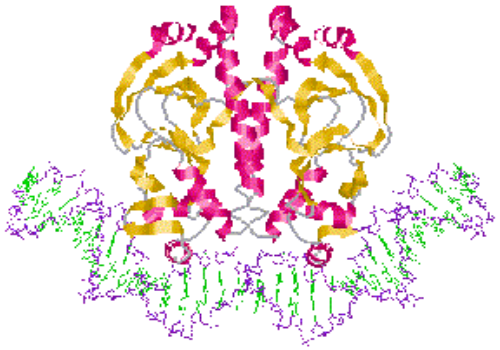
Punnett Squares, Testcross, Monohybrid, dihybrid and trihybrid cross



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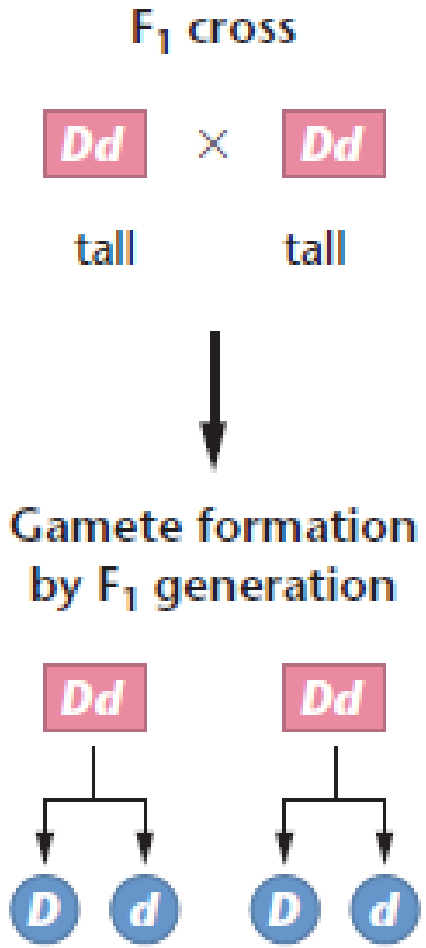
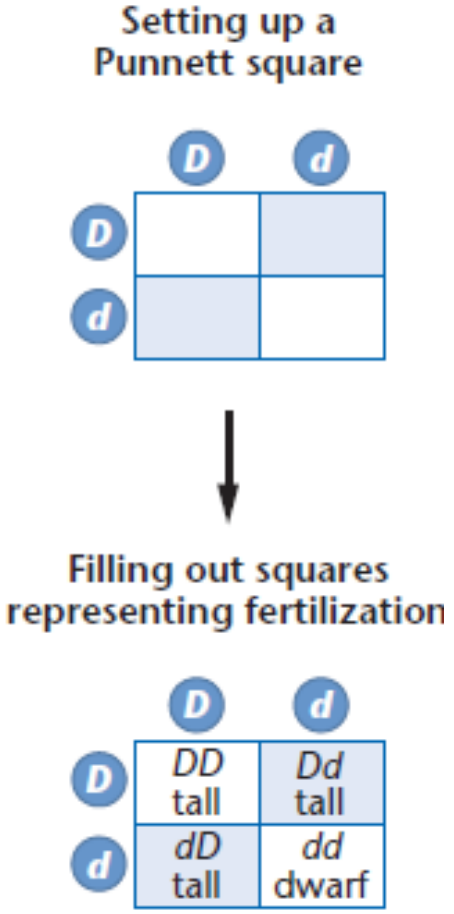
Outline of course

- Punnett Squares
- Testcross
- Monohybrid
- Dihybrid and trihybrid cross
- Chi-Square Analysis Evaluates the Influence of Chance on Genetic Data

