

Primary Sources

Interviews

Hughes, Elizabeth. Interview conducted by Dr. Michael Bliss. November 22, 1980.

The transcript of this interview, which Dr. Bliss shared with me, provided me with some amazing quotes from Elizabeth Hughes. Elizabeth was one of the first people to receive insulin from Frederick Banting. She was three days short of fifteen when she had her first injection in Toronto. She had been on the starvation diet for three years and was near the end of her life. Once she started receiving insulin she exchanged a nightmarish life with a normal one. These quotes convey how radical this change in her life would have seemed to her. Although my project focuses on Elizabeth Hughes, she just represents all the other people with diabetes who rely on insulin to stay alive. Each time someone is diagnosed with diabetes they encounter insulin and exchange premature death with a normal life.

Photographs

“Alexander Fleming.” Encyclopedia Britannica.

<http://www.britannica.com/biography/Alexander-Fleming>. March 31, 2016.

This photograph shows Alexander Fleming, the discoverer of penicillin, looking intently at a petri dish. I used this photo to add historical context.

“Banting’s and Best’s laboratory, where insulin was discovered.” University of Toronto Archives.

http://archives.library.utoronto.ca/dbtw-wpd/exec/dbtwpub.dll?AC=GET_RECORD&XC=/dbtw-wpd/exec/dbtwpub.dll&BU=http%3A%2F%2Farchives.library.utoronto.ca%2Fdbtw-wpd%2Ftextbase%2F175image%2F&TN=175image&SN=AUTO19534&SE=1480&RN=1&MR=10&TR=0&TX=1000&ES=0&CS=1&XP=&RF=175report&EF=&DF=175expanded&RL=0&EL=0&DL=0&NP=3&ID=&MF=&MQ=&TI=0&DT=&ST=0&IR=29&NR=0&NB=0&SV=0&BG=&FG=&QS=&OEX=ISO-8859-1&OEH=ISO-8859-1. January 15, 2016.

This is the laboratory at the University of Toronto, Canada, where Frederick Banting and Charles Best discovered insulin. I used this image to show what the place looked like so people could picture it better.

“Banting’s Handwritten Paper.” October 30, 1920. Canadian Diabetes Association.
<http://www.diabetes.ca/about-cda/banting-house/the-birth-of-an-idea>. January 12, 2016.

This is Banting’s handwritten idea in his notebook that he wrote at 2am on October 31, 1920. He thought he had devised a way to isolate the “internal secretion” of the pancreas that we now call insulin.

“Bottle of insulin with beige label printed in black and red rubber stopper.” 1923.
University of Toronto.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=B10001&Page=0001&size=1&query=Bottle%20of%20insulin%20with%20beige%20label%20printed%20in%20black%20and%20red%20rubber%20stopper&browsertype=title&startrow=1&transcript=off&highlight=yes#bibrecord>. January 27, 2016.

This image shows a bottle of early insulin produced in Toronto in 1923 by Connaught Laboratories.

“Chart for Elizabeth Hughes.” August 19, 1922. University of Toronto.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=M10011&Page=0001&size=1&query=Chart%20for%20Elizabeth%20Hughes&browsertype=title&startrow=1&transcript=off&highlight=yes#bibrecord>. January 29, 2016.

This is one of Elizabeth’s medical charts where she wrote down what she ate and how much insulin she took. I used this image to show that lots of record keeping was still involved.

“Citation to F. G. Banting and J. J. R. Macleod accompanying the Nobel Prize.”

<http://heritage.utoronto.ca/fedora/repository/default%3A11579>. January 23, 2016.

This is the written citation that Banting and Macleod received along with the Nobel Prize. It has the signatures of twenty-one members of the Nobel Prize Committee. This demonstrates that the discovery was significant enough to be awarded the Nobel Prize.

“The daughter of the chief justice on her honeymoon: Mr. and Mrs. W. T. Gossett.”
January 1930. University of Toronto.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10051&Page=0001&size=1&query=banting%20AND%20hughes&searchtype=fulltext&searchstrategy=all&startrow=1>

&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. March 7, 2016.

This photograph shows Elizabeth on her honeymoon. It shows that she is able to bike, which is something she wouldn't have even dreamed about before she started receiving insulin.

"Daughter of U. S. Secretary of State tries new Toronto discovery." August 17, 1922. *Toronto Daily Star*.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10033&Page=0001&size=1&query=banting%20AND%20hughes&searchtype=fulltext&searchstrategy=all&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. March 7, 2016.

This photograph has pictures of Elizabeth, her mother, and Banting.

"Dr. Banting." November 4, 1923. *New York Herald*.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10080&Page=0001&size=1&query=banting%20AND%20nobel%20AND%20prize&searchtype=fulltext&searchstrategy=All&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. April 7, 2016.

This photo shows Banting walking down a street in London, Ontario after announcing his discovery.

"Elmer V. McCollum." Medical Archives.

<http://www.medicalarchives.jhmi.edu/papers/mccollum.html>. April 1, 2016.

This is a photograph of Elmer McCollum, who isolated Vitamin A in 1912 and Vitamin D in 1922. I used this photo to add historical context.

"Formal photograph of Leonard Thompson." University of Toronto.

<http://heritage.utoronto.ca/fedora/repository/default%3A11864>. January 30, 2016.

Leonard Thompson was the first person to receive insulin via injection. He had been diagnosed with diabetes in 1919. He was fourteen when he started using insulin in 1922, and he lived on it for thirteen years until he died in 1935 at the age of twenty-seven. He died from bronchopneumonia and complications from diabetes.

“Frederick G. Banting.” 1923. Nobel Foundation.
http://www.nobelprize.org/nobel_prizes/medicine/laureates/1923/banting-bio.html.
January 7, 2016.

This is a picture of Banting as a young man.

