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Finalist

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As a little girl, I remember watching my grandfather, a type II diabetic, routinely taking medications to regulate his blood-sugar. As a few years passed with the same scene of carefully balancing his diet and pricking his fingers to test his blood, I had forgotten about this condition until my mother was diagnosed with gestational diabetes while carrying my brother. Taking biology in high school opened my eyes on the topic of diabetes and its connection to the human genome, as I gained an understanding as well as an infinite fascination of genetics.

Scientists have known for over a century that the genomes of life on earth are related. However, only recently have researchers discovered hereditary factors of certain human genetic disorders, such as diabetes, a disorder also prominent in house-cats, can be mapped by the sequencing of animal DNA. Another animal used in diabetes research were mice. Professor Leslie Lyons of University of Missouri in 2004 showed that disorders common to cats and humans share mutations on the same gene (McKie). Animal genome sequencing of mice by Medical College of Wisconsin demonstrated rodents' genome closely mirrors humans in diabetes-related sections ("Scientists…").

Diabetes mellitus is a class of metabolic diseases characterized by the inability to adequately regulate blood-sugar, due to the insufficient production of insulin or non-response to hormones. Insulin, a functional protein produced in the pancreas by the beta cells in the islets of Langerhans, is released into the bloodstream to lower the glucose concentration.

Common forms of diabetes, type I, II, and gestational, are polygenic, related to multiple genes. Type I, juvenile diabetes, is a chronic, autoimmune disease in which insulin-producing cells of the pancreas are attacked as a foreign threat leading to deficiency of the protein, whereas type II diabetes, adult-onset diabetes, is caused by the inability to use insulin. Unlike Type-I and II, which are lifelong, gestational diabetes is the high blood-sugar that occurs during pregnancy.

Recent developments in animal genome sequencing have shown connections between domestic feline, mouse, and human genomes. Studies by the National Human Genome Research Institute scientific director Daniel Kastner used DNA-sequencing technology to identify major regions of the human genome outside the protein-coding genes for the specialization of pancreatic regulation, giving insight on the dysfunction of regulatory elements in the diabetic islets (MacDougall). Without the help of animal biomedical research, there would be no such advancements in the understanding of diabetes.

To sequence the genome, scientists take samples from the animal from which DNA is extracted and analyzed by a capillary-electrophoresis machine for enzyme-cut segments matched to the correct nucleotide. Through electrophoresis, mouse phenotypes were compared to a diabetic human's, investigated under the Human Genome Project (Hsu). Biomedical research of animal genomes is both harmless to animals and beneficial in development of genetic-based medications for the diabetic community.

Mutations in different genes cause variation in the product of each protein-encoding area, leading to a higher risk of diabetes. Biomedical analysis of mouse and cat genomes led to the

discovery of numerous genes associated with diabetes. The sulfonylurea receptor (SUR), encoded by gene ABCC8, is a protein of the ATP-binding cassette transporters which compose the ATP-sensitive potassium channel (KATP) located in the pancreas. The channel relays signals from glucose metabolism to membrane depolarization in response to an increase of adenosine triphosphate caused by an excess of glucose (Vaxillaire). The inhibition of KATP is initiated by the binding of SUR, stimulating the secretion of insulin into the bloodstream to lower blood-sugar concentration. Recessive mutation of ABCC8 is associated with the impaired release of insulin in type II diabetics, causing an inability to stimulate insulin release due to lack of transporting protein (Dean). An allele of ABCC8, 1273AGA, increases the probability of hereditary type II diabetes by a two-fold (Florez). Synthetic SUR is used in pharmaceuticals for treatments similar to the ones in my grandfather's medicine cabinet as an artificial stimulant of the release of insulin to decrease blood-sugar concentration. Without the help of biochemical animal research, my grandfather would not be living as comfortably with the aid of his precious medications.

As biomedical research on the links between diabetes and the animal genome progresses, I cannot help but wonder what valuable information lies within the genetic coding of the next animal I pet. Advancements in genomic research prove not how much we know, but how little we actually do. The continuation of animal research can unlock an entire new realm of knowledge that could improve the lives of millions around the world.

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