

SCIENTISTS ONCE THOUGHT THE BRAIN PLAYED LITTLE PART IN DIABETES—A DISEASE IN WHICH THE BODY IS UNABLE TO PRODUCE OR USE THE HORMONE INSULIN FROM THE PANCREAS. NOW, NEW RESEARCH INDICATES THAT THE BRAIN HAS ITS OWN INSULIN RECEPTORS AND PLAYS A BIG ROLE IN NORMAL BLOOD SUGAR CONTROL. SCIENTISTS ARE ONLY BEGINNING TO UNDERSTAND THE DETAILS OF THE BRAIN'S ROLE IN NORMAL INSULIN AND GLUCOSE CONTROL, DIABETES, AND THE COGNITIVE DEFICITS ASSOCIATED WITH THE DISEASE. BETTER TREATMENTS FOR PEOPLE WITH DIABETES ARE SURE TO FOLLOW.

DIABETES, THE BRAIN, AND COGNITION

Prick my finger, again. My blood sugar is too high, too low. Inject insulin, again. Will I be one of the many at risk for Alzheimer's disease? Will I gain more weight? These are just some of the worries that people with diabetes face on a daily basis. But thankfully, new brain research may soon benefit people with this chronic disease.

Scientists once thought the brain played little part in diabetes—a disease in which the body is unable to produce or use insulin from the pancreas, the organ that produces it. It was long believed that insulin was made exclusively by the pancreas and that the hormone's effects were limited to the body's peripheral tissues. These tissues respond to insulin by letting in blood sugar, or glucose—energy for the body's cells.

Now, new studies indicate that the brain has its own insulin receptors—proteins located on the surface of cells—and play a big role in normal glucose control.

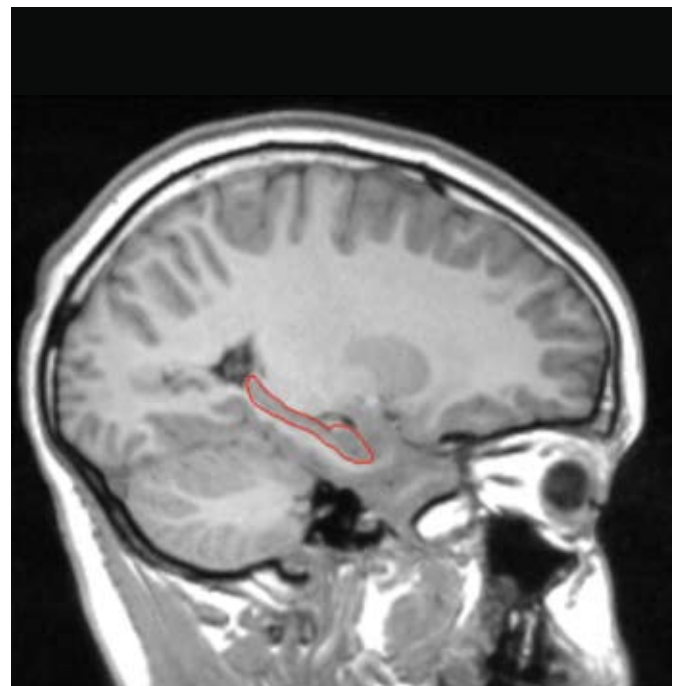
Diabetes can damage many parts of the body, leading to loss of vision and sensation, strokes, and heart disease. Nearly 73,000 Americans die from diabetes annually, making

it one of the top disease killers. Diabetes also is associated with impaired cognitive function and increased risk for dementia, including Alzheimer's disease.

Advanced knowledge of how the brain is involved in normal insulin and glucose control, and in diabetes, could lead to:

- Better understanding of the two types of diabetes: Type I and the more common Type II, which accounts for almost 95 percent of all diabetes cases in North America.
- Enhanced treatments for diabetes—even obesity and other metabolic disorders.

New research is helping to uncover the link between diabetes and Alzheimer's disease. When diabetes strikes and insulin's signal is ignored by cells, the brain may not get the large amount of glucose energy it needs, especially for memory. Loss of brain cells and memory function may result, especially in the hippocampus—a brain region involved in learning and memory. Increased insulin concentrations also appear to boost levels of beta-amyloid—a protein involved in the formation of senile plaques that can lead to Alzheimer's.



▲ THE BRAIN IMAGE ABOVE SHOWS THE HIPPOCAMPUS (OUTLINED IN RED), WHICH IS INVOLVED IN LEARNING AND MEMORY. NEW RESEARCH SUGGESTS THAT REPEATED EPISODES OF HIGH OR LOW BLOOD SUGAR IN PEOPLE WITH DIABETES MAY LEAD TO COGNITIVE IMPAIRMENTS ASSOCIATED WITH THIS STRUCTURE.

PUBLISHED WITH PERMISSION FROM HERSHEY, T., WASHINGTON UNIVERSITY SCHOOL OF MEDICINE, NEUROIMAGING LABORATORY, DEPARTMENT OF PSYCHIATRY.

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Scientists are only beginning to understand how general cognitive deficits occur, but new studies are providing some clues.

Insulin and related growth proteins in the brain are vital for cell survival, and both glucose and insulin appear to regulate many brain functions, including learning and memory. Dysfunction of these chemicals contributes to cognitive deficits. Chronic episodes of high or low levels of blood glucose may directly affect insulin's actions in the brain or damage brain cells, leading to cognitive impairments. Diabetes may be wreaking havoc especially in the hippocampus. The hypothalamus—a brain region that regulates metabolic processes and activities like hunger, thirst, and body temperature—also

appears to be involved, especially areas that respond to low blood sugar and regulate energy balance, body weight, and the sensitivity of the liver and muscles to insulin.

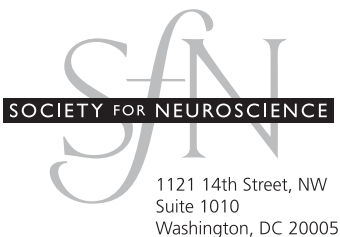
Current treatments for diabetes involve a healthful diet and exercise, pills that control glucose levels, or frequent injections of insulin, often accompanied by unwanted side effects, such as weight gain. But studying the role that the brain plays in diabetes and its treatment is giving hope for more effective medications.

Recently, scientists improved rats' reaction to insulin therapy twofold—thus reducing the need for insulin. By enhancing brain cell signaling involved in normal insulin response in the hypothalamus, scientists heightened insulin's abil-

ity to lower blood sugar in the treatment of diabetes.

In another study, researchers reduced the incidence of diabetes in mice by 80 percent by removing pain nerves that innervate the pancreas. Scientists discovered that these nerves played a role in regulating blood sugar control and were functioning abnormally in animal models of diabetes. Researchers also reversed diabetes by injecting the pancreas with a small protein secreted by these pain nerves.

Better and more efficient treatments will help combat diabetes and also decrease unwanted side effects. Research into the brain's role in diabetes and its treatment may be the key to helping people with diabetes worry about one less thing.



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