

parents: $E^3E^4 \times E^4E^4$

F₁ generation

	E^3	E^4	
E^4	E^3E^4	E^4E^4	1/2 honey 1/2 white
E^4	E^3E^4	E^4E^4	

3. parents: $E^2E^4 \times E^3E^4$

F₁ generation

	E^2	E^4	
E^3	E^2E^3	E^3E^4	1/2 apricot 1/4 honey
E^4	E^2E^4	E^4E^4	1/4 white

4.5 Practice (pages 145–146)

1. dominance: one allele masks the effect of another
 codominance: both alleles express together
 incomplete dominance: two alleles that are equally dominant interact to produce a new phenotype

2. parents: $C^RC^{W'} \times C^{W'}C^{W'}$

F₁ generation

	C^R	$C^{W'}$	
$C^{W'}$	$C^RC^{W'}$	$C^{W'}C^{W'}$	1/2 white 1/2 pink
$C^{W'}$	$C^RC^{W'}$	$C^{W'}C^{W'}$	

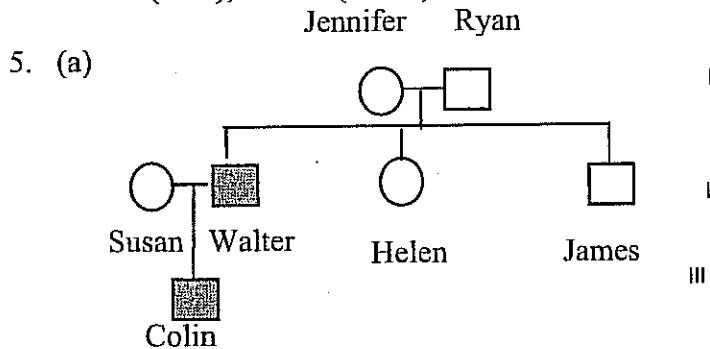
3. parents: $H^rH^r \times H^rH^{rw}$

F₁ generation

	H^r	H^r	
H^r	H^rH^r	H^rH^r	1/2 red 1/2 roan
H^{rw}	H^rH^{rw}	H^rH^{rw}	

4. L = long gene and R = round gene. The combination of L and R genes produced all oval phenotypes, so this is an example of incomplete dominance. The genotypes and their respective phenotypes are: LL = long, RR = round, LR = oval, RL = oval.

Therefore, the offspring of two oval-shaped parents, $LR \times LR$ will be: $1/4 LL$ (long), $1/2 LR$ (oval), $1/4 RR$ (round).



- (b) The probable genotypes of Jennifer and Ryan are Dd and Dd , respectively.
 (c) The probable genotypes of Susan and Walter are Dd and dd , respectively.
 (d) The genotypes of Helen and James can be either Dd or DD , they can't be determined with certainty since no information is given regarding the phenotype of any of their children.

4.5 Practice (pages 146–147)

- Genetic screening attempts to identify genetic conditions prior to birth or to predict these conditions prior to conception. Genetic information is obtained through a variety of methods including detailed pedigrees and biochemical testing for known disorders. Methods of prenatal diagnosis can indicate the sex of the child as well as the presence of many genetic conditions. Amniocentesis and chorionic villi sampling (CVS) are the most widely used techniques.
- Genetic screening can help to prevent disorders before they occur, and allows parents to prepare should a child have a genetic disorder. For example, a disorder known as PKU, when detected in newborns, can be remedied through a carefully monitored diet.
- Some methods of genetic screening risk damage to the fetus during testing; also, an incorrect diagnosis might result in abortion, which carries risks for the mother. There are many possible answers, some of which touch on ethical matters.
- Some issues associated with genetic screening include: is genetic screening like selecting genes?; what kinds of genes would be selected?; should people be allowed to select traits for offspring?
- Many possible answers. Students should consider the balance between protecting the rights of individuals and the needs of society.

Case Study: A Mystery (pages 147–148)

- (a) The potential murderer must have had blood type O negative. The only possibilities are Henry, Tom, and Beth. Henry refused to give a blood sample but he can be eliminated because neither of his parents had freckles, and since the nonfreckle condition is recessive it would be impossible for Henry to have freckles. Tom also does not have freckles, so he is not the murderer. However, he is the child who is not biologically related to Lord Hooke. His daughter, Beth, has freckles and blood type O

negative. Beth must have murdered the Lord to prevent him from discovering the truth and to ensure her future inheritance.

- (b) The process of elimination is most effective. See above.
 (c) See above.

