

## Chapter 18 – Complex Traits

I. Most traits are complex & the product of more than 1 gene and are influenced by the environment

II. When multiple genes are involved, the effect of an individual gene on phenotype can be obscured.

III. Different genotypes can have similar phenotypes

A. **Fig 18.4: Multiple genes contributing to a complex trait.** Three unlinked genes, each with 2 alleles, influence intensity of red in wheat. Little effect of environment. Each dominant gene form increases the amount of red pigment in a wheat seed.

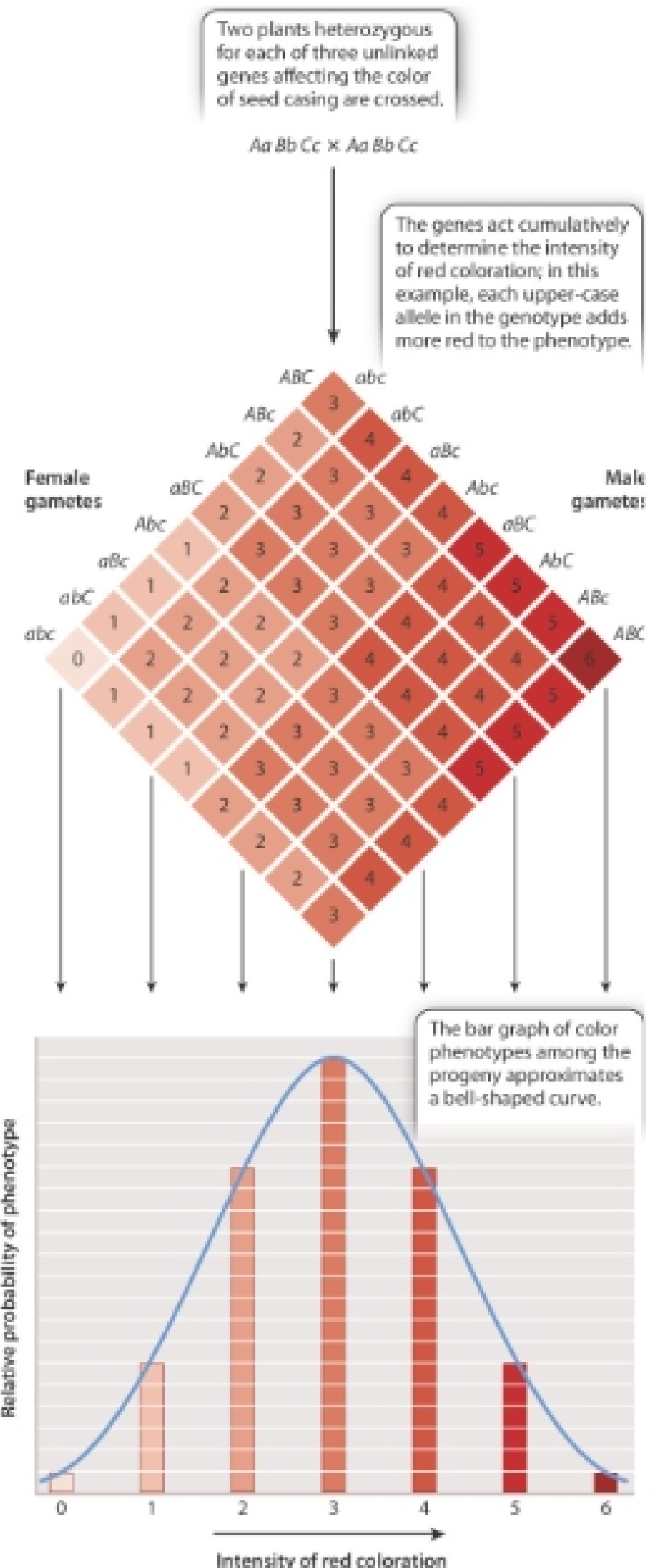
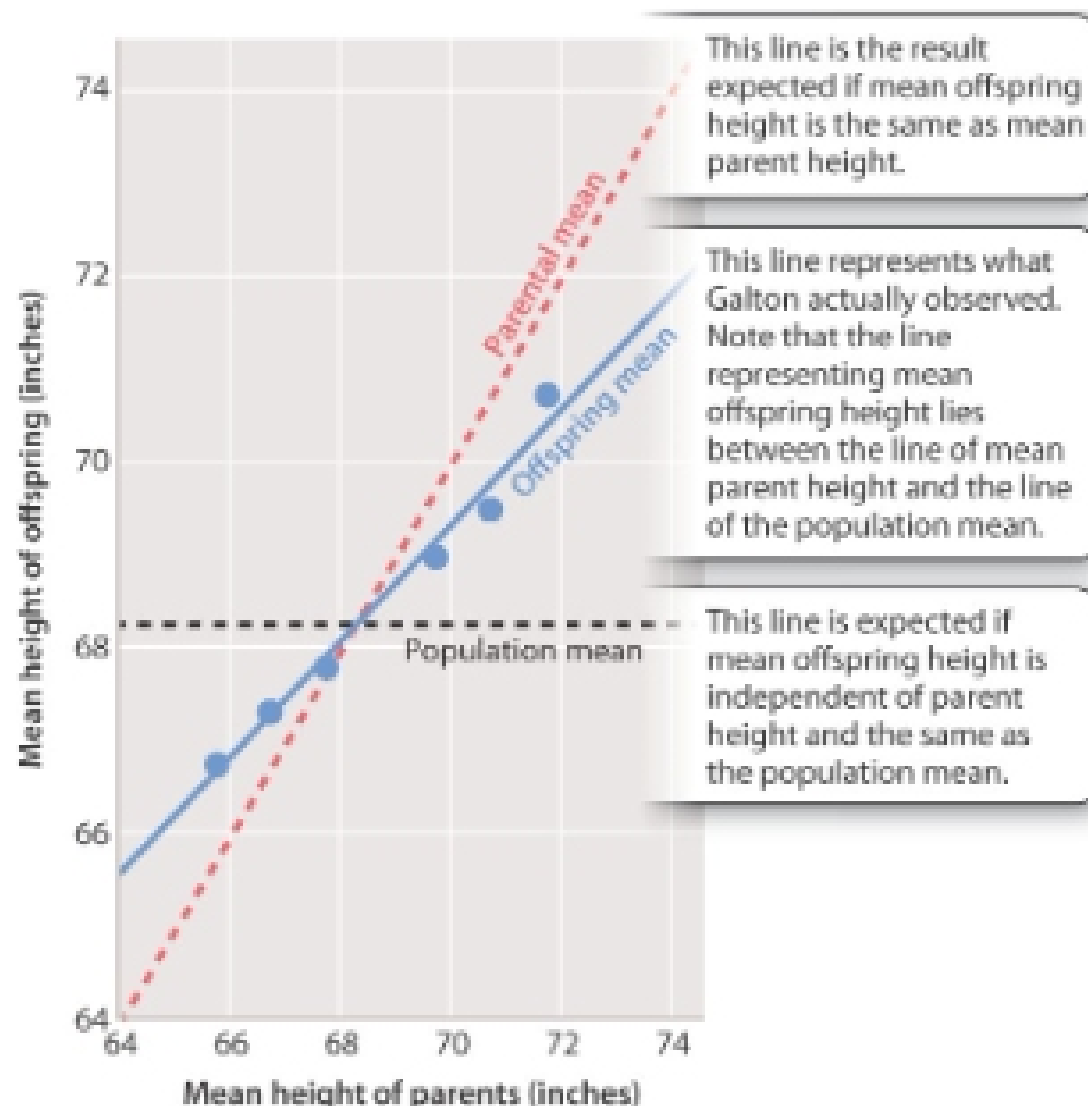
1. Wheat can be from white to dark red
2. Each parent is intermediate in color. Color distribution in normal (bell shaped)