“Frederick Grant Banting and Charles H. Best.” 1921. University of Toronto Archives.
http://archives.library.utoronto.ca/dbtw-wpd/exec/dbtwpub.dll?AC=GET_RECORD&XC=/dbtw-wpd/exec/dbtwpub.dll&BU=http%3A%2F%2Farchives.library.utoronto.ca%2Fdbtw-wpd%2Ftextbase%2F175image%2F&TN=175image&SN=AUTO16953&SE=1327&RN=6&MR=10&TR=0&TX=1000&ES=0&CS=1&XP=&RF=175report&EF=&DF=175expanded&RL=0&EL=0&DL=0&NP=3&ID=&MF=&MQ=&TI=0&DT=&ST=0&IR=38&NR=0&NB=0&SV=0&BG=&FG=&QS=&OEX=ISO-8859-1&OEH=ISO-8859-1. January 12, 2016.

Dogs were used in Banting and Best’s early research. This is a picture of Banting and Best with one of the dogs.

“Graduation Photograph of Charles Best 1921.” 1921. University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11829>. January 7, 2016.

This photograph of Charles Best, a biochemistry student, was taken at his graduation. Banting and Best started their research shortly after Best graduated.

“John James Rickard Macleod.” 1925. University of Toronto Archives.
http://archives.library.utoronto.ca/dbtw-wpd/exec/dbtwpub.dll?AC=GET_RECORD&XC=/dbtw-wpd/exec/dbtwpub.dll&BU=http%3A%2F%2Farchives.library.utoronto.ca%2Fdbtw-wpd%2Ftextbase%2F175image%2F&TN=175image&SN=AUTO10835&SE=1505&RN=0&MR=10&TR=0&TX=1000&ES=0&CS=1&XP=&RF=175report&EF=&DF=175expanded&RL=0&EL=0&DL=0&NP=3&ID=&MF=&MQ=&TI=0&DT=&ST=0&IR=217&NR=0&NB=0&SV=0&BG=&FG=&QS=&OEX=ISO-8859-1&OEH=ISO-8859-1. January 27, 2016.

J. J. Macleod was the head of the laboratory where Banting and Best performed their research. Macleod, an expert on diabetes, was a professor of physiology at the University of Toronto. He did not perform the research himself but took on more of a mentoring role.

“Jonas Salk.” The Jonas Salk Legacy Foundation.
<http://www.jonassalklegacyfoundation.org/jonassalk.html>. April 1, 2016.

This is a photograph of Jonas Salk, who discovered the polio vaccine in 1953. I included this photo to add historical context.

“Nobel Prize medal inscribed to F. G. Banting.” 1923. University of Toronto.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=A10012&Page=0001&size=1&query=banting%20AND%20nobel%20AND%20prize&searchtype=fulltext&searchstrategy=All&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. April 7, 2016.

This is the Nobel Prize medal that Banting received along with the cash prize. I used this image to show how important the discovery of insulin is.

“Note card recording the first clinical use of extract.” December 20-21, 1921. University of Toronto.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=W10011&Page=0001&size=1&query=Note%20card%20recording%20the%20first%20clinical%20use%20of%20extract&browsetype=title&startrow=1&transcript=off&highlight=yes#bibrecord>. January 29, 2016.

This is Banting’s note of the first test of insulin on a person with diabetes, Dr. Joe Gilchrist. At that point insulin was not approved for injection into humans, so Banting gave his friend, Gilchrist, insulin orally. Banting knew that this extract was potent, and he was surprised and disappointed that it did not help Gilchrist. This test was very important because it showed that insulin could not be taken by mouth.

“Notes on first examination of Elizabeth Hughes.” August 16, 1922. University of Toronto.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=W10006&Page=0001&size=0&query=Notes%20on%20first%20examination%20of%20Elizabeth%20Hughes&browsetype=title&startrow=1&transcript=off&highlight=yes>. January 29, 2016.

These are Banting’s handwritten notes on the first examination of Elizabeth Hughes. Banting commented on Elizabeth’s dry, scaly skin and her brittle hair.

“One of the early patients before and after insulin therapy.” Diabetes in India.

http://www.diabetesindia.com/diabetes/diabetes_insulin5.htm. January 12, 2016.

This picture shows a girl with diabetes before and after treatment with insulin. She is skin and bones before, and after looks like a normal, healthy girl. I used this image to demonstrate the dramatic change in people after receiving insulin.

“Photograph of Banting with dog.” April 1922. University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11792>. January 23, 2016.

This photograph shows Banting petting one of the experiment dogs.

“Photograph of Banting performing surgery on a dog.” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11757>. January 23, 2016.

Banting is performing surgery on a dog in this picture. It gives an idea of what the surgery would have looked like to an observer.

“Photograph of the Charles Evans Hughes Family.” 1916. University of Toronto.
<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=P10026&Page=0001&size=1&query=Photograph%20of%20the%20Charles%20Evans%20Hughes%20family%20%201916&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 18, 2016.

This is a photograph of Elizabeth’s family. She had three older siblings: Charlie, Helen, and Catherine.

“Photograph of C. H. Best.” 1928. University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11821>. January 23, 2016.

This photo shows Charles Best several years after the discovery of insulin. I used this photo as part of a slideshow on the Discoverers of Insulin page. Best went on to be a biochemist.

“Photograph of C. H. Best and F. G. Banting. 1924. University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11761>. January 23, 2016.

This photo shows Banting and Best sitting together in a study. It was taken a couple years after they discovered insulin.

“Photograph of Dr. Joseph Gilchrist.” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11845>. January 23, 2016.

Dr. Joe Gilchrist was the first person to receive insulin, but it had no effect because it was taken orally; the stomach's digestive juices destroyed it. Gilchrist was later put on insulin injections. Gilchrist was in the same medical class as Banting. He was diagnosed with diabetes in 1917. The batches of insulin were tested on him after they were tested on rabbits.

"Photograph of Elizabeth Hughes with her mother 1918." 1918. University of Toronto. <http://heritage.utoronto.ca/fedora/repository/default%3A11870>. January 7, 2016.

Elizabeth Hughes was one of the first to be treated with insulin. She is with her mother, Antoinette Hughes.

"Photograph of Elizabeth Hughes ca. 1923." 1923. University of Toronto. <http://heritage.utoronto.ca/fedora/repository/default%3A11855>. January 23, 2016.

