*1. Joe is colorblind. His mother and father both have normal vision, but his mother’s father (Joe’s maternal grandfather) is colorblind. All of Joe’s other grandparents have normal color vision. Joe has three sisters—Patty, Betsy, and Lora—all with normal color vision. Joe’s oldest sister Patty is married to a man with normal color vision; they have two children, a 9-year-old colorblind boy and a 4-year-old girl with normal color vision.

a. Using correct symbols and labels, draw a pedigree of Joe’s family.
b. What is the most likely mode of inheritance for colorblindness in Joe’s family?
c. If Joe marries a woman who has no family history of colorblindness, what is the probability that their first child will be a colorblind boy?
d. If Joe marries a woman who is a carrier for the colorblind allele, what is the probability that their first child will be a colorblind boy?
e. If Patty and her husband have another child, what is the probability that it will be a colorblind boy?

**2. A man with a specific unusual genetic trait marries an unaffected woman and they have four children. Pedigrees of this family are shown below, but the presence or absence of the trait in the children has not been indicated. For each type of inheritance, indicate how many children of each sex are expected to express the trait by coloring in the appropriate circles and squares. Assume that the trait is rare and fully penetrant.

a. Autosomal recessive trait
b. Autosomal dominant trait

![Diagram of pedigrees]

- Pedigree a
- Pedigree b
- Pedigree c
- Pedigree d
- Pedigree e

*3. For each of the pedigrees (a, b, c, d, e) shown below, give the most likely mode of inheritance assuming that the trait is rare. Carefully explain your reasoning.
Pedigree b

Pedigree c

Pedigree d
*4. The trait shown in the pedigree below is expressed only in the males of the family. Is the trait Y-linked? Why or why not? If you believe the trait is not Y-linked, propose an alternate explanation for its inheritance.

**5. A geneticist studies a series of characteristics in monozygotic twins and dizygotic twins, obtaining the concordances shown below. For each characteristic, indicate whether the rates of concordance suggest genetic influences, environmental influences, or both. Explain your reasoning.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Monozygotic concordance (%)</th>
<th>Dizygotic concordance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migraine headaches</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Eye color</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>Measles</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Clubfoot</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>Handedness</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
In a study of schizophrenia (a mental disorder involving disorganization of thought and withdrawal from reality), Kety et al. (1978) looked at the prevalence of the disorder in the biological and adoptive parents of individuals who were adopted as children. They found the following results.

<table>
<thead>
<tr>
<th>Adopted persons</th>
<th>Biological parents</th>
<th>Adoptive parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>With schizophrenia</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Without schizophrenia</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>


What conclusions can you make from these results concerning the role of genetics in schizophrenia? Explain your reasoning.

**7.** The pedigree below illustrates the inheritance of Nance-Horan Syndrome, a rare genetic condition in which affected individuals have cataracts and abnormally shaped teeth.

a. On the basis of this pedigree, what do you think is the most likely mode of inheritance for Nance-Horan Syndrome?

b. If couple III-7 and III-8 have another child, what is the probability that the child will have Nance-Horan Syndrome?

c. If III-2 and III-7 mated, what is the probability that one of their children would have Nance-Horan Syndrome?

*8. The following pedigree illustrates the inheritance of ringed hair, a condition in which each hair is differentiated into light and dark zones. What mode(s) of inheritance are possible for the ringed-hair trait in this family?


*9. Ectodactyly is a rare condition in which the fingers are absent and the hand is split. This condition is usually inherited as an autosomal dominant trait. Ademar Freire-Maia reported ectodactyly occurring in the family from Sao Paulo, Brazil, whose pedigree is shown below. Is this pedigree consistent with autosomal dominant inheritance? If not, what mode of inheritance is most likely? Explain your reasoning.


***10. Androgen insensitivity syndrome is a rare disorder of sexual development in which individuals with an XY karyotype, genetically male, develop external female features. All individuals with androgen insensitivity syndrome are infertile. In the past, some researchers proposed that androgen insensitivity syndrome is inherited as a sex-limited, autosomal dominant trait. (It is sex-limited because females cannot express the trait.) Other investigators suggested that this disorder is inherited as an X-linked recessive trait. Draw a pedigree that would show conclusively that androgen insensitivity syndrome is inherited as a sex-limited, X-linked recessive trait, and that excludes the possibility that it is sex-limited, autosomal dominant. If you believe that no pedigree can conclusively differentiate between the two choices (X-linked recessive and sex-limited, autosomal dominant), explain why. Remember that all affected individuals are infertile.