

EUKARYOTE CELL

An electron micrograph of a eukaryotic cell, showing various organelles. The image is in grayscale and shows a complex internal structure. A large, dark, bean-shaped structure is labeled as a mitochondrion, and a large, light-colored, oval structure is labeled as a plastid chloroplast. The text 'EUKARYOTE CELL' is in a box at the top left. A small gray box with a white arrow is in the top right corner. Two red arrows point from labels to the organelles. A large red text box is at the bottom.

MITOCHONDRION

**PLASTID
CHLOROPLAST**

**MITOCHONDRION EVOLUTION
SCENARIO
IDENTICAL TO
PLASTID EVOLUTION**

HOST CELL

DNA W\ HISTONE PROTEINS

LARGE RIBOSOMES

AEROBIC

PROKARYOTE

AEROBIC RESPIRATION

DNA W\OUT HISTONE PROTEINS

SMALL RIBOSOMES

AEROBIC PROKARYOTE UNDERGOES ENDOSYMBIOSIS

MUTUALISTIC ENDOSYMBIOSIC RELATIONSHIP EVOLVES

HOST CELL

DNA W\ HISTONE PROTEINS

LARGE RIBOSOMES

AEROBIC
PROKARYOTE
AEROBIC RESPIRATION
DNA W\OUT HISTONE PROTEINS
SMALL RIBOSOMES

MUTUALISTIC ENDOSYMBIOSIC RELATIONSHIP EVOLVES



MITOCHONDRION EVOLUTION

HOST CELL

DNA W\ HISTONE PROTEINS

LARGE RIBOSOMES

ORGANELLE

DNA W\OUT HISTONE PROTEINS

SMALL RIBOSOMES

MITOCHONDRION EVOLUTION



MITOCHONDRION EVOLUTION

HOST CELL

DNA W\ HISTONE PROTEINS

LARGE RIBOSOMES

MITOCHONDRION

DNA W\OUT HISTONE PROTEINS

SMALL RIBOSOMES

MITOCHONDRION EVOLUTION

EUKARYOTE CELL

A transmission electron micrograph (TEM) of a eukaryotic cell. The image shows a large nucleus with a prominent nucleolus and dense chromatin. Surrounding the nucleus is the endoplasmic reticulum, consisting of rough and smooth membranes. Numerous mitochondria are visible, characterized by their double membrane structure and internal folds called cristae. The cytoplasm is filled with various organelles and a network of cytoskeletal fibers. A red arrow points from a label to one of the mitochondria.

MITOCHONDRION

**ENDOSYMBIOTIC
THEORY**



**ENDOSYMBIOTIC
THEORY
SUPPORTING
EVIDENCE**



PROPONENT: ENDOSYMBIOTIC THEORY

LYNN MARGULIS

ELECTRON MICROSCOPE



M&P



EUKARYOTE CELL

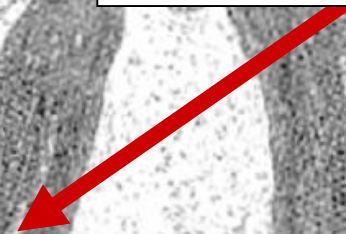
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

EUKARYOTE CELL

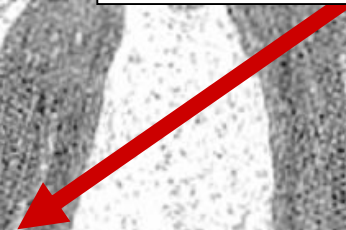
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

DNA

EUKARYOTE CELL

H

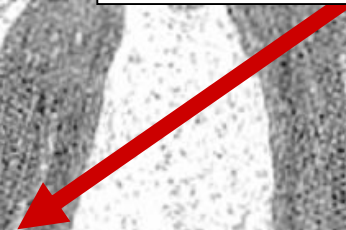
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

DNA PROKARYOTE-LIKE

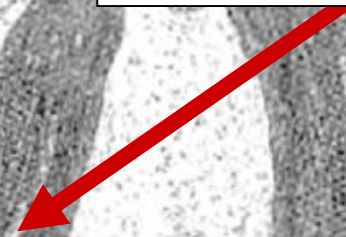
EUKARYOTE CELL



MITOCHONDRION



PLASTIDS

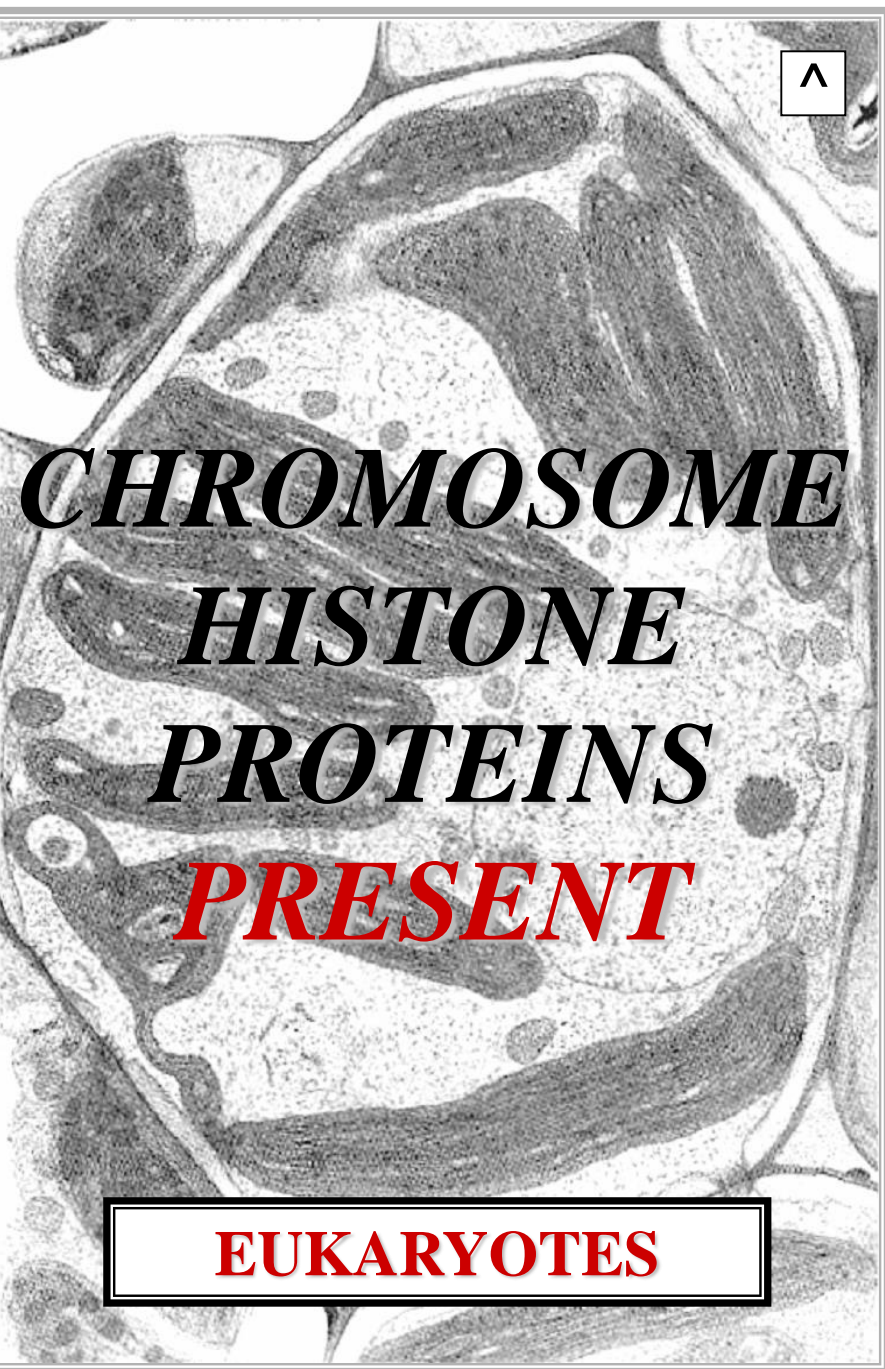


HISTONE PROTEINS: ABSENT



CHROMOSOME
HISTONE
PROTEINS
ABSENT

PROKARYOTES



CHROMOSOME
HISTONE
PROTEINS
PRESENT

EUKARYOTES

EUKARYOTE CELL

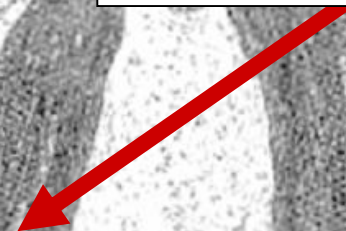
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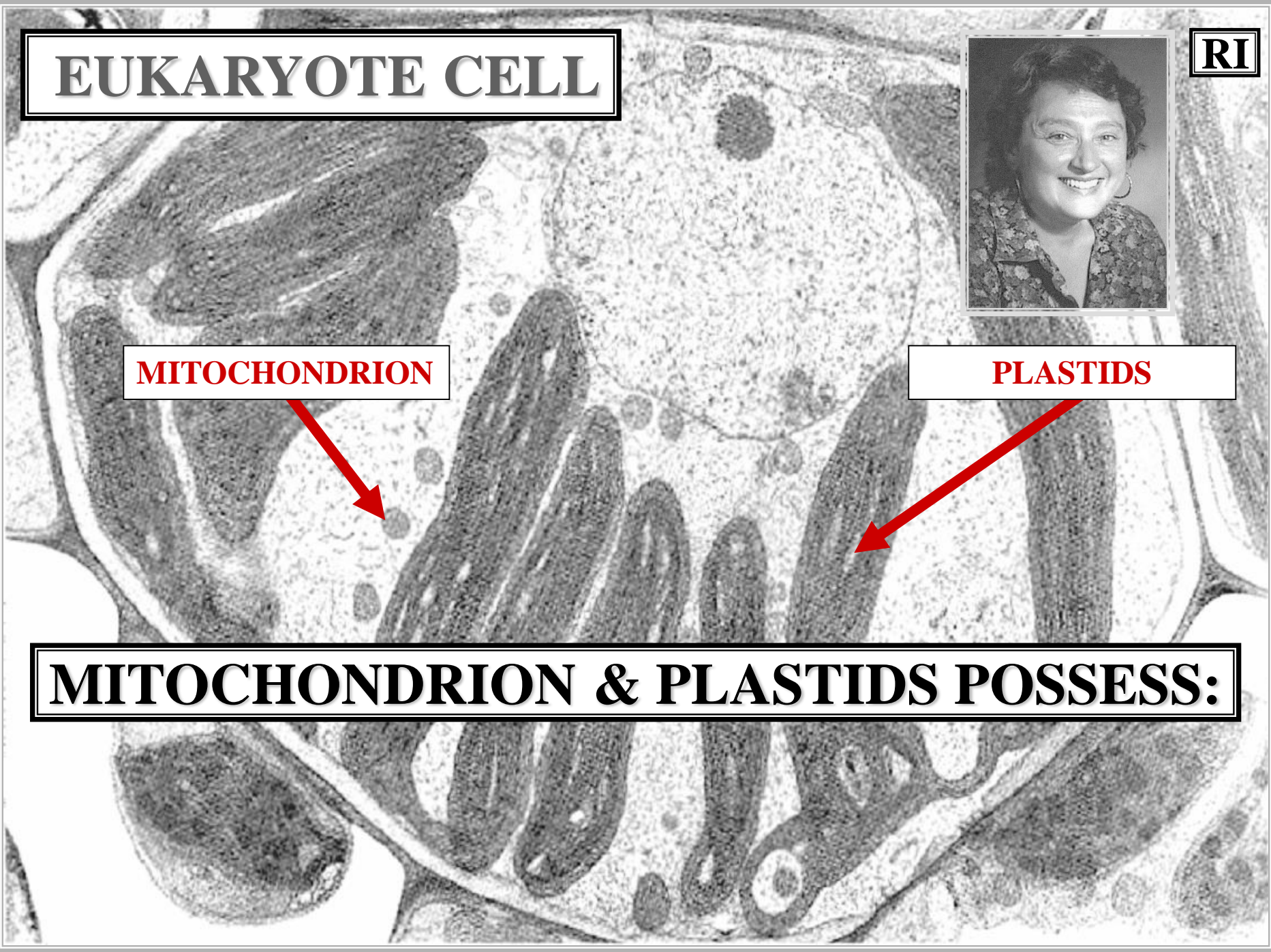
MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:



EUKARYOTE CELL

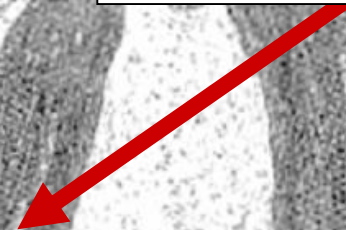
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

RIBOSOMES

EUKARYOTE CELL

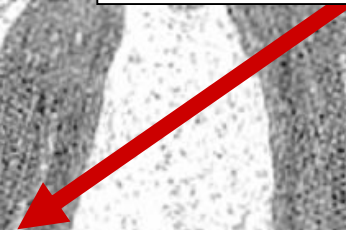
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