Punnett Squares





F_2 results

Genotype	Phenotype
1 *DD*	3/4 tall
2 *Dd*	
1 *dd*	1/4 dwarf
1:2:1	3:1

The Testcross: One Character

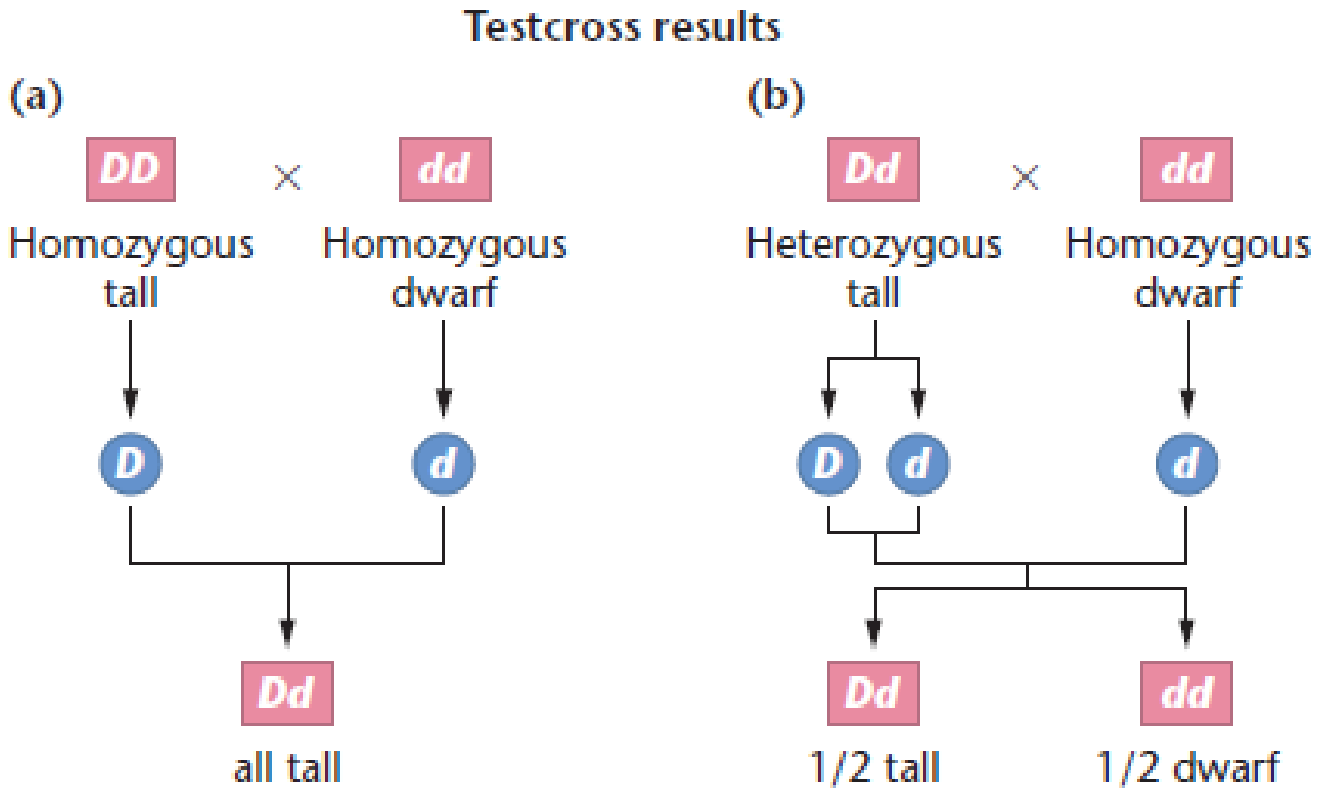
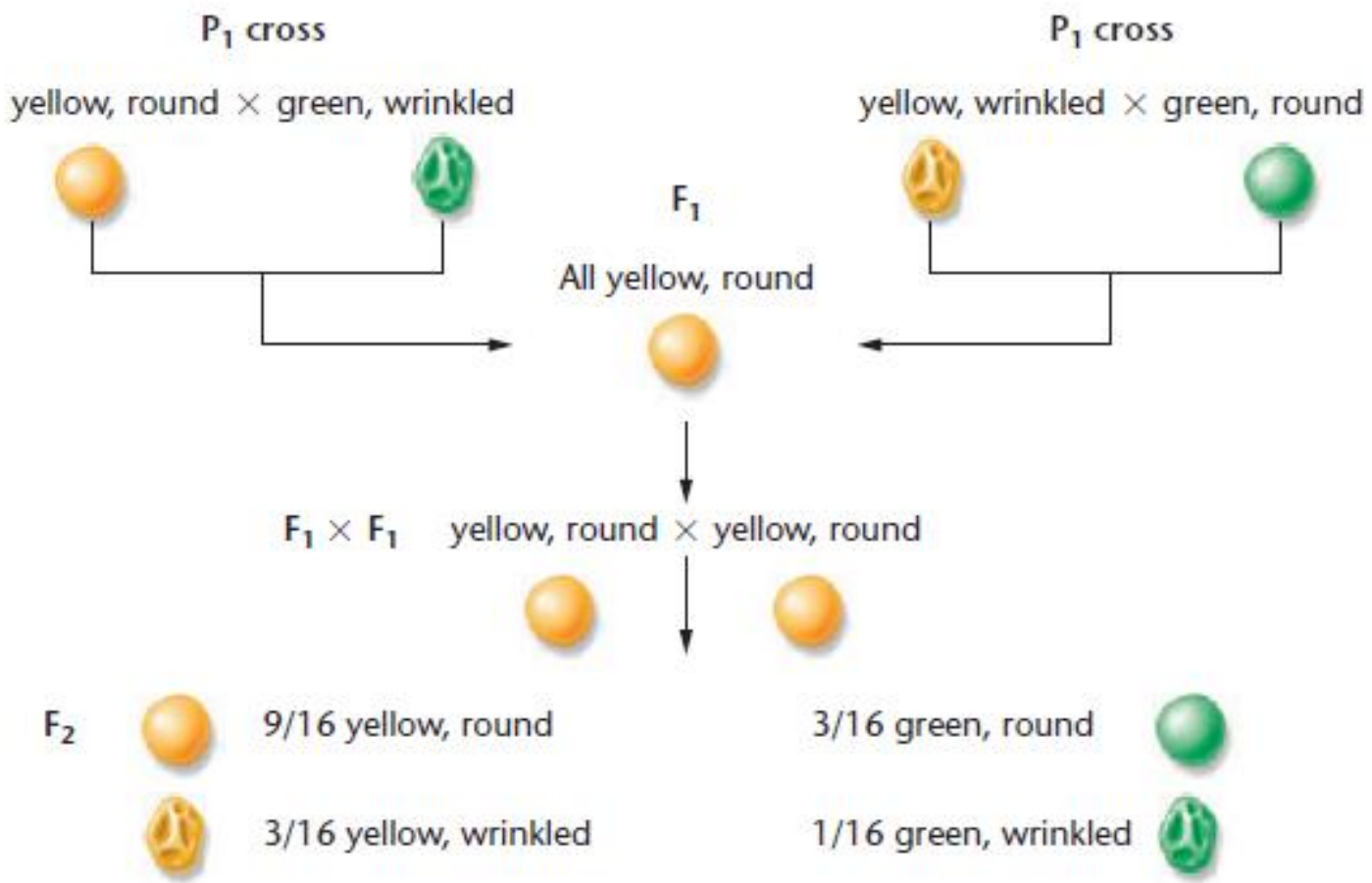
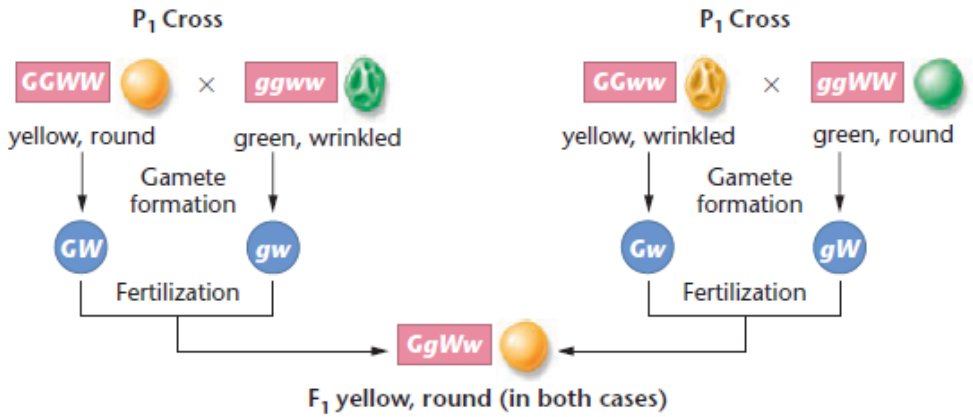


