



$\text{CO}_2 + \text{RIBULOSE BISPHOSPHATE / (RUBP)}$

**FEEDBACK**

**RIBULOSE BISPHOSPHATE  
CARBOXYLASE  
(RUBP-CARBOXYLASE)**

**UNSTABLE C6 COMPOUND**

**PHOSPHOGLYCERATE / (PGA)**

**PHOSPHOGLYCERATE / (PGA)**

**ATP**

**ATP**

**ALL RXTS  
REQUIRE  
A SPECIFIC  
ENZYME**

**BISPHOSPHOGLYCERATE / (BIPGA)**

**BISPHOSPHOGLYCERATE / (BIPGA)**

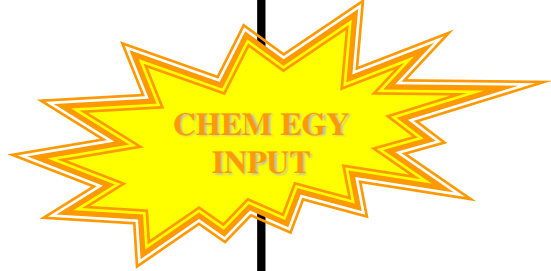
**NADPH**

**NADPH**

**C3**

**PHOSPHOGLYCERALDEHYDE / (PGAL)**

**PHOSPHOGLYCERALDEHYDE / (PGAL)**



**COMPLEX SERIES  
CHEMICAL RXTs  
(CSCR)**

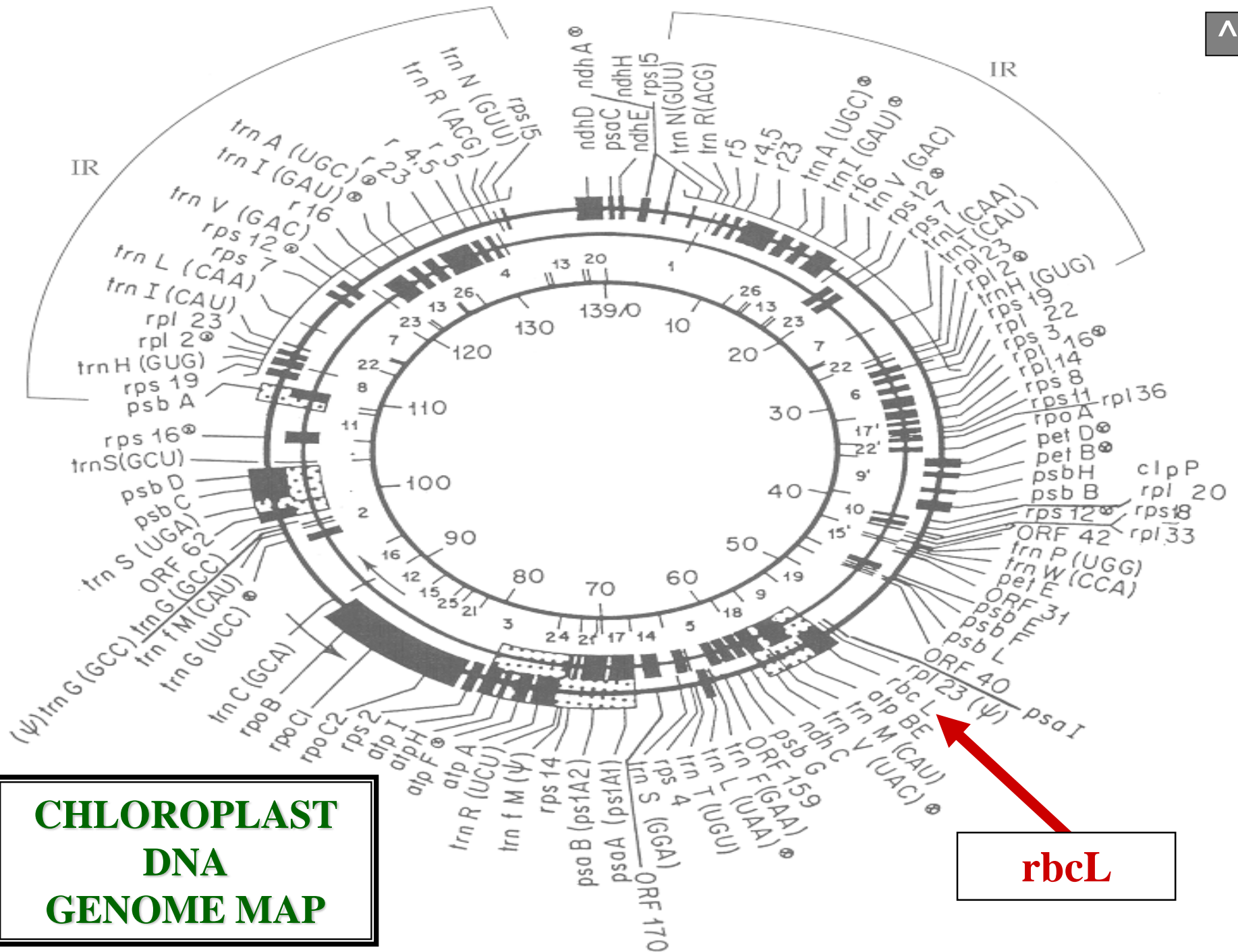
**ATP**

**GLUCOSE  
ENTERS  
METABOLISM**

**RIBULOSE BISPHOSPHATE / (RUBP)**

# CALVIN CYCLE





**MOLECULAR  
TAXONOMY  
METHOD  
TOOLS**

# **MOLECULAR TAXONOMY**

## **TOOLS**



**CENTRIFUGE**

# **MOLECULAR TAXONOMY**

## **TOOLS**

# **MOLECULAR TAXONOMY**



## **TOOLS**

**CENTRIFUGE**

**RESTRICTION ENZYMES**

**MOLECULAR TAXONOMY**

**TOOLS**

# **MOLECULAR TAXONOMY**

## **TOOLS**

**CENTRIFUGE**

**RESTRICTION ENZYMES**

**GENE NUCLEOTIDE SEQUENCER**

# **MOLECULAR TAXONOMY**

## **TOOLS**

# **MOLECULAR TAXONOMY TOOLS**



**CENTRIFUGE**  
**RESTRICTION ENZYMES**  
**GENE NUCLEOTIDE SEQUENCER**  
**DATA BASE**

**MOLECULAR TAXONOMY  
TOOLS**