RIBOSOMES PROKARYOTE-LIKE

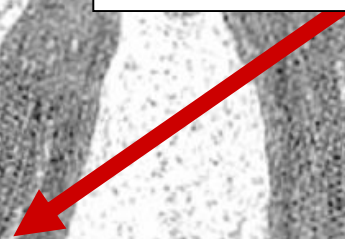
EUKARYOTE CELL



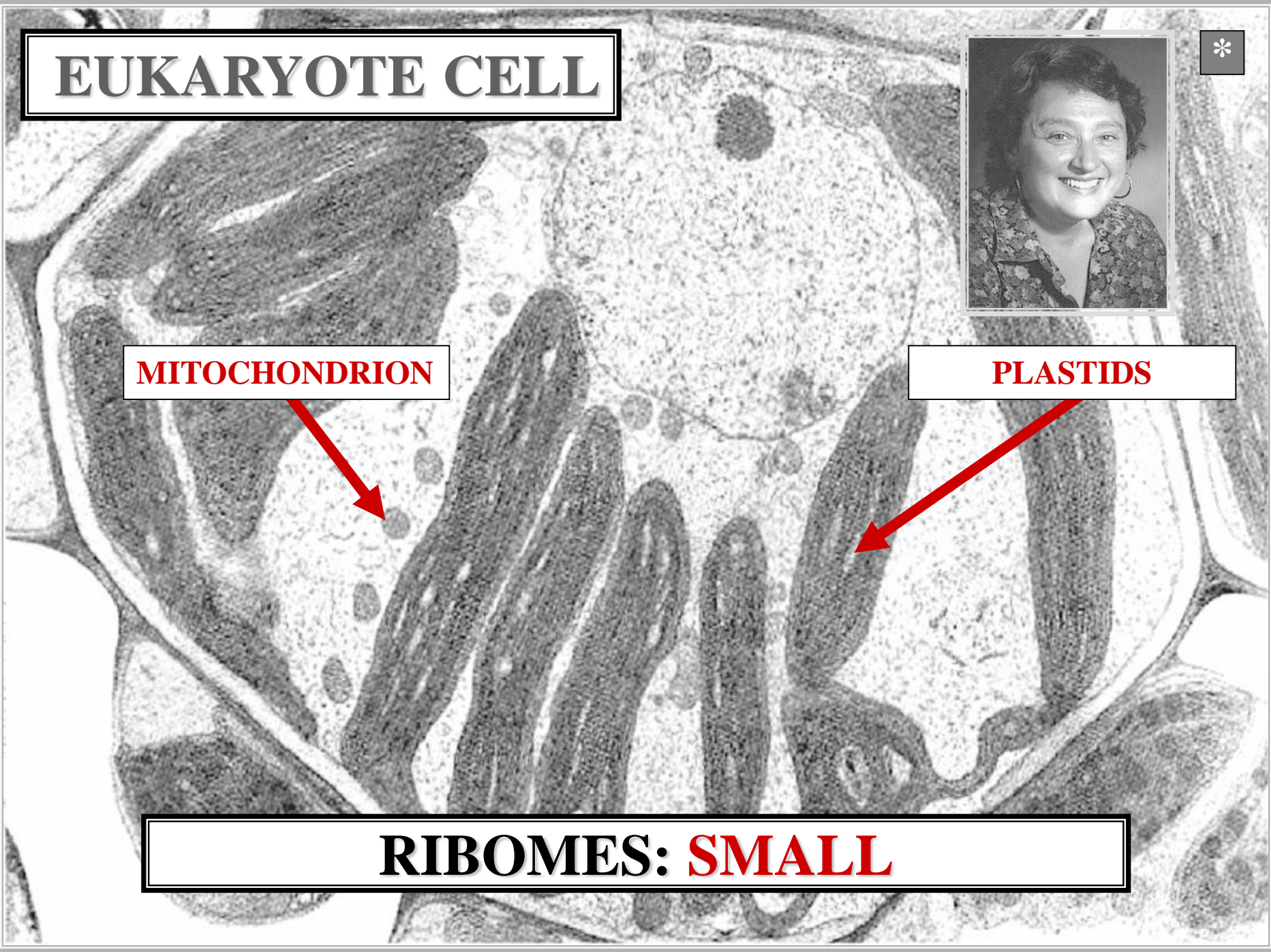
MITOCHONDRION



PLASTIDS



RIBOMES: SMALL



This electron micrograph shows several large, dark, roughly spherical ribosomes. They have a granular, textured surface and are scattered across the field of view. The background is light and mostly clear.

RIBOSOMES
SMALL SIZE

PROKARYOTES

This electron micrograph shows a large, complex cell structure, likely a eukaryotic cell. The cell is filled with various organelles, including a prominent nucleus with a nucleolus. Numerous small, dark, spherical ribosomes are visible throughout the cytoplasm. A small white box with a black border and a black caret symbol is located in the top right corner of the image.

RIBOSOMES
LARGE SIZE

EUKARYOTES

EUKARYOTE CELL

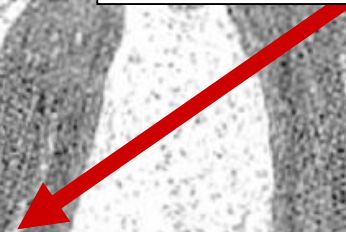
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

EUKARYOTE CELL

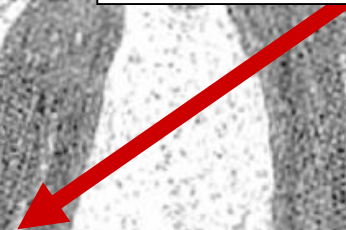
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

REPRODUCTION

EUKARYOTE CELL

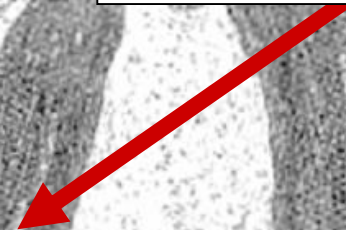
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MITOCHONDRION



PLASTIDS



MITOCHONDRION & PLASTIDS POSSESS:

REPRODUCTION PROKARYOTE-LIKE

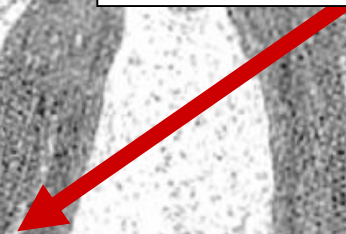
EUKARYOTE CELL



MITOCHONDRION



PLASTIDS



REPRODUCTION: BINARY FISSION

An electron micrograph showing several rod-shaped prokaryotic cells. The cells have a thick, textured outer layer and a granular internal structure. They are arranged in a somewhat diagonal pattern across the frame.

***REPRODUCTION
BINARY FISSION
PRESENT***

PROKARYOTES

An electron micrograph showing a cross-section of a eukaryotic cell. The cell is large and contains various organelles, including a nucleus with a prominent nucleolus, mitochondria with cristae, and a complex endoplasmic reticulum. A small box with a question mark is in the top right corner.

***REPRODUCTION
BINARY FISSION
ABSENT***

EUKARYOTES

QUESTION



DOES THIS EVIDENCE
SUPPORT OR REFUTE
THE
ENDOSYMBIOTIC
THEORY?

QUESTION

EUKARYOTE CELL

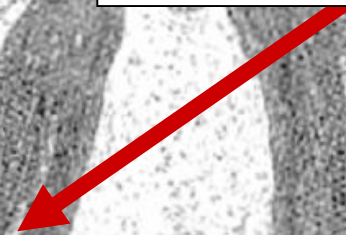
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MITOCHONDRION



PLASTIDS



DNA PROKARYOTE-LIKE

EUKARYOTE CELL

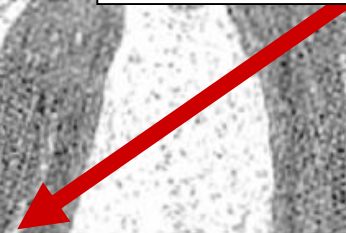
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MITOCHONDRION



PLASTIDS



RIBOSOMES PROKARYOTE-LIKE

EUKARYOTE CELL



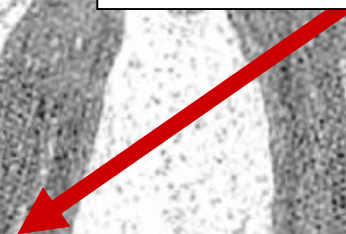
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MITOCHONDRION



PLASTIDS



REPRODUCTION PROKARYOTE-LIKE



ANSWER

**EVIDENCE SUPPORTS
ENDOSYMBIOTIC
THEORY**

ANSWER

EUKARYOTE CELL

An electron micrograph of a eukaryotic cell, showing various organelles. The cell is filled with a complex network of membranes and structures. A large, dark, oval-shaped structure is visible on the left, and several elongated, dark structures are scattered throughout the cytoplasm. The background is a light, granular texture representing the cytoplasm and other cellular components.