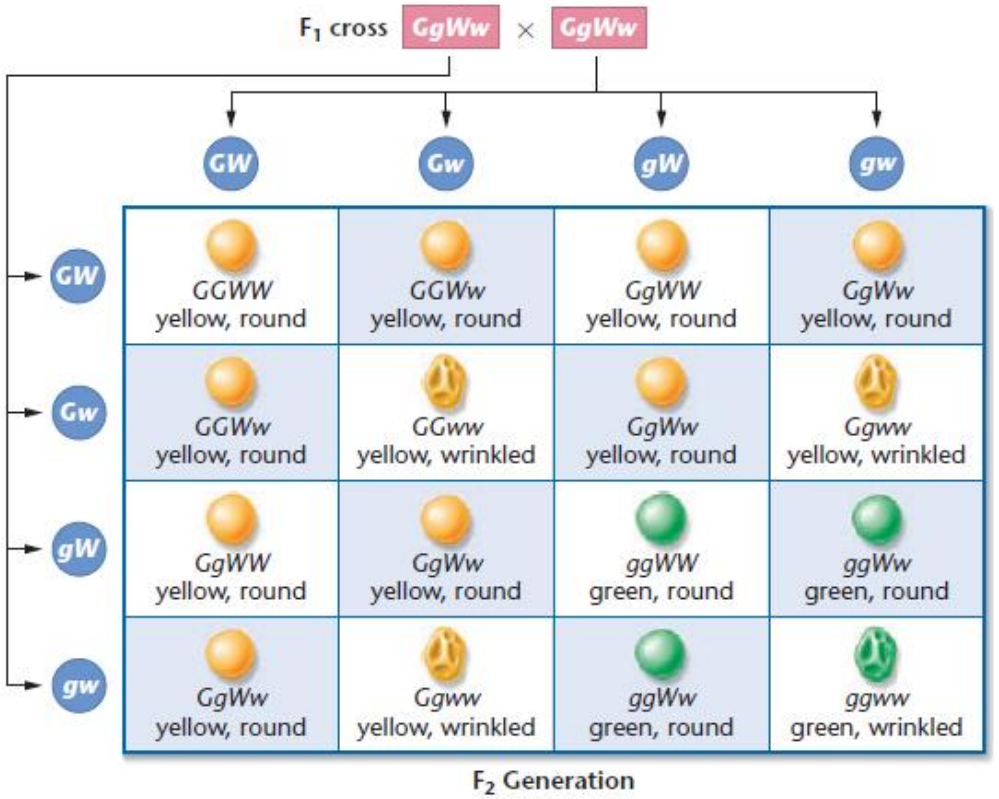
FIGURE 3.4 Testcross of a single character. In (a), the tall parent is homozygous, but in (b), the tall parent is heterozygous. The genotype of each tall P_1 plant can be determined by examining the offspring when each is crossed with the homozygous recessive dwarf plant.

Mendel's Dihybrid Cross Generated a Unique F2 Ratio



Mendel's Dihybrid Cross Generated a Unique F2 Ratio





F_2 Genotypic ratio	F_2 Phenotypic ratio
1/16 *GGWW* 2/16 *GGWw* 2/16 *GgWW* 4/16 *GgWw*	9/16 yellow, round
1/16 *GGww* 2/16 *Ggww*	3/16 yellow, wrinkled
1/16 *ggWW* 2/16 *ggWw*	3/16 green, round
1/16 *ggww*	1/16 green, wrinkled

