Making a Difference:

Milestones in Public Health & Biotechnology: Canadian Connections

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Lecture #4 – From Insulin to Heparin (1920s-30s)

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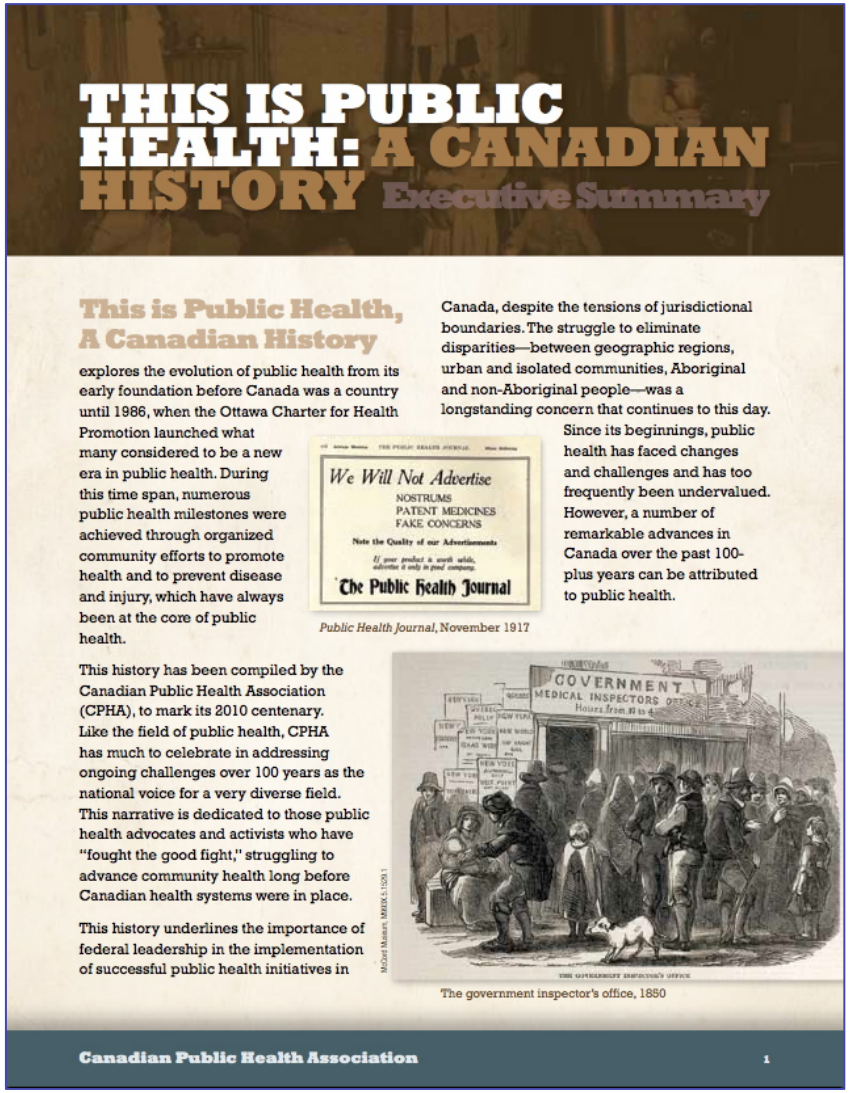
Living and Learning in Retirement, Course E
Class #2, October 6, 2017
Glendon College, York U., Room A002

Previous lecture slides available via:
http://healthheritageresearch.com/clients/LLiR/

Introduction

- The 1920s and 1930s saw two transformative advances in made-in-Canada biotechnology: one is well known – the discovery of insulin
- The other, less known, but more broadly significant, was the development of heparin at Connaught Labs
- Heparin, like insulin, is an extract of animal tissue and is used to control blood coagulation, making possible open-heart surgery, heart-lung machines and kidney dialysis.
- Indeed, heparin sparked a surgical revolution
- In today's class we'll recount the dramatic discovery of insulin story, and then trace its development and impact in Canada and beyond by the end of the 1930s, including on the development of Heparin



C.J. Rutty, *This is Public Health: A Canadian History* (Canadian Public Health Association eBook, 2010) - https://www.cpha.ca/history-e-book

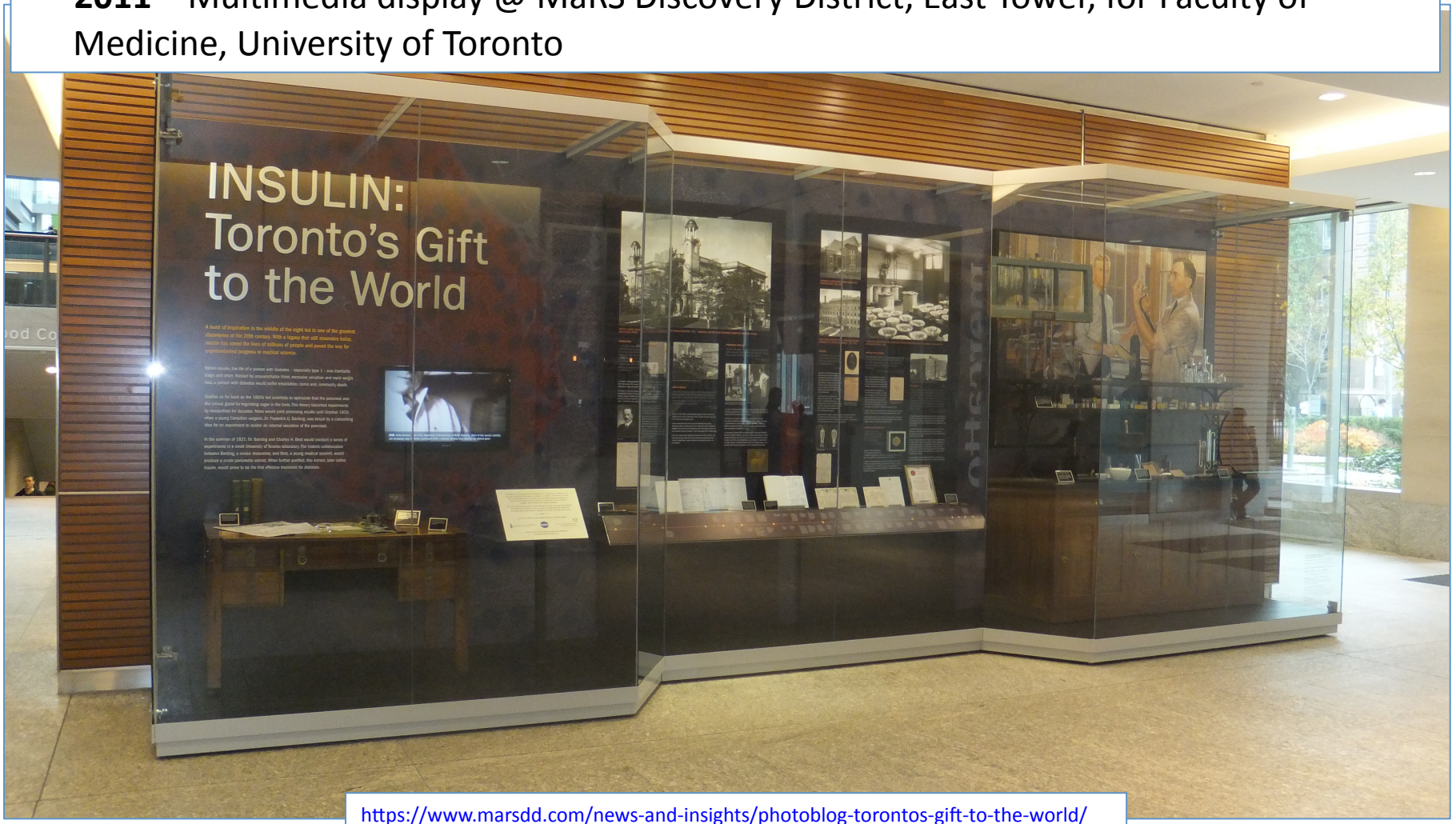
Displaying the Insulin Story in Toronto

- I have curated two public exhibits on the Discovery & Development of Insulin:
- **2008** – 16 Posters @ Diabetes Clinic, Toronto General Hospital, Eaton Wing, 12th floor

http://healthheritageresearch.com/Insulin/TGH-posters/TGHInsulinPosters.html

Displaying the Insulin Story in Toronto

- I have curated two public exhibits on the Discovery & Development of Insulin:
- **2011** – Multimedia display @ MaRS Discovery District, East Tower, for Faculty of Medicine, University of Toronto

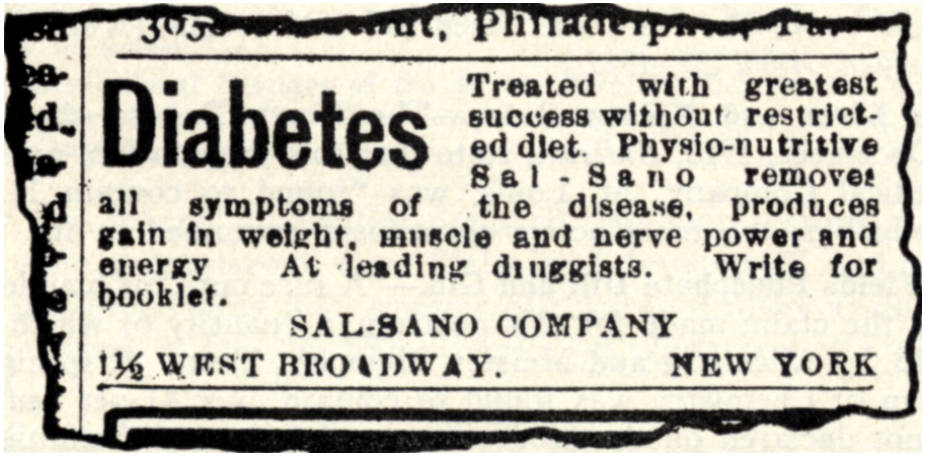


https://www.marsdd.com/news-and-insights/photoblog-torontos-gift-to-the-world/

Deadly Diabetes, Before Insulin

- Before Insulin, the life of a person with diabetes, especially a child with type 1, was inevitably tragic and short, dominated by unquenchable thirst, starvation diets and a body that ultimately feeds on itself

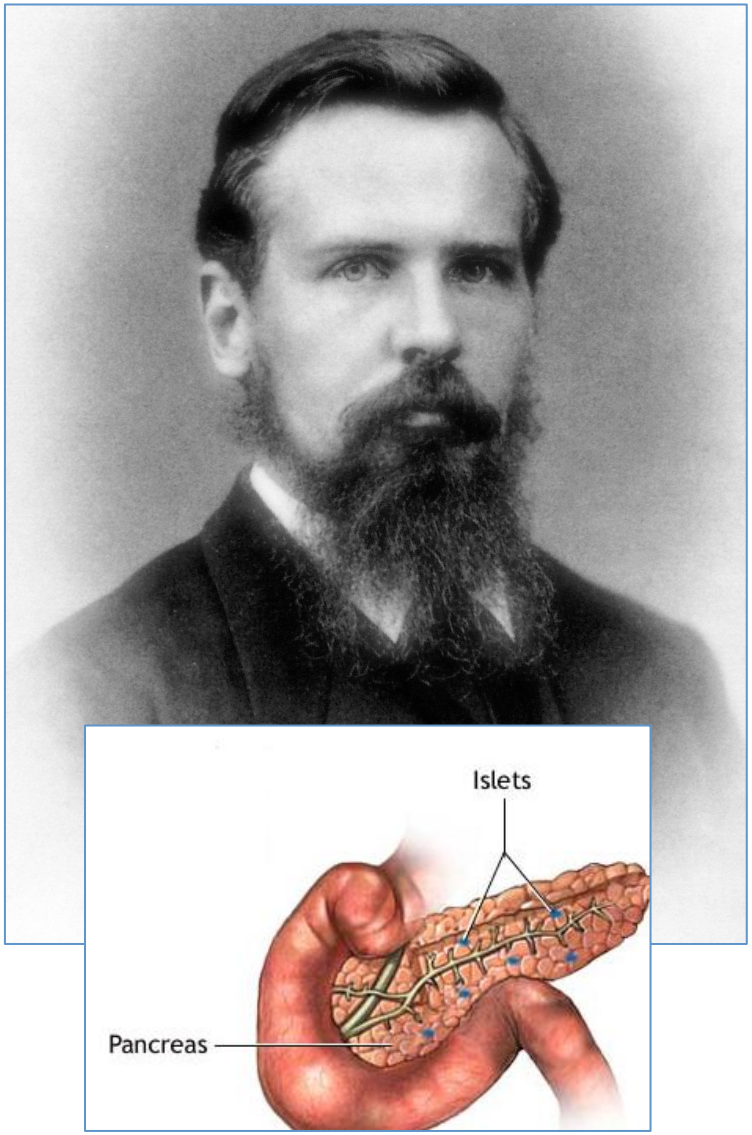
- Beyond strict dietary control, very little could be done to prevent death, despite the claims of patent medicines and others offering dubious cures



Deadly Diabetes, Before Insulin

- **250 B.C.** – First use of “diabetes” (from the Greek “to pass through”)
- **1675 –** “diabetes mellitus” term first used (“mellitus” Latin for honey or sweet)
- **1869 –** Paul Langerhans (right) identifies “insulin”-producing “islets of Langerhans” in pancreas
- **1889 –** Role of pancreas in diabetes discovered; diabetes developed in dogs when pancreas removed
- **1910 –** Discovered that diabetes caused by the lack of “insulin” in the pancreas

- This work led researchers to conduct a variety of insulin extraction experiments, but with none yielding promising results until a young Canadian surgeon was struck by an compelling idea in October 1920



Banting's Idea

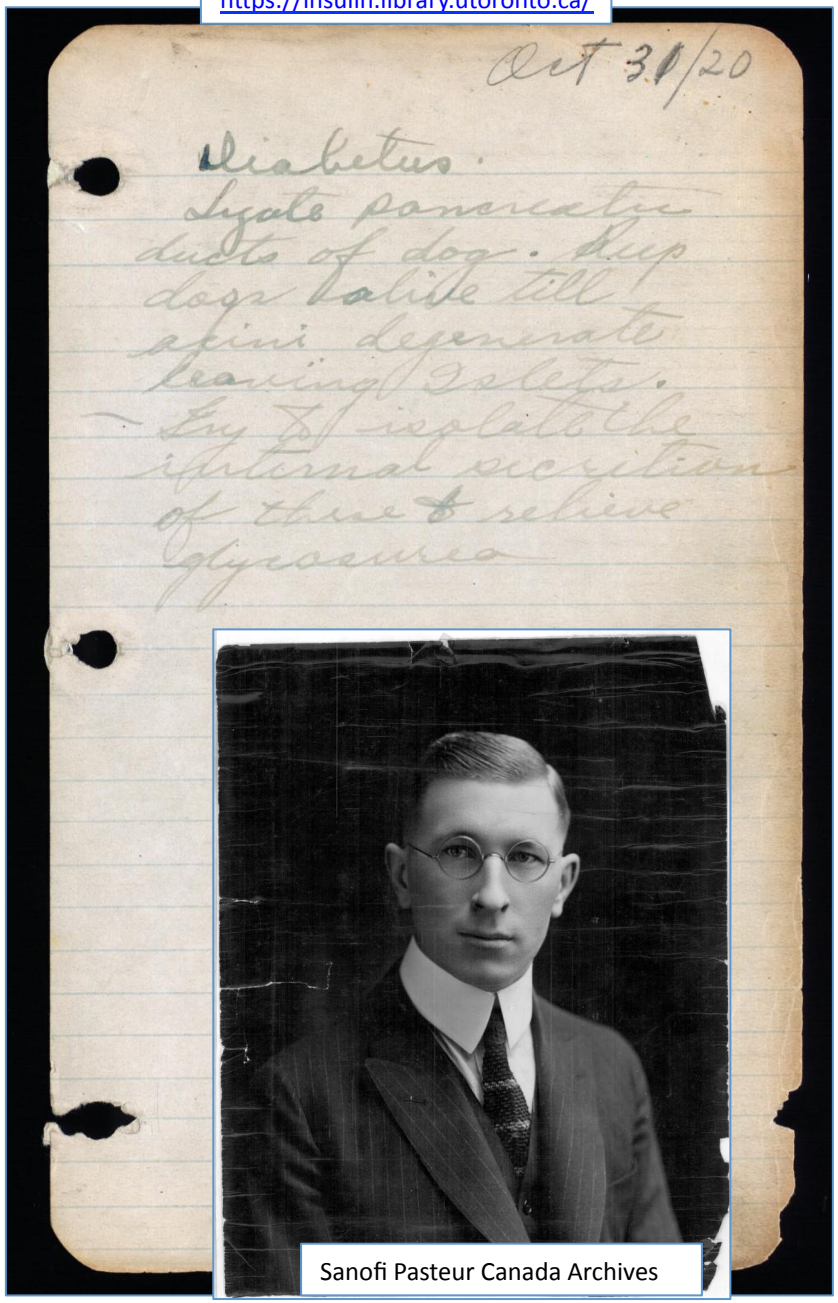
- **Oct. 31, 1920 (2:00 am)** - The Insulin story began in London, ON, when Dr. Frederick Banting awoke with a compelling idea

