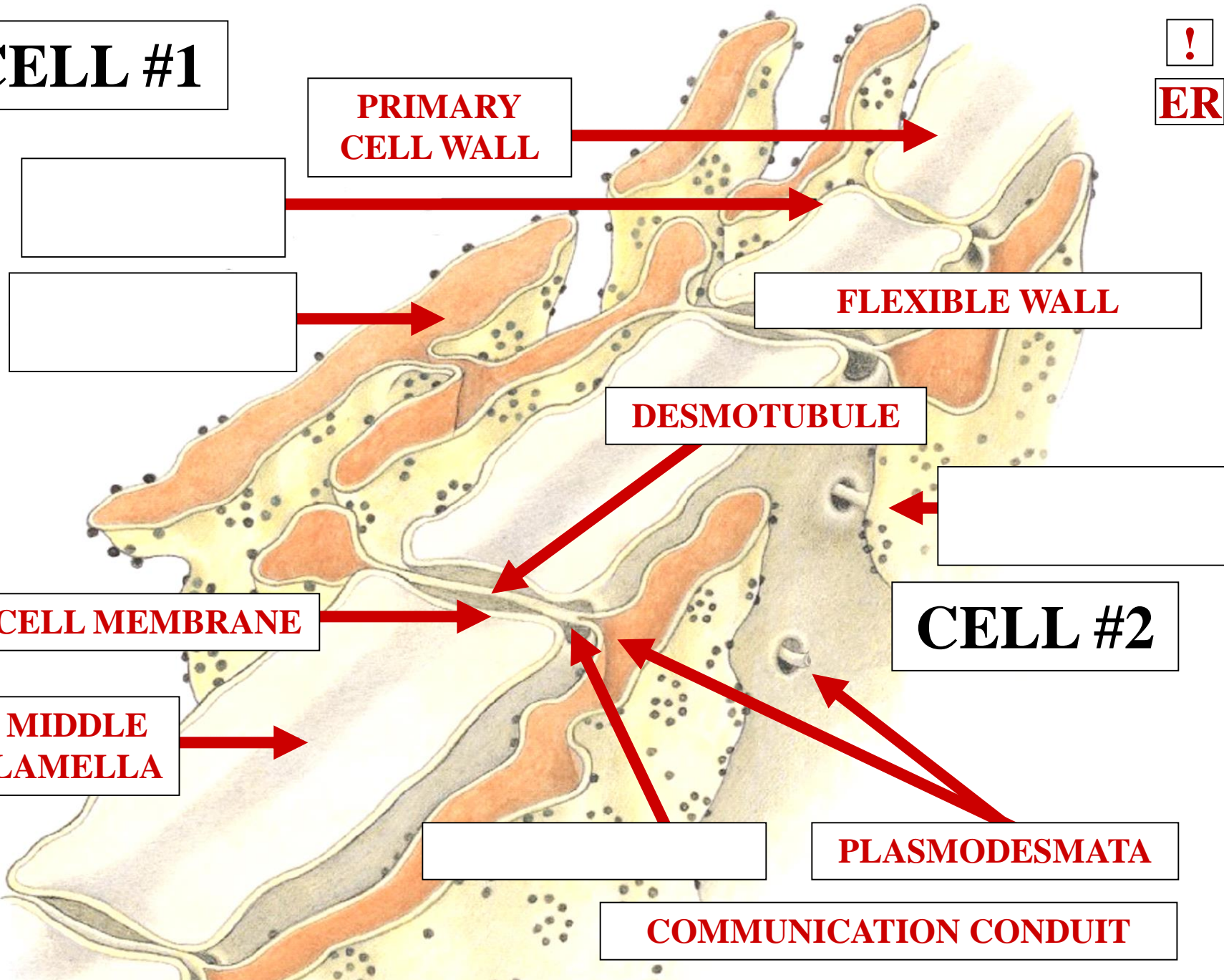
CELL #2

CELL MEMBRANE

**MIDDLE
LAMELLA**

PLASMODESMATA

COMMUNICATION CONDUIT



CELL #1

C

**PRIMARY
CELL WALL**

[Empty box]