Triybrid gamete formation

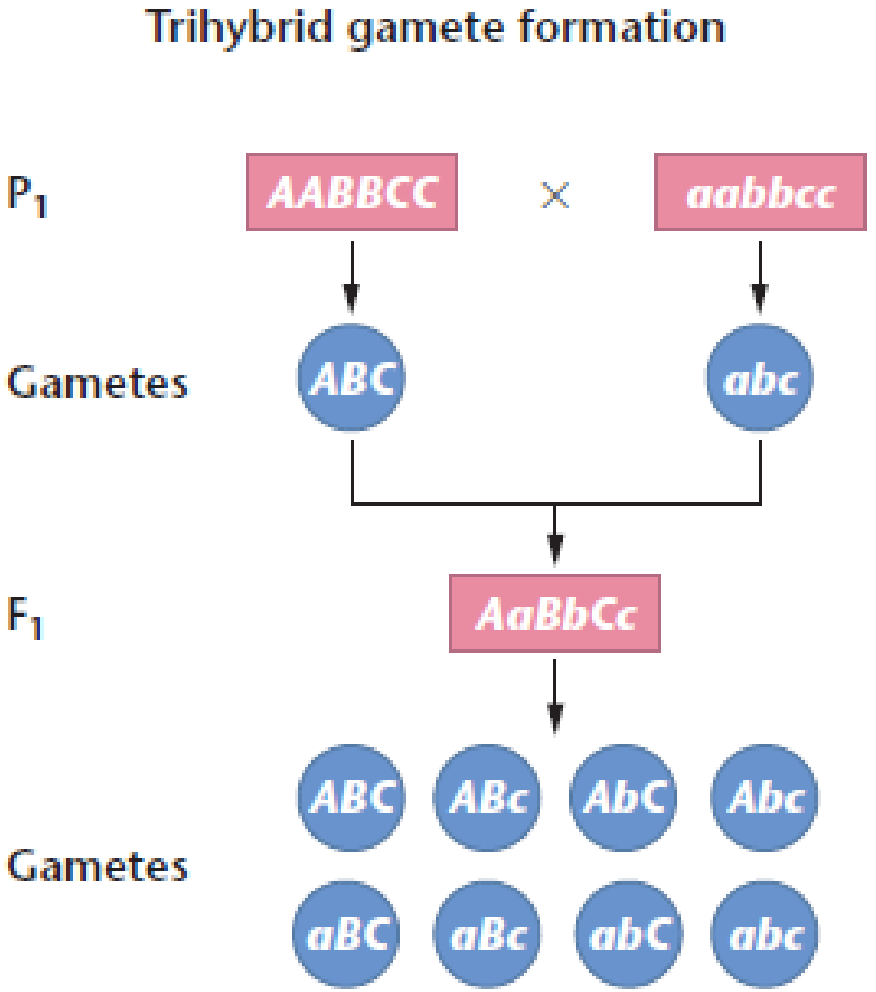


FIGURE 3.8 Formation of P_1 and F_1 gametes in a trihybrid cross.

Generation of F2 trihybrid phenotypes

Generation of F_2 trihybrid phenotypes

A or *a*	*B* or *b*	C or *c*	Combined proportion
3/4 *A*	3/4 *B*	3/4 C	(3/4)(3/4)(3/4) *ABC* = 27/64 *ABC*
		1/4 *c*	(3/4)(3/4)(1/4) *ABc* = 9/64 *ABc*
	1/4 *b*	3/4 C	(3/4)(1/4)(3/4) *AbC* = 9/64 *AbC*
		1/4 *c*	(3/4)(1/4)(1/4) *Abc* = 3/64 *Abc*
1/4 *a*	3/4 *B*	3/4 C	(1/4)(3/4)(3/4) *aBC* = 9/64 *aBC*
		1/4 *c*	(1/4)(3/4)(1/4) *aBc* = 3/64 *aBc*
	1/4 *b*	3/4 C	(1/4)(1/4)(3/4) *abC* = 3/64 *abC*
		1/4 *c*	(1/4)(1/4)(1/4) *abc* = 1/64 *abc*

