

<card: This program contains graphic images of people suffering from diabetes. Parental discretion is advised.>

Announcer: The following is a dLife television special presented with minimal commercial interruption.

<card: A dLife TV special The Story of Insulin>

<card: Jim Turner, Insulin user for 36 years>

Jim Turner: A 100 years ago, diabetes was a swift, brutal death sentence. Imagine, a fatal disease with no real treatment and a life expectancy of as little as three weeks upon diagnosis.

<card: Nicole Johnson Baker, Insulin user for 13 years>

Nicole Johnson Baker: The discovery of insulin is one of the greatest achievements in modern medicine and, without it, we wouldn't be alive.

Jim Turner: No, I, I remember my first shot of insulin. I was 17. I had felt horrible for months and when I went into the hospital, they gave me a shot of this mysterious something and an hour later I went up to the nurse and I said, "Whatever that was that you gave me, I want that."

Nichole Johnson Baker: The benefits for humanity have been immeasurable so, please, sit back and enjoy The Story of Insulin.

<Fade to black>

<music>

<card: Diabetes (di-a-'bE-tEz) from the Greek word meaning "a siphon">

Robert Rapaport, M.D.: Diabetes, as you know, has been around and known for about 2,500 years and yet insulin has been around for perhaps 100 years.

<card: An estimated 177 MILLION people worldwide suffer from diabetes>

Child: It's a disease where your pancreas dies and it doesn't make insulin any more.

<card: Approximately 50 MILLION people worldwide use insulin>

Bob Cleveland: There's no way of recovering from diabetes so I was very fortunate that insulin was discovered.

<shots of insulin in old bottles>

<card: The Story of Insulin>

<music>

<historic pictures of sick people>

Jim Turner Voice: For nearly 3,000 years, cultures around the world have tried to define diabetes. All sorts of names described the condition that left patients emaciated, unable to process food or drink.

<card: The sugar sickness, the pissing evile>

Jim Turner Voice: Regardless of name, diabetes held one reality: a certain early and painful death for the person afflicted.

<card: the melting down of flesh and limb into urine>

<card: Professor Michael Bliss, Author, The Discovery of Insulin>

Professor Michael Bliss: It was a pretty frightening and pretty clearly recognizable disease and it was also a disease that, until the 19th century, physicians could do nothing about.

<card: Robert Rapaport, M.D. Mount Sinai Hospital>

Robert Rapaport, M.D.: Put that in perspective. A disease that's been around for two, 3,000 years and yet most of what we know about both what diabetes it is and how we treat it has occurred over the past hundred years. So the advances over the past hundred years have been phenomenal.

<music - black and white film>

Jim Turner Voice: By the late 1800s, industrial progress offered countless improvements to the way people live but none of them changed the brutal realities for sufferers of diabetes. Medical researchers all over the world struggled just to define, let alone cure, this devastating disease.

<portrait of Oskar Minkowski>

<card: Oskar Minkowski (1858-1931) German pathologist>

Professor Michael Bliss: In 1889, Oskar Minkowski discovered that if you took the pancreas out of a dog, it instantly developed severe diabetes and, and quickly died.

Jim Turner Voice: Minkowski discovered that the pancreas has two functions: aid digestion and to produce the hormone that regulates blood sugar.

<shots of pancreas>

Professor Michael Bliss: The speculation was that there was maybe something being made in the Islets of Langerhans that was the mysterious something.

<old black and white film>

Jim Turner Voice: The mysterious something was insulin and, as the world moved faster, doctors around the globe raced to unlock its secret.

<shots of men in laid on film: Georg Zuelzer (1870-1949), German scientist; Israel Kleiner (1885-1966), American researcher; Nicolae Paulescu (1869-1931), Romanian Physiologist>

Jim Turner Voice: Each new discovery was a small step that other researchers could build upon. But, despite this progress, little changed in diabetic treatment.

<newspaper clippings and headlines>

Jim Turner Voice: By the dawn of the 20th century, doctors were still prescribing all sorts of diets to keep people with diabetes alive.

Professor Michael Bliss: Gradually, it was realized that the, the key to dieting for diabetes was simply total calorie control and that, if you couldn't burn up uh... normal amounts of food, you should only be given as much food as you could burn up.

<photograph of: Frederick Allen (1869-1964), American physician>

Jim Turner Voice: And, according to the leading diet therapist at the time, Dr. Frederick Allen, if you had diabetes, you could only burn up 800 to 1,000 calories a day for six days and even less on the seventh.

Professor Michael Bliss: Dr. Allen talked about it as an under-nutrition approach. The patients talked about it as starvation.