This is a photograph of Elizabeth Hughes a year after receiving insulin. She looks like a normal, healthy girl. I used this picture on my Encounter page to contrast with Banting's description of her before being put on insulin.

"Photograph of Elizabeth Hughes." December 22, 1930. University of Toronto. <http://heritage.utoronto.ca/fedora/repository/default%3A11832>. January 23, 2016.

This is a picture of Elizabeth when she was in her twenties. Before she started receiving insulin it was not expected that she would live that long. She still looks very healthy, not at all like the dying girl she was years before.

"Photograph of Elliott P. Joslin." University of Toronto. <http://heritage.utoronto.ca/fedora/repository/default%3A11748>. January 23, 2016.

Dr. Elliott Joslin of Boston, Massachusetts, was one of the most famous experts on diabetes before insulin was developed. He ran a clinic for people with diabetes, treating them with Allen's starvation diet.

"Photograph of F. B. Allen." University of Toronto. <http://heritage.utoronto.ca/fedora/repository/default%3A11835>. January 23, 2016.

Dr. Frederick Allen developed the starvation diet that allowed people with diabetes to live for a few years beyond diagnosis. He ran a place called the

Psychiatric Institute where people with diabetes could live and be treated. He was known for being very stern.

“Photograph of F. G. Banting holding a rabbit.” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11777>. January 23, 2016.

This photograph shows Banting holding a black lab rabbit. After James Collip, a biochemist, joined the team, the batches of new insulin were tested on rabbits.

“Photograph of F. G. Banting with white dog.” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11803>. April 7, 2016.

This is a photo of Banting in his laboratory with one of the research dogs.

“Photograph of F. G. Banting as a young man.” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11881>. January 15, 2016.

This is a photograph of Banting as a young man.

“Photograph of J. B. Collip as a graduate student.” 1914. University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11818>. January 27, 2016.

This photo shows Collip dressed in a white lab coat in a laboratory.

“Photograph of J. B. Collip ca. 1920.” 1920. University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11752>. January 7, 2016.

This is a photo of James Collip in 1920. His main contribution was to purify the extract for use on humans.

“Photograph of J. J. R. Macleod in academic robes ca. 1923” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11876>. March 24, 2016.

This photograph shows Macleod a year after the discovery of insulin.

“Photograph of pancreas of dog 28.” University of Toronto.
<http://heritage.utoronto.ca/fedora/repository/default%3A11783>. January 27, 2016.

This is the removed pancreas of dog 28. The pancreas weighed 15.5 kilograms according to the paper it is on. Pancreases like this were ground up and made into insulin.

“To Prepare Insulin.” 1922. University of Toronto.

[http://link.library.utoronto.ca/insulin/digobject.cfm?idno=W10001&Page=0001&size=0&query=To%20prepare%20insulin.%20Collip%20process%20Dec.%2022/21%20\[ie%201922\]&browsetype=title&startrow=1&transcript=off&highlight=yes](http://link.library.utoronto.ca/insulin/digobject.cfm?idno=W10001&Page=0001&size=0&query=To%20prepare%20insulin.%20Collip%20process%20Dec.%2022/21%20[ie%201922]&browsetype=title&startrow=1&transcript=off&highlight=yes). February 3, 2016.

This is a sheet of notebook paper on which is written Collip’s method of purifying insulin.

Articles

“Codein and Diabetes.” *The Honolulu Star-Bulletin*. October 8, 1913.

<http://chroniclingamerica.loc.gov/lccn/sn82014682/1913-10-06/ed-2/seq-8/#date1=1836&index=9&rows=20&words=diabetes+DIABETES+Diabetic&searchType=basic&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. December 17, 2015.

This article is about “Fulton’s Diabetic Compound,” one of the “cures” that people came up with before insulin.

“Colonial Water.” *The Jewish South*. January 22, 1897.

<http://chroniclingamerica.loc.gov/lccn/sn94051168/1897-01-22/ed-1/seq-1/#date1=1836&index=1&rows=20&words=Diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. January 6, 2016.

This is an advertisement for water that “cures” diabetes.

“On the Curability of Bright’s Disease and Diabetes.” *The Bennington Evening Banner*. October 4, 1907.

<http://chroniclingamerica.loc.gov/lccn/sn95066012/1907-10-04/ed-1/seq-3/#date1=1836&sort=relevance&rows=20&words=Diabet+Diabetes+DIABETES&searchType=basic&sequence=0&index=7&state=&date2=1922&proxtext=+diabetes&y=0&x=0&dateFilterType=yearRange&page=2>. April 6, 2016.

This article advertises another “cure” for diabetes. Several opinions are given, all stating that this is a real cure.

“Diabetes and Bright’s Disease.” *Albuquerque Daily Citizen*. February 27, 1903.
<http://chroniclingamerica.loc.gov/lccn/sn84020613/1903-02-27/ed-1/seq-7/#date1=1836&sort=relevance&rows=20&words=diabetes+Diabetes&searchType=basic&sequence=0&index=2&state=&date2=1922&proxtext=+diabetes&y=0&x=0&dateFilterType=yearRange&page=2>. March 8, 2016.

This is another article supporting “Fulton’s Diabetic Compound.” It claims that there is no doubt that this compound cures diabetes and Bright’s disease, both of which were thought to be incurable.

“Diabetes in Children.” *The Salt Lake Tribune*. September 29, 1907.
<http://chroniclingamerica.loc.gov/lccn/sn83045396/1907-09-29/ed-1/seq-5/#date1=1836&index=8&rows=20&words=Diabetes+DIABETES&searchType=basic&sequence=0&state=&date2=1922&proxtext=+diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. March 8, 2016.

This article gives a warning to all parents with children who have diabetes. The John F. Fulton Co. says that their product, Fulton’s Compound, which is supposed to cure Bright’s disease and diabetes, will only cure diabetes in adults. (This is probably type 2, but there was no distinction between type 1 and type 2 then.) It may delay the effects of diabetes in children, but it will not save them from death.

