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Understanding Inheritance: Results from Studies of Cells

Around 1900, as more powerful microscopes were invented, scientists began to examine cells in greater detail to learn more about inheritance. They wanted to know which structures in cells carried the information for traits. They also wanted to know where genes are found.

As scientists used microscopes and stains to see the structures inside cells, they made some important discoveries:

1. All plant and animal cells have a nucleus.

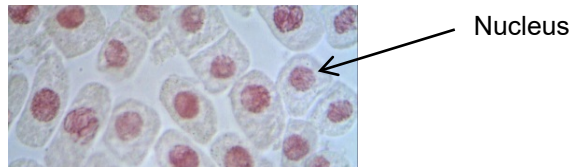


Photo courtesy of Shoba Shanti

2. When a cell gets ready to divide, individual chromosomes inside the nucleus can be seen under a microscope when the right stain is used.

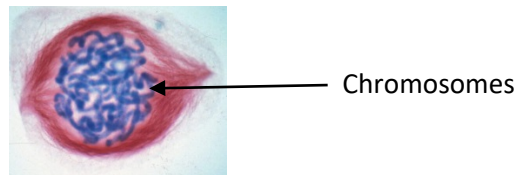


Photo courtesy of Andrew S. Bajer, University of Oregon

3. Each individual chromosome makes a copy of itself before the cell divides.

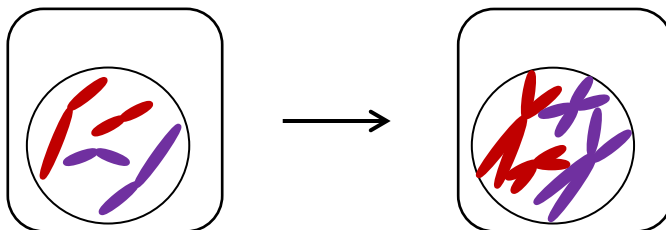


Figure 1. Artist's drawing of chromosomes making copies of themselves before the cell divides. The two red chromosomes came from the mother, and the two purple chromosomes came from the father. Humans have 23 pairs of chromosomes instead of the two pairs shown here.

- When the cell divides, each new cell gets exactly one of each copied chromosome.

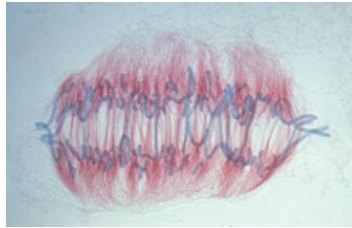


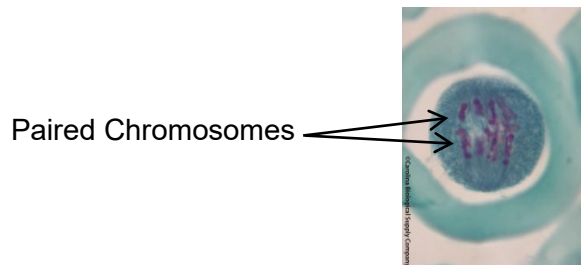
Photo courtesy of Andrew S. Bajer, University of Oregon

Figure 2. Photograph of the copies of each chromosome separating when a cell divides.

Scientists also discovered that when a new individual is made, special kinds of cells combine. These cells are called **egg cells** and **sperm cells**. Scientists thought that genes must be found in egg and sperm cells just as they're found in other body cells.

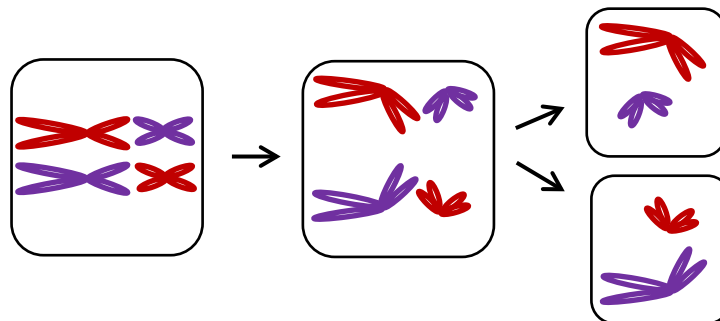
When scientists studied how egg and sperm cells are made, they discovered that this process is a bit different from the way other body cells are made. Here's how this process works:

- The cells that divide to make sperm and egg cells begin with a pair of each type of chromosome.*** All cells in most animals and plants start with a pair of each chromosome, but when egg and sperm cells are made, the pairs of chromosomes attach to each other. This attachment doesn't happen when other body cells are made.



*This applies only to organisms that reproduce sexually.

- Each sperm or egg cell gets just one chromosome from each original pair of chromosomes.** When other body cells are made, the new cells get both chromosomes in a pair. The diagram shows that one chromosome is passed to the new cells, even though the chromosome still has an identical copy attached.



In sperm and egg cells, one more division takes place to separate the copied chromosomes:

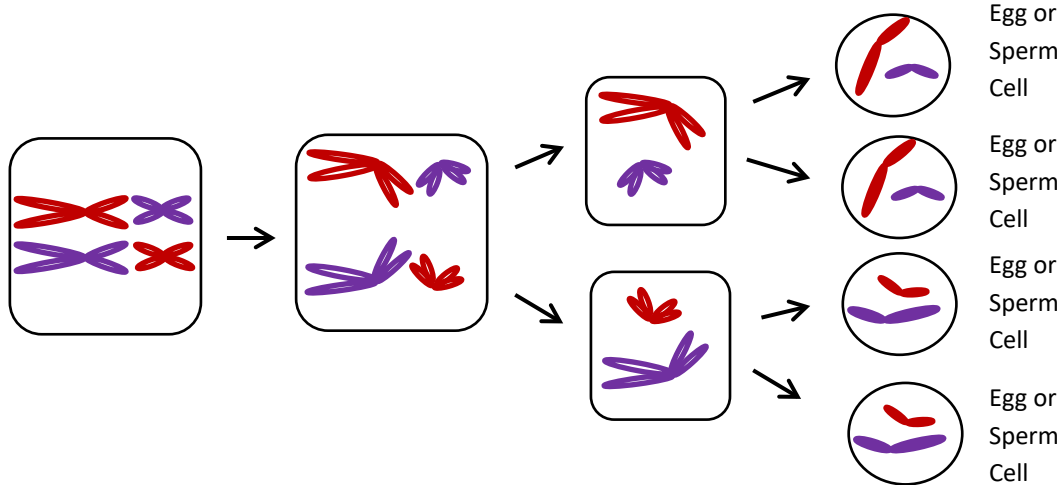


Figure 3. Each egg or sperm cell has half the chromosomes found in normal body cells.

- 3. Then the sperm and egg combine to make an individual offspring.** The chromosomes from the sperm combine with the chromosomes from the egg. **The offspring get one chromosome from the father's original pair, and one from the mother's original pair. The resulting cell now has a pair of chromosomes, just like all of the body cells.**

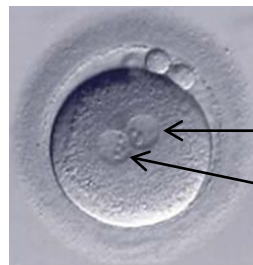


Photo courtesy of Atlanta Center for Reproductive Medicine

In 1902, a young scientist named Walter Sutton formulated a hypothesis about cells. He saw that when the eggs and sperm are made, the way chromosomes move is similar to Mendel's description of the way genes move.

Sutton concluded that because genes behave in exactly the same way as chromosomes, they must be found on chromosomes. The way chromosomes move when egg and sperm cells are made explains the patterns of inheritance that Mendel observed.