B. **General conclusion:** no environment is best for all genotypes

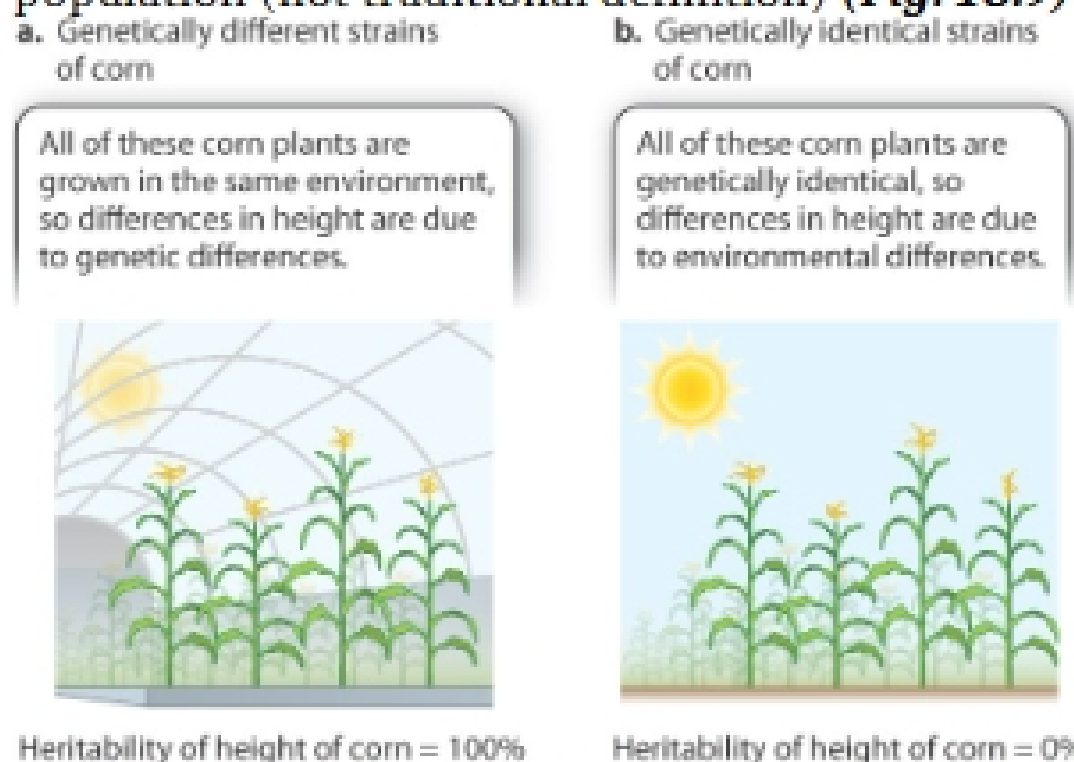
IV. Understanding the effect of a genotype requires understanding the effect of the environment

A. **Fig. 18.8 – Height data**

1. Shows regression towards the mean
2. Regression towards mean is shown because combinations of genes that result in extreme phenotypes tend to be broken up during meiosis
3. Environmental influence on parents' phenotypes is not reproduced in offspring



**V. Heritability:** the proportion of total variation due to genetic differences in a particular population (not traditional definition) (**Fig. 18.9**)



**A. Fig 18.9:** height differences are 100% due to heritability, because the environment is constant

**B.** If human height was 100% heritable, the offspring mean would equal the parental mean (back to fig. 18.8). However, it's influenced by environment