- Banting had read an article about the pancreas and diabetes for a lecture he was preparing and was struck with an idea for an experiment to isolate the internal secretion from the pancreas that might control diabetes

- He jotted down in a notebook,

- "Diabetus: Ligate pancreatic ducts of dog. Keep dogs alive till acini degenerate leaving Islets. Try to isolate the internal secretion of these and relieve glycosurea"

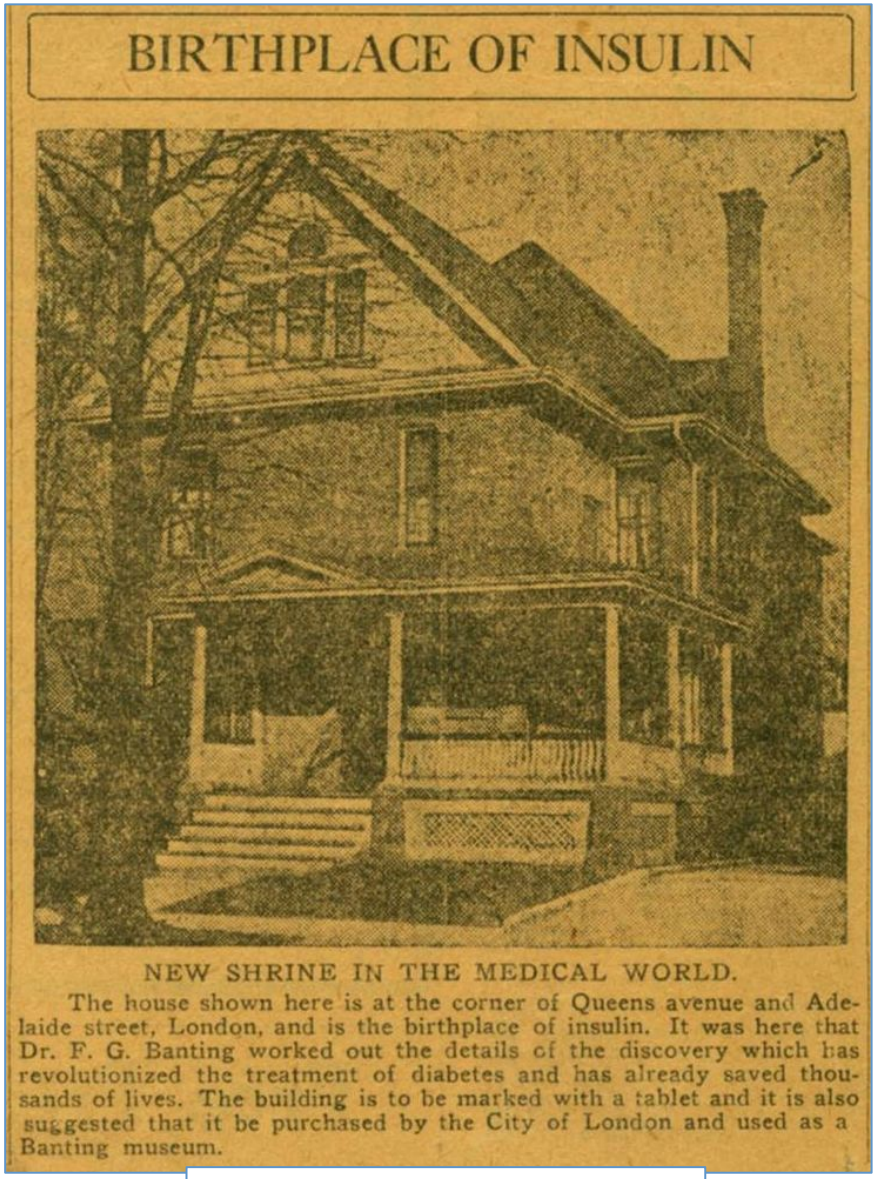
https://insulin.library.utoronto.ca/



Sanofi Pasteur Canada Archives

Banting's Idea

- Born on November 14, 1891 in Alliston, Ontario, Dr. Frederick G. Banting brought a surgeon's perspective to the problem of diabetes.
- **1912** - He had entered the University of Toronto and graduated with an expedited class because of WWI.
- After the war, he worked at the Christie Street Hospital for Veterans in Toronto and the Hospital for Sick Children before moving to London, Ontario.
- **1920** - Banting started his own practice in London, but lack of patients led him to work as a demonstrator in the University of Western Ontario medical school


BIRTHPLACE OF INSULIN

NEW SHRINE IN THE MEDICAL WORLD.

The house shown here is at the corner of Queens avenue and Adelaide street, London, and is the birthplace of insulin. It was here that Dr. F. G. Banting worked out the details of the discovery which has revolutionized the treatment of diabetes and has already saved thousands of lives. The building is to be marked with a tablet and it is also suggested that it be purchased by the City of London and used as a Banting museum.

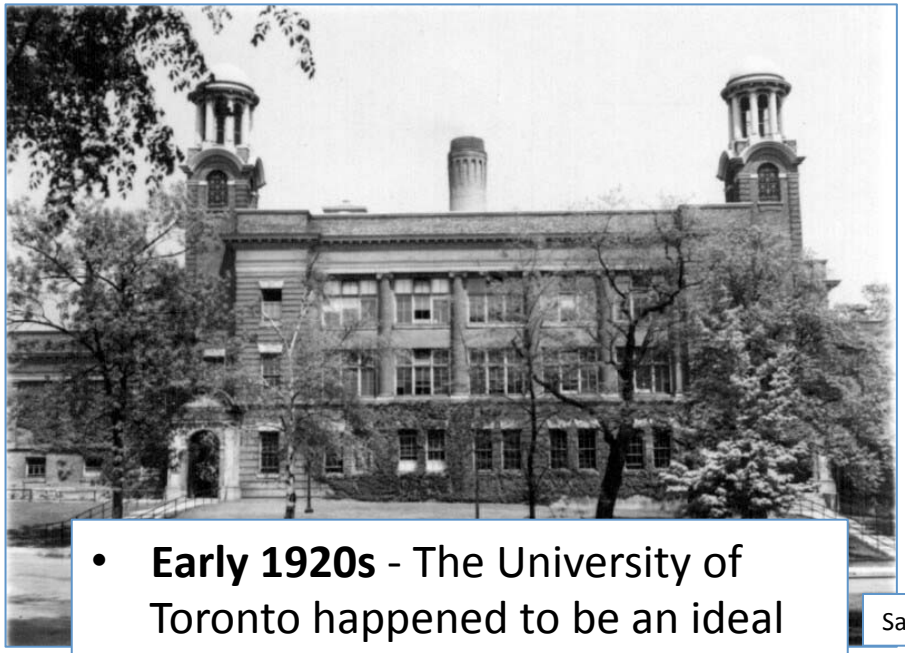
https://bantinghousenhsc.wordpress.com/

Banting's Idea

https://bantinghousenhsc.wordpress.com/

Banting's Idea

- **Nov. 6, 1920** – Banting took his idea to the University of Toronto and presented it to Dr. J.J.R. Macleod, Professor of Physiology and a specialist in the study of diabetes



- **Early 1920s** - The University of Toronto happened to be an ideal institution in which Banting could develop his idea

Sanofi Pasteur Canada Archives

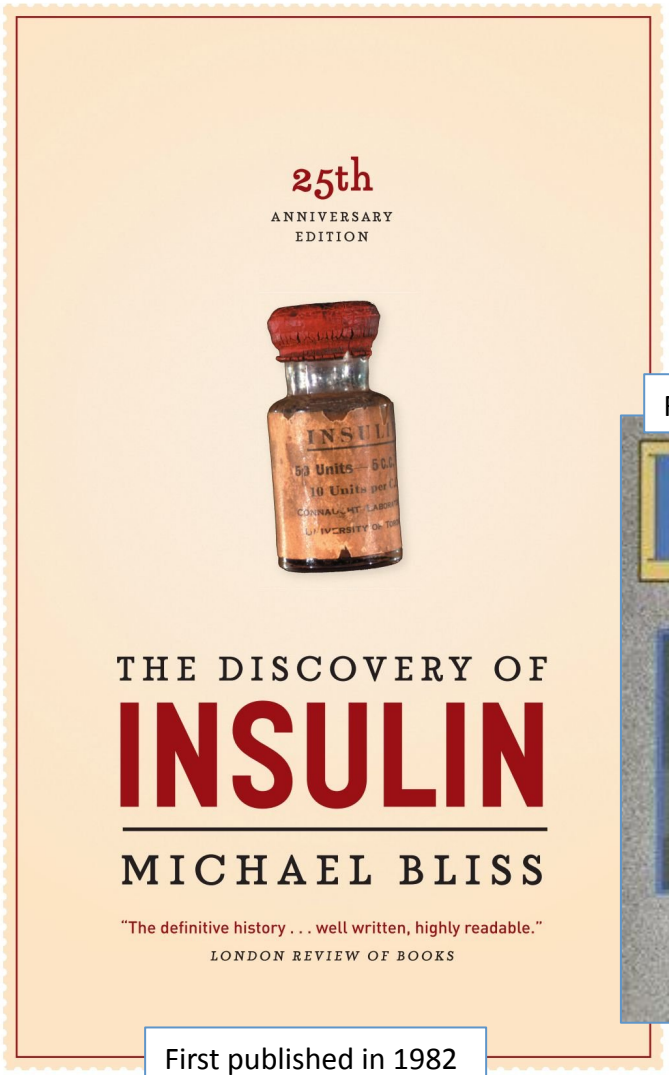
Banting's Idea

- U. of T. stood at the centre of a uniquely linked group of medical and scientific institutions - Toronto General Hospital (r), the Hospital for Sick Children (l), and, as discussed in recent classes, its singular public health biologicals producer, Connaught Antitoxin Laboratories - each ready to play key roles in the insulin story.

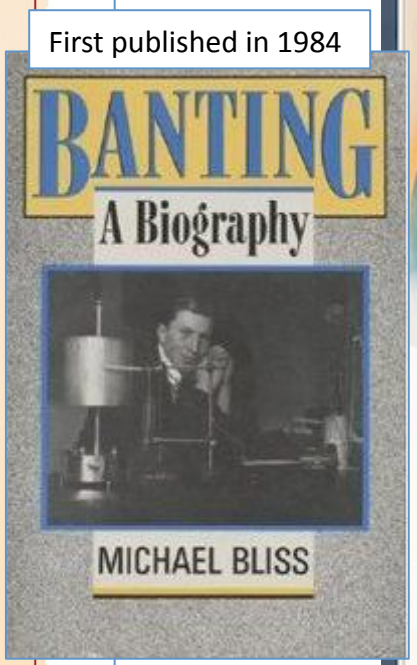
Sanofi Pasteur Canada Archives

Discovering Insulin in Toronto

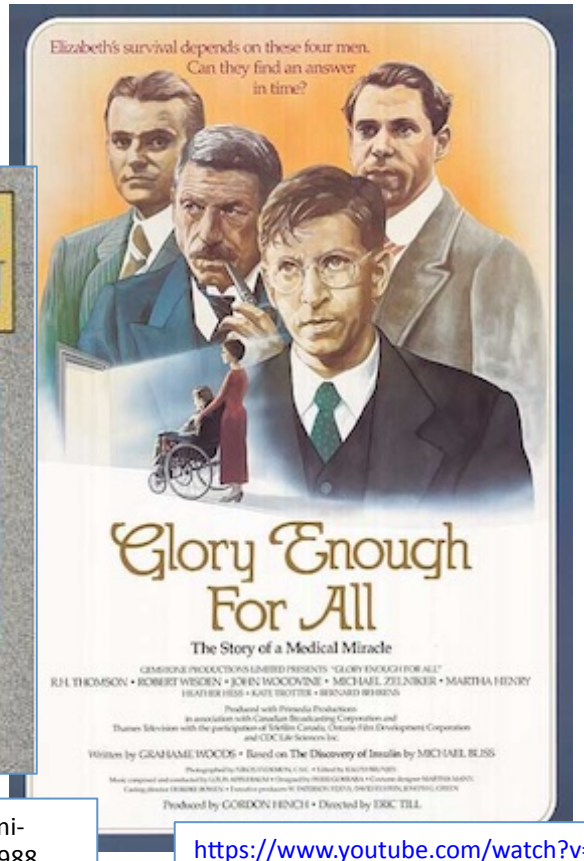
- Michael Bliss and the history of the history of the discovery of Insulin
- Ultimately, as Bliss concluded, there is glory enough for all…



First published in 1982



First published in 1984



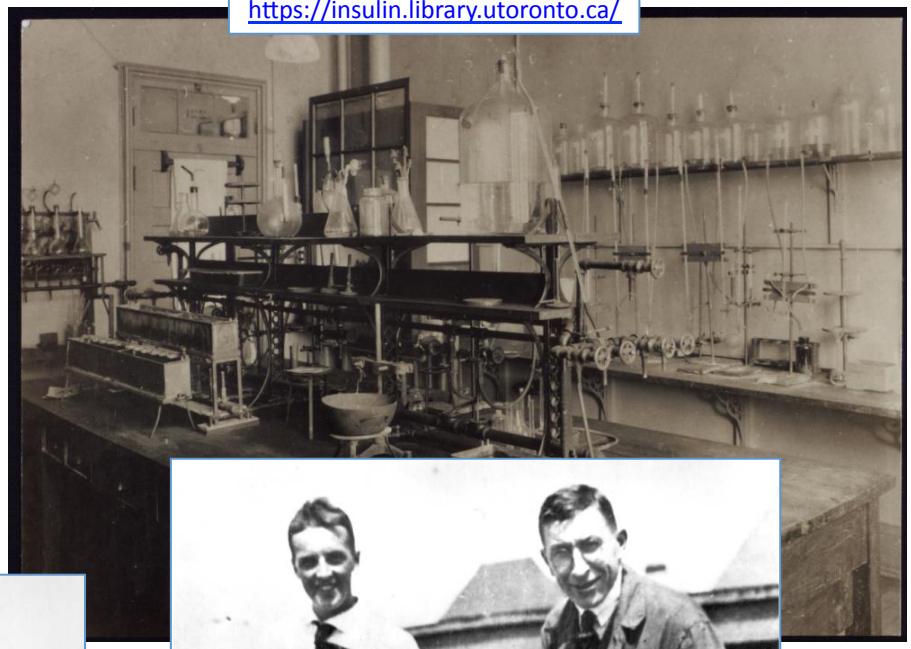
"Glory Enough For All", mini-series, originally aired in 1988

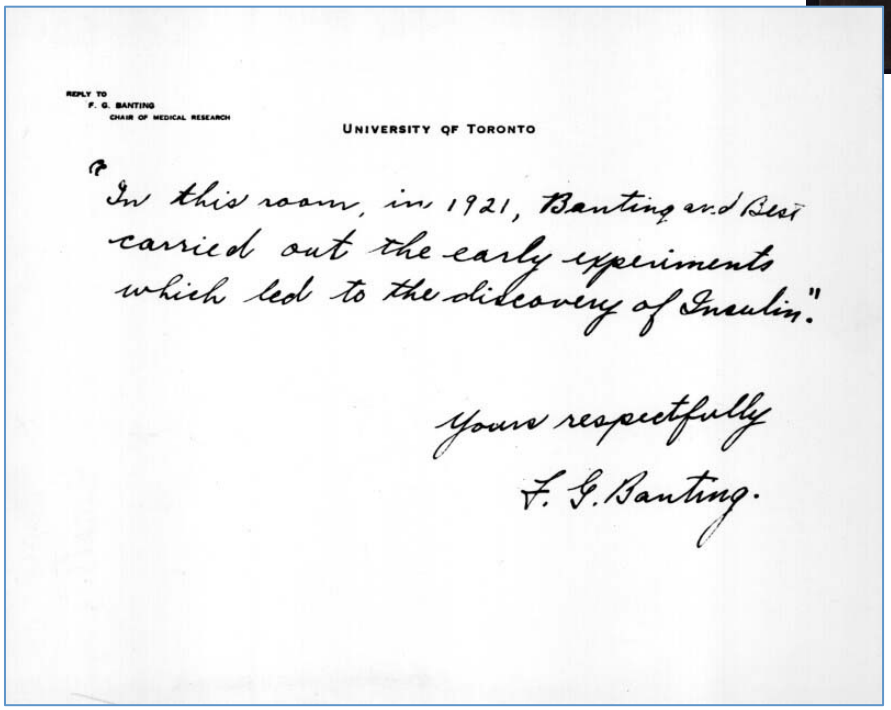
https://www.youtube.com/watch?v=brChPJ3AzkE

Discovering Insulin in Toronto

https://insulin.library.utoronto.ca/

- After meeting Macleod, who was intrigued, though skeptical, Banting was given a small lab, access to experimental dogs, a $100 budget, and the assistance of Charles Best, a recent graduate in Physiology and Biochemistry





REPLY TO
F. G. BANTING
CHAIR OF MEDICAL RESEARCH

UNIVERSITY OF TORONTO

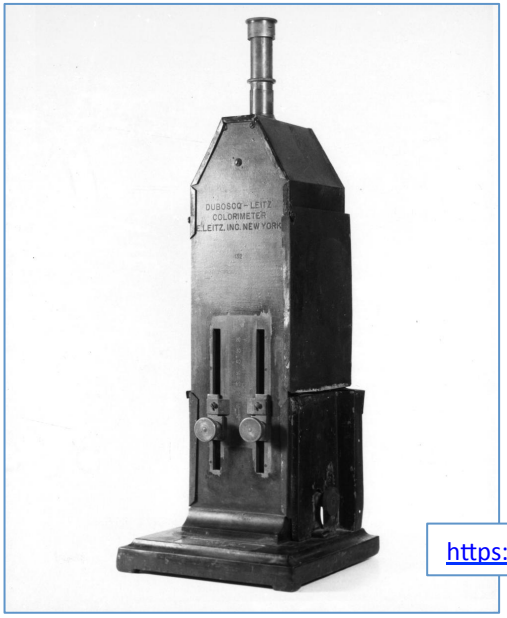
"In this room, in 1921, Banting and Best carried out the early experiments which led to the discovery of Insulin."

