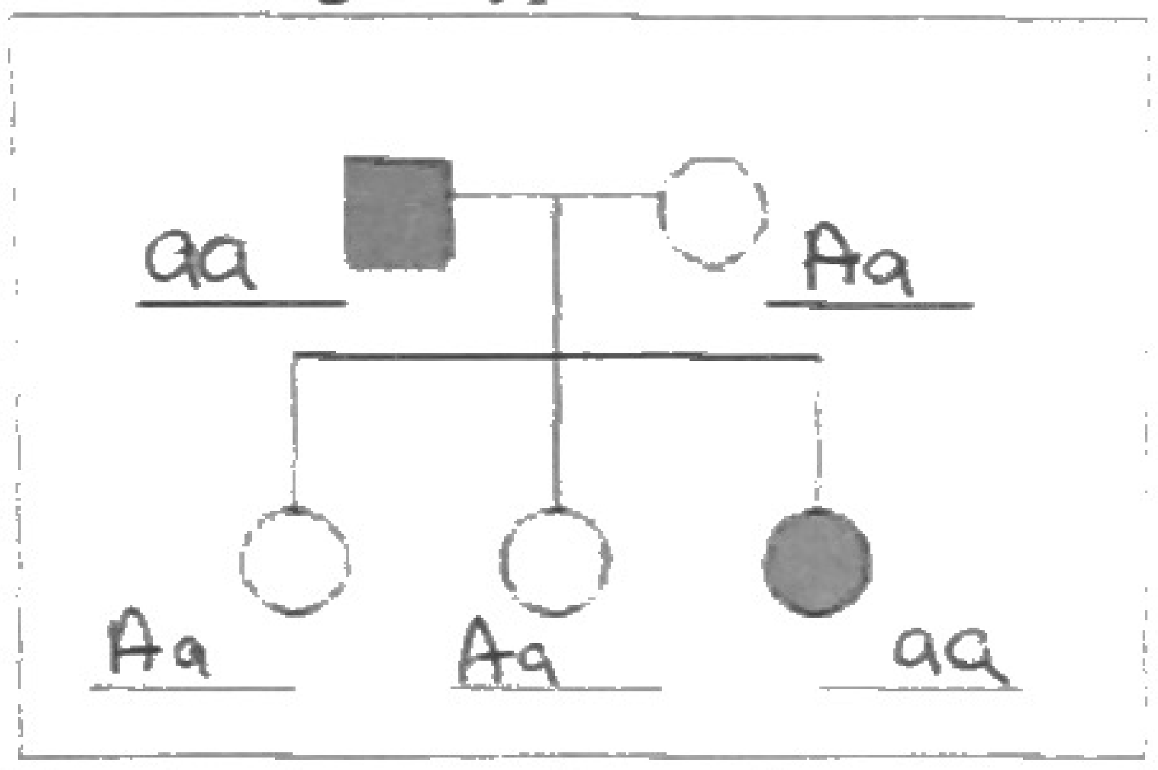
Pedigrees Practice

In humans, albinism is a recessive trait. The disorder causes a lack of pigment in the skin and hair, making an albino appear very pale with white hair and pale blue eyes or in some cases red eyes. This disorder also occurs in animals, a common albino found in a laboratory is the white rat. The pedigrees below trace the inheritance of the allele that causes albinism.

1. Given the following genotypes, state the phenotype (normal or albino)
   a. AA: normal
   b. Aa: normal
   c. aa: albino
2. Label the genotype for each of the following individuals in the pedigree below. (AA, Aa, aa)

