OUTLINE 13

Extensions to Mendel's Rules

A. Partial dominanace
- **1. incomplete dominanace**
- **2. Co-dominance**

B. More than 2 possible alleles at a locus
- **1. Human ABO blood groups**

C. Polygenic Inheritance
- **1. Human skin color**
- **2. Human eye color**

D. Sex-linked Inheritance

RULES OF PROBABILITY

1. When all outcomes equally likely, the probability that a particular outcome will occur is

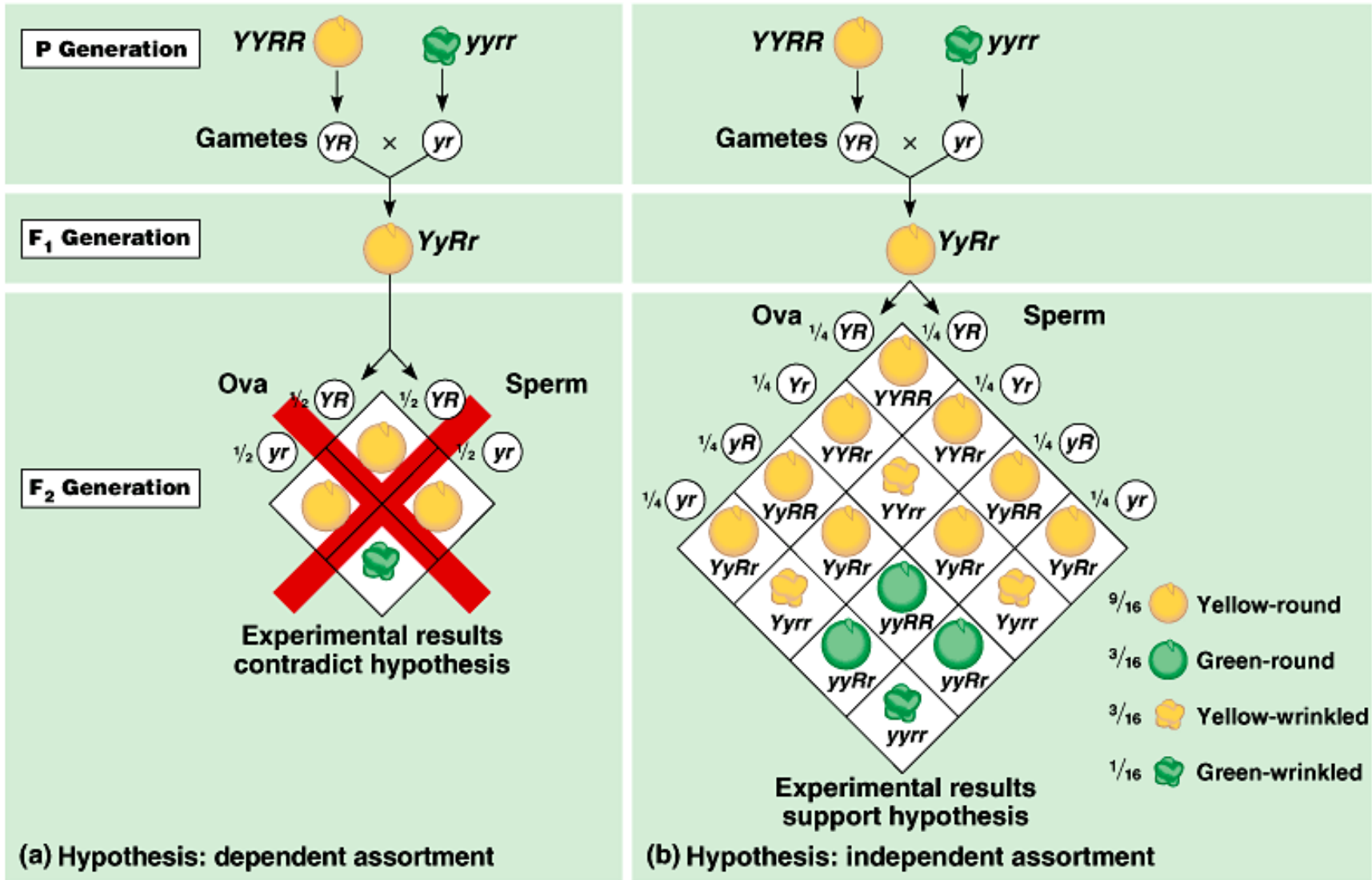
#ways to obtain that outcome / total # possible outcomes

2. The product rule = the "AND" rule

For 2 independent events, the probability of observing 2 particular outcomes (outcome 1 AND outcome 2) is the PRODUCT of their independent probabilities.

3. The addition rule = the "OR" rule
The probability of observing either one OR another outcome is equal to the SUM of their independent probabilities.