**ENDOPLASMIC
RETICULUM**

FLEXIBLE WALL

DESMOTUBULE

**ENDOPLASMIC
RETICULUM**

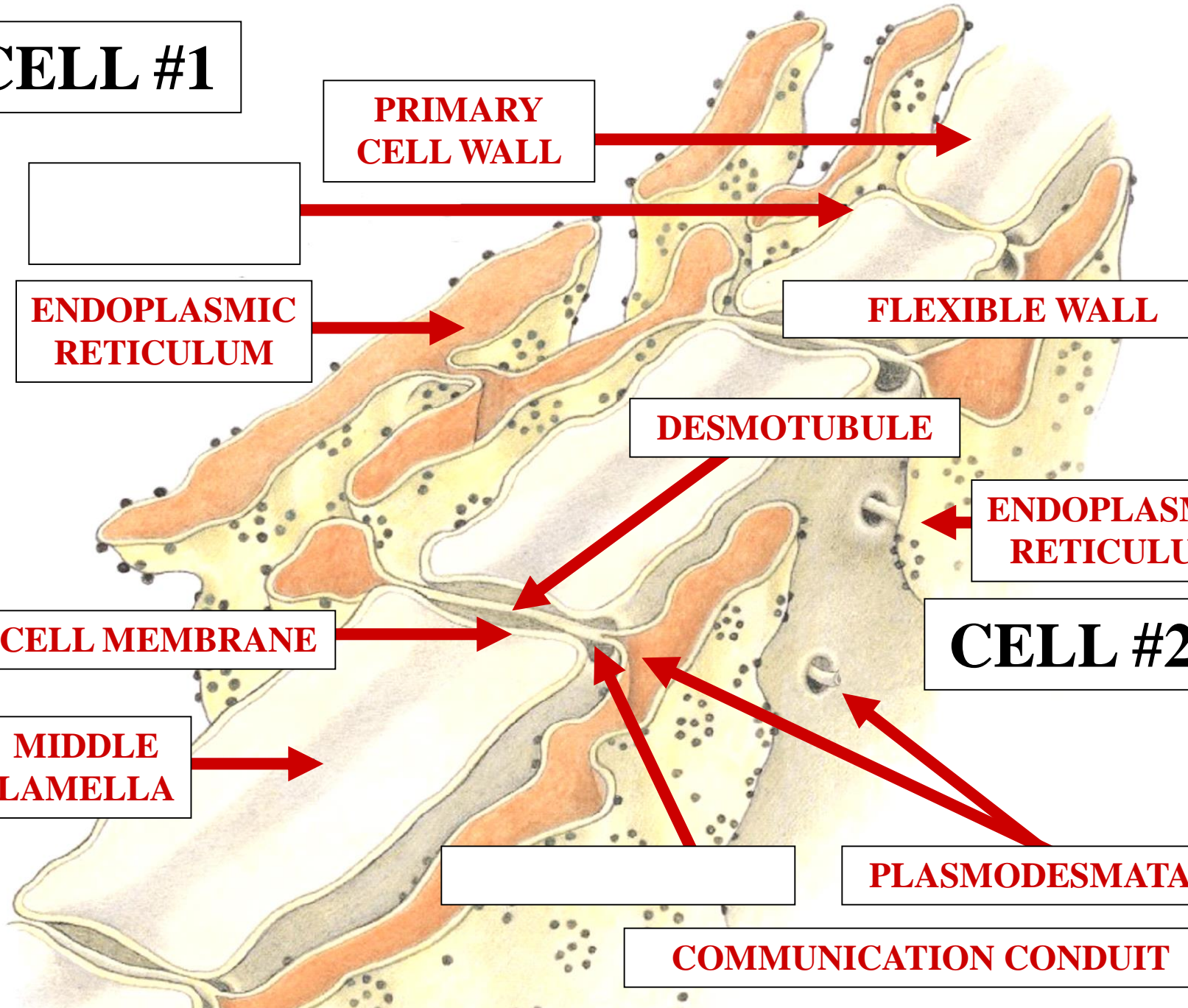
CELL MEMBRANE

CELL #2

**MIDDLE
LAMELLA**

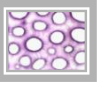
PLASMODESMATA

COMMUNICATION CONDUIT



CELL #1

**PRIMARY
CELL WALL**



**ENDOPLASMIC
RETICULUM**

FLEXIBLE WALL

DESMOTUBULE

**ENDOPLASMIC
RETICULUM**

CELL MEMBRANE

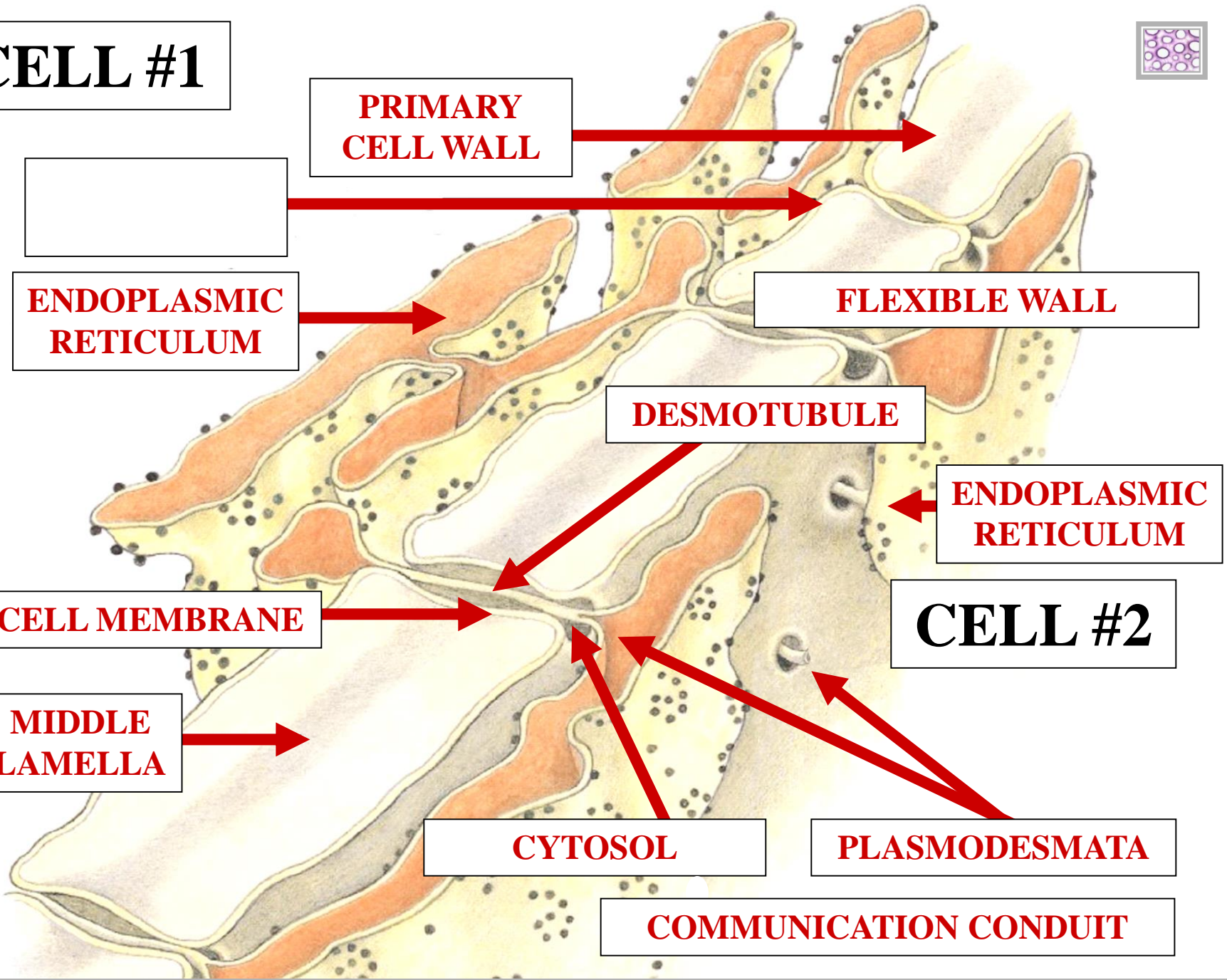
CELL #2

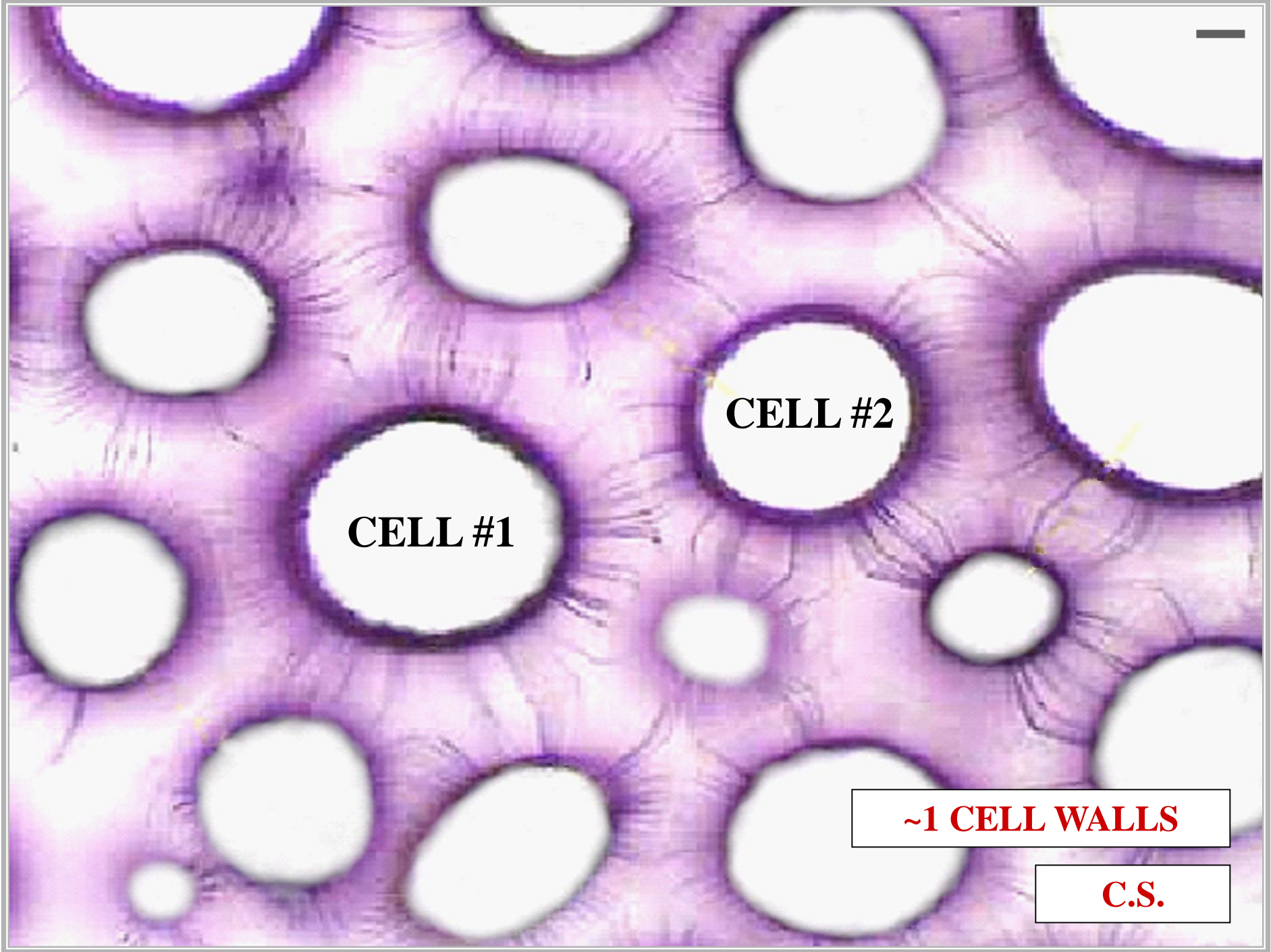
**MIDDLE
LAMELLA**

CYTOSOL

PLASMODESMATA

COMMUNICATION CONDUIT



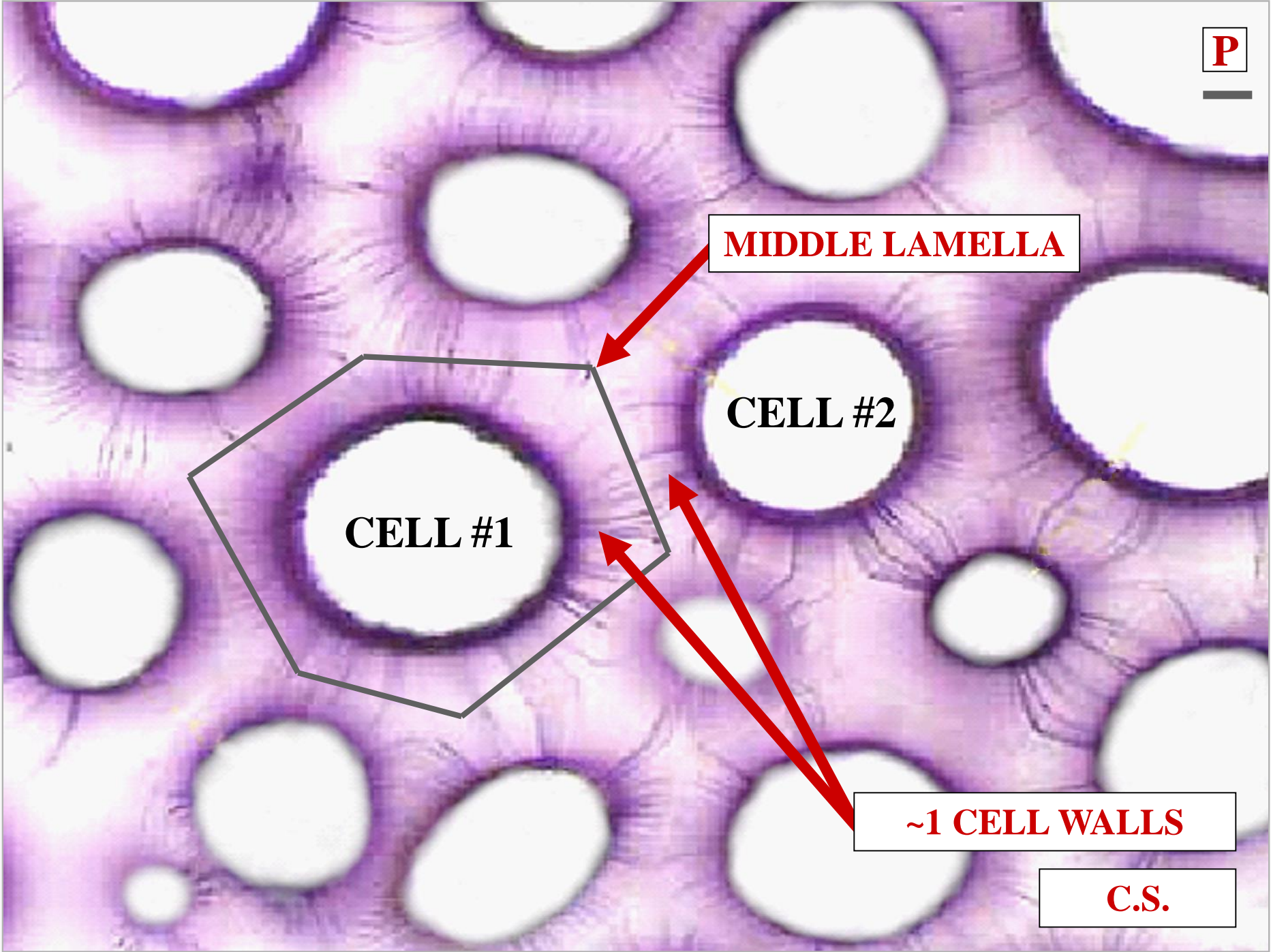


CELL #1

CELL #2

~1 CELL WALLS

C.S.



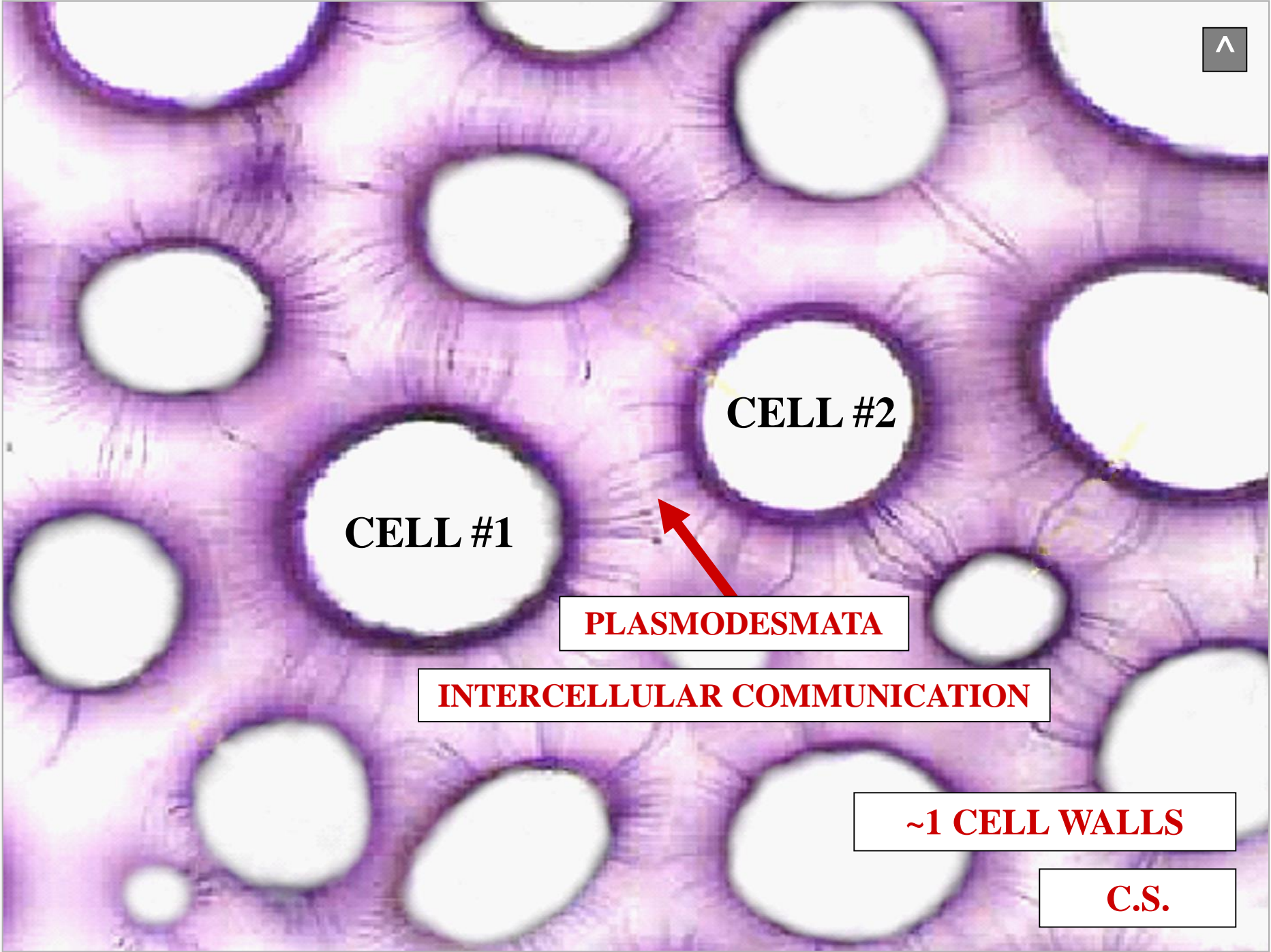
MIDDLE LAMELLA

CELL #2

CELL #1

~1 CELL WALLS

C.S.



CELL #1

CELL #2

PLASMODESMATA

INTERCELLULAR COMMUNICATION

~1 CELL WALLS

C.S.

PRIMARY PIT FIELD

PRIMARY PIT FIELD

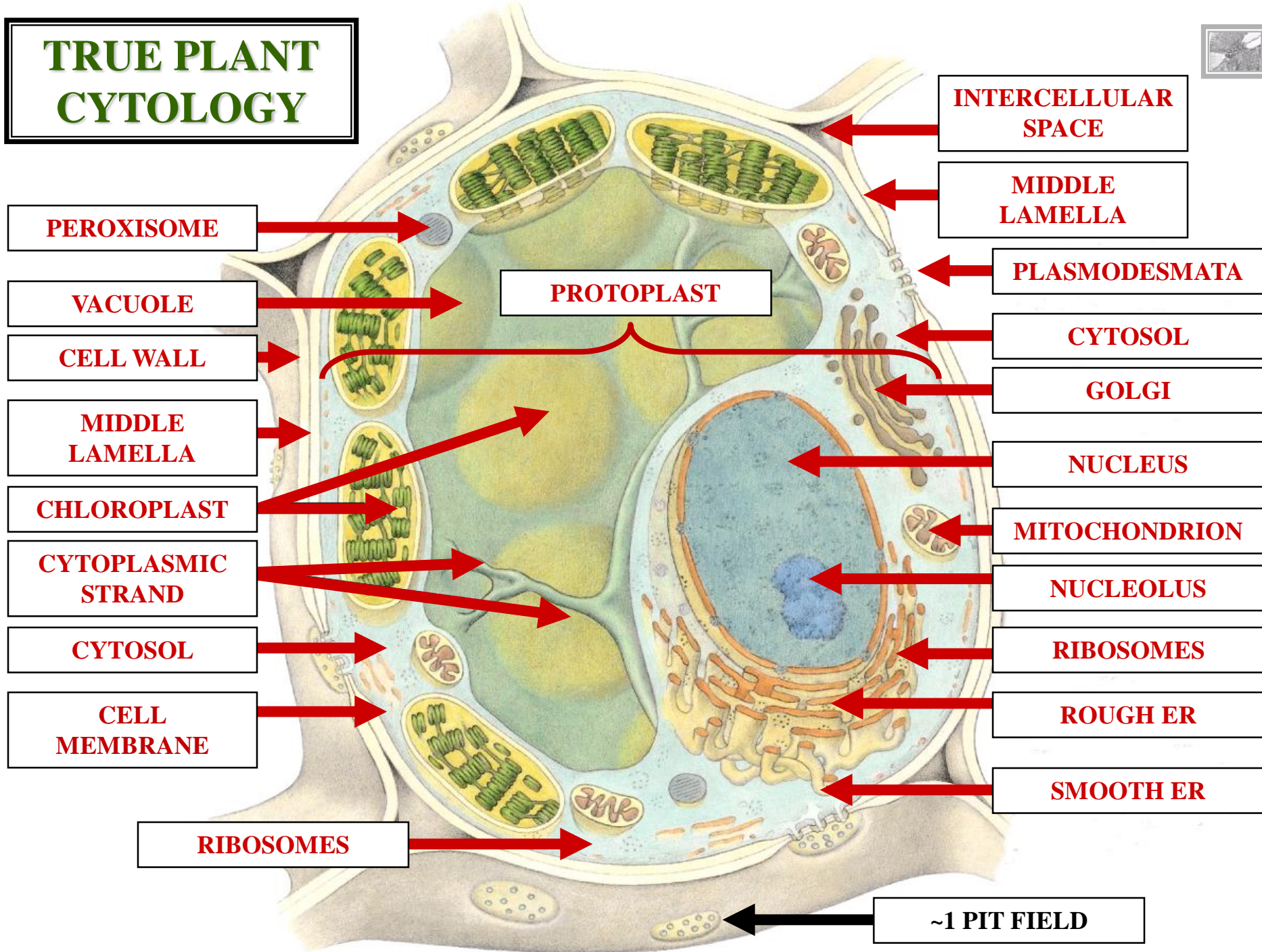


PRIMARY PIT FIELD

**PRIMARY WALL
PLASMODESMATA
CLUSTER**

PRIMARY PIT FIELD

TRUE PLANT CYTOLOGY



CELL #1

**PRIMARY
CELL WALL**

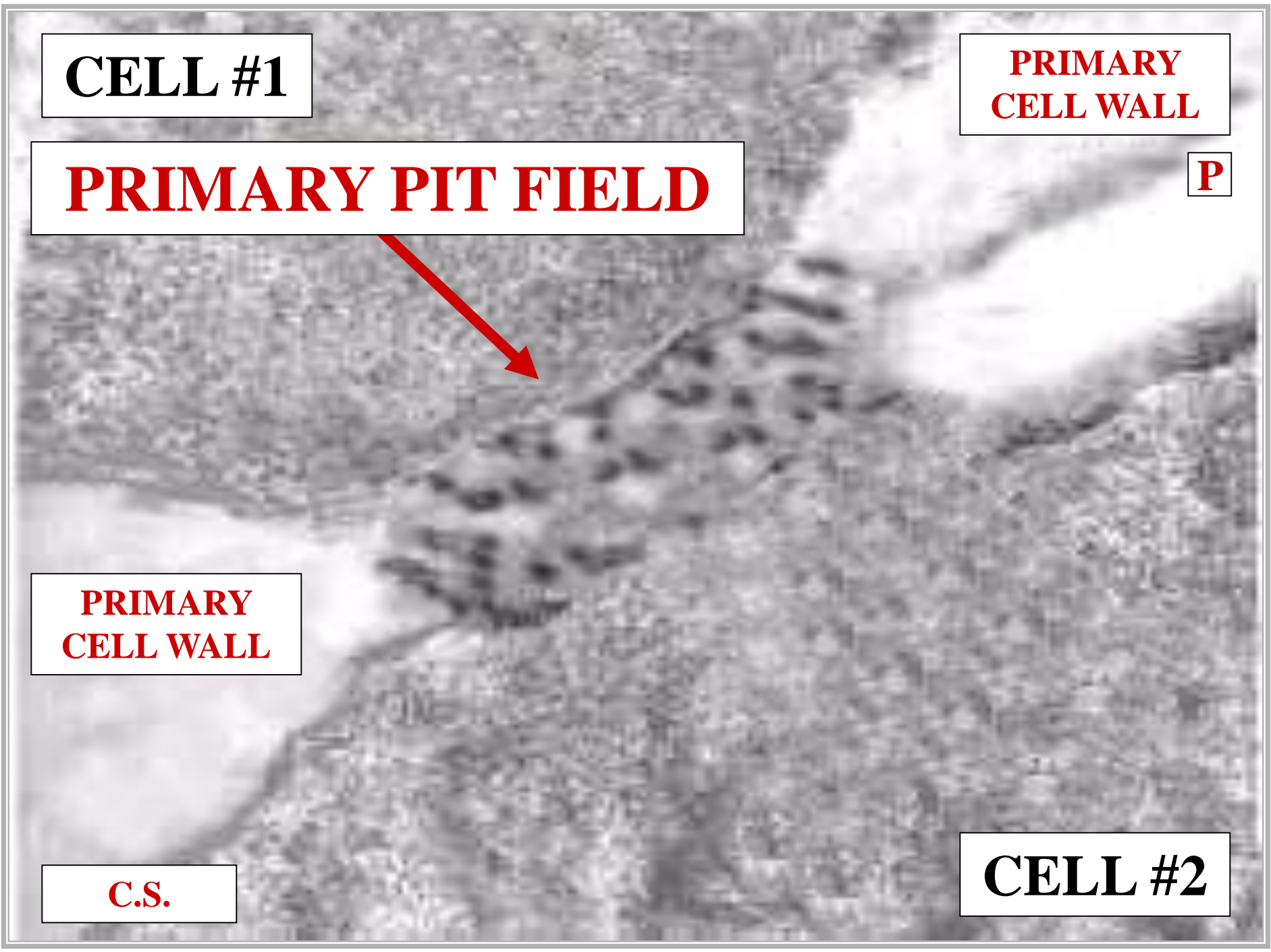
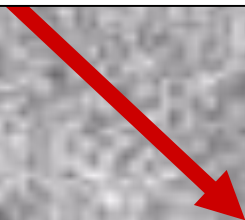
PRIMARY PIT FIELD

P

**PRIMARY
CELL WALL**

C.S.