Pedigrees Reveal Patterns of Inheritance of Human Traits

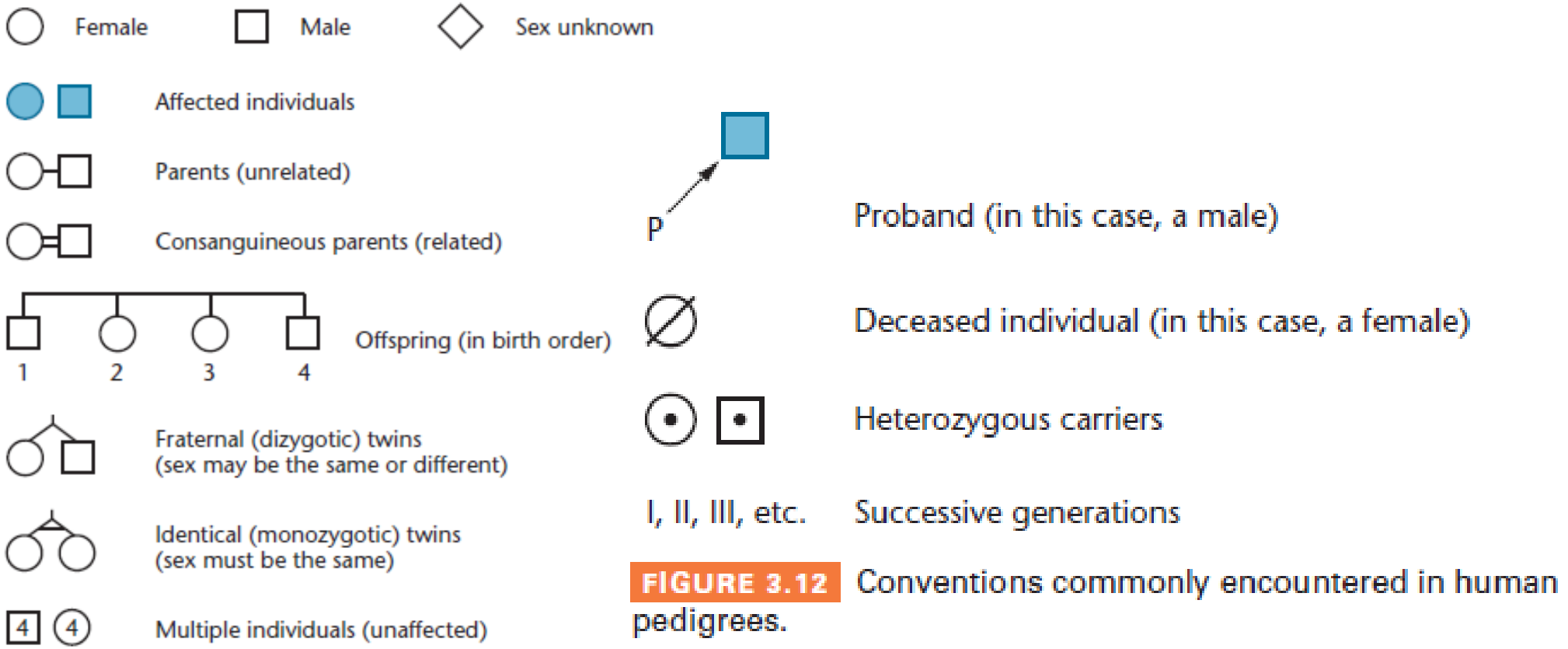


FIGURE 3.12 Conventions commonly encountered in human pedigrees.

