

Complex Inheritance and Human Heredity

section 1 Chromosomes and Human Heredity

MAIN Idea

Chromosomes can be studied using karyotypes.

What You'll Learn

- the role of telomeres
- how nondisjunction leads to Down syndrome and other abnormalities
- the benefits and risks of fetal testing

Mark the Text

Identify Main Ideas

Highlight the main idea of each paragraph.

Picture This

- Apply** Examine the karyotype. Are these chromosomes from a male or female?

Before You Read

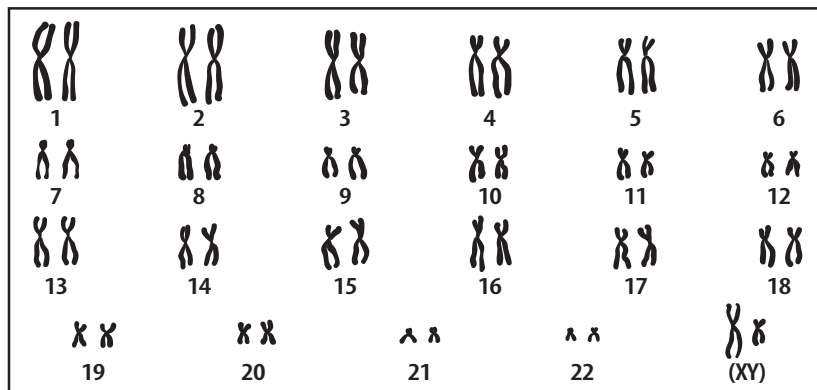
Think about the traits that people in a family might share. On the lines below, list the ways that people in families resemble each other. Then read to learn more about how scientists study genetic material.

Read to Learn

Karyotype Studies

Genetics not only is the study of genes, it is also the study of chromosomes. Images of chromosomes that have been stained during metaphase are studied. The staining bands mark identical places on homologous chromosomes. The homologous chromosomes are arranged, from biggest to smallest, to produce a micrograph called a **karyotype** (KER ee uh tipe). A karyotype is shown in the figure below.

Chromosomes of a human cell




_____ (No. of chromosome pairs) × 2 = _____ (No. of chromosomes)

Telomeres

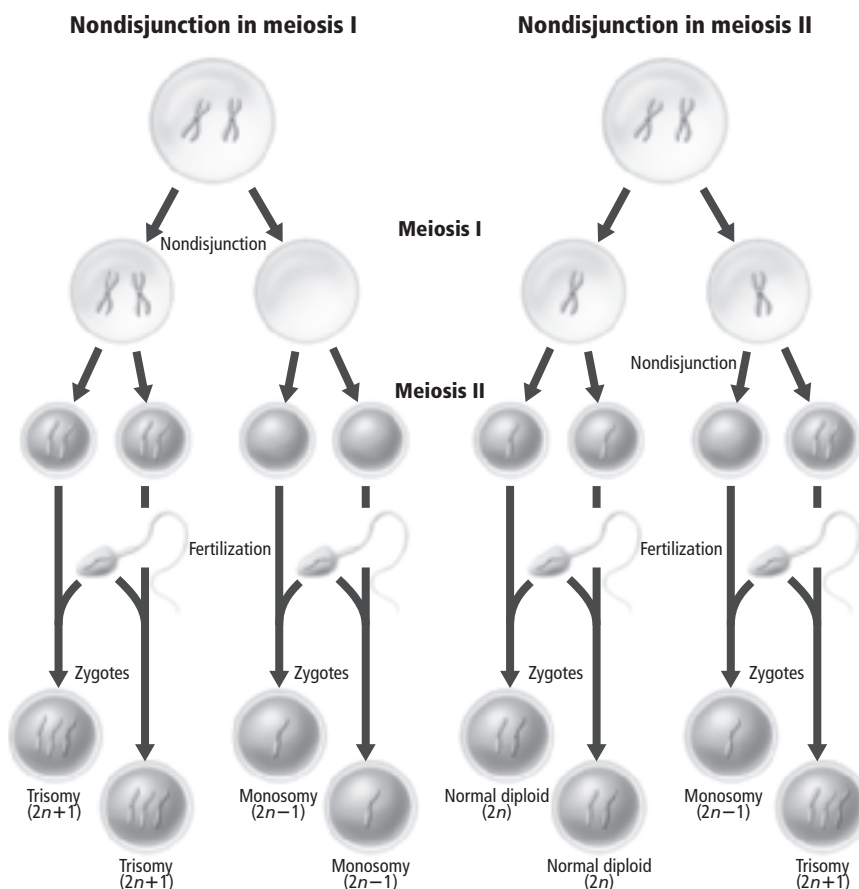
Telomeres are protective caps at the ends of chromosomes. They are made of DNA and proteins. Scientists have discovered that telomeres might be involved in both aging and cancer.

Nondisjunction

During cell division, the chromosomes separate and move to opposite poles of the cell. This ensures that each new cell has the correct number of chromosomes.

Cell division during which sister chromatids do not separate properly is called **nondisjunction**. Nondisjunction does not often occur. 

Nondisjunction during meiosis results in gametes that do not have the correct number of chromosomes. When one of these gametes undergoes fertilization, the offspring will not have the correct number of chromosomes. The figure below shows nondisjunction during meiosis. Trisomy (TRI so me) means having a set of three chromosomes. Monosomy (MAH nuh so me) means having only one copy of a chromosome.



Reading Check

2. Define What happens during nondisjunction?

Picture This

3. Evaluate Does nondisjunction during meiosis produce any normal gametes? Explain.

How does nondisjunction lead to Down syndrome?








Down syndrome is usually the result of an extra copy of chromosome 21. People with Down syndrome have distinctive facial features, are short, and have heart defects and mental disability. Approximately one out of 800 children born in the United States has Down syndrome. Older women have a greater chance of having a child with Down syndrome.

Does nondisjunction occur with sex chromosomes?

People can inherit incorrect numbers of both autosomes and sex chromosomes. The results of nondisjunction in sex chromosomes are shown in the figure below. A female with Turner's syndrome has only one sex chromosome. A male with Klinefelter's syndrome has two X chromosomes and one Y chromosome.

Picture This

4. Label Circle the pictures that show a trisomy in the sex chromosomes.

Nondisjunction in Sex Chromosomes							
Genotype	XX	XO	XXX	XY	XXY	XYY	OY
Example							
Phenotype	Normal female	Female with Turner's syndrome	Nearly normal female	Normal male	Male with Klinefelter's syndrome	Normal or nearly normal male	Results in death

Fetal Testing

A couple with a genetic disorder in the family might want to know if the developing baby, known as a fetus, has the disorder. Older couples might want to know the chromosome number of the fetus. Many fetal tests are available for observation of both the mother and the fetus. Fetal tests can provide important information to the parents and the physician.

Some risk is present in any test or procedure. The physician needs to consider health problems of the mother and the health of the fetus. The physician would not want to perform any tests that might harm the mother or the fetus. Physicians closely monitor the health of the mother and the fetus during testing.

Reading Check

5. State the purpose of fetal testing.
