

2020 PSBR High School Essay Contest
Finalist

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Over 30 million Americans are affected by type 2 diabetes, my grandmother being one of them. People with this condition have cells that do not react normally to insulin, which is produced by the pancreas and lets blood sugar into the cells to be used as energy. Cells either resist insulin, or do not produce enough insulin to maintain normal blood sugar levels. People with type 2 diabetes may experience increased thirst, frequent urination, increased hunger, unintended weight loss, fatigue, blurred vision, slow-healing sores, frequent infections, and areas of darkened skin. To assist their understanding and treatment of this common disease, scientists have commonly worked with animals in the past, and still currently work with animals.

The discovery of insulin can be credited to Frederick G. Banting, with the help of Charles Best and John MacLeod. Other scientists have previously attempted to discover insulin, but were unable to do so. Banting believed they failed to discover insulin, because digestive enzymes destroyed the insulin before it could be extracted. During his experiments in 1921, Banting utilized laboratory dogs. He ligated their pancreatic ducts until the cells that produce the digestive enzymes degenerated and only islet cells remained. He extracted the residue left in the pancreas and tested the urine for diabetes. In the years after its discovery, insulin from cattle and pigs was used to treat diabetes.

Metformin is the most commonly prescribed medicine to treat type 2 diabetes. It contains insulin and helps control the amount of glucose in the blood. It also decreases the amount of glucose absorbed from food, and increases the body's response to insulin. The development of this drug was aided by animal research and testing. In the 1920s, German biochemist Karl Slotta suggested that metformin lowered blood glucose in rabbits. Later in 1957, Jean Sterne, a French physician, successfully tested on humans. Metformin was approved in the United States by the FDA in 1995 after testing on mice, rats, and rabbits.

Another subject of research relating to type 2 diabetes is the delivery of insulin. Examples of delivery methods are insulin pumps, insulin patches, and inhaled insulin. Insulin pumps were based on pumps that infuse parathyrin into dogs and other animals. Insulin patches continuously release a small dose of insulin, and have been tested on diabetic rats. Inhaled insulin is in the form of a dry powder that is inhaled through the mouth. It then travels directly to the lungs where it enters the bloodstream. Testing on dogs has helped identify the relationship between the amount of inhaled insulin and the amount of insulin circulating the bloodstream. These results carried over to successful human testing.

Recently, scientists at the Mayo Clinic have been experimenting on mice and their senescent cells—a type of cell that is no longer able to divide. These cells release molecules

that may harm important cells in the pancreas and could cause type 2 diabetes. Two molecular biologists at the Mayo Clinic in Rochester, Minnesota, Darren Baker and Jan van Deursen, manipulated mice so their senescent cells would be destroyed when they were injected with a drug. Their results showed that mice whose senescent cells were killed were healthier than mice whose senescent cells were able to build up. Mice without senescent cells had kidneys that worked better, had hearts that were more resilient to stress, explored their cages more, and developed cancers at a later age. These mice also lived 20-30% longer than ones who had a buildup of senescent cells. Currently, researchers, including Baker and van Deursen, are searching for drugs that can either eliminate senescent cells or stop these cells from damaging surrounding tissue. This new possible therapy could have a large impact on the development of type 2 diabetes.

Research and testing on animals have greatly affected the knowledge and development of treatment for type 2 diabetes, a condition that affects many Americans and others around the world. The discovery of insulin was the result after testing on the pancreas of dogs, and insulin from cattle and pigs was used to treat diabetes soon after. The development and approval of metformin, the drug commonly used to treat type 2 diabetes, can be credited to testing on rabbits, mice, and rats. Different methods of insulin delivery have been assisted by testing on dogs and rats, and the possible prevention of type 2 diabetes can be attributed to research on mice. These advancements could not have been done without animal research and testing.

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