Genetically Engineered Mice Preventing the Spread of Lyme Disease

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**One Health Paradigm**

The One Health Paradigm is describing how the health of humans is closely intertwined with the health of the animals and the environment. Over the recent years, the connection between animals and humans have become more important and will be for the future. As a result, the population is growing and the need for animals play an important role for food, companionship, livelihood, and more. Being in close contact with animals and the environment increases the chances for disease to be spread to humans.

I am taking this course for a general elective class, but I want to take this class because I wanted to know the importance of how diseases can spread easily from wildlife to humans and cause a worldwide pandemic. Two important things that I have learned from this course so far is how genetic testing has helped decrease the rate of specific diseases and how diseases can cause damage to us humans, wildlife, and the environment and how we can prevent this.

**Lyme Disease**

Lyme disease is the most common vector-borne disease in the United States (*Lyme disease* 2022). Lyme Disease is transmitted through a bite of infected blacklegged ticks to humans. If treated properly, the disease will go away within a week, however if you do not treat then it can spread to heart, joints, and nervous system. Lyme Disease is very popular in the northeast coast in the United States. According to Centers for Disease Control and Prevention, they estimate approximately 300,000 people get Lyme Disease per year (*How many people get Lyme disease?* 2021). Even though this is not a popular disease, we still see a spread of the disease and want to prevent animals spreading to us humans. A 2018 report by Quest Diagnostics said cases in California shot up by 195% from 2015 to 2017 (Romo, 2023). This is on the rise and needs action quickly before it becomes a worldwide pandemic.

**The Answer to Decrease Lyme Disease**

In the late 1900s, they have found a vaccine for Lyme Disease, however the vaccine was not sufficient and was later discontinued since it did not prevent humans from the disease. In current research, they are developing a new vaccine called VLA15 that is designed to protect people against the strains of the Lyme disease bacterium. VLA15 is a multivalent, protein subunit vaccine that targets the outer surface protein A *(OspA) of*Borrelia (*Lyme disease vaccine* 2022). Humans may not have a vaccine at this moment, but dogs have a vaccine. Although dogs cannot transmit infected ticks to humans directly, they can bring infected ticks to your homes. Being able to vaccinate the dogs will help prevent the spread of Lyme disease significantly. A new treatment that has started to become popular is using stem cell therapy. Stem cells can turn into the cells of damaged organs when they touch the damaged organs (*Lyme treatment with Stem Cell*).

In today’s world, we do not have a sustainable cure for Lyme disease that we can rely on right now. We are from being close to an answer for a rising disease that can cause damage to humans in the following years. I believe the next big step to help prevent the spread of Lyme disease is to genetically modify mice. If we would be able to genetically modify mice, then the Lyme disease rate would decrease over the years.

**Lyme Disease Experiment**

Since mice closely mimic the human body, we can do tests on them to find answers to protect us from diseases. Genetically engineered mice are useful for elucidating basic biological processes, studying relationships between gene mutations and disease phenotypes, and modeling human disease (*Nomenclature of genetically engineered and Mutant Mice*). We are able to give the mice genetic code that would be resistance to the bacteria that causes Lyme disease. These mice with the genetic code would mate with non-genetic mice which then the offspring would carry the genetic code as well. The mice would multiply where almost all would be carrying the genetic code. The mice who don’t carry Lyme with genetic code means fewer ticks that bite them would be infected. This cycle would then mean less ticks that bite humans would carry Lyme. After this cycle happens, I would have a controlled area with mice with genetic code, tick who doesn’t carry Lyme and a human for test subject. We would run this test over a certain amount of people to see the results.

**Lyme Disease Results**

The results of genetically modifying mice would significantly decrease the rate of Lyme disease over the years. Genetic modified mice being able to mate with native mice and their offspring becoming immune to Lyme disease will help stop the spread of the tick-borne disease. This will be beneficial to humans since the mice will lowering the number of ticks from transmitting to humans which would lower the rate of diseases in the world. Humans will not have to worry about being sick for long periods of times and sometimes not fully recovering from the disease. In non-humans, Lyme disease can do serious harm to animals if left untreated. Since vaccines are available for dogs, still having the genetically modifying mice will make sure to lower the number of ticks around so it does not spread between animals. This will benefit all non-humans since we will see less ticks in the world and will not carry them. Climate change is a huge factor on why the ticks are expanding their geographical area with Lyme disease. Having the genetic modified mice to eliminate ticks will lower the number of diseases around the world. If we would be able to spread the number of genetically modified mice and bring out a vaccine, we would see a huge decrease in Lyme disease and potentially preventing it from becoming a worldwide pandemic.

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