

## **Chapter 3: Darwinian Natural Selection**

### **1) Charles Robert Darwin (1809 – 1882)**

- a. 1831 was “naturalist” on Beagle**
- b. Traveled widely throughout the Atlantic and Pacific**
- c. 1838 starts discussing the theory of natural selection**
- d. 1859 published “On the Origin of Species”**

### **2) Alfred Russel Wallace (1823-1913)**

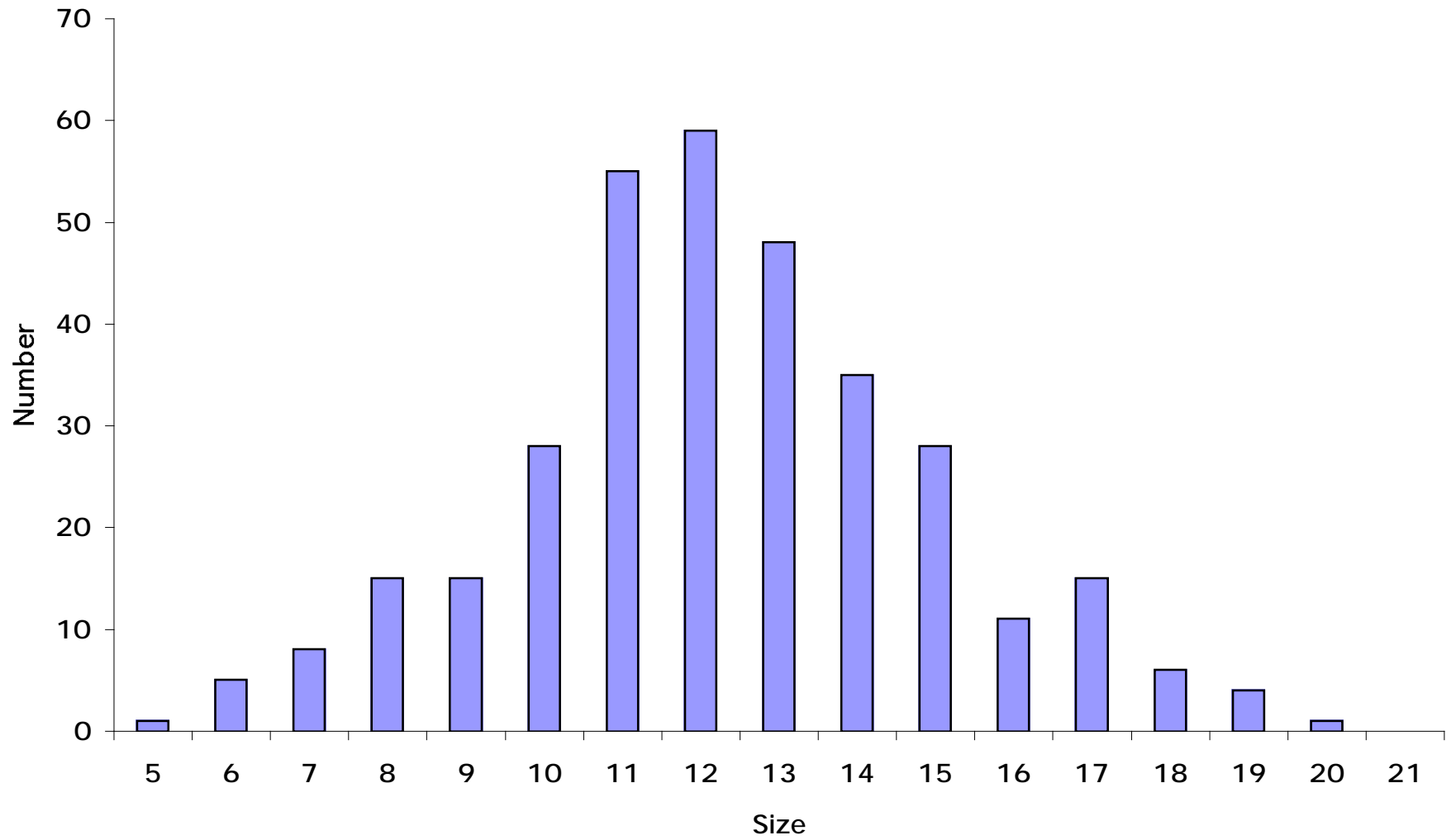
- a. Naturalist working extensively in South America**
- b. 1858 sent Darwin a copy of his manuscript “ON the Tendency of Varieties to Depart Indefinitely from the Original type”**

