

Here, kitty, kitty

On December 22, 2001, a kitten named CC made history as the first cat - and the first domestic pet - ever to be CC's [genetic material](#), are pictured below.

But do you notice something odd about this picture? If CC is a clone - an exact genetic copy - of Rainbow, then why don't they look exactly alike?



Photos courtesy TAMU, College of Veterinary Medicine

The answer lies on the [X chromosome](#). In cats, a [gene](#) that helps determine coat color resides on this [chromosome](#). Both CC and Rainbow, being females, have two X chromosomes. (Males have one X and one [Y chromosome](#).) Since the two cats have the exact same X chromosomes, they have the same two coat color genes, one specifying black and the other specifying orange.

So why do they look different?

Very early in her development, each of Rainbow's cells "turned off" one entire X chromosome - and therefore, turned off either the black color gene or the orange one. This process, called [X-inactivation](#), happens normally in females, in order to prevent them from having twice as much X-chromosome activity as males. It also happens randomly, meaning that not every cell turns off the same X chromosome.

As a result, Rainbow developed as a mosaic of cells that had one or the other coat color gene inactivated - some patches of cells specified black, other patches specified orange, and still others specified white, due to more complex genetic events. This is how all calico cats, like Rainbow, get their markings.

CC looks different because the [somatic cell](#) that Rainbow donated to create her contained an activated black gene and an inactivated orange gene. What's interesting is that, as CC developed, her cells did not change that inactivation pattern. Therefore, unlike Rainbow, CC developed without any cells that specified orange coat color. The result is CC's black and white tiger-tabby coat. Rainbow and CC are living proof that a clone will not look exactly like the donor of its genetic material.

Cloning :

Why not try cloning for your self? Go to the following website and clone a mouse. Write all of the steps as you go through the process.

<http://learn.genetics.utah.edu/units/cloning/clickandclone/>

Continue to study cloning

Answer the following questions:

1. What is cloning?
2. What are some reasons for cloning?
3. What are some risks with cloning?
4. Who has the right to have children, no matter how they are created? Who doesn't? Why?
5. Is human cloning "playing with nature?" If so, how does that compare with other reproductive technologies such as [in vitro fertilization](#) or [hormone treatments](#)?
6. Does cloning to create stem cells, also called [therapeutic cloning](#), justify destroying a [human embryo](#)? Why, or why not?
7. If a clone originates from an existing person, who is the parent?
8. What are some of the social challenges a cloned child might face?
9. Do the benefits of human cloning outweigh the costs of human dignity?
10. Should cloning research be regulated? How, and by whom?

Go to <http://learn.genetics.utah.edu/units/cloning/>
To see what others say about these issues.

Write a one – two page paper about cloning and submit it on Turnitin.com