Sections 4.3–4.5 Questions (pages 148–150)

- A dominant allele masks the effect of a recessive allele. For example, yellow seeds colour is a dominant trait in pea plants, green seed colour is a recessive trait. Many students might incorrectly assume that dominant conditions are the most common conditions.
- This is an example of incomplete dominance. The cream coat is a new phenotype produced by the interaction of the yellow and white alleles.
- (a) 3 generations are shown in the pedigree chart.
 (b) 5 children were born to parents of the first generation.
 (c) The genotype for the mother is Pp , the father has genotype pp .
 (d) The theoretical probability of inheriting the P allele is 50%. Consequently, the likelihood that a second generation child will not have inherited the gene for PKU is 50%, and these children will not exhibit the disorder.
 (e) They could have a child with PKU. Child III-5 was fortunate not to inherit the P allele. If parent II-6 (Pp) provides sperm cells with the dominant allele, the child will have the disorder.
- Because the F_1 generation contained a homozygous D^3 offspring (dead) both parents must carry the D^3 gene. Therefore, the full-colour male must be D^1D^3 , and the dilute-colour female must be D^2D^3 .
- (a) parents: $C^hC^a \times C^aC^a$

F_1 generation

	C^h	C^a	
C^a	C^hC^a	C^aC^a	1/2 Himalayan 1/2 albino
C^a	C^hC^a	C^aC^a	

- (b) Because the F_1 generation contained an albino offspring, both parents must carry the recessive C^a gene. Therefore, the full-colour rabbit has genotype CC^a , and the light-gray rabbit has genotype C^hC^a .

- (c) The chinchilla phenotype is produced by the genotype $C^{ch}C^{ch}$. Because the light-grey rabbit had an albino mother, C^aC^a , it must be genotype $C^{ch}C^a$. Therefore, the F_1 generation is:

	C^{ch}	C^{ch}	
C^{ch}	$C^{ch}C^{ch}$	$C^{ch}C^{ch}$	1/2 chinchilla 1/2 light grey
C^a	$C^{ch}C^a$	$C^{ch}C^a$	

- (d) Test crosses are performed with the homozygous recessive genotype, in this case, C^aC^a . Because the F_1 generation contains equal numbers of Himalayan and light-grey rabbits, the genotype of the light-grey parent rabbit must be $C^{ch}C^h$.

6. parents: $C^mC^m \times C^rC^m$

F_1 generation

	C^m	C^m	
C^m	C^mC^m	C^mC^m	1/2 cremello 1/2 palomino
C^r	C^rC^m	C^rC^m	

7. possible crosses: $I^A I^A \times I^B I^B$, $I^A I^A \times I^B I^O$, $I^A I^O \times I^B I^B$, $I^A I^O \times I^B I^O$

$I^A I^A \times I^B I^B$	$I^A I^O \times I^B I^B$																									
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4.6 Practice (page 154)

1. (a) parents: $BBHh \times bbhh$

F₁ generation

	B	B
b	Bb	Bb
b	Bb	Bb

	H	h
h	Hh	hh
h	Hh	hh

1/2 black, short
1/2 black, long

- (b) parents: $BbHh \times bbhh$

F₁ generation

	B	b
b	Bb	bb
b	Bb	bb

	H	h
h	Hh	hh
h	Hh	hh

1/4 black, short
1/4 black, long
1/4 white, short
1/4 white, long

- (c) parents: $BBhh \times BbHh$

F₁ generation

	B	B
B	BB	BB
b	Bb	Bb

	h	h
H	Hh	Hh
h	hh	hh

1/2 black, short
1/2 black, long

2. The male cocker spaniel has genotype $BbHh$, female A has genotype $bbHH$, female B has genotype $BbHh$, and female C has genotype $bbhh$. Female C is the key to this question as she is homozygous recessive, $bbhh$. Thus, the pairing of female C and the male is a test cross. The test cross indicates that the male must be heterozygous for both traits and his genotype must be $BbHh$. The mating with female A, who is white, solid, produced no spotted offspring. Therefore, female A does not have the recessive, spotted gene, and her genotype is $bbHH$. The mating with female B, who is black, solid, produced a white, spotted offspring. Thus, female B must have been heterozygous for both traits, and her genotype is $BbHh$.
3. The mother's genotype is $I^O I^O Rh^- Rh^-$. The father could be any one of four genotypes: $I^A I^A Rh^+ Rh^+$, $I^A I^A Rh^+ Rh^-$, $I^A I^O Rh^+ Rh^+$, $I^A I^O Rh^+ Rh^-$. Thus the child's phenotype could be A, Rh⁺; A, Rh⁻; O, Rh⁺; or O, Rh⁻.