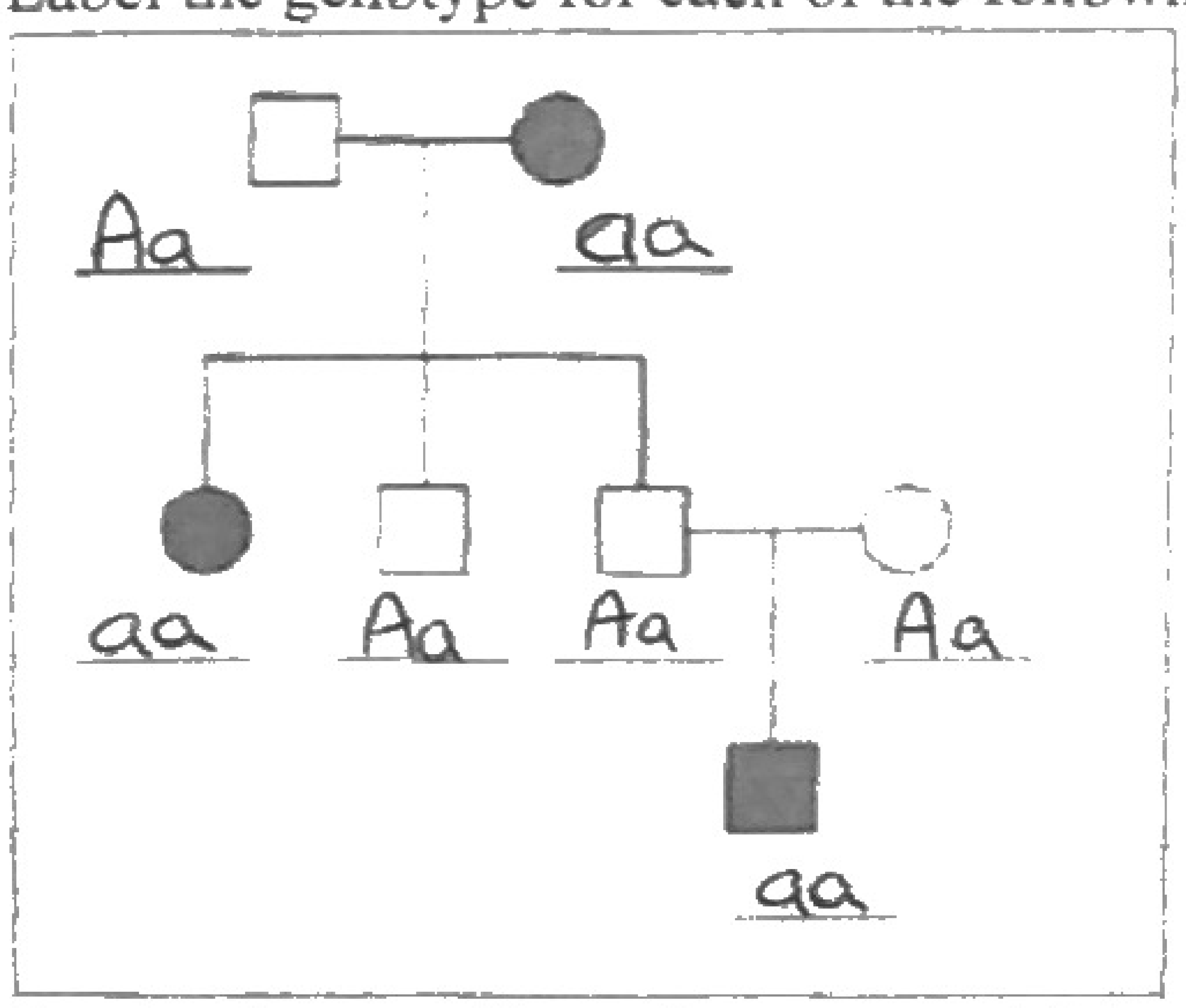


	A	a
a	Aa	aa
a	Aa	aa

3. For the above pedigree, how many children does this family have? 3 females

4. For the above pedigree, what are the sexes of the children? all female

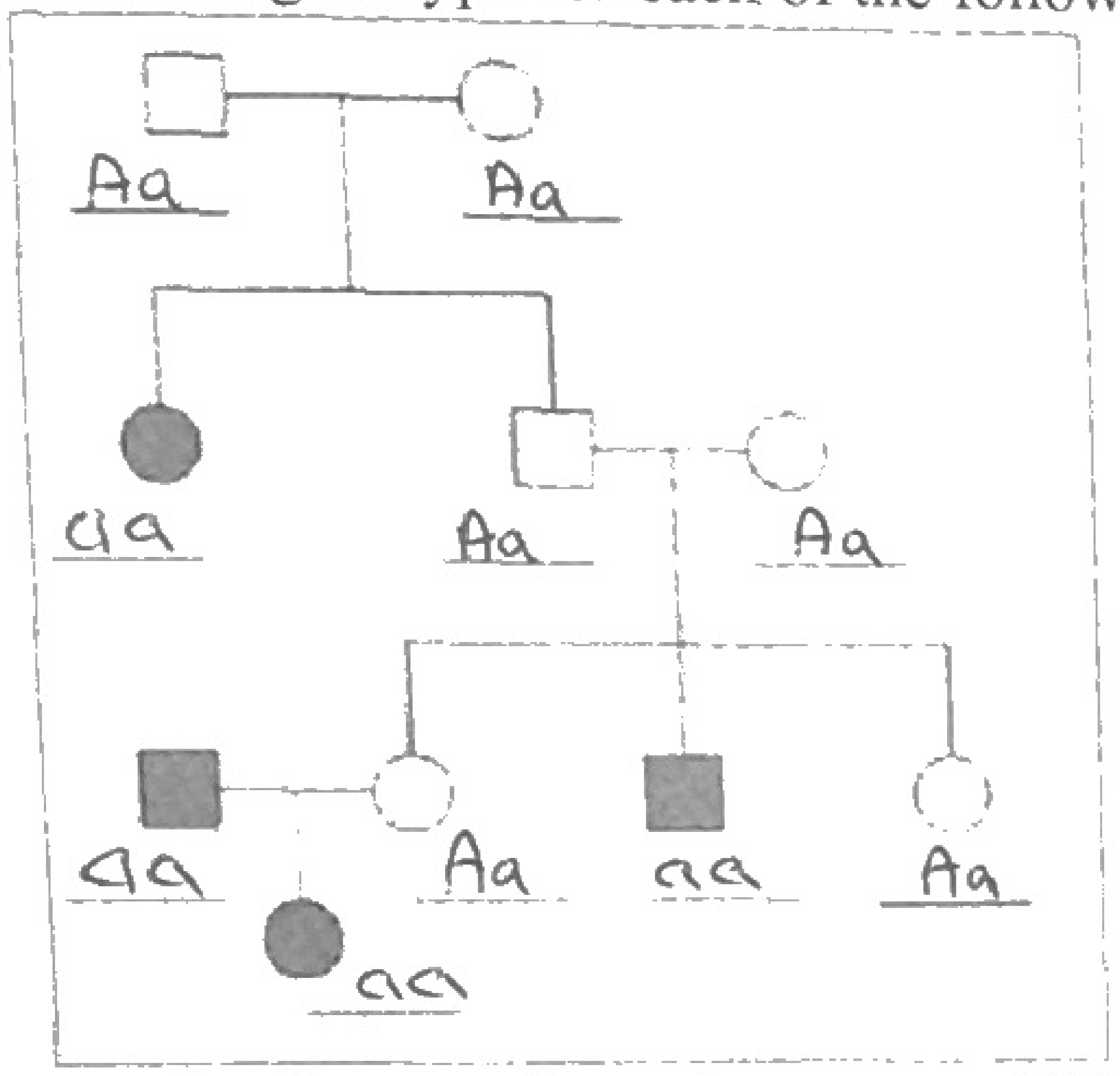
5. Label the genotype for each of the following individuals in the pedigree below. (AA, Aa, aa)