CELL #2



CELL #1

**PRIMARY
CELL WALL**

PRIMARY PIT FIELD

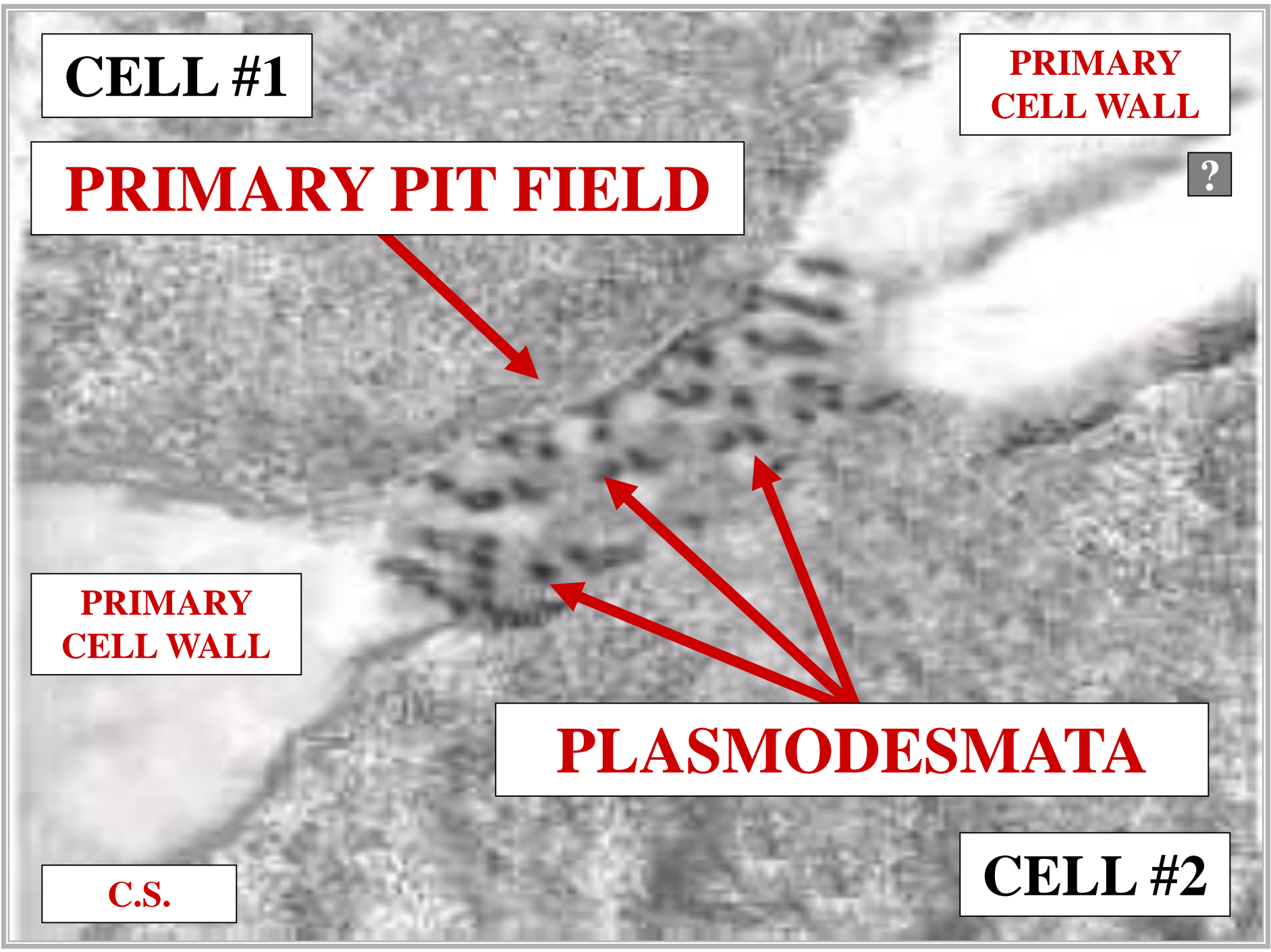
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**PRIMARY
CELL WALL**

PLASMODESMATA

C.S.

CELL #2



CELL #1

PRIMARY PIT FIELD

**PRIMARY
CELL WALL**

M

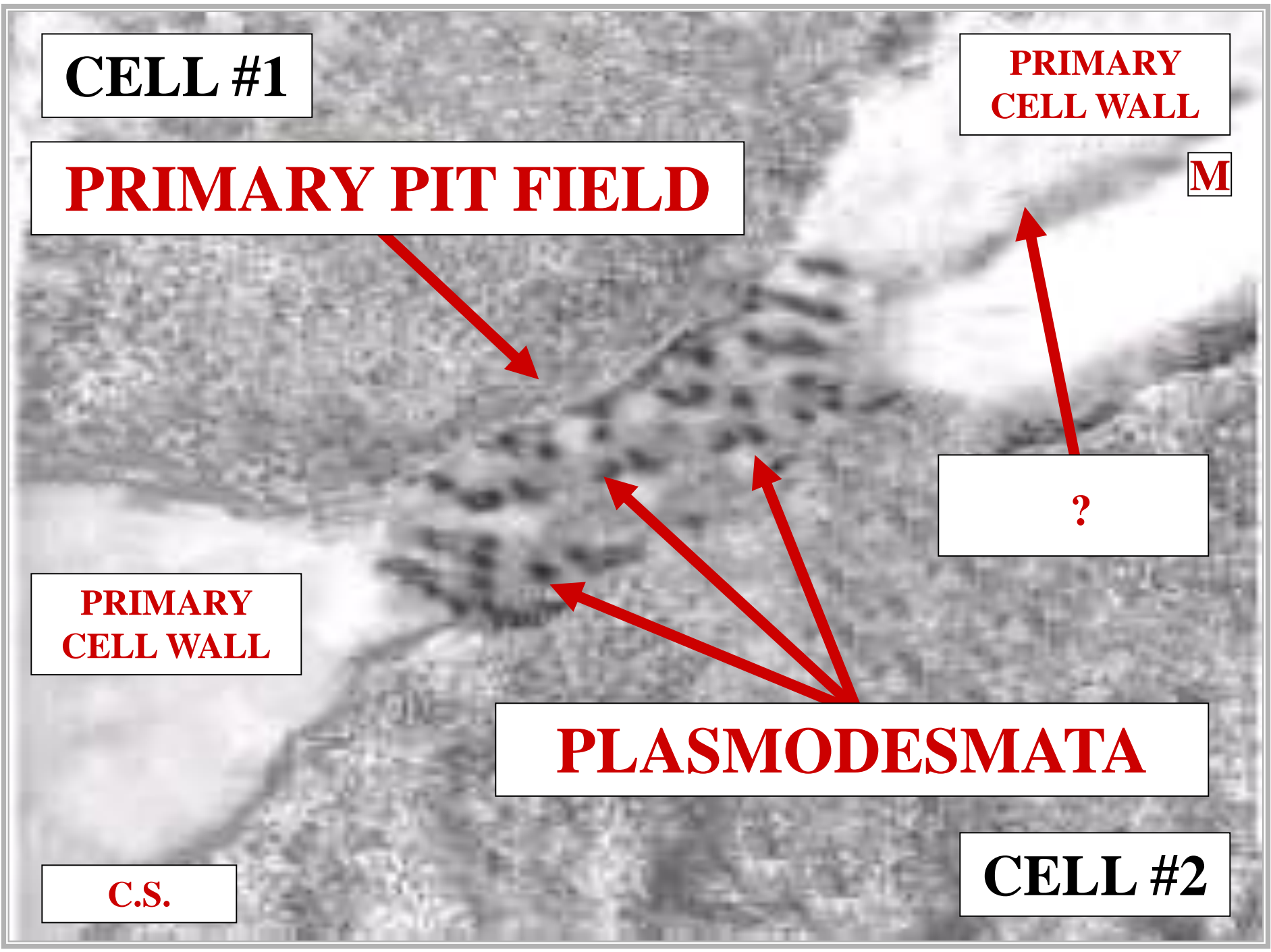
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**PRIMARY
CELL WALL**

PLASMODESMATA

C.S.

CELL #2



CELL #1

PRIMARY PIT FIELD

**PRIMARY
CELL WALL**



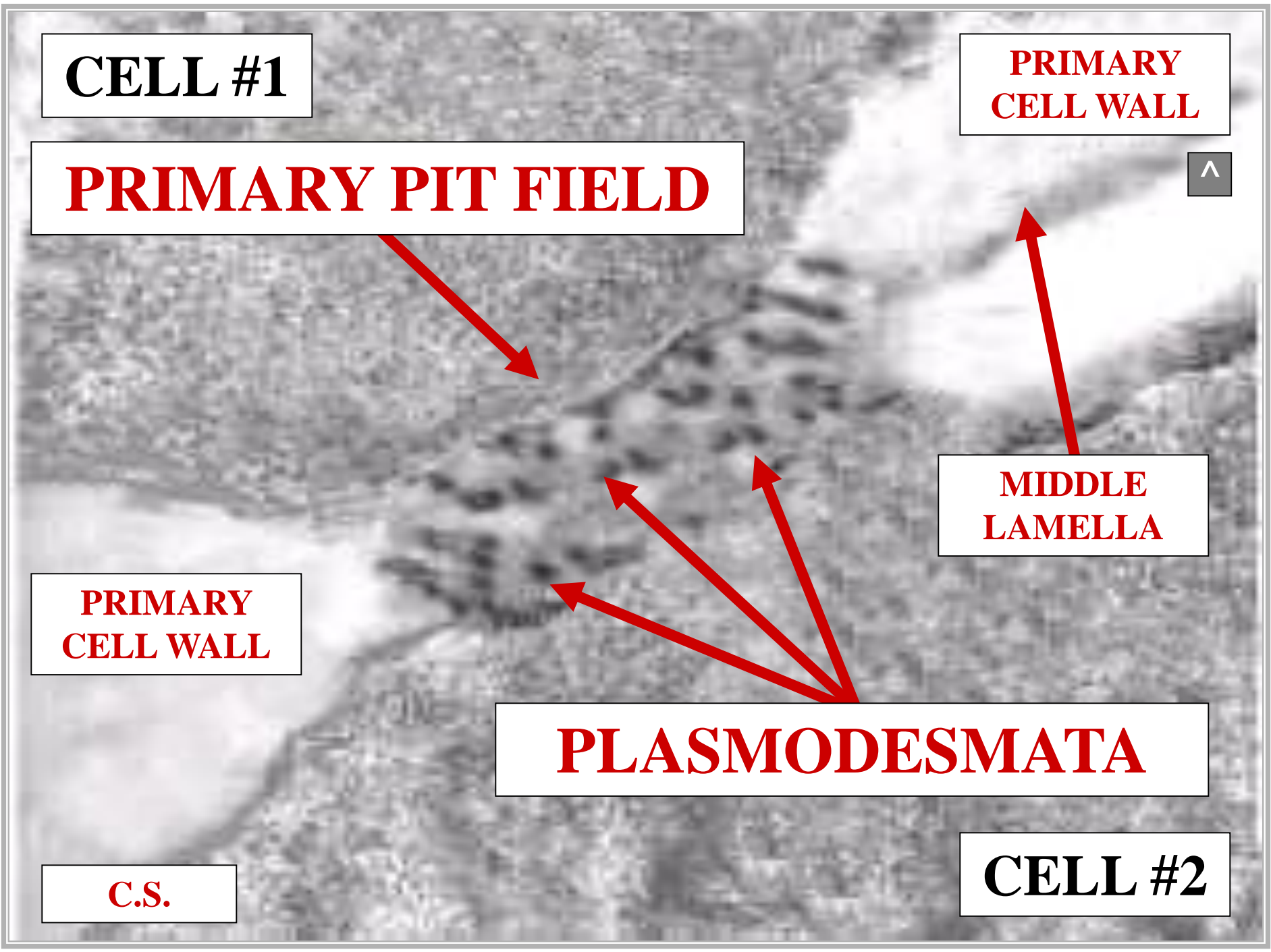
**MIDDLE
LAMELLA**

**PRIMARY
CELL WALL**

PLASMODESMATA

C.S.