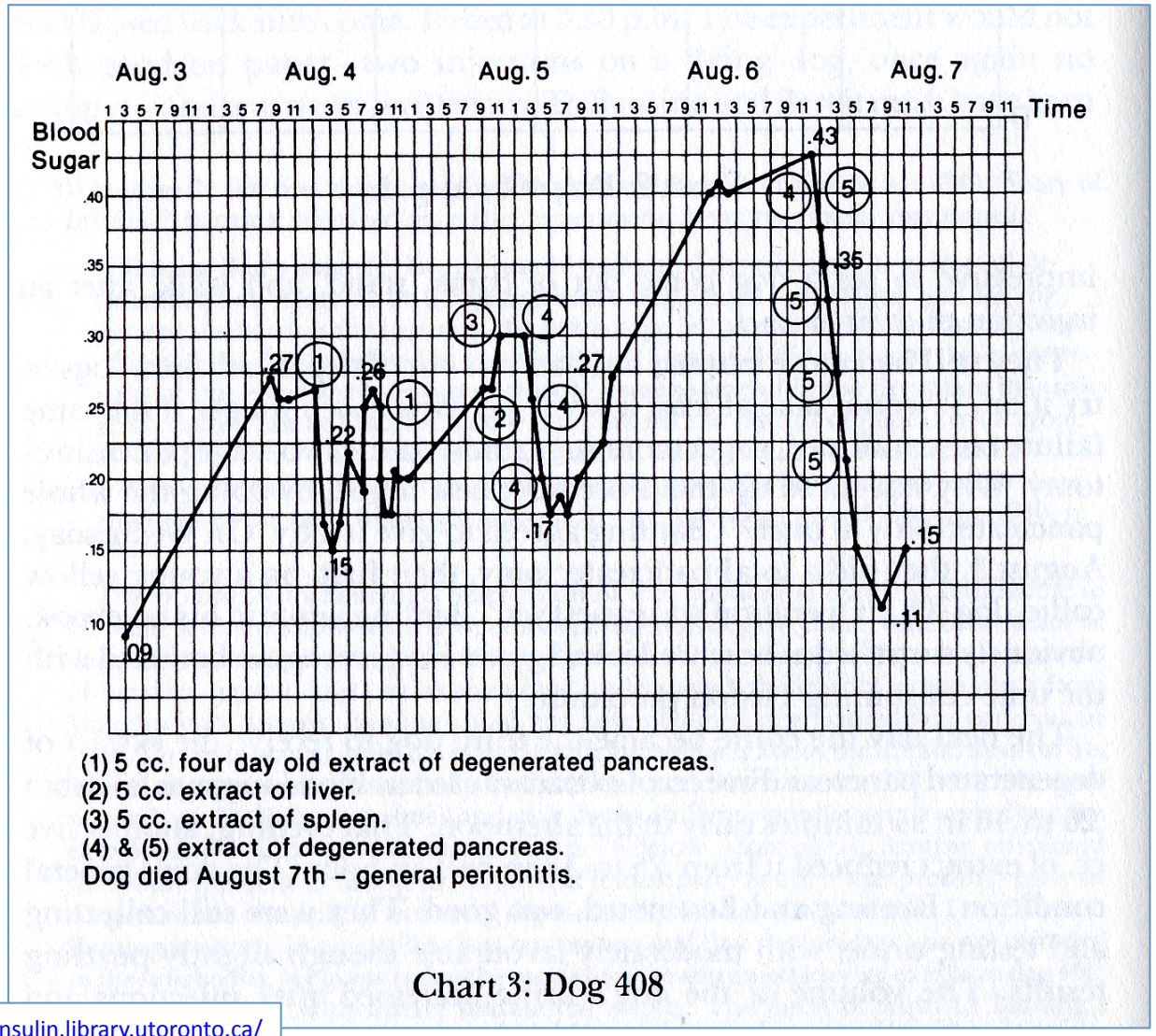
Yours respectfully

F. G. Banting.

Discovering Insulin in Toronto

- **May-Aug 1921** – During an especially hot summer, Banting and Best reported encouraging results with a pancreatic extract controlling blood sugar levels in de-pancreatized dogs.



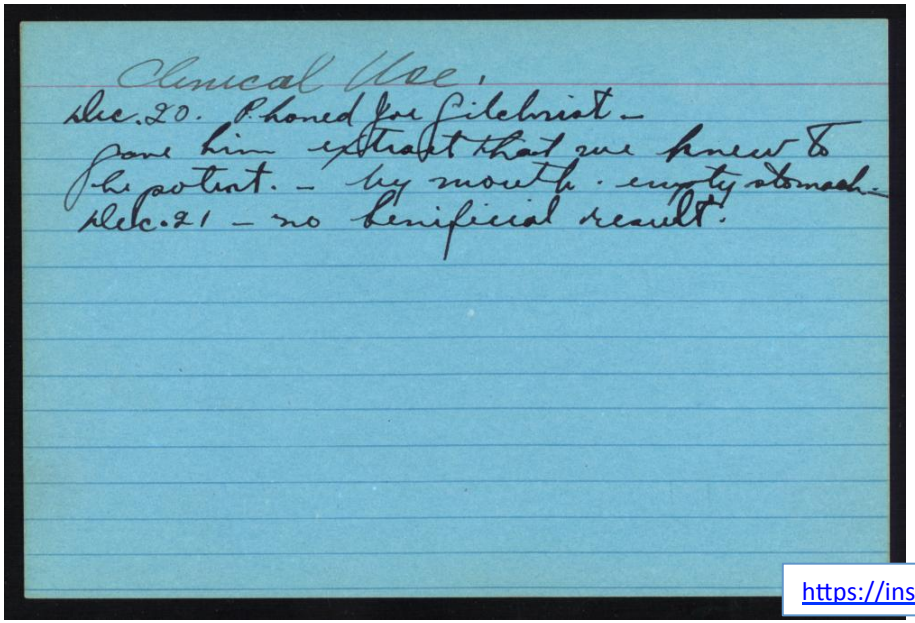


https://insulin.library.utoronto.ca/

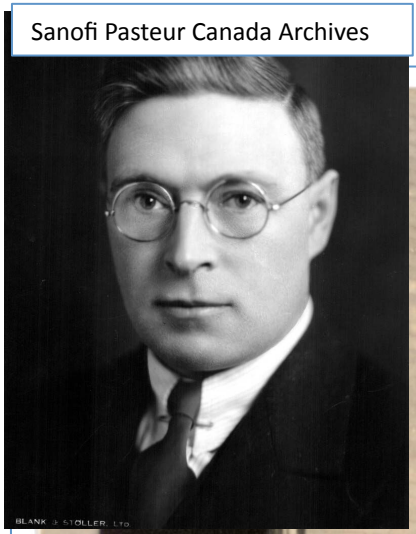
Discovering Insulin in Toronto

- **Dec 1921** - Dr. James Bertram Collip, a biochemist from the University of Alberta on sabbatical in Toronto, joins Banting and Best to help purify the extract.

- Encouraging results with dog #33, “Marjorie,” lead to the extract’s first human use (administered orally), but it was unsuccessful



Sanofi Pasteur Canada Archives



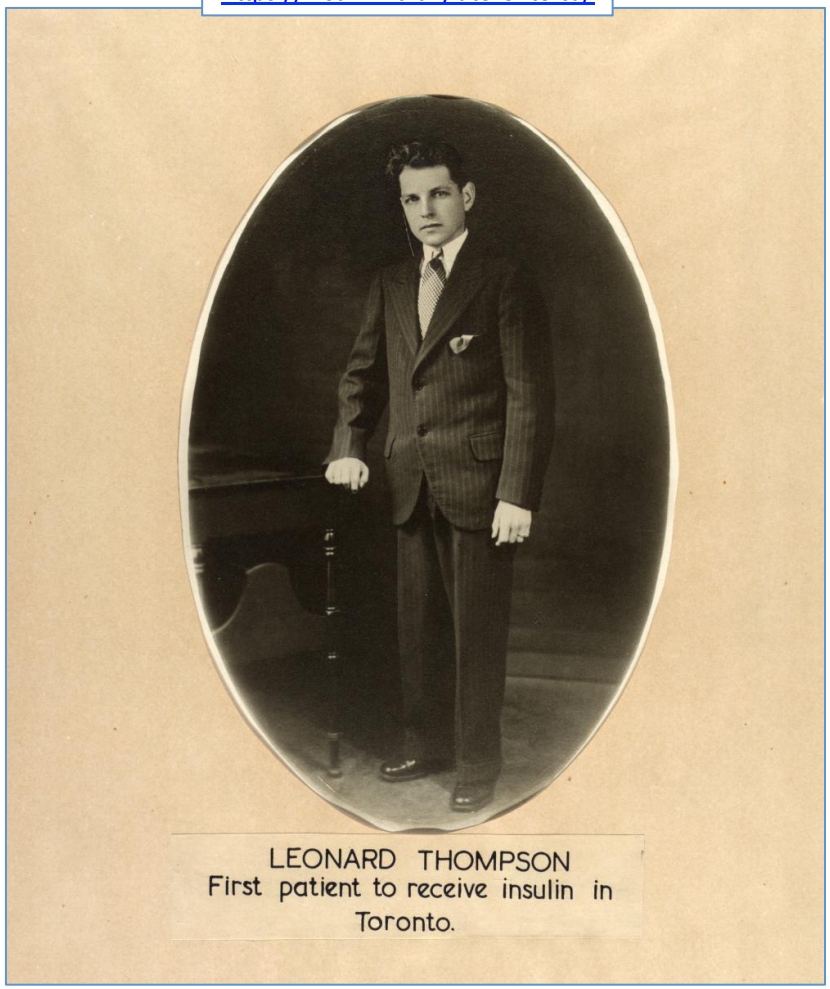
https://insulin.library.utoronto.ca/

Discovering Insulin in Toronto

- **Jan 11, 1922** - 14-year-old Leonard Thompson is the first to receive an injection of the extract, but with no effect

- **Jan 23, 1922** – Leonard receives Collip's more purified extract, with good results

https://insulin.library.utoronto.ca/



LEONARD THOMPSON
First patient to receive insulin in Toronto.

The Journal of Laboratory and Clinical Medicine

VOL. VII ST. LOUIS, FEBRUARY, 1922 No. 5

ORIGINAL ARTICLES

THE INTERNAL SECRETION OF THE PANCREAS*

BY F. G. BANTING, M.B., AND C. H. BEST, B.A.

THE hypothesis underlying this series of experiments was first formulated by one of us in November, 1920,† while reading an article dealing with the relation of the isles of Langerhans to diabetes.[1] From the passage in this article, which gives a résumé of degenerative changes in the acini of the pancreas following ligation of the ducts, the idea presented itself that since the acinous, but not the islet tissue, degenerates after this operation, advantage might be taken of this fact to prepare an active extract of islet tissue. The subsidiary hypothesis was that trypsinogen or its derivatives was antagonistic to the internal secretion of the gland. The failures of other investigators in this much-worked field were thus accounted for.

The feasibility of the hypothesis having been recognized by Professor J. J. R. Macleod, work was begun, under his direction, in May, 1921, in the Physiological Laboratory of the University of Toronto.

Developing Insulin in Toronto

https://insulin.library.utoronto.ca/

- **Jan 25, 1922** - Encouraged by Leonard Thompson's successful treatments, but concerned about the future control of the new extract's production, Connaught's Director, John FitzGerald (right), facilitated an agreement with Banting, Best, Collip and Macleod

- He offered them the Lab's facilities (in the basement of the Medical Building) to help develop methods to produce the extract for clinical trials

January 25th 1922.

MEMORANDUM IN REFERENCE TO THE CO-OPERATION OF THE CONNAUGHT ANTITOXIN LABORATORIES IN THE RESEARCHES CONDUCTED BY DR. BANTING, MR. BEST AND DR. COLLIP UNDER THE GENERAL DIRECTION OF PROFESSOR J. J. R. MACLEOD TO OBTAIN AN EXTRACT OF PANCREAS HAVING A SPECIFIC EFFECT ON BLOOD SUGAR CONCENTRATION.

The Connaught Antitoxin Laboratories will co-operate under the following conditions with the above mentioned workers:-

1) Dr. Banting, Mr. Best and Dr. Collip each agrees not to take any steps which would result in the process of obtaining an extract or extracts of pancreas being patented, prepared by any commercial firm with the aid of any of the above, or otherwise exploited during the period of co-operation of the Connaught Antitoxin Laboratories.

2) That no step involving any modification in policy concerning these researches be taken without a preliminary joint conference between Dr. Banting, Mr. Best and Dr. Collip, and Professor MacLeod and Professor FitzGerald being held;

...of the extract or extracts being shown
...the Connaught Antitoxin Laboratories
...the above outlay without any return.

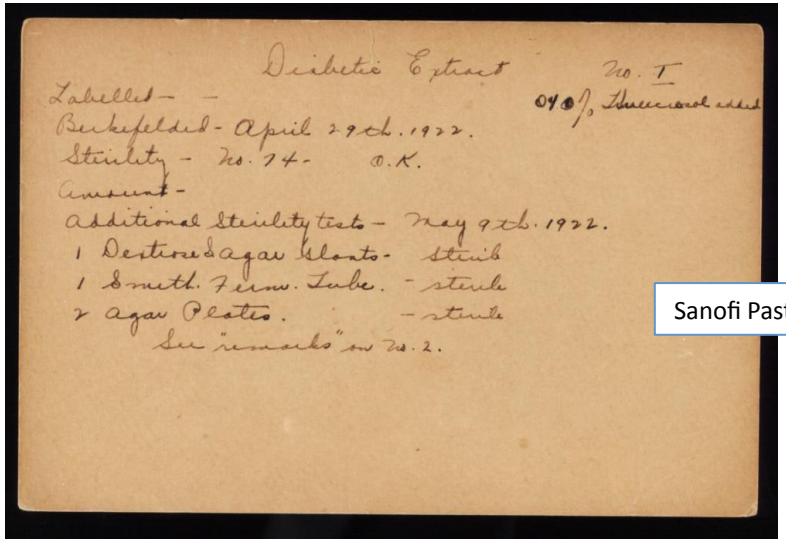
J. J. R. Macleod
C. H. Best
J. B. Collip
F. G. Banting.