6. For the above pedigree, how many children does the original couple have? 3 kids

7. For the above pedigree, how many grandchildren does the original couple have? What is the sex of the grandchild(ren)? 1 male grandchild

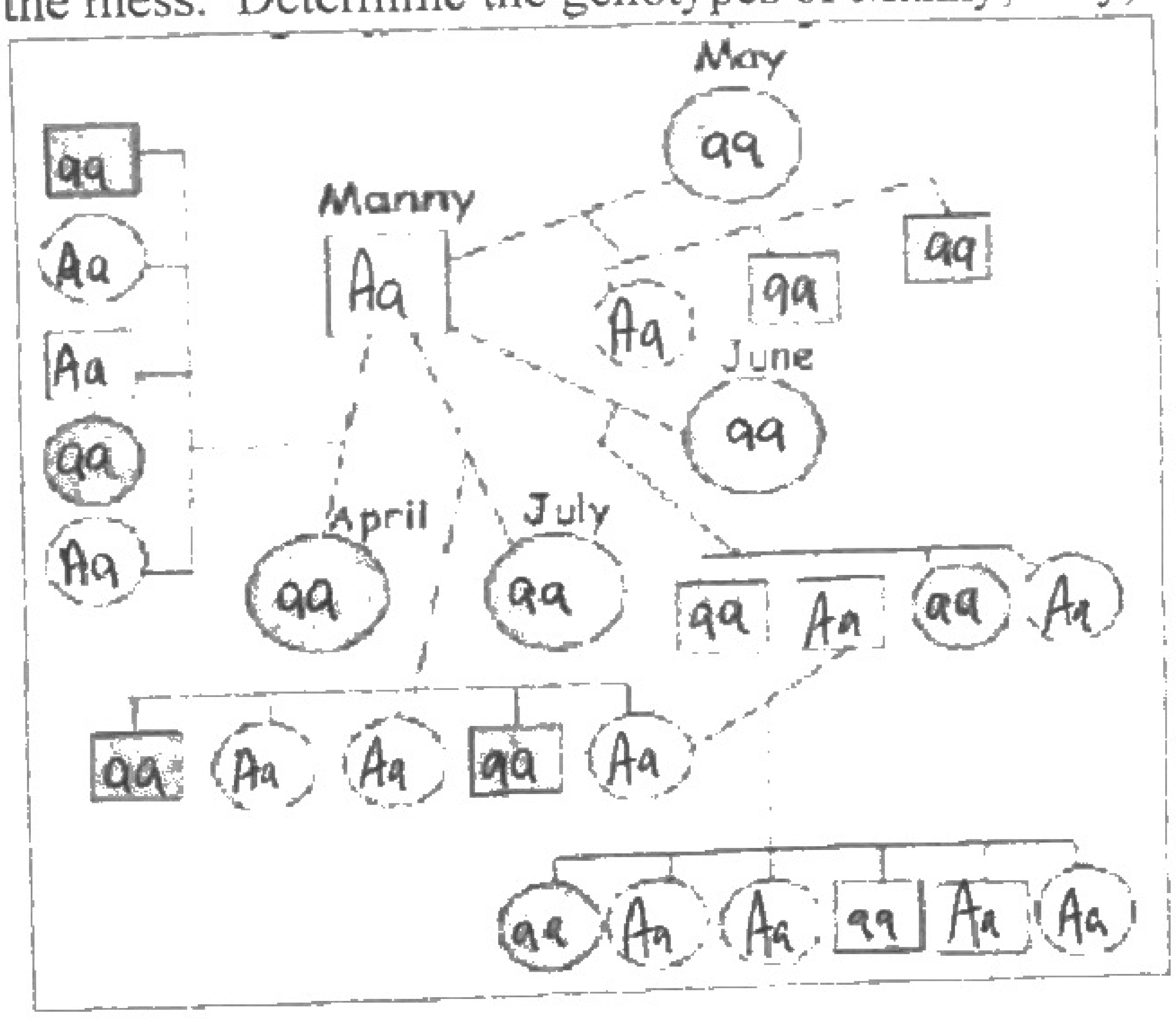
8. Label the genotype for each of the following individual in the pedigree below (AA, Aa, aa)



9. For the above pedigree, how many children does the original couple have? 2 (male & female)

10. For the above pedigree, how many grandchildren? 3 (2 female & 1 male)

11. Rats can produce a lot more offspring than humans, making a pedigree more difficult to manage. A researcher has four female white rats named April, May, June, and July. One night, the cage was left open in the lab and a brown rat got into the female's cage. Six weeks late, the rats had litters of babies of varying colors. Two of the offspring managed to reproduce before the researcher was able to sort out the mess. Determine the genotypes of Manny, May, June, April and July.