<shots of bone-thin people>

Professor Michael Bliss: Very few patients were able to stay alive an extra year or two, buying time, desperately hoping that before you starve to death, something better will turn up.

<old black and white war films>

Jim Turner Voice: When World War I arrived in 1914, it consumed all available resources. There was no money left for the medical researchers racing to find an effective treatment. And patients continued to waste away.

<shots of starving patients>

Professor Michael Bliss: Allen and the other doctors had said to the patients, hold on, hold out as long as you can because, as long as you're alive, there's hope.

Jim Turner Voice: There was no treatment in sight and diabetes continued to ravage its victims, sometimes striking even the most privileged of people.

<shot of Elizabeth Hughes and then Charles Evans Hughes>

Professor Michael Bliss: Little Elizabeth Hughes became diabetic in 1918. Her father, Charles Evans Hughes, was a great figure in American political history. He ran for the presidency. He served as chief justice, so the Hughes are right at the top of American society.

Jim Turner Voice: But whatever the family stature, Elizabeth's parents had a daughter with diabetes. They brought her to Dr. Allen, who immediately put her on his famous diet.

Professor Michael Bliss: She started dieting about early 1919. She was 12 years old, weighed 75 pounds. By late winter of 1921, her weight was in the low 50 pounds and, for weeks on end, she would be held to 350 to 400 calories a day.

<pictures of Elizabeth before and after>

<Letter from Elizabeth to her mother, Bermuda, 1920>

Female voice: I'm quite sure that's everything. My diet is going beautifully, as usual, and the way things look now, I'm sure Dr. Allen, when he does see me, will have a good report to make. I'm gaining in strength, too...

Professor Michael Bliss: Elizabeth Hughes became the prize case, a well-disciplined little girl who followed her diet uh... absolutely to the letter except once. At Thanksgiving, she snitched a piece of turkey skin and was caught and balled out and never did it again.

<shots from the war>

Jim Turner Voice: Nobody would have guessed that Elizabeth's strength and spirit would keep her alive through the end of the war but it did. Now she and countless other diabetes sufferers prayed for a medical miracle to emerge.

Professor Michael Bliss: In the summer, I believe, of 1921, she resolved that she would not lose the ability to walk, no matter how weak and thin she got.

<Letter from Elizabeth to her mother, Bermuda, 1920>

Female voice: My muscles are very weak but I practice steps and take exercise every day to help that now and, as I...

Professor Michael Bliss: At the end of 1921, she was still able to walk, even though, by this time, she was little more than a living human skeleton.

Jim Turner Voice: At the same time, a Canadian surgeon named Fred Banting was returning from the war.

<shots of Fred Banting>

Jim Turner Voice: He was 30 years old, broke, had never even treated anyone with diabetes, but a strong will, big dreams and destiny would intertwine he and Elizabeth, forever changing the course of modern medicine.

<shots of Fred Banting and Elizabeth Hughes>

<Fade to black>

<card: This program contains graphic images of people suffering from diabetes. Parental discretion is advised.>

<shot of old insulin bottle>

Jim Turner Voice: A chain of events quickly unfolded in the fall of 1920 that led to what has been described as one of the greatest medical advances since penicillin.

<picture of Fred Banting, (1891-1941), Canadian physician>

Jim Turner Voice: Fred Banting, an unknown former frontline surgeon, struggling to make ends meet, stumbled across an article. This tiny event triggered a monumental discovery.

Professor Michael Bliss: He reads an article by Moses Barron and, on the night of October 31st, 1920, Banting jots down in his notebook a little idea for research on diabetes.

<shot of Banting's notes>

Male voice: Ligate pancreatic ducts of dog. Keep dogs alive till acini degenerate, leaving islets...

Jim Turner Voice: It seemed like such a crazy idea that even Banting doubted its potential success. He wanted to remove the pancreas from hundreds of laboratory dogs to isolate the cells that produce insulin. From these extracts, he would then produce pure insulin to regulate the blood sugar of human patients. To make his idea work, he returned to his alma mater, the University of Toronto, where he met with world-renowned physiologist, J. J. R. Macleod.

<photos of Macleod and Banting>

Professor Michael Bliss: From their very first meeting, Banting and Macleod were not particularly copasetic. Uh... Macleod was a senior professor articulate, very learned. Banting was a young guy who knew almost nothing about what he was trying to talk about.

Jim Turner Voice: But Banting was a dreamer with just enough salesmanship to win over the academic.