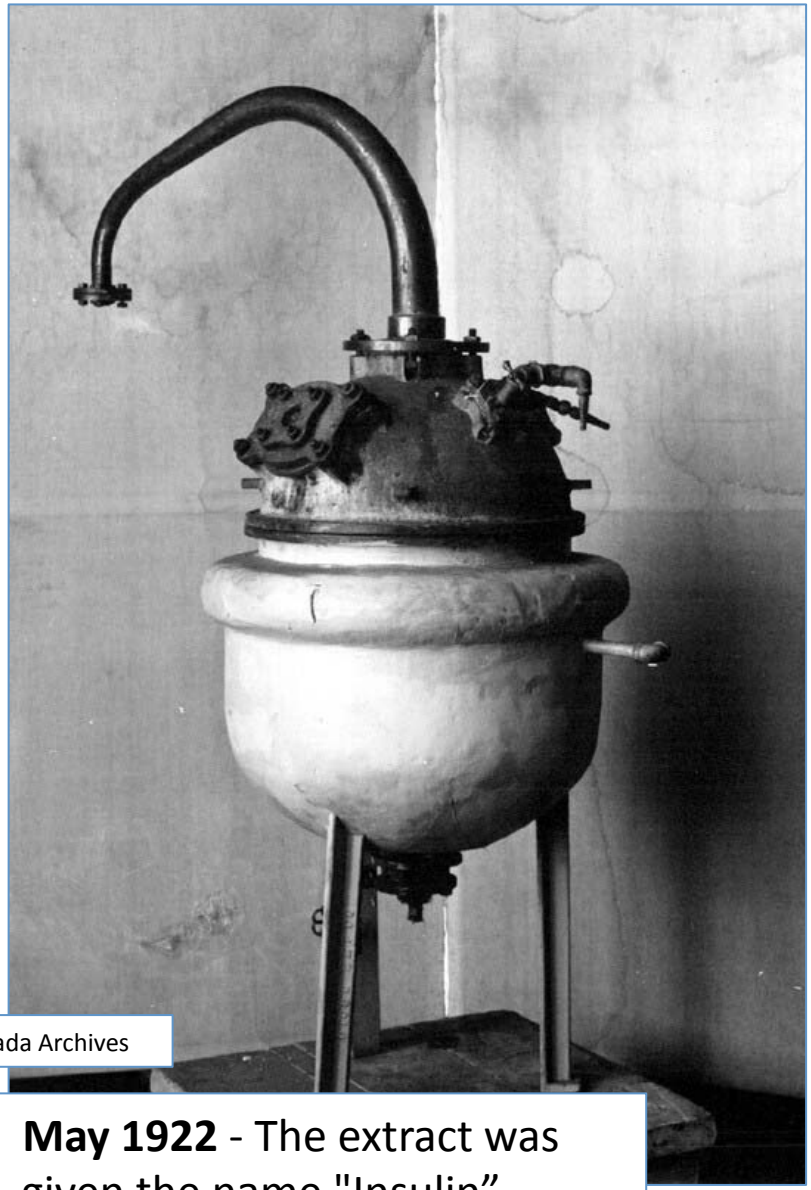
Sanofi Pasteur Canada Archives

- Clinical trials of the extract soon began in several locations in Toronto (ie. Toronto General Hospital) and elsewhere, including in the U.S., through Banting and several diabetic specialists

Developing Insulin in Toronto

- Moving to large-scale insulin production was a major challenge for Connaught.
- **March-May 1922** - After frustrating failures, production was restored under Best's direction
- Connaught then dedicated its full, though modest, resources to insulin production and output rose steadily


Diabetic Extract No. I
Labelled –
Berkefeld - April 29th. 1922.
Sterility - No. 74 - O.K.
Amount -
Additional Sterility tests – May 9th. 1922.
1 Dextrose Agar Glucose - sterile
1 Smith. Ferm. Tube. - sterile
2 Agar Plates. - sterile
See "remarks" on No. 2.



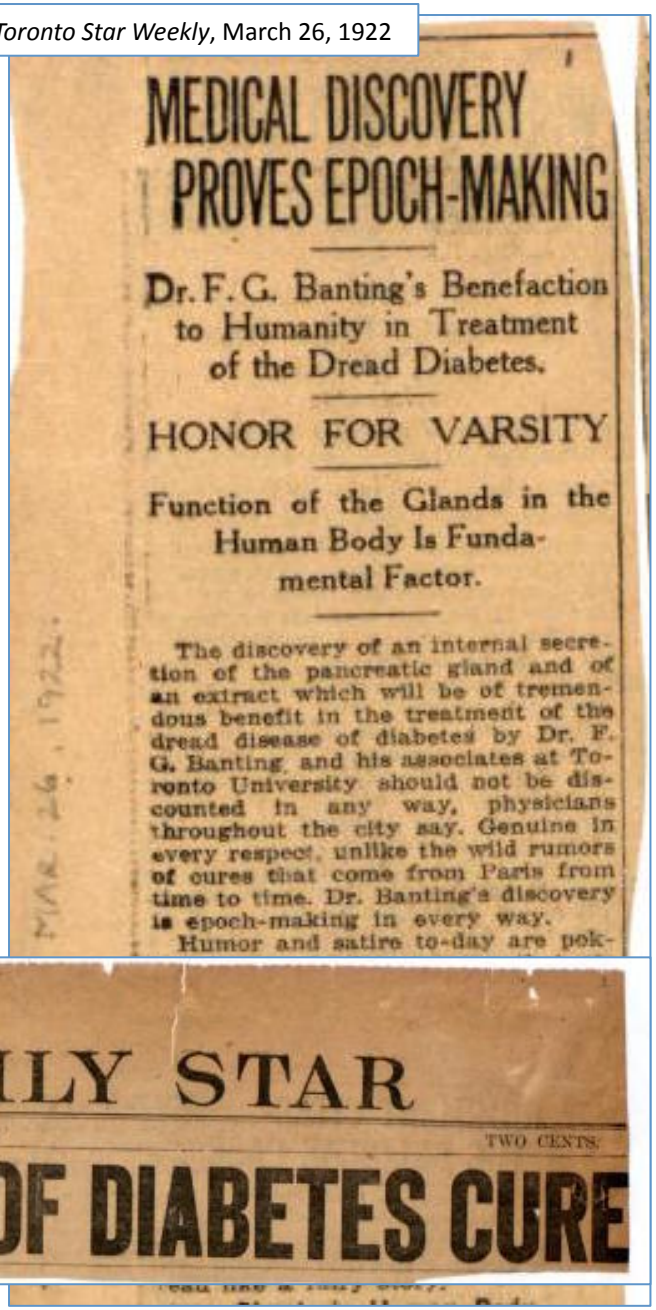
Sanofi Pasteur Canada Archives

- **May 1922** - The extract was given the name "Insulin"

Developing Insulin in Toronto

- News of the first successful use of the pancreatic extract attracted unprecedented international attention to Toronto
- It also put intense pressure on Connaught scientists to further refine and purify the extract for clinical trials and to increase production, while keeping the price as low as possible

Toronto Star Weekly, March 26, 1922



MEDICAL DISCOVERY PROVES EPOCH-MAKING

Dr. F. G. Banting's Benefaction to Humanity in Treatment of the Dread Diabetes.

HONOR FOR VARSITY

Function of the Glands in the Human Body Is Fundamental Factor.

The discovery of an internal secretion of the pancreatic gland and of an extract which will be of tremendous benefit in the treatment of the dread disease of diabetes by Dr. F. G. Banting and his associates at Toronto University should not be discounted in any way, physicians throughout the city say. Genuine in every respect, unlike the wild rumors of cures that come from Paris from time to time. Dr. Banting's discovery is epoch-making in every way.

Humor and satire to-day are pok-

Toronto Star, March 22, 1922, p. 1

THE TORONTO DAILY STAR

30TH YEAR. TWENTY-EIGHT PAGES. TORONTO, WEDNESDAY, MARCH 22, 1922. TWO CENTS.

TORONTO DOCTORS ON TRACK OF DIABETES CURE

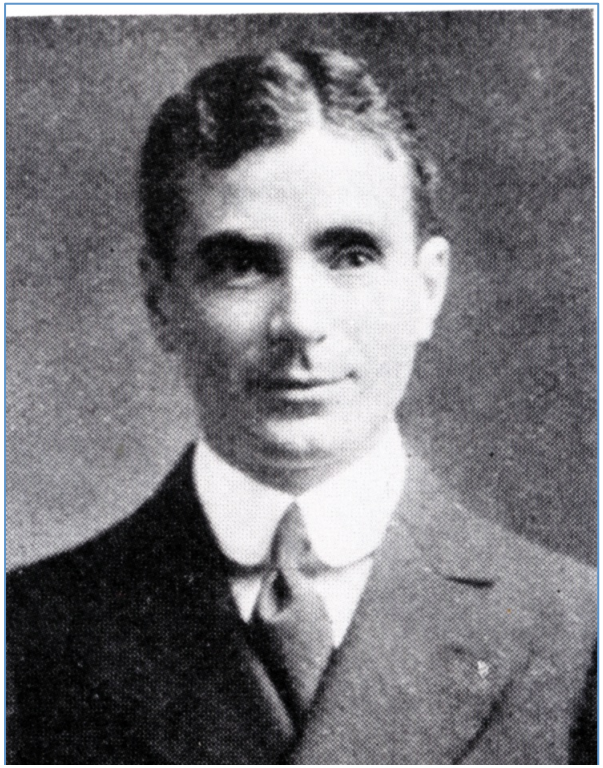
Developing Insulin in Toronto

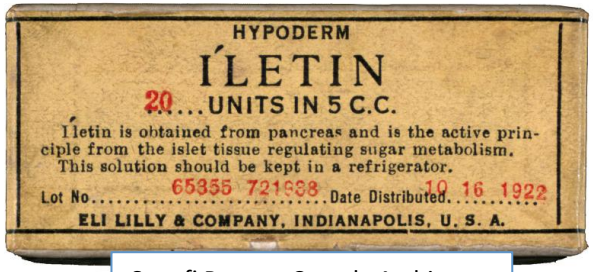
- **May 30, 1922** - A unique collaboration agreement arranged between the University of Toronto and Eli Lilly & Co. of Indianapolis, designed to expedite the the development of large scale insulin production methods

- This and other agreements relating to insulin production, licensing and patent protection was negotiated by the University of Toronto's Insulin Committee

- Charles Best assumed leadership of Connaught's Insulin production and worked closely with Eli Lilly, especially the company's Research Director, Dr. G.H.A. Clowes (right)

- The agreement granted Eli Lilly exclusive rights to supply Insulin (sold as "Iletin") in the United States until June 1924

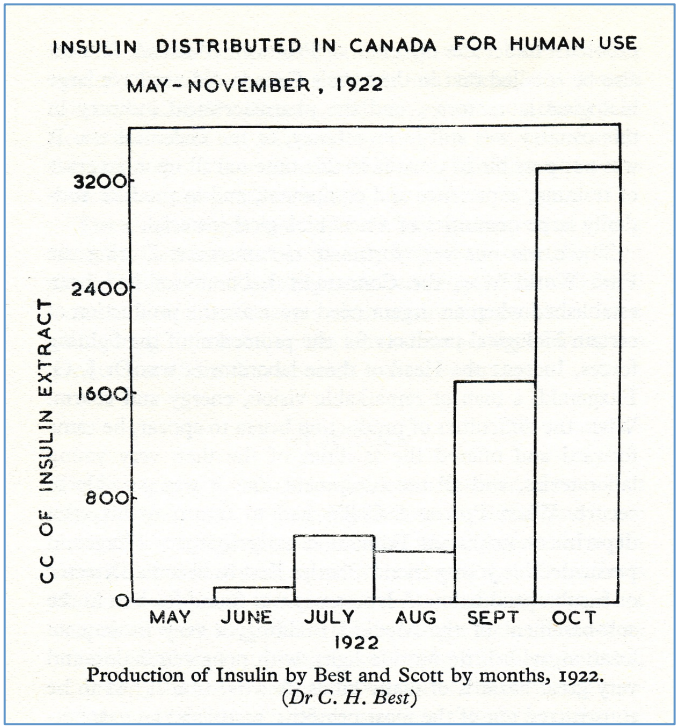




Sanofi Pasteur Canada Archives

Insulin: From Toronto To The World

- Press coverage of insulin's first clinical trials in Toronto led to a wave of requests for this diabetes "cure" from all over the world
- The severe insulin supply challenges during 1922 meant only a few critically ill patients, mostly children, could be treated.



Production of Insulin by Best and Scott by months, 1922.
(*Dr C. H. Best*)


HAVE THEY ROBBED DIABETES OF ITS TERRORS?

Shown in these pictures are the four Toronto medical men on the University staff who figure most prominently in the discovery of a pancreatic extract to be used in the clinical treatment of diabetes in human beings. This is one of the most important medical discoveries of modern research, whose possibilities as an ultimate cure of this dread disease are very encouraging, it may be gathered from the announcement to-day of the success of the extract on seven human patients at the Toronto General Hospital since January this year. Dr. F. G. Banting on the upper left, a young man of 30, a graduate from Toronto University in 1916, brought his hypothesis at the basis of the experiments with him from London, Ontario, last May. Associated with him in all the experimental work has been a younger man still, Dr. C. H. Best, only 23 years of age, on the upper right, a nephew of Mrs. Prof. Hallam, of Wycliffe College, and a son of Dr. H. H. Best, of Maine. Dr. Best on account of the promise of his work, was chosen by Prof. J. J. R. MacLeod, associate Dean of Medicine at the University, and one of the most eminent authorities on diabetic research, to assist Dr. Banting in his experiments. Dr. J. B. Collip, on the lower left, professor of bio-chemistry at the University of Alberta, on leave of absence this year as assistant-professor of pathological chemistry at Toronto, a graduate of 1912, has greatly facilitated the work in refining and concentrating the extract from ox pancreas that was finally used on human beings for the first time in January at the General Hospital.

Star Weekly

Toronto Star Weekly, March 26, 1922

Insulin: From Toronto To The World

- Almost all of these early patients were American, some from prominent families, including Elizabeth Hughes (below)
- Elsie Needham of Galt, ON (right), was the only Canadian among this group of early patients.

Toronto Star, Aug 17, 1922

DAUGHTER OF U.S. SECRETARY OF STATE TRIES NEW TORONTO DISCOVERY.

On the left is Mrs. Charles Evans Hughes, who accompanied her daughter to Toronto this week to take a new treatment for diabetes, which has been worked out at the University of Toronto. In the centre is her fifteen-year-old daughter, who is here to take the treatm ent. On the right is Dr. F. G. Banting, 160 Bloor street west, who is the originator of the insulin treatment for diabetes, and who for over a year has been doing research work along with Mr. C. H. Best, of Toronto. The new treatment has already prolonged the lives of many sufferers from the disease.

Uncertain, Oct 1922

INSULIN METHOD SAVES GALT GIRL

Hope Had Been Abandoned for Child Suffering From Diabetes.

Eleven-year-old Elsie Needham, of Galt, is a patient in the Hospital for Sick Children receiving the diabetes treatment perfected by Dr. Banting of this city. The child was brought to the city two weeks ago. Her condition was pronounced hopeless by a number of medical men who examined her prior to her parents deciding to send her to Toronto.

The child was unconscious for several days, and little hope was held out for her recovery. While the disease had reached an advanced stage, the child has responded to the treatment wonderfully well. Her condition continues to show signs of improvement each succeeding day. Last night at the hospital it was stated little Elsie had recovered consciousness, and appeared to be gain-

Insulin: From Toronto To The World

- **April 1923** - Canada's insulin supply finally found a firm foothold thanks to funds from the Ontario government, a New York City diabetic, and Connaught's reserves, to establish an insulin production plant in U of T's vacant YMCA building on campus

Uncertain, April 1923

ONTARIO LEADS THE WAY TO THE WORLD

43

To-morrow the Ontario Government will open the former Y.M.C.A. uilding at the University of Toronto as headquarters for the free dis- ribution of insulin to those unable to pay for it. This is due to the in- iative of the new Provincial Minister of Health, Hon. Dr. Forbes God- rey, who by his prompt recognition of the duty devolving upon the state uch matters has the satisfaction of having blazed the trail for the rities in the Old Land, who are to adopt a similar policy.

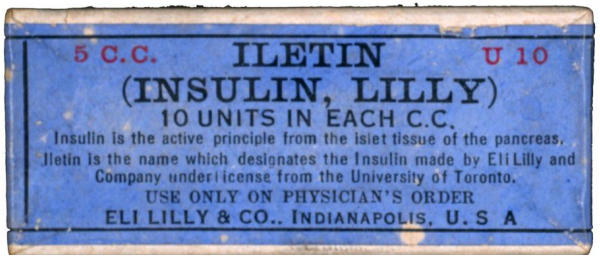
- Soon Connaught was supplying insulin for all of Canada.