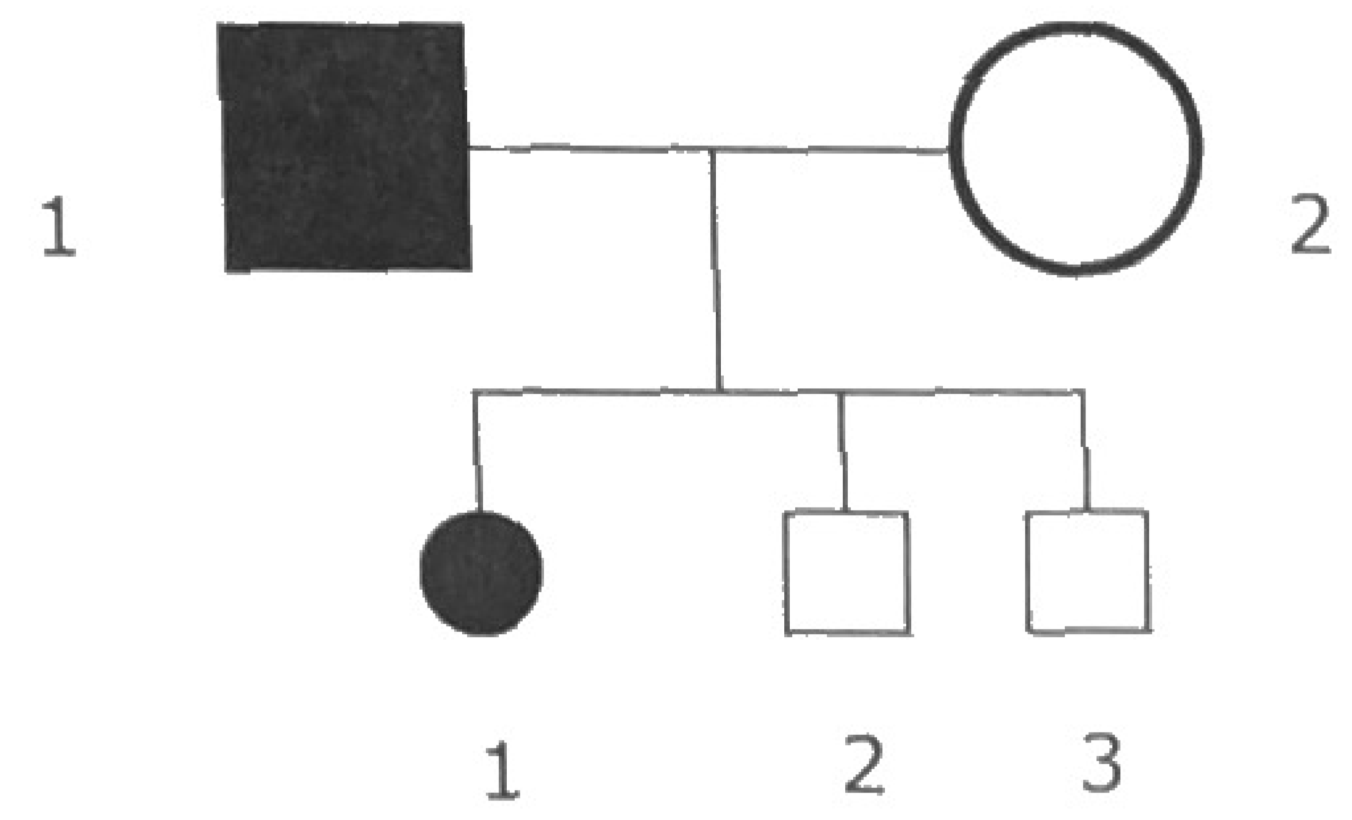


Figure A

1. What is the sex of the oldest child? F
2. What is the sex of the youngest child? M

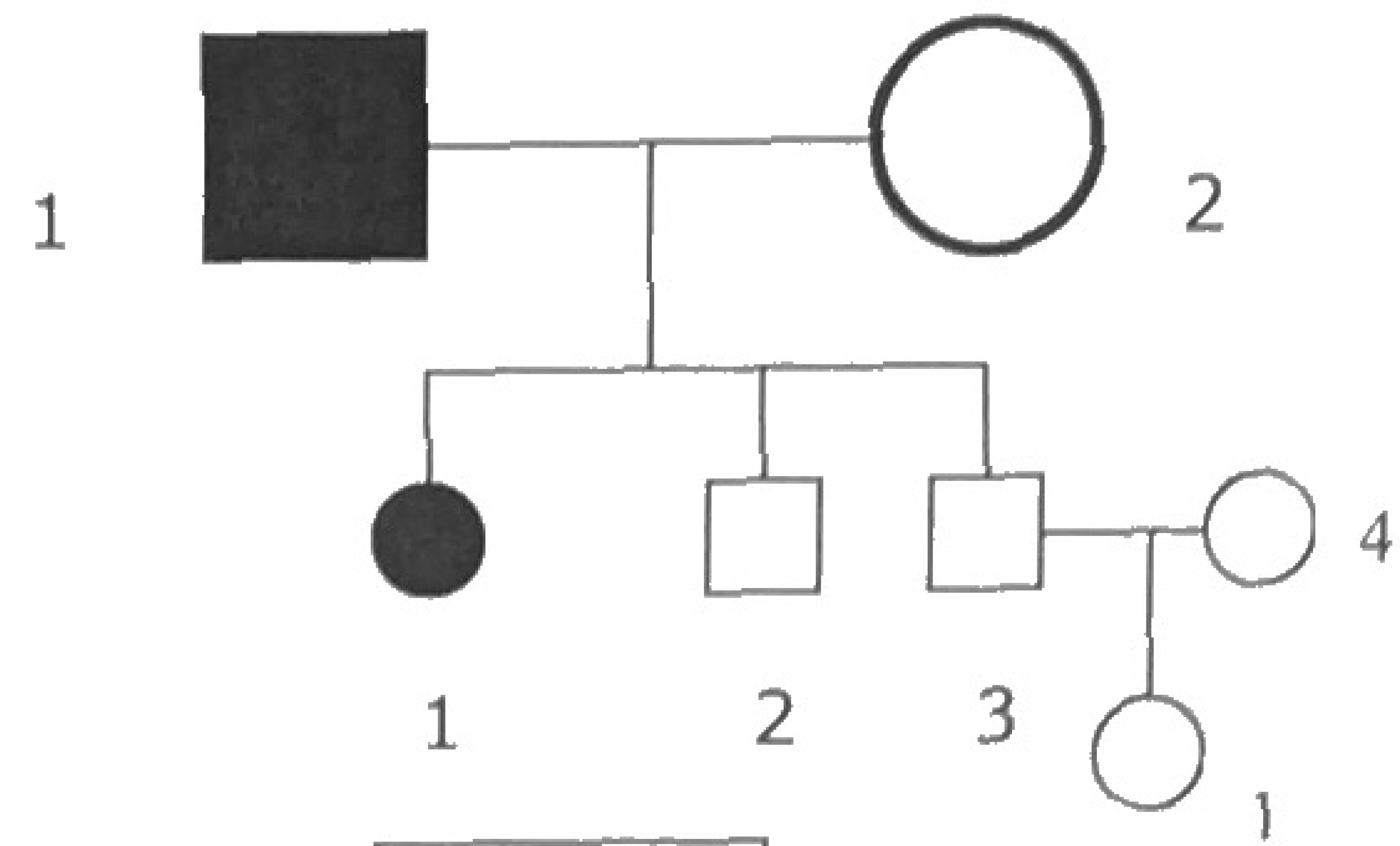


Figure B

1. Which person above is the daughter-in-law? 4
2. To whom is she married? Child #3
3. What is the sex of their child? Female

Determining Genotypes:

If we look at a specific trait (earlobe shape) there are two general shapes of earlobes. The first being individuals with the dominant, free ear lobes (E) and the recessive, attached ear lobes (e). Individuals on a pedigree chart hat have unshaded symbols have a least one dominant gene and show the dominant trait.

Rules one must follow to predict genotype:

- Any person on apedigree chart that has a shaded symbol must be assigned two (2) recessive genes.
- Place lower case letters under the person's symbol.
- Any person on a pedigree chart that has an unshaded symbol must be assigned a dominant gene.
- Place a capital letter under the person's symbol.
- To determine the second gene for persons who show a dominant trait a Punnett square must be used. See Figure C.