MITOCHONDRION

PLASTIDS

**ENDOSYMBIOTIC
THEORY**



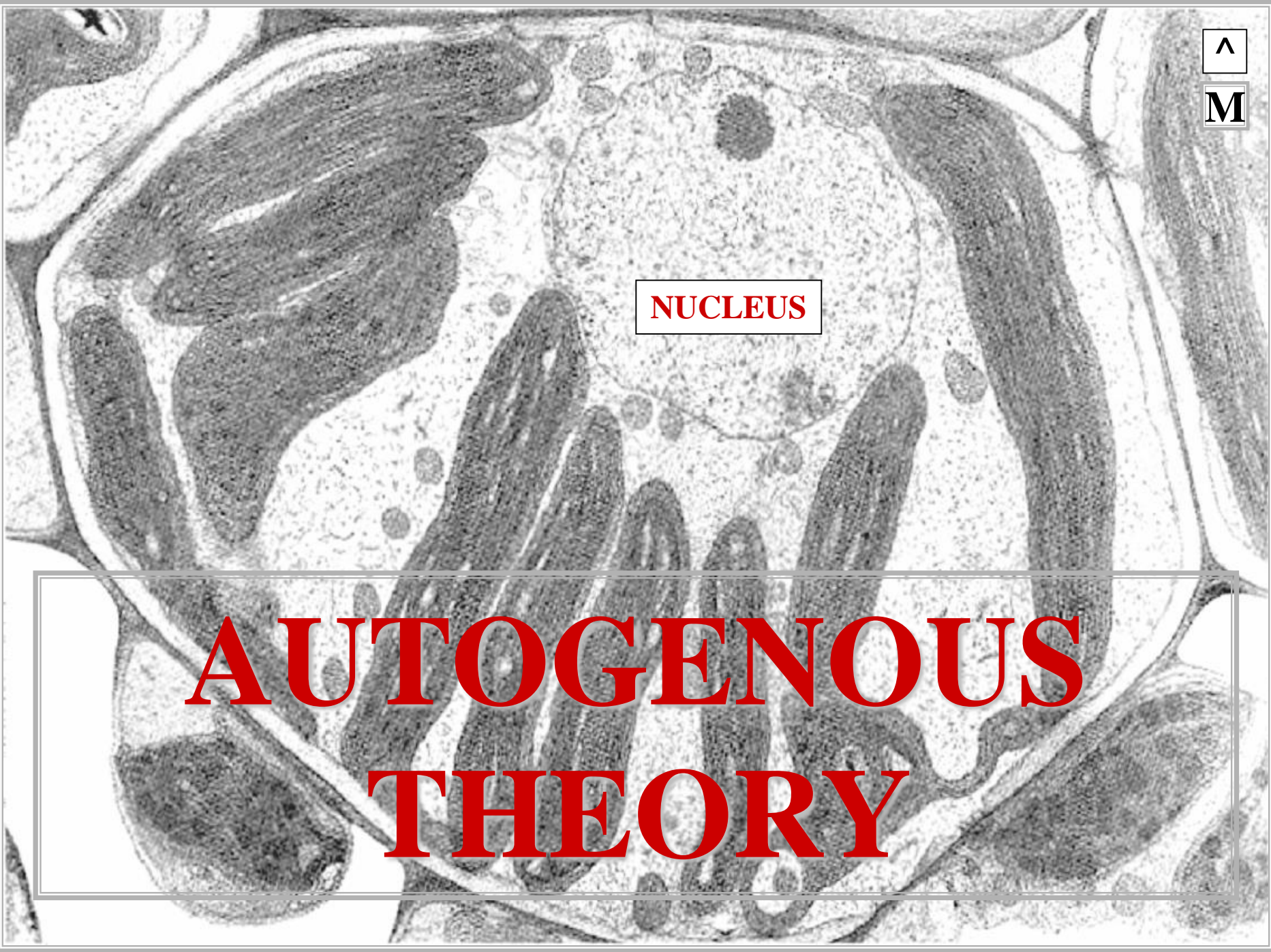
DMBO EVOLUTION SUMMARY

NUCLEUS

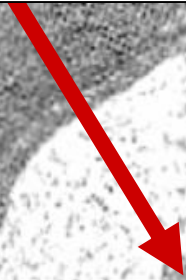
NUCLEUS EVOLUTION

NUCLEUS

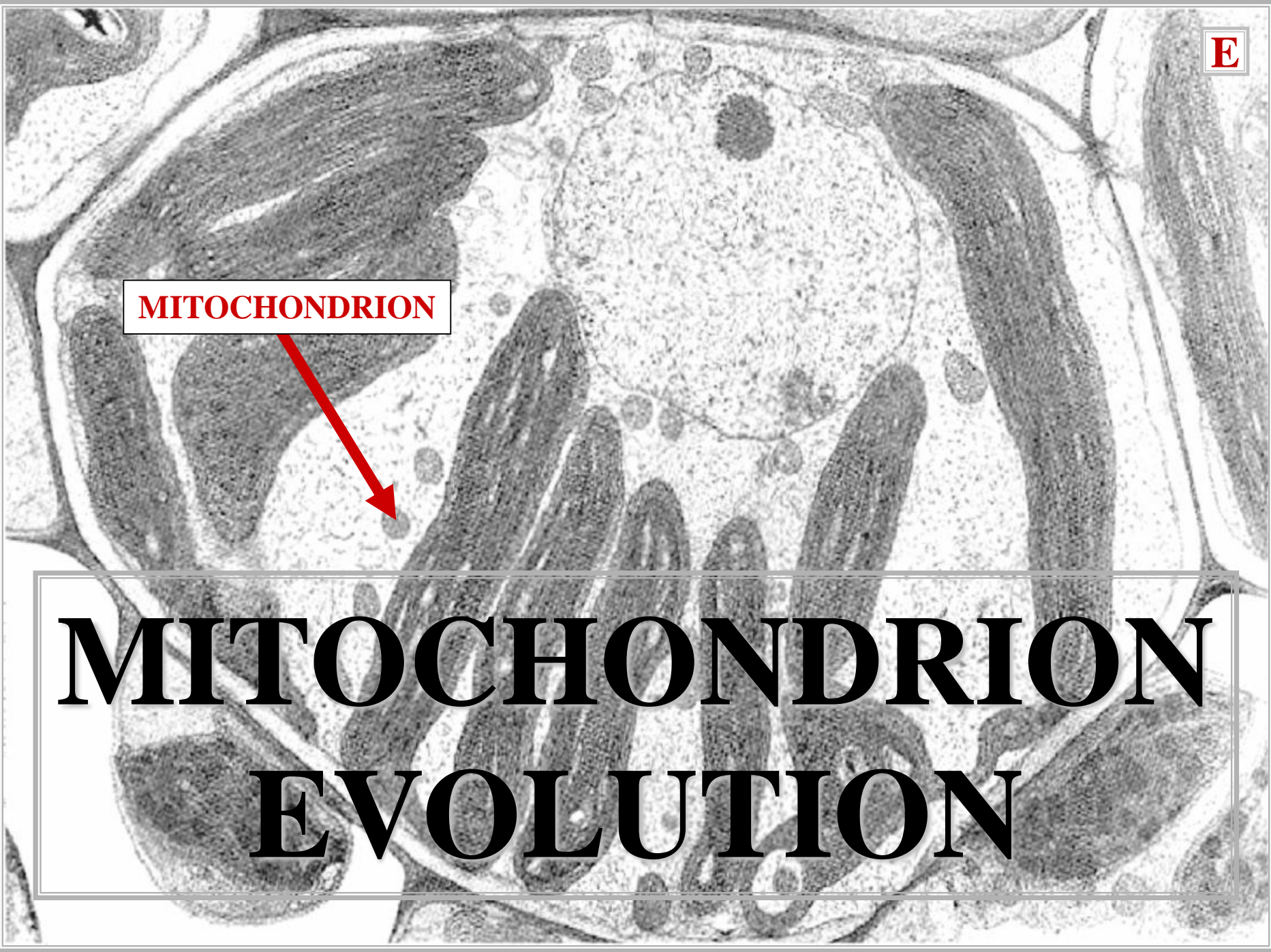
AUTOGENOUS THEORY



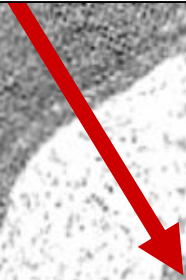
MITOCHONDRION



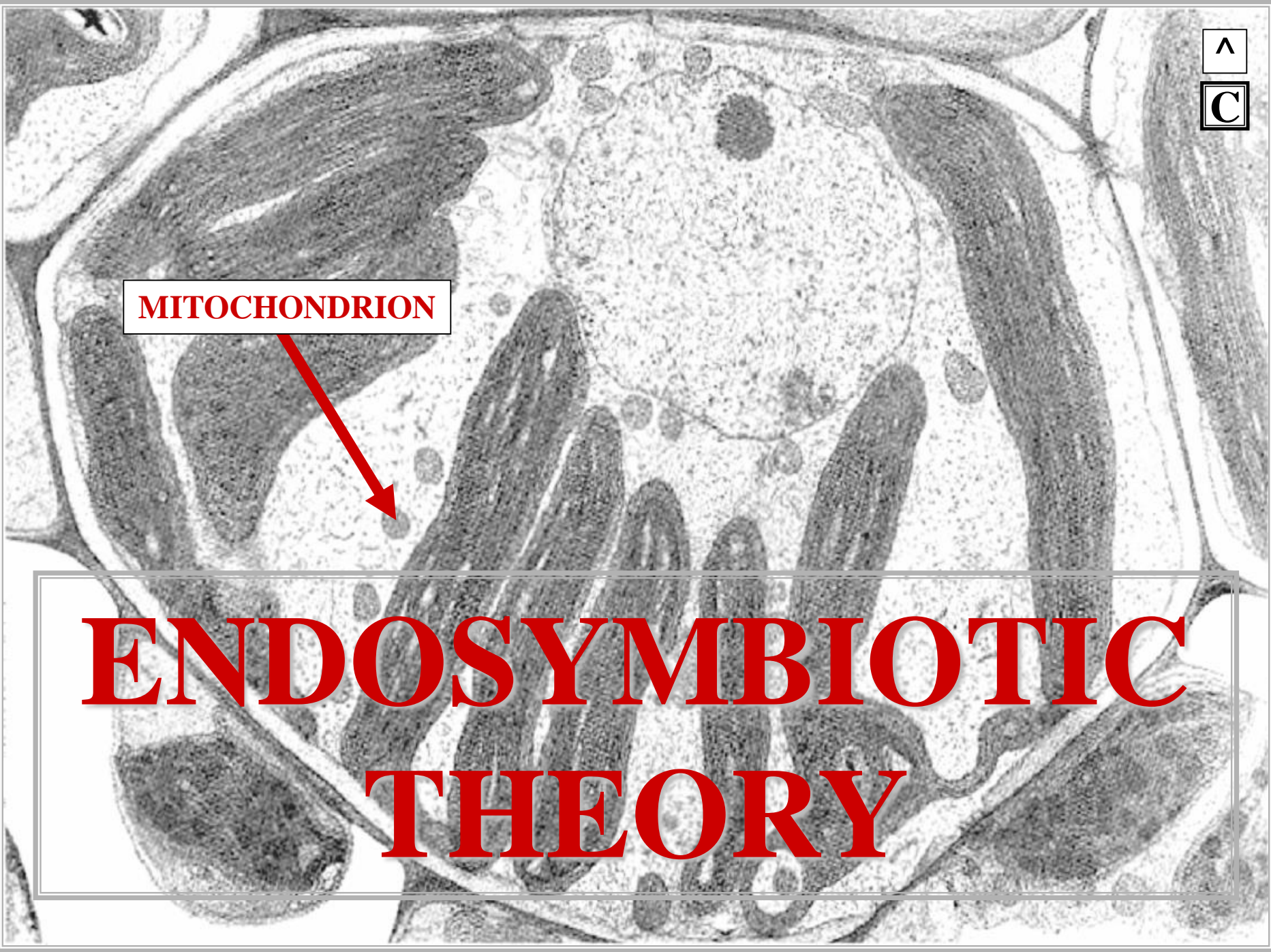
MITOCHONDRION EVOLUTION



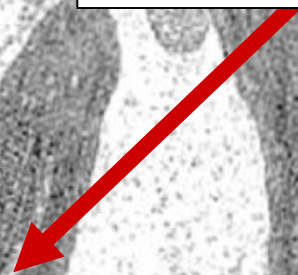
MITOCHONDRION



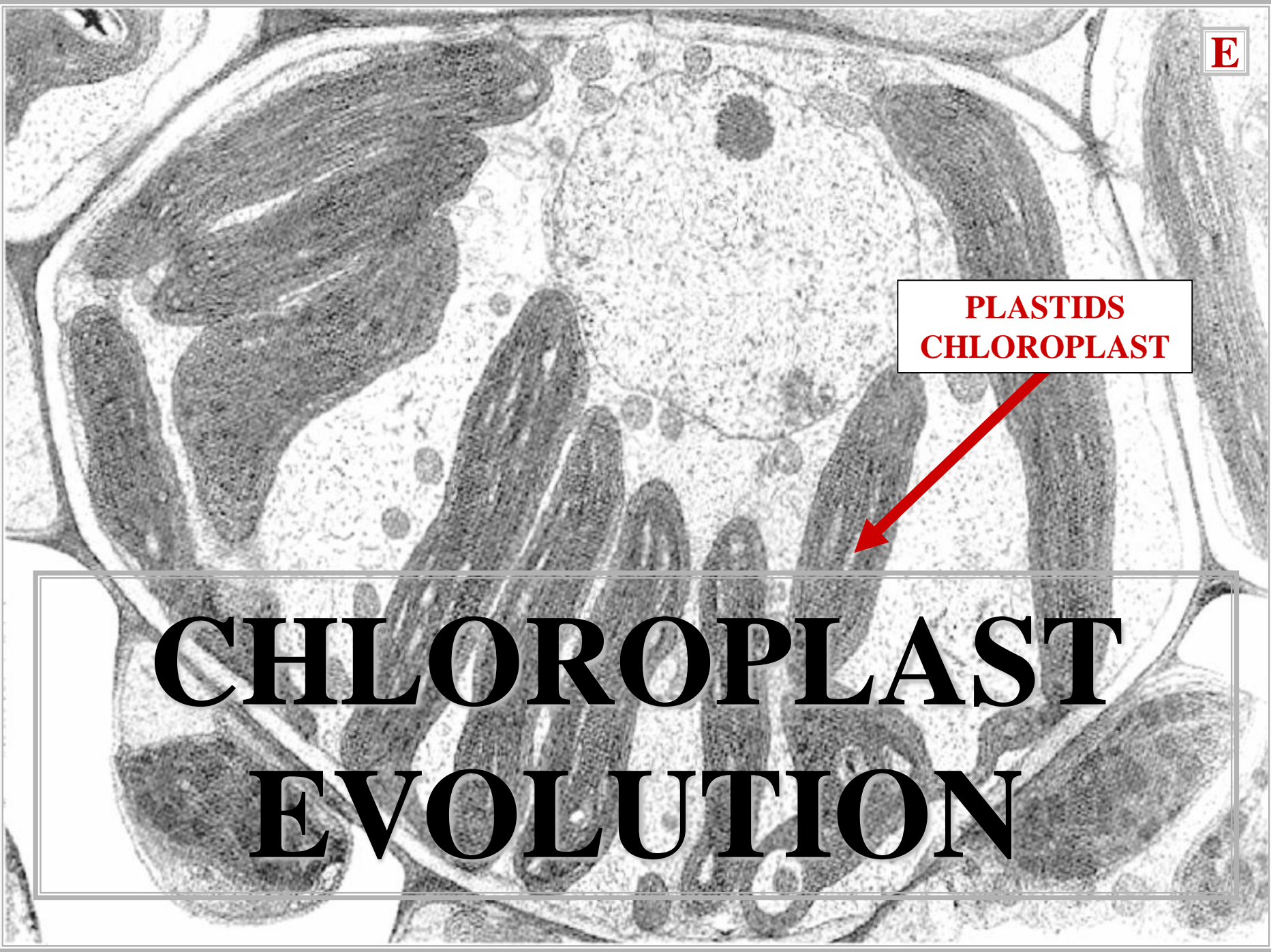
ENDOSYMBIOTIC THEORY



**PLASTIDS
CHLOROPLAST**

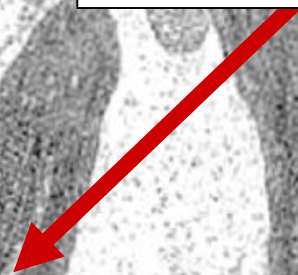


CHLOROPLAST EVOLUTION

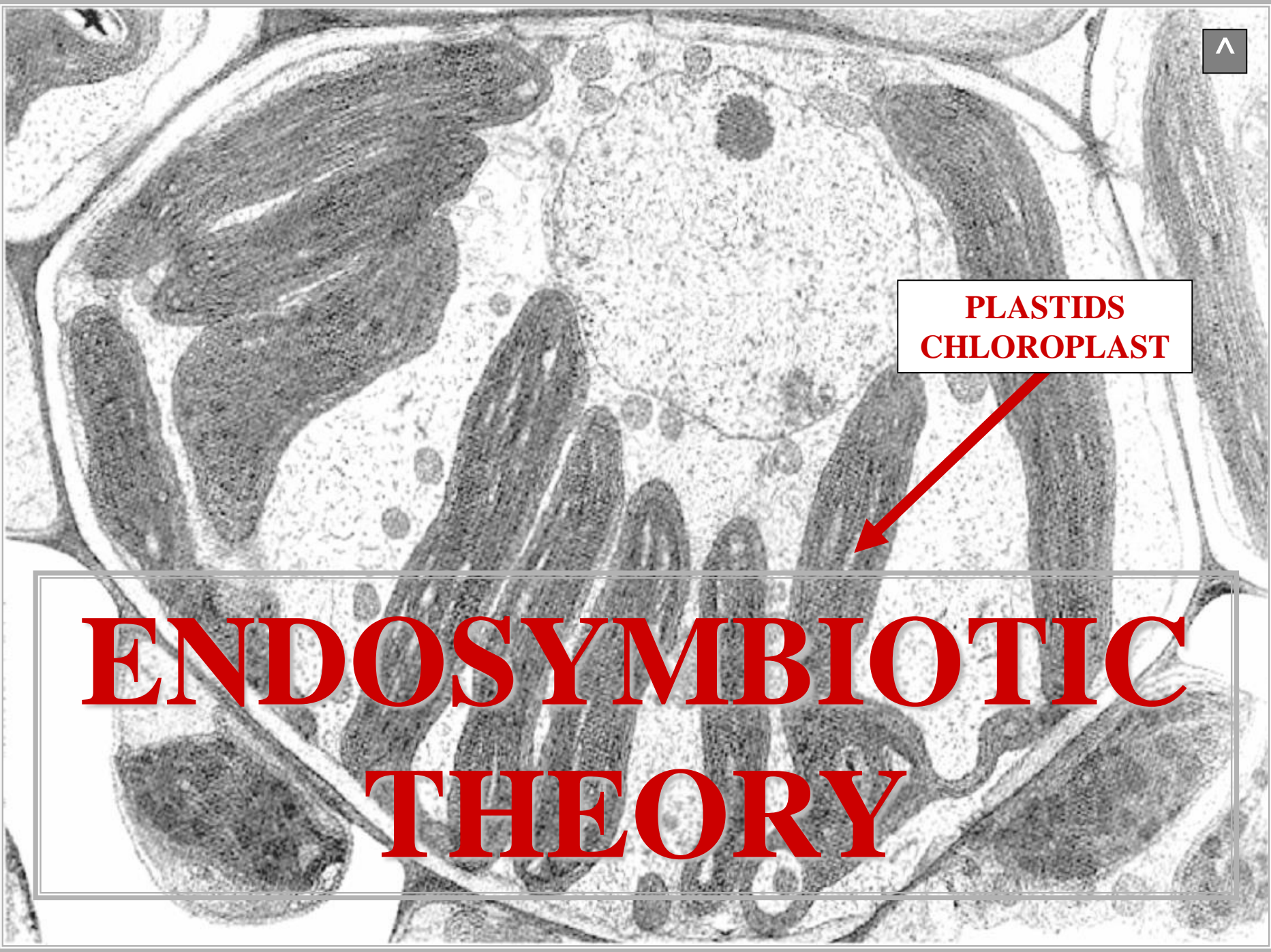




**PLASTIDS
CHLOROPLAST**



ENDOSYMBIOTIC THEORY





~1.8

BILLION YEARS



**DIVERSE
PROKARYOTE
&
EUKARYOTE
BIOTA**