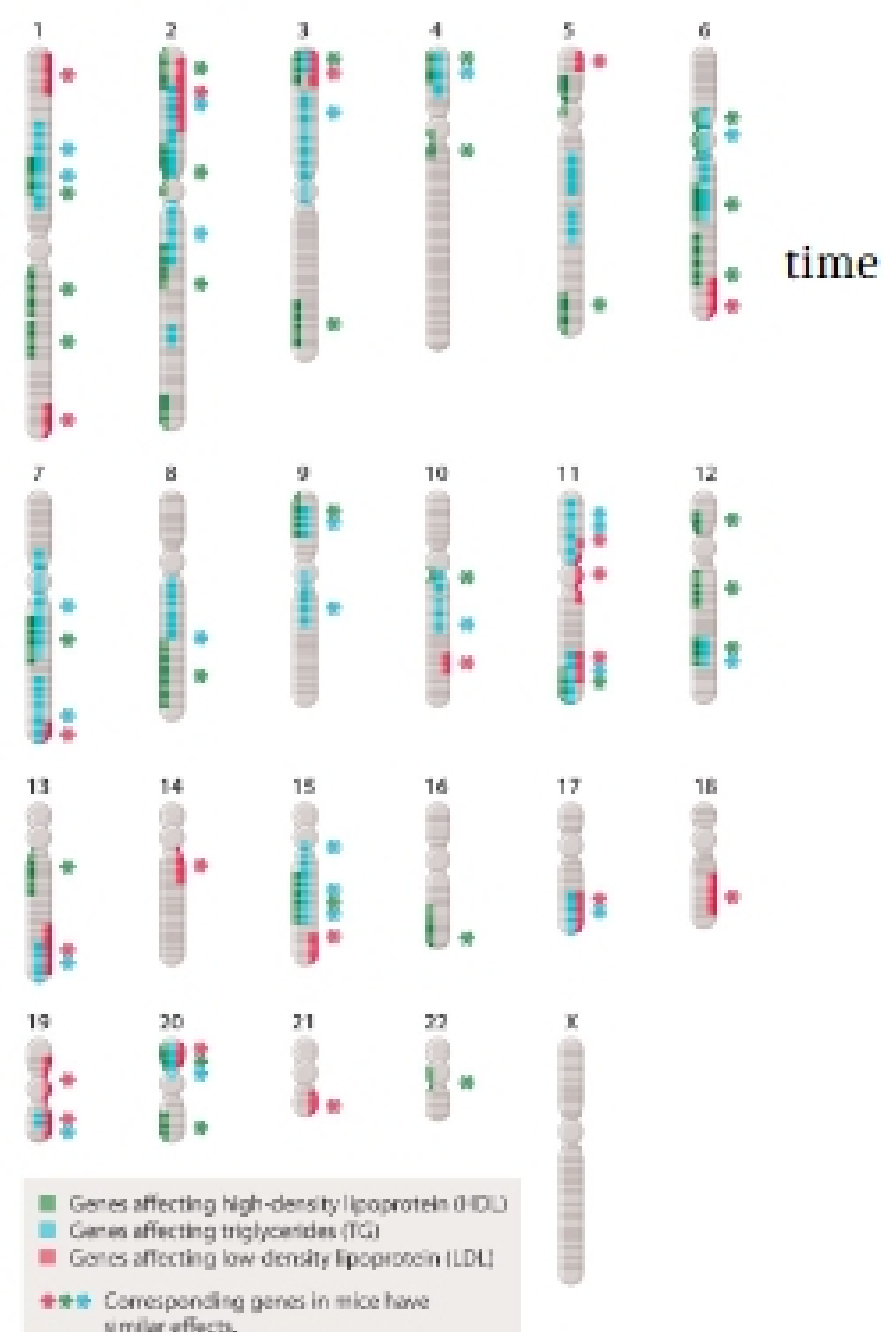
**C.** Magnitude of heritability is not an intrinsic characteristic of a trait  
 1. Applies to the trait in a particular population across the range of environments that exist at that particular