**Both worked on discerning the PROCESS of speciation by looking at the PATTERN of speciation.**

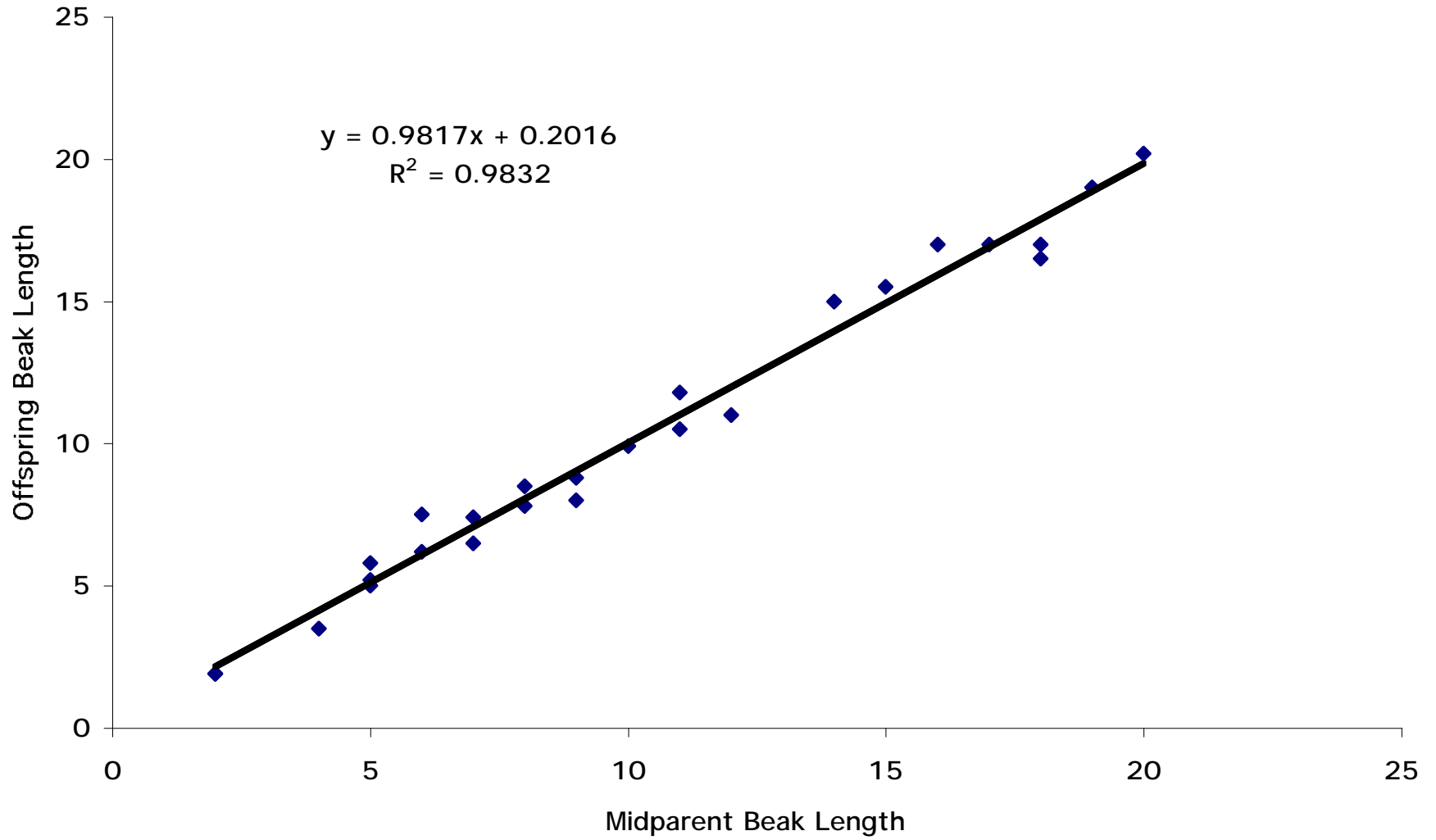
### **3) 1900 Gregor Mendel demonstrates the particulate nature of inheritance (not blending).**

