Language Arts Connection

Knockout Mice

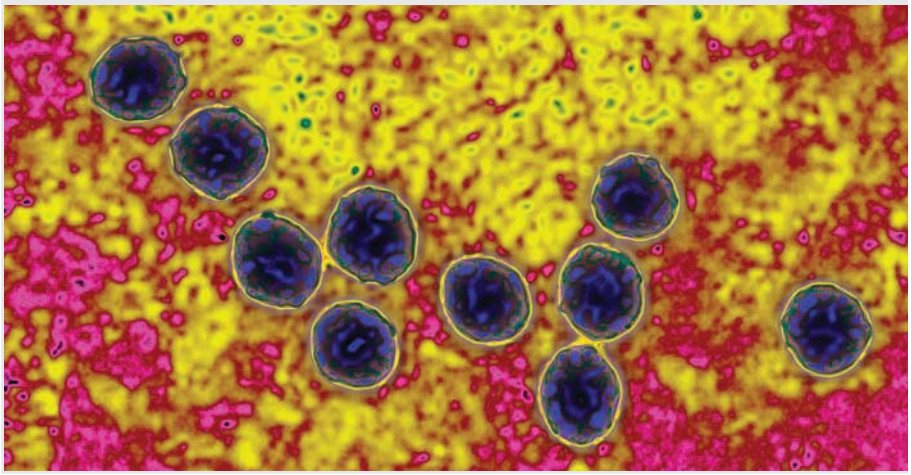
Knockout mice have a gene of interest knocked out, which means the gene is turned off. Knockout mice are often used in genetic engineering, allowing researchers to study structure and function in gene expression. Many knockout mice are named for the gene that has been deactivated. For example, the p53 knockout mouse does not have the *p53* gene, which produces a protein that stops tumor growths. This line of mice is susceptible to cancer. Other mice have genes knocked out that affect obesity, anxiety, and other traits.

Knockout mice have been used in thousands of experiments studying many different diseases. Recently, knockout mice helped scientists confirm the link between Zika infections in pregnant women and birth defects.

The Zika virus was identified in humans in 1952. The first major outbreak of Zika occurred in 2007. Another major outbreak occurred in 2016 and scientists started to study the effects of Zika infections in more detail. Of particular interest were reports that the Zika virus causes microcephaly, a birth defect characterized by a small head and abnormal brain development. Scientists needed to learn more about the link between Zika and birth defects to accurately advise the public on the risks of Zika infections.

Mice are not ideal models for testing the effects of Zika because the mouse immune system prevents a sustained Zika infection. To solve this problem, a group of scientists knocked out a key immune system gene. When the gene was not expressed, the Zika virus could replicate within pregnant mice. None of the fetuses survived, but scientists did find concentrations of the Zika virus in the placenta that were 1000 times higher than the concentration of Zika in the mother's blood. The placenta is responsible for supplying blood to the fetus. A high viral concentration in the placenta supports the hypothesis that Zika affects the placenta, thereby harming the fetus.

FIGURE 17: The Zika Virus



The Zika virus was also found in the heads of the fetuses. This suggests that Zika directly affects brain development. Scientists have continued the Zika research using knockout mice and other techniques, and there is now a confirmed link between Zika and birth defects in humans.

Knockout mice provide a valuable model for studying the effects of gene expression, but there are limitations. Some genes behave differently in mice than in humans. A knocked-out gene may fail to produce a response in mice when the gene is known to cause a response in humans. Or the gene may cause a different response in humans than is seen in mice. These constraints must be considered when developing or selecting a knockout mouse model for an experiment. Knockout mice are imperfect models in these cases, though they still may provide some information about the function of genes.

Language Arts Connection

Answer the following questions in your Evidence Notebook. Use evidence from the text to support your answers:

1. What happens when a gene is knocked out in a mouse?
2. How are structure and function related in the development of knockout mice?
3. What is a limitation of using knockout mice for disease models?

LABELING GMOs | MODELING GENETIC ENGINEERING | BACK FROM EXTINCTION
Go online to choose one of these other paths.