CELL #2



**SECONDARY
CELL WALL
PIT PAIR**

**SECONDARY
CELL WALL
PIT PAIR**

SECONDARY CELL WALL PIT PAIR



**SECONDARY WALL CONDUIT
BETWEEN ADJACENT CELLS**

SECONDARY CELL WALL PIT PAIR

SECONDARY CELL WALL PIT PAIR



**SECONDARY WALL CONDUIT
BETWEEN ADJACENT CELLS**

INTERCELLULAR COMMUNICATION

**SECONDARY CELL WALL
PIT PAIR**

SECONDARY CELL WALL



PIT PAIR

**SECONDARY WALL CONDUIT
BETWEEN ADJACENT CELLS**

INTERCELLULAR COMMUNICATION

**ARISE OVER
PRIMARY PIT FIELD**

SECONDARY CELL WALL

PIT PAIR

CELL #1

**PRIMARY
CELL WALL**

PRIMARY PIT FIELD

PP2

**SECONDARY
CELL WALL**

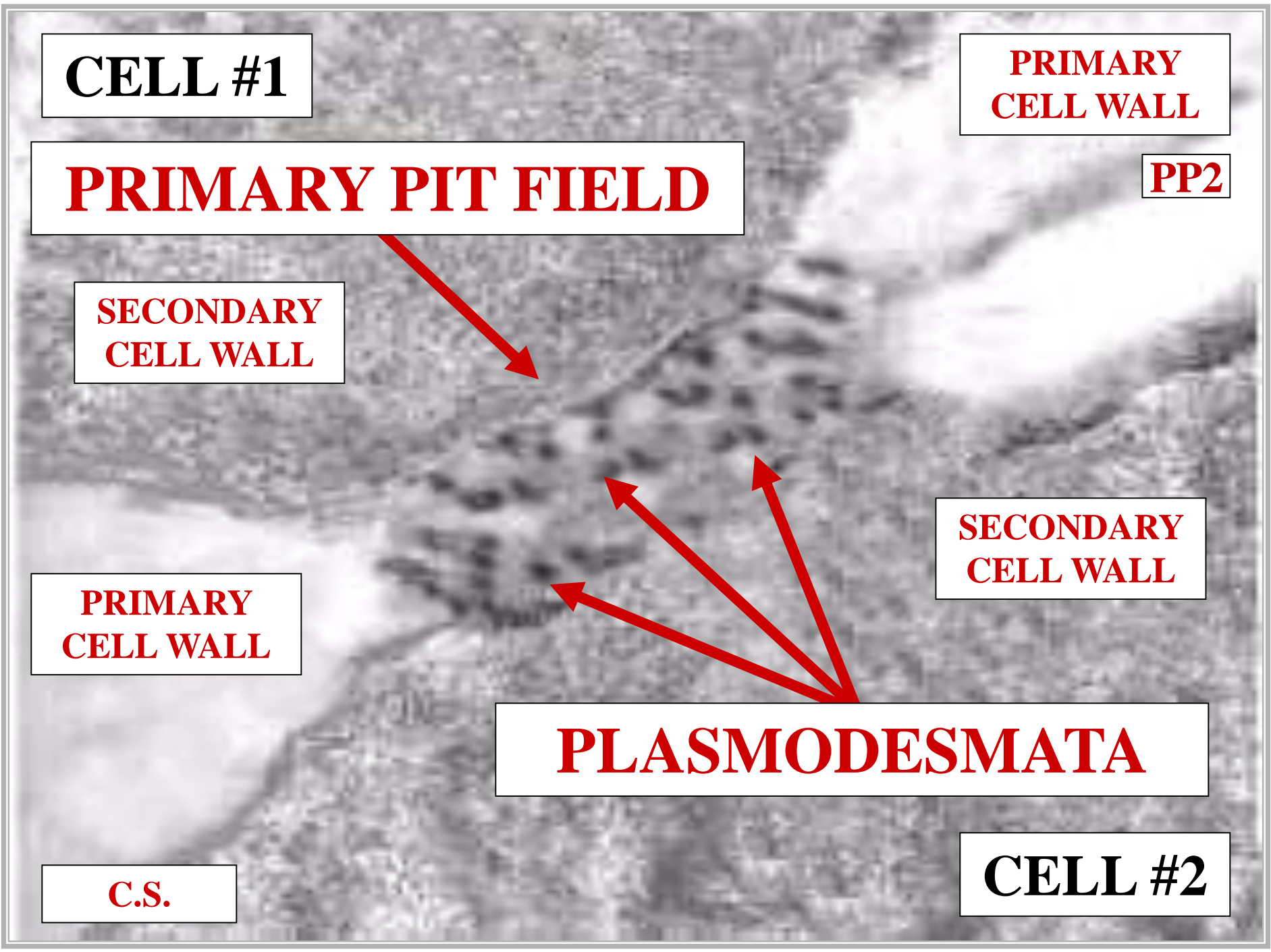
**PRIMARY
CELL WALL**

**SECONDARY
CELL WALL**

PLASMODESMATA

C.S.

CELL #2

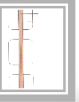


CELL #1

**PRIMARY
CELL WALL**

PIT PAIR

?



**SECONDARY
CELL WALL**

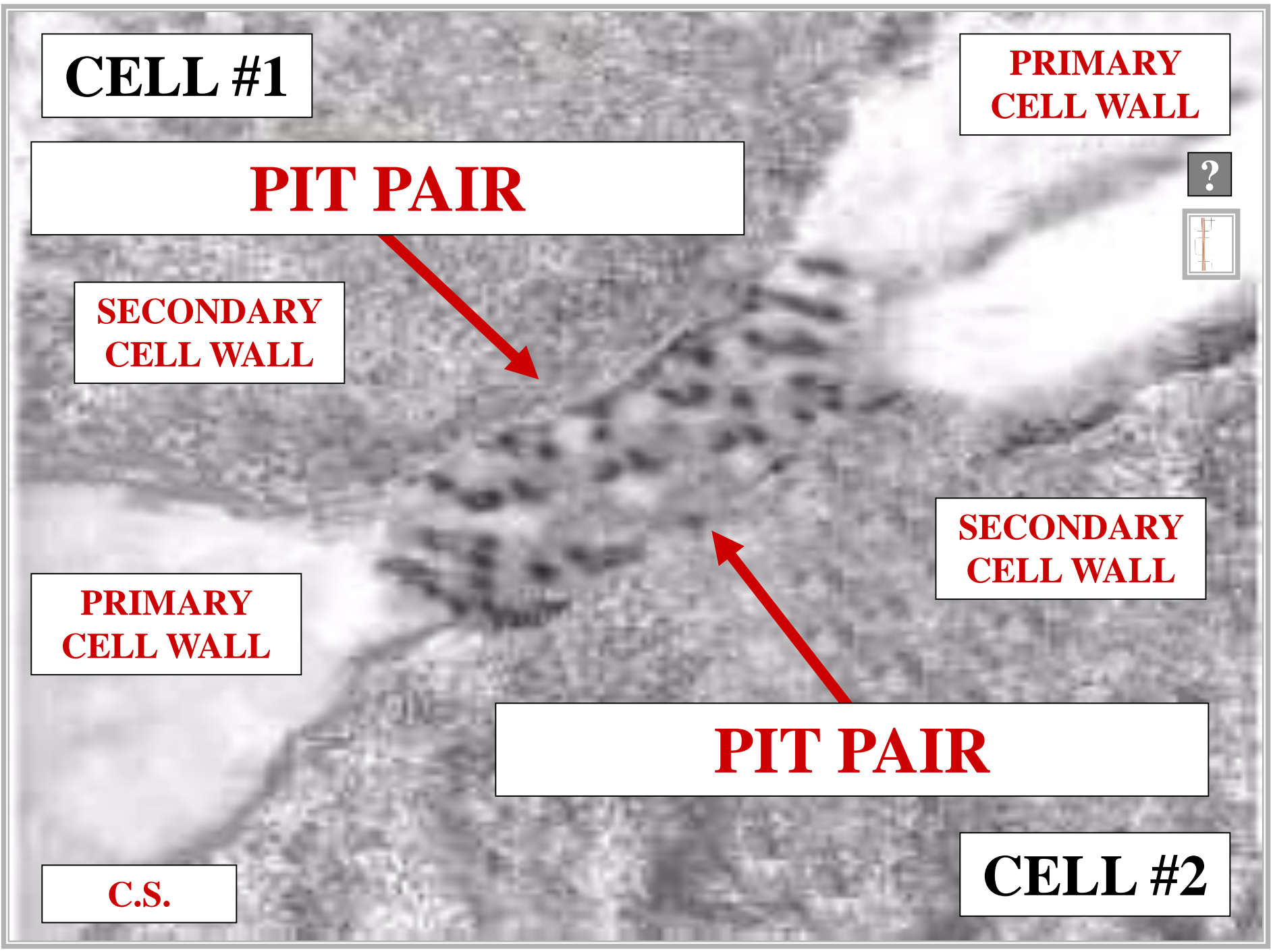
**PRIMARY
CELL WALL**

**SECONDARY
CELL WALL**

PIT PAIR

C.S.

CELL #2



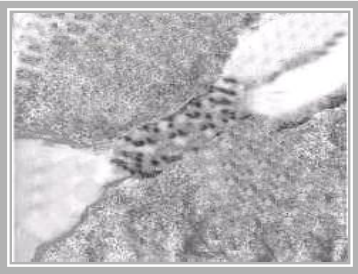
CELL #1

MIDDLE LAMELLA

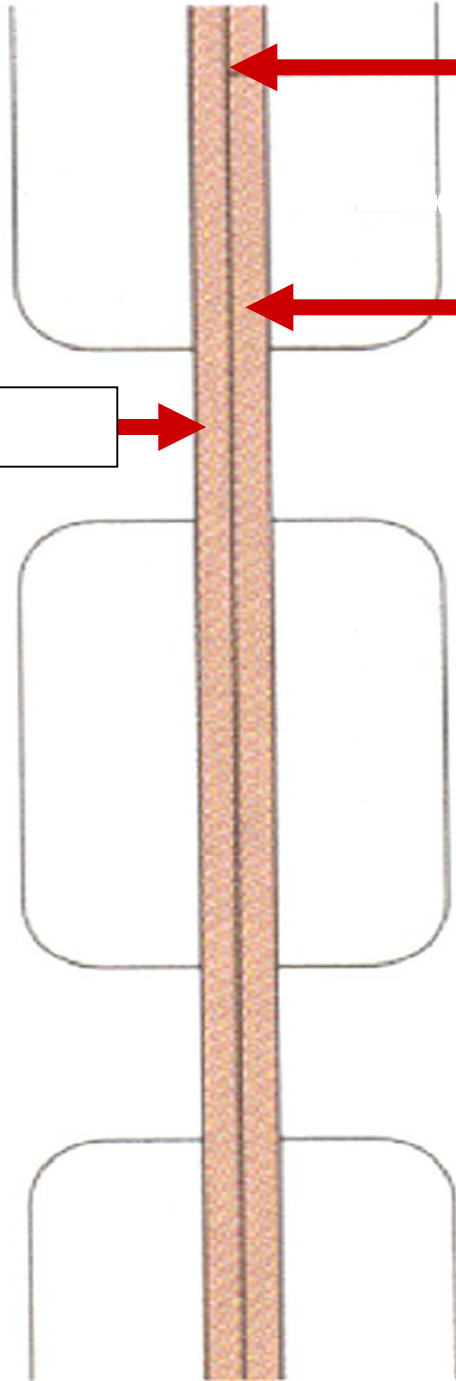
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CELL #2



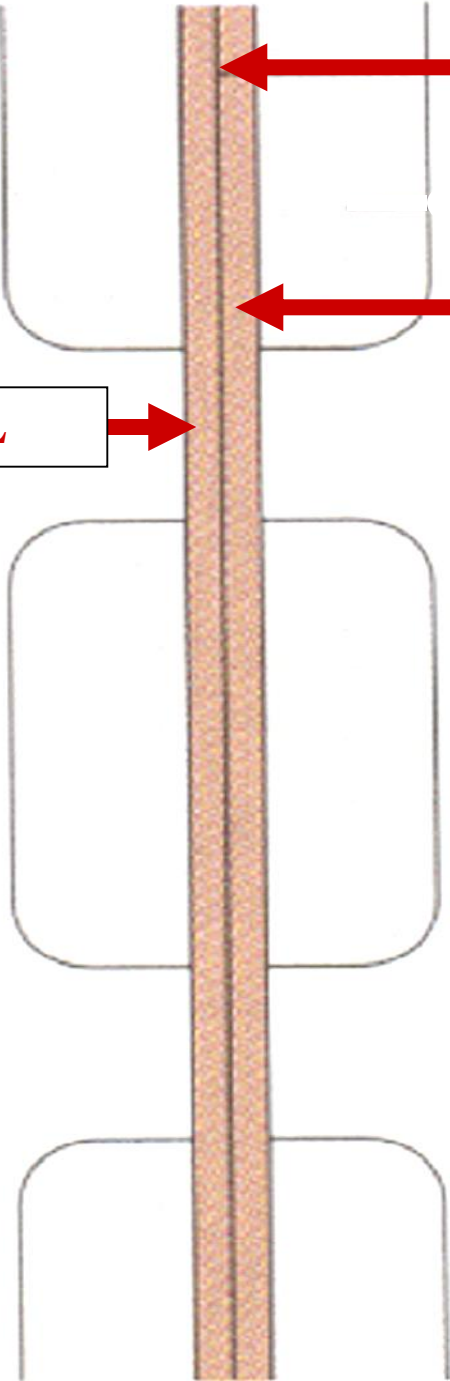
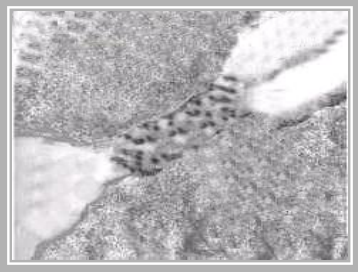


CELL #1

MIDDLE LAMELLA

PRIMARY WALL

PRIMARY WALL



CELL #2

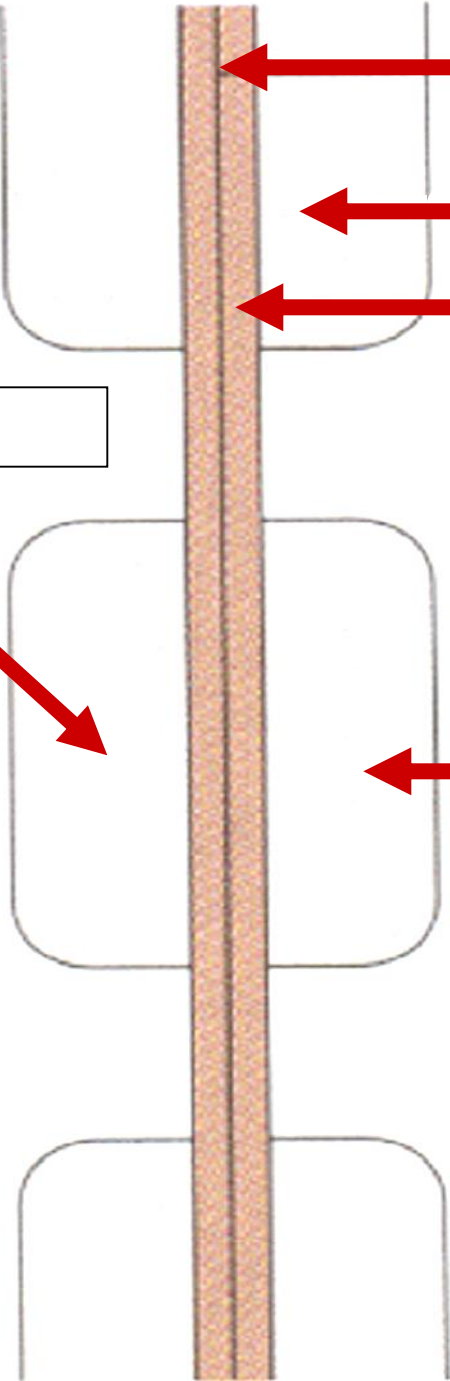
CELL #1

MIDDLE LAMELLA

?

PRIMARY WALL

?



?