### **4) 1953 James Watson and Francis Crick published the structure of the material of inheritance (i.e., DNA).**

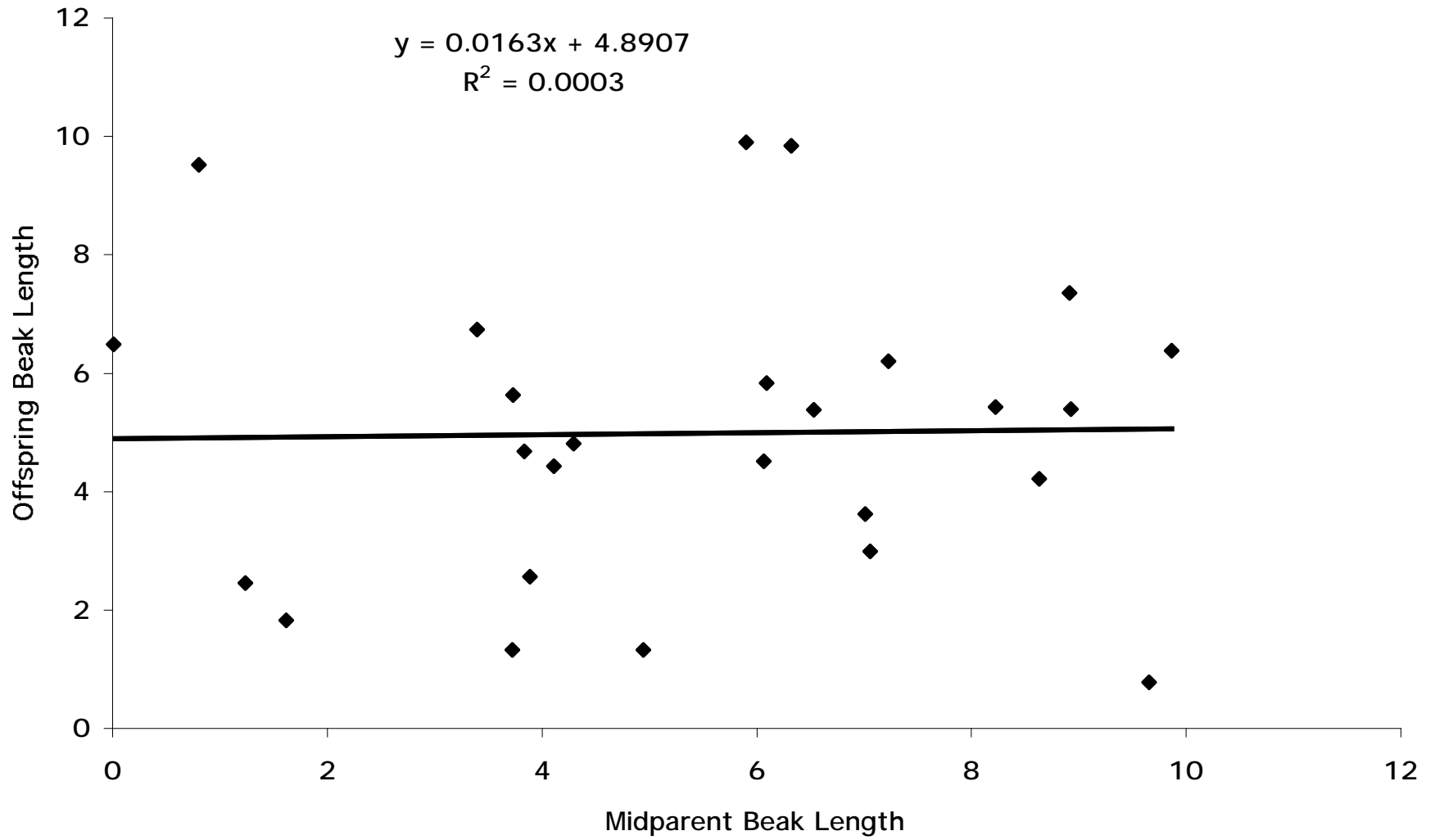
## Normally distributed Character



### Parent - Offspring Correlation in Beak Length



### Parent - Offspring Correlation in Beak Length



# Natural Selection and Darwin's Postulates

- 1) **Individuals within species are variable**
- 2) **Some of these variations are passed on to offspring**
- 3) **In every generation, more offspring are produced than can survive.**
- 4) **The survival and reproduction of individuals are not random: The individuals who survive and reproduce are those with the most favorable variations.**

**As a result there is a change in the frequency of characters from one generation to the next. These characters confer increased fitness on the individuals that possess them.**

**Increased fitness is only RELATIVE to others in the population**

<b>Character</b>	<b><u>A</u></b>	<b><u>B</u></b>
<b>Number of Offspring</b>	<b>10</b>	<b>11</b>
<b>% surviving to reproduce</b>	<b>90%</b>	<b>75%</b>
<b>Number of Offspring reproducing</b>	<b>9.00</b>	<b>8.25</b>
<b>Selection coefficient (s)</b>	<b>0.0</b>	<b>0.0833</b>
<b>Relative Fitness</b>	<b>1.0</b>	<b>0.9167</b>

## **The Nature of Natural Selection**

- 1) Natural Selections Acts on Individuals, but the consequences are to the population (or species) not the individual.**
  - a. Individuals don't evolve.**
- 2) Natural Selection Acts on the Phenotype, but Evolution is the change in heritable variation.**
  - a. Changes in frequency of nonheritable characters are not evolution (color and body size).**