“Diabetes on the Increase.” *The Daily Telegram*. July 1, 1915.
<http://chroniclingamerica.loc.gov/lccn/sn85059715/1915-07-01/ed-1/seq-12/#date1=1836&index=7&rows=20&words=diabetes+Diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. December 17, 2015.

This article explains that the number of people with diabetes has been increasing, and unlike most diseases, it seems to target the elite, rather than the poor.

“Diabetes Sufferers Should not Give up in Despair.” *Richmond Times-Dispatch*. June 24, 1917.
<http://chroniclingamerica.loc.gov/lccn/sn83045389/1917-06-24/ed-1/seq-4/#date1=1836>

&index=17&rows=20&words=Diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=+diabetes&y=0&x=0&dateFilterType=yearRange&page=1. March 8, 2016.

This article sings the praises of “Warner’s Safe Diabetes Remedy.” It includes a quote from a man with diabetes who took the remedy and was “cured.” This is another false cure.

“Divides honors with Best Nobel Prize for research.” University of Toronto. October 1923.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10160&Page=0001&size=1&query=banting%20AND%20nobel%20AND%20prize&searchtype=fulltext&searchstrategy=All&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. April 7, 2016.

Banting divided his share of the Nobel Prize with Best. Best contributed substantially to the discovery of insulin and many think he should have been awarded the Prize as well.

“Dr. Banting’s Hard Work Won Nobel Prize.” *New York Herald*. November 4, 1923.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10080&Page=0001&size=1&query=banting%20AND%20nobel%20AND%20prize&searchtype=fulltext&searchstrategy=All&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. April 7, 2016.

This article says that it was Banting’s refusal to give up that enabled him to discover insulin.

“Elizabeth H. Gossett, a Trustee Of Barnard College, Is Dead at 73.” *New York Times*. April 27, 1981.

<http://search.proquest.com.ezproxy.frederick.edu/history/docview/121849030/6119E32A7015453APQ/1?accountid=10972>. March 31, 2016.

This article is Elizabeth’s obituary. It does not mention Elizabeth’s diabetes, as she tried to hide that fact.

“Emotional Diabetes.” *The Commoner*. December 1, 1916.

<http://chroniclingamerica.loc.gov/lccn/46032385/1916-12-01/ed-1/seq-29/#date1=1836&index=0&rows=20&words=Diabetes+diabetes+DIABETES+diabetic&searchType=basic>

&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1. January 6, 2016.

This article talks about diabetes being caused when people are under stress. They say that the symptoms disappear as soon as the stress dissipates.

“Foley’s Kidney Cure.” *The Bennington Evening Banner*. October 4, 1907.

<http://chroniclingamerica.loc.gov/lccn/sn95066012/1907-10-04/ed-1/seq-3/#date1=1836&sort=relevance&rows=20&words=Diabet+Diabetes+DIABETES&searchType=basic&sequence=0&index=7&state=&date2=1922&proxtext=+diabetes&y=0&x=0&dateFilterType=yearRange&page=2>. April 6, 2016.

This article says that “Foley’s Kidney Cure” will save you from getting Bright’s disease or diabetes. I used this article and others like it to show that people were desperate to find some way to cure diabetes. Before insulin diabetes was deadly and unstoppable.

“A Great Discovery.” *The Muskogee Cimeter*. May 4, 1905.

<http://chroniclingamerica.loc.gov/lccn/sn83025060/1905-05-04/ed-1/seq-2/#date1=1836&index=11&rows=20&words=Diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. December 17, 2015.

A man with diabetes claims that “Dodd’s Kidney Pills” cure diabetes. He says that he would be cured if he had “conformed strictly to a diabetes diet.”

“Helmbold’s Preparations.” *The Evening Telegram*. October 12, 1870.

<http://chroniclingamerica.loc.gov/lccn/sn83025925/1870-10-12/ed-1/seq-5/#date1=1836&index=12&rows=20&words=diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. December 17, 2015.

This is another false cure for diabetes, published in 1870, approximately fifty years before the discovery of insulin.

“Helped by Insulin ‘Cure.’” University of Toronto. October 16, 1922.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10109&Page=0001&size=1&qquery=banting%20AND%20miss%20AND%20hughes&searchtype=fulltext&searchstrate>

gy=all&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. March 7, 2016.

This article describes Elizabeth's diet before being put on insulin and her recovery once she started receiving it. It also mentions the limited quantity of insulin available at the time.

"Hughes' Daughter 'Cured' of Diabetes." *The News*. December 16, 1922.
http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10066&Page=0001&size=1&query=banting%20AND%20miss%20AND%20hughes&searchtype=fulltext&searchstrategy=all&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord. March 7, 2016.

This article talks about Elizabeth's recovery, Banting's doubt that insulin is a cure, and the future goal of being able to take insulin by mouth.

"Miss Hughes Back in the Capital." *New York American*. December 17, 1922.
<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10068&Page=0001&size=1&query=Miss%20Hughes%20back%20in%20the%20capital&browsetype=title&startrow=1&transcript=off&collection=banting>. March 18, 2016.

This article states that Elizabeth has returned to Washington, DC from Toronto. It says that Banting's remedy, insulin, has caused her to regain weight and strength.

"Miss Hughes is Treated with Banting's Remedy." *Evening Public Ledger*. October 14, 1922.
<http://chroniclingamerica.loc.gov/lccn/sn83045211/1922-10-14/ed-1/seq-1/#date1=1836&index=0&rows=20&words=Banting+diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=banting+diabetes&y=0&x=0&dateFilterType=yearRange&page=1>. January 7, 2016.

This newspaper article talks about Elizabeth Hughes being treated with insulin in Toronto. It goes on to explain the recoveries of the other patients once they started receiving insulin.

"New Treatment Aids Miss Hughes." *New York American*. October 15, 1922.
http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10045&Page=0001&size=1&query=banting%20AND%20miss%20AND%20hughes&searchtype=fulltext&searchstrategy=all&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibrecord.

query=New%20treatment%20aids%20Miss%20Hughes&browsertype=title&startrow=1&transcript=off&collection=banting. March 18, 2016.