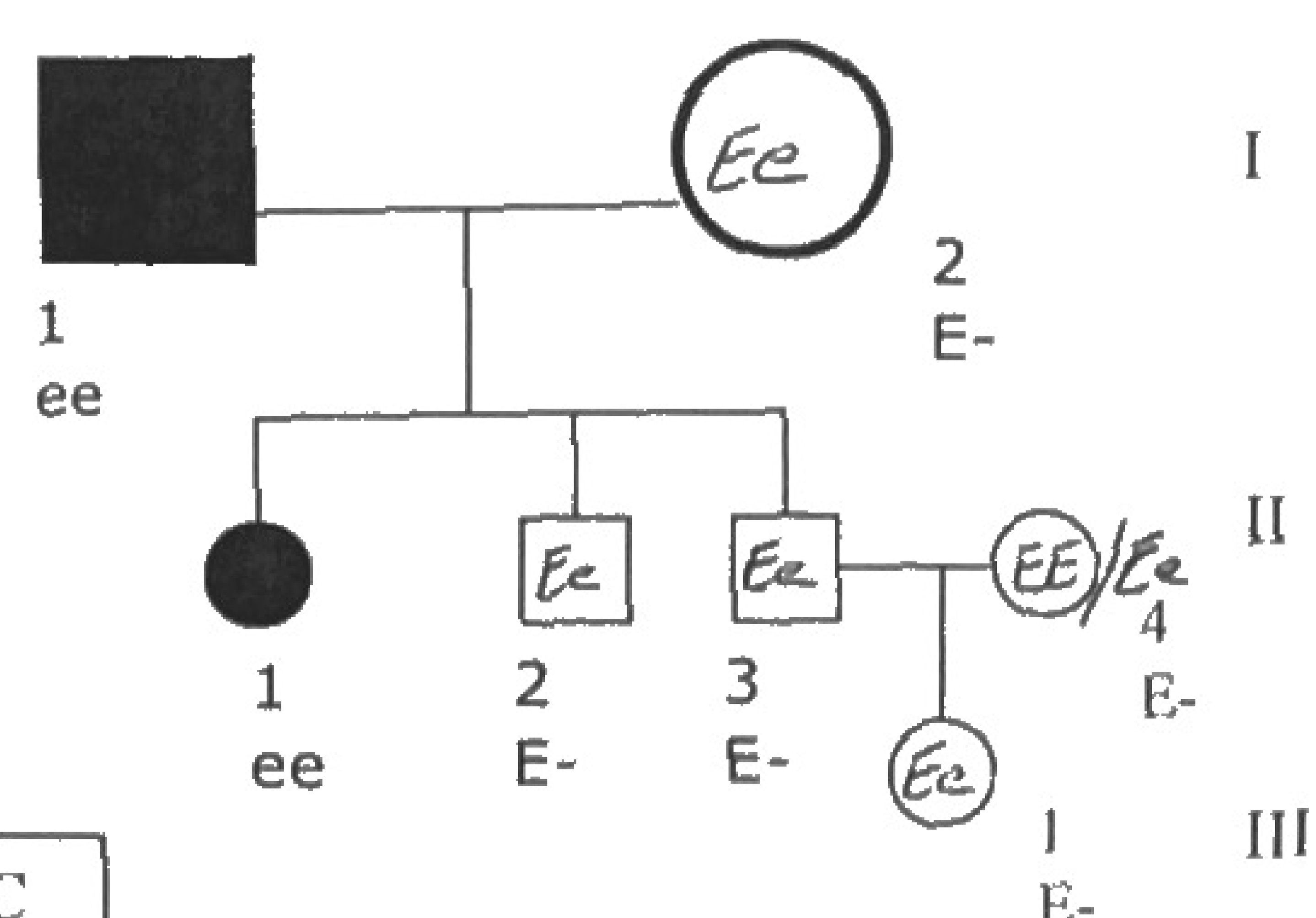


Figure C

	e	e
E	Ee	Ee
e	ee	ee

Looking at figure C, we can determine that the grandfather (I-1) is ee. The grandmother, we know, has one dominant gene. By looking at her three children, can we determine whether her second gene is dominant or recessive? If the grandmother were to be dominant (EE), would she be able to have a child with the genotype (ee)? By using the Punnett square, you will be able to see that this would be impossible. Thus, the grandmother must be heterozygous (Ee).

Answer the following questions using figure C:

1. Can an (Ee) parent and an (ee) parent have the results shown in generation II?
   yes
2. Predict the second gene for person II-2. Ee
3. Predict the second gene for person II-3. Ee
4. Could child II-2 or II-3 be (EE)? No
   Explain. The father is homozygous recessive and the mother is heterozygous. There is no possible way to have homozygous dominant

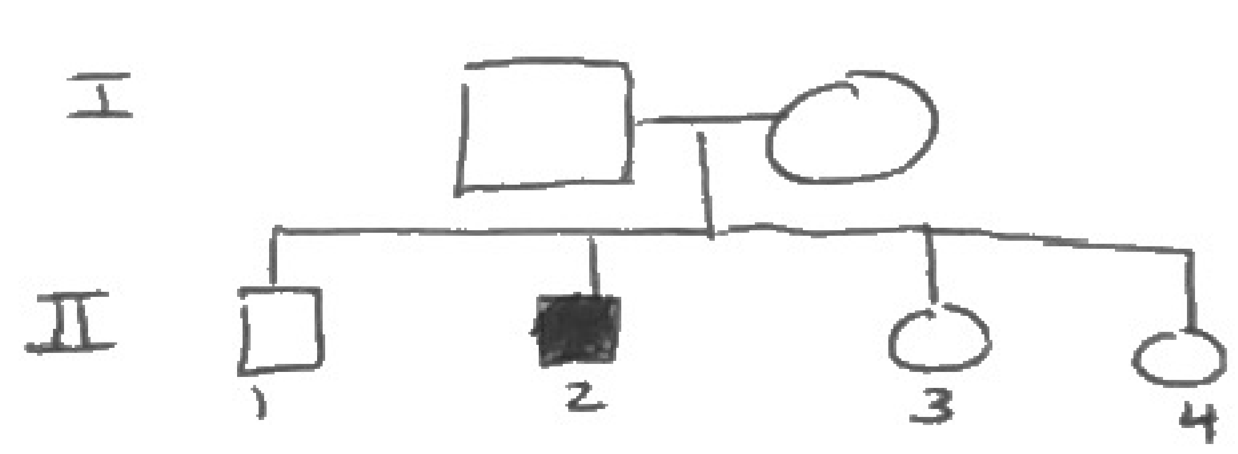
To predict the second gene for person II-4, a different method must be used, since she could be either (EE) or (Ee).

1. Can an (EE) person married to an (Ee) person II-3 have children with free earlobes?
   yes
2. Can an (Ee) person married to an (Ee) person II-3 have children with free earlobes?
   yes