<photo of J. J. R. Macleod (1876-1935), Scottish physiologist>

Professor Michael Bliss: Macleod was favorable enough that he said, "Well, if you wanna come back at the end of the year, I might be able to give you some help." He said to his two graduate students, "Well, you guys help Banting out. He needs all the help he can get."

<card: Professor Michael Bliss, University of Toronto>

Professor Michael Bliss: Uh... and the two graduate students tossed a coin to see who would work first with Banting. Charles Best won the coin toss and nobody knows the name of the guy who lost. <laughs>

<photos of Charles Best (1899-1978), Canadian physiologist>

Professor Michael Bliss: Best was a 21-year-old science graduate. He was not in medicine. He was a bright guy and ambitious and looked forward to working with Banting on this s-strange idea.

<shot of laboratory>

Jim Turner Voice: The conditions were inadequate: a single lab and only a handful of dogs to work with. Still, in the middle of 1921, Banting and Best went to work on their laboratory dogs. Banting thought that, by surgically cutting off the digestive function of the pancreas, it would cease to produce digestive enzymes. It might produce pure insulin.

<shots of Banting and Best and paraphernalia>

Jim Turner Voice: The work was promising but there was a problem: They were quickly running out of dogs and if they ran out of dogs, the research stopped.

Professor Michael Bliss: Fred Banting was a stubborn, determined person who had risked everything on one idea. He had given up his practice, he was out of money. In a way, he just gambled everything.

<photographs of Banting>

Jim Turner Voice: Banting and Best were so desperate for more animals that they resorted to catching stray dogs on the street. This makeshift solution kept the research going long enough for Banting to conceive of a better plan.

Professor Michael Bliss: Banting made a big breakthrough when he discovered that his original idea was wrong in the sense that he could dispense with all of this stuff about ligating ducts and letting the pancreas atrophy. He just went to the slaughterhouse and he got fresh uh... beef or pork pancreas and it turned out that it worked just as well. The trouble was that it was maddeningly inconsistent. You'd give an extract and the blood sugar would go down and then you'd give another extract and nothing would happen.

Jim Turner Voice: Despite their differences, Banting wrote Macleod.

<shot of letter>

Male voice: The number of problems that are presenting themselves is becoming greater and greater. Some of them I would wish to present for your approval. (1) The securing of the most active and concentrated form of the substance which Best and I call Isletin...

Professor Michael Bliss: By Christmas of 1921, their results were so inconsistent that Banting thought they had to have help, so did Macleod.

Jim Turner Voice: The challenge was getting the alcohol level in the extract just right so that it was both pure enough and nontoxic for human consumption.

Professor Michael Bliss: They brought a fourth member of the research team on board, a man named James B. Collip, who had a Ph.D. in biochemistry and had a lot of expertise at working with extracts of tissue.

<shot of James Collip (1892-1965), Canadian biochemist>

Jim Turner Voice: Collip, though intrigued by Banting's work, was hired by Macleod, who set him up in a separate laboratory, and instructed him not to share his results with

Banting or Best. So the race was to see which lab would be the first to refine the extract enough for use in human trials.

Professor Michael Bliss: The patient chosen to first get the pancreatic extract was a 14-year-old boy named Leonard Thompson. He was reduced to 65 pounds from his diabetes and was within a few weeks of death.

<shot of Leonard Thompson - very thin>

Professor Michael Bliss: On January the 11th, 1922, the clinicians in Toronto General Hospital injected Leonard Thompson with a pancreatic extract made by Banting and Best. Great milestone in history? Well, no, because that first test failed.

<shot of Banting and Best>

Professor Michael Bliss: Twelve days later, on January 23rd, 1922, they resumed administration of extract on Leonard Thompson and, this time, they got spectacular success.

Jim Turner Voice: Leonard Thompson flourished with Collip's extract.

<photo of Leonard Thompson after insulin injections>

Jim Turner Voice: The chemist had determined exactly the right amount of alcohol to purify Banting's elixir.

Professor Michael Bliss: The key breakthrough was Collip's ability to purify Banting and Best's crude extract.

Jim Turner Voice: The early patients were a lucky few and, after surviving three years on a starvation diet that nearly killed her, Elizabeth Hughes was one of them.

Professor Michael Bliss: Fred Banting examined 15-year-old Elizabeth Hughes on August 16th, 1922. She was five feet tall, she weighed 45 pounds and was clearly within a day or two of death from the starvation. He began giving her insulin and we have an amazing record with wonderful letters of Elizabeth coming back to life.

<shots of letters>

Jim Turner Voice: In 1923, Fred Banting and J. J. R. Macleod were jointly awarded the Nobel Prize for medicine.