This newspaper clipping talks about Elizabeth's weight gain and overall progress. It states that this type of recovery has been happening in many other cases.

"Nobel Lecture." Nobel Foundation. September 15, 1925.
http://www.nobelprize.org/nobel_prizes/medicine/laureates/1923/banting-lecture.html.
January 6, 2016.

This is the transcript of Banting's Nobel lecture. He talks about his early research and how insulin has saved the lives of many people.

"No More Diabetes." *The Guthrie Daily Reader*. October 7, 1913.
<http://chroniclingamerica.loc.gov/lccn/sn86063952/1913-10-07/ed-1/seq-6/#date1=1836&index=10&rows=20&words=DIABETES+Diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=diabetes&y=0&x=0&dateFilterType=yearRange&page=1>.
December 17, 2015.

This is an advertisement for "Warner's Safe Diabetes Remedy," another false cure for diabetes.

"Physicians Here Honor Author of Diabetes Cure." *New York Tribune*. December 22, 1922.
<http://chroniclingamerica.loc.gov/lccn/sn83030214/1922-12-22/ed-1/seq-4/#date1=1836&index=2&rows=20&words=Banting+Diabetes&searchType=basic&sequence=0&state=&date2=1922&proxtext=banting+diabetes&y=0&x=0&dateFilterType=yearRange&page=1>.
January 7, 2016.

This article contains an amazing quote from Frederick Allen. He comments on the fact that Banting was not a diabetes specialist but a surgeon. The article also talks about Allen's reaction to the extract; he is worried that people with diabetes will not control their eating at all. The article gives some information about the research and tells of some other people's reactions to insulin.

"The Preacher's Evidence." *The Muskogee Cimeter*. June 30, 1904.
<http://chroniclingamerica.loc.gov/lccn/sn83025060/1904-06-30/ed-1/seq-3/#date1=1836&index=15&rows=20&words=diabetes+Diabetes&searchType=basic&sequence=0&stat>

e=&date2=1922&proxtext=+diabetes&y=0&x=0&dateFilterType=yearRange&page=1.
March 8, 2016.

This article consists of a preacher telling how he had diabetes and how “Dodd’s Kidney Pills” cured him. The article states that diabetes is an advanced stage of kidney disease, but it is really an autoimmune disease that targets the pancreas.

“Science’s New Cure Leads Hughes’s Child to Health.” University of Toronto. October 15, 1922.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10030&Page=0001&size=1&q uery=hughes&searchtype=fulltext&searchstrategy=All&startrow=91&media=all&sort=titl e_sort&photo=on&refine=no&transcript=off#bibrecord. March 30, 2016.

This article gives details about Elizabeth’s weight gain, her previous diet, and her extraordinary recovery.

“University honours professors Banting and Macleod as winners of the Nobel Prize award for medicine in board of governors' banquet held at Hart House.” *The Globe*. November 27, 1923.

http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10082&Page=0001&size=1&q uery=banting%20AND%20nobel%20AND%20prize&searchtype=fulltext&searchstrategy =All&startrow=1&media=all&sort=title_sort&photo=on&refine=no&transcript=off#bibreco rd. April 7, 2016.

This newspaper article talks about Banting’s and Macleod’s invitations to a banquet at Hart House in honor of their receiving the Nobel Prize. The fact that the discoverers of insulin were awarded the Nobel Prize shows that the discovery itself was extremely important.

Letters

Allen, Frederick, MD. Letter to Frederick Banting. August 16, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?ldno=L10029>. January 4, 2016.

Frederick Allen, one of the leading experts on diabetes at the time, wrote to Banting about how successful insulin was with his patients. I used this letter to show that it was not just Elizabeth who was saved by insulin.

Allen, Frederick, MD. Letter to Frederick Banting. October 28, 1923. University of Toronto Archives. <http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10331>. January 7, 2016.

Frederick Allen congratulates Banting on the awarding of the Nobel Prize to him and Macleod.

Hughes, Elizabeth. Letter to her mother. August 22, 1922. University of Toronto Archives. <http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10006&Page=0001&size=1&query=Letter%20to%20mother%2022/08/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. January 28, 2016.

One line in this letter from Elizabeth to her mother reads, "To think that I'll be leading a normal existence is beyond all comprehension." I used the quote and the clip of the letter to bring out how amazing this drug would have seemed to her.

Hughes, Elizabeth. Letter to her mother and father. September 24, 1922. University of Toronto. <http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10007&Page=0003&size=1&query=Letter%20to%20mother%20and%20father%20%2024/09/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. April 7, 2016.

This letter contains Elizabeth's "I declare you'd think it was a fairy tale" quote. Elizabeth was writing to her mother and father, and she says that they have to see the meals she is eating and the weight she has gained for themselves. Otherwise they would think it was a fairy tale. I used this quote for my title because it draws out that living a normal life with diabetes was completely unheard of. What many people with diabetes now take for granted was a fairy tale to Elizabeth and her parents.

Hughes, Elizabeth. Letter to her mother. October 9, 1922. <http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10105&Page=0005&size=1&query=Letter%20to%20Mumsey%20and%20Father%208/10/1922&browsetype=title&startrow=1&transcript=on&collection=hughes>. March 7, 2016.

Elizabeth describes a concert she attended. She would have been unable to go before receiving insulin. It demonstrates extremely clearly how Elizabeth exchanged a miserable existence with a normal one.

Hughes, Elizabeth. Letter to her mother. October 21, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10106&Page=0001&size=1&query=Letter%20to%20mother%2021/10/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. March 4, 2016.

Elizabeth begs her mother to not tell the newspaper reporters about her recent weight gain; she says that other doctors are “kidding” Banting for using her as advertising. She mentions a trip to the library and another concert she attended.

Hughes, Elizabeth. Letter to her mother. November 8, 1922.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10107&Page=0003&size=1&query=Letter%20to%20mother%208/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. March 7, 2016.

Elizabeth looks forward to seeing her parents at Christmas. She also comments on the rainy weather and the results of a local election.

