The twin epidemics of obesity and its cousin, diabetes, have been the target of numerous studies at Harvard and its affiliated hospitals and institutions. Among seminal findings was the first study to document the extraordinarily tight connection between the two diseases. Research done by Harvard School of Public Health showed that being even slightly overweight increased diabetes risk five times, and being seriously obese increased it 60 times

Harvard researchers are targeting obesity and its cousin, diabetes

When it comes to the nation's growing obesity and diabetes epidemics, the more we know, the more the evidence points to one conclusion: We've been set up.

Important findings about humanity's past, about how we live and eat today, and even about how we typically treat type 2 diabetes — with medications that themselves induce weight gain — are providing clues that explain how the past two decades could see an explosion in overweight and obese Americans and skyrocketing cases of type 2 diabetes, which is usually closely tied to the problem.

Harvard's extensive research on the subject weaves a story of ancient humans who were both extraordinarily active and able to easily gain weight in times of plenty. It illuminates how a modern diet rich in refined carbohydrates and heavy in red meat has preyed on Paleolithic instincts, creating an obese nation, a health crisis, and what one researcher describes as a hard-to-escape cycle of weight gain, insulin resistance, and weight-retaining diabetic medication, leading to more pounds.

Hundreds of other Harvard investigators in recent decades have produced a dizzying array of findings on obesity and diabetes. Even a casual look at the years of research on the subject shows a slew of results on how lifestyle affects weight and how weight affects health. It shows new genes discovered, laser surgery to save diabetics' eyesight, new diabetes drug candidates, and advances in using stem cells to replace the insulin-producing beta cells that diabetes destroys. Findings also illuminate humanity's active, running past, to help us understand the problem's roots.

They believe it now. Studies have shown that becoming overweight is a major risk factor in developing type 2 diabetes. Today, roughly 30 percent of overweight people have the disease, and 85 percent of diabetics are overweight. Diabetes cases have risen along with obesity. Not all diabetes cases are linked to weight. Genetics also comes into play. People with diabetic family members are at higher risk. For them, even five or six extra pounds can start a dangerous cycle leading to the disease.

Unlike in type 1 diabetes, where the body directly attacks insulin-producing cells, in type 2 the body's tissues gradually become less sensitive to insulin. This causes beta cells to work harder and eventually break down. Though not everyone with type 2 diabetes is overweight, it is type 2 — which accounts for roughly 90 percent of all diabetes cases — that has been linked to weight gain.

Both forms of the disease disrupt insulin flow. Cells have trouble getting the energy they need to function properly. Meanwhile, blood sugar rises. In untreated diabetes, high blood sugar can cause comas and death. Even when the disease is treated, poor sugar control can damage organs, causing complications. Less severe cases can be treated with medication, diet, and exercise, while more severe cases require insulin injections.

Diabetes is the nation's seventh-leading cause of death and a prime cause of kidney failure, blindness, nontraumatic limb amputations, heart disease, and stroke

Humans are born fat compared with other animals — 15 percent body fat compared with a chimp's 4 or 5 percent. Part of the reason body fat is so necessary, Lieberman said, is that our big brains use a lot of energy, 20 percent of our metabolism even when we're sleeping. In addition, human babies' extended helplessness made having a few extra pounds an advantage come lean times.

Our bodies, adapted to gain weight even on the lean diets of yesteryear, simply balloon amid today's plentiful, refined foods. Our ancient ancestors' diet was heavy on tubers, fruits, and vegetables, and lean meat from game animals.

Department of Nutrition, said that getting Americans' diet right can mean the difference between being healthy or ill. Studies have shown that not smoking, eating properly, and keeping a healthy weight — a body mass index of under 25 — reduces the risk of diabetes by 90 percent. Apart from lung cancer, there is no other disease that can be almost eliminated with simple lifestyle changes

In the years since that first paper linking weight and diabetes, studies by Harvard researchers have highlighted the ties between what and how much people put in their bodies and ailments such as diabetes, cancer, and heart disease. Research has shown that increased consumption of soda and fruit juice has closely paralleled the diabetes and obesity epidemics. It has found that even a little bit of moderate-intensity physical activity, such as walking 30 minutes a day, lowers the risk of type 2 diabetes by 30 percent. It has found that coffee lowers diabetes risk, that not all fats are bad, and that not all carbohydrates are good.

Recent studies have also linked red meat and diabetes, with processed meats such as hot dogs, sausages, and deli meats the riskiest, according to HSPH Professor Hu.

Across Harvard's campuses and affiliated institutions, scientists are applying cutting-edge techniques to the problem. Chad Cowan, assistant professor of stem cell and regenerative biology and co-leader of the Harvard Stem Cell Institute's (HSCI) diabetes program, is applying both genetic and stem cell-based approaches to type 2 diabetes.

Genetic studies of diabetes are incredibly complex, Cowan said. Initial studies often identify an active area rather than a single gene, requiring more work to discover what specific genes are doing. Researchers then have to figure out whether the genes are active in pancreatic beta cells, muscle cells, liver cells, or fat cells, which all play roles in the disease.

"That's been the very difficult next step, to get to the functional level," Cowan said. "That's where stem cells come in."

Cowan has taken advantage of stem cell technology to grow cells from both healthy and diabetic donors. His lab has created cell lines from different tissues that can be compared, genetically manipulated, and even used for chemical screenings to aid the search for new medicines.

Weight loss remains an important goal for type 2 diabetics. Studies have shown that losing just 7 percent of one's body weight can increase insulin sensitivity 57 percent. Under a research, a weight loss program has helped 450 people with type 2 diabetes to lose an average of 24 pounds and to keep most of it off three years later. It has improved their disease profile enough that 70 percent were able to reduce their medicine, and 21 percent of those taking insulin were able to stop. Annual total health care savings were calculated at $1,619 per patient, with $996 saved on diabetes-only care.

It takes a comprehensive approach, providing nutritional counseling to devise a healthy, low-calorie diet, an exercise program to burn calories, and counseling to help patients modify their behavior. Diet, of course, is just half the equation. Our ancient ancestors not only ate leaner whole foods, they also were extraordinarily active. The average hunter-gatherer walked or ran between 9 and 15 kilometers a day. When they were in one place, they worked to prepare food, climbed after fruit, dug for tubers, and the like. Can you imagine if everyone walked 9 to 15 kilometers a day? Would there be obesity today? Absolutely not