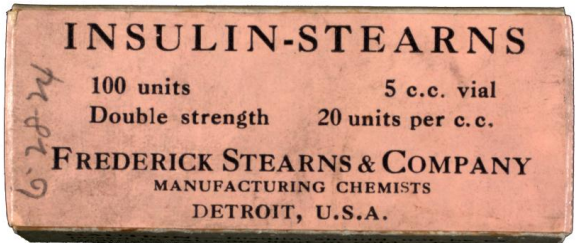
Sanofi Pasteur Canada Archives

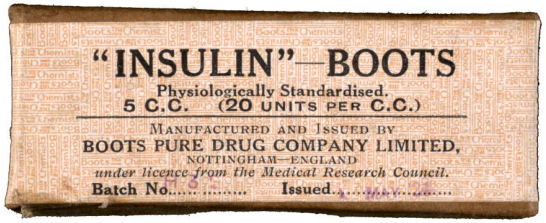
Insulin: From Toronto To The World

- As Insulin production steadily grew in Canada, the University of Toronto Insulin Committee focused on licensing its production in other countries
- Eli Lilly had exclusive U.S. rights until 1924, when other American firms were granted licenses
- In the U.K., the Medical Research Council was given the right to issue licenses there
- Firms in Australia and Denmark also received early licenses

- By 1926, insulin was patented and trademarked in 44 countries, with the Insulin Committee carefully regulating who produced it

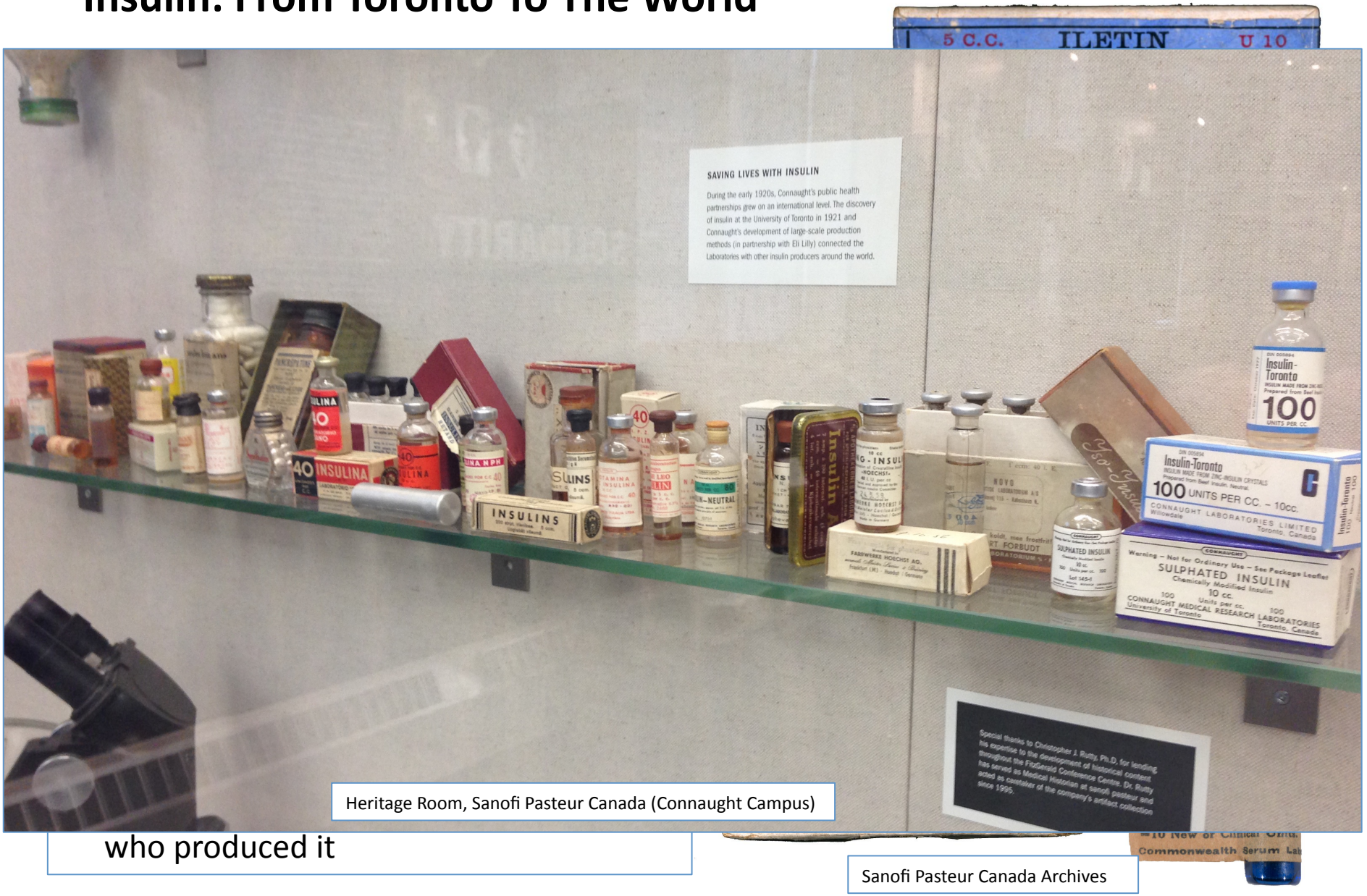






Sanofi Pasteur Canada Archives

Insulin: From Toronto To The World

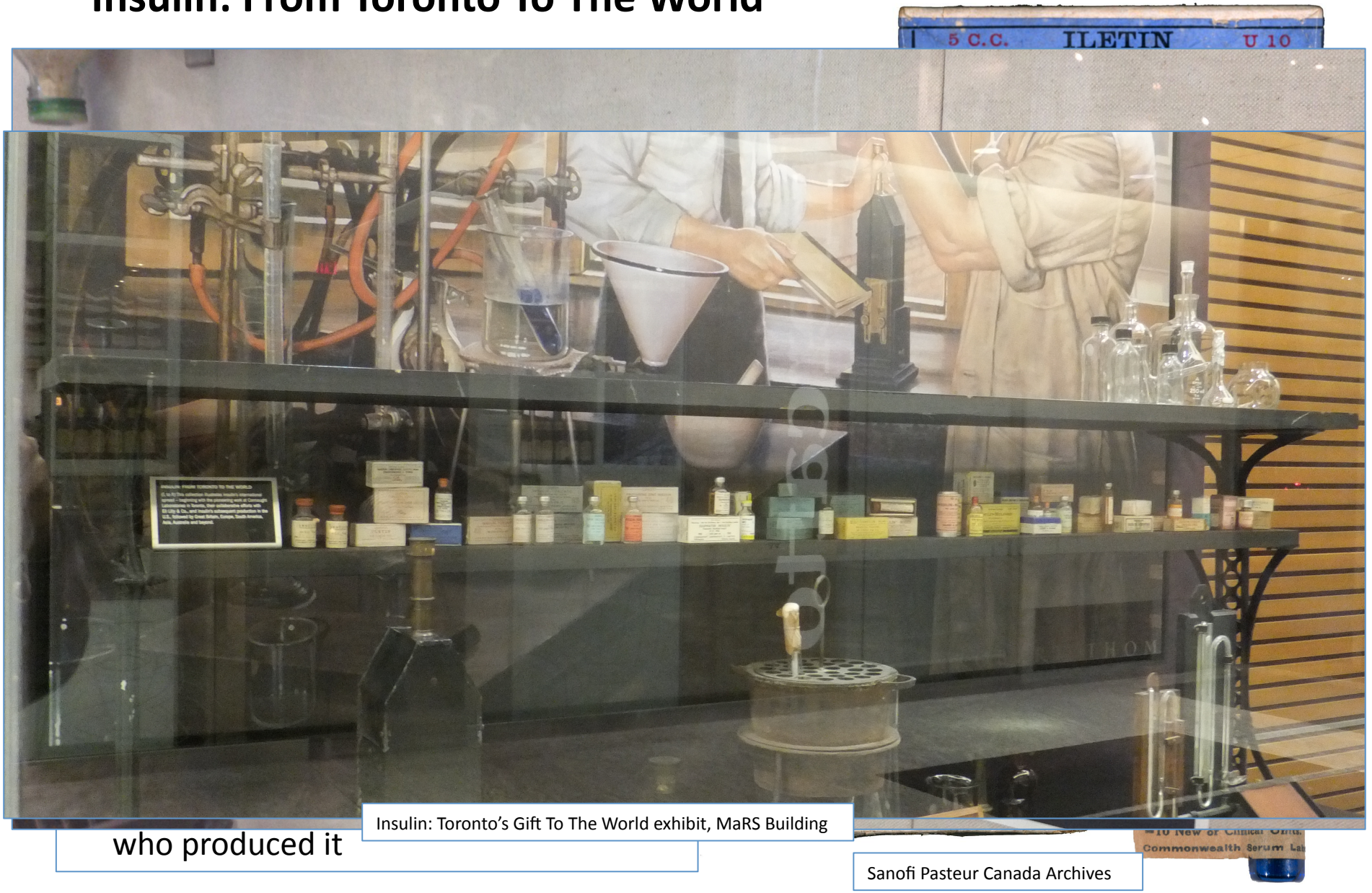


Heritage Room, Sanofi Pasteur Canada (Connaught Campus)

who produced it

Sanofi Pasteur Canada Archives

Insulin: From Toronto To The World



Insulin: Toronto's Gift To The World exhibit, MaRS Building

who produced it

Sanofi Pasteur Canada Archives

Insulin: Honouring the Discoverers

- **May 1923** - Ontario government funded the Banting and Best Chair of Medical Research at U. of T.
- **July 1923** – Federal government awarded Banting with a lifetime annuity
- **Oct 1923** - A greater global honour came when Banting and Macleod won the Nobel Prize for Medicine

- However, recognizing that two others were similarly deserving, Banting shared his half of the Prize with Best and Macleod shared his with Collip

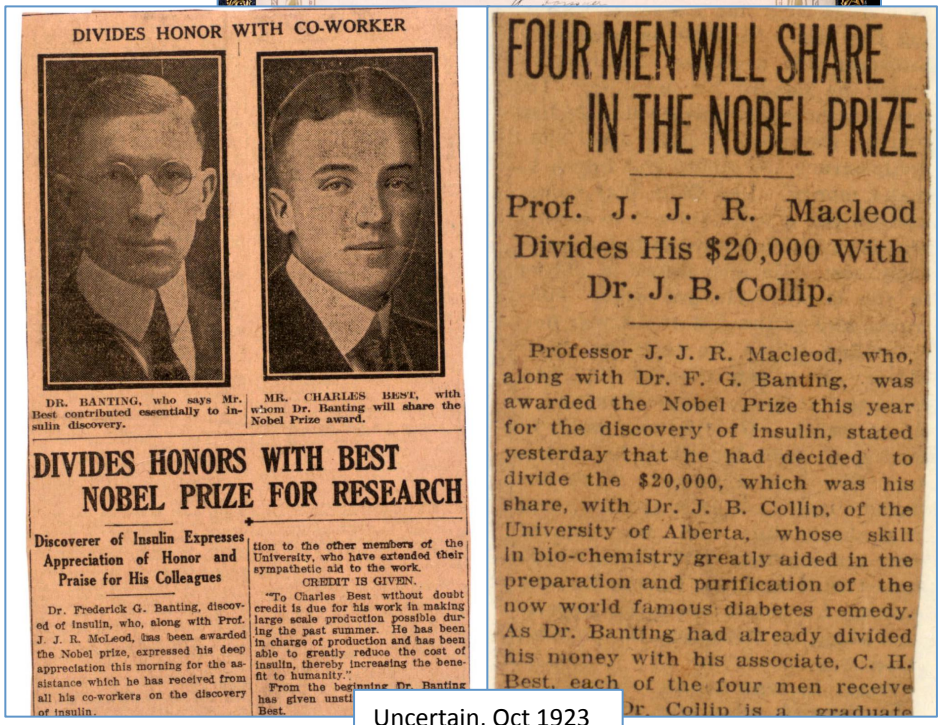

K. KAROLINSKA MEDIKO KIRURGISKA INSTITUTET

vilket enligt testamente, som den 27 november 1895 upprättats av ALFRED NOBEL, äger att med NOBELPRIS belöna den viktigaste upptäckt, varmed de fysiologiska och medicinska vetenskaperna under den senaste tiden rikatats, har denna dag beslutit att tillerkänna det år 1923 utgående priset till

FREDERICK G. BANTING
OCH
JOHN J. R. MACLEOD

för deras upptäckt av insulin.

Stockholm den 25 oktober 1923.


DIVIDES HONOR WITH CO-WORKER

DR. BANTING, who says Mr. Best contributed essentially to insulin discovery.

MR. CHARLES BEST, with whom Dr. Banting will share the Nobel Prize award.

DIVIDES HONORS WITH BEST NOBEL PRIZE FOR RESEARCH

Discoverer of Insulin Expresses Appreciation of Honor and Praise for His Colleagues

Dr. Frederick G. Banting, discoverer of insulin, who, along with Prof. J. J. R. McLeod, has been awarded the Nobel prize, expressed his deep appreciation this morning for the assistance which he has received from all his co-workers on the discovery of insulin.

tion to the other members of the University, who have extended their sympathetic aid to the work.

CREDIT IS GIVEN.

"To Charles Best without doubt credit is due for his work in making large scale production possible during the past summer. He has been in charge of production and has been able to greatly reduce the cost of insulin, thereby increasing the benefit to humanity."

From the beginning Dr. Banting has given unsti... Best.

FOUR MEN WILL SHARE IN THE NOBEL PRIZE

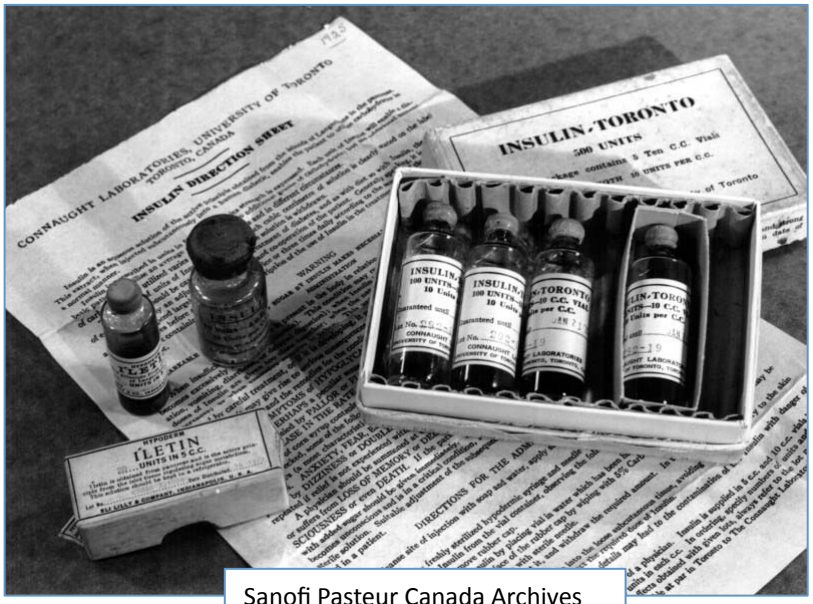
Prof. J. J. R. Macleod Divides His $20,000 With Dr. J. B. Collip.

Professor J. J. R. Macleod, who, along with Dr. F. G. Banting, was awarded the Nobel Prize this year for the discovery of insulin, stated yesterday that he had decided to divide the $20,000, which was his share, with Dr. J. B. Collip, of the University of Alberta, whose skill in bio-chemistry greatly aided in the preparation and purification of the now world famous diabetes remedy. As Dr. Banting had already divided his money with his associate, C. H. Best, each of the four men receive... Dr. Collip is a graduate...

Uncertain, Oct 1923

Insulin's Impact on Public Health

- **1923-24** – While Connaught's Insulin production increased and the world's attention had been focused on Toronto in the wake of the Nobel Prize news, U of T's and Connaught's other public service work with vaccines production and in public health research and education, had already attracted international attention, especially from the Rockefeller Foundation



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Toronto Star, Nov 29,1923

HURSDAY, NOVEMBER 29, 1923.

INSULIN PRODUCTION 250,000 UNITS WEEKLY

And Price Has Dropped From Five Cents to Two Cents Per Unit

Tucked away in an obscure corner of the University of Toronto grounds, overshadowed by the new Electrical Engineering Building and flanked by a row of venerable elms, stands a two-storey, red brick building formerly occupied by the University Y. M. C. A. A year or two ago it was planned to remove the building as it was not suitable for any University purpose. To-day, housing, as it does, the only "Insulin Laboratory" in Canada, the building, together with the recently installed equipment, is worth upwards of $35,000.

