BIOTECHNO ACTIVITY BOOK

Compiled by :

EDUHEAL FOUNDATION

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Preface

Biotechno Activities book is a small step torwards encouraging school students to take up biotechnology. We at EduHeal Foundation still need lot of help and encouragement from school teachers and Principal in accomplishment of our goal. It is you who form the vital link between EduHeal Foundation and students as you can further encourage students to know about biotechnology on a day to day basics. We would also not sit idle but make efforts to increase interest :

- By publishing books like Biotechno Activities Books.
- Create awareness by conducting Nationwide Biotechnology Olympiad.
- Teacher Tranining Programme in basics of genetics and Biotechnology.
- Career Development Workshop for Students.
- Virtual Genetic Lab.
- Networking to enhance school/Govt./ Industry Interface.

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With best wishes

Dr. Sandeep Ahlawat
Managing Trustee
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CLASS - IX

Story of Chromosomes

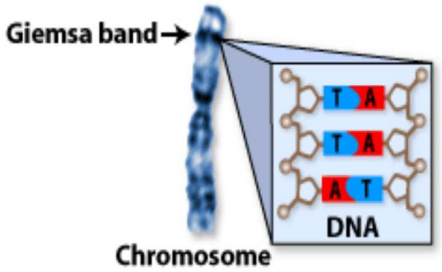
We can learn a lot by looking at **chromosomes**! They can tell us everything from the likelihood that an unborn baby will have a **genetic disorder** to whether a person will be male or female. Scientists often analyze chromosomes in prenatal testing and in diagnosing specific diseases.

What are chromosomes and why do we need them?

Chromosomes are compact spools of **DNA**. If you were to stretch out all the DNA from one of your cells, it would be over 3 feet (1 meter) long from end to end! You can think of chromosomes as "DNA packages" that enable all this DNA to fit in the nucleus of each cell. Normally, we have 46 of these packages in each cell; we received 23 from our mother and 23 from our father.

(If you want to have some more basic knowledge you can read the lower standards Biotechno activity book)

Why do chromosomes look like this?



Chromosomes are very small but can be specially prepared so we can see them using a microscope. Chromosomes are best seen during mitosis (cell division), when they are condensed into the fuzzy shapes you see here. Chromosomes taken from dividing cells are attached to a slide and stained with a dye called Giemsa (pronounced JEEM-suh). This dye gives chromosomes a striped appearance because it stains the regions of DNA that are rich in adenine (A) and thymine (T) base pairs.

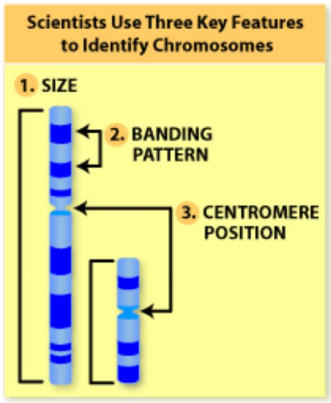
Why do scientists look at chromosomes?

Scientists can diagnose or predict genetic disorders by looking at chromosomes. This kind of analysis is used in prenatal (before birth)

testing and in diagnosing certain disorders, such as Down syndrome, (Condition when one have 47 chromosomes) or in diagnosing a specific type of leukemia. Such diagnosis can help patients with genetic disorders receive any medical treatment they need more quickly.

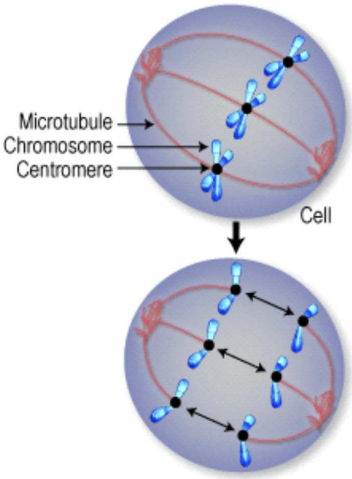
How Do Scientists Read Chromosomes?

To "read" a set of human chromosomes, scientists first use three key features to identify their similarities and differences:



1. **Size**. This is the easiest way to tell two different chromosomes apart.
2. **Banding pattern**. The size and location of Giemsa bands on chromosomes make each chromosome pair unique.
3. **Centromere position**. Centromeres are regions in chromosomes that appear as a constriction. They have a special role in the separation of chromosomes into daughter cells during mitosis cell division (mitosis and meiosis).