EARTH

MUTATION

EARTH

MUTATION

**NATURAL
SELECTION**

EARTH

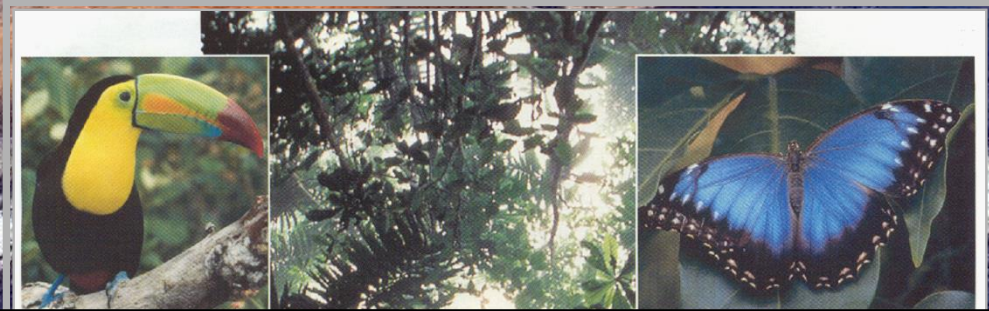


MUTATION

**NATURAL
SELECTION**

SPECIATION

EARTH



~10 MILLION SPECIES



EARTH

**END
LECTURE
MATERIAL
FINAL EXAM**

CHAPTER 24

SPECIATION

SPECIATION

SPECIATION



SPECIATION

**EVOLUTION
NEW SPECIES**

SPECIATION

QUESTION

**WHAT DRIVES
SPECIATION?**

QUESTION

ANSWER

MUTATIONS

ANSWER

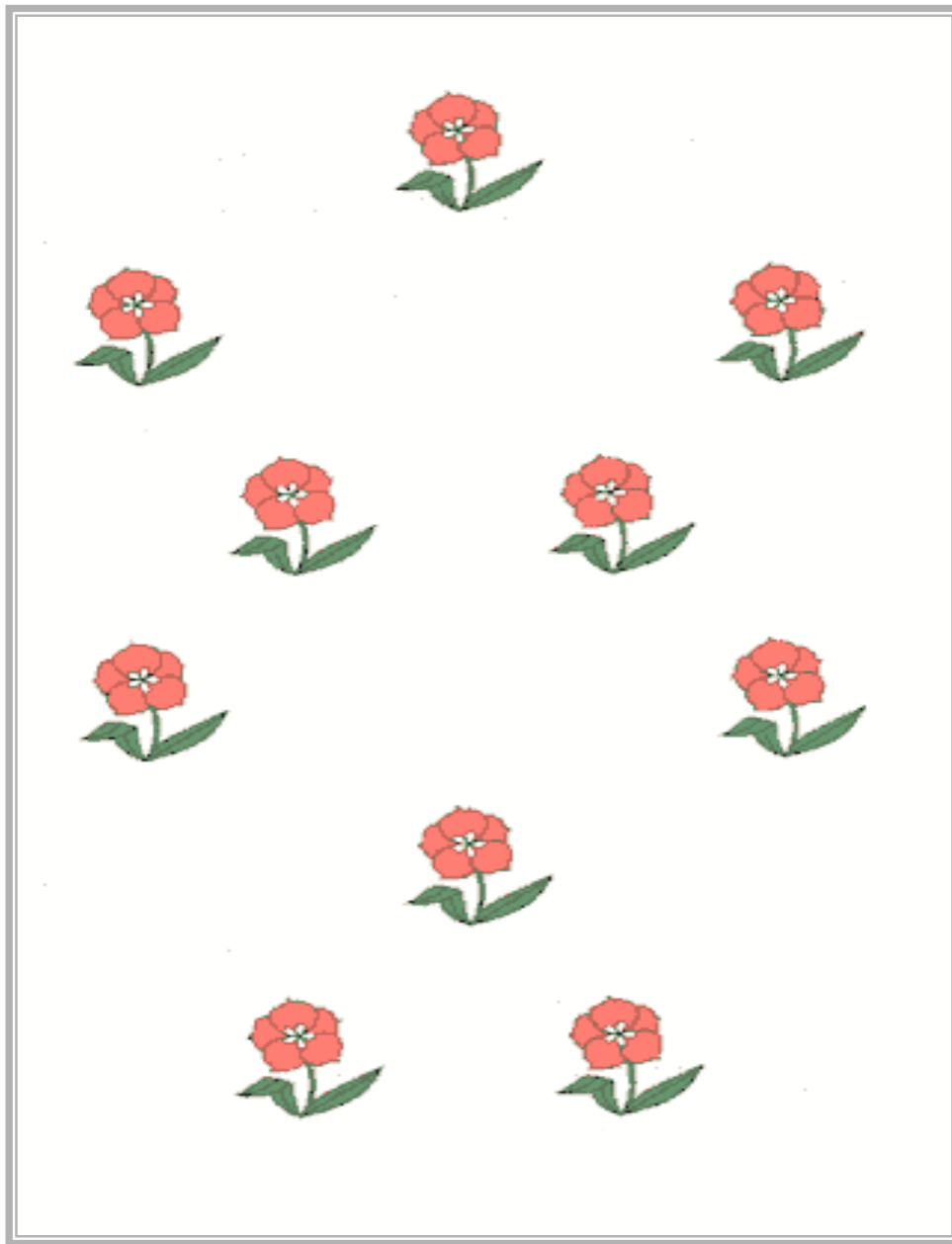
MUTATION

MUTATION

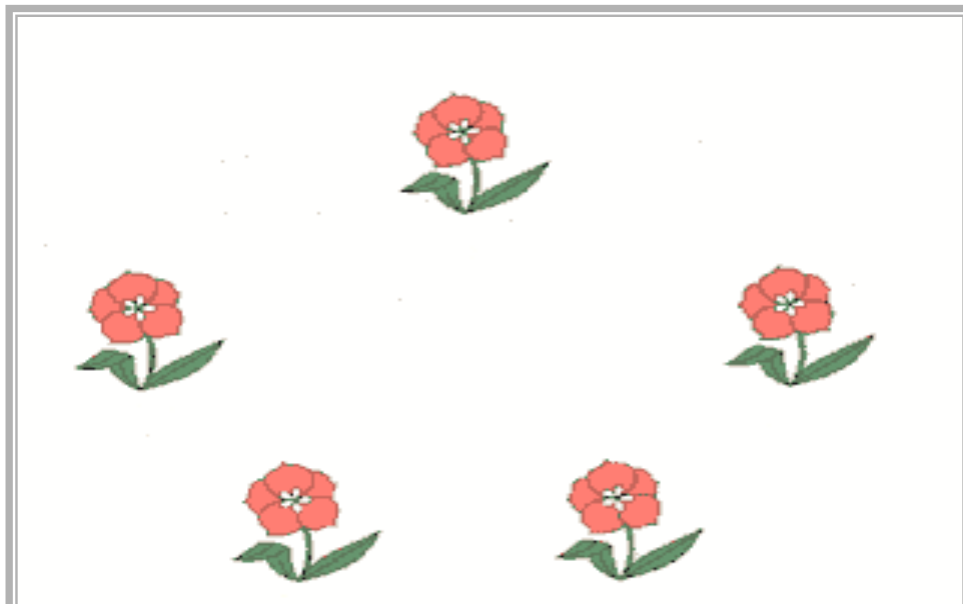


CHANGE DNA STRUCTURE
OR
CHANGE DNA CONTENT

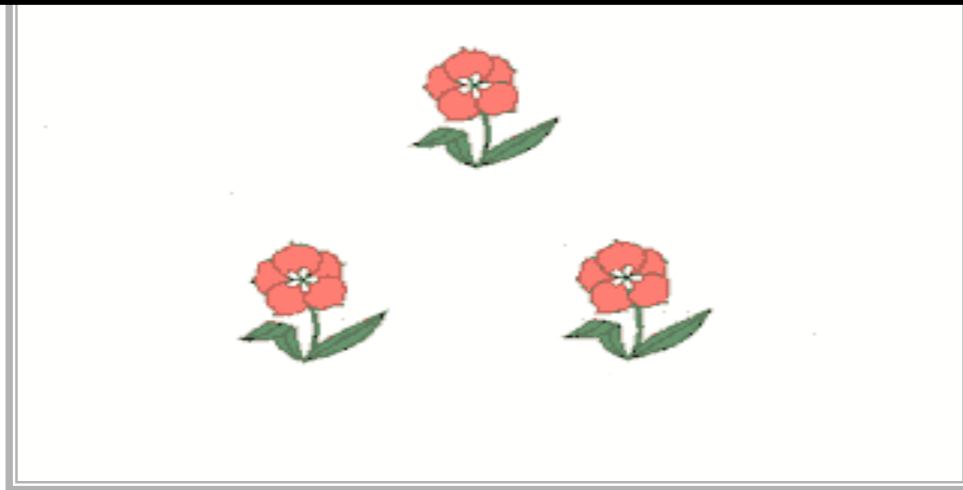
MUTATION



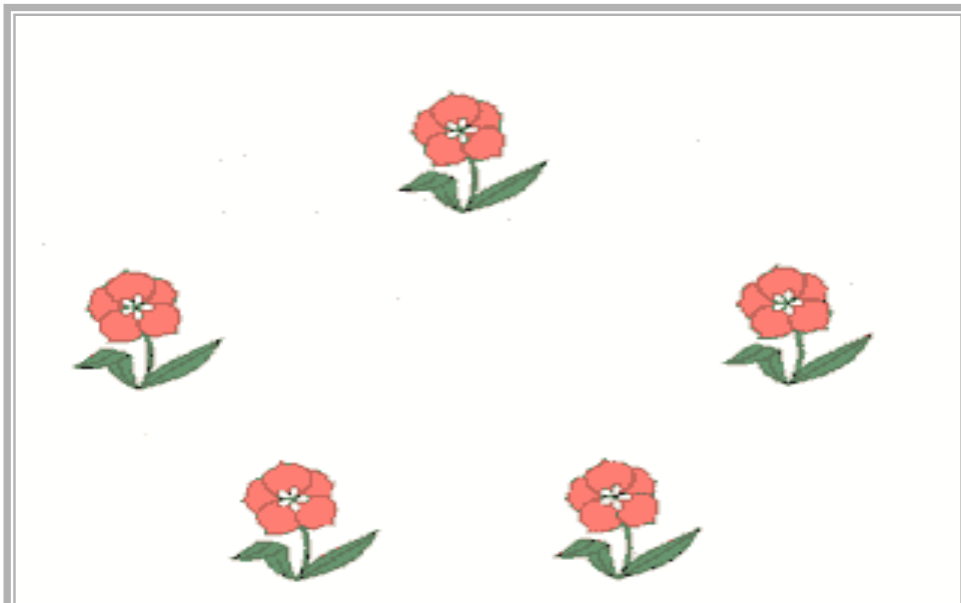
PARENTAL SPECIES



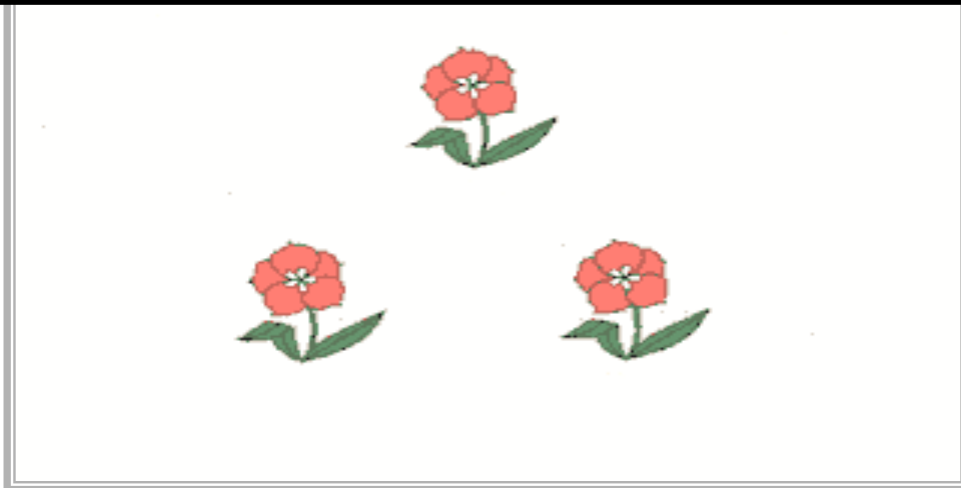
DNA MUTATION



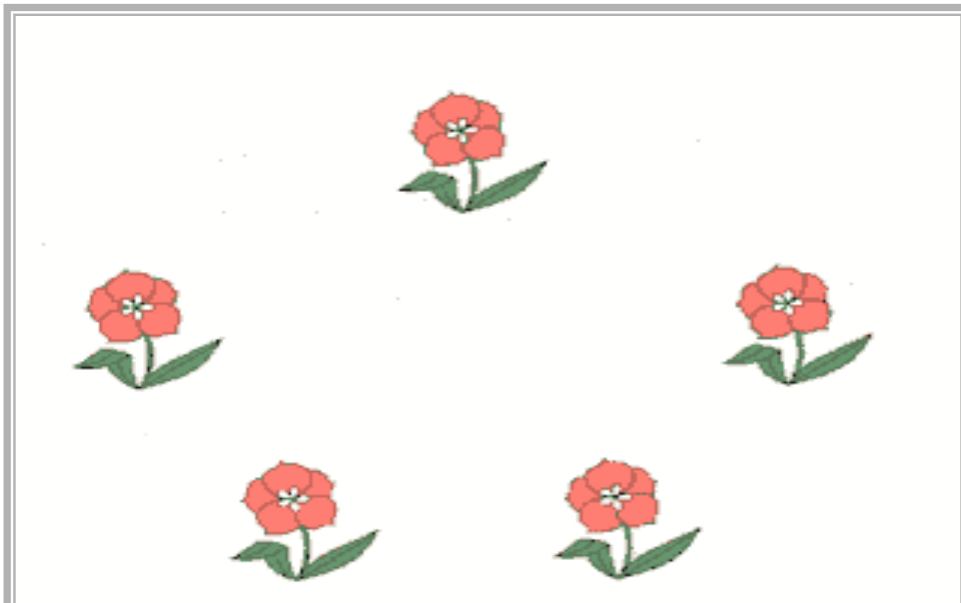
