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a) The given results indicate that the cremello and chestnut are homozygous traits. Palomino is a heterozygous trait as it produces offspring in a 2:1:1 ratio when palomino self-crossed. The alleles are incompletely dominant since Palomino phenotype resulted from chestnuts crossed with cremellos.

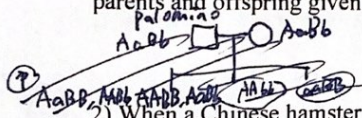
Genetic Questions 2

September 2021

1) Palomino horses have a golden-yellow coat, chestnut horses have a brown coat, and cremello horses have a coat that is almost white. A series of crosses between the three different types of horses produced the following offspring:

Cross	Offspring
palomino x palomino	13 palomino, 6 chestnut, 5 cremello
chestnut x chestnut	16 chestnut
cremello x cremello	13 cremello
palomino x chestnut	8 palomino, 9 chestnut
palomino x cremello	11 palomino, 11 cremello
chestnut x cremello	23 palomino

- a) Explain the inheritance of the palomino, chestnut, and cremello phenotype in horses knowing that these phenotypes are dependent on one gene only. ~~The genes that determine coat color are co-dominant~~
- b) Assign symbols to the alleles that determine these phenotypes, and list the genotypes of all parents and offspring given in the preceding table.



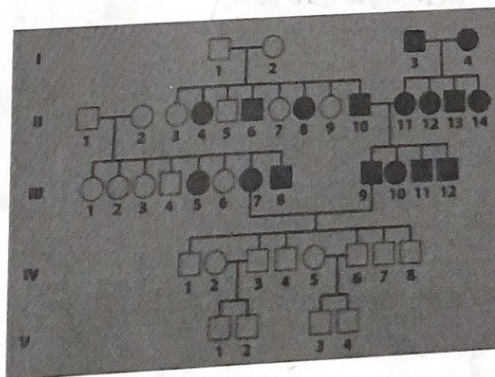
- 2) When a Chinese hamster with white spots is crossed with another hamster that has no spots, approximately 1/2 of the offspring have white spots and 1/2 have no spots. When two hamsters with white spots are crossed, 2/3 of the offspring possess white spots and 1/3 have no spots.

What is the genetic basis of white spotting in Chinese hamsters?

White-spotting hamster: Tt heterozygous

1 gene contribute to several characteristics (dominant phenotype and recessive lethality)

3) A. C. Stevenson and E. A. Cheeseman studied deafness in a family in Northern Ireland and recorded the following pedigree (A.C. Stevenson and E.A. Cheeseman. 1956. *Annals of Human Genetics* 20: 177-231.)



- a) If you consider only generations I through III, what is the most likely mode of inheritance for this type of deafness? the genealogy for deafness is recessive on autosomal

- b) Provide a possible explanation for the resulting phenotypes in generations IV and V.

III-7 and III-9 are homozygous for recessive alleles at two different loci that control hearing ability. s.t. complementation in their offspring

4) For your work as a mouse geneticist you need a pure-breeding mouse strain that has a normal long tail and a black fur color. Luckily, you already have a pure-breeding line that has a short tail and black fur and another pure-breeding line that has a long tail and brown fur. By crossing the two lines you try to get your pure-breeding mouse line with long tails and black fur. The F1 generation you get from this cross has short tails and black fur. You cross sisters and brothers from the F1 generation. In the next generation (F2) you will have some mice with long tails, some with short tails, some with black fur and some with brown fur. You need to eliminate the alleles for short tails and the one for brown fur. Which of these traits is easier to eliminate from your population by selective breeding? Show the crosses!

Assume we have alleles A and a for tail length and B and b for fur color.

P: $\text{short tail, black fur}$ \times $\text{long tail, brown fur}$
 $AA BB \times aa bb$

F1: $Aa Bb \times Aa Bb$

Short tails, black fur

	AB	Ab	aB	ab
AB	AA BB	AA Bb	Aa BB	Aa Bb
Ab	AA Bb	AA bb	Aa Bb	Aa bb
aB	Aa BB	Aa Bb	aa BB	aa Bb
ab	Aa Bb	Aa bb	aa Bb	aa bb

long tail trait is easier to eliminate because short tail trait is recessive.

Now we choose the mice that ~~have~~ long tails and Black furs. their genotypes might be $aa BB$, $aa Bb$. We want to get pure breeding line with genotype $aa BB$. then we could self-cross these long-tail, black-fur mice generation by generation and get rid of the filials with brown furs. Finally we can get pure breeding line that has long tails and black furs.