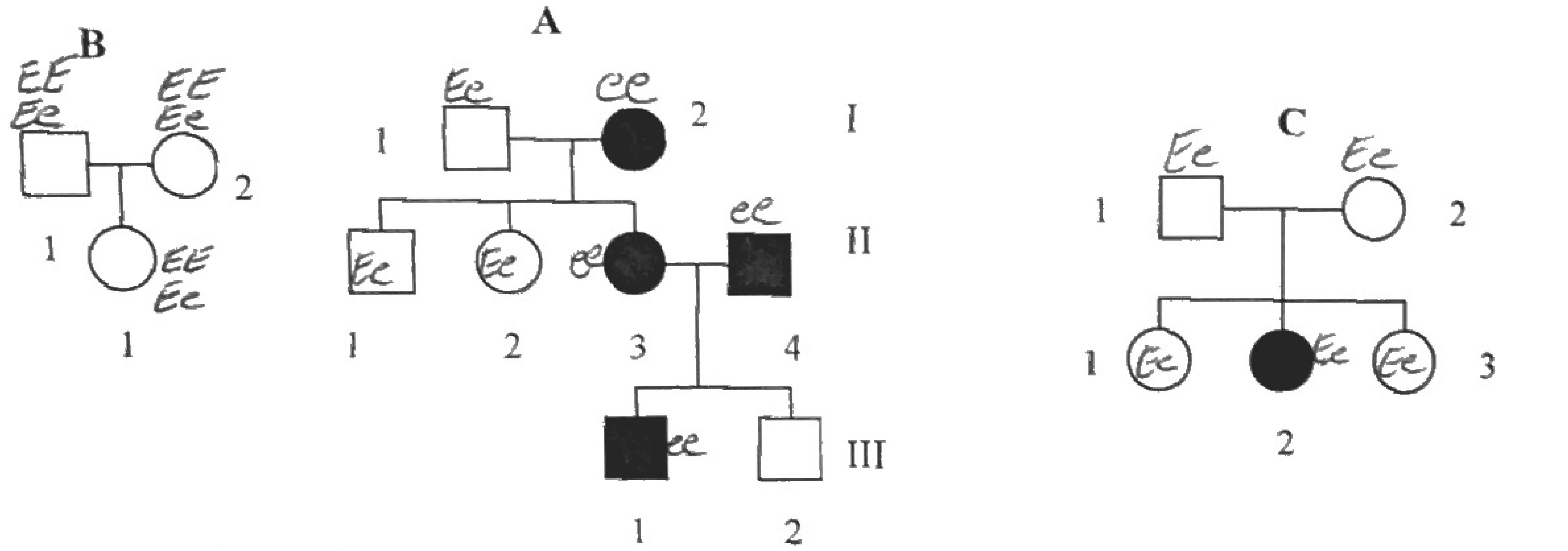
In this case, the second gene from person II-4 cannot be predicted using the Punnett square. Either genotype (EE) or (Ee) may be correct. When this occurs both genotypes are placed under the person's symbol. Predicting the second gene for III-1 results in her not being able to be predicted because if you look at your Punnett square, she could be either (EE) or (Ee) since her father is heterozygous. At some time in the future, if II-3 and II-4 have many more children, one might be able to predict II-4. When both parents show a dominant trait and their children all show a dominant trait, one cannot predict the second gene for anyone if only a small family is available.

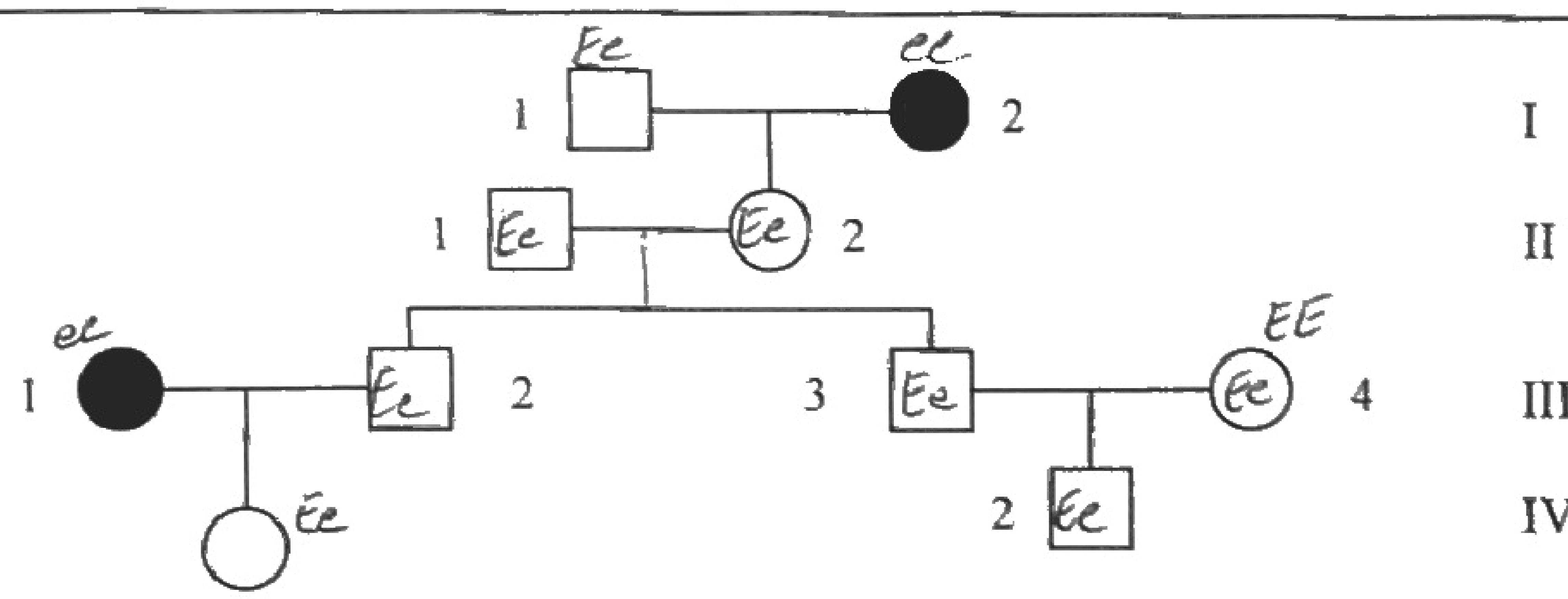
Summary:

1. Draw a complete pedigree, labeling each of the main parts, for a family showing two parents and four children.
2. Make the oldest two children boys and the youngest girls.
3. Indicate, on the pedigree, that child II-2 has attached earlobes.