PARENTAL SPECIES



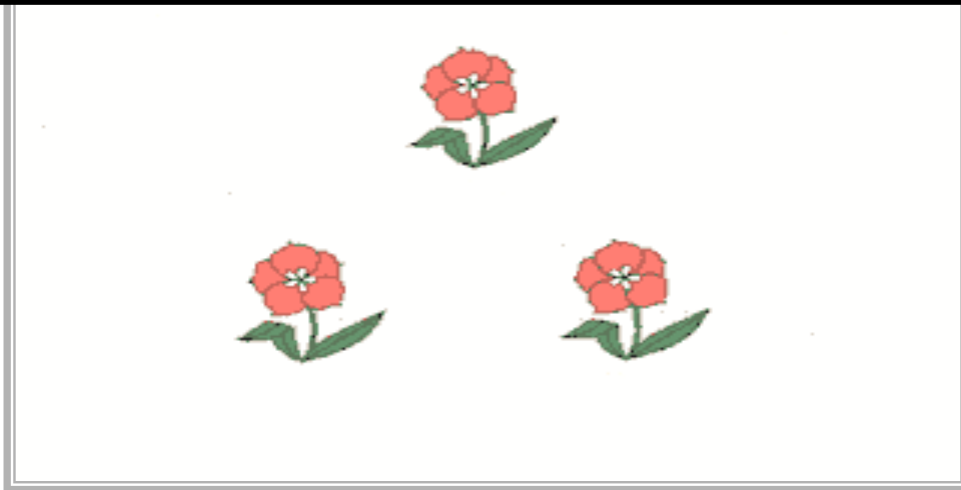
GENE CHANGE



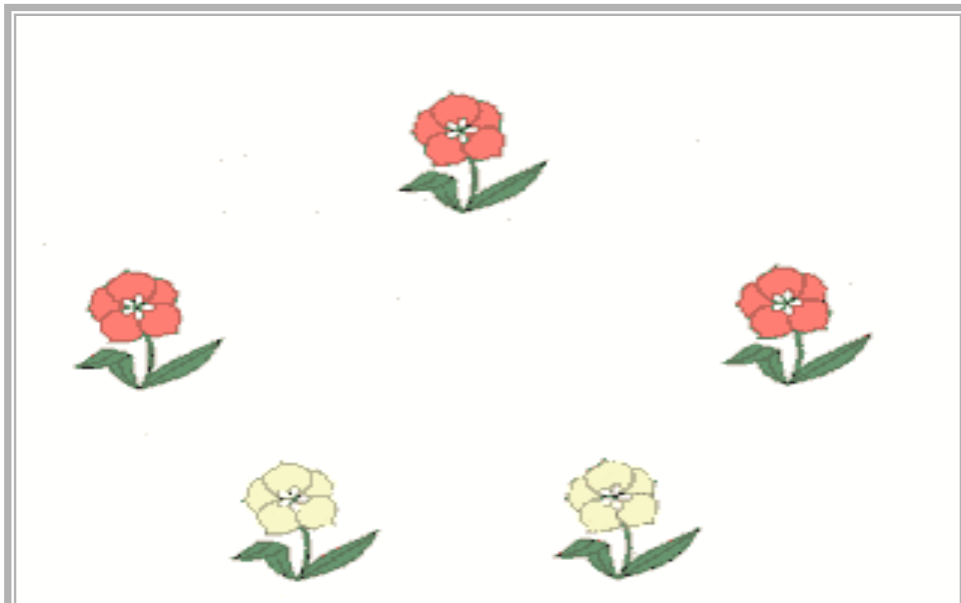
PARENTAL SPECIES



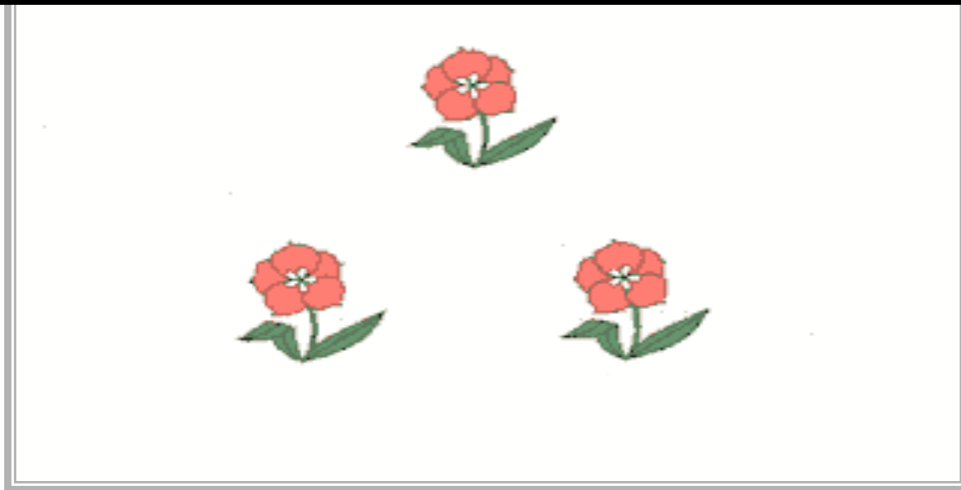
GENOTYPE CHANGE



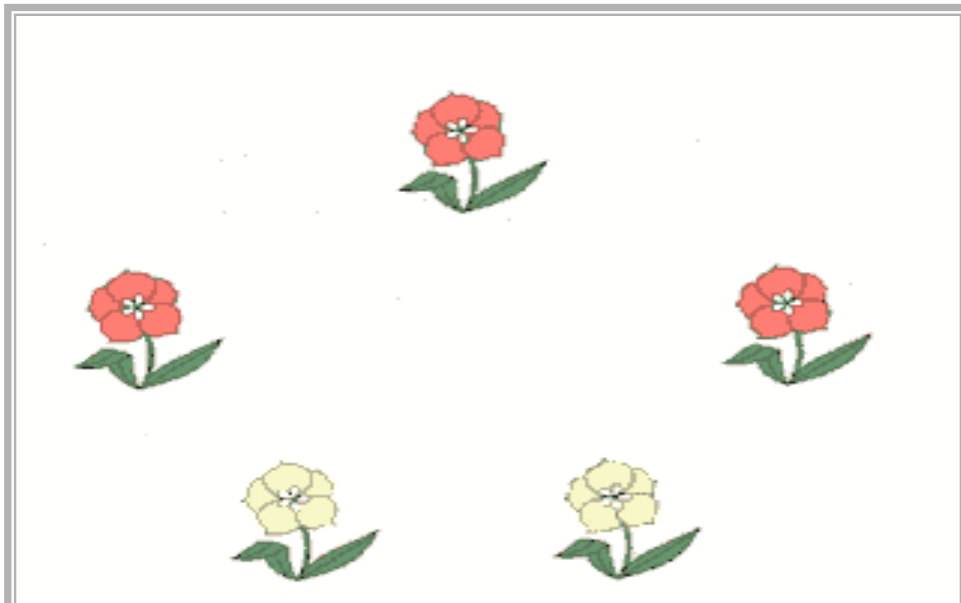
PARENTAL SPECIES



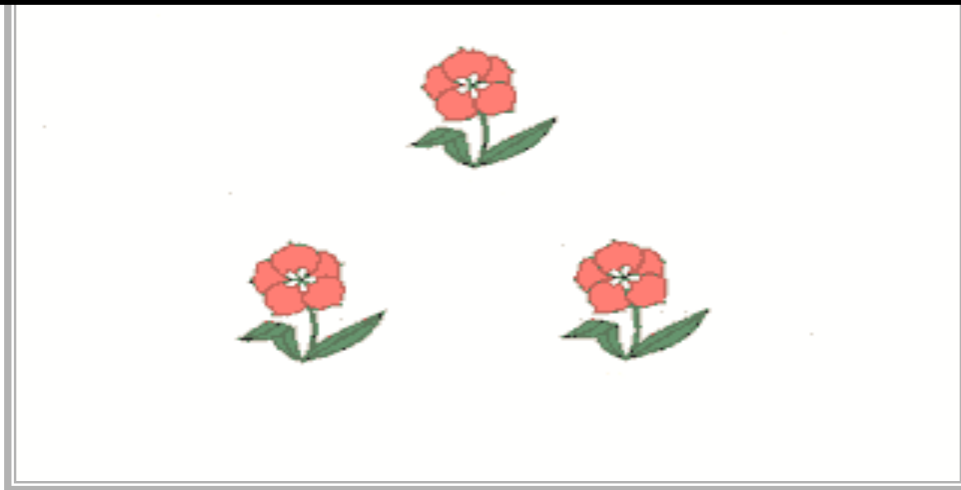
PHENOTYPE CHANGE



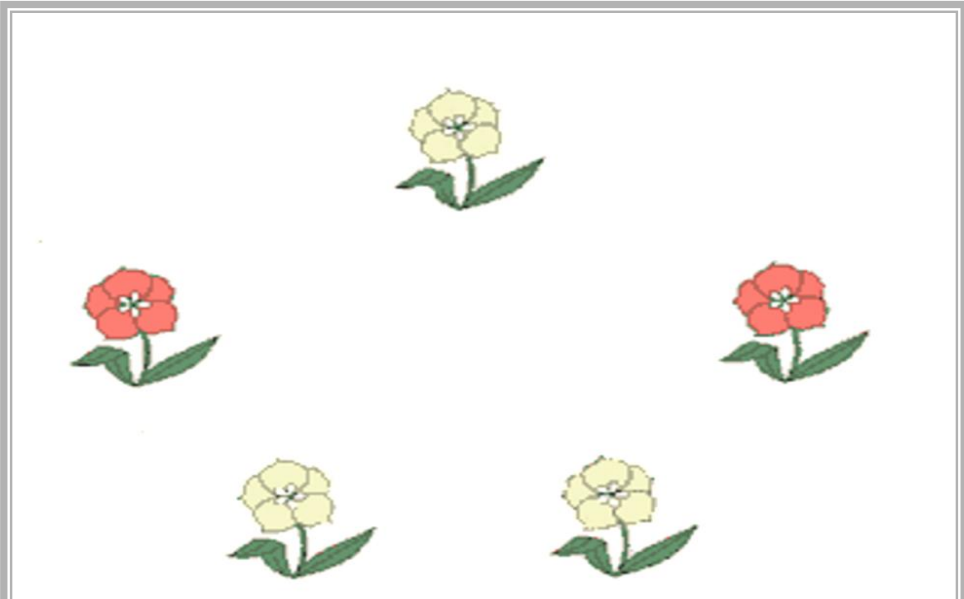
MUTATION: WHITE FLOWERED PLANTS



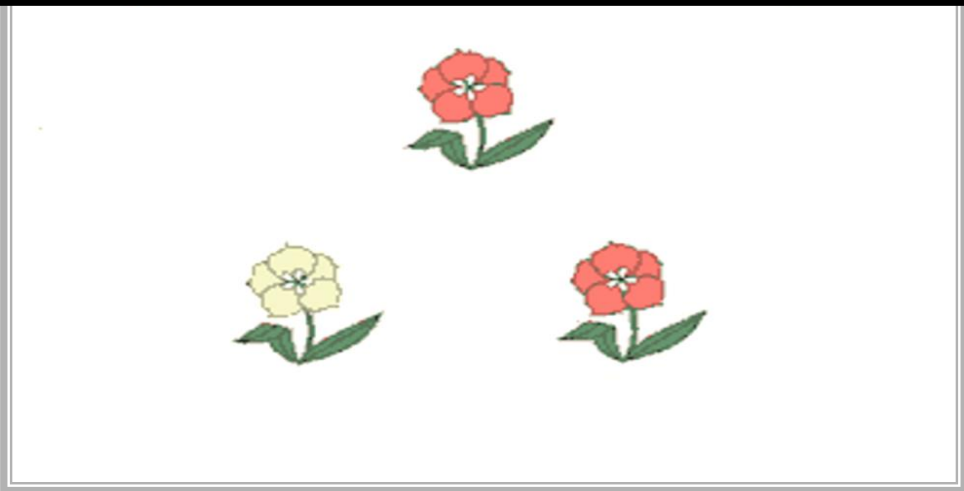
NATURAL SELECTION



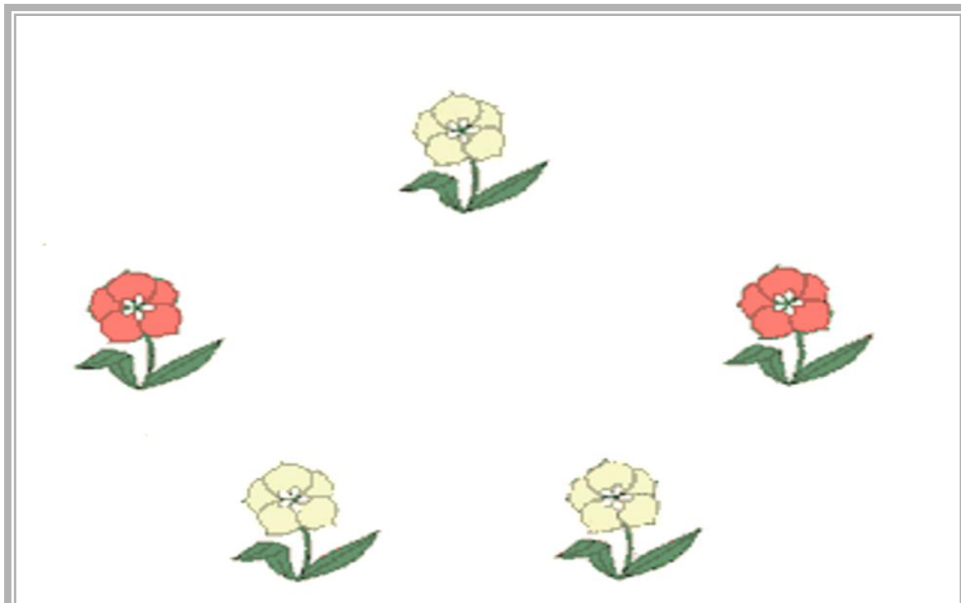
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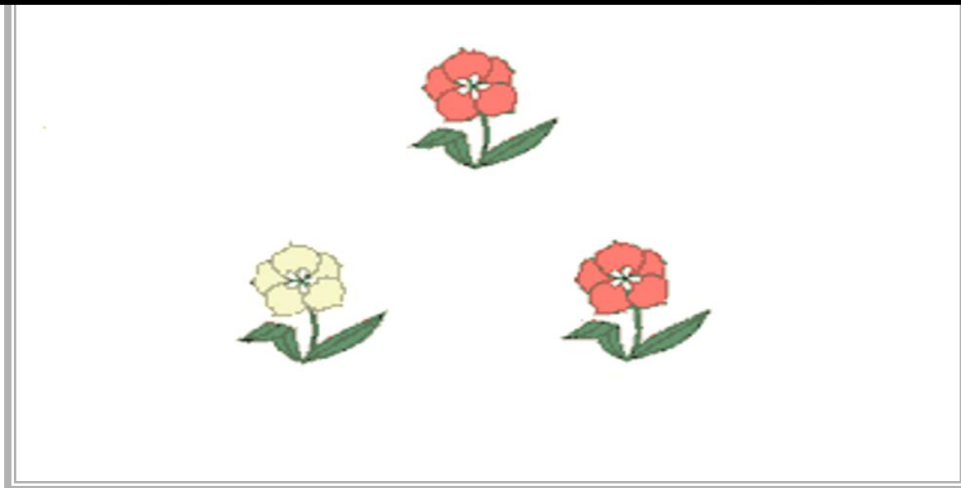
NEW SPECIES



DAUGHTER SPECIES



SPECIATION



DAUGHTER SPECIES

SPECIATION TYPES

SPECIATION TYPES

ANAGENETIC SPECIATION

SPECIATION TYPES

SPECIATION TYPES