The Insulin Laboratory is one of the latest chapters in the romance of insulin. It stands as a confirmation of the success of the research of Dr. F. G. Banting and his fellow-investigator, Charles H. Best, M.A. Its management and operation are in the hands of Mr. Best, who has from the beginning been in charge of the large-scale production of insulin. The laboratory is operated as a division of the Connaught Anti-Toxin Laboratories, of which Dr. J. G. Fitzgerald is director and Dr. R. D. Defries associate director. The business administration is in charge of Dr. Fitzgerald and Dr. Defries. Mr. Best is assisted in the new laboratories by D. A. Scott, M.A., as assistant director, and a staff of 26 persons working day and night shifts.

Big Production Now

The erection of such a completely equipped plant was made possible through the Ontario government's grant of $25,000, the remaining $10,000 to $15,000 being secured from funds of the laboratory and from private donations. The plant is now producing in the neighborhood of 250,000 units a week for distribution throughout Canada, Ireland, South Africa, Central America, New Zealand, Australia, and other countries where plants have not been established. The average dosage for the diabetic patients for whom such a large quantity of insulin is being prepared varies from 15 to 20 units a day.

The price for which insulin is distributed is, as with other products of the Connaught Laboratories, governed entirely by costs of material and of production. The Connaught Laboratories are not engaged in commercial business but constitute a department of the University of Toronto. Mr. Best has called attention to the gradual fall in the price of insulin. In May, 1923, the material was sold at 5 cents per unit, in June at 3 cents, and now at 2 cents per unit.

How It is Prepared

The distribution of insulin is effected through two channels. The first is hospitals which have organized departments for the administration of insulin. The second is through physicians trained in the use of insulin. For these latter a special short course of instruction was provided at the University of Toronto last July under the direction of Professor Duncan Graham.

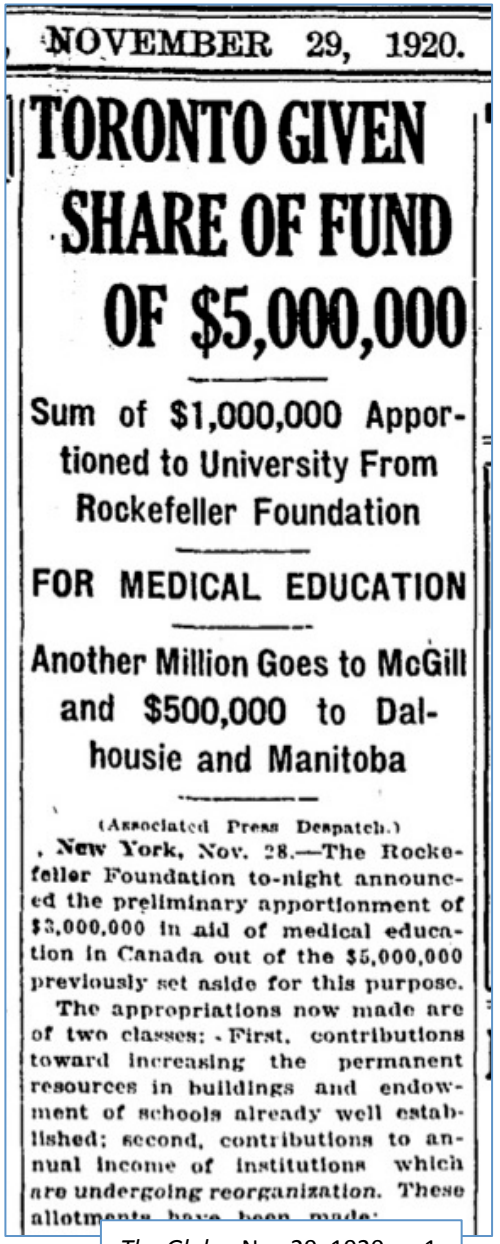
The preliminary stages in the preparation of the health-giving extract are conducted in a large laboratory in the north-east corner of the in-

Insulin's Impact on Public Health

- **1913** - The Rockefeller Foundation established to focus its substantial financial resources on improving medical education in the United States and Canada, and, through its International Health Commission, to further public health education and research

- **1916-18** – School of Hygiene and Public Health at Johns Hopkins University, Baltimore, established with Rockefeller funding; the 1st such School of Hygiene, with a 2nd created at Harvard in 1921

- **1920** – To improve medical education in Canada, Rockefeller Foundation pledged $5,000,000 to be shared between Canadian medical schools, with U. of T. receiving $1,000,000



NOVEMBER 29, 1920.

TORONTO GIVEN SHARE OF FUND OF $5,000,000

Sum of $1,000,000 Apportioned to University From Rockefeller Foundation

FOR MEDICAL EDUCATION

Another Million Goes to McGill and $500,000 to Dalhousie and Manitoba

(Associated Press Despatch.)

New York, Nov. 28.—The Rockefeller Foundation to-night announced the preliminary apportionment of $3,000,000 in aid of medical education in Canada out of the $5,000,000 previously set aside for this purpose.

The appropriations now made are of two classes: First, contributions toward increasing the permanent resources in buildings and endowment of schools already well established; second, contributions to annual income of institutions which are undergoing reorganization. These allotments have been made:

The Globe, Nov 29, 1920, p. 1

Insulin's Impact on Public Health

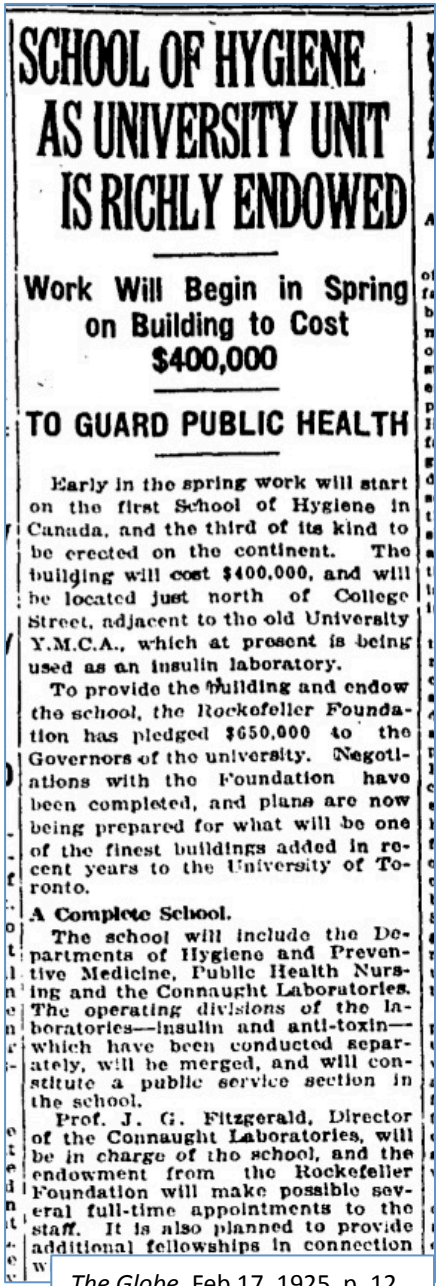
- **1923** – Rockefeller Foundation contributed $10,000 to Toronto General Hospital and the Hospital for Sick Children to support Banting's Insulin studies

- Rockefeller Foundation also looking for a 3rd institution to further showcase its support of public health education and research and U. of T. was an obvious choice

- **1923** – Rockefeller officials met with John FitzGerald, who was not shy about what was really needed:

- *A new building to house Connaught's expanding responsibilities with Insulin and other biological public health products, along with a growing program of public health teaching and research*

- **Feb 1925** – Full details announced of Rockefeller's gift to create School of Hygiene @ U. of T



SCHOOL OF HYGIENE AS UNIVERSITY UNIT IS RICHLY ENDOWED

Work Will Begin in Spring on Building to Cost $400,000

TO GUARD PUBLIC HEALTH

Early in the spring work will start on the first School of Hygiene in Canada, and the third of its kind to be erected on the continent. The building will cost $400,000, and will be located just north of College Street, adjacent to the old University Y.M.C.A., which at present is being used as an insulin laboratory.

To provide the building and endow the school, the Rockefeller Foundation has pledged $650,000 to the Governors of the university. Negotiations with the Foundation have been completed, and plans are now being prepared for what will be one of the finest buildings added in recent years to the University of Toronto.

A Complete School.

The school will include the Departments of Hygiene and Preventive Medicine, Public Health Nursing and the Connaught Laboratories. The operating divisions of the laboratories—insulin and anti-toxin—which have been conducted separately, will be merged, and will constitute a public service section in the school.

Prof. J. G. Fitzgerald, Director of the Connaught Laboratories, will be in charge of the school, and the endowment from the Rockefeller Foundation will make possible several full-time appointments to the staff. It is also planned to provide additional fellowships in connection

The Globe, Feb 17, 1925, p. 12

Insulin's Impact on Public Health

- **1925** – Rockefeller Foundation committed $400,000 (or $5.5 million today) for a new building plus $250,000 (or $3.5 million today) to endow a Dept. of Epidemiology & Biometrics, and a Dept. of Physiological Hygiene; a Dept. of Hygiene & Preventive Medicine would also be accommodated

- The new building would also accommodate Connaught's main production, distribution and research operations and a shared administration with the School

- The Canadian Public Health Association would also be accommodated in the new building

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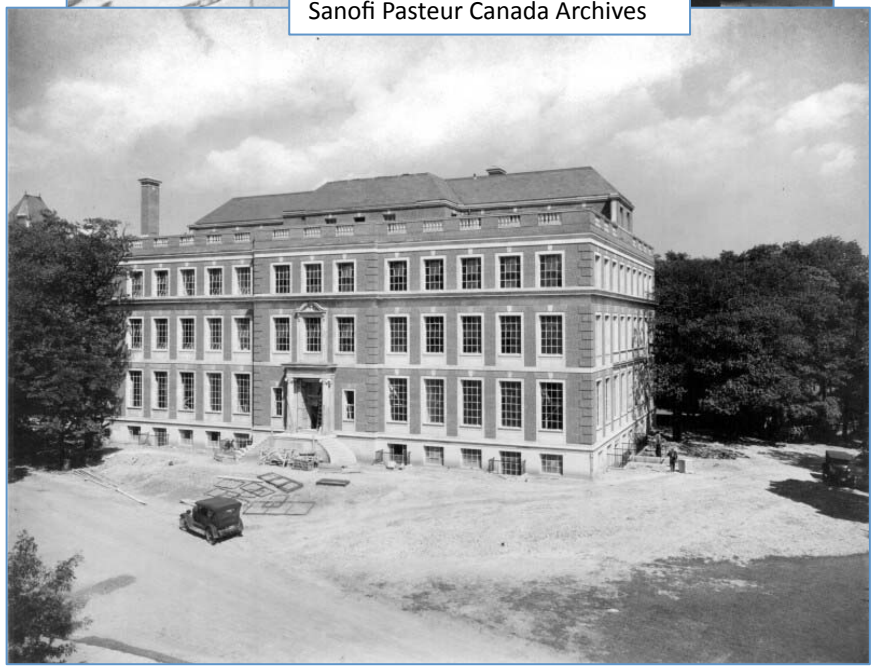

Insulin's Impact on Public Health

- Proceeds from sales of Connaught's products were directed to the Connaught Labs Research Fund, which provided the School with a further endowment of $250,000

- **June 9, 1927** – The School of Hygiene Building was formally opened with a special event a Convocation Hall followed by a tour led by FitzGerald along with Frederick Banting and Charles Best

Sanofi Pasteur Canada Archives

UNIVERSITY BUILDING TO BE OPENED JUNE 9

Sir George Newman Will Officiate at School of Hygiene Ceremony

NEW HOME OF INSULIN

Sir George Newman, K.C.B., Chief Medical Officer of the Ministry of Health for England and Wales, will officiate at the opening of the new School of Hygiene of the University of Toronto, which takes place on Thursday morning, June 9, it was announced yesterday.

The formal opening of the new building, which fronts on College Street, and is situated just east of the Mining and Electrical Buildings, and just south of the Biology Building of the university, will occur as one of the events of Commencement Week, which continues at the uni-

The Globe, May 5, 1927, p. 14

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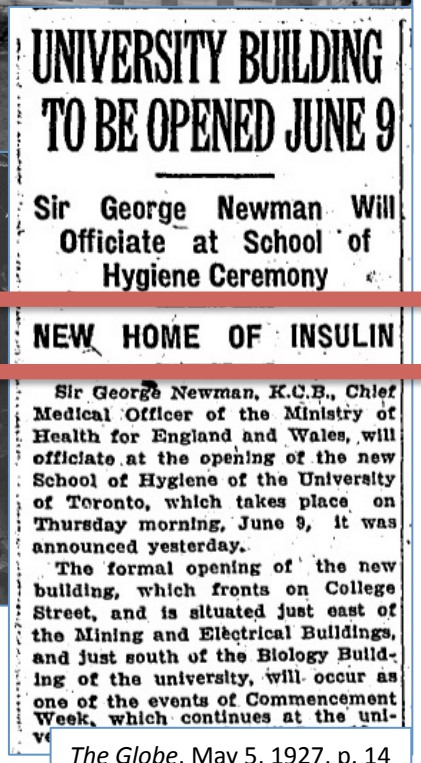

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The Globe, May 5, 1927, p. 14

- As was prominently noted, the new School of Hygiene Building would be the "new home of Insulin"

Insulin's Impact on Public Health

- In the Hygiene Building's new Insulin Plant, the production process began by mincing frozen beef or pork pancreas with alcohol
- Connaught made a deal with all the meat packers in Canada to secure pancreas tissue at the lowest possible price
- The insulin-containing extract was separated from the pancreas and the alcohol removed by vacuum distillation
- The remaining material was filtered and the insulin separated out by adding sodium chloride

Sanofi Pasteur Canada Archives

Insulin's Impact on Public Health

- **Late 1920s** - An additional process was introduced to further purify insulin into a crystalline form
- Connaught's expanded Insulin production process based on crystalizing insulin, along with the design of the Hygiene Building's Insulin plant, was led by Dr. David A. Scott
- A specialist in chemistry and mineralogy, Scott joined Connaught in 1922 and worked very closely with Best on solving Insulin production challenges

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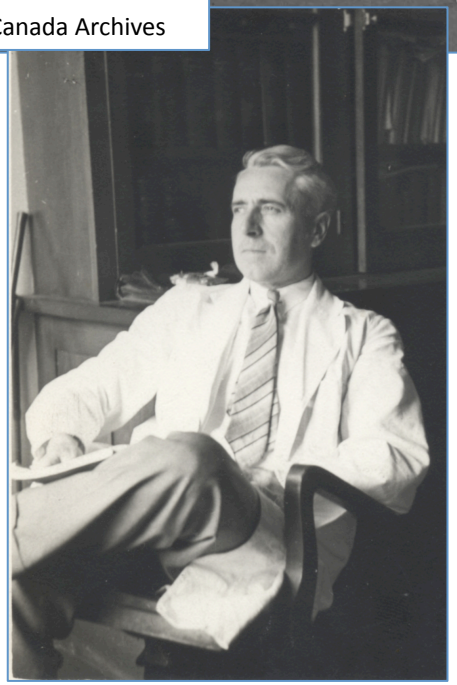
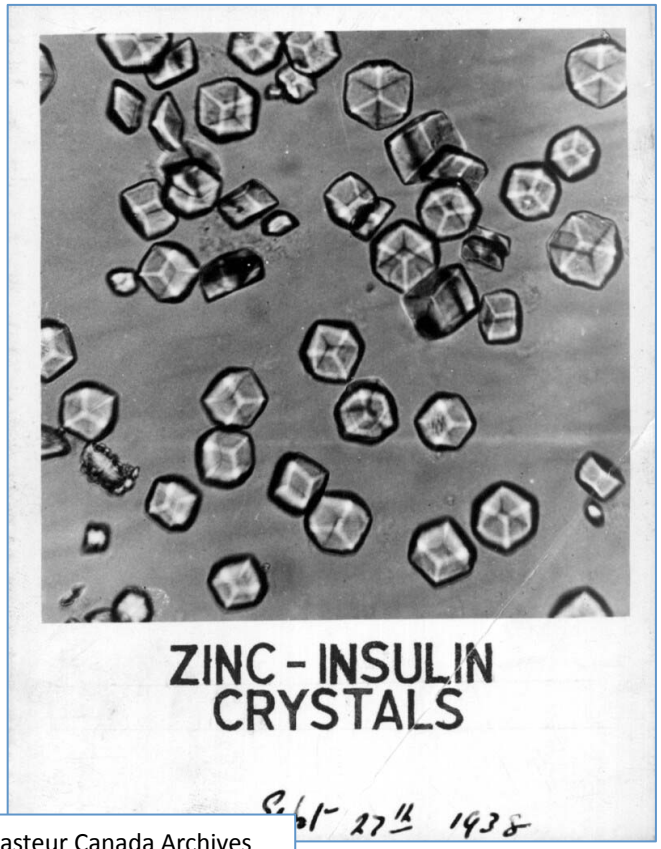


Insulin's Impact on Public Health

- **1931** – Scott also discovered that the secret to a consistent and large supply of insulin was the addition of small amounts of zinc chloride.

