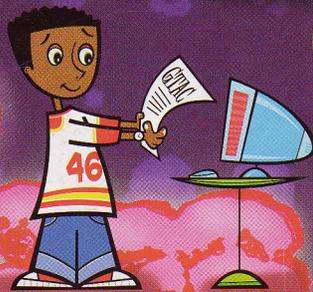


AMERICAN MUSEUM OF NATURAL HISTORY 

THE GENE SCENE



What Makes You YOU?

All About Cloning

Crack a Case With a DNA Detective

www.amnh.org

What Makes YOU YOU?

What Makes ME

ME?



Genetics is fun!
So much to learn!
Oooh! But I have one concern.
I've searched and searched.
Where ARE my genes?
You've got to help me!
Spill the beans!



What makes you you?
What makes me me?
A lot is due to heredity.
Your genes control
What makes you you,
From the color of your hair
To the size of your shoe.

Dogs and frogs are made of **cells**.
Bananas have them, too.
These teeny-tiny building blocks
Even make up YOU!

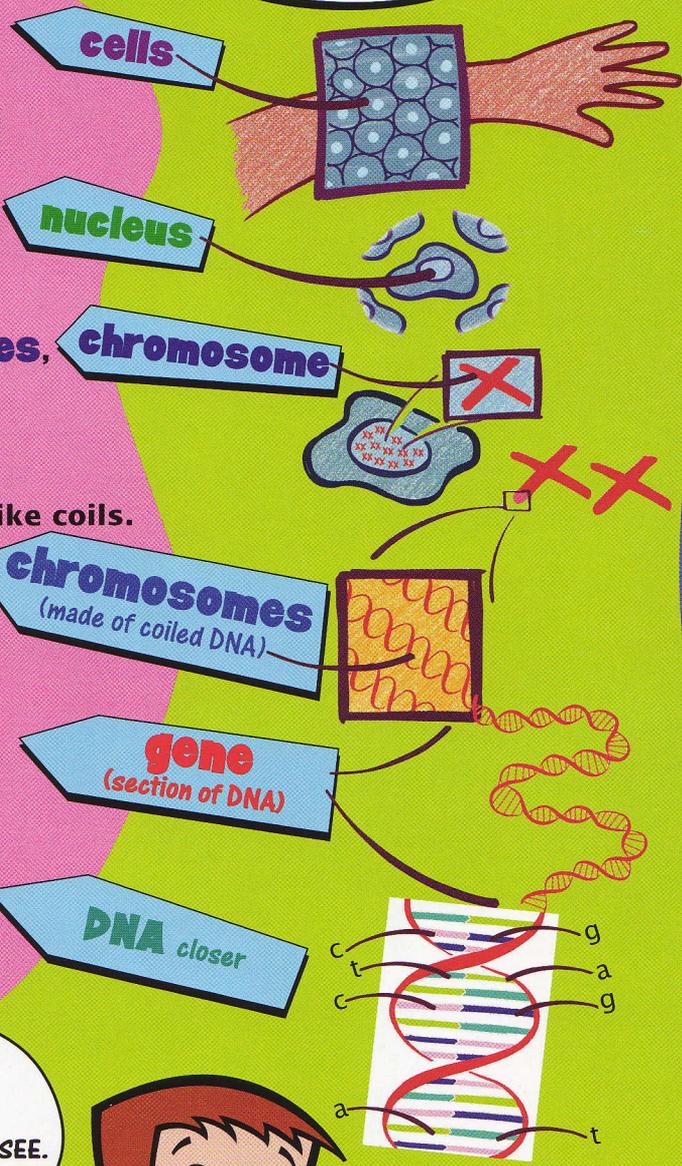
This thing here's the **nucleus**.
It's small, but even so:
It tells the cell just what to do,
It really runs the show.

Then, there are your **chromosomes**.
They're 46 in all.
Half from mom, and half from dad,
They're really, really small.

Your **chromosomes** are shaped like coils.
They always come in pairs.
They're made of stuff called **DNA**,
That's shaped like spiral stairs.