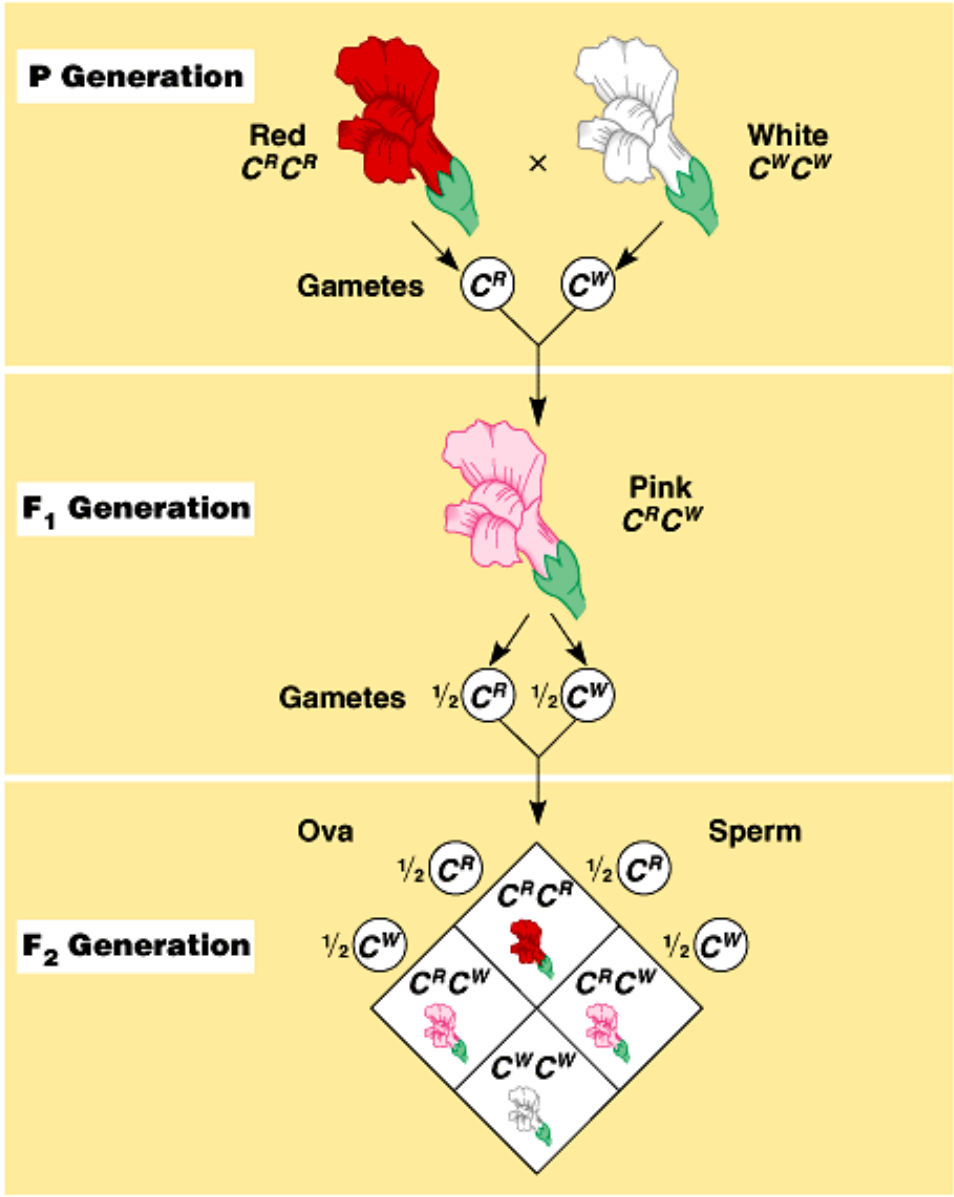
Fig. 14.7 A Dihybrid Cross



Application of Mendel's Rules assumes:

1. **One allele completely dominates the other**
2. **All genes have 2 allelic forms**
3. **All traits are monogenic (affected by only one locus)**
4. **All chromosomes occur in homologous pairs**
5. **All genes assort independently**
6. **An allele is completely expressed when either dominant or heterozygous**
7. **Each trait is controlled by a different set of factors**

Fig. 14.9



Incomplete Dominance

Co-dominance

CC (blue) x C'C' (yellow)

CC' (green)

