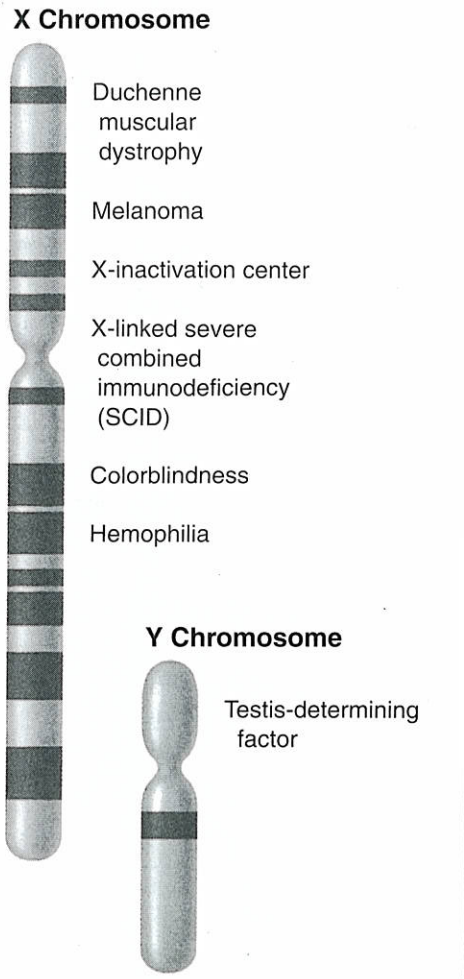

▲ **Figure 14–12** Genes on X and Y chromosomes, such as those shown in the diagrams, are called sex-linked genes. **Interpreting Graphics** *Which chromosome carries more genes?*

Sex-Linked Genes

Is there a special pattern of inheritance for genes located on the X chromosome or the Y chromosome? The answer is yes. Because these chromosomes determine sex, genes located on them are said to be **sex-linked genes.** Many sex-linked genes are found on the X chromosome, as shown in **Figure 14–12.** More than 100 sex-linked genetic disorders have now been mapped to the X chromosome. The human Y chromosome is much smaller than the X chromosome and appears to contain only a few genes.

Colorblindness Three human genes associated with color vision are located on the X chromosome. In males, a defective version of any one of these genes produces colorblindness, an inability to distinguish certain colors. The most common form of this disorder, red-green colorblindness, is found in about 1 in 10 males in the United States. Among females, however, colorblindness is rare—only about 1 female in 100 has colorblindness. Why the difference?

Males have just one X chromosome. Thus, all X-linked alleles are expressed in males, even if they are recessive. In order for a recessive allele, such as the one for colorblindness, to be expressed in females, there must be two copies of the allele, one on each of the two X chromosomes. This means that the recessive phenotype of a sex-linked genetic disorder tends to be much more common among males than among females. In addition, because men pass their X chromosomes along to their daughters, sex-linked genes move from fathers to their daughters and may then show up in the sons of those daughters, as shown in **Figure 14–13.**

Figure 14–13 **X-linked alleles are always expressed in males, because males have only one X chromosome.** Males who receive the recessive X^c allele all have colorblindness. Females, however, will have colorblindness only if they receive two X^c alleles.