CELL #2

CELL #1

MIDDLE LAMELLA

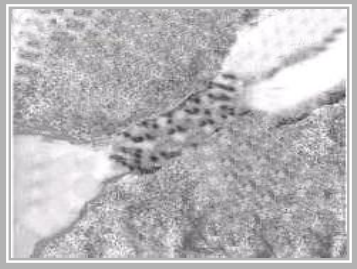
PF

SECONDARY WALL

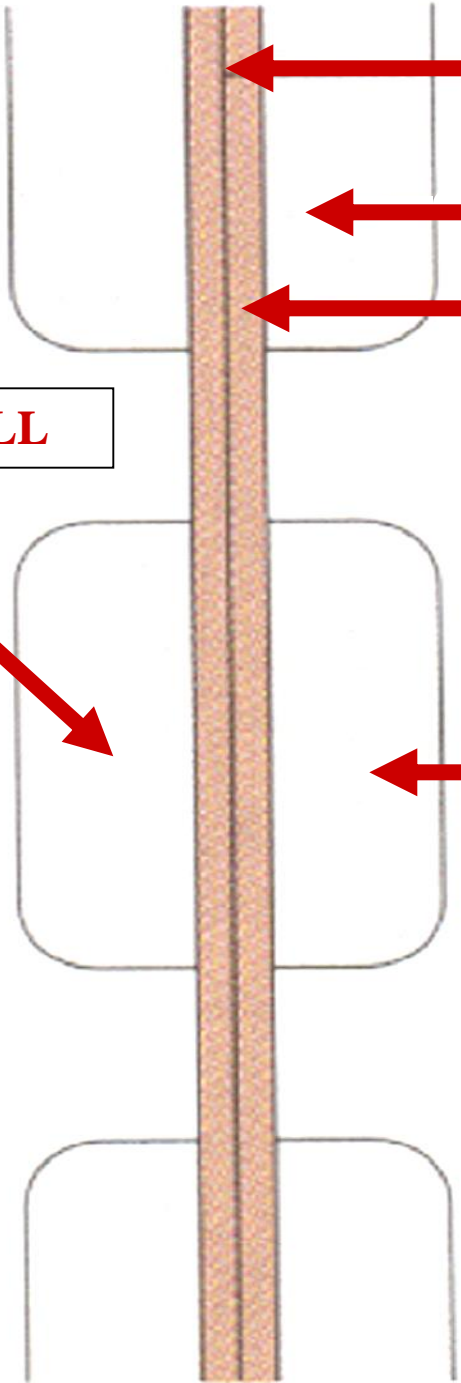
PRIMARY WALL

SECONDARY WALL

SECONDARY WALL



CELL #2



CELL #1

P2

MIDDLE LAMELLA

SECONDARY WALL

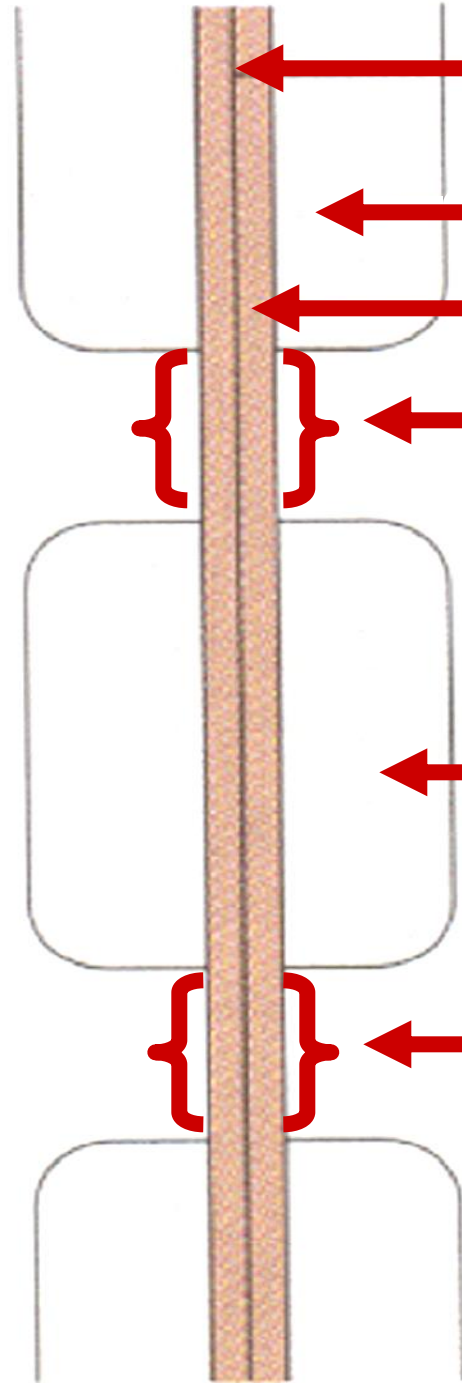
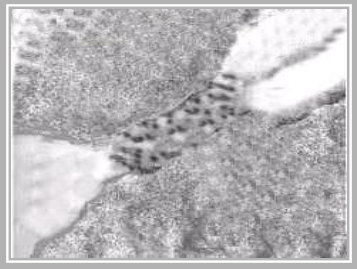
PRIMARY WALL

**PRIMARY PIT
FIELD**

SECONDARY WALL

**PRIMARY PIT
FIELD**

CELL #2



CELL #1



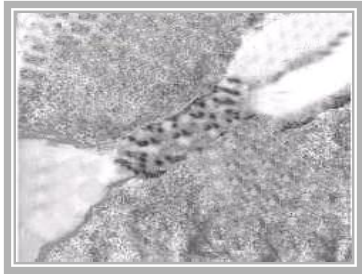
MIDDLE LAMELLA

SECONDARY WALL

PRIMARY WALL

**PRIMARY PIT
FIELD**

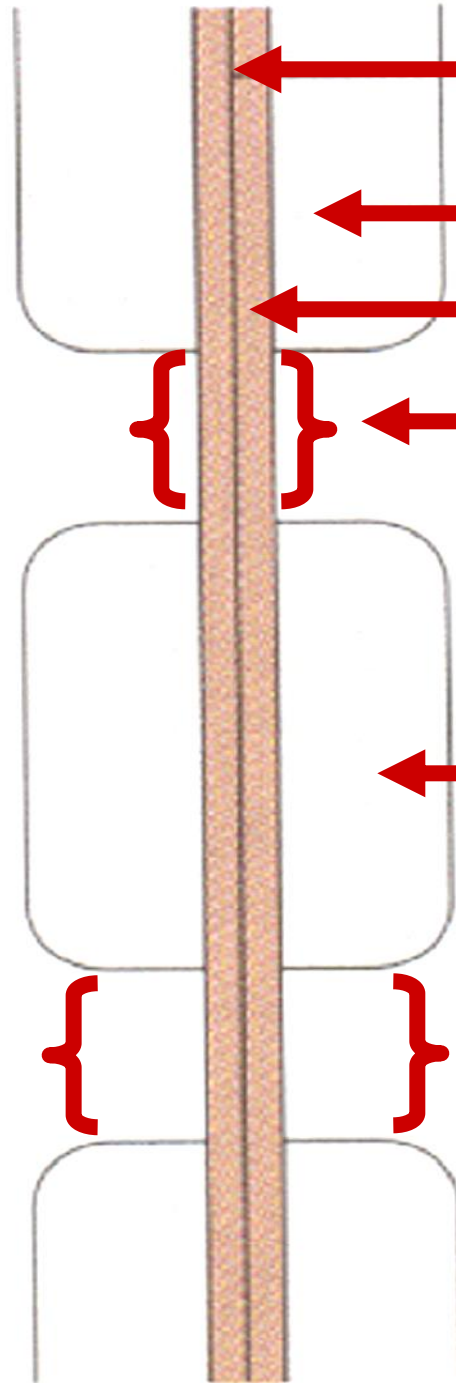
SECONDARY WALL



PIT PAIR

PIT PAIR

CELL #2





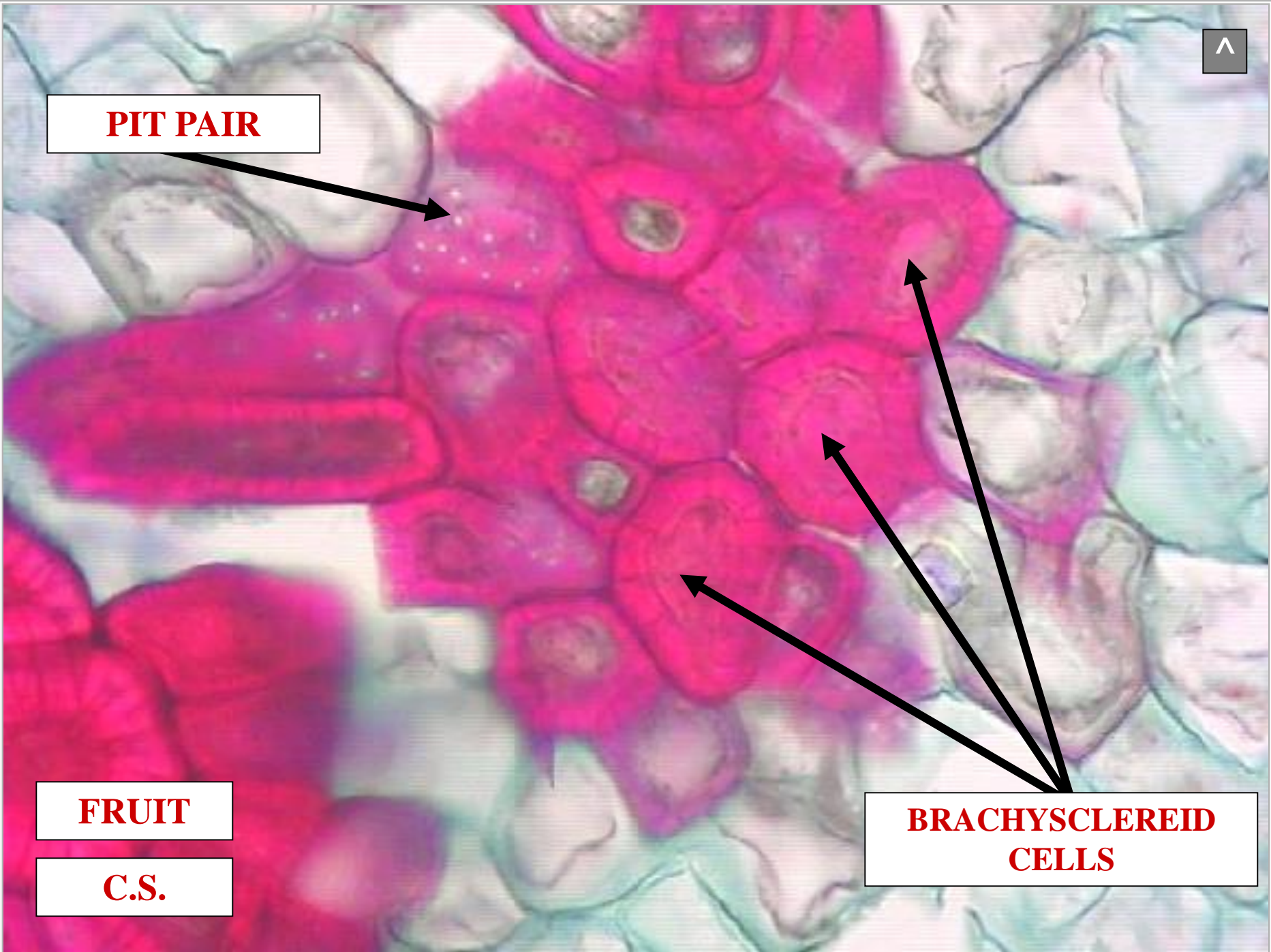
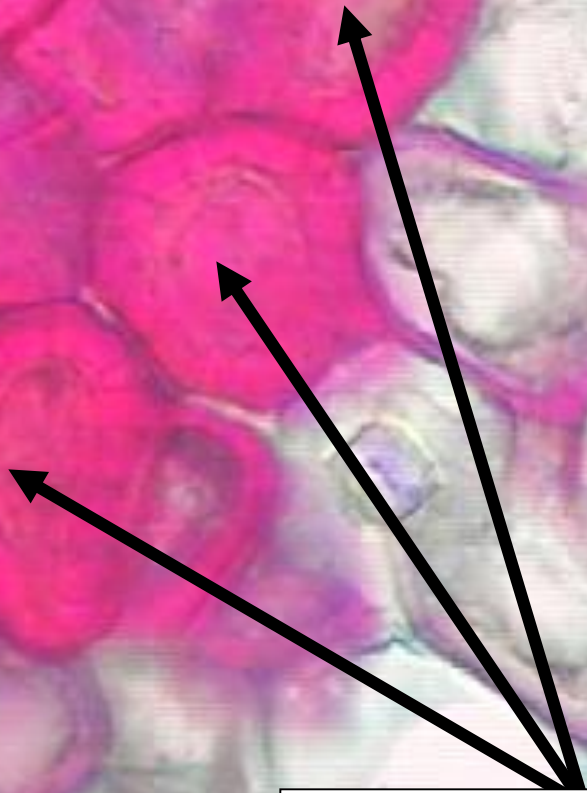
PIT PAIR



FRUIT

C.S.