Genes are the sections of DNA,
Where many traits are placed.
Learning what each gene controls
Is the puzzle experts face.

DNA is made of four **bases**
We call them **G, C, A, and T**.
These bases are in every plant
And animal you see!



I GET IT NOW!
WHAT MAKES YOU YOU,
WHAT MAKES ME ME,
SHAPES EVERY LIVING THING YOU SEE.
WE'RE ALL RELATED IN A WAY
BECAUSE WE ALL HAVE DNA!



ALL ABOUT CLONING:

The Good, the Baaaa'd, and the Woolly

IAN MADE A LITTLE LAMB, LITTLE LAMB, LITTLE LAMB.
 IAN MADE A LITTLE LAMB AND DOLLY WAS HER NAME.
 WHEN SHE GREW, SHE WAS JUST LIKE MOM
 JUST LIKE MOM, JUST LIKE MOM.
 WHY WAS SHE JUST LIKE MOM?
 THEIR DNA'S THE SAME!



In 1997, a 7-month-old sheep named Dolly became a celebrity. Dr. Ian Wilmut, a Scottish scientist, announced to the world that he had created her using a procedure called cloning. Cloning is a method that scientists use to produce a genetic copy of another individual. In other words, Dolly is a **clone** of her mother.

Well, actually, Dolly had **three** mothers. One mother gave Dolly her DNA, one mother supplied an egg, and the third mother, her surrogate mother, gave birth to her.

Normally, an animal gets half of its DNA from its mother and half from its father. Dolly is an

identical twin of the mother who gave her her DNA. But Dolly is six years younger.

However, Dolly and her mother are not identical in every way. Since Dolly and her "DNA mother" have different experiences, they are different in many ways. Like human twins, clones have unique personalities.

It took scientists 277 tries to succeed in cloning Dolly. To make her, Dr. Wilmut used a complicated method called "nuclear transfer." In this method, scientists remove a nucleus from one cell and transfer, or move, it to a different cell.



Dolly and her birth mother

HOW THEY CLONED A SHEEP

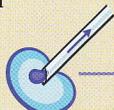
1 Scientists took udder cells from Dolly's DNA mother. They let the cells multiply and then they stopped the process when they had divided enough.



udder cells



2 They took an egg cell from a different sheep and removed the nucleus.



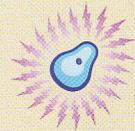
egg cell

3 They put one udder cell next to the egg cell and joined them using electricity. The egg cell now contained all the udder cell's DNA.

udder cell



egg cell without nucleus



cells join together due to electric current

4 The egg cell divided until it developed into an embryo. An embryo is the early stage of an animal before it has been born or hatched. This embryo was placed inside a third sheep. Five months later, this sheep gave birth to Dolly.



cells grow into an embryo

WHY CLONE?

Scientists have explored cloning technology for several reasons. Some use cloned animals to study and fight deadly diseases.

What other animals have been cloned?



COWS

Some cows produce much more milk than others. By cloning these cows, farmers could make milk more quickly and cheaply.

MICE

Scientists use special mice to study diseases like cancer. Cloning them could help scientists research how diseases progress.



MONKEYS

To develop new medicines for humans, scientists use animals that are as identical as possible. Cloned monkeys could help improve the development of these medicines.

Why clone a sheep?

There's no sheep shortage, but scientists are able to create sheep whose milk contains medicine. If scientists can then clone these special sheep, it may be possible to produce more medicine at a faster rate.



Many people, however, strongly oppose cloning animals, no matter what the benefits. In their view, cloning is messing with nature and should be against the law.

Can cloning bring back extinct dinosaurs?



Cloning anything is tricky. You need very special conditions, and most importantly, you need DNA. In the movie *Jurassic Park*, a scientist brings extinct dinosaurs back to life by cloning DNA found in ancient dinosaur blood. *T. rex*, one of the last large dinosaurs to roam the Earth, lived 65 million years ago. We've never found well-preserved DNA this old. And we probably never will.