

A lighthouse costs less than shipwrecks.



Prevention costs less than disease.

## The National Insulin Resistance Council

A not-for-profit disease prevention organization

### Diabetes and Insulin Resistance

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For centuries, a diabetes diagnosis was a near certain death sentence. Tragic as it was ruthless, diabetes especially targeted children. Nearly all its victims contracted the disease, and died from it, before they turned 40. From the time of the Greeks, it was recognized that a diabetic suddenly ceased to have the ability to generate energy, no matter what food they might eat.

Such a person loses the vital ability to create insulin. Research has shown that he or she has become the victim of an auto-immune malfunction. Responding to a not yet fully understood genetic instruction, the body's own disease fighting tools attack and destroy the pancreas' beta cells, the source of insulin, as if they were an infection. This classical form of diabetes is known today as *type 1* or *insulin-dependent diabetes*. Patients, unable to make their own insulin, must have externally supplied insulin to live. One hundred percent genetically determined, the number of new type 1 diabetes cases has remained in lock-step with total population over time and now numbers about 115,000 a year in the US. Prior to the industrial revolution, this was the only form of diabetes though it has had different names over time. Many Americans still refer to it as juvenile diabetes.

In 1924, Frederick Banting, a young doctor working in Canada, was joined by an even younger Charles Best. Banting had a theory. Best had just completed undergraduate work and had not yet begun his medical studies, but was riveted by the opportunity to work with Banting and do so in the laboratories and with the guidance of the established researcher John MacLeod of the University of Toronto. They were joined by James Collip, an excellent biochemist. Together, Banting and Best, doing experiments on dogs, figured out where insulin was created. Using this new knowledge, they found insulin's source in cows. Then they extracted insulin from cows and gave it to diabetic dogs successfully. That sequence became the discovery of medical insulin. They proved the theory by providing insulin to a diabetic human, restoring his metabolic functions, if imperfectly. That discovery was worthy of the Nobel Prize in 1929 for Banting and MacLeod. Historians today agree that Best should have been named in the award, and to a lesser degree, so should have Collip.

If you are genetically programmed to get type 1 diabetes, you sadly will. Great strides in finding better ways of making and providing insulin have occurred since the 1920's. Recent marked successes in pancreatic transplants have resulted in actual cures for thousands of type 1 diabetics, a spectacular medical advance. There are also promising experiments with beta cell implants aimed at rebuilding a diabetic's natural insulin production. In less than a century, these medical advances completely changed the prognosis for such people. Type 1 diabetics can now live full, if imperfect lives. And, of course, there is active genetic research effort aimed at preventing the development of the disease altogether.

As dramatic as those medical developments have been, other forces altered the diabetes picture in even more seismic ways, but not for the better.

What used to be called adult-onset diabetes occurred before 1900 in such trivial numbers and was so limited to the elderly, that it was thought of more as a part of normal aging than as a disease. Compare that with now. Over 95% of all diabetics get *type 2 diabetes*, the *non-insulin dependent* form of the disease, and onset is occurring at ever younger ages. This number has grown so fast that the total death rate attributable to diabetes has grown *five times faster* than our total population between 1980 and 2000. About one of every five deaths in the US among people 25 and older is now directly attributable to diabetes, and it is implicated in many more, especially those from sudden heart failure.

The reason this form of the disease is called *non-insulin dependent diabetes* is that most type 2 diabetics continue to make their own insulin. In fact, they usually make too much of it because they have *insulin resistance*.

All diabetics endure the requirement to constantly and properly rebalance the glucose and insulin levels in their blood. When, what, how much, how quickly, and at what intervals they eat are one set of tools used in the balancing act. About 15% of type 2 diabetics control their disease with only those tools. Another 57% use medications that blunt the effects of excess insulin. Only 28% are insulin-dependent diabetics and must also determine when and how much insulin to inject. All diabetics must frequently check their blood glucose levels by testing to see that the balance is maintained. Too high a glucose level (*hyperglycemia*) can induce one form of diabetic shock. Too low a glucose level (*hypoglycemia*) can result in another form of diabetic shock.

Too much insulin creates its own host of toxic problems. Chronic ones are slowly destructive, leading to the most serious blood vessel failures that cause kidney and heart disease, blindness and amputations. One of them is *acute hyperinsulinemia*, insulin shock, which can kill. [Click [here](#) to see our **Insulin Resistance** background paper for more information on non-diabetic effects of excess insulin].