<shot of award and newspaper articles>

Jim Turner Voice: While only two names appeared on the award, one presenter at the ceremony stated that, "In the discovery of insulin, there is glory enough for all."

Professor Michael Bliss: As a result of this collaboration of four people who didn't like each other and who occasionally literally fought each other, nonetheless, within 18 months, this team gave the world an effective treatment for diabetes.

<shots of newspaper articles>

Jim Turner Voice: News soon spread about the remarkable results that Elizabeth Hughes and others had achieved but the remaining masses still suffering from diabetes would wait until someone learned to mass produce the miracle drug. They waited with their lives hanging in the balance.

<music>

<Shot of very ill thin patient>

<Fade to black>

<card: Jim Turner>

Jim Turner: In the final days of 1921, Frederick Banting and his team learned to synthesize insulin in a laboratory in Toronto. The discovery was soon proclaimed as a miracle cure for diabetes but that turned out to be not quite right. It was certainly a spectacular conquest but it wasn't a cure. It was really just the starting point for the remarkable work of curing thousands of people all over the world.

<card: Nichole Johnson Baker>

Nichole Johnson Baker: The challenge was to improve the discovery, purify it, mass produce it and then distribute it to everyone who needed it, many just barely clinging to life. Our story resumes with those challenges.

<Fade to black>

<music>

<shot of building then before and after shots of patients>

Jim Turner Voice: By the winter of 1922, Banting's team was hand making small batches of the miracle hormone and administering it to their patients. The success stories were remarkable, but the Toronto team could barely keep up with the small number of patients in clinical trials. What was worse were the countless people worldwide clamoring for a chance to get relief from the starvation diets that had kept them alive just long enough to see the great discovery. If they couldn't find a bigger supply of insulin, the patients who had survived and those who had tasted the promise of insulin would simply waste away and die.

<card: Professor Michael Bliss, Author, The Discovery of Insulin>

Professor Michael Bliss: In the early days, you got all the chilled beef or pork pancreas that you could and then you ground it up and you began the extraction process. The real problem was how to get-- to, to go from a soup of ground up pancreas to pure, crystal pure insulin.

Jim Turner Voice: The Toronto team was overwhelmed. They needed more money, better facilities and, most importantly, time to figure out the complex chemical work, but time was not something they had on their side. They were running out of insulin and with limited patient data, a short supply of hormone and no means to mass produce, there seemed an insurmountable gap between healing a single patient and mass producing the miracle hormone.

<shot of George Clowes, Research Director, Eli Lilly & Co.>

Professor Michael Bliss: The one person who was really enthusiastic was a man named George Clowes, who happened to be the research director for Eli Lilly & Co of

Indianapolis. Clowes said to Macleod and Banting, "Gee, this looks good. We'd like to collaborate with you in developing it."

<shots of relevant places such as production of insulin, horse-drawn cart of insulin, et cetera>

Jim Turner Voice: The Canadians initially declined, hoping to resolve production problems on their own but then disaster. The insulin was gone. Fred Banting went back to Eli Lilly and the large American drug company agreed to take on the challenge of mass producing the hormone for distribution in North America. The results were astounding, changing the lives of people with diabetes forever.

<shot of Augusta Krogh (1874-1949), Danish Physiologist, and Marie Krogh>

Jim Turner Voice: Meanwhile, Danish scientist Augusta Krogh traveled to Toronto with a personal interest: His wife, Marie, had been diagnosed with diabetes and Krogh knew that her only hope for survival was the availability of insulin in their home country. He went to Toronto to ask permission to mass produce it, and when the answer was yes, he went back to Denmark to start what eventually became Novo Nordisk.

Professor Michael Bliss: So the two big insulin producers, in fact, have their roots back in 1922. Lilly because of an enterprising research director, Novo Nordisk because August Krogh's wife had become diabetic and he wanted to know how to make insulin so he could save his wife's life.

Jim Turner Voice: Marie Krogh survived and, when insulin hit the commercial market in late 1923, millions of patients around the world saw a renewed chance at life. Every story was different, but Bob Cleveland is certainly representative of those early recipients.

<old photo of Cleveland children as youngsters>

Announcer: He was five years old, living in Syracuse, New York, when he was diagnosed with diabetes.

Bob Cleveland: I remember my mother said I was skin and bones when I did go to the hospital.

Jim Turner Voice: Bob learned young that, even with insulin, treatment for diabetes required rigid management. He was lucky enough to have a mother up to the challenge.

