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Humanized Mice

The Essential Need for Animals in Medical Research

Introduction

What exactly is a humanized mouse? Well to start it's simply just a mouse that has received some human genes or immune cells. Immune cells are typically delivered by an IV, similar to the way humans receive IVs, only on a much smaller scale. Early in the COVID-19 pandemic, scientists discovered the ACE2 gene enables the SARS-CoV-2 virus to enter human cells and infect the body. To focus their research, they used mice that were "humanized" with the ACE2 gene to develop safe and effective COVID-19 vaccines at a record speed.

However, COVID-19 is not the first biomedical success made possible thanks to these "humanized" mice. Since 1974, humanized mice have helped scientists understand and conquer cancers like leukemia, autoimmune diseases like Type 1 diabetes and many types of viral infections.

Top prescription drugs for allergies, asthma, cancer, dementia, depression/anxiety, Alzheimer's, Parkinson's, heart disease, high blood pressure, HIV/AIDS, lupus and more; anti-diabetic medications; and vaccines for COVID-19, the flu, hepatitis and other diseases involved biomedical research with humanized mice.[i]

"Mighty mice" that were genetically engineered to lack myostatin and therefore displayed twice the average muscle mass of a mouse even launched into space in 2019 for health research on muscle and bone density loss.[ii] Medical advancements are possible thanks to the incredible contributions of these small yet mighty animals.

We've highlighted some of the disease areas that have benefitted the most from research involving humanized mice.

COVID-19

Research with rodents such as genetically modified mice is key for understanding how SARS-CoV-2 attacks human bodies and for testing drugs and therapies for treating the disease it causes.

Advancements in vaccine development led to the availability of COVID-19 vaccines ready at an unprecedented rate during the coronavirus pandemic.

Humanized hACE2 mice helped scientists develop COVID-19 vaccines. Decades of research with genetically modified mice went into the mRNA technology used in vaccines authorized in the U.S.[iii]

Cancer

Cancer treatment success rates are higher today than ever before thanks to research involving mouse models of cancer.

Transgenic and knock-out mice have contributed to the development of vaccines and treatments for breast, colon, ovarian, pancreatic and prostate cancer.[iv]

Alzheimer's Disease

Genetically modified mice allow

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scientists to explore aspects of Alzheimer's disease in a living system. Scientists developed a mouse model that produces a human beta-amyloid protein to advance research and test potential drugs for this disease.[v] These mouse models can mimic late-onset Alzheimer's in humans. Researchers study aging, genetic and environmental factors with mice to gain knowledge about the disease and to find effective treatments to prevent cognitive decline.

Heart Disease

Humanized mice are an ideal model for heart disease research.[vi] Humanized mice susceptible to inflammatory heart disease are key for developing treatments for patients living with cardiovascular disease. Genetic abnormalities that predispose people to heart valve disease are common. Genetically engineered mouse models of heart disease help scientists learn about these genetic predispositions and the likely contributing factors for heart disease.[vii]

Diabetes

Unlike the more common Type 2 diabetes, Type 1 diabetes quickly becomes deadly without regular insulin injections.

Humanized mouse strains that spontaneously develop Type 1 diabetes help evaluate therapies that diabetic human patients benefit from.[viii]

Researchers "cured" Type 1 diabetes in humanized mouse models of the disease, and for the first time an experimental Type 1 diabetes treatment may have cured a clinical trial patient in 2021.[ix] The initial results are promising, but the trial is ongoing. The treatment consists of an infusion of stem cells that produce insulin.

"It's a whole new life," reportedly said Mr. Brian Shelton, who was the first patient to receive the infusion. "It's like a miracle." Gene and cell therapy experts tested the treatment with humanized mice prior to use in Mr. Shelton; preclinical work resulted in humanized mice and rats being cured of diabetes.

Influenza

Transgenic mice expressing a human anti-influenza protein help scientists understand how the flu infects the body.

Researchers are using transgenic mice to study how strains of influenza virus cross the species barrier between animals and how they cross over from animals to humans.

Scientists also use transgenic mice in their quest for a universal influenza virus.[x]

Hepatitis

Hepatitis B is one of the most prevalent infectious diseases associated with human liver diseases. Transgenic, transfected and chimeric mice led to the development of effective vaccines for hepatitis B.[xi]

There is currently no vaccine for hepatitis C, but scientists are making progress in developing a humanized mouse model of hepatitis C to help in the discovery of a hep C vaccine.[xii]

HIV/AIDS

HIV/AIDS was a death sentence in 1981. But today people with it can live normal lives by managing systems with medications developed thanks to animal research, including humanized mice models.

Since 1988 several types of humanized mice have been used by researchers to develop antiretroviral therapies for HIV/AIDS and in the ongoing search for a cure for HIV/AIDS.[xiii]

Humane and responsible animal research takes us from hope to treatments and cures.

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[i] https://fbresearch.org/top-drugs/

[ii] https://www.jax.org/news-and-insights/2020/september/mighty-mice-in-space

[iii] https://www.statnews.com/2020/11/10/the-story-of-mrna-how-a-once-dismissed-idea-became-a-leading-technology-in-the-covid-vaccine-race/

[iv] https://clincancerres.aacrjournals.org/content/12/18/5312

[v] https://www.nia.nih.gov/news/new-genetically-modified-mouse-model-mimics-multiple-aspects-human-alzheimers-disease

[vi] https://pubmed.ncbi.nlm.nih.gov/10199887/

[vii] https://www.frontiersin.org/articles/10.3389/fcvm.2021.683074/full

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[xi] https://www.frontiersin.org/articles/10.3389/fmicb.2021.715450/full

[xii] https://www.pei.de/EN/newsroom/press-releases/year/2020/20-towards-hepatitis-c-vaccine-mouse-model-developed.html

[xiii] https://www.frontiersin.org/articles/10.3389/fimmu.2021.636775/full