

If one species differs from another this is called interspecific variation. But members of the same species also differ from each other this is intraspecific variation. So how do we measure the differences between the characteristics of organisms when every one is unique?

Making measurements:

Biologists have to take many measurements of the same thing as they are usually measuring some aspect of living organisms and all of these are different. So they take samples:

Random Sampling:

This involves taking measurements on individuals, selected from the population of organisms which is being investigated. In theory, if these individuals are representative of the population as a whole, then the measurements can be relied upon.

There are several reasons why the measurements are not representative.

Sampling bias: selection process may be biased. Investigators may be making unrepresentative choices like picking buttercups from a dry area instead of a muddy one.

Chance: even if sampling bias is avoided, the individuals chosen may, by pure chance not be representative. The 50 buttercups chosen might be the 50 tallest in the population.

The best way to avoid sampling bias is to eliminate as far as possible, human involvement in choosing samples. This can be achieved by random sampling. One method is:

1. **divide the study area into a grid of numbered lines**
2. **Using random numbers from a table or generated by a computer, obtain a series of coordinates**
3. **Take samples at the intersection of each pair of coordinates.**

We cannot completely remove chance from the sampling process but we can minimise its effect by:

1. **using a large sample size (the more individuals the smaller the probability that chance will influence result)**
2. **Analysis of the data collected. Can determine the extent to which chance may have influenced the data.**

Quantitative investigations of variation

The normal distribution curve:

A bell shaped curve. This is typical for a feature that shows continuous variation like height in humans.

The mean: sum of sampled values divided by the number of items

The mode: the single value of a sample that occurs most often.

The median: central or middle value of a set of values. They need to be in ascending order.

Mean and standard deviation:

The mean is the measurement at the maximum height of the curve.

The standard deviation is a measure of the width of the curve. It gives an indication of the range of values either side of the mean.

Calculating standard deviation:

Standard deviation =

Σ = the sum of

X = measured value

-x = mean value

n = total number of values in the sample