# MOLECULAR TAXONOMY





# PLANT EXTRACT



# CENTRIFUGE PLANT EXTRACT





# ISOLATE CHLOROPLAST DNA

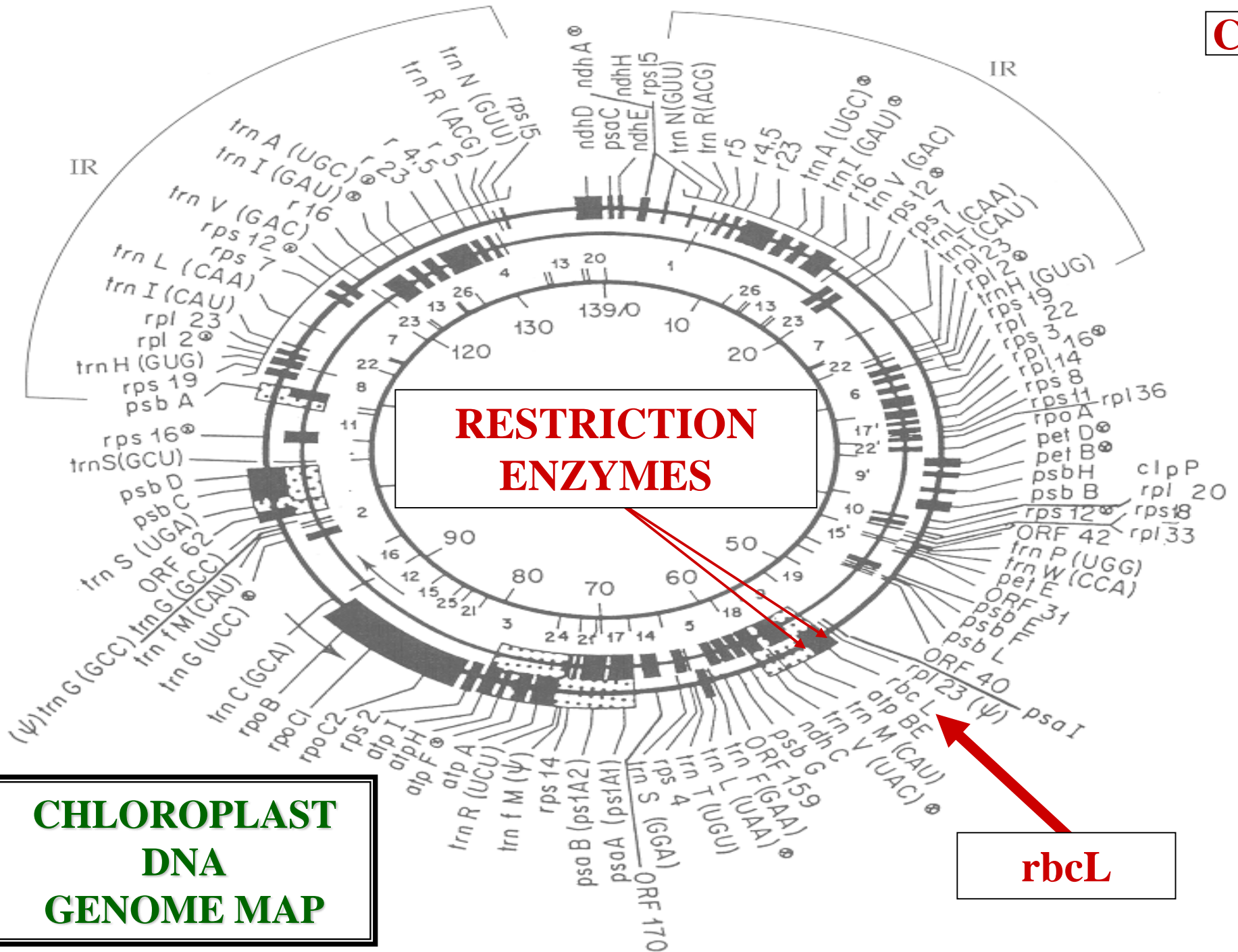


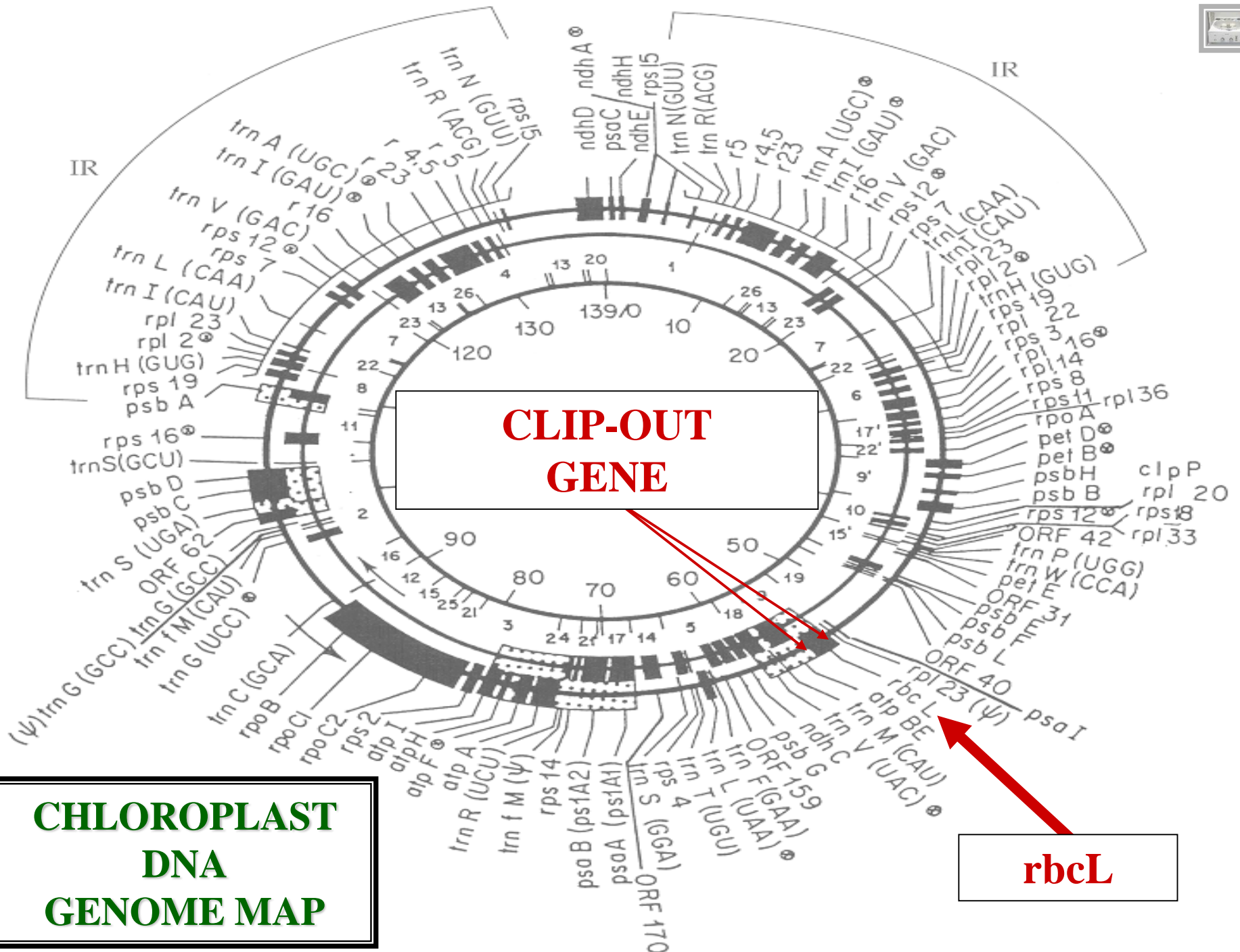
R

+



**ISOLATED  
CHLOROPLAST  
DNA**





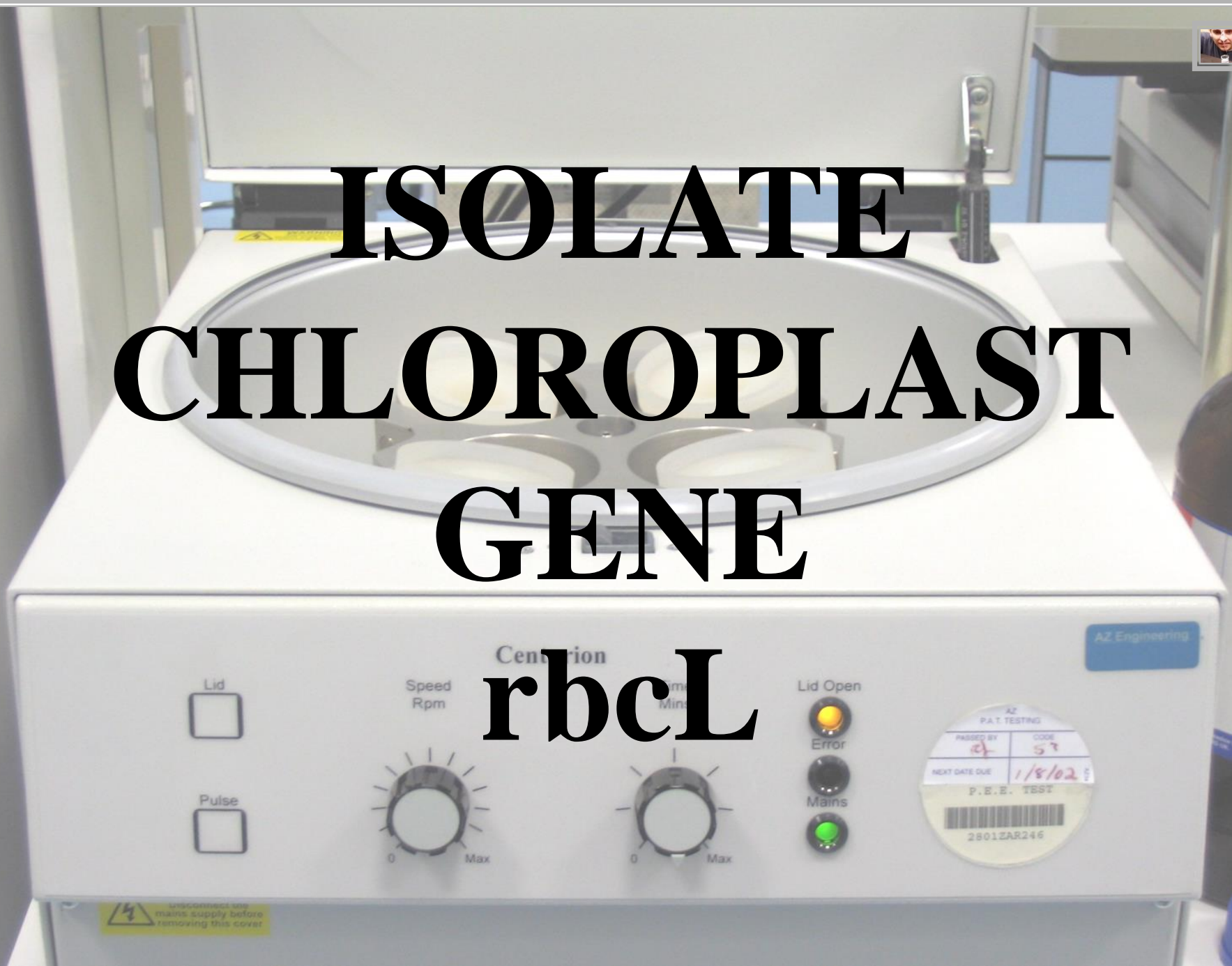
# CENTRIFUGE CHLOROPLAST DNA







# ISOLATE CHLOROPLAST GENE rbcL

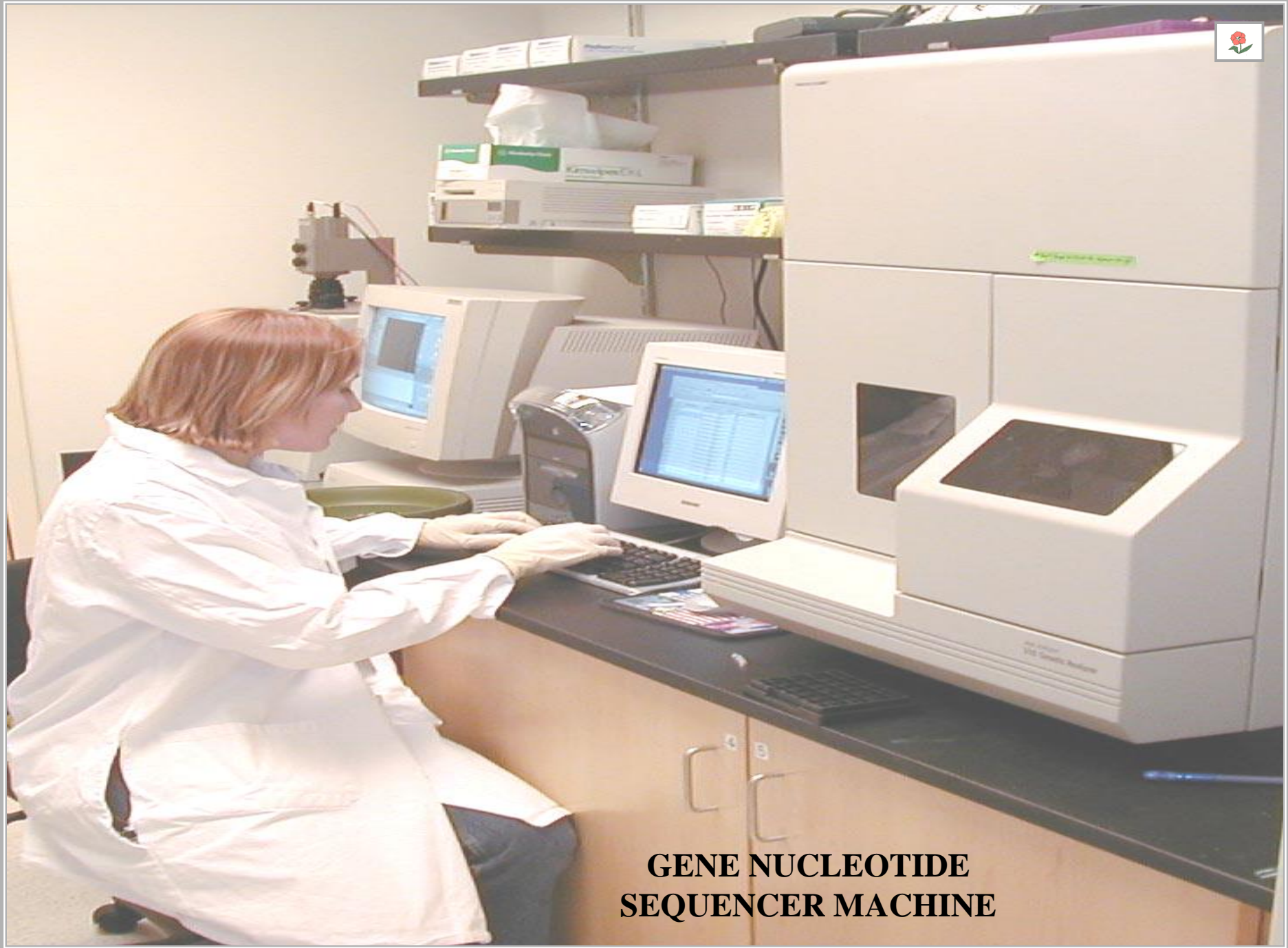


Disconnect the mains supply before removing this cover



**ISOLATED  
CHLOROPLAST  
rbcL GENE**





**GENE NUCLEOTIDE  
SEQUENCER MACHINE**

**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**NUCLEOTIDE SEQUENCES**

**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**

**DIFFERENT NUCLEOTIDE SEQUENCES**

**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**DIFFERENT SPECIES**

**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**





**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**



**SAME SPECIES**

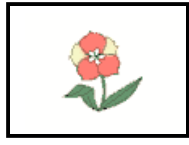
**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #4 = A-A-C-C-T-A-A-C-G**



**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #4 = A-A-C-C-T-A-A-C-G**

**DIFFERENT NUCLEOTIDE SEQUENCES**

**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #4 = A-A-C-C-T-A-A-C-G**



**DIFFERENT SPECIES**

**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #4 = A-A-C-C-T-A-A-C-G**



**rbcL PLT #5 = A-A-C-C-T-A-A-C-G**





**rbcL PLT #1 = A-A-C-C-T-A-G-C-C**



**rbcL PLT #2 = A-A-C-C-T-A-A-C-C**



**rbcL PLT #3 = A-A-C-C-T-A-A-C-C**



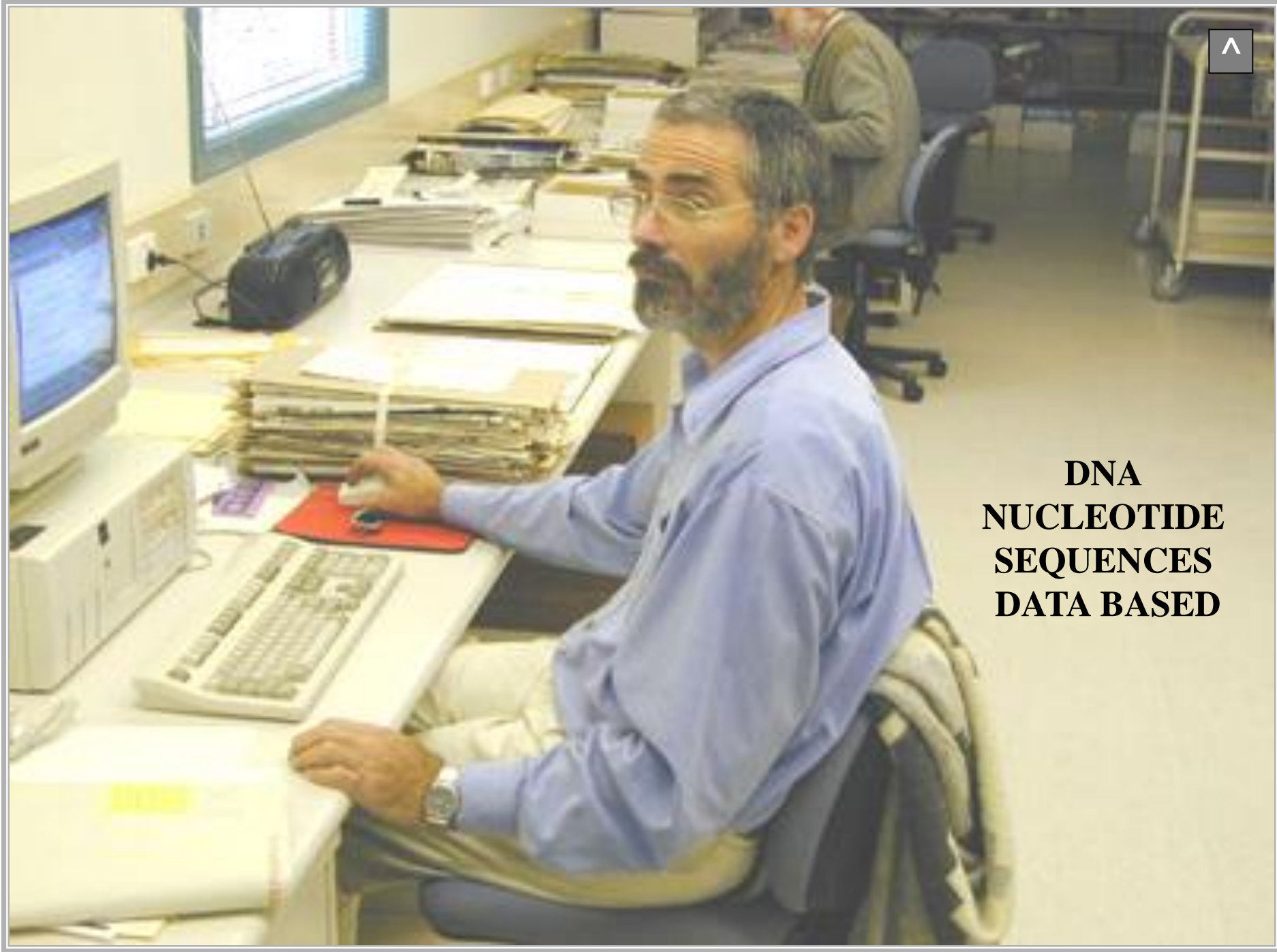
**rbcL PLT #4 = A-A-C-C-T-A-A-C-G**



**rbcL PLT #5 = A-A-C-C-T-A-A-C-G**



**SAME SPECIES**



**DNA  
NUCLEOTIDE  
SEQUENCES  
DATA BASED**



# DATA ANALYSIS

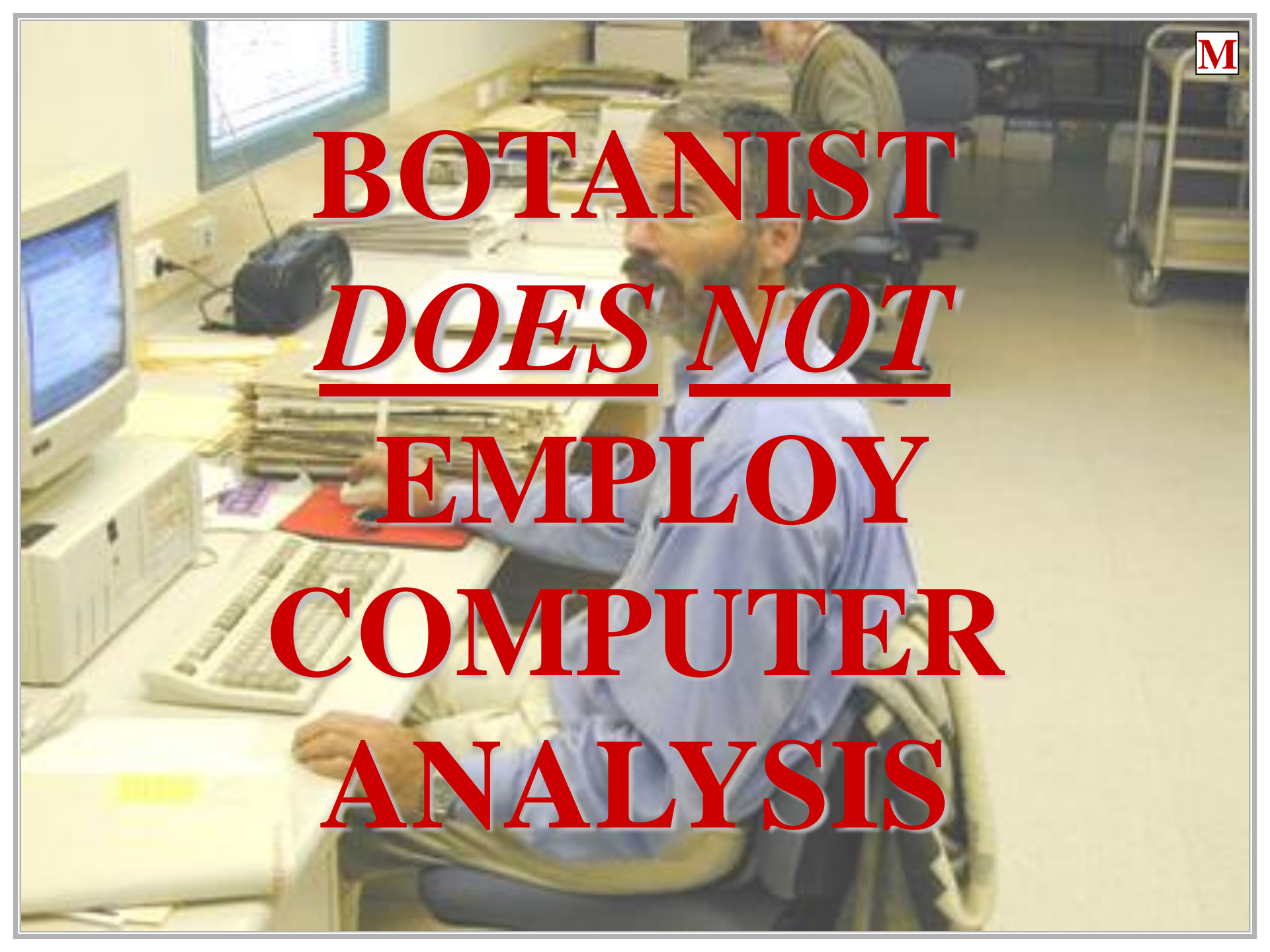




**CLASSICAL  
ANALYSIS  
VS  
NUMERICAL  
ANALYSIS**



# CLASSICAL DATA ANALYSIS



**BOTANIST  
DOES NOT  
EMPLOY  
COMPUTER  
ANALYSIS**

A man with a beard and glasses, wearing a light blue button-down shirt, is seated at a desk in an office. He is looking towards the camera while his right hand rests on a computer mouse. The desk is cluttered with papers, a keyboard, and a computer monitor. In the background, another person is visible, and there are office chairs and a metal cart. The text "BOTANIST MANUALLY ASSIGNS SPECIES LIMITS" is overlaid in large, bold, red, serif font across the center of the image.

**BOTANIST  
MANUALLY  
ASSIGNS  
SPECIES LIMITS**



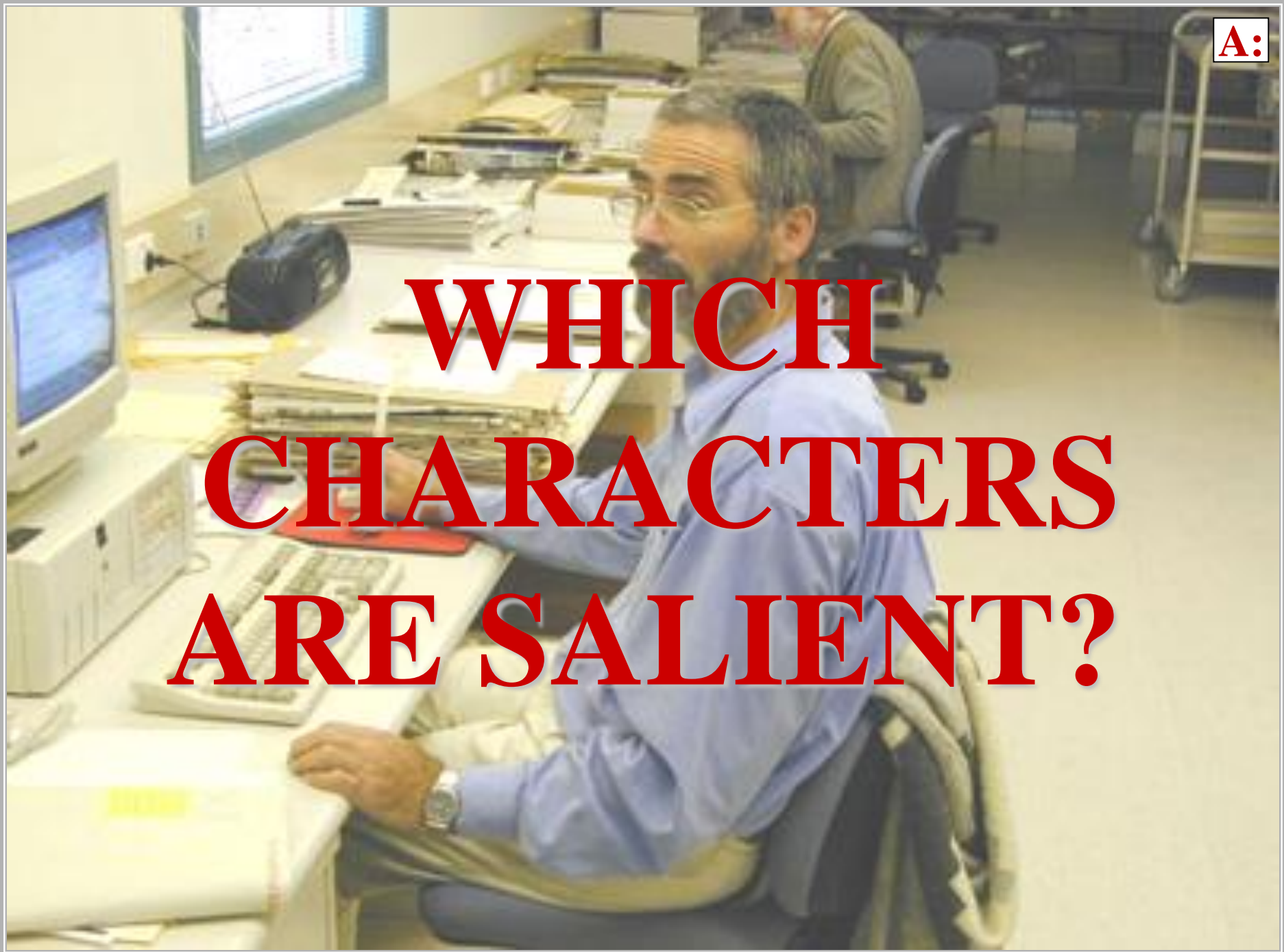
**BOTANIST  
USES FEW  
CHARACTERS**



**BOTANIST  
USES SALIENT  
CHARACTERS  
ONLY**



**WHICH  
CHARACTERS  
ARE SALIENT?**





**ANSWER:  
DEPENDS ON THE  
BOTANIST**



A man with a beard, wearing a light blue long-sleeved shirt, is seated at a desk in a laboratory or office environment. He is looking towards a computer monitor on the left. The desk is cluttered with papers, a keyboard, and a mouse. In the background, another person is visible at a desk, and a metal cart is on the right. The text "DIFFERENT BOTANISTS DIFFERENT SALIENT CHARACTERS" is overlaid in large, bold, red letters across the center of the image.

**DIFFERENT  
BOTANISTS  
DIFFERENT  
SALIENT  
CHARACTERS**



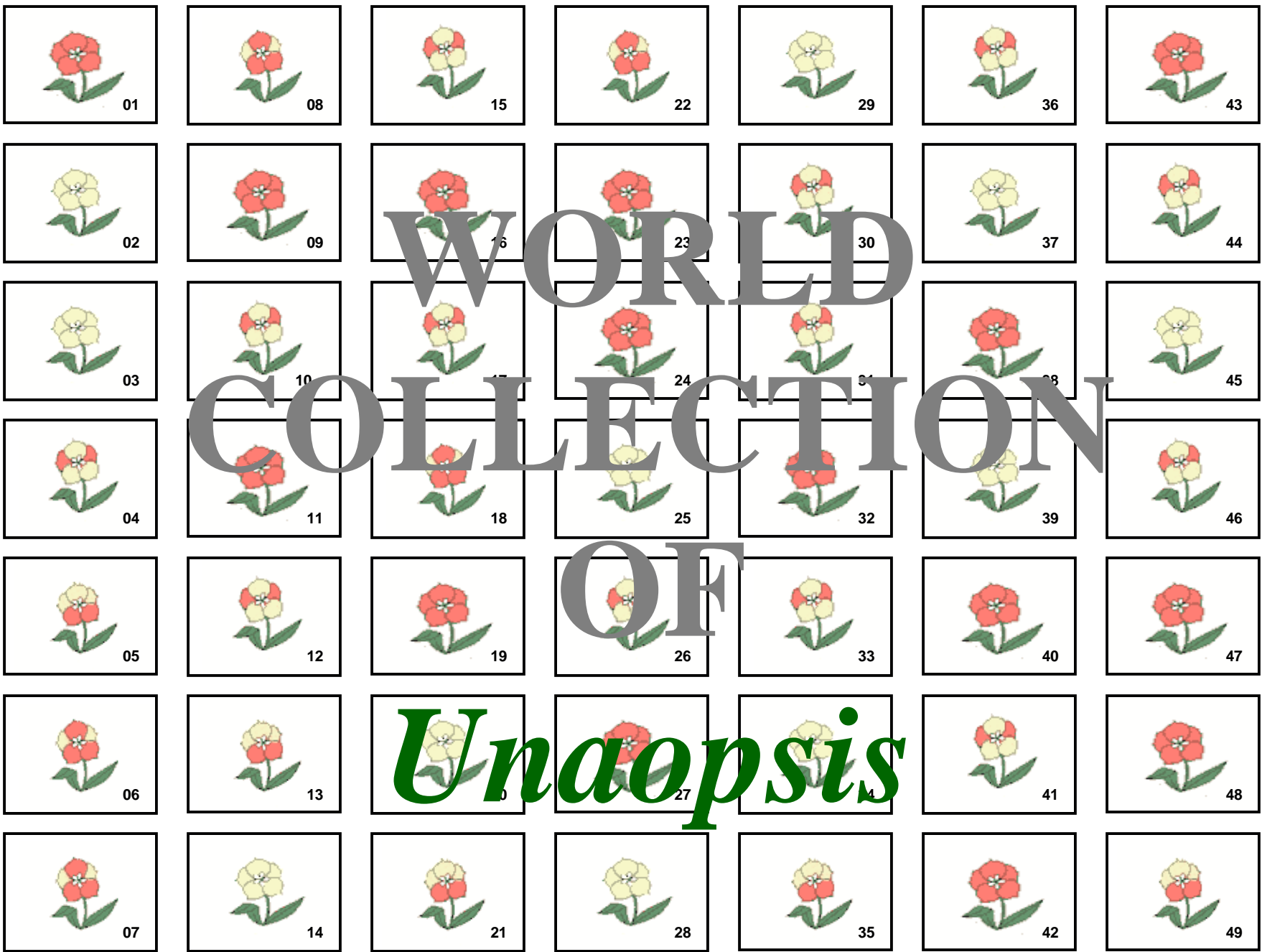
**DIFFERENT  
BOTANISTS  
DIFFERENT  
RESULTS**



**CLASSICAL  
ANALYSIS:  
HIGHLY  
SUBJECTIVE**



**CLASSICAL  
DATA  
ANALYSIS  
APPLIED**



01

08

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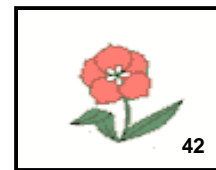
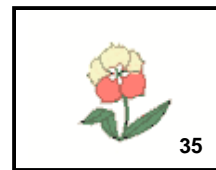
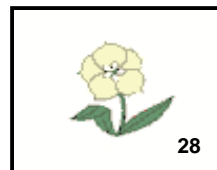
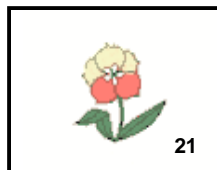
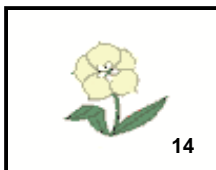
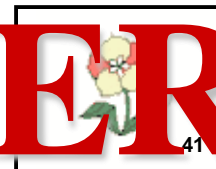
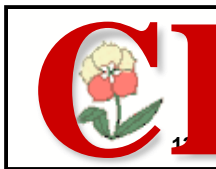
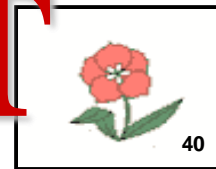
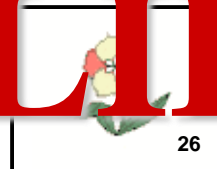
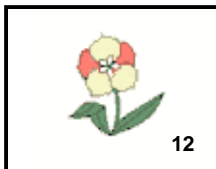
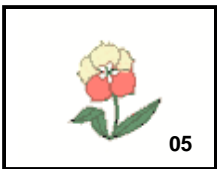
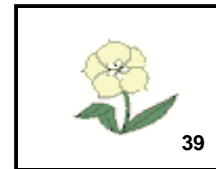
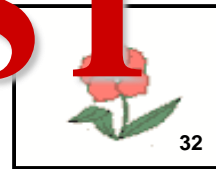
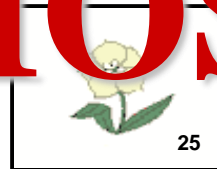
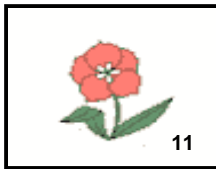
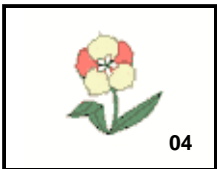
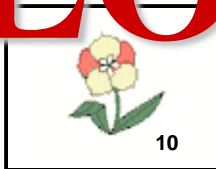
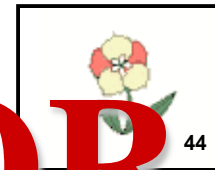
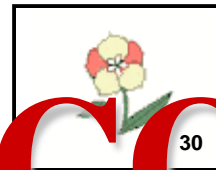
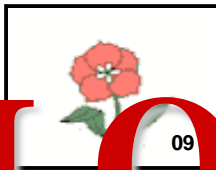
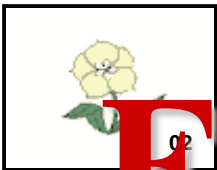
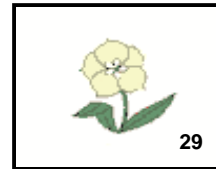
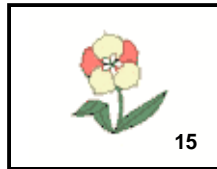
35

42

49

WORLD  
COLLECTION  
OF

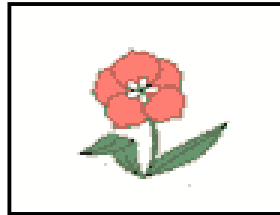
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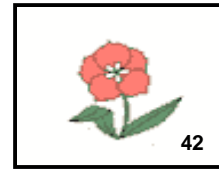
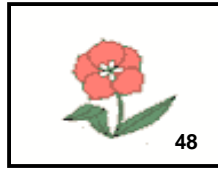
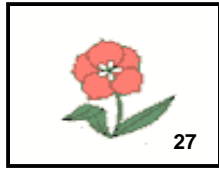
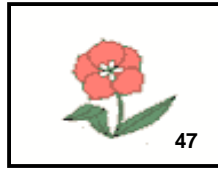
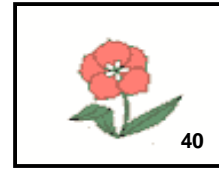
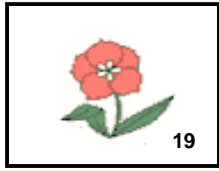
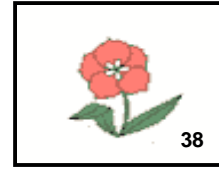
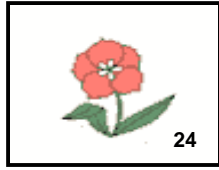
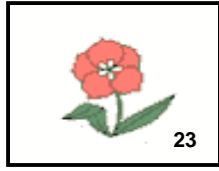
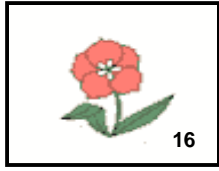
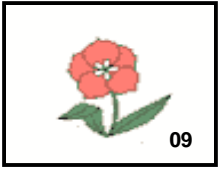
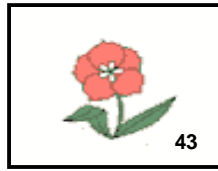
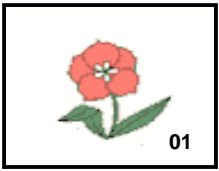


**FLOWER COLOR**  
**MOST**  
**SALIENT**  
**CHARACTER**

# **OUTCOME**

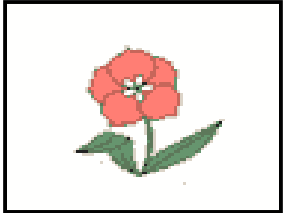
# **CLASSICAL ANALYSIS**



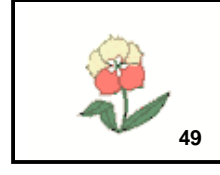
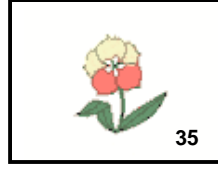
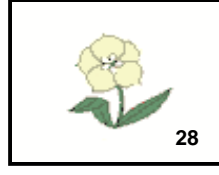
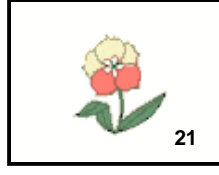
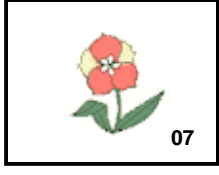
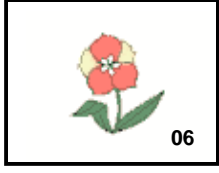
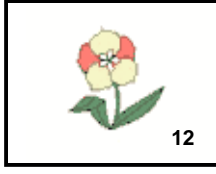
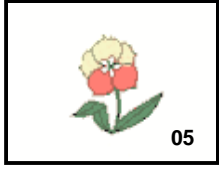
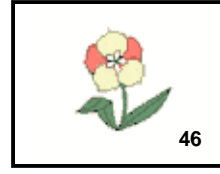
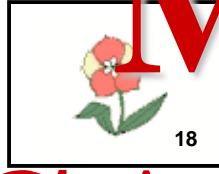
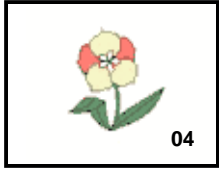
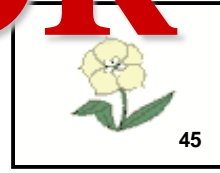
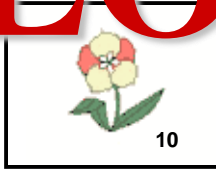
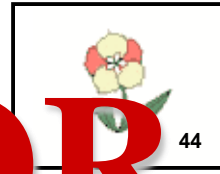
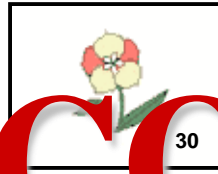
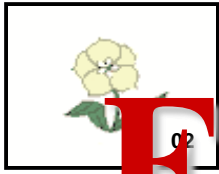
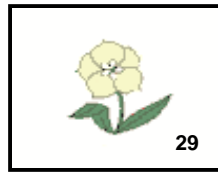
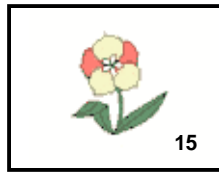




# **OUTCOME CLASSICAL ANALYSIS**



**1 SPECIES**



**FLOWER COLOR**

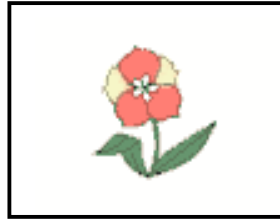
**MOST**

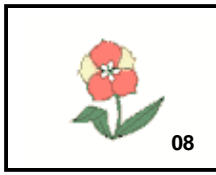
**SALIENT**

**CHARACTER**

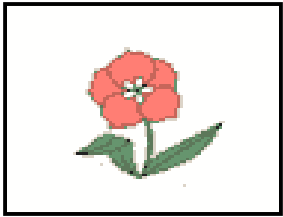
# **OUTCOME**

# **CLASSICAL ANALYSIS**

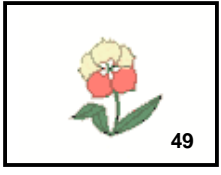
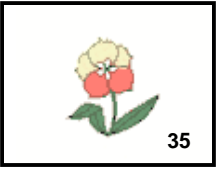
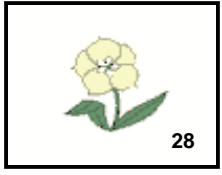
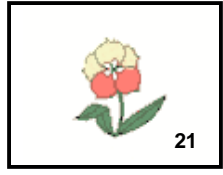
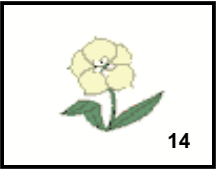
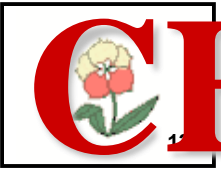
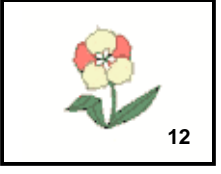
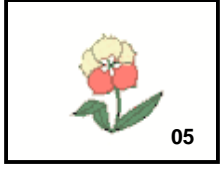
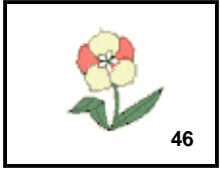
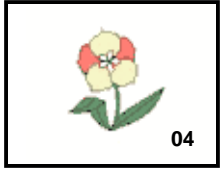
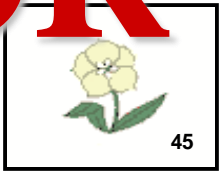
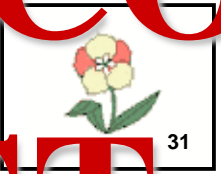
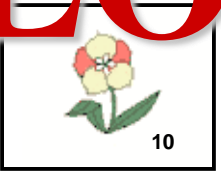
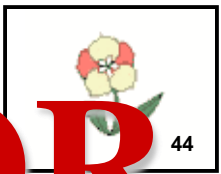
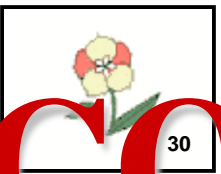
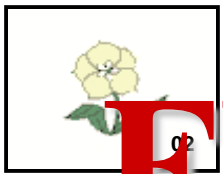
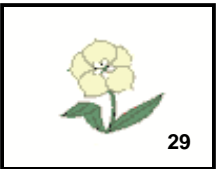
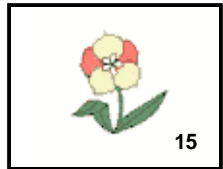




# **OUTCOME CLASSICAL ANALYSIS**



**2 SPECIES**



**FLOWER COLOR**

**MOST**

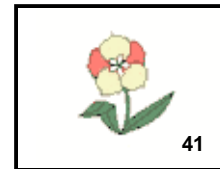
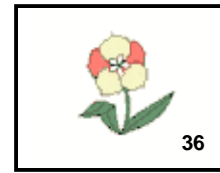
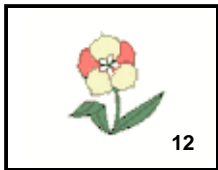
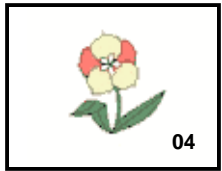
**SALIENT**

**CHARACTER**

# **OUTCOME**

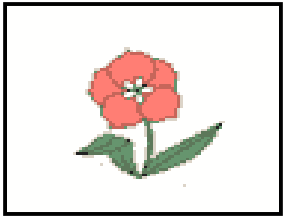
# **CLASSICAL ANALYSIS**



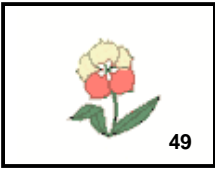
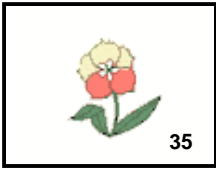
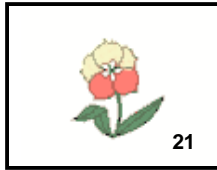
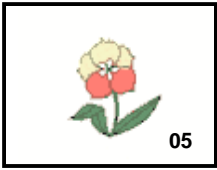
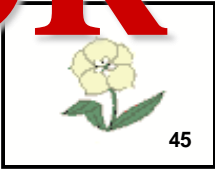
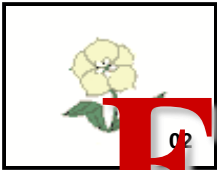




# OUTCOME CLASSICAL ANALYSIS



**3 SPECIES**



**FLOWER COLOR**

**MOST**

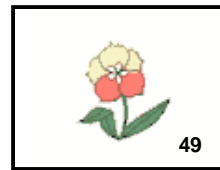
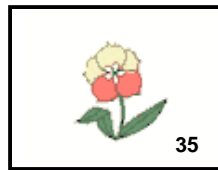
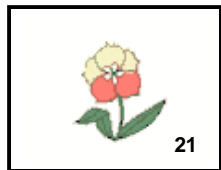
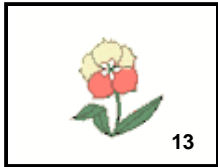
**SALIENT**

**CHARACTER**

# **OUTCOME**

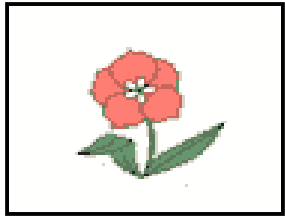
# **CLASSICAL ANALYSIS**



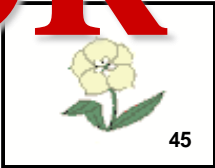
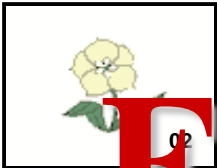


# **OUTCOME**

# **CLASSICAL ANALYSIS**



**4 SPECIES**



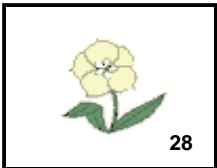
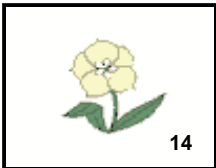
**FLOWER COLOR**

**MOST**



**SALIENT**

**CHARACTER**

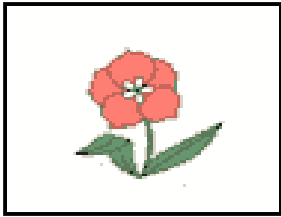


# **OUTCOME**

# **CLASSICAL ANALYSIS**



# OUTCOME CLASSICAL ANALYSIS

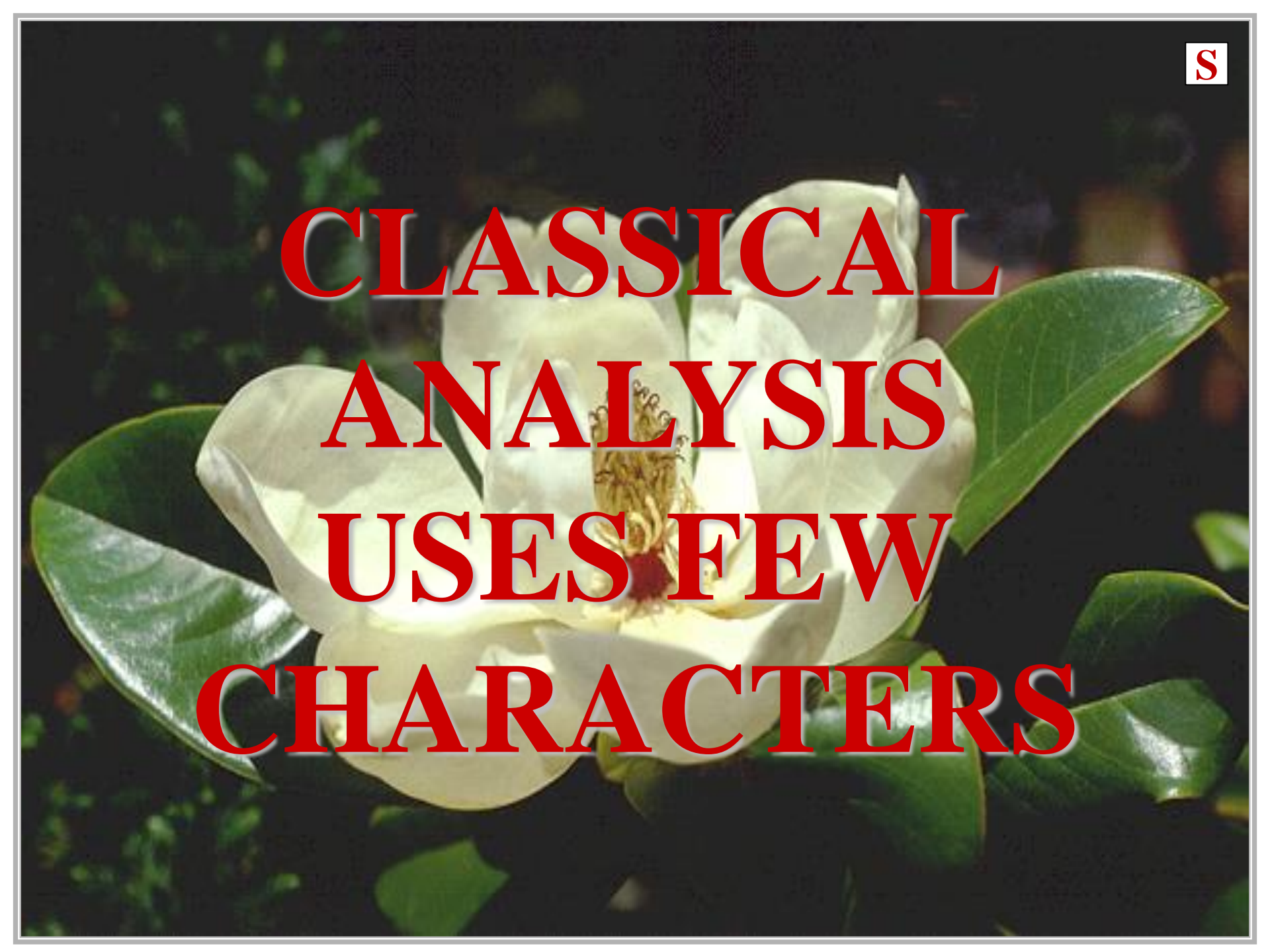


**5 SPECIES** *Unaopsis*





# CLASSICAL ANALYSIS SUMMARY

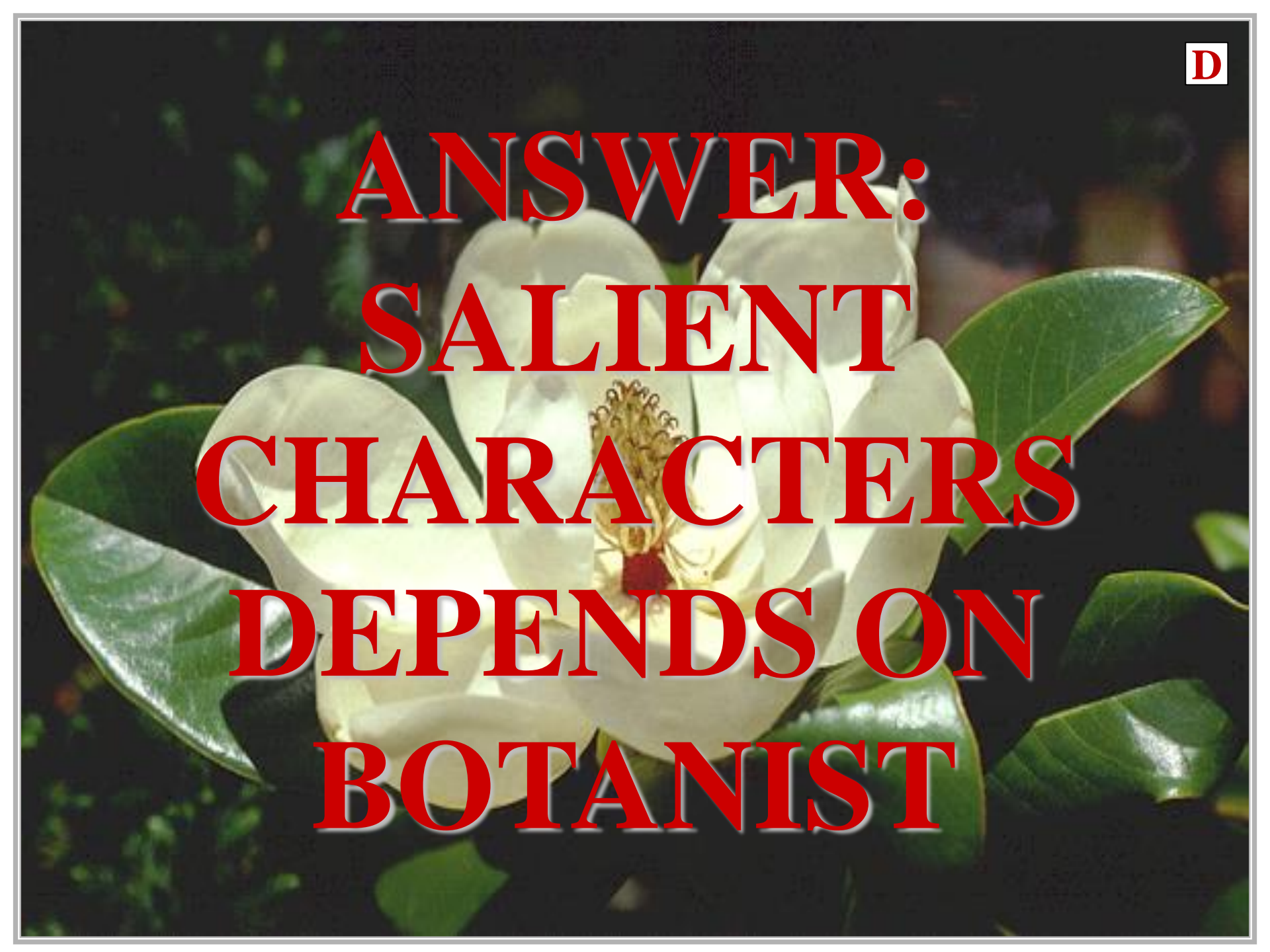


**CLASSICAL  
ANALYSIS  
USES FEW  
CHARACTERS**




**SALIENT  
CHARACTERS  
USED ONLY**

**WHICH  
CHARACTERS  
ARE  
SALIENT  
CHARACTERS?**



**ANSWER:  
SALIENT  
CHARACTERS  
DEPENDS ON  
BOTANIST**

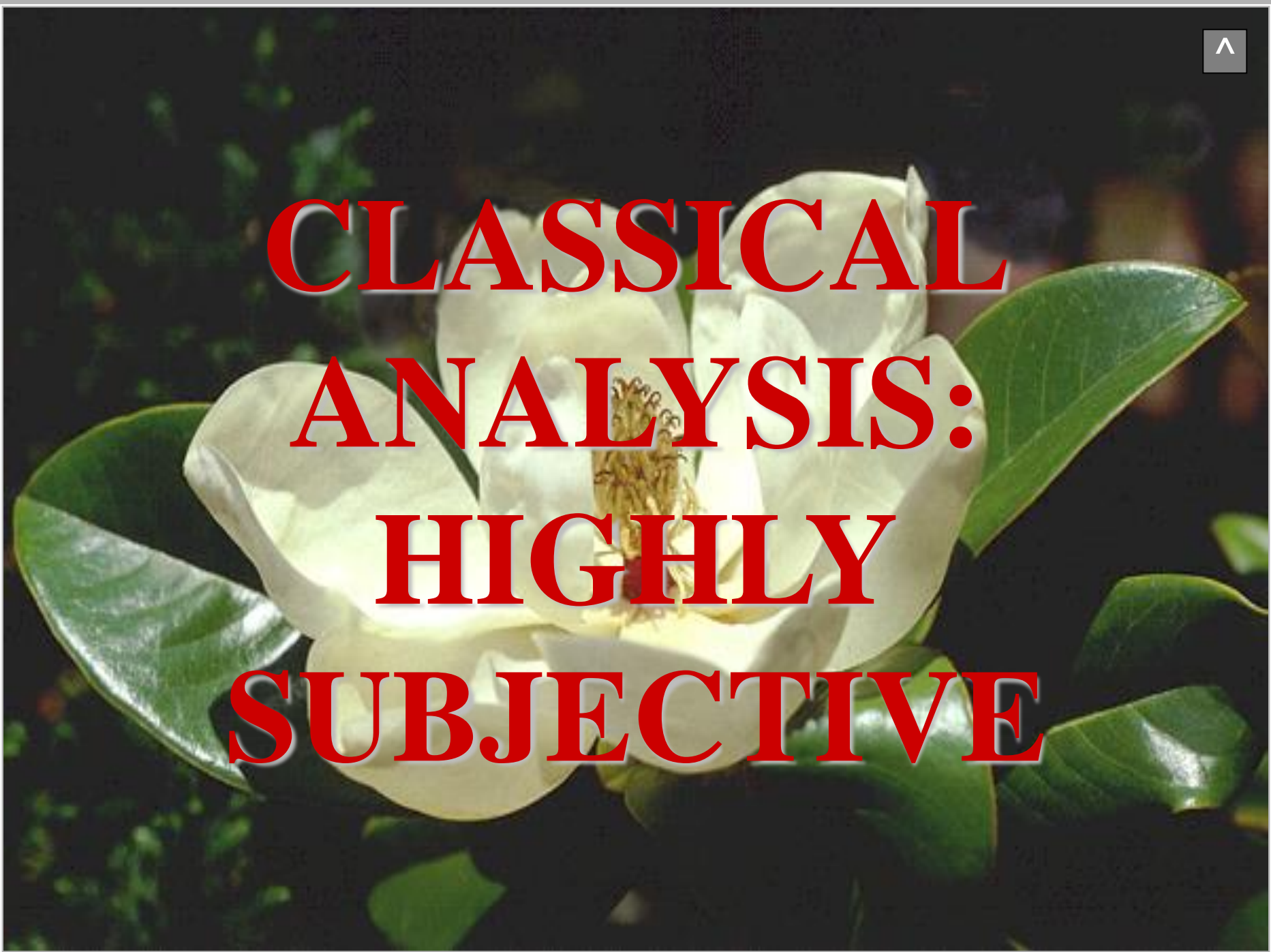
**DIFFERENT  
BOTANISTS  
DIFFERENT  
SALIENT  
CHARACTERS**



**DIFFERENT  
BOTANISTS  
DIFFERENT  
RESULTS**



**CLASSICAL  
ANALYSIS:  
HIGHLY  
SUBJECTIVE**





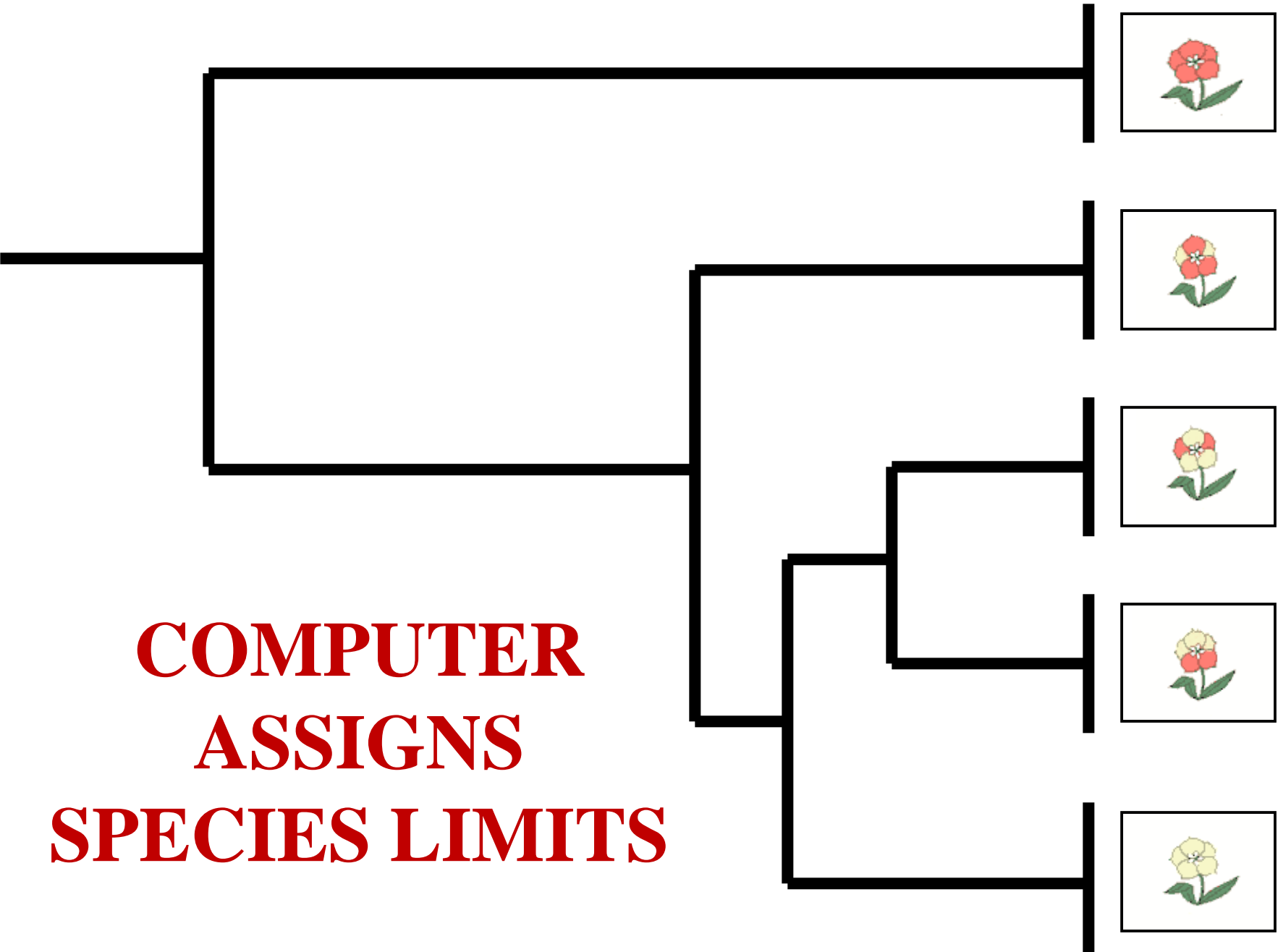


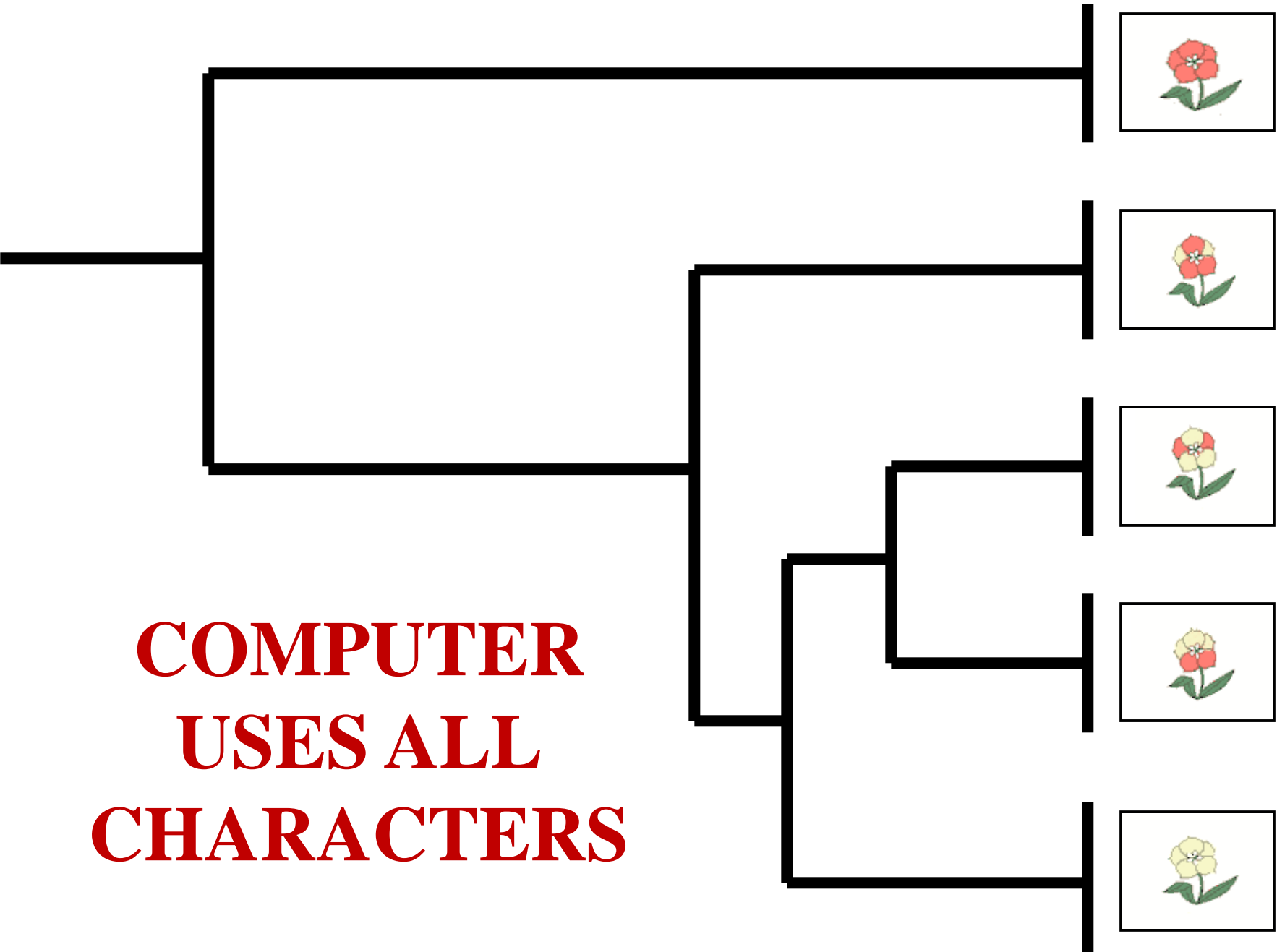
# NUMERICAL DATA ANALYSIS

**BOTANIST  
*DOES*  
EMPLOY  
COMPUTER  
ANALYSIS**

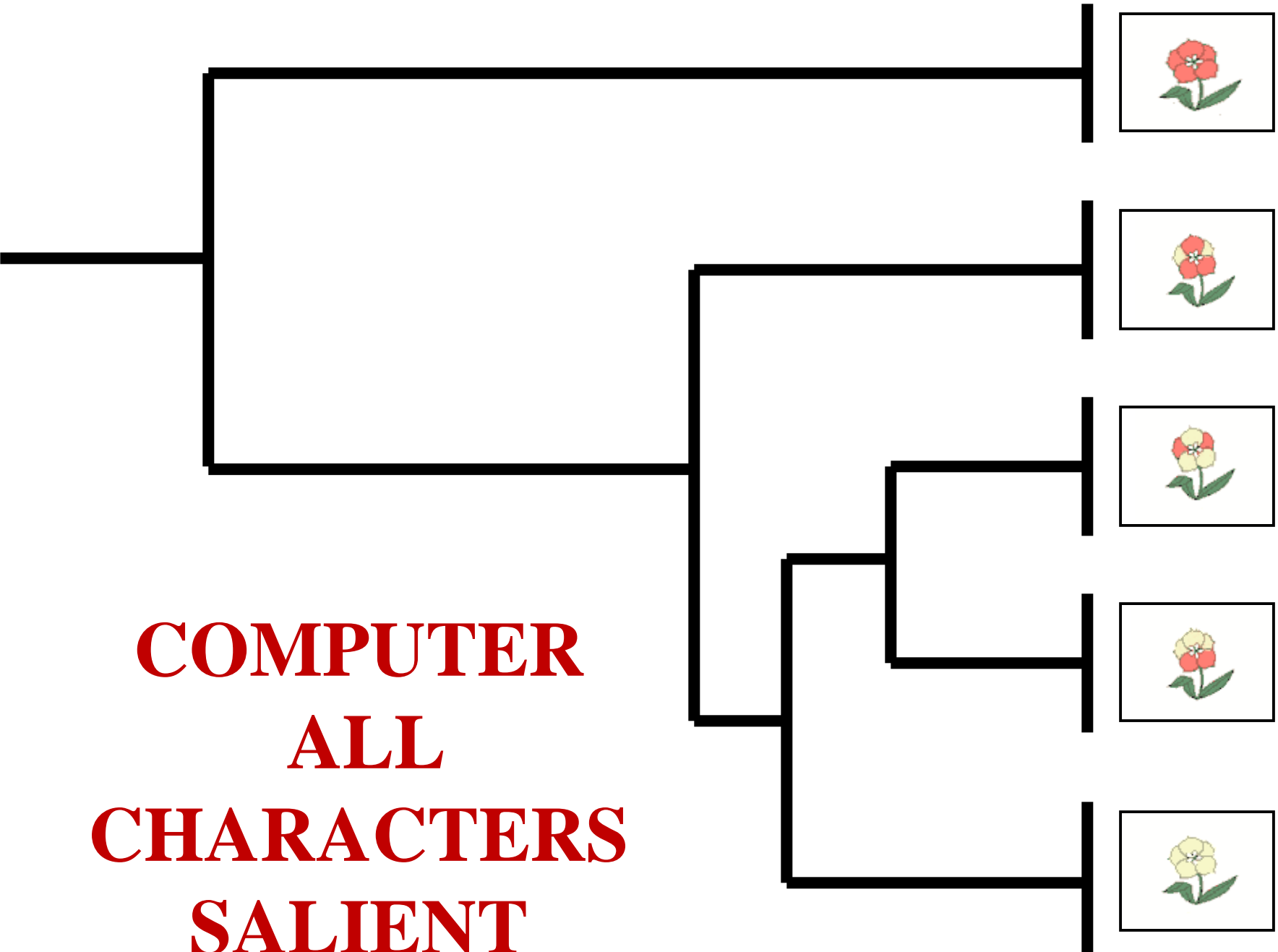


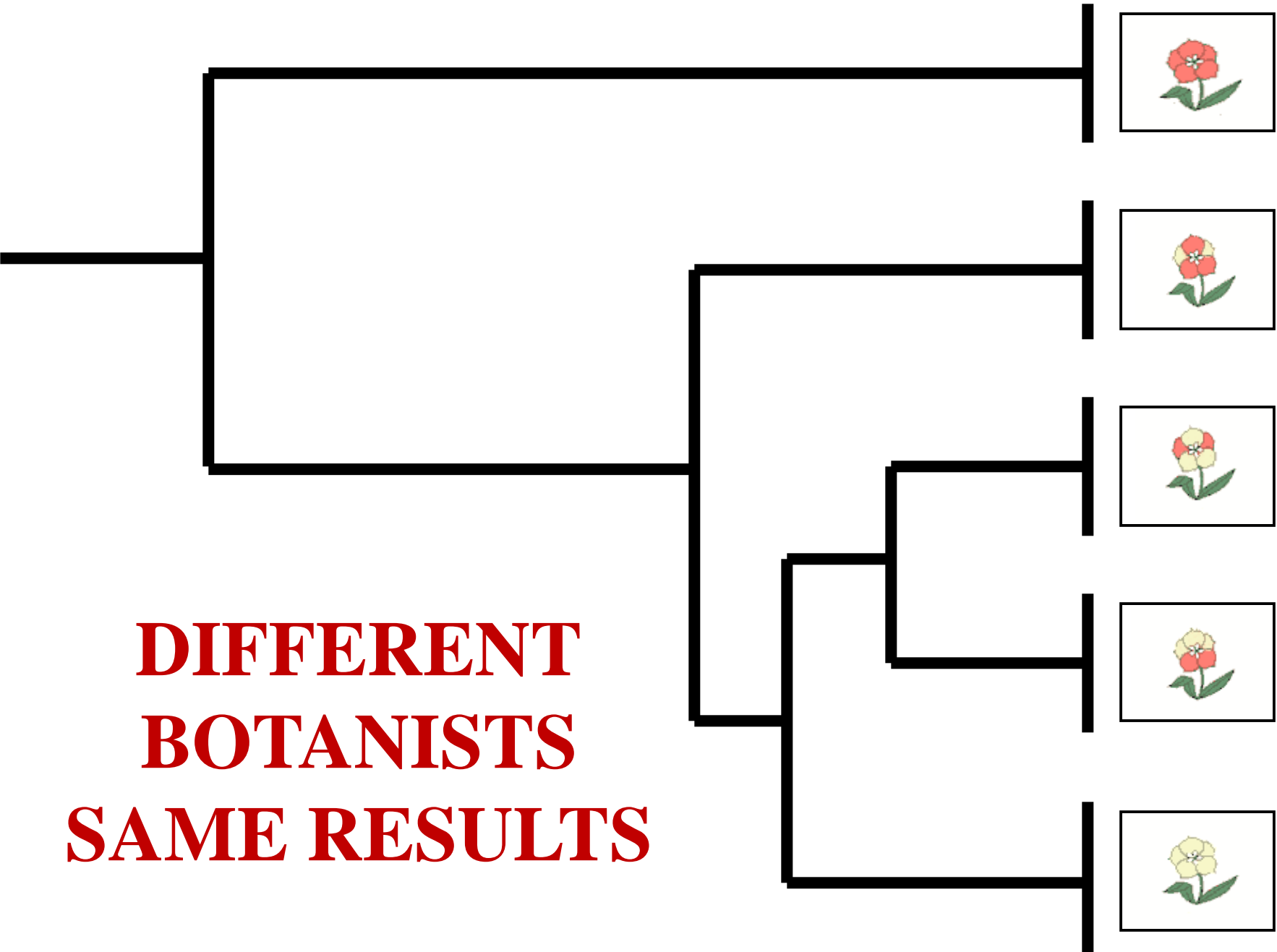
**COMPUTER  
ASSIGNS  
SPECIES LIMITS**



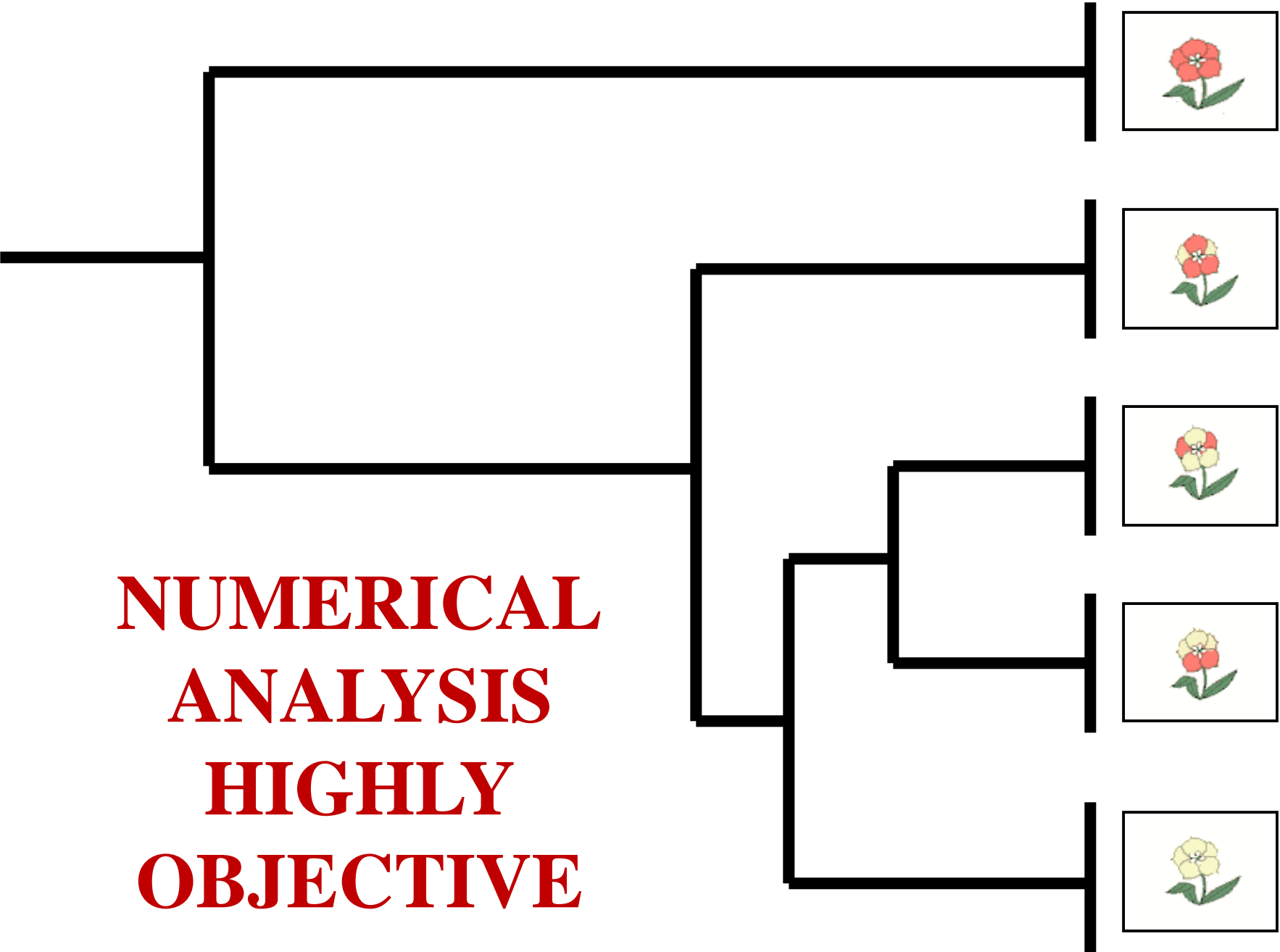


**COMPUTER  
USES ALL  
CHARACTERS**





**DIFFERENT  
BOTANISTS  
SAME RESULTS**

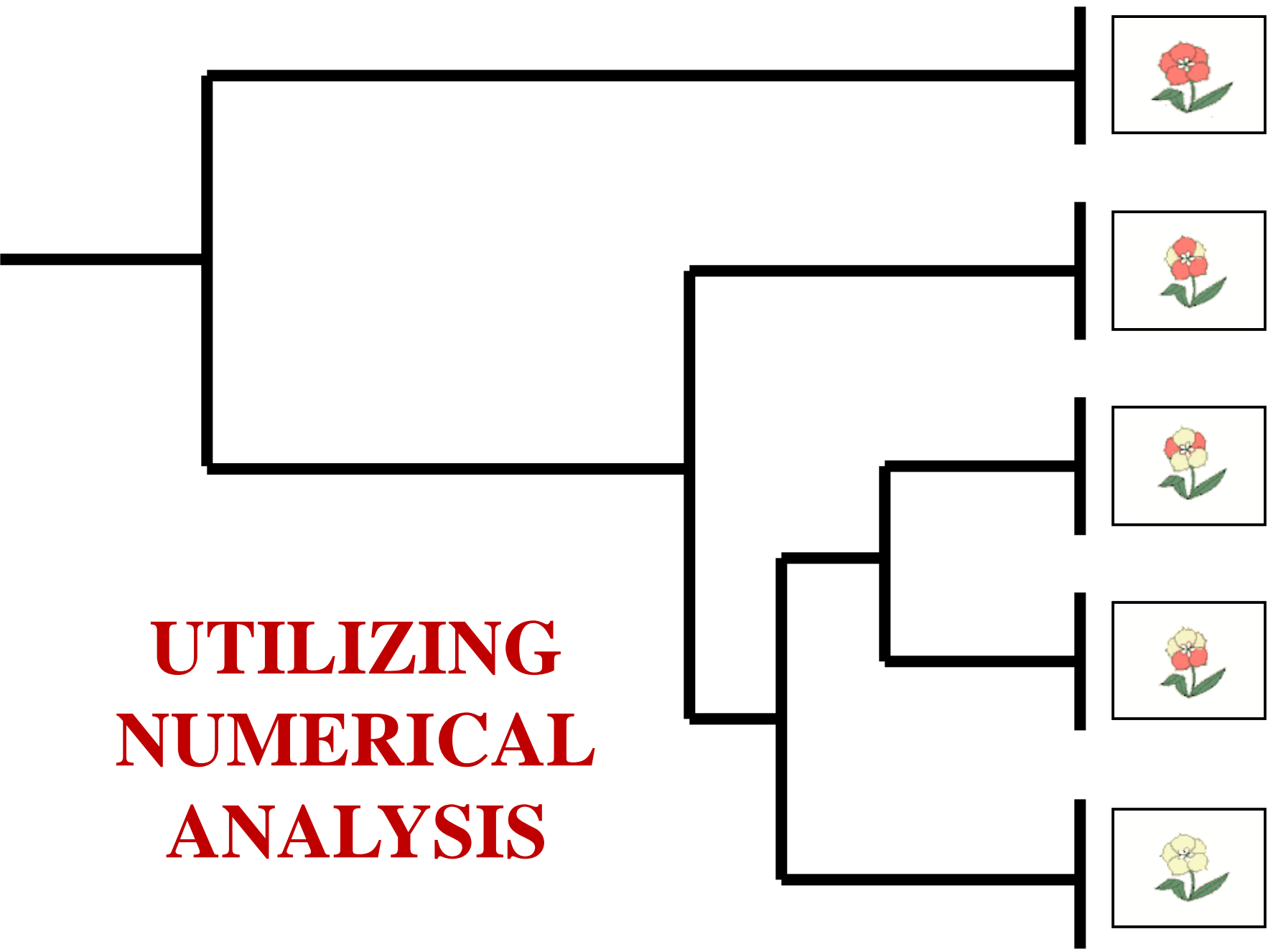




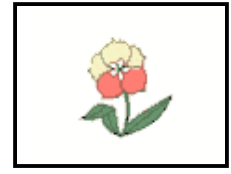


**NUMERICAL  
DATA  
ANALYSIS  
APPLIED**

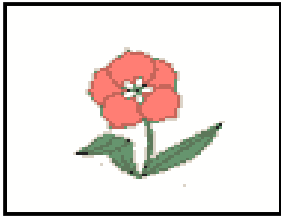




**UTILIZING  
NUMERICAL  
ANALYSIS**



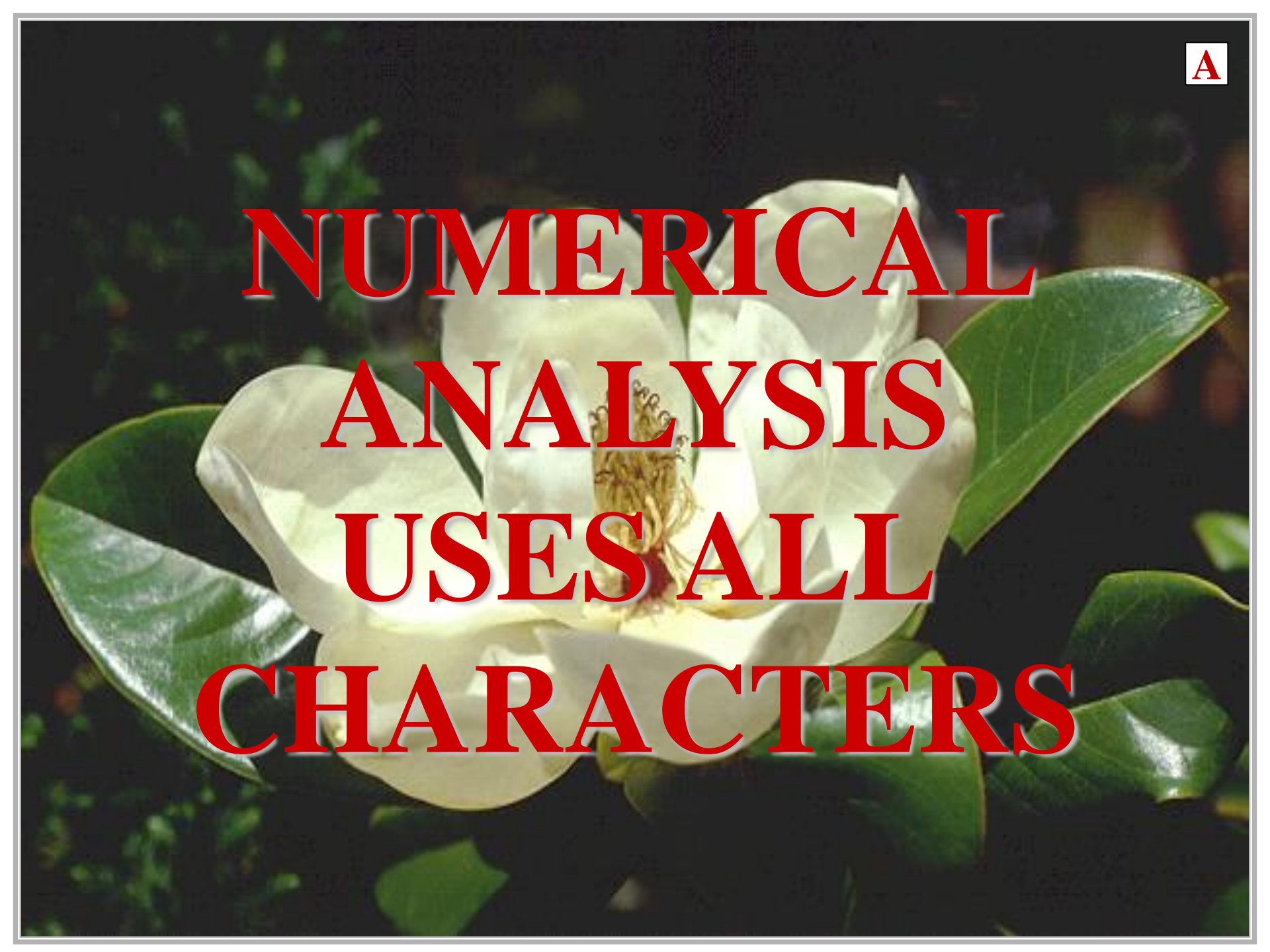
# OUTCOME CLASSICAL ANALYSIS



**5 SPECIES** *Unaopsis*



# NUMERICAL ANALYSIS SUMMARY



**NUMERICAL  
ANALYSIS  
USES ALL  
CHARACTERS**

**ALL  
CHARACTERS  
SALIENT**



**DIFFERENT  
BOTANISTS  
SAME  
RESULTS**



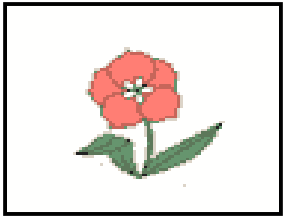


**NUMERICAL  
ANALYSIS:  
HIGHLY  
OBJECTIVE**



**BOTH ANALYSES  
STILL  
EMPLOYED**

# OUTCOME DATA ANALYSIS



**5 SPECIES** *Unaopsis*

**MONOGRAPH  
OUTSET  
*Unaopsis*  
TEN  
RECOGNIZED  
NAMES/SPECIES**

*Unaopsis alpha*

*Unaopsis beta*

*Unaopsis delta*

*Unaopsis epsilon*

*Unaopsis gamma*

*Unaopsis kappa*

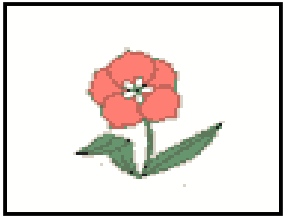
*Unaopsis omega*

*Unaopsis sigma*

*Unaopsis theta*

*Unaopsis unaopsis*

# POST DATA ANALYSIS



**5 SPECIES** *Unaopsis*

# APPLY NOMENCLATURE

# **NOMENCLATURE**



**NOMENCLATURE**

**NAMING ORGANISMS**

**NOMENCLATURE**



# NOMENCLATURE SYSTEMS

# **NOMENCLATURE SYSTEMS**



**COMMON NAMES**

# **NOMENCLATURE SYSTEMS**

# **NOMENCLATURE SYSTEMS**



**COMMON NAMES**  
**SCIENTIFIC NAMES**

**NOMENCLATURE  
SYSTEMS**

# COMMON NAMES