insulin insufficiency in the brain

IN TORONTO, CANADA, 1922, Leonard, a 14-year-old young man, weighing a mere 65 pounds, lay dying of type 1 diabetes in a hospital ward. At that time hospitals had dedicated wards where 50 children could be congregated, suffering the trauma and ultimate death of insulin insufficiency. For hundreds of years, up to that time, the diagnosis of diabetes in a child was a death sentence. A starvation diet was the treatment of the time. Leonard, though, would be the first to receive a new treatment, an injection of insulin. The initial injection was impure and Leonard suffered a severe allergic reaction to it. Days later he was treated again with a purified dose. This time it was a success.

Insulin is a hormone that you literally cannot live without. Just like a car cannot run without gas, the body depends largely upon glucose to produce energy. Insulin is kind of like the hand that opens the tank to allow glucose into the cells from the blood stream. Insulin brings blood sugar down to normal levels by regulating the uptake of blood glucose into muscle for energy production, or into the liver to be stored as glycogen, or into adipose cells to be stored as fat. Insulin also impacts protein production, regulates some enzyme activity, and promotes growth. With type 1 diabetes special cells in the pancreas no longer produce insulin and it must be injected. Insulin insufficiency, or perceived insulin insufficiency, however, can be experienced in other states as well.

Insulin resistance is a condition in which body cells are no longer as perceptive to insulin's presence or as sensitive to its action. The cells have a diminished response to insulin. It's as if they have earplugs on and cannot hear insulin knocking. This results in excess glucose in the blood. The pancreas attempts to turn up the volume by secreting more and more insulin, resulting in increased blood insulin levels. During the initial stages, insulin resistance typically goes on undetected. Blood sugar levels may not be elevated, but overworking the pancreas comes at a price. Insulin's ability to stimulate and regulate is diminished. Signs and symptoms of insulin resistance and elevated insulin levels include: fatty liver, abdominal obesity, sugar and carb cravings, increased risk of gout, polycystic ovarian syndrome, elevated triglycerides, and eventually elevated blood sugar levels. Ultimately the ability of the pancreas to keep up can become exhausted resulting in decreasing insulin production.

Insulin resistance is involved in the development of the scourges of our era: metabolic syndrome, type 2 diabetes, obesity, heart disease, and last, but not least, intellect impairment. What scientists have learned in the past few decades is that the brain is an insulin sensitive organ. Previously, the accepted view had been that human brain glucose uptake was an entirely insulin-independent process. Now we know different.

The brain is a voracious, insatiable glucose consumer, requiring 25 percent of the body's fuel (glucose) at rest, though it constitutes only 3 percent of body mass. Glucose homeostasis in the brain is vital and glucose can, and does, infuse the brain without the need for insulin. This does not lessen insulin's impact on brain function however. While not fully defined, insulin's function in the brain has been found to be involved in learning, memory, brain metabolism, brain plasticity, neuron growth, regulating feeding behavior, and emotional and cognitive brain function. Insulin "promotes the health of brain cells—their growth, survival, remodeling, and normal functioning."[1] It promotes glucose uptake in neurons in the hippocampus and frontal lobes, areas of the brain responsible for memory and executive control functions such as will power. The junction between neurons, where communication between brain cells occurs, is strengthened by insulin, helping to form new memories. Insulin also regulates other hormones that are involved in learning and memory. Researchers are finding that when glucose uptake is more efficient, as a result of insulin, these functions improve.

> **DEMENTIA, THE LOSS OF MEMORY AND BRAIN PLASTICITY, HAS BEEN ASSOCIATED WITH TYPE 2 DIABETES AND OBESITY.**

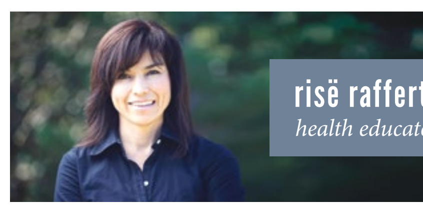
Dementia, the loss of memory and brain plasticity, has been associated with type 2 diabetes and obesity. The prevalence of dementia in diabetic populations is reportedly double that of healthy patient populations. Alzheimer's disease has also been associated with insulin sensitivity. Some researchers have relabeled Alzheimer's as type 3 diabetes. In addition to this, insulin appears to be important in the development of several neuropsychiatric disorders as well as neurodegenerative diseases such as schizophrenia, depression, and Parkinson's disease. Impaired glucose tolerance affects up to 80 percent of Parkinson's patients. Individuals with depression have an approximately 60 percent higher risk of developing type 2 diabetes, while individuals with diabetes are at an elevated risk of developing depression.

The impact of insulin resistance on feeding behavior is quite provocative as well. Experiments conducted with rodents have demonstrated that "administration of insulin into the brain inhibits food intake and reduces body weight, while mice lacking insulin receptors in the brain become obese."[2] From inside the cell, a lack of insulin receptors or insulin resistance has the same effect as insulin insufficiency to some degree. Gene-Jack Wang, MD, professor of Radiology at Stony Brook University and researcher at the U.S. Department of Energy's Brookhaven National Laboratory in Upton, N.Y. comments on his research with animals that "increased insulin resistance precedes the lack of control associated with pathological overeating."[3] If this is true, then enhancing insulin sensitivity in the brain has the potential of helping millions of Americans regain appetite control and experience weight reduction.

After Leonard's life was saved, the wonderful discovery of insulin quickly spread. It was not long before the whole world heard of the discovery of the life-saving substance. It was one thing, however, to hear of a cure and another for it to be accessible to the children throughout the world who were wasting away into an untimely death. This took more time, commitment, teamwork, controversies, perseverance through experimental trials and failures, and the transfer of the mass production of insulin to others better equipped. In 1923, however, there was reportedly enough insulin produced for North America. To the child suffering from insulin insufficiency, the only thing that really mattered was that it was given to them personally.

Jesus' work on earth was intensely personal. He was not philosophical, abstract, or unapproachable. As Teacher, Healer, Savior, He contacted men and women individually, relationally. Let us not think that Jesus' work today must be done differently.

1. "Brain Insulin Resistance Contributes to Cognitive Decline in Alzheimer's Disease," *Penn Medicine*, 3/23/12, http://www.uphs.upenn.edu/news/News_Releases/2012/03/insulin/.
2. Oksana Kaidanovich-Beilin, Danielle S. Cha and Roger S. McIntyre, "Metabolism and the Brain," *The Scientist*, 12/1/12, http://www.the-scientist.com/?articles.view/articleNo/33338/title/Metabolism-and-the-Brain/.
3. "High sugar intake linked to low dopamine release in insulin resistant patients," *ScienceDaily*, 6/10/13. www.sciencedaily.com/releases/2013/06/130610223722.htm.



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