ANAGENETIC SPECIATION
CLADOGENETIC SPECIATION

SPECIATION TYPES

ANA GENETIC SPECIATION

ANA GENETIC SPECIATION

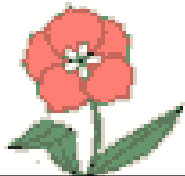
ANAGENETIC SPECIATION



1 SPECIES EVOLVES
INTO
1 NEW SPECIES

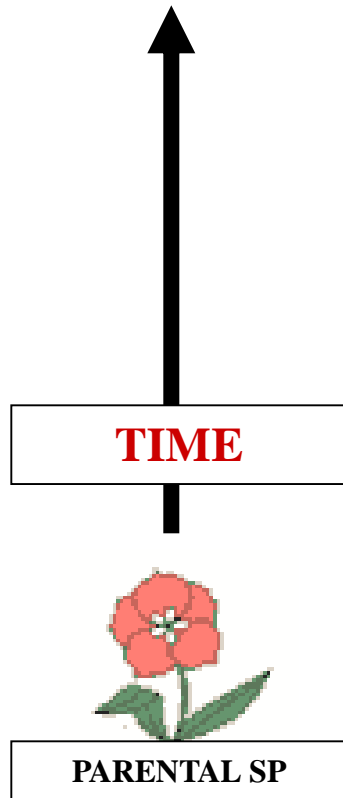
ANAGENETIC
SPECIATION

ANAGENETIC VS CLADOGENETIC SPECIATION

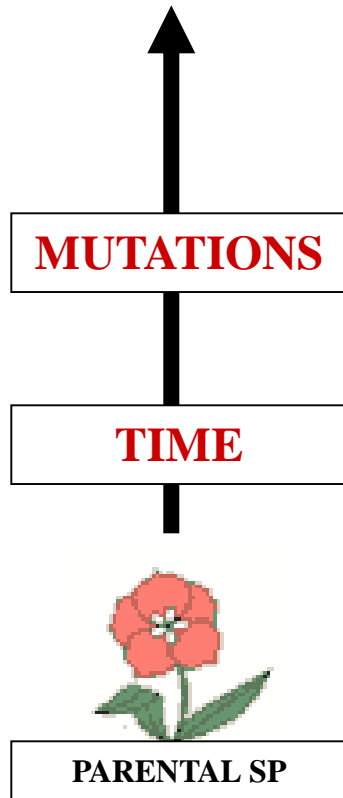


PARENTAL SP

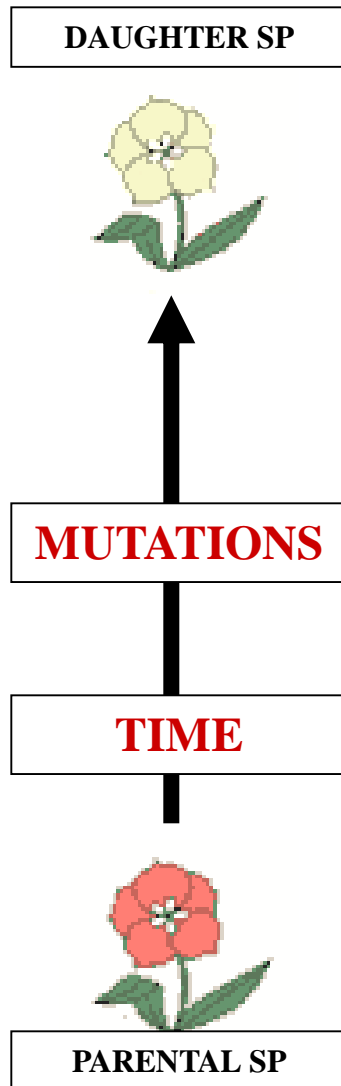
ANAGENETIC VS CLADOGENETIC SPECIATION



ANAGENETIC VS CLADOGENETIC SPECIATION



ANAGENETIC VS CLADOGENETIC SPECIATION



ANAGENETIC VS CLADOGENETIC

**ANAGENETIC
SPECIATION**

SPECIATION

DAUGHTER SP



MUTATIONS

TIME



PARENTAL SP

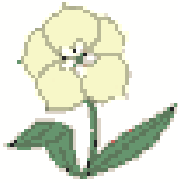
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**ANAGENETIC
SPECIATION**