Continuous traits

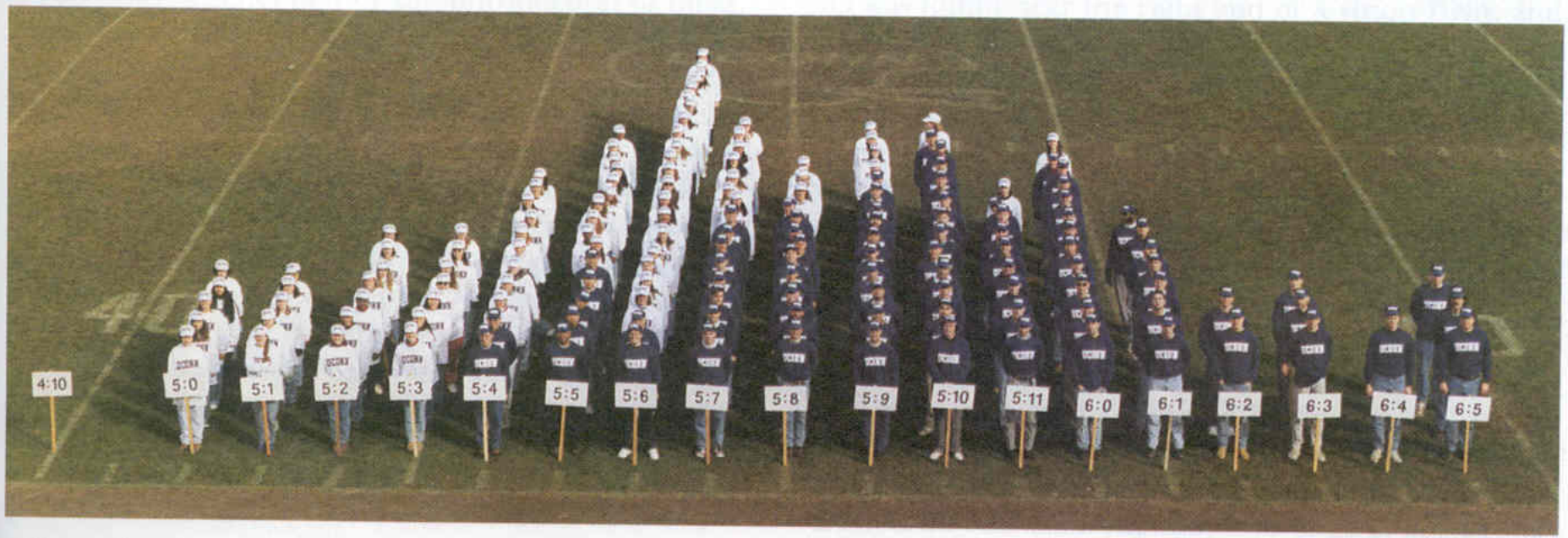


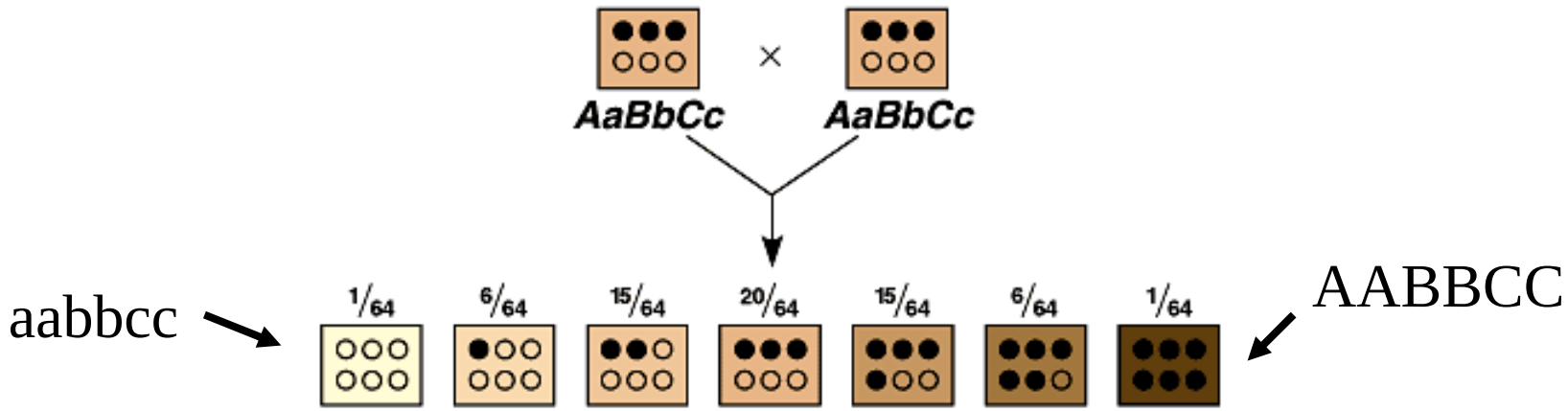
FIGURE 3.—A modern version of Figure 2, from Connecticut State University in 1996. The means and standard deviations in inches are as follows: males, 70.1 ± 3.0; females, 64.8 ± 2.7; combined, 67.6 ± 4.0. Photo from LINDA STRAUSBAUGH.