- This discovery led to Scott overseeing the establishment of the first international standard for insulin.



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Insulin's Impact on Public Health

- **1936** – Scott (centre) worked with Dr. A.M. Fisher (left) to improve Protamine Insulin, which was the first long acting Insulin developed by Dr. H.C. Hagedorn (right) of Nordisk Laboratories in Denmark

- They added trace amounts of zinc, resulting in a more stable and longer acting form of Insulin that was patented through the UofT Insulin Committee and rapidly adopted globally

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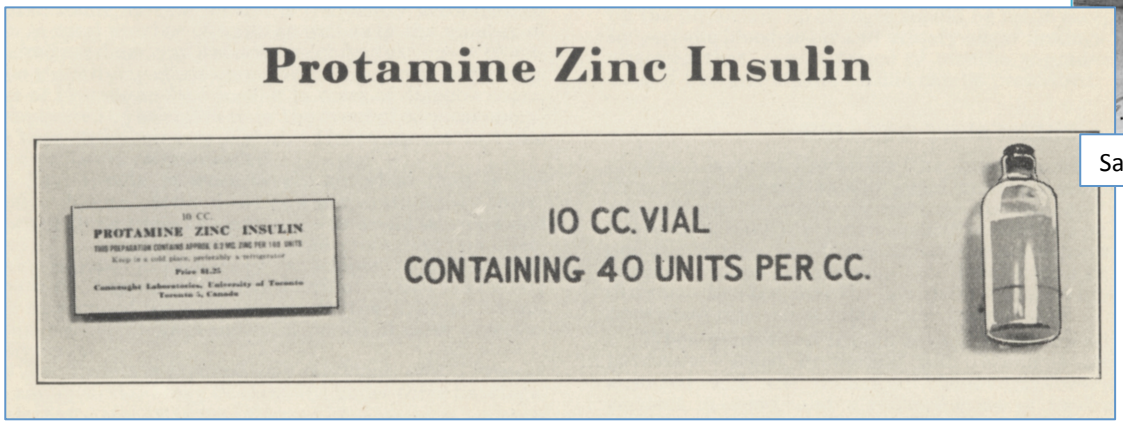
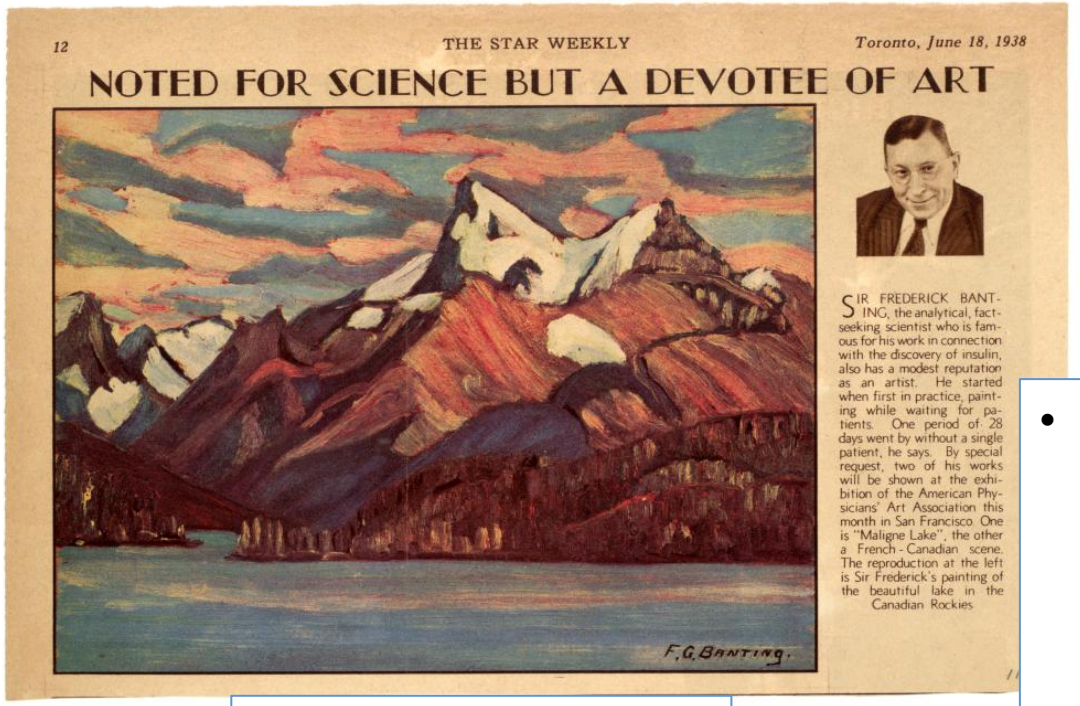


Insulin's Impact On Its Discoverers: *Frederick Banting*

- Banting would focus on medical research, but was drawn to a growing interest in art, especially painting with A.Y. Jackson, a member of the Group of Seven



12 THE STAR WEEKLY Toronto, June 18, 1938

NOTED FOR SCIENCE BUT A DEVOTEE OF ART

SIR FREDERICK BANTING, the analytical, fact-seeking scientist who is famous for his work in connection with the discovery of insulin, also has a modest reputation as an artist. He started when first in practice, painting while waiting for patients. One period of 28 days went by without a single patient, he says. By special request, two of his works will be shown at the exhibition of the American Physicians' Art Association this month in San Francisco. One is "Maligne Lake", the other a French-Canadian scene. The reproduction at the left is Sir Frederick's painting of the beautiful lake in the Canadian Rockies.

F.G. BANTING.

Toronto Star Weekly, June 18, 1938, p. 12

Sanofi Pasteur Canada Archives

- There were great expectations that Banting would make another major medical discovery, which proved quite frustrating, and art provided an important escape

Insulin's Impact On Its Discoverers: *Frederick Banting*

- When World War II started, Banting became involved with aviation medicine studies
- He also worked closely with the British Air Force and was on a secret flight to Britain on February 20, 1941, when his small plane crashed shortly after taking off from Gander, Newfoundland
- Banting died the next day and was buried at Mount Pleasant Cemetery in Toronto.

THE EVENING TELEGRAM

VOL. LXV., NO. 263 34 PAGES TORONTO, TUESDAY, FEBRUARY 25, 1941 PRICE THREE CENTS

HOME EDITION

BANTING CRASH PROBED

Planes Rushed To Scene Of Wreck On Newfoundland Coas

Secret Anti-Gas Formula Being Rushed To Britain When Banting Met Death

Invasion Defense Discovered by Famed Savant Not Lost With His Death — Planes Sent to Newfoundland Crash Scene to Bring Out Bodies — Pilot Saved by Parachute

Royal Canadian Air Force planes are on their way to Newfoundland to bring back to Canada the body of Sir Frederick Banting, killed on war service, while Canadian and British authorities are preparing a full investigation into the plane crash which took his life.

Two others died with Sir Frederick, Canada's outstanding scientist, when the plane bearing him to England on "a mission of high national and scientific importance" crashed near Musgrave Harbor, on Newfoundland's desolate east coast, about 145 miles northwest of St. John's.

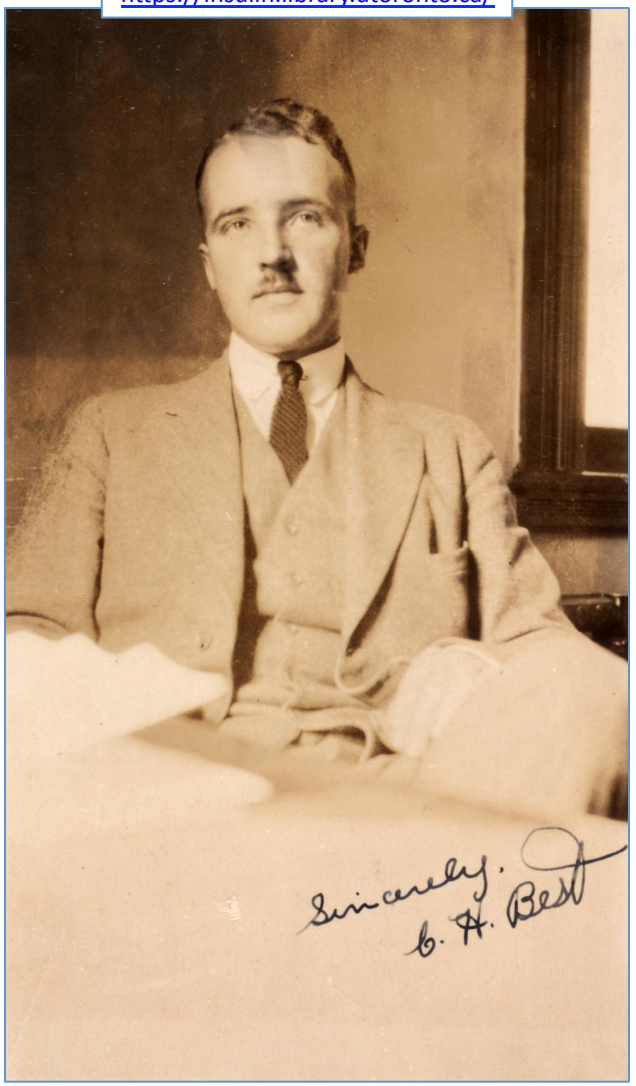
They were Navigator William Bird, of Kidderminster, England, and William Snailham, of Bedford, N.S.

The only survivor is Captain Joseph Creighton Mackey, of Kansas City, the pilot. Trappers brought him to shelter last night. He was not injured. To-day the pilot returned with a search party to the scene of the crash.

Toronto Telegram, Feb 25, 1941, p. 1

Insulin's Impact On Its Discoverers: *Charles Best*

https://insulin.library.utoronto.ca/



- **May 17, 1921** - The day after graduating in Biochemistry and Physiology, Charles Best joined Frederick Banting in a small University of Toronto lab to start the work that would lead to the discovery of insulin

- Charles Best was born in Maine of Canadian parents from Nova Scotia. Inspired by his general practitioner father, Charles enrolled at the University of Toronto in 1916, but his studies were interrupted by the start of WWI; resumed in 1918, focused on Physiology & Biochemistry

- J.J.R. Macleod was impressed with Best's work and when Macleod agreed to give Banting a lab, Best was an obvious candidate to assist, although a coin toss would decide if Best, or a classmate, would get the job.

Insulin's Impact On Its Discoverers: *Charles Best*

- **1925** – Best completed his M.D. course amidst the insulin discovery and development period, and he also got married and then pursued postgraduate studies in Europe.

- **1927** - Best returned to Toronto to continue as Connaught's Assistant Director until 1929, and to also serve as Head of the Department of Physiological Hygiene at the School of Hygiene.

- **Late 1920s** - Best also initiated studies of liver extract as a treatment of anemia, and focused especially on the development of Heparin to control blood coagulation, this work very much involving Connaught.

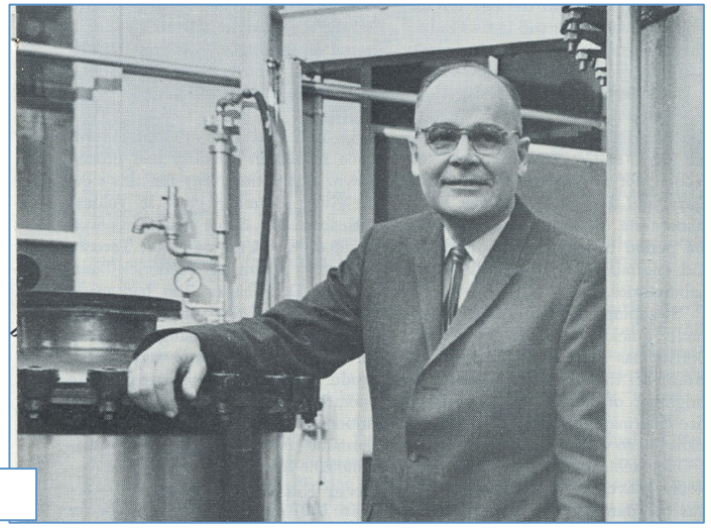
Sanofi Pasteur Canada Archives

Insulin's Impact On Its Discoverers:
Charles Best (& Dr. J.K.W. Ferguson)

Sanofi Pasteur Canada Archives

- Dr. J.K.W. (Kenneth) Ferguson (1907-1999), who would serve as Director of Connaught Laboratories from 1955 to 1972, was the last of the Lab's Directors during its time as part of the University of Toronto

- Dr Ferguson was perhaps the last person to have known all 4 of the discoverers of Insulin, especially Charles Best



Insulin's Impact On Its Discoverers:
Charles Best (& Dr. J.K.W. Ferguson)

Dr. Ferguson with Chris Rutty, Craig Defries (R.D. Defries' great nephew), James FitzGerald (J.G. FitzGerald's grandson), John Sparkes (Biostatistics, Connaught) @ Connaught Labs, 1996

Sanofi Pasteur Canada Archives

- I got to know Dr. Ferguson quite well during the last few years of his life through my historical work with Connaught Labs, as he was also interested in history of medicine and often visited the Connaught Labs Library & Archives, where I was often working

- Through Dr. Ferguson and a biographical project I did for him, I learned a lot about the discoverers of Insulin, and also the developers of Heparin

Read a short article I wrote about the history of Heparin here, http://healthheritageresearch.com/Heparin-Conntact9608.html

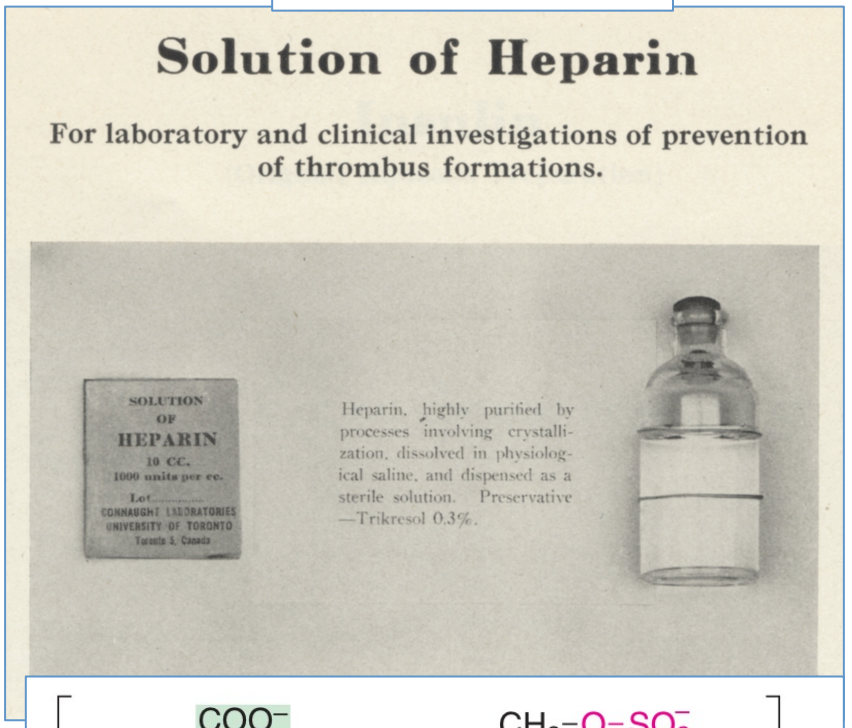
Insulin's Sequel:
Heparin, The Miracle Blood Anti-Coagulant

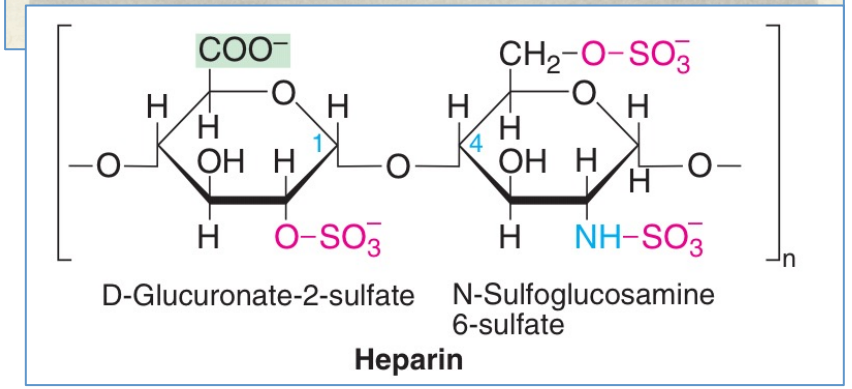
- **1928-1937** – For Connaught Labs and Canadian biotechnology the clear sequel to Insulin's discovery and development was Heparin

