



Genetics Practice Problems

1. If a woman who is homozygous dominant (WW) for widow's peak (a dominant trait) has a child with a man who is homozygous recessive (ww), will their child have a widow's peak?
2. If two people with attached earlobes have a baby, is there any way that their baby could have detached earlobes? (Detached earlobes are dominant over attached).
3. Could two people with red hair have a baby with blonde hair? (Red hair is recessive).
4. Is it possible for two people with freckles to have a baby without freckles? (Freckles are dominant).
5. Draw the following pedigree and label the alleles: One of Ina's adult teeth grew in through the roof of her mouth. Her husband Stan has normal teeth. Their two children Rick and Gwen had normal teeth, but Ina and Stan's other child, Joanne, had a tooth growing through the roof of the mouth. Gwen married Don, and their daughter Brittany also has this trait. Joanne married Klaus, and their children Michael and Erik have normal teeth. Rick married Brenda; their daughter Candace has this trait, but son Curtis doesn't.
6. If a man who is heterozygous for a crooked little finger (Cc) and a woman who is homozygous for a straight little fingers (cc) have children, what would be the predicted genotypic ratio for their kids?
7. Draw the following pedigree and label the alleles: Margaret and John both have wavy hair. Their daughter Lila has curly hair and their sons Walter and Jim both have wavy hair. Earl has straight hair and his wife, Heidi, has wavy hair. Their son Basil and daughters Florence and Daisy all have straight hair, but their other son Frank has wavy hair. Frank and Lila married, and their sons, Brian and Gary, both have curly hair. What pattern of inheritance does curly hair follow? (Hint: heterozygotes have a phenotype that is halfway between curly and straight hair).
8. Is there any way that a woman with straight thumbs could have a baby with hitchhiker's thumbs? (Straight thumbs are dominant over hitchhiker's).
9. Draw the following pedigree: Oliver is missing his incisor teeth. His wife Ruth has her incisors. Both their son Lee and their daughter Grace are missing their incisors. Both Lee and Grace married partners with normal teeth. Grace's sons Sky and Zack and daughter Ruth have incisors. Lee's sons Ian and Donald have all of their teeth, but daughter Fiona and son Brady are missing their incisors. After drawing the pedigree, does this trait follow simple dominance or some other type of dominance?



10. What are the odds that two parents with brown hair would have three children with blonde hair? (Brown hair is dominant over blonde).
11. If a woman with hitchhiker's thumbs (hh) and straight little fingers (cc) has a baby with a man who has crooked little fingers (Cc) and normal thumbs (Hh), what are the chances that their baby would have both crooked little fingers and hitchhiker's thumbs?
12. The phenotypic ratio for colour (red is dominant over white) and height (long-stemmed is dominant over short-stemmed) in rose plants is 9:3:3:1. Are the genes for colour and height linked?
13. Draw the following four-generation pedigree and assign genotypes whenever possible: Joyce is allergic to milk, but her husband Ed is not. Their sons Theo and Timothy are also allergic to milk, but their daughters Angela and Christine are not. Tim is married to Ollie, who is not allergic to milk. Their sons Timmy and Brian are both allergic to milk. Christine is married to Ross, who is not allergic to milk. Their son Rossie is allergic to milk, but daughter Sarah is not. Angela married Dennis, who is allergic to milk. Their daughter Erin is allergic to milk, but their other daughter Alison isn't. Erin married Jeff, who isn't allergic to milk. Their son Han is allergic to milk. What type of inheritance pattern is this? Where do you think this gene is located?

Answers:

1. Yes, their child will definitely have a widow's peak, since all their offspring would be heterozygous for widow's peak.

	♀		
♂		W	W
	w	Ww	Ww
	w	Ww	Ww

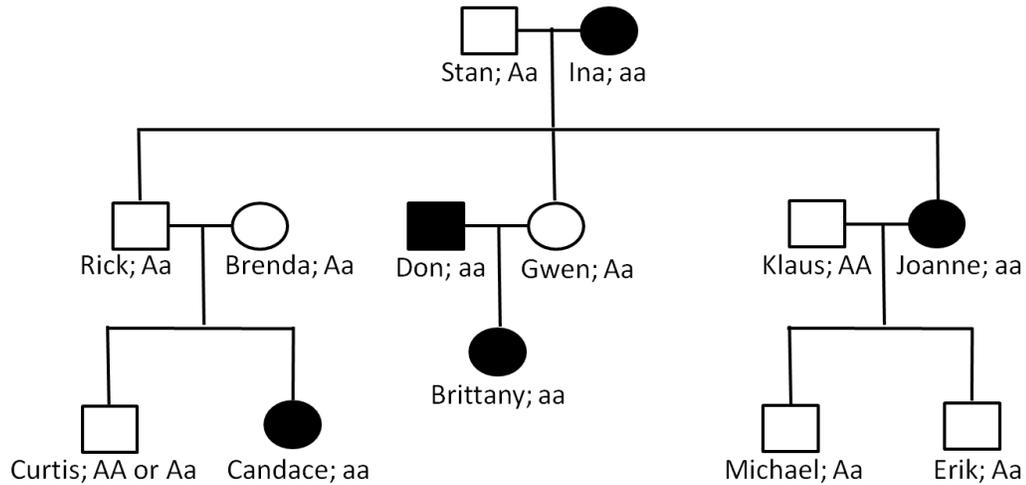
2. No, there is no way that their baby could have detached earlobes, since both parents must have been homozygous recessive to have attached earlobes. Their baby will also have homozygous recessives genes for attached earlobes.
3. No, it is not possible for two red-heads to have a child with hair any colour other than red. Since all hair colours are dominant over red, anyone with red hair must be homozygous recessive.



4. Yes, two people with freckles could have a baby without freckles if both the parents were heterozygous. If this were the case, there would be a $\frac{1}{4}$ chance that their baby wouldn't have freckles.

	♀	
♂	F	f
F	FF	Ff
f	Ff	ff

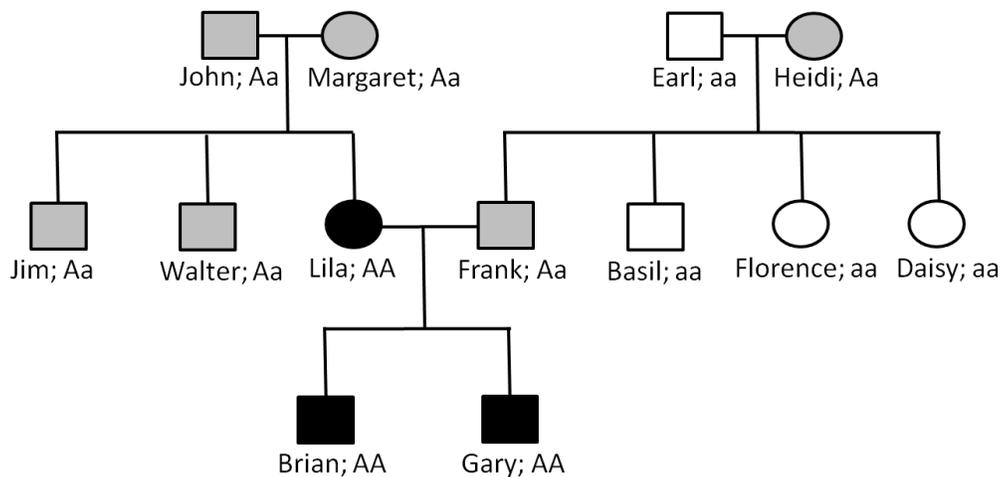
5.



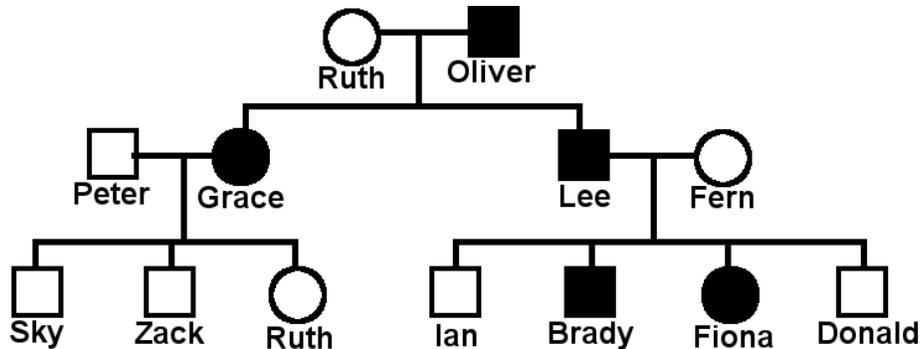
6. Their children will have a 1:1 ratio for heterozygous crooked little fingers and homozygous straight fingers. 50% of their children will be heterozygous (Cc) for crooked little fingers, and 50% of their children will be homozygous for straight little fingers.

	♀	
♂	C	c
C	Cc	Cc
c	Cc	cc

7. The pattern of inheritance in this family demonstrates that curly hair is seen in individuals who are homozygous for the dominant allele. Heterozygotes have wavy hair, and those who are homozygous recessive have straight hair.



8. Yes, a woman with straight thumbs could have a baby with hitchhiker's thumbs if she was heterozygous for hitchhiker's thumbs and the father is either homozygous recessive (leading to a 50% chance) or heterozygous (leading to a 25% chance). If the woman were homozygous dominant for straight thumbs, however, it would be impossible for her to have a baby with hitchhiker's thumbs unless a mutation occurred.
9. This trait doesn't follow the patterns of inheritance for simple dominance, co-dominance, or incomplete dominance.



10. Assuming that both parents are heterozygous for brown hair, there is a $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} = \frac{1}{64}$ chance that they would have three children with blonde hair. If either or both of the parents are homozygous for brown hair, then there would be no chance that they would have children with blonde hair.
11. One quarter of their offspring would be expected to have both crooked little fingers and hitchhiker's thumbs.

♀ /				
♂	ch	ch	ch	ch
CH	CcHh	CcHh	CcHh	CcHh
Ch	Cchh	Cchh	Cchh	Cchh
cH	ccHh	ccHh	ccHh	ccHh
ch	cchh	cchh	cchh	cchh

12. No, these traits are not linked. They have been inherited separately. The 9:3:3:1 pattern of inheritance is characteristic of independent assortment.

Key: T- tall allele
t – short allele
R- red allele
r – white allele

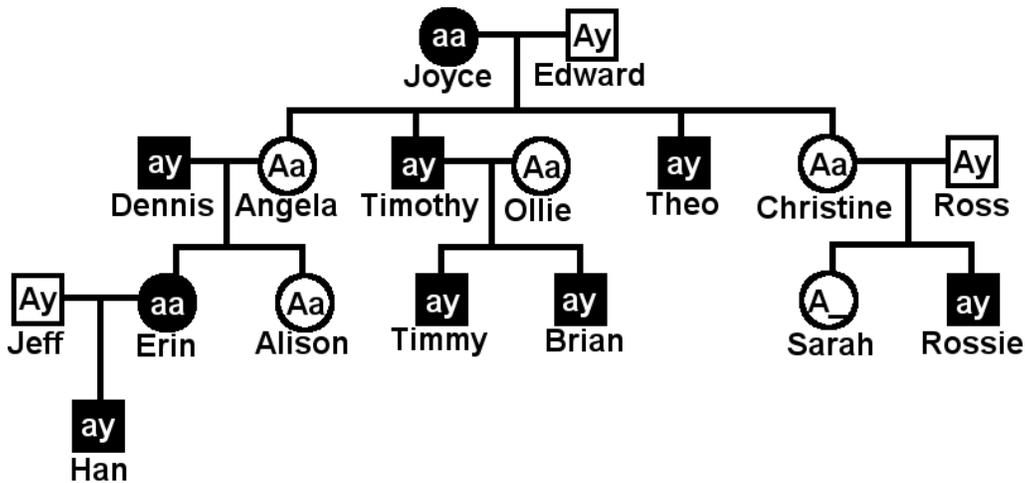
Phenotype totals: Red, long-stemmed: 9
Red, short stemmed: 3
White, long stemmed: 3
White, short stemmed: 1



♀ \ ♂		TR	Tr	tR	tr
TR	TTRR	TTRr	TtRR	TtRr	
Tr	TTRr	TTrr	TtRr	Ttrr	
tR	TtRR	TtRr	ttRR	ttRr	
tr	TtRr	Ttrr	ttRr	ttrr	

13. This trait shows a sex-linked pattern of inheritance. The gene for milk allergy is almost certainly on the x chromosome, which explains why the milk allergy is more prevalent in males than females in this family (males only receive one copy of the x chromosome, so any offspring with one allele will inherit it, while girls would need both alleles).

Key: a = allergic
 A = not allergic
 y = missing allele (males only have one x chromosome)
 _ = unknown allele



*** The genotypes may also be written as X^AY (for males not allergic), X^aY (for allergic males), X^AX^a (for females that are carriers but not allergic), X^AX^A (for females that are not allergic/carriers), and X^aX^a (for allergic females).