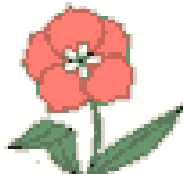
SPECIATION

DAUGHTER SP



MUTATIONS

DOES NOT DERIVE BIO-DIVERSITY



PARENTAL SP

CLADOGENETIC SPECIATION

CLADOGENETIC SPECIATION

CLADOGENETIC SPECIATION



1 SPECIES EVOLVES
2 NEW SPECIES

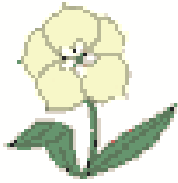
CLADOGENETIC
SPECIATION

ANAGENETIC VS CLADOGENETIC

**ANAGENETIC
SPECIATION**

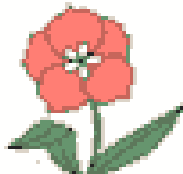
SPECIATION

DAUGHTER SP

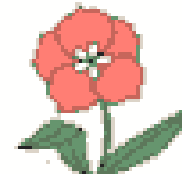


MUTATIONS

DOES NOT DERIVE BIO-DIVERSITY



PARENTAL SP



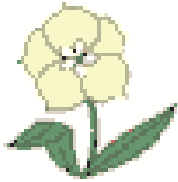
PARENTAL SP

ANAGENETIC VS CLADOGENETIC

**ANAGENETIC
SPECIATION**

SPECIATION

DAUGHTER SP



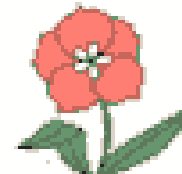
MUTATIONS

DOES NOT DERIVE BIO-DIVERSITY



PARENTAL SP

TIME



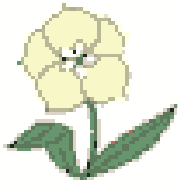
PARENTAL SP

ANAGENETIC VS CLADOGENETIC

**ANAGENETIC
SPECIATION**

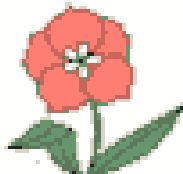
SPECIATION

DAUGHTER SP

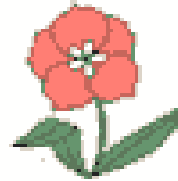


MUTATIONS

DOES NOT DERIVE BIO-DIVERSITY

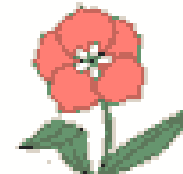


PARENTAL SP

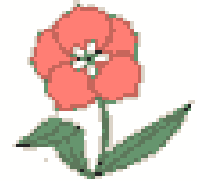


ISOLATION

TIME



PARENTAL SP

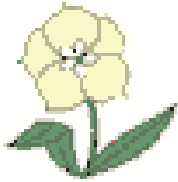


ANAGENETIC VS CLADOGENETIC

ANAGENETIC SPECIATION

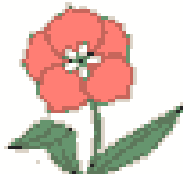
SPECIATION

DAUGHTER SP



MUTATIONS

DOES NOT DERIVE BIO-DIVERSITY

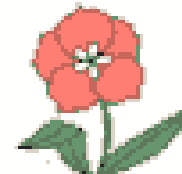


PARENTAL SP

MUTATIONS

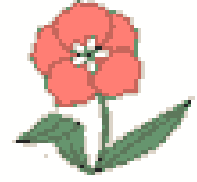
ISOLATION

TIME



PARENTAL SP

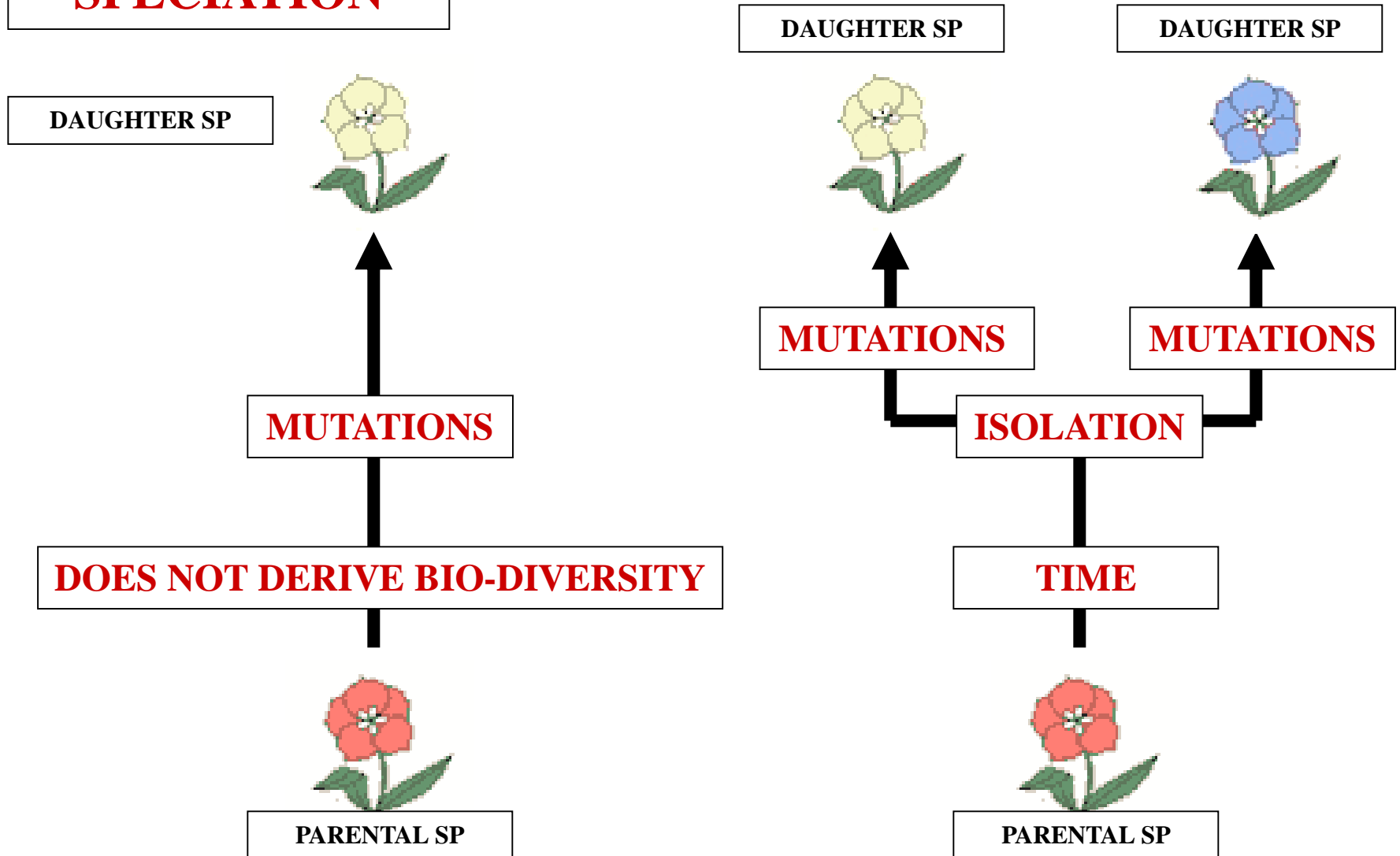
MUTATIONS



ANAGENETIC VS CLADOGENETIC

ANAGENETIC SPECIATION

SPECIATION



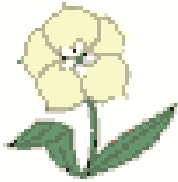
ANAGENETIC VS CLADOGENETIC

**ANAGENETIC
SPECIATION**

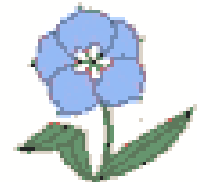
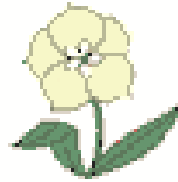
SPECIATION

**CLADOGENETIC
SPECIATION**

DAUGHTER SP



DAUGHTER SP



MUTATIONS

MUTATIONS

MUTATIONS

DOES NOT DERIVE BIO-DIVERSITY

ISOLATION

TIME

PARENTAL SP



PARENTAL SP



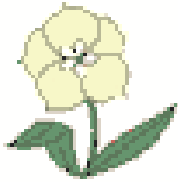
ANAGENETIC VS CLADOGENETIC

**ANAGENETIC
SPECIATION**

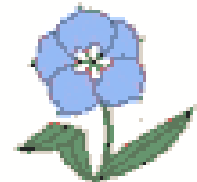
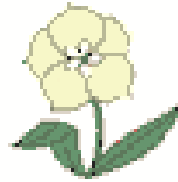
SPECIATION

**CLADOGENETIC
SPECIATION**

DAUGHTER SP



DAUGHTER SP



MUTATIONS

MUTATIONS

MUTATIONS

ISOLATION

DOES NOT DERIVE BIO-DIVERSITY

DOES DERIVE BIO-DIVERSITY

PARENTAL SP



PARENTAL SP



CLADOGENETIC SPECIATION TYPES

**CLADOGENETIC
SPECIATION
TYPES**

ALLOPATRIC SPECIATION

**CLADOGENETIC
SPECIATION
TYPES**

**CLADOGENETIC
SPECIATION
TYPES**

ALLOPATRIC SPECIATION
SYMPATRIC SPECIATION

**CLADOGENETIC
SPECIATION
TYPES**

**SYMPATRIC
DISTRIBUTION
VS
ALLOPATRIC
DISTRIBUTION**

SYMPATRIC DISTRIBUTION

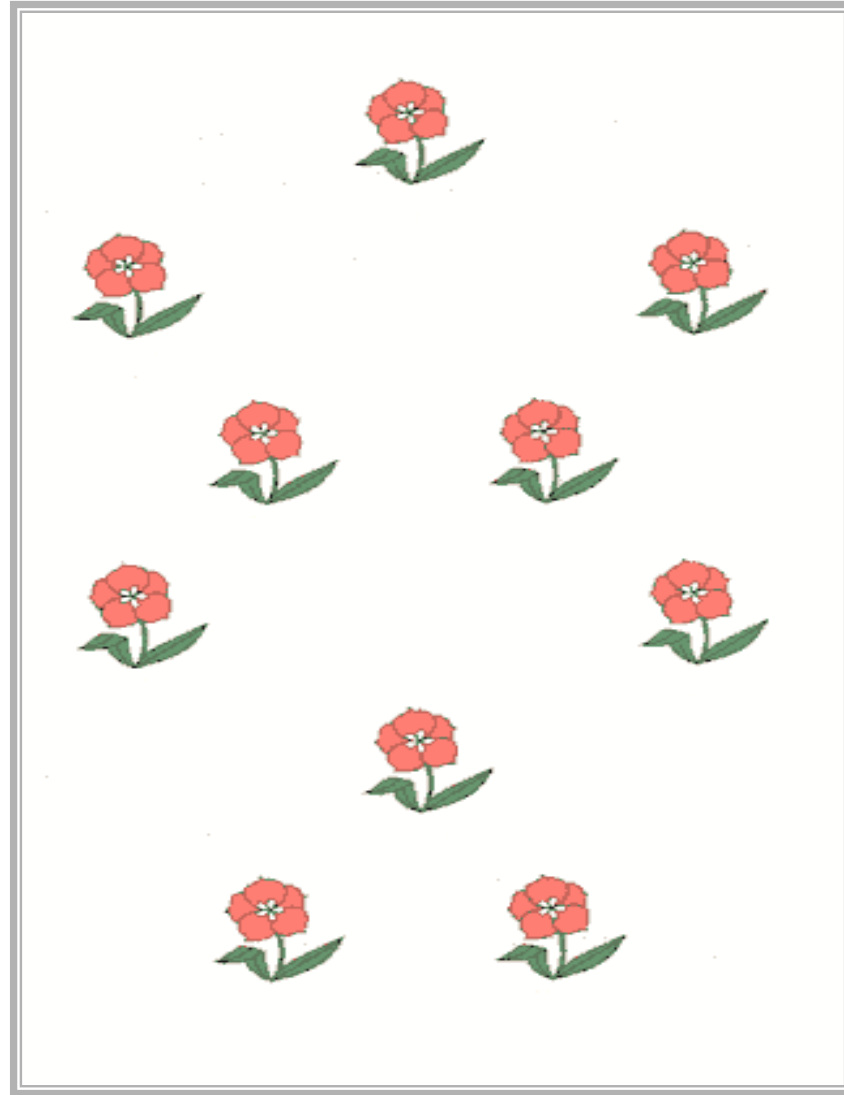
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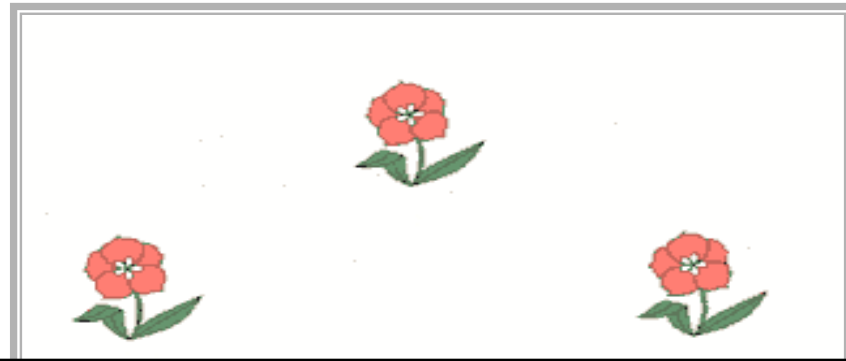
**POPULATION
OCCUPIES SAME
GEOGRAPHIC AREA**