Using these key features, scientists match up the 23 pairs — one set from the mother and one set from the father.



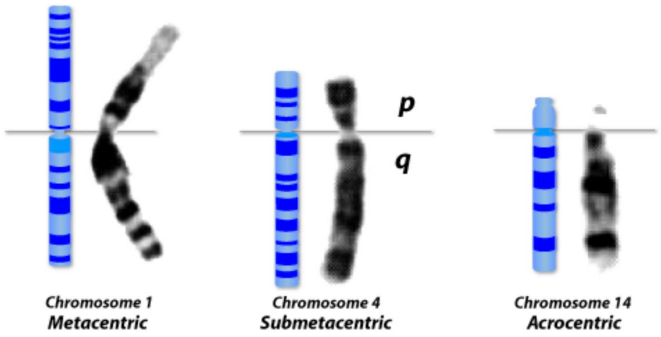
During cell division, centromeres attach to microtubules which pull the chromosomes to opposite ends of the cell.

What are centromeres for?

Centromeres are required for chromosome separation during cell division. The centromeres are attached to microtubules, which are proteins that can pull chromosomes toward opposite

ends of each cell (the cell poles) before the cell divides. This ensures that each daughter cell will have a full set of chromosomes.

Normally, each chromosome has only one centromere.



The position of the centromere relative to the end of the chromosome helps scientists tell chromosomes apart. Centromere position can be described three ways: metacentric, submetacentric or acrocentric.

In metacentric (pronounced met-uh-CEN-trick) chromosomes, the centromere lies near the center of the chromosome.

Submetacentric (pronounced SUB-met-uh-CEN-trick) chromosomes have a centromere that is off-center, so that one chromosome arm is longer than the other. When chromosomes are aligned, they are oriented so that the short arm, designated "p" (for petite), is at the top, and the long arm, designated "q" (simply for what follows the letter "p"), is at the bottom.

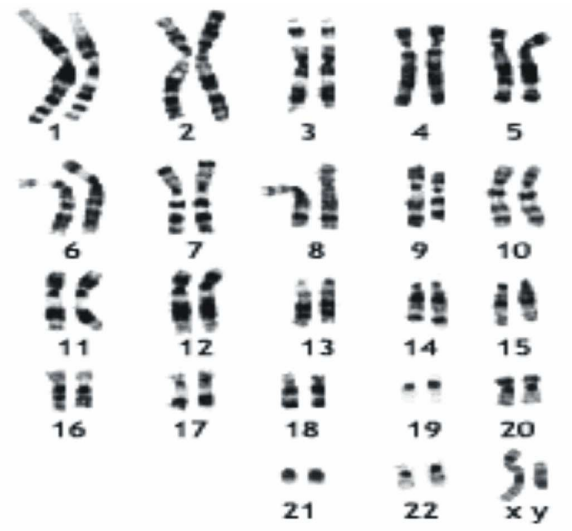
In acrocentric (pronounced ACK-ro-CEN-trick) chromosomes, the centromere resides very near to one end.

Making a Karyotype

A karyotype is an organized profile of a person's chromosomes. In a karyotype, chromosomes are arranged and numbered by size, from largest to smallest. This arrangement helps scientists quickly identify

chromosomal alterations that may result in a genetic disorder.

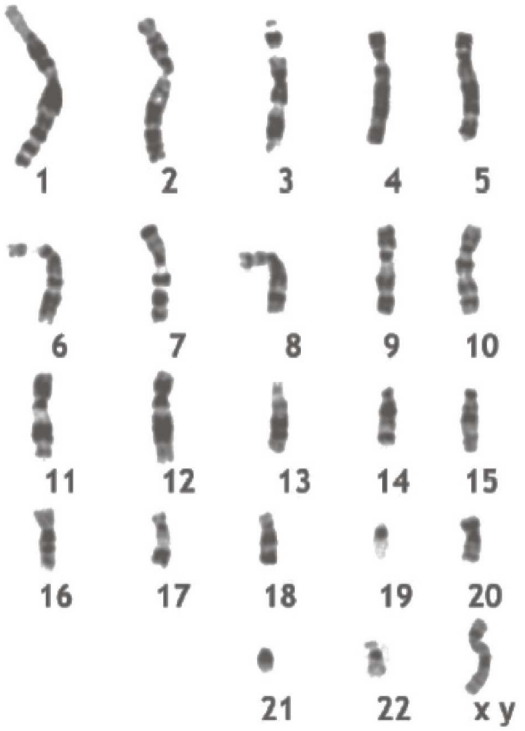
To make a karyotype, scientists take a picture of someone's chromosomes, cut them out and match them up using size, banding pattern and centromere position as guides.