**BRACHYSCLEREID
CELLS**



PROTOPLAST

PROTOPLAST

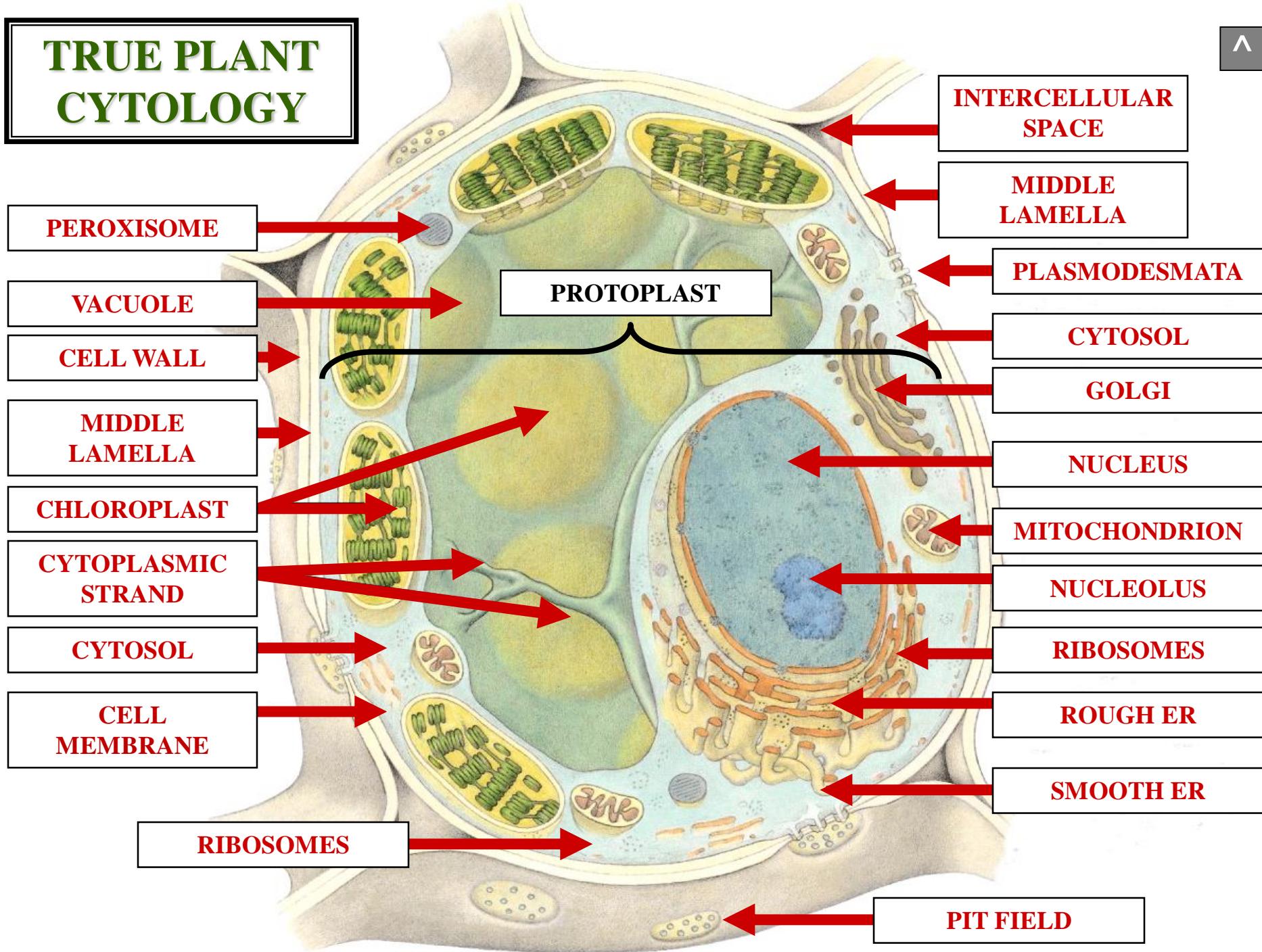


PROTOPLAST

**LIVING CONTENT
BEYOND
CELL WALL**

PROTOPLAST

TRUE PLANT CYTOLOGY



CELL MEMBRANE

CELL MEMBRANE



CELL MEMBRANE

**OUTER PROTOPLAST
BOUNDARY**

CELL MEMBRANE



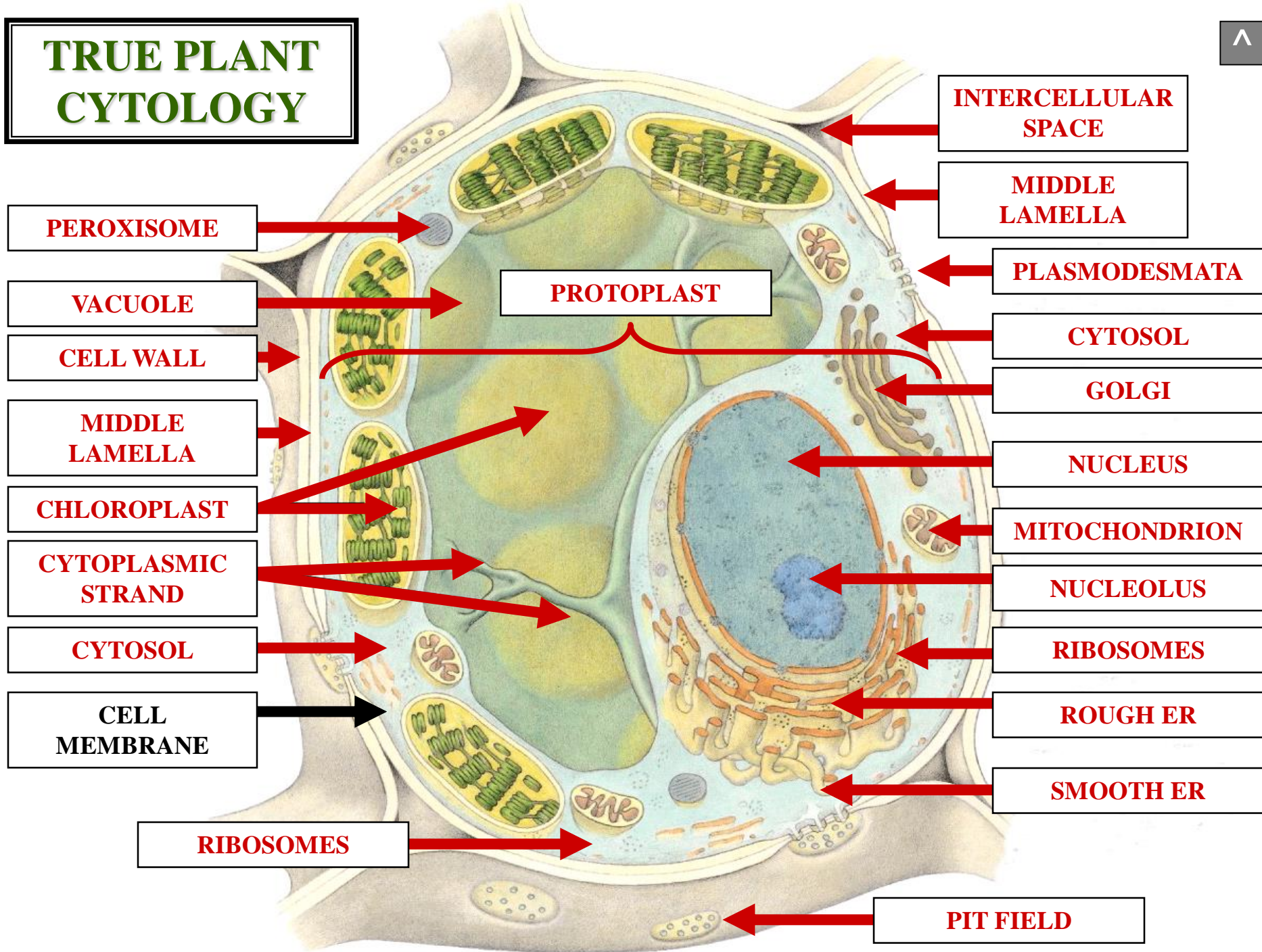
CELL MEMBRANE

**OUTER PROTOPLAST
BOUNDARY**

**MEDIATES TRANSPORT
INTO & OUT OF CELL**

CELL MEMBRANE

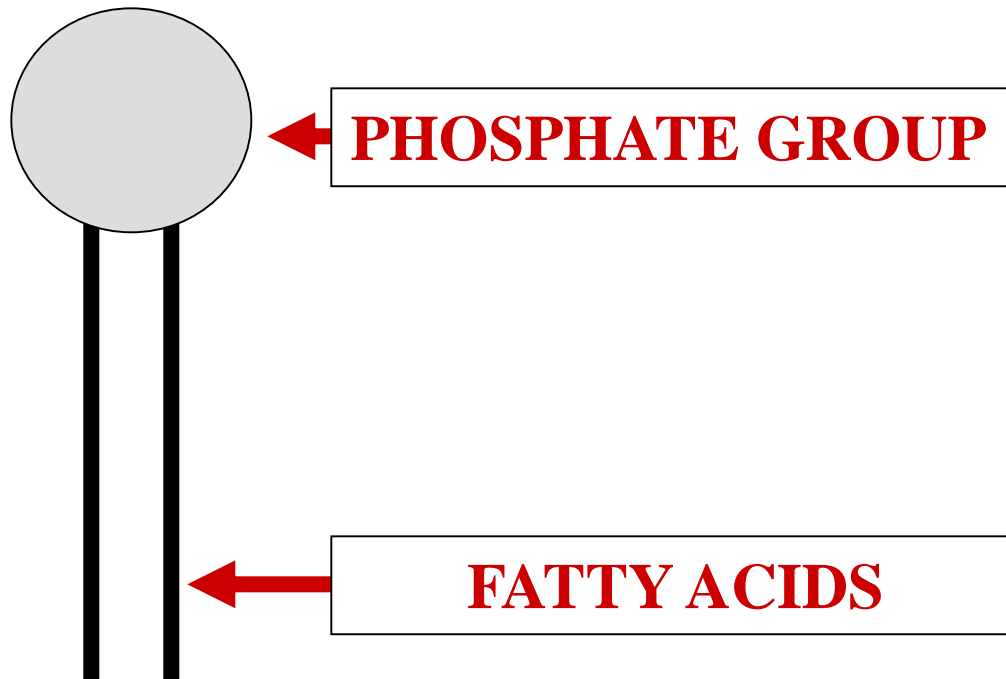
TRUE PLANT CYTOLOGY





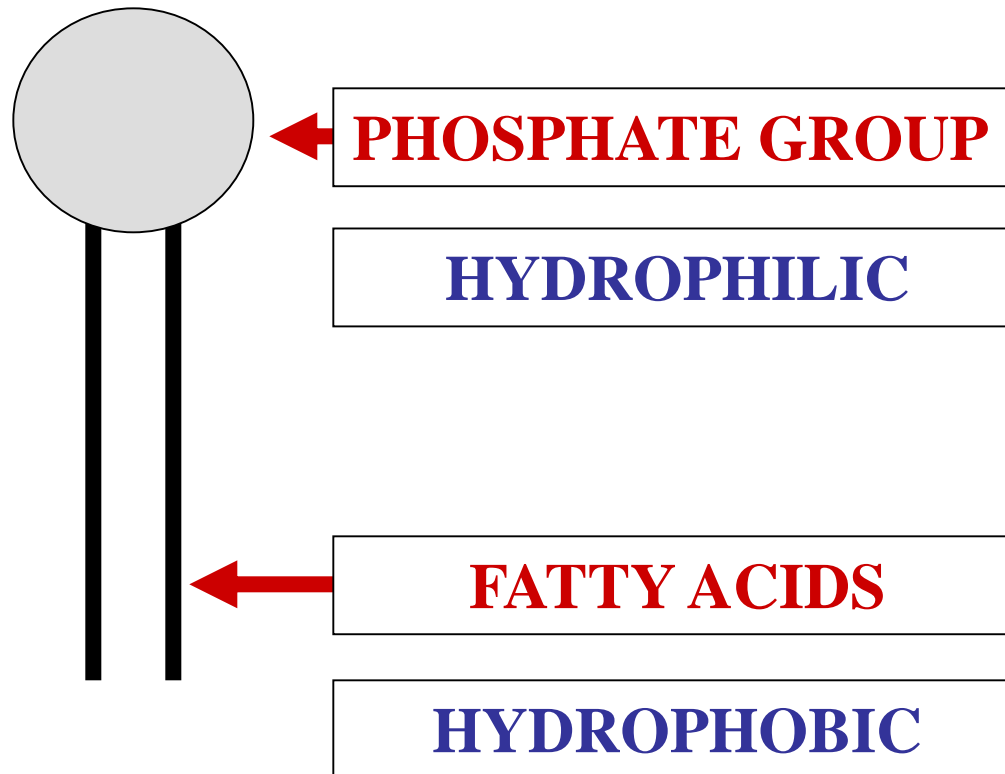
CELL MEMBRANE COMPOSITION

CELL MEMBRANE COMPOSITION



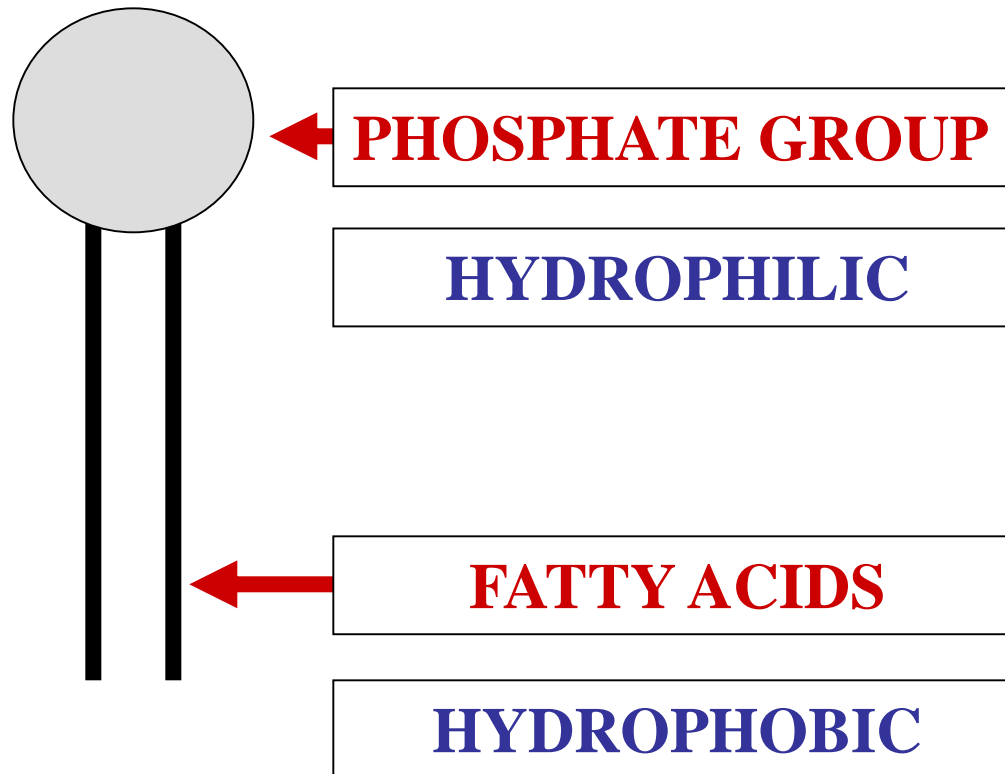
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CELL MEMBRANE COMPOSITION