Hughes, Elizabeth. Letter to her mother. November 11, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10108&Page=0001&size=1&query=Letter%20to%20mother%2011/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 25, 2016.

Elizabeth mentions how Banting came to her with a new batch of insulin. She was supposed to have her “carbohydrate resistance” tested again when the new batch came and she was very glad when Banting forgot about it.

Hughes, Elizabeth. Letter to her mother. November 14, 1922. University of Toronto Archives.

[://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10109&Page=0001&size=1&query=Letter%20to%20Mumsey%2014/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes](http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10109&Page=0001&size=1&query=Letter%20to%20Mumsey%2014/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes). February 25, 2016.

Elizabeth talks about how one batch of insulin was especially potent and then she had three reactions (low blood sugars) in one night.

Hughes, Elizabeth. Letter to her mother. November 19, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10110&Page=0001&size=1&query=Letter%20to%20Mumsey%2019/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 25, 2016.

Elizabeth describes a concert by Paderewski that she attended. She says that he was encored multiple times. She was impressed that he could play the piano for so long. This underlines that she was able to participate in activities with insulin that she was unable to do before.

Hughes, Elizabeth. Letter to her mother. November 21, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10111&Page=0001&size=1&query=Letter%20to%20Mrs.%20Hughes%20regarding%20a%20recent%20newspaper%20article%20ca.%2021/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 25, 2016.

Elizabeth tells her mother about when she first gave herself insulin. She describes the whole process as though she is the captain of her ship. She then pleads with her mother to not hire a new nurse. Elizabeth explains that she can manage her diet and reactions and that she doesn't like someone constantly looking over her.

Hughes, Elizabeth. Letter to her mother. November 23, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10112&Page=0001&size=1&query=Letter%20to%20Mumsey%2023/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 18, 2016.

Elizabeth tells her mother that she gave herself insulin after Ruth Whitehill, another girl with diabetes in Toronto, had given herself insulin. She describes Banting's reaction and says that he was tickled.

Hughes, Elizabeth. Letter to her mother. November 25, 1922. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10113&Page=0001&size=1&query=Letter%20to%20Mumsey%2025/11/1922&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 18, 2016.

Elizabeth tells her mother about the new snowfall and how excited she is to go out in it. Elizabeth says that she is unable to go out immediately because some diabetes experts are coming, including Frederick Allen, to see her progress for themselves. She also describes an animal fair she went to.

Hughes, Elizabeth. Letter to her mother. September 9, 1923. University of Toronto Archives.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=L10114&Page=0001&size=1&query=Letter%20to%20Mumsey%209/09/1923&browsetype=title&startrow=1&transcript=off&collection=hughes>. February 18, 2016.

Elizabeth tells her mother about the weather and some of her recent activities, such as swimming. This letter, written about a year after she started receiving insulin, demonstrates that Elizabeth could lead an active life.

Books

Joslin, Elliott, MD. *A Diabetic Manual for the Mutual Use of Doctor and Patient*. California: Lea & Febiger, 1941.

This book is Joslin's handbook on diabetes care. It contains a photograph of a girl injecting herself with insulin that I used on my timeline to add historical context.

Secondary Sources

Books

Bankston, John. *Frederick Banting and the Discovery of Insulin*. Bear, Delaware: Mitchell Lane Publishers, 2001.

This book includes timelines that helped me get an idea of the flow of events in Banting's life and the history of diabetic research.

Bliss, Michael. *Banting: A Biography*. Toronto: University of Toronto Press, 1984.

Although this book doesn't focus on the discovery of insulin, but on Banting's whole life, it was good for giving a brief, manageable narrative of the discovery.

Bliss, Michael. *The Discovery of Insulin*. Toronto: University of Toronto Press, 2000.

This book was one of my most helpful resources. It includes a very detailed narrative of the discovery of insulin and helped solidify in my mind the order of events. Some of my secondary sources refer to Dr. Bliss. He studied Banting's and Best's lab notebooks and wrote the chronological parts of his book from them.

Cooper, Thea and Arthur Ainsberg. *Breakthrough: Elizabeth Hughes, the Discovery of Insulin, and the Making of a Medical Miracle*. New York: St. Martin's Press, 2010.

This book helped me understand what happened in Elizabeth's life after she was diagnosed with diabetes. It also tells the story of the discovery of insulin.

Cox, Caroline. *The Fight to Survive: A Young Girl, Diabetes, and the Discovery of Insulin*. New York: Kaplan Publishing, 2009.

This book tells Elizabeth's story in great detail. It really conveys how hard her life was while she was on the starvation diet. It alternately tells the stories of Banting and Elizabeth. This helped me get a picture of what was happening in Toronto while Elizabeth was getting weaker and weaker.

Levine, I. E. *The Discoverer of Insulin: Dr. Frederick G. Banting*. New York: Julian Messner, Inc., 1959.

This book presents a brief overview of Banting's life and his work discovering insulin. It was good for getting familiar with the story, though it did not go into much depth.

Scheiner, Gary, CDE. *Think Like a Pancreas: A Practical Guide to Managing Diabetes With Insulin*. Boston: Da Capo Press, 2004.

This book provides very detailed descriptions of different kinds of diabetes. This book was written to help people get better control of their diabetes.

Simmons, John Galbraith. *Doctors & Discoveries: Lives that Created Today's Medicine*. Boston: Houghton Mifflin Company, 2002.

This book had one chapter about the discovery of insulin. The book contained chapters on other major breakthroughs in medical research.

Stevenson, Lloyd. *Sir Frederick Banting*. Toronto: The Ryerson Press, 1946.

This book gave me biographical information about Banting. Banting was the youngest of the five children of William and Margaret Banting. He went to medical school and was supposed to graduate in 1917, but because of World War I, he and the other students were rushed through their courses and graduated a year early so they could help with the war. In one battle Banting's arm was wounded severely by a piece of shrapnel. He was told to go to the ambulance and get help. However, Banting just bandaged up his arm and continued working. He was awarded the Military Cross in honor of his bravery. After the war he started his own practice in London, Ontario. However, he was not successful and earned almost no money. He got a job at Western University where he gave medical lectures. One of the lectures was on the pancreas. He did not know anything about it so he read whatever he could. It was at this time that he has his idea for isolating the internal secretion of the pancreas (insulin).