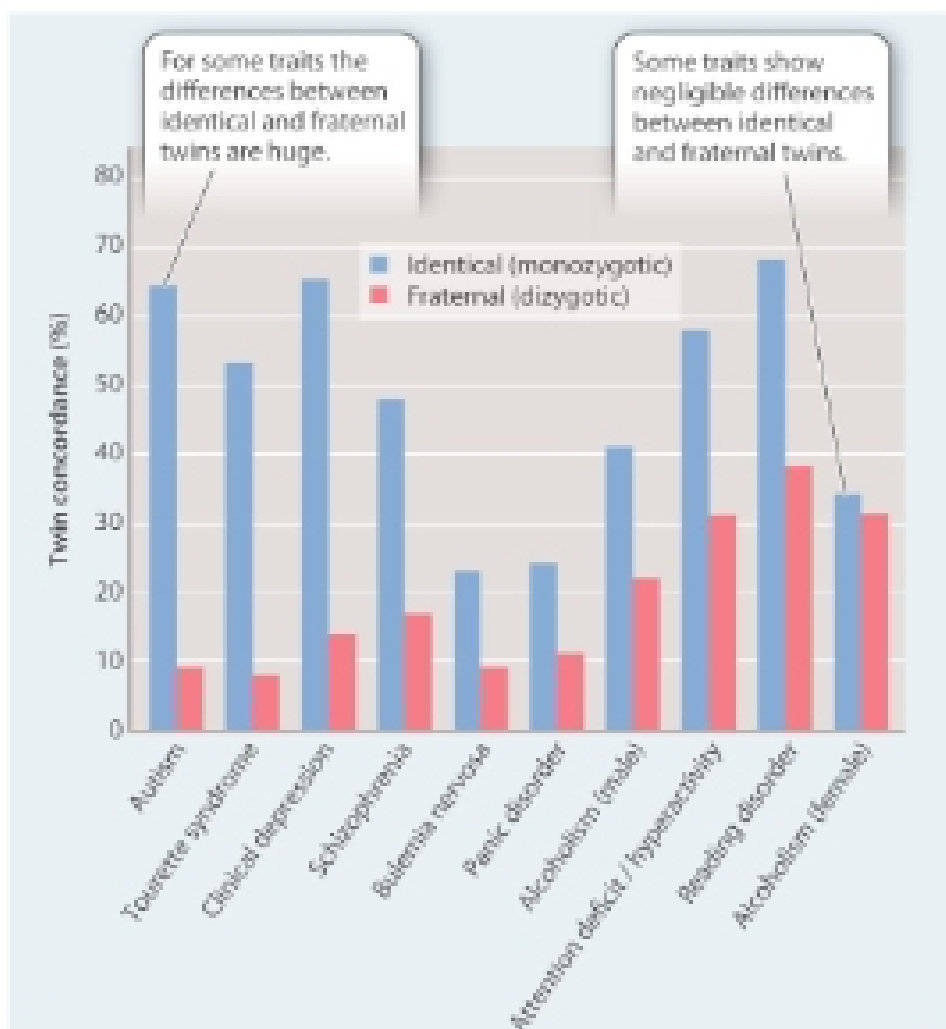
**VI. Twin Studies**

**A.** Twin studies suggest strong effect of environment on behavioral disorders (eg. alcoholism), but little effect on other disorders, such as autism, etc. (**fig. 18.11**)

**B.**

**VII. Most common diseases are affected by many genes; each on its own causes a small effect (**fig. 18.13**)**





### 18.11

<b><i>Typical differences between:</i></b>	<b><u>Prokaryotes</u></b>	<b><u>Eukaryotes</u></b>
<b>Cell size</b> (big or small)	<b>Small</b> (1-10um)	<b>Big</b> (10-100 um)
<b># of genes</b> (few or many)	<b>Few</b> (500 - 4000)	<b>Many</b> (6,000 - 30,000)
<b>Gene structure</b> (simple or complex)	<b>Simple</b> (no introns)	<b>Complex</b> (introns)
<b>Cell structure</b> (simple or complex)	<b>Simple:</b> no membrane bound organelles	<b>Complex:</b> membrane bound organelles