- While the story of Heparin story is less known than Insulin's, its impact on medicine has been much broader, especially on the development of modern surgery and any medical technology requiring the control of blood coagulation

- Heparin is a still mysterious molecule present in various animal tissues and is responsible for regulating blood coagulation

Sanofi Pasteur Canada Archives





Insulin's Sequel:
Heparin, The Miracle Blood Anti-Coagulant

- **1916** - Heparin was discovered by Jay McLean, a 2nd year medical student at John's Hopkins University, working under the direction of physiologist William Henry Howell

- McLean extracted the anti-coagulating substance from dog liver, but did little further work with it, leaving Howell to conduct further research and name it "heparin" (derived from "hepar", the Greek term for liver)

- **Early 1920s** - A version of Heparin was produced by a Boston firm, but it proved to be toxic

THE PURIFICATION OF HEPARIN AND ITS PRESENCE IN BLOOD

W. H. HOWELL

From the School of Hygiene and Public Health, Johns Hopkins University

Received for publication November 28, 1924

In 1918 in a paper by Howell and Holt (1) a substance was described under the name of heparin which has a marked effect in preventing the coagulation of blood. The nature of its effect upon the processes of coagulation was investigated in some detail. Subsequently in a brief communication to the American Physiological Society (2) I described a second method of obtaining this material which gave a more constant and reliable product in a form suitable for laboratory experimentation.[1] On account of the high phosphorus content (about 5 per cent) of the product obtained it was assumed that the substance might belong to the group of phosphatids, but more recent work has shown that this assumption was

American Journal of Surgery, 17 (1925), p. 553

Developing Heparin:
Best Takes The Lead

- **1928-29** – Charles Best, after spending a couple of years studying in London, UK, saw potential in revisiting Heparin and taking advantage of Connaught's expertise with insulin production to investigate preparing a purified product

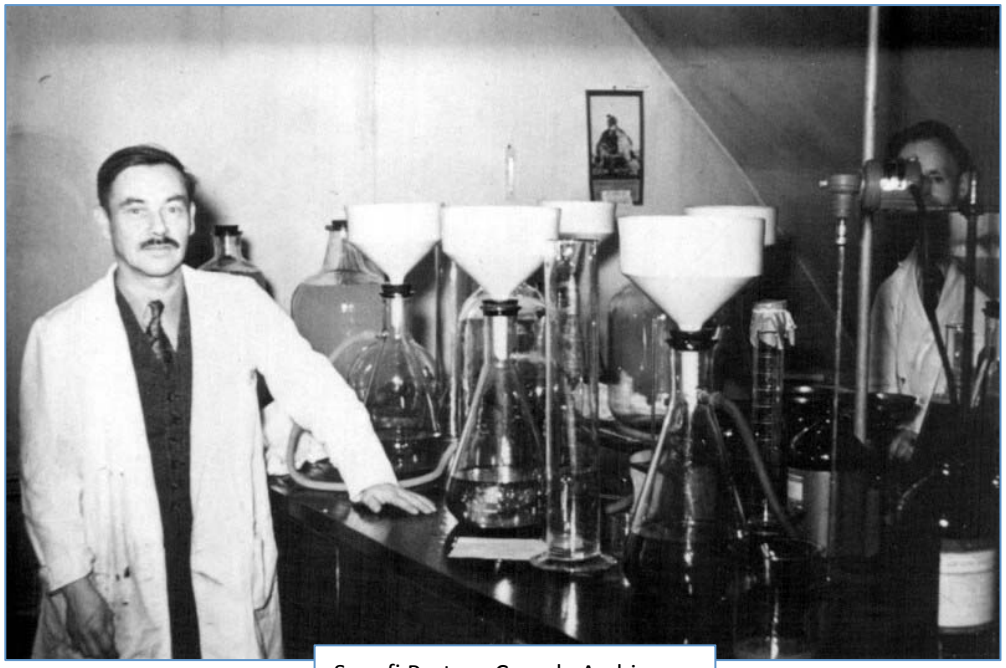
- Best was newly appointed Head of the Department of Physiology at the University of Toronto, and also Associate Director of Connaught

Sanofi Pasteur Canada Archives

Developing Heparin: *Best Takes The Lead*

- **1929** - Best set out to systematically explore methods to,
  - 1), purify and then produce heparin in large, but affordable quantities
  - 2), study its effects in animals and then humans

- For the first part of the first goal, Best turned Arthur F. Charles, a specialist in organic chemistry, who was Best's graduate student when he started on the project



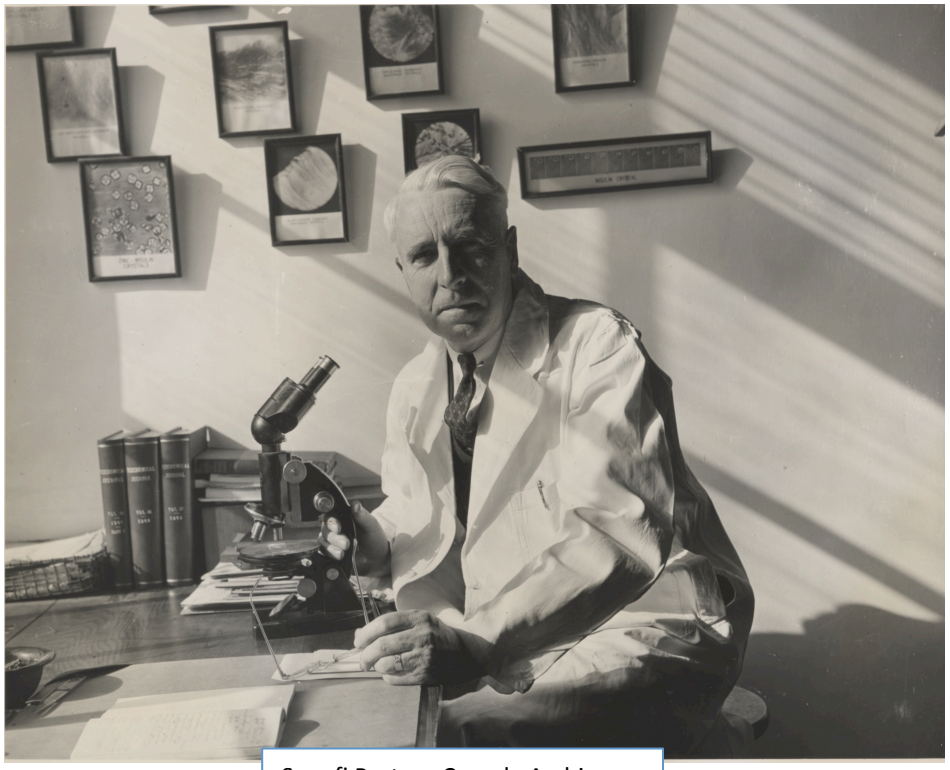
Sanofi Pasteur Canada Archives

- However, progress was steady, but slow over the next few years, focused on developing methods to extract heparin from beef liver

Developing Heparin:
Best Takes The Lead

- **1933** – By this time, David Scott (right) had joined Charles in the project, utilizing his experience with insulin production to work out a method to extract heparin from not only beef liver, but also lung and intestine tissue on a larger scale

- Charles and Scott took advantage of the arrangement Connaught had with all the meat processors in the country for pancreas tissues for Insulin production to utilize for heparin work otherwise discarded beef organs



Sanofi Pasteur Canada Archives

Developing Heparin:
Purification and Production

- **1933** – Charles and Scott published their first papers on their work, which described how the yield of extracted heparin could be doubled if the beef tissues, especially lung, were allowed to autolyse for 24 hours before extraction

- However, the smell emanating from the autolysing, or rotting tissue, was so bad that production had to move from the School of Hygiene Building up to the more open environment of the Connaught "Farm" site

Sanofi Pasteur Canada Archives

The Preparation of Heparin from Beef Lung

By A. F. CHARLES and D. A. SCOTT

(Presented by C. H. BEST, F.R.S.C.)

In an earlier publication (1) from these laboratories, a method for the preparation of large quantities of heparin from beef liver was described. Data have also been reported (2) concerning the relative amounts of heparin obtained from various beef tissues. This work showed that, of the tissues used, liver, muscle and lung, gave the richest yields of heparin. The amount of heparin obtained from lung was somewhat greater than that from liver. In view of this fact it seemed desirable to use beef lung as a source of heparin. Further, lung is a cheap raw material. It had also been noted in certain stages of the purification of heparin from beef liver that substances antagonistic in action to heparin were present. It was hoped that these substances might not be encountered if beef lung were used as a source of the anticoagulant.

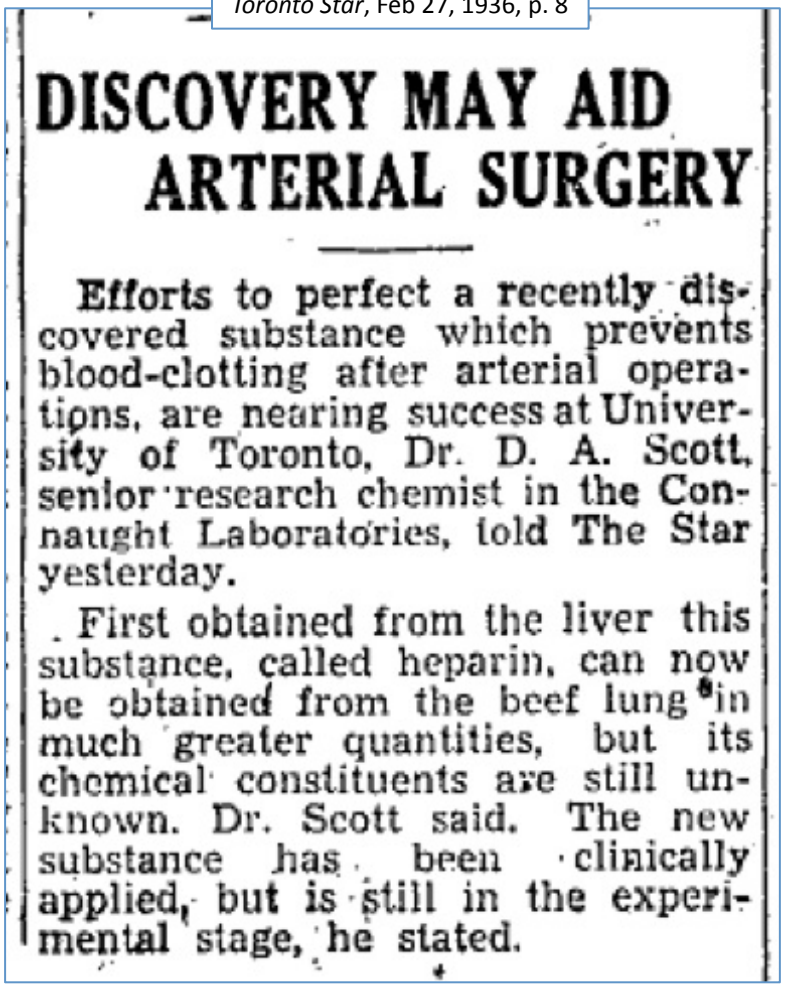
Developing Heparin:
Purification and Production

- **1933-36** - While studying heparin's elusive and mysterious chemistry, Charles and Scott were able to develop a method to purify and finally crystalize the extract into a standardized dry form that could be administered in a salt solution

- Heparin thus became Connaught's second product, after Insulin, to be recognized as an international standard.

- While animal testing had been encouraging, It was now time to focus on preparing Heparin for clinical testing

Toronto Star, Feb 27, 1936, p. 8



DISCOVERY MAY AID ARTERIAL SURGERY

Efforts to perfect a recently discovered substance which prevents blood-clotting after arterial operations, are nearing success at University of Toronto, Dr. D. A. Scott, senior research chemist in the Connaught Laboratories, told The Star yesterday.

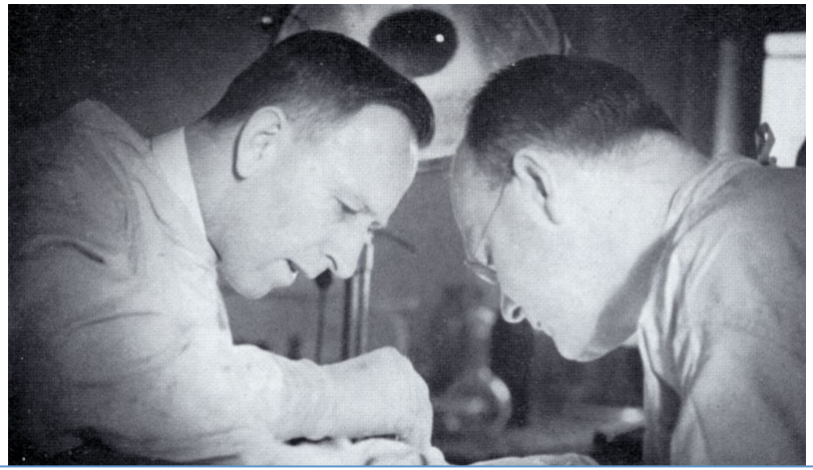
First obtained from the liver this substance, called heparin, can now be obtained from the beef lung in much greater quantities, but its chemical constituents are still unknown. Dr. Scott said. The new substance has been clinically applied, but is still in the experimental stage, he stated.

Testing Heparin:
Pioneering Surgical Science

- **1935-37** – To undertake clinical studies of Heparin, Best turned to prominent Toronto surgeon, Dr. Gordon Murray (left), based at Toronto General Hospital

- Murray's experimental surgery with various animals demonstrated that Heparin effectively cleared up internal blood clots, and also seemed useful for many other dangerous operations where blood coagulated quickly

- **April 1937** – The first human tests with purified heparin were conducted, although a cruder form was tested in selected cases earlier with encouraging results



THE USE OF HEPARIN IN THROMBOSIS*

GORDON D. W. MURRAY, M.D., AND CHARLES H. BEST, M.D.
TORONTO, CAN.

THE discovery of heparin in Howell's laboratory, in 1916, and his demonstration that it was a natural anticoagulant of blood, raised hopes that it might also be a preventive of thrombosis. Unfortunately the early experiments on animals and the clinical use of the drug as a preventive of clotting in blood transfusions were discouraging, owing to the toxic symptoms produced. In 1929, however, one of us (C. H. B.) initiated research on the purification of heparin, in the Connaught Laboratories, and Charles and Scott[1] succeeded in preparing it in the form of a crystalline, barium salt, which was 100 times more potent than the original crude material and completely free of toxic properties. This success revived our interest in the possible clinical value of the drug and encouraged us to study, both upon animals and patients, its influence on those pathologic conditions which are based upon thrombosis.

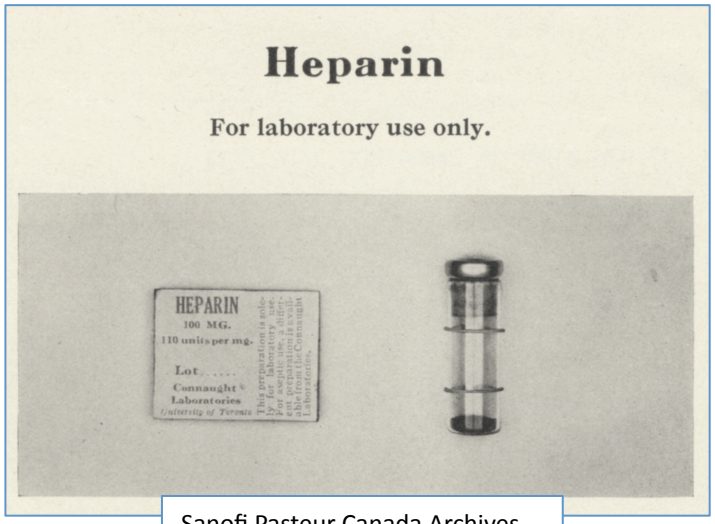
That heparin has a profound influence in preventing thrombosis has been amply demonstrated by a long series of experiments upon animals, begun in the Department of Surgery, in 1932, and reported elsewhere,[2] in which it was shown that the thrombosis, which normally results from mechanical (Fig.

Annals of Surgery, 108 (Aug 1938), p. 163

Testing Heparin:
Pioneering Surgical Science

- **1937** – The early trials of Heparin soon involved hundreds of complex surgical cases during which heparin played an essential and often dramatic life-saving role.

- It was clear that Connaught's heparin was a safe, easily available and effective blood anticoagulant.



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HEPARIN AND THROMBOSIS

By C. H. Best, *Toronto*

At