Straus, Eugene. *Medical Marvels: The 100 Greatest Advances in Medicine*. Amherst, New York: Prometheus Books, 2006.

I read this book early in my research to get a general idea of the process Banting and Best went through to discover insulin.

Images/Photographs

“Anatomy of the Pancreas.” Geeky Medics. <http://geekymedics.com/pancreatic-cancer/>. January 12, 2016.

I used this diagram to show where the pancreas is in the body. It is below the liver and behind the stomach.

“Artificial Pancreas.” Diatribe. <http://diatribe.org/issues/57/learning-curve>. May 17, 2016.

This is an example of an artificial pancreas. It was being tested at a camp for kids with diabetes. It has two pumps: one for insulin and one for glucagon, which is a hormone that tells the liver to secrete glucose into the bloodstream.

“Artificial Pancreas at a Glance.” Healthline. <http://www.healthline.com/diabetesmine/artificial-pancreas-what-you-should-know#2>. May 17, 2016.

This diagram shows how the artificial pancreas works. The continuous glucose monitor sensor communicates with a receiver that then sends the information to a control algorithm device, which decides if insulin or glucagon should be delivered. The command is sent to the pump on the person’s body, which then delivers the correct dose of either insulin or glucagon.

“AutoSyringe.” Deka Research. http://www.dekaresearch.com/images/Auto_Syringe2.jpg. May 17, 2016.

The AutoSyringe was the first commercial insulin pump. It was a big, clunky device. I used this image to show how far we have come in terms of diabetes equipment.

“A Child Affected by Rickets.” December 14, 2012. BBC. <http://www.bbc.com/news/health-20710028>. April 1, 2016.

This is a photograph of a child with rickets. Rickets is caused by a Vitamin D deficiency. Thanks to Elmer McCollum, Vitamin D is known to solve this problem. I used this photo to add historical context to my project.

“DexCom G4™ Platinum Receiver Kit for Continuous Glucose Monitoring.” Finnegan Medical Supply.

<https://www.finneganmedicalsupply.com/detail/dexcom-g4trade-platinum-receiver-kit-for-continuous-glucose-monitoring>. May 7, 2016.

The DexCom G4 is a continuous glucose monitor. It continuously tracks the user's blood sugar and alerts when the blood sugar goes too high, too low, and when it goes up or down too quickly. I used this image to give an idea of what explorations in the field of diabetes care have produced.

“The Discoverers of Insulin.” Banting House NHSC.

<https://bantinghousenhsc.wordpress.com/2015/12/06/banting-and-best-and-macleod-and-collip/>. January 15, 2016.

This image is composed of pictures of the four main discoverers of insulin. Although this image is composed of primary images, I decided it should go under my secondary sources because the overall image was created later.

“NovoLog.” Drug Infos. <http://druginfos.com/novolog/>. May 16, 2016.

NovoLog, which is often used to fill insulin pumps, is an example of synthetic human insulin. Human insulin reduces the chances of a person having an allergic reaction. Reactions to animal insulin were much more common.

“OneTouch Verio.” Medical Expo.

<http://www.medicalexpo.com/prod/lifescan/product-71126-679567.html>. May 17, 2016.

The OneTouch Verio is a modern glucometer. I used this image to show what the explorations that are happening now have produced.

“Tandem t:slim Insulin Pump.” Liberty.

<http://www.libertymedical.com/insulin-pump/products/tandem-t-slim/>. May 7, 2016.

The Tandem t:slim is the first touchscreen insulin pump, as well as the smallest. This is an example of the product of modern explorations in the field of diabetes care.

“T:slim Insulin Pump.” Tandem Diabetes Care.
<https://www.tandemdiabetes.com/products>. May 17, 2016.

The t:slim is the smallest pump on the market, as well as the only one that is touchscreen. I used this image in my timeline to show the advances in diabetes equipment since the invention first insulin pump.

Articles

“Continuous Subcutaneous Insulin Infusion: Intensive Treatment, Flexible Lifestyle.” Medscape. <http://www.medscape.org/viewarticle/460365>. May 17, 2016.

This article gives a brief history of the insulin pump. It describes the first insulin pump, which was invented by Dr. Arnold Kadish in the early 1960s; the AutoSyringe, nicknamed the “Big Blue Brick”, which was the first commercial insulin pump; and modern pumps such as MiniMed pumps. It quotes many studies that prove how pumps are beneficial.

“The Discovery of Insulin.” February 2009. Nobel Foundations.
<http://www.nobelprize.org/educational/medicine/insulin/discovery-insulin.html>. February 4, 2016.

This article provided me with a very important piece of information: when insulin was available for anyone who needed it. Eli Lilly, a company who made insulin, was able to supply all of North America with insulin by 1923.

“Dr. Banting’s Hypothesis: Part I.” Banting House NHSC.
<https://bantinghousenhsc.wordpress.com/2013/10/31/dr-bantings-hypothesis-part-i/>. February 3, 2016.

This article explains the technical terms behind Banting’s hypothesis, “Diabetes [*sic*] Ligate pancreatic ducts of dogs. Keep dogs alive till acini degenerate leaving Islets. Try to isolate the internal secretion of these to relieve glycosurea [*sic*].” The pancreatic ducts are the passages through which the digestive juices pass to

get to the small intestine. Ligation (tying of the pancreatic ducts) wouldn't allow the juices to get through and the acini, the cells that produce the juices, would degenerate and stop producing the juices. The "internal secretion" of the pancreas is what we now know as insulin. It is produced by the beta cells in the Islets of Langerhans, which are named after Paul Langerhans, who discovered them in 1869. Banting thought ligation was necessary because he thought that the external secretion (the digestive juices) destroyed the internal secretion (insulin). When a person develops diabetes, the alpha cells in the Islets of Langerhans are destroyed as well. These cells produce glycogen, which is a hormone that tells the liver when to secrete glucose into the bloodstream. Because of this, people with diabetes often experience hypoglycemia (when the blood glucose drops below normal) because the liver doesn't secrete the needed glucose.