Activity : Cut and paste Karyotype

Cut out chromosomes here

Paste chromosomes here with their match



Hint : while matching take into account the size of chromosome and position of Centromere

Disease occur in a person who have something different, such as.

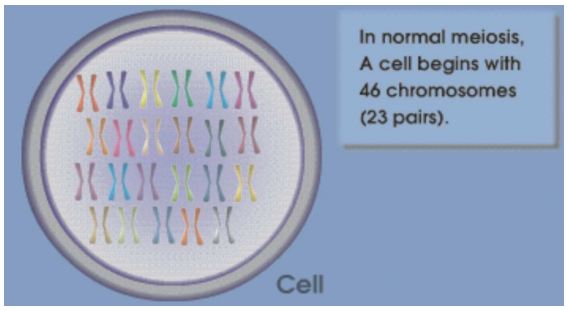
- Too many or too few chromosomes?
- Missing pieces of chromosomes?
- Mixed up pieces of chromosomes?

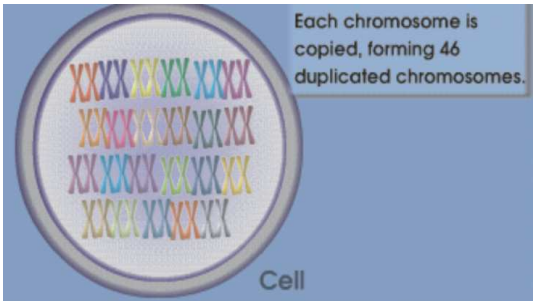
To understand how our cells might end up with too many or too few chromosomes, we need to know how the cells normally get 46 chromosomes.

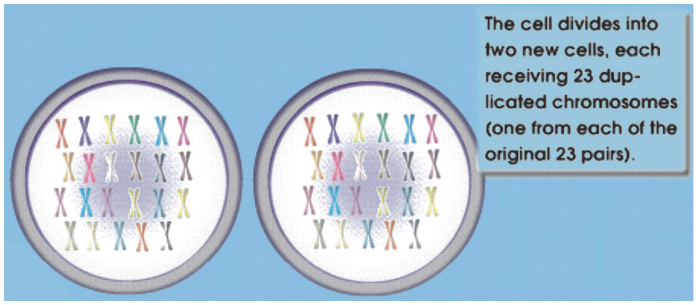
First we need to understand meiosis. Meiosis is the cell division process that produces egg and sperm cells (gametes), which normally have 23 chromosomes each.

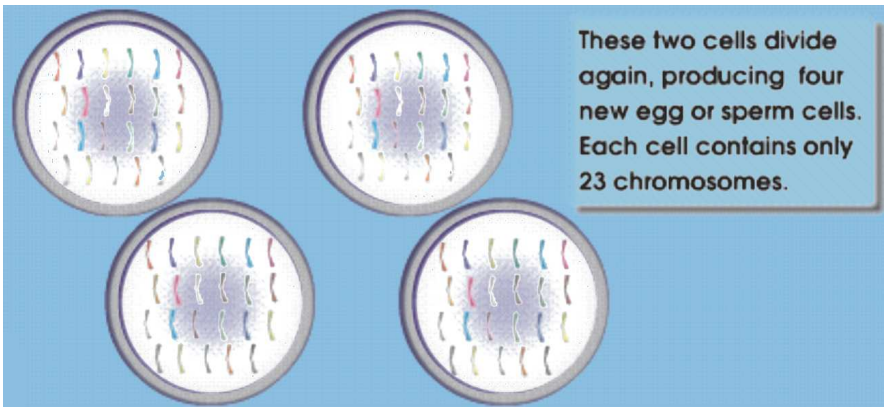
If eggs and sperm only have one set of chromosomes, then how do we end up with 46 chromosomes? During fertilization, when the egg and sperm fuse, the resulting zygote has two copies of each chromosome needed for proper development, for a total of 46.

Fertilization









Sometimes chromosomes are incorrectly distributed into the egg or sperm cells during meiosis. When this happens, one cell may get two