<card: Bob Cleveland, insulin user for 80 years>

Bob Cleveland: Occasionally, she'd have to buy a loaf of sliced bread, a slice of that bread would weigh maybe 30 grams so she'd have to cut a piece of it off or cut the crust off so that I only had 20 grams.

Jim Turner Voice: A few years later, Bob's older brother, Gerald, was also diagnosed with diabetes.

<card: Gerald Cleveland, insulin user for 73 years>

Gerald Cleveland: When I was diagnosed, I felt that uh... the world kinda dumped in on me and uh... I was uh.. going to have a different kind of life.

Jim Turner Voice: And with two boys suffering from diabetes, administering insulin required a brutal routine.

Bob Cleveland: It was morning, noon and dinnertime, my mother would give it to me in my legs and then, after they got out of commission because of so many shots, uh... I had it in my uh... arms.

Gerald Cleveland: We had needles that had to be sharpened with a wet stone and boiled up after every use.

Announcer: Testing sugar levels also required an extreme effort by today's standards. There were no quick blood tests or easy home kits. Readings required boiling urine samples in a test tube with chemicals multiple times each day. But it wasn't just the mechanics that made living with the disease so difficult. Life expectancies weren't measured in weeks any more, they were up to more than 30 years. For the first time ever, people were living on insulin with diabetes. They, and the people around them, were facing a lot of new challenges.

<Photos and video of insulin users.>

Gerald Cleveland: I didn't like to be separated out from the normal group and uh... so I would say very little about it and uh... keep it quiet as much as I could.

<Old photo of Bob Cleveland and his wife.>

Bob Cleveland: We dated for about six months before she found out that I was a diabetic and I was actually afraid to tell her because I knew she was the one I wanted and I was afraid she'd back off and-- just like employers did when they found out. That was it.

Jim Turner Voice: The brothers continued to manage their diabetes. Over the next five decades, technology created dramatic changes in the way they and everyone else around them lived. But surprisingly little changed in the treatment of diabetes.

<Video of insulin production.>

Professor Michael Bliss: Really no breakthroughs in insulin productions. Very frustrating for everybody. Until, in the early 1980s, when Lilly introduced Humulin, we entered a new era.

Jim Turner Voice: Scientists figured out how to inject insulin genes into self-replicating cells through DNA recombinant therapy. It was an extraordinary moment. Finally, an endless supply of pure, human insulin, no longer dependent on animal extraction.

<More video of insulin production.>

Jim Turner Voice: DNA technology has unleashed a whole new wave of developments, long-lasting, short-acting, better, more efficient insulins are available today. Home testing devices have gone a long way to give patients more control over their own management and delivery systems have dramatically improved. Thinner needles, disposable syringes, pens, pumps. But the power of the insulin story is most evident in the children whose lives it saved. Elizabeth Hughes lived until 1982 and became a wife, mother and grandmother.

<Photo of Banting and video of Bob and Gerald Cleveland walking on sidewalk.>

Jim Turner Voice: Some 85 years after Fred Banting conceived of a crazy idea, Bob and Gerald Cleveland still walk the streets of their Syracuse neighborhood. And, after surviving for nearly 80 years on insulin, they stand as shining examples of the power of this discovery and the millions of lives it has saved.

Man: I've been on insulin for 35 years.

Man: 26 years.

Man: 13 years now.

Woman: 12 and a half years.

Woman: Eight years.

Child: About a year and a half.

Child: A year and two weeks.

<collage of people who take insulin>

Robert Rapaport, M.D.: To think of a condition that, prior to the discovery of insulin, was completely untreatable, that patients died because of the lack of being able to receive insulin, is inconceivable today.

<more people in a collage>

Teen: My insulin is like my best friend.

<and yet more>

Man: Ah, it's a love/hate relationship. <laughs>

<and more faces>

Man: The reality is, when I, when I take the insulin, I'm not different any more and this is what insulin allows me to do. It allows me, as a type II diabetic, to be normal.

<more people>

Man: Insulin technically is the chemical that allows your body to, to use what you're, you're eating for energy but uhm... without insulin, you couldn't survive.

<more faces>

Man: It's a stage in the development of treating diabetes. It's not the final stage. It's not the first stage but it's where we are.

<many faces>

Jim Turner Voice: We'll be right back.

<Fade to black>

Jim Turner: A special thanks to Eli Lilly, Nova Nordisk and Santa Fe Adventists for making this special program available to all people with diabetes.

<Fade to black>

<card: dLife TV is produced by LifeMed Media and does not represent the views or opinions of CNBC, Inc.>

<credits>

End of Episode 126