Pedigrees Reveal Patterns of Inheritance of Human Traits

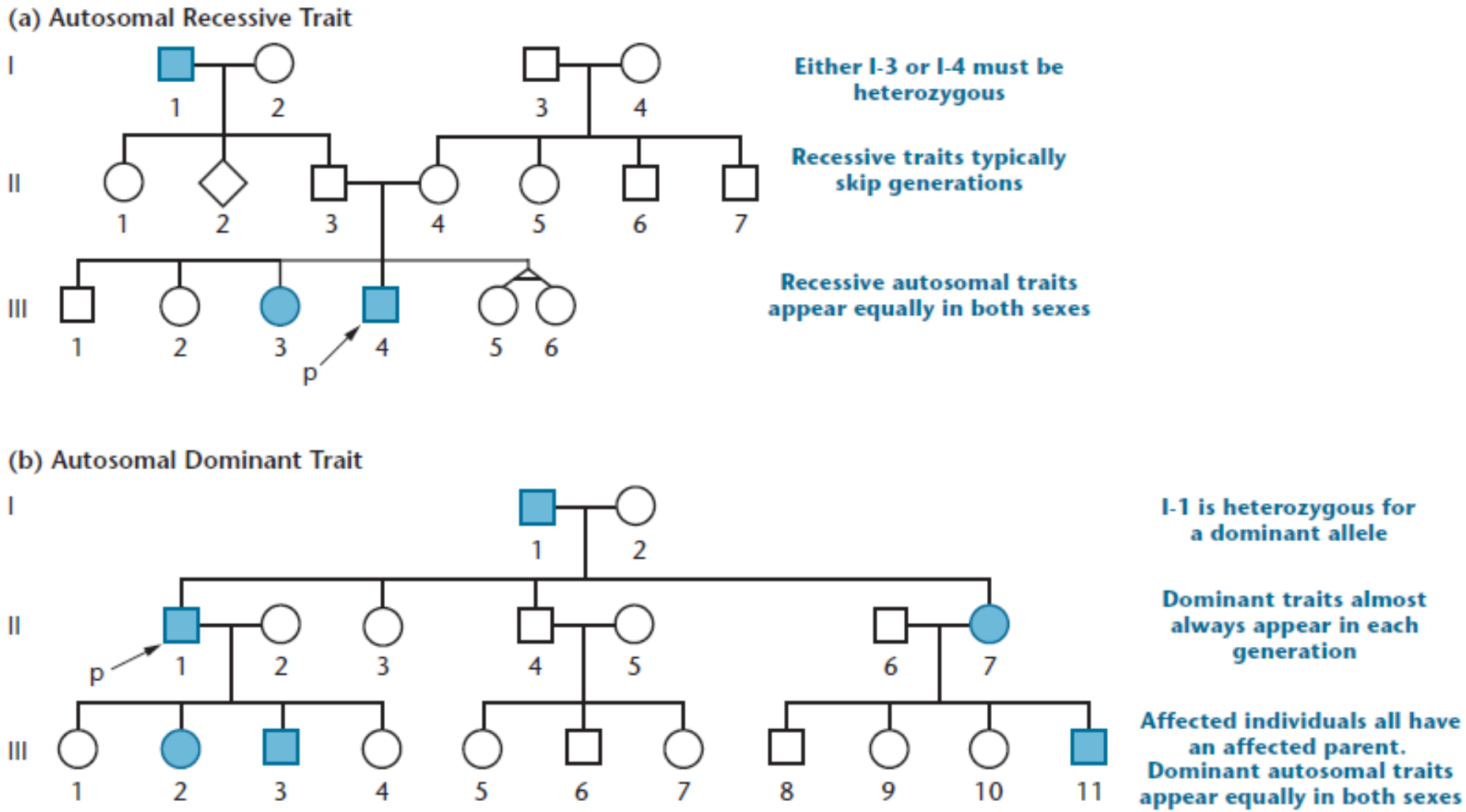


FIGURE 3.13 Representative pedigrees for two characteristics, each followed through three generations.