Crow, 1997 Genetics 147:1

Fig 14.12 Polygenic inheritance of skin tone

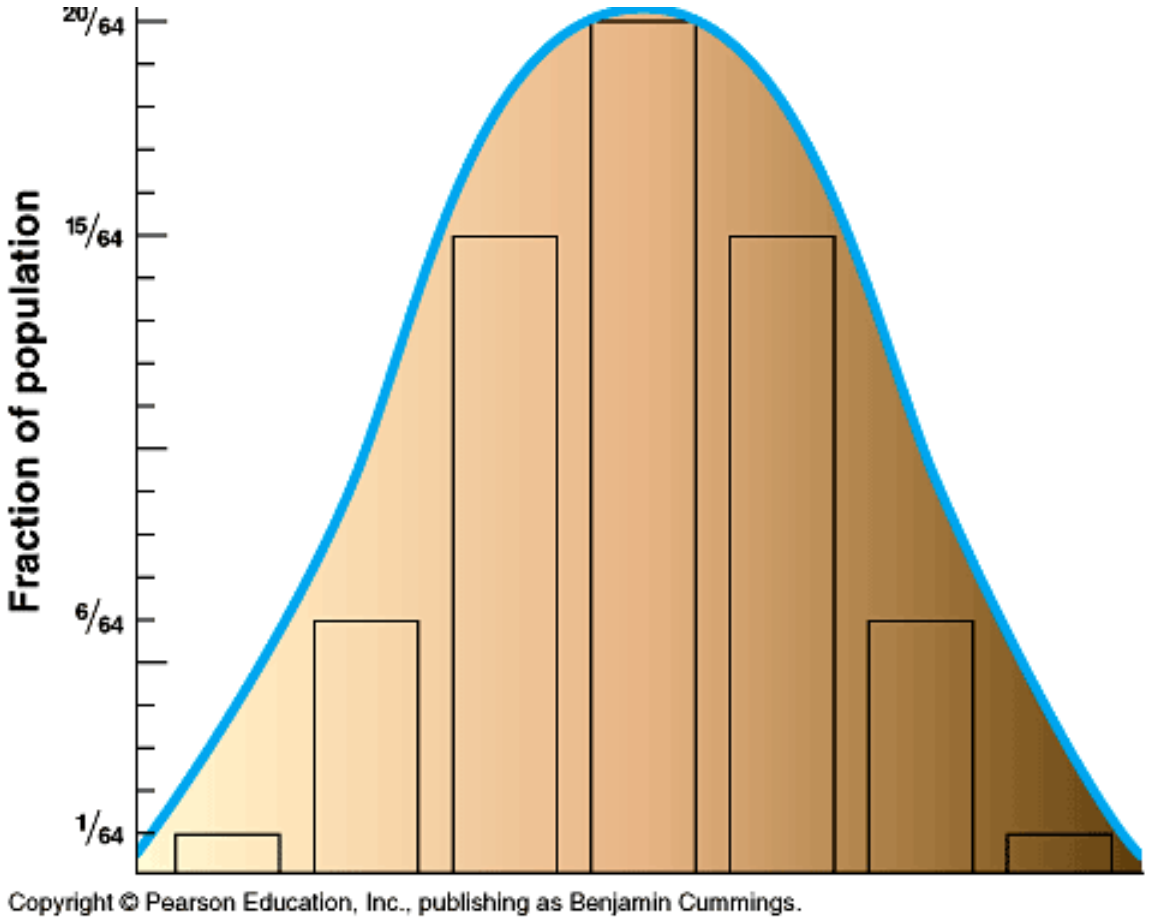
3 loci: each has two possible alleles: A,a B,b C,c,
each capital allele adds one unit of darkness
each lower case allele adds nothing

Parents with intermediate tone



Offspring can have tone darker or lighter than either parent

Fig 14.12


Fraction of population
20/64
15/64
6/64
1/64
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0 1 2 3 4 5 6
Number of 'darker' alleles

Hypothetical mechanism for determination of eye color in Humans

Gene for melanin production B (produce) dominant to b (none)

2 Modifier loci affect amount of pigment deposited

CC’ and DD’ each non prime allele contributes one unit of deposition

G’type at B	Modifier loci	Phenotype
B_	CCDD	Dk brown (+4)
B_	CCDD’	Med. Brown (+3)
B_	CC’DD’	Lt Brown (+2)
B_	CC’D’D’	Hazel (+1)
BB	C’C’D’D’	Green
Bb	C’C’D’D’	Greenish blue
Bb	any g’type	Blue

Hypothetical mechanism for determination of eye color in Humans

A possible cross:

P	bbCCDD (Blue)	X	BbC’C’D’D” (Gr-blue)
Gametes	bCD		BC’D’, bC’D’
F1	BbCC’DD” (Lt. Brown)		bbCC’DD’ (Blue)