As any diabetes specialist will tell you, balancing insulin and glucose levels in many diabetic patients is not easy. Nearly all will have too much of glucose or insulin or both at times. And the effects are cumulative. That's why many diabetics, whether type 1 or 2, experience complications after they've had the disease a while. It is no coincidence that most, if not all of the possible complications involve vascular and nerve tissue damage.

The CDC's (<http://www.cdc.gov/diabetes/pubs/factsheet05.htm>) National Diabetes Fact Sheet for 2005 says that there are nearly 21 million diabetics in the US, over 9% of our total population aged 20 and over. Of those, about half are age 60 and over, or more than 20% of that age group. That would be bad enough if that latter group were not about to nearly double in size between now and 2025. There are an estimated 54 million more pre-diabetics (those who don't quite meet the criteria for the disease, but whose glucose levels are not quite normal either). For some demo-ethnic groups, the portion of their populations with the disease is 50% higher than in the general population.

Diabetes is the leading cause of blindness and end-stage kidney failure, and causes over eighty thousand lower-limb amputations a year. Two thirds of diabetics develop heart disease and a third suffers severe periodontal disease. All of these started with *insulin resistance* and involve the failure of blood vessels and nerve tissue.

You may be feeling lucky that you have a nine out of ten chance to not have *insulin resistance*. The problem is, stricken or not, we all pay for this situation, even though the sick pay more. Direct diabetes healthcare alone already costs over \$92 billion a year, and over \$120 billion when you include lost time, compensation and other indirect costs. Huge and rapidly growing Medicare, Medicaid and Social Security disability and survivor payment obligations, all funded by our taxes, should make even the healthiest and wealthiest among us cringe when we tie those costs to unabated increasing disease incidence.

Recall that for type 1 diabetics, no known behavior change can avert the genetically-programmed emergence of the disease. For *type 2 diabetes*, there is an important ray of hope. While *insulin resistance* is also genetically determined, its activation and impact is directly and heavily influenced by our behavior. Research has convincingly demonstrated that exercise and weight control directly affect the onset and severity of *type 2 diabetes*. Multiple studies have shown that aggressive weight management forestalls the onset of the disease by years, and in some cases altogether. In more than a few cases, the right behavioral changes can reverse the disease's progression. Note that 72% of type 2 diabetics do not take insulin.

It follows that the more we know about how our behavior does this, the more we can influence when and even whether we get diabetes. We should all strive for good health by exercising vigorously, eating properly, and being lean. Those are the very behavioral things we would need to do if we had symptoms of *metabolic syndrome* or *PCOS* and wanted to get rid of them. They are the very behavioral things *type 2 diabetics* must do. Most people don't know whether they are *insulin resistant*, but those who do have an imperative to tune up their lifestyles.

Anthropologists think that most humans who lived before about 1850 burned over 3000 calories a day. That compares with today's more typical 2000 calorie burn rate. Why this dramatic decrease? Lifestyle has changed more in the last 150 years than in all of previous history. A number of factors combined to cause this result. Instead of walking or running from place to place, we ride in cars, buses, trains, elevators and escalators. Instead of most of us working on family farms working the fields day after day, most of us live in cities and sit in swivel chairs all day. It stands in stark contrast that 15% of adult African-Americans have *type 2 diabetes*, while Africa's Masai tribes-people have none at all. Since the genetics are not nearly as different as the life-style, it must be the latter that accounts for these wildly different outcomes.

Meanwhile, just as our requirements have dropped dramatically, we've developed and depend on a cornucopia of preserved and processed food loaded with energy content. Before the industrial revolution, diet was dependent on what was fresh and in season. Sweeteners were a scarce and expensive condiment, hardly the near-food group that sugar is today. In fact, it is only in these last few hundred years that regular meals, let alone three of them, became daily events.

The math is not complex. Cut the required number of calories by a third by doing less physically, then add lots of extra ones in meals, snacks and drinks. That equals bulging waistlines, activated *insulin resistance* and all its consequences including diabetes at the prevalence levels none of us can afford.

The goal of the National Insulin Resistance Council (NIRC) is to *prevent* millions of non-infectious disease cases tied to *insulin resistance* including diabetes, heart failure, stroke and recently-linked Alzheimer's. It sponsors, operates, and collaborates with others on programs that lead to *early identification* of affected individuals and fosters targeted *active prevention* programs.