- 3) Natural Selection is backward looking, not forward looking.**
  - a. Because something may be useful tomorrow is not natural selection**
- 4) Natural Selection Can Produce New Traits, Even Though it Acts on Existing Traits.**
  - a. Horse's leg**
- 5) Natural Selection is NOT Perfect or Optimal**
  - a. Relative fitness differences is important**
- 6) Natural Selection is nonrandom, but it is Not progressive**
  - a. *E. coli* is a good bacteria and you are a very bad bacteria**
- 7) Fitness is not Tautological (circular)**
  - a. Fitness is a correlation**
- 8) Natural Selection Acts on Individuals Not Groups**
  - a. i.e., there is no such thing as Altruism (actions that while decreasing the actors fitness increase the groups).**
  - b. This point is arguable**

## Natural Selection and Darwin's Postulates After the Modern Synthesis

- 1) As a result of mutation creating new alleles, and segregation and independent assortment shuffling alleles into new combinations, individuals within populations are variable for nearly all traits.
- 2) Individuals pass their alleles on to their offspring intact.
- 3) In most generations, more offspring are produced than can survive.
- 4) The individuals that survive and go on to reproduce, or who reproduce the most, are those with the alleles and allelic combinations that best adapt them to their environment.

Genotype	<u>AA</u>	<u>Aa</u>	<u>aa</u>
Number of Offspring	10	11	10
% surviving to reproduce	90%	75%	25%
Number of Offspring Reproducing	9.00	8.25	2.5
Selection coefficient (s)	0.0	0.0833	0.7222
Relative Fitness	1.0	0.9167	2.778