PHOSPHOLIPID

CELL MEMBRANE COMPOSITION



PHOSPHOLIPID: AMPHIPATHIC

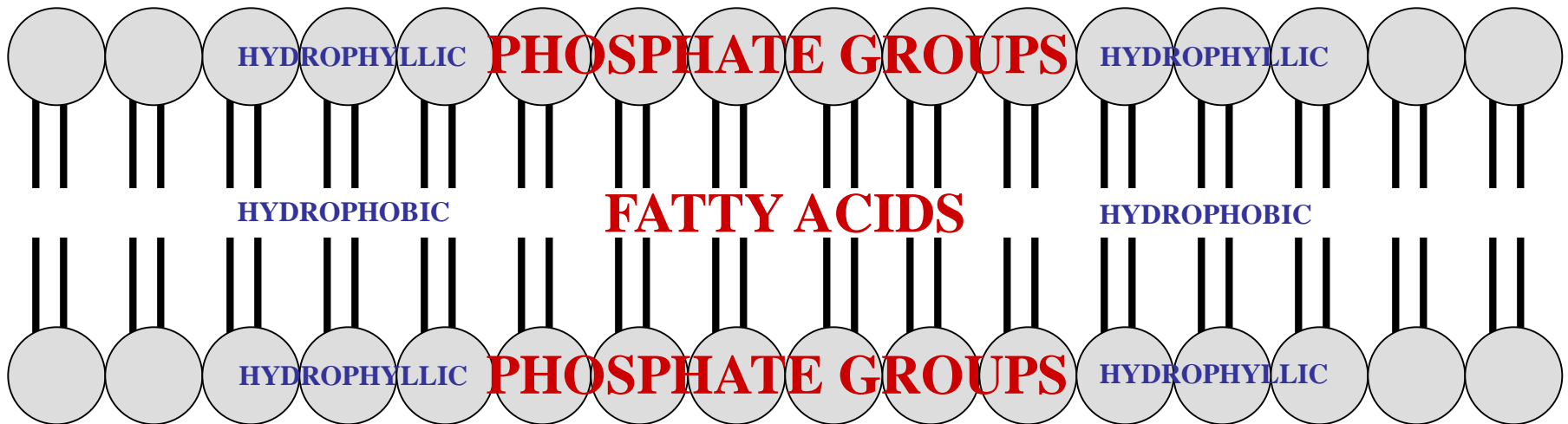
CELL MEMBRANE COMPOSITION



WATER

WATER

WATER



WATER

WATER

WATER

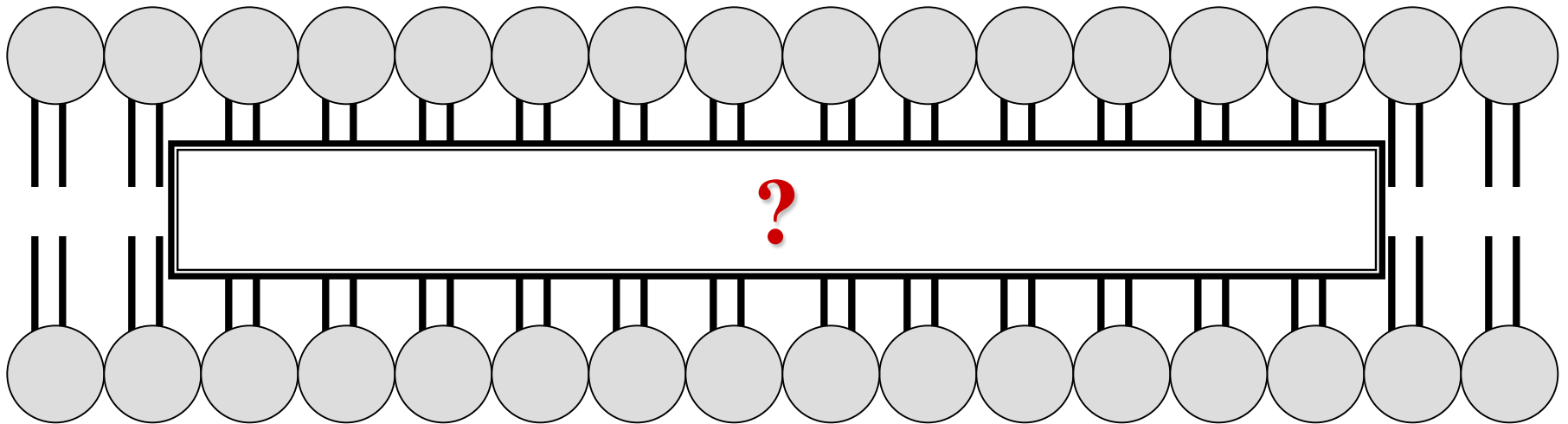
CELL MEMBRANE COMPOSITION

CELL MEMBRANE COMPOSITION

WATER

WATER

WATER



WATER

WATER

WATER

CELL MEMBRANE COMPOSITION

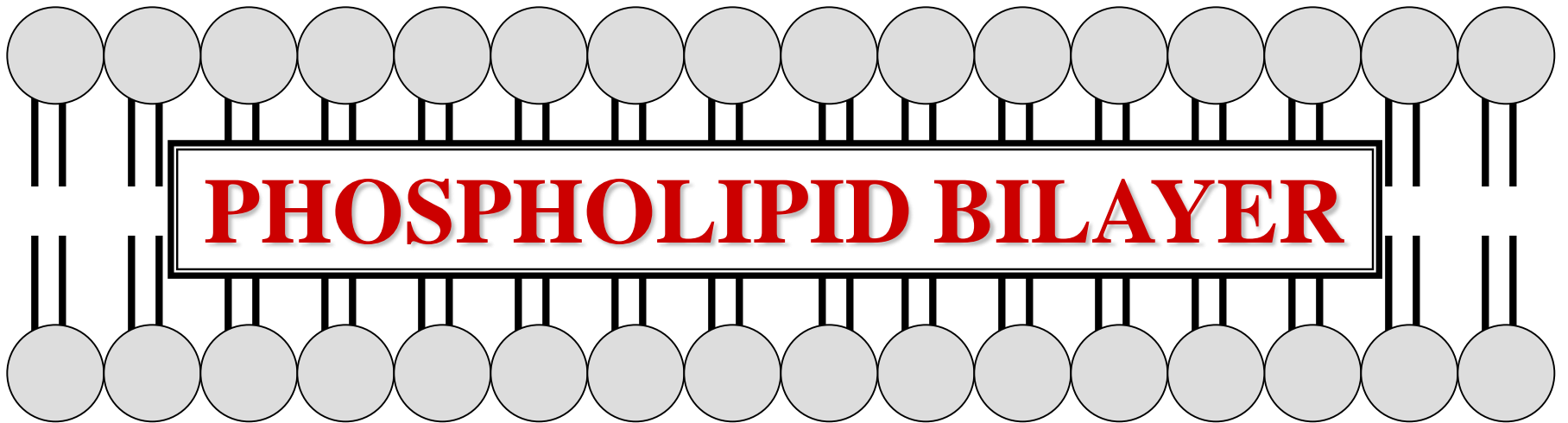
CELL MEMBRANE COMPOSITION



WATER

WATER

WATER



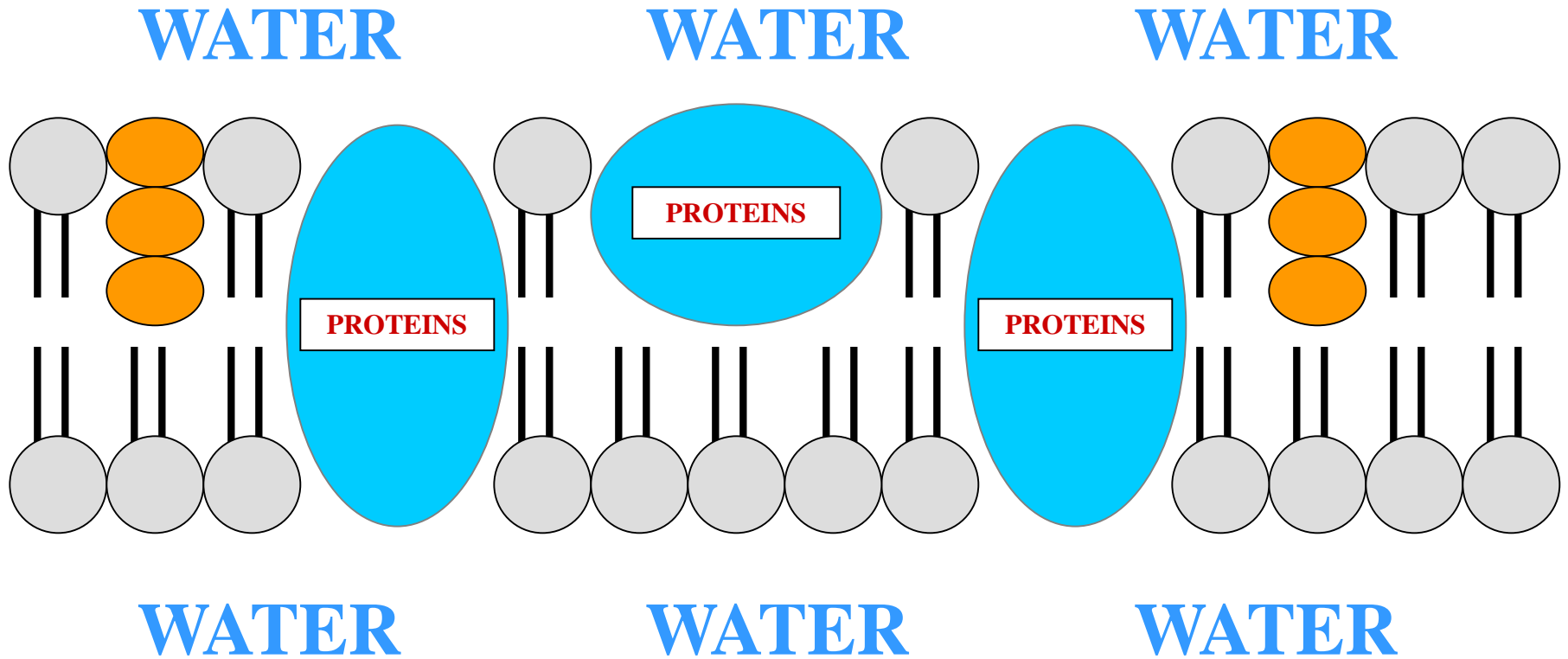
WATER

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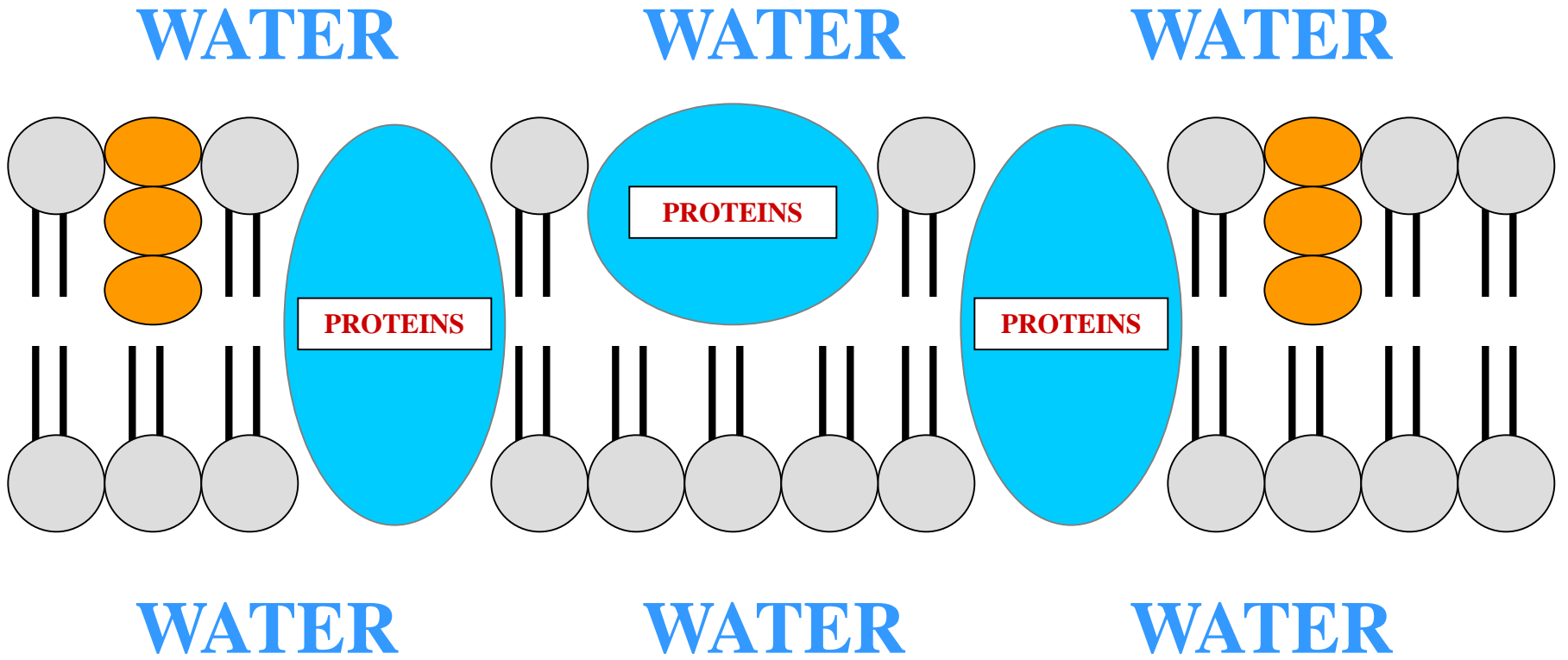
CELL MEMBRANE COMPOSITION