"History of Insulin." Diabetes.co.uk.

<http://www.diabetes.co.uk/insulin/history-of-insulin.html>. May 16, 2016.

This timeline marks important advances in the use of insulin. A major one is the ability to synthetically produce human insulin. I used this fact on my timeline.

"Sir Frederick G. Banting." Banting House NHSC.

<https://bantinghousenhsc.wordpress.com/sir-doctor-frederick-grant-banting/>. February 3, 2016.

Banting's life is briefly recounted in this article. It tells about his early life, his work in the war, the discovery of insulin, and his life afterwards.

"Tandem Diabetes Care Announces FDA Clearance of the t:slim Insulin Delivery System." <http://investor.tandemdiabetes.com/releasedetail.cfm?ReleaseID=806247>. May 17, 2016.

This article talks about the FDA approval of Tandem's t:slim insulin pump on November 16, 2011. The t:slim was Tandem's first pump on the market. It is the smallest pump now available and it has a bright color touchscreen, which is a feature that no other pump has.

"Teddy Ryder: Banting's Living Miracle." *Toronto Star*. February 20, 1983.

<http://link.library.utoronto.ca/insulin/digobject.cfm?idno=C10002&Page=0001&size=1&q>

query=Teddy%20Ryder:%20Banting%27s%20living%20miracle&browsertype=title&startrow=1&transcript=off&collection=banting. March 17, 2016.

Teddy Ryder was one of the first people to receive insulin. He was six years old and weighed only twenty-two pounds when he started receiving insulin. A short time later he wrote a letter to Banting telling him about how he could now climb a tree. Elizabeth was not the only person to benefit from Banting's discovery.

"Timeline." Duke University Libraries.

<http://library.duke.edu/digitalcollections/mma/timeline/>. March 30, 2016.

This timeline is composed of major medical discoveries and breakthroughs from the mid 1800s to the late 1900s. I selected some events from around the time of the discovery of insulin to add historical context.

"T1D Facts and Figures." Juvenile Diabetes Research Foundation. March 2014.

<http://cc.jdrf.org/wp-content/uploads/sites/70/2014/07/2014-JDRF-Fact-Sheet-1.pdf>.
March 18, 2016.

This is a list of statistics about diabetes. Thirty thousand people are diagnosed with type 1 diabetes each year, but this is only a tiny fraction of the twenty-six million Americans who have some kind of diabetes.

"Understanding Dr. Banting's Hypothesis: Part II." Banting House NHSC.

<https://bantinghousenhsc.wordpress.com/2014/01/23/understanding-dr-bantings-hypothesis-part-ii/>. February 3, 2016.

This article explains how insulin works in the body. When food is eaten, glucose builds up in the bloodstream. Signals are sent to the beta cells in the pancreas, which secrete insulin into the bloodstream. The insulin goes to a cell and attaches itself to an "insulin receptor." Once the insulin has attached itself to the receptor, the cell opens up the "glucose receptors." The glucose then enters the cell through the receptors. Once in the cell, the glucose is converted into energy. When someone has type 1 diabetes there is no insulin, so the glucose never gets out of the bloodstream. This results in hyperglycemia (high blood glucose). The cells cannot get any energy so they effectively "starve" to death.

Interviews

Bliss, Michael. Professor at the University of Toronto. Email interview conducted by Katherine Harvey. December 13, 2015.

Michael Bliss was a professor of history at the University of Toronto. He wrote two books relating to the discovery of insulin: *Banting: A Biography* and *The Discovery of Insulin*. Dr. Bliss pointed me in the direction of the Thomas Fisher Rare Book Libraries, which supplied me with many of my primary sources.

Cogen, Fran. MD, CDE (Certified Diabetes Educator), Director of Diabetes Services at Children's National Medical Center and at Washington Nationals Diabetes Care Complex, Professor of Pediatrics at the George Washington University. Interview conducted by Katherine Harvey. February 4, 2016.

Dr. Cogen is the Director of Diabetes Services at Children's National Medical Center. She is also a professor of pediatrics at the George Washington University. My interview with Dr. Cogen provided me with explanations of diabetes and the starvation diet. I used three clips of her on my website.

Scheiner, Gary. MS, CDE (Certified Diabetes Educator). Email interview conducted by Katherine Harvey. February 1, 2016.

Gary Scheiner is a certified diabetes educator and the founder of Integrated Diabetes, an organization that helps people with diabetes management. He is the author of the book *Think Like a Pancreas*. This interview helped reinforce information from other sources.

Videos

"The Artificial Pancreas Project." Harvard Gazette.

<http://news.harvard.edu/gazette/story/2016/01/artificial-pancreas-system-aimed-at-type-1-diabetes-mellitus/>. May 17, 2016.

In this video clip, Frank Doyle, the dean of the Harvard John A. Paulson School of Engineering and Applied Sciences, explains what the artificial pancreas is and Harvard's plans for testing it. He talks about how the body's unpredictability is the greatest challenge in developing an artificial pancreas.

Websites

“Banting House National Historic Site of Canada (NHSC).”

<http://www.diabetes.ca/about-cda/banting-house>. February 3, 2016.

Banting House is a museum dedicated to Frederick Banting in London, Ontario. The website that goes with the museum has some very helpful articles about Banting’s hypothesis that explain what all the technical terms mean. It also includes primary pictures.

“Nobel Foundation.” <http://www.nobelprize.org/>. February 6, 2016.

Banting and Macleod were awarded the Nobel Prize for Physiology or Medicine in 1923. This website provided me with Banting’s 1923 Nobel lecture and primary photos.

“University of Toronto.” <https://www.utoronto.ca/>. January 12, 2016.

This was one of my most helpful sources. The Thomas Fisher Rare Book Libraries, which are part of the University of Toronto, provided me with Banting’s and Best’s lab notebooks and Elizabeth’s letters to her mother. There are many primary photographs, including pictures of the first people to receive insulin and Banting with his lab dogs.