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Mitosis, Meiosis, and Calico Cats

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Introduction:

This activity is a short PowerPoint presentation followed by an online quiz. It is aimed at high school students who have already studied mitosis and meiosis. It can be used as an introduction to non-disjunction, or as an extension after non-disjunction has already been taught.

Goals of the project:

1. Review Mitosis
2. Review Meiosis
3. Be able to utilize the understanding of mitosis and meiosis to solve a new problem
4. Relate meiosis to solving a genetics problem using a Punnett square.
5. Understand the process of nondisjunction and how it relates to meiosis
6. Understand the process of X inactivation in somatic cells.

How are the goals being achieved:

1. Through a powerpoint presentation that reviews mitosis and meiosis and relates it to the occurrence of calico coats in cats.
2. Learning is tested by a short online quiz following the presentation.

Teacher Notes:

Tortoiseshell cats are the result of a sex-linked gene for fur color on the X-chromosome. Black is dominant and orange is recessive, so male cats who inherit their one X chromosome either have black or orange. (There are many other genes for fur color, too!).

In the female cat, one X chromosome in each cell in the growing embryo is inactivated and called a Barr body. In a cat who is heterozygous (XOX^b) for this gene, each area of the cat's body will have different cells with either the black gene or the orange gene in the remaining active gene, depending on which gene was inactivated during development. A calico cat is a tortoiseshell cat with another gene for white patches present.

A male tortoiseshell or calico cat is almost impossible. . . unless non-disjunction occurs. A male cat will have to be XXY and be heterozygous for black/orange in order to become tortoiseshell or calico.

Student Activity:

Use the PowerPoint presentation to review mitosis and meiosis, and to see how female and male calico cats are produced. There is an opportunity for the students to do a Punnett square with XY chromosomes. At the end of the presentation is an online quiz to test the student's knowledge.