**SYMPATRIC
DISTRIBUTION**

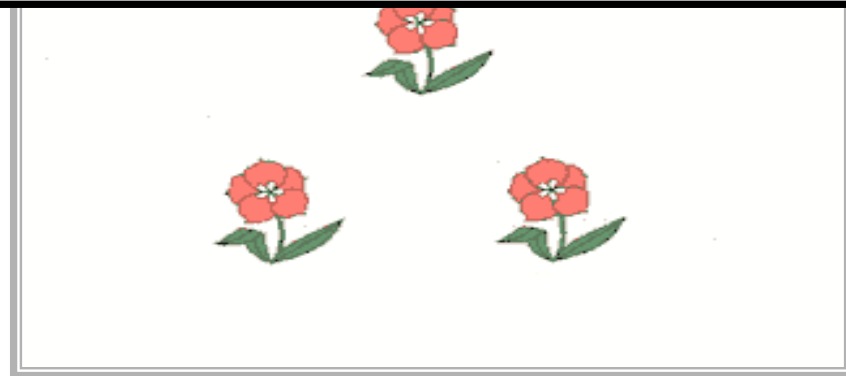
**GEOGRAPHIC
AREA**



**GEOGRAPHIC
AREA**



SYMPATRIC DISTRIBUTION



ALLOPATRIC DISTRIBUTION

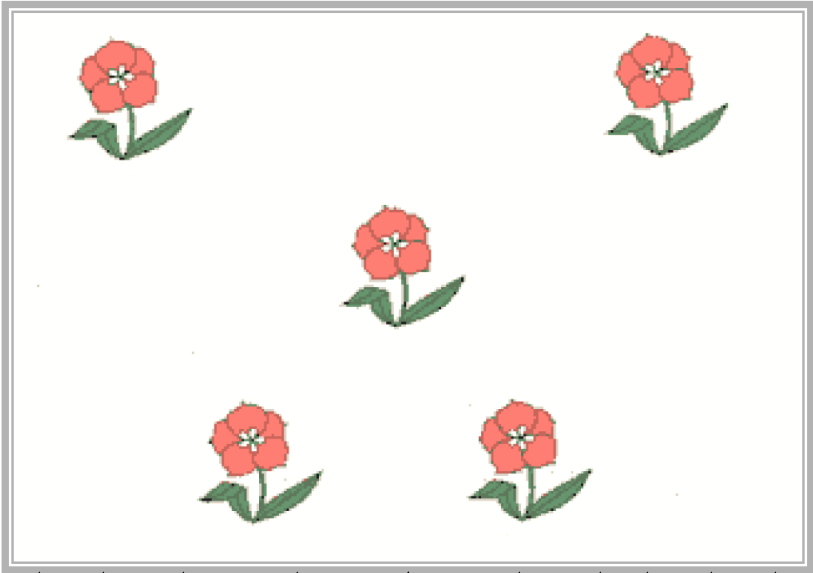
ALLOPATRIC DISTRIBUTION



**POPULATION
OCCUPIES DIFFERENT
GEOGRAPHIC AREAS**

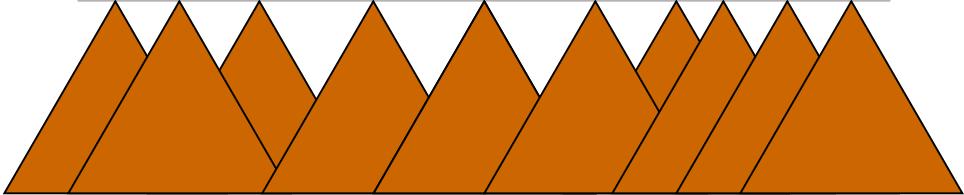
**ALLOPATRIC
DISTRIBUTION**

**NORTHERN
POPULATION**



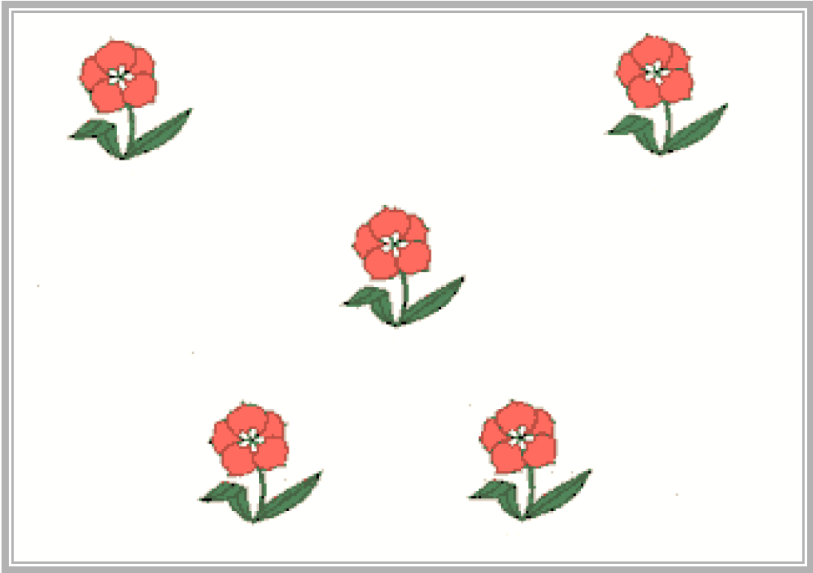
**GEOGRAPHIC
AREA**

**MOUNTAIN
RANGE**



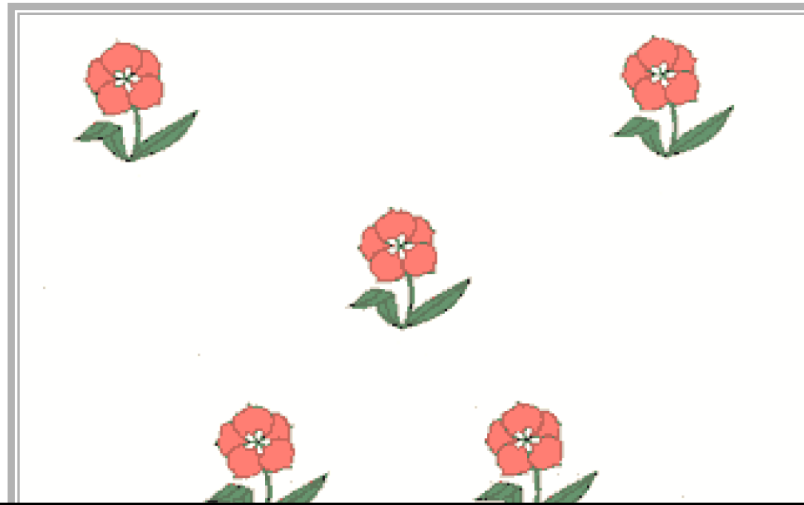
**MOUNTAIN
RANGE**

**SOUTHERN
POPULATION**



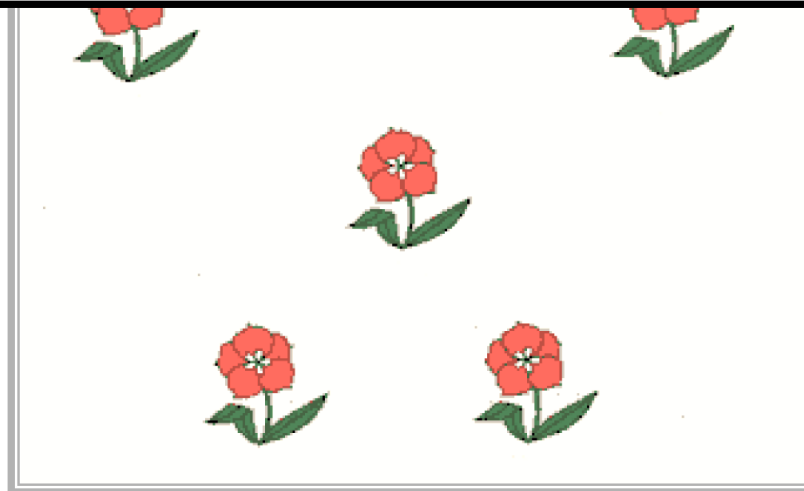
**GEOGRAPHIC
AREA**

NORTHERN
POPULATION



ALLOPATRIC DISTRIBUTION

SOUTHERN
POPULATION

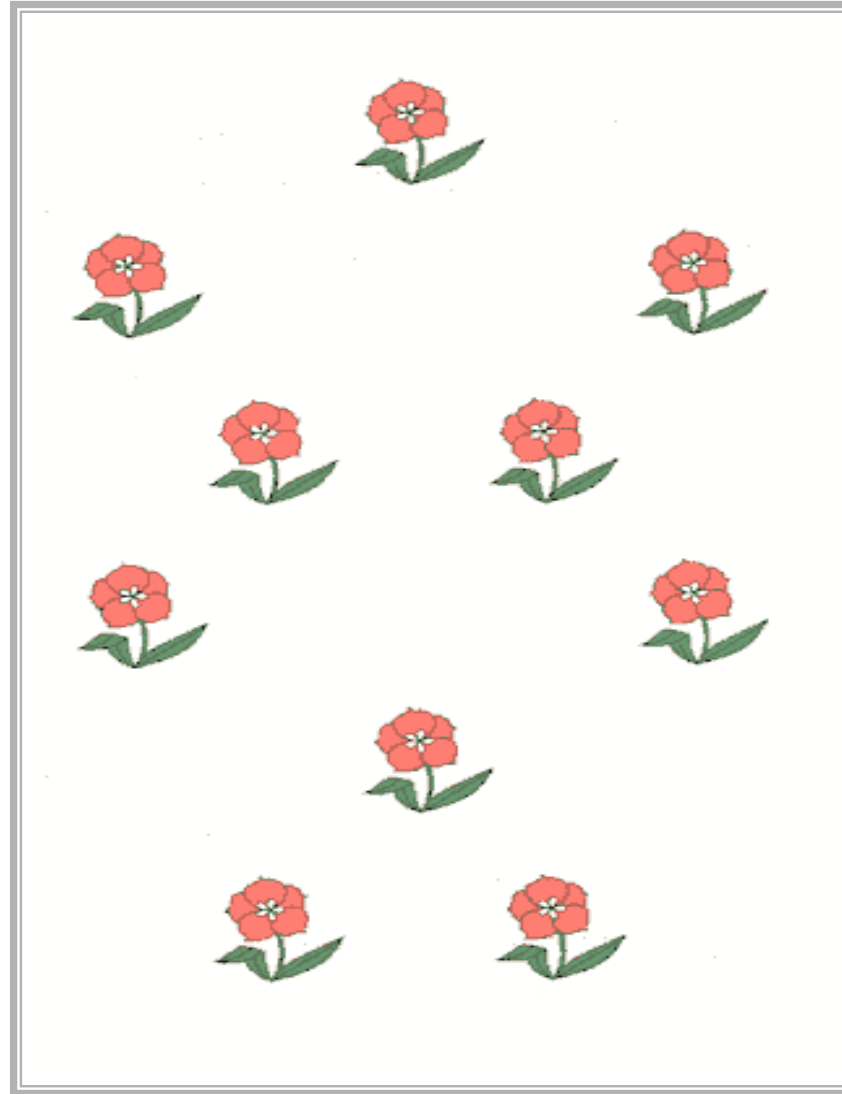


ALLOPATRIC SPECIATION

**ALLOPATRIC
SPECIATION
SCENARIO**

ALLOPATRIC SPECIATION

**GEOGRAPHIC
AREA**

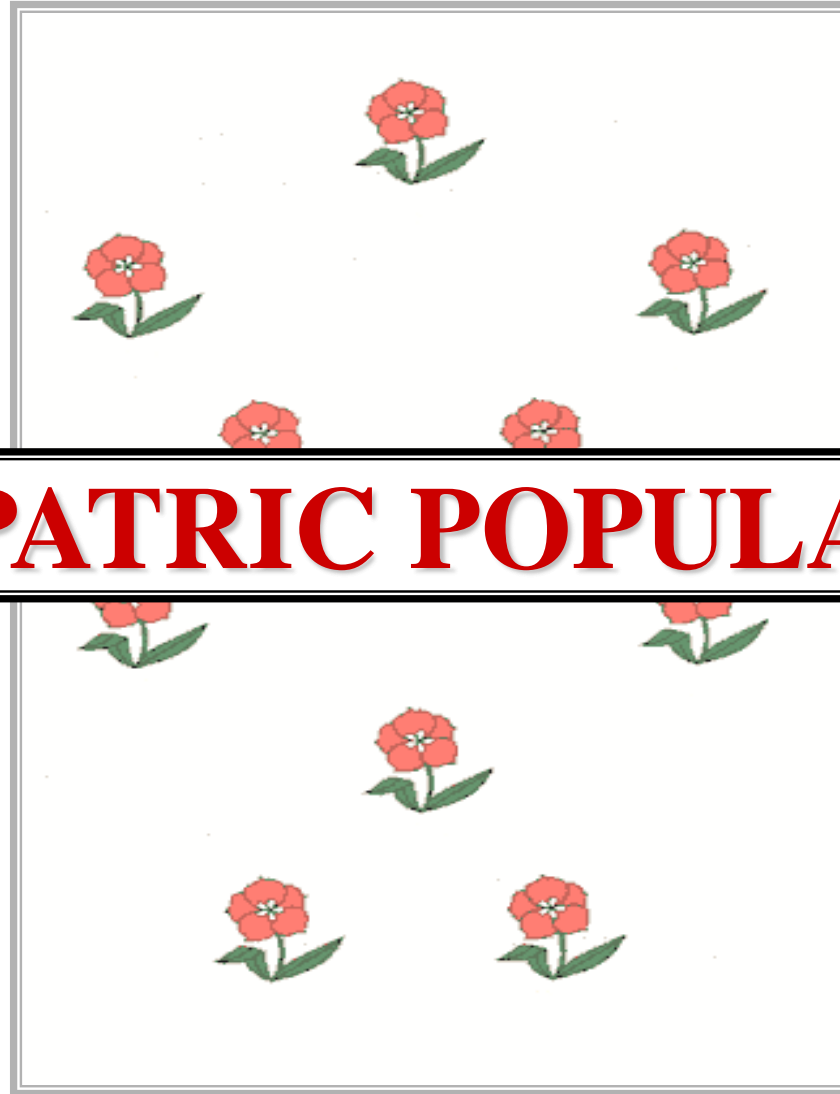


**GEOGRAPHIC
AREA**

PARENTAL POPULATION

ALLOPATRIC SPECIATION

T



SYMPATRIC POPULATION

PARENTAL POPULATION