CELL MEMBRANE COMPOSITION



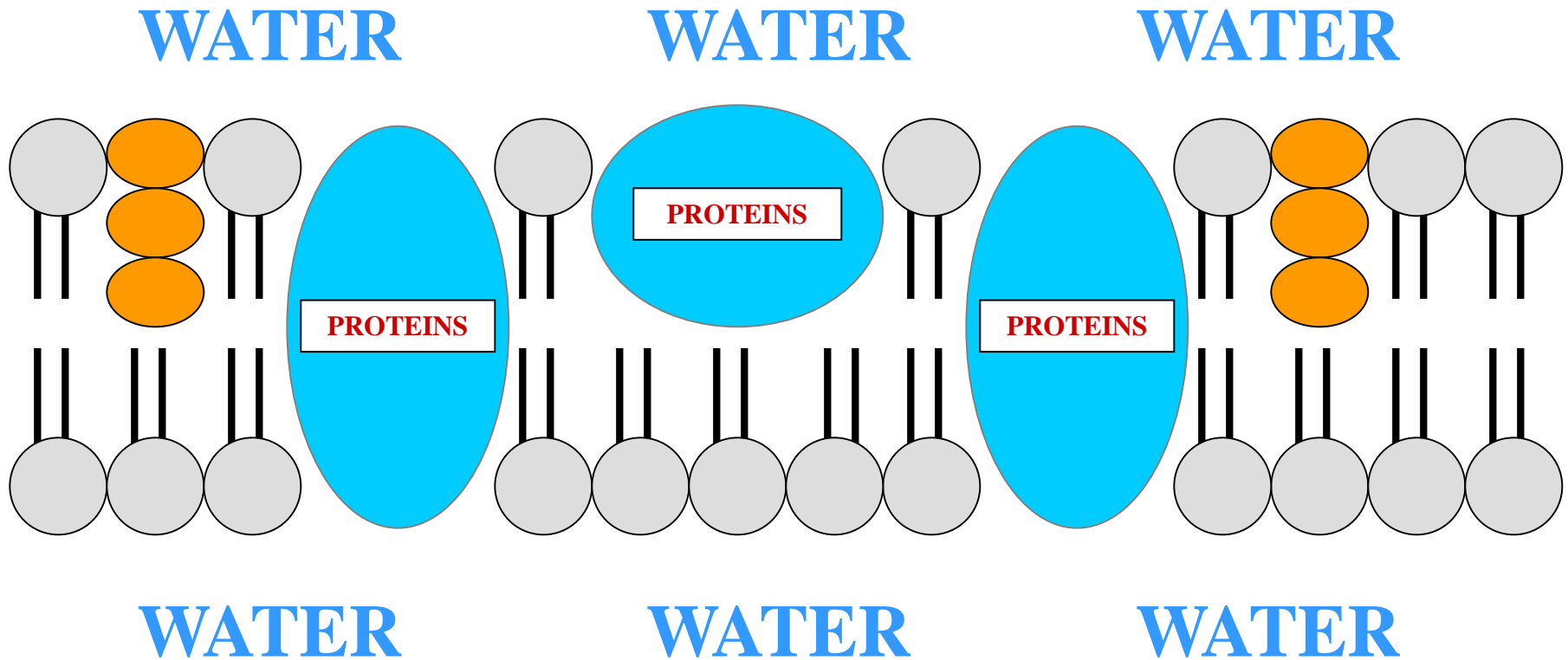
CELL MEMBRANE COMPOSITION

CELL MEMBRANE COMPOSITION



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CELL MEMBRANE COMPOSITION



FLUID MOSAIC MODEL

CYTOPLASM

CYTOPLASM

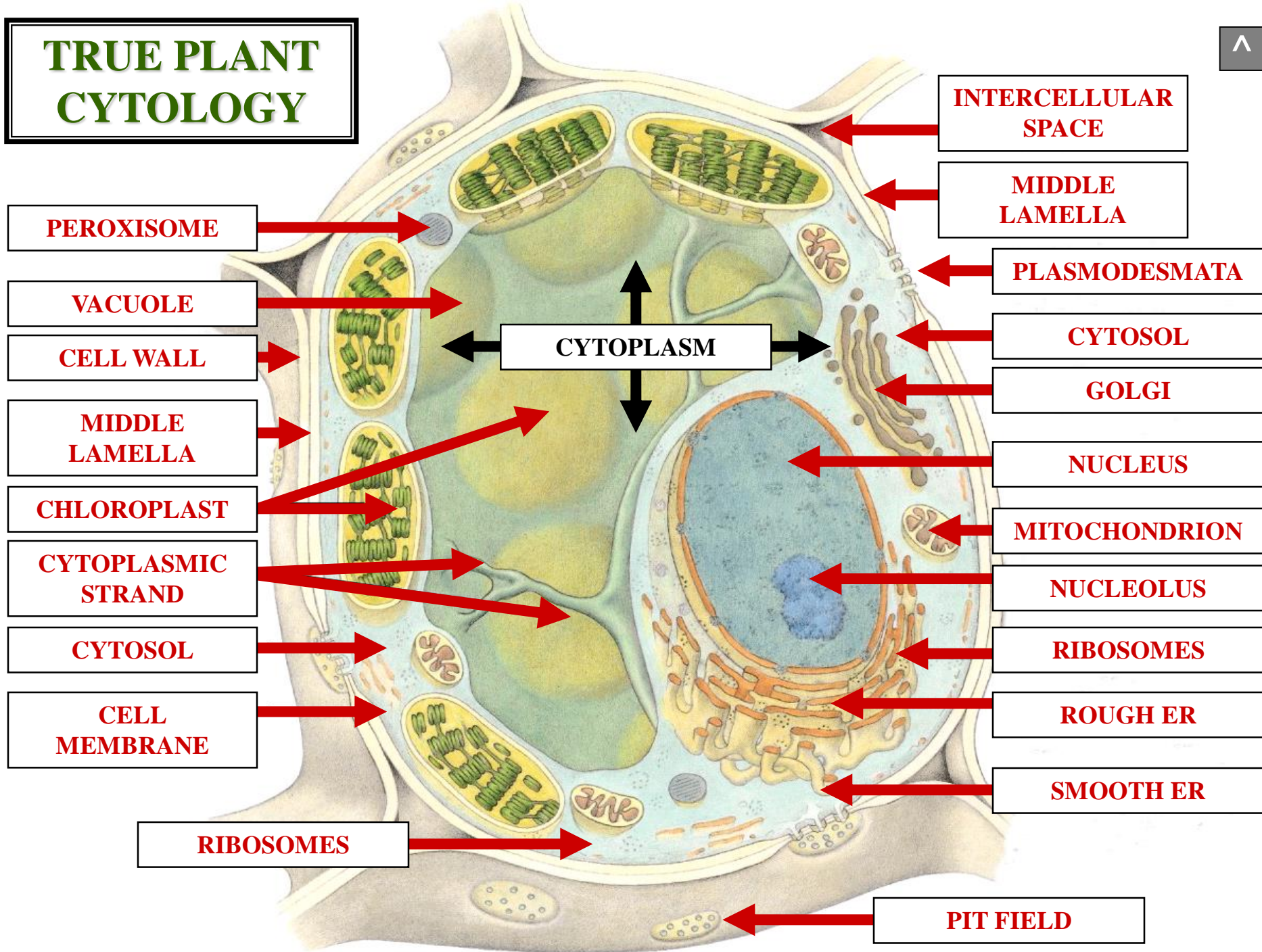


CYTOPLASM

**CONTENT BEYOND
CELL MEMBRANE**

CYTOPLASM

TRUE PLANT CYTOLOGY



CYTOPLASM COMPONENTS

CYTOPLASM COMPONENTS

CYTOSOL

CYTOPLASM COMPONENTS

CYTOPLASM COMPONENTS

**CYTOSOL
ORGANELLES**

CYTOPLASM COMPONENTS

CYTOSOL



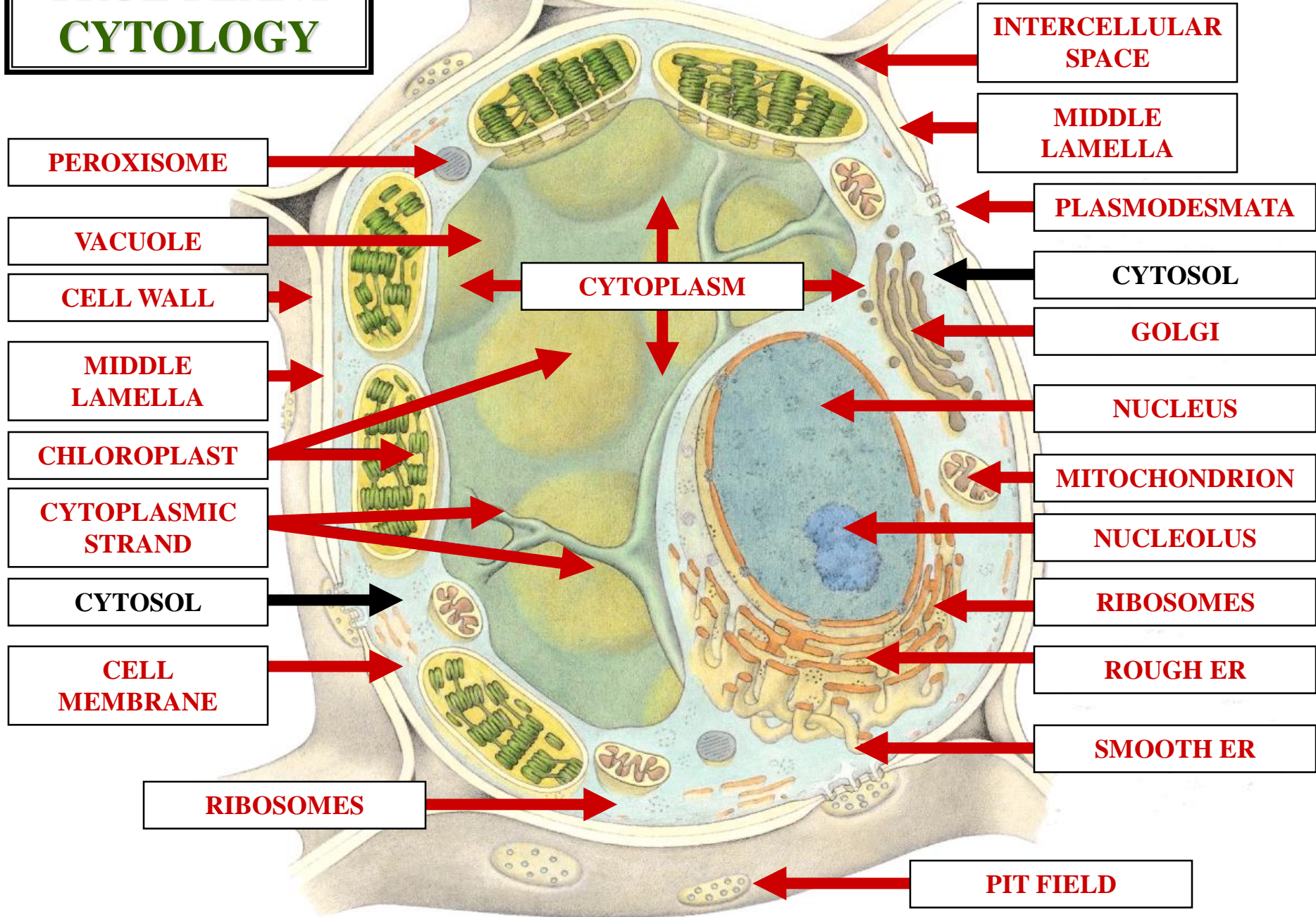
CYTOSOL

FLUID MATRIX

CYTOSOL

TRUE PLANT CYTOLOGY

CS





CYTOPLASMIC STREAMING



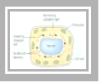
CYCLOSIS

CYTOPLASMIC 
STREAMING

SYNONYMOUS

CYCLOSIS

CYTOPLASMIC STREAMING CYCLOSIS



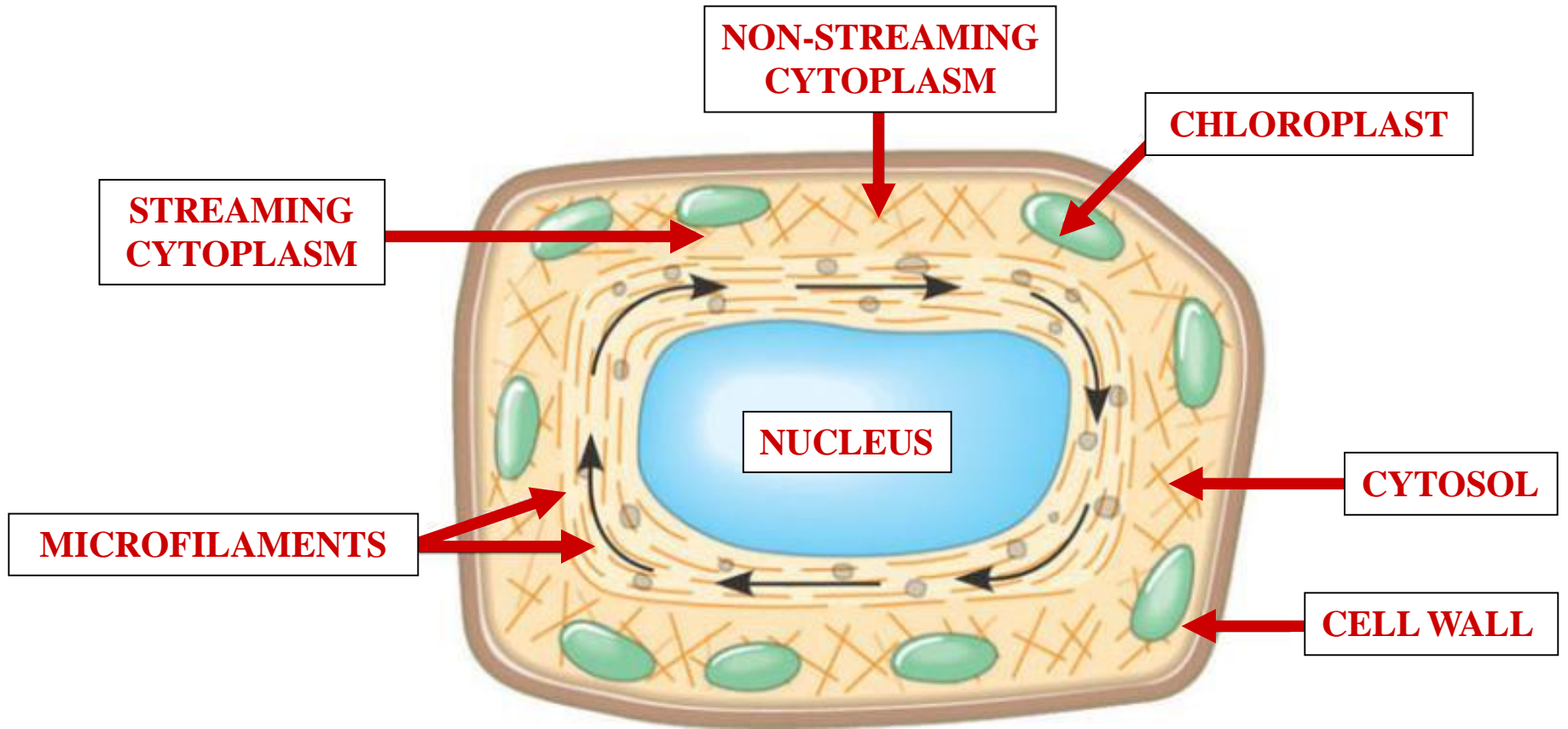
**CYTOSOL MOVEMENT
MIXES METABOLITES**

**CYTOPLASMIC STREAMING
CYCLOSIS**

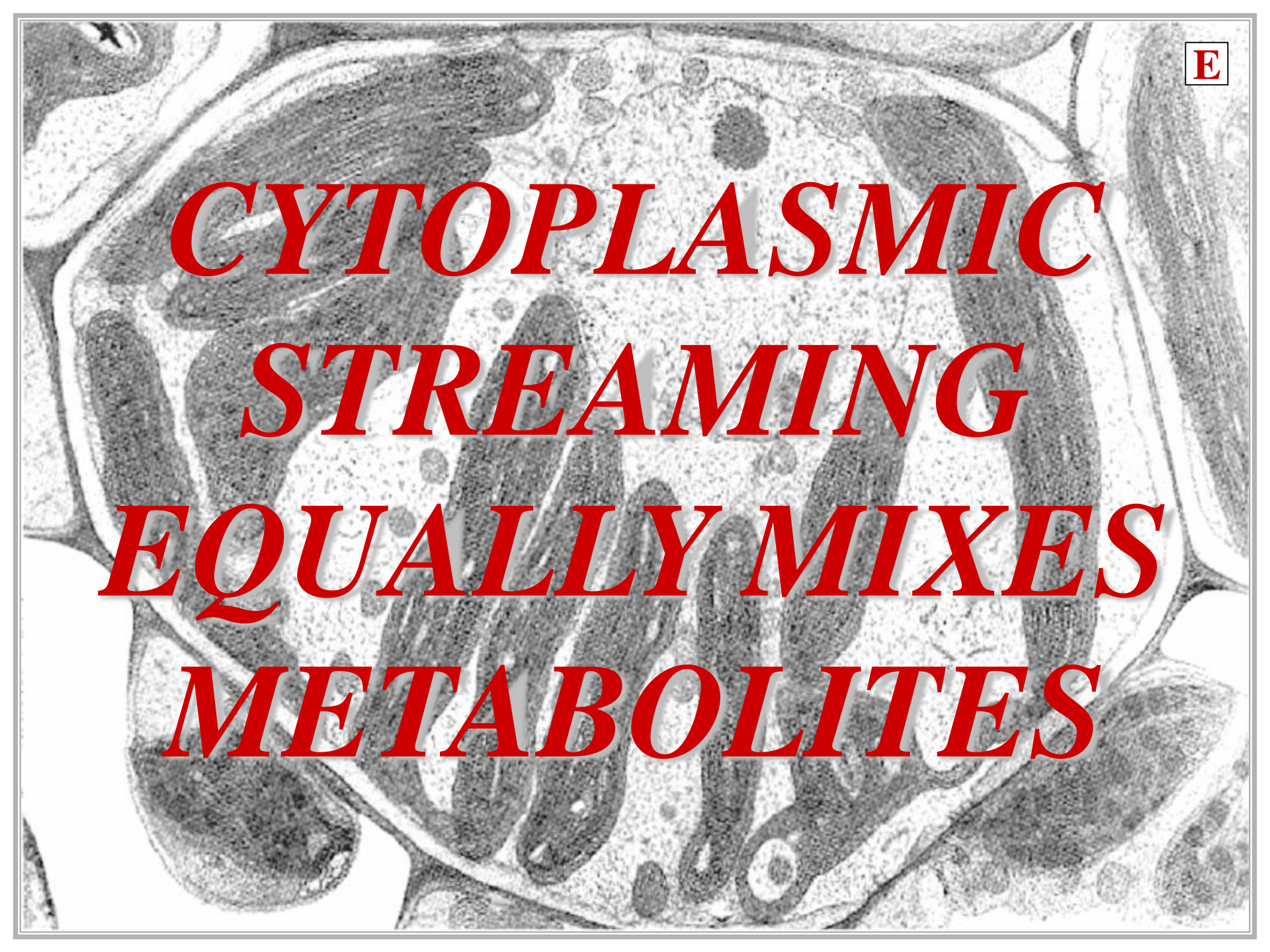
CYTOPLASMIC STREAMING



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***