Chi-Square Analysis

TABLE 3.1 Chi-Square Analysis

(a) Monohybrid

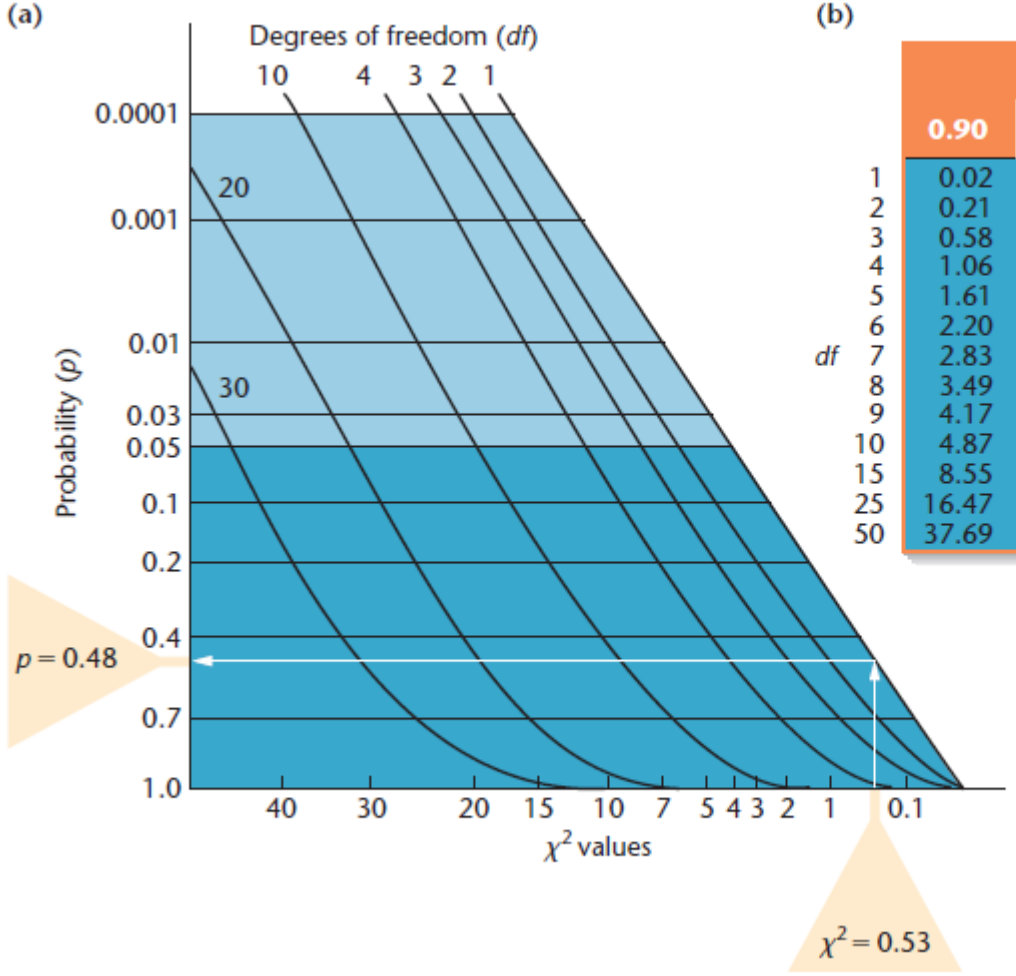
Cross	Expected Ratio	Observed (o)	Expected (e)	Deviation ($o - e = d$)	Deviation^2	d^2/e
3/4		740	3/4(1000) = 750	740 − 750 = −10	$(-10)^2 = 100$	100/750 = 0.13
1/4		260	1/4(1000) = 250	260 − 250 = +10	$(+10)^2 = 100$	100/250 = 0.40
		Total = 1000				$\chi^2 = 0.53$
						$p = 0.48$

(b) Dihybrid

Cross	Expected Ratio	Observed (o)	Expected (e)	Deviation ($o - e = d$)	Deviation^2	d^2/e
9/16		587	567	+20	400	0.71
3/16		197	189	+8	64	0.34
3/16		168	189	−21	441	2.33
1/16		56	63	−7	49	0.78
		Total = 1008				$\chi^2 = 4.16$
						$p = 0.26$

Chi-Square Analysis

(a)



(b)

df	Probability (p)					
	0.90	0.50	0.20	0.05	0.01	0.001
1	0.02	0.46	1.64	3.84	6.64	10.83
2	0.21	1.39	3.22	5.99	9.21	13.82
3	0.58	2.37	4.64	7.82	11.35	16.27
4	1.06	3.36	5.99	9.49	13.28	18.47
5	1.61	4.35	7.29	11.07	15.09	20.52
6	2.20	5.35	8.56	12.59	16.81	22.46
7	2.83	6.35	9.80	14.07	18.48	24.32
8	3.49	7.34	11.03	15.51	20.09	26.13
9	4.17	8.34	12.24	16.92	21.67	27.88
10	4.87	9.34	13.44	18.31	23.21	29.59
15	8.55	14.34	19.31	25.00	30.58	37.30
25	16.47	24.34	30.68	37.65	44.31	52.62
50	37.69	49.34	58.16	67.51	76.15	86.60

χ^2 values

Fails to reject the null hypothesis

Rejects the null hypothesis