4. Using pedigrees A, B, and C below, predict the genotype of these families.
5. What is wrong with pedigree A? III-2 could not have that genotype Because BOTH parents are homozygous recessive.





Determine what is wrong with the above pedigree and then answer the questions that follow.

1. How many generations are shown in the above pedigree? 4
2. How many people have free earlobes? 8 ppl
3. How many people have attached earlobes? 2 ppl
4. Identify the generation number of those persons with attached earlobes.
   I-2 & III-1
5. How many children did the original generation contain? 1
6. Predict the genotypes of all persons in the pedigree above.
   See Pedigree above

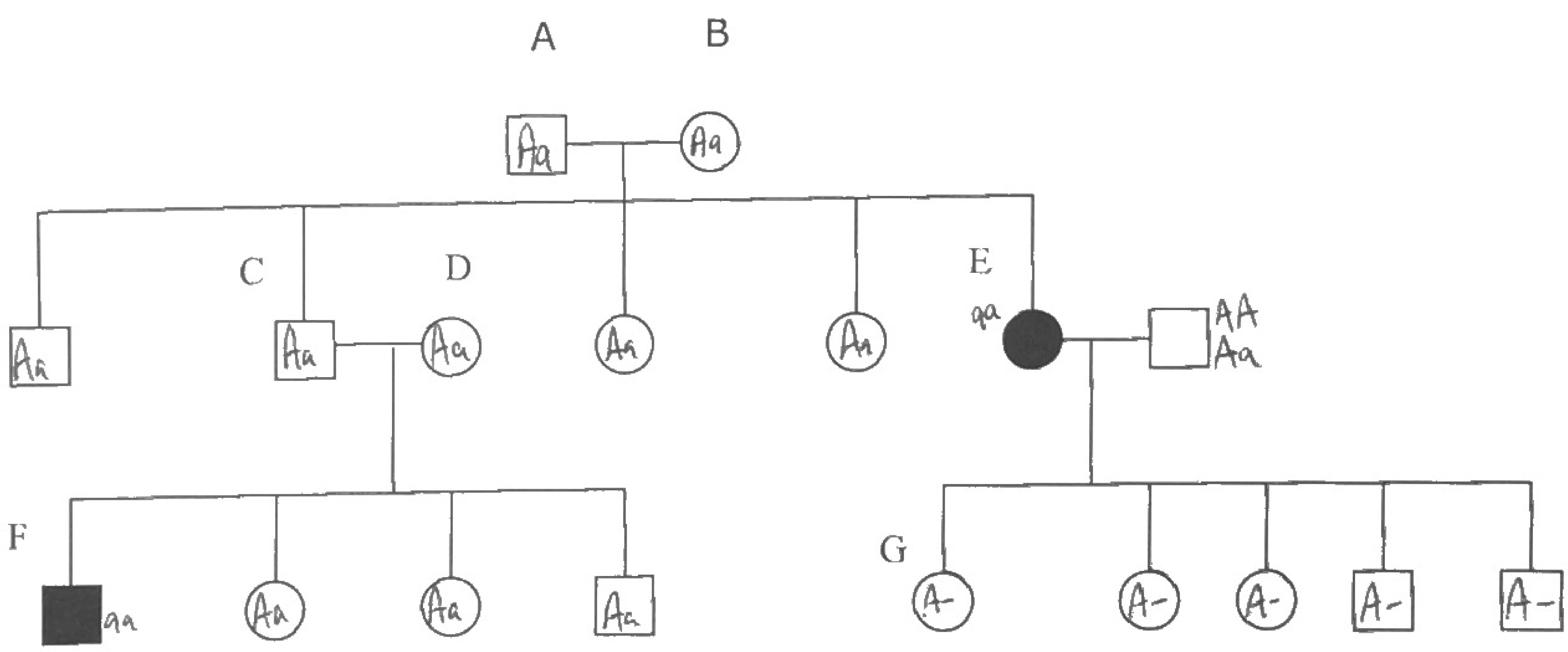
Pedigree analysis

Many traits in humans are controlled by genes. Some of these traits are common features like eye color, straight or curly hair, baldness, attached vs. free ear lobes, the ability to taste certain substances, and even whether you have dry or sticky earwax! Other genes may actually cause disease. Sickle cell anemia, muscular dystrophy, cystic fibrosis are each caused by a specific allele of a human gene and can therefore be inherited from one generation to the next.

Human geneticists illustrate the inheritance of a gene within a family by using a pedigree chart. On such a chart, males are symbolized by a square (□) and females are symbolized by a circle (O). People who are affected by a disease are symbolized by a dark circle or square.

The pedigree chart below shows inheritance of the gene that causes albinism. A and B represent a couple who had five children, including C and E. Only one of the children, E, was albino. E and her husband had five children, including G.

In the pedigree below, write the genotypes of the individuals who are labeled with letters, using (A) to represent the dominant allele and (a) to represent the recessive allele. Start by indicating the genotypes of E and F. Then use the Punnett Square to figure out what the genotypes for C and D must be. Next, determine the genotypes of A and B. Finally, determine the genotype of G.



Many other genes are inherited in the same manner as this recessive allele which causes albinism. These include the genes for some genetic diseases, such as cystic fibrosis, Tay Sachs disease, and phenylketonuria.