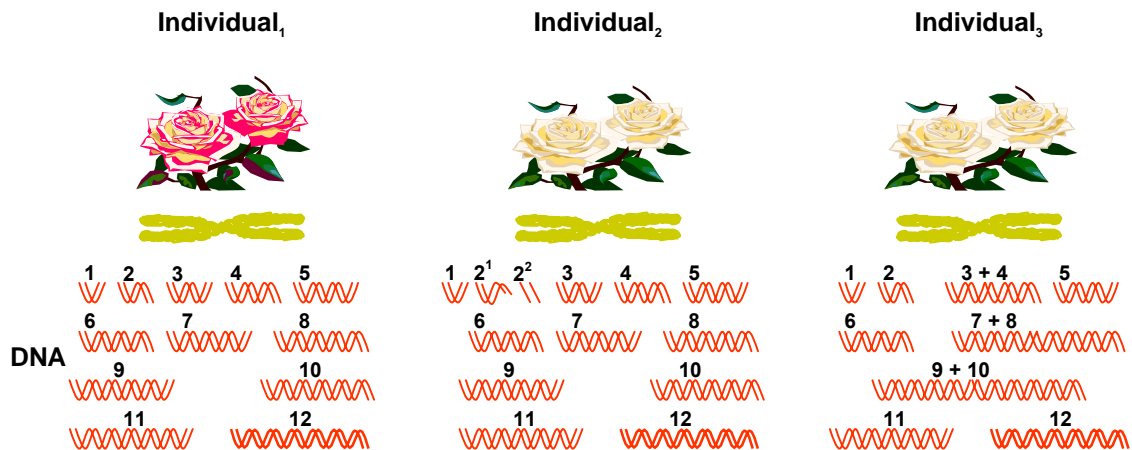


Appendix 8 to:
Measures of Genetic Diversity

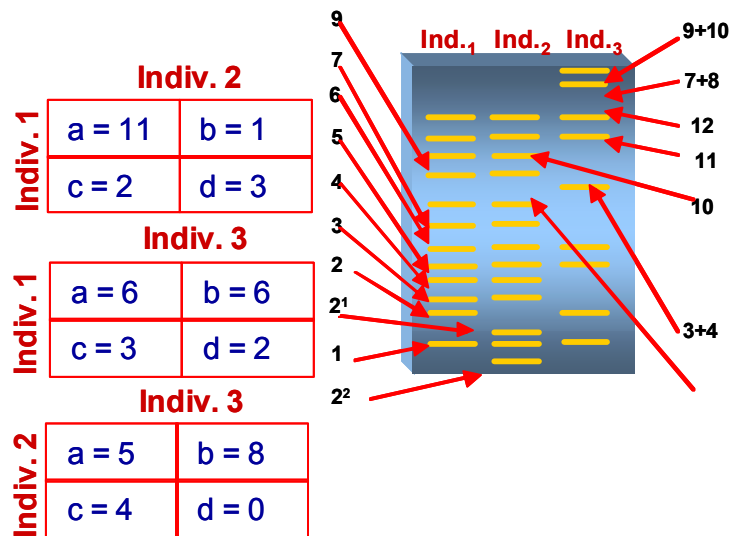
Morphological and molecular similarities



Let's say we have three individual roses (1, 2, 3). Numbers 2 and 3 look morphologically alike, whereas number 1 looks different.

If we look at the DNA fragments, supposedly generated with a molecular marker, we see that Individuals 1 and 2 seem more similar. So, what happened? This shows the importance of studying genetic diversity at all possible levels. The combination of information from different types of markers—that is, those that refer to functional genes and those that show polymorphism in the genomic regions—will give the best approximation to knowledge on present genetic variation. The same would apply if we could combine morphological and molecular data.

In this Appendix, we show the type of errors we may incur if conclusions are based on only one type of marker data.



$$J_{1,2} = \frac{11}{11+1+2} = 0.786 \quad J_{1,3} = \frac{6}{6+6+3} = 0.400 \quad J_{2,3} = \frac{5}{5+8+4} = 0.294$$

Based on the DNA band profile obtained in the gel for the three individuals, the pairwise distances are calculated, using the Jaccard coefficient:

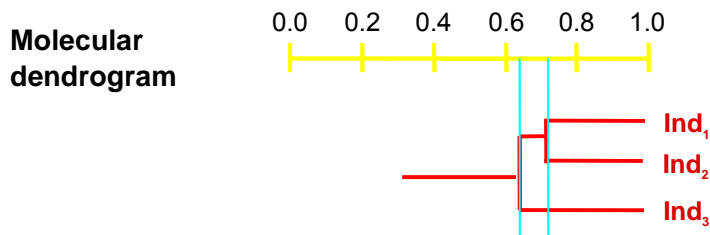
$$J = \frac{a}{a + b + c}$$

We then make the distance matrix and draw the dendrogram:

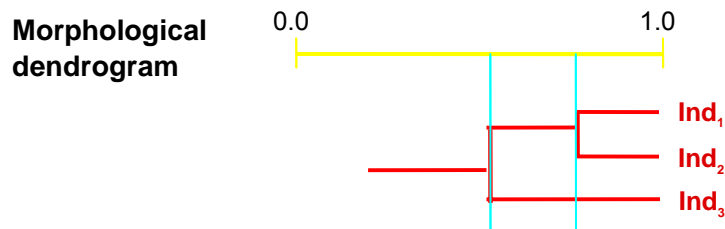
| | Ind ₁ | Ind ₂ | Ind ₃ |
|------------------|------------------|------------------|------------------|
| Ind ₁ | 1 | | |
| Ind ₂ | 0.786 | 1 | |
| Ind ₃ | 0.400 | 0.294 | 1 |

| | Ind ₁₂ | Ind ₃ |
|-------------------|-------------------|------------------|
| Ind ₁₂ | 1 | |
| Ind ₃ | 0.347 | 1 |

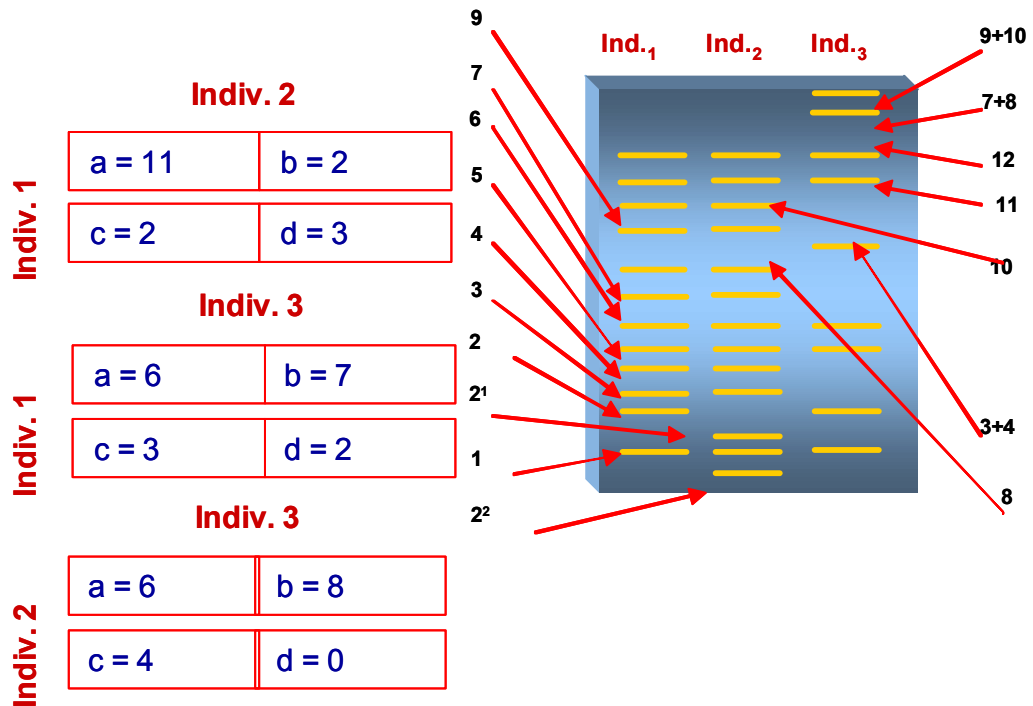
$$S_{1,2,3} = \frac{S_{1,3} + S_{2,3}}{2} = 0.347$$



This dendrogram results from the molecular data. We can now compare it with another dendrogram, shown below, that was developed from morphological observations, and note differences. According to the molecular dendrogram, Individuals 1 and 2 are closer together, even though the morphological data suggest that Individuals 2 and 3 are closer.



But, we can use both molecular and morphological data, combining them and redoing the process with both data simultaneously.

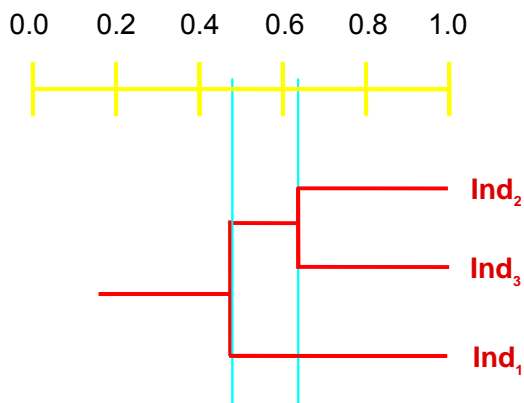


$$J_{1,2} = \frac{11}{11+2+2} = 0.733 \quad J_{1,3} = \frac{6}{6+7+3} = 0.375 \quad J_{2,3} = \frac{6}{6+8+4} = 0.333$$

| | Ind ₁ | Ind ₂ | Ind ₃ |
|------------------|------------------|------------------|------------------|
| Ind ₁ | 1 | | |
| Ind ₂ | 0.733 | 1 | |
| Ind ₃ | 0.375 | 0.333 | 1 |

| | Ind ₁₂ | Ind ₃ |
|-------------------|-------------------|------------------|
| Ind ₁₂ | 1 | |
| Ind ₃ | 0.554 | 1 |

$$S_{(1,2)3} = \frac{S_{1,3} + S_{2,3}}{2} = 0.554$$



The combined dendrogram shows grouping distances that differ from either molecular or morphological dendrogram alone. We may therefore assume that the information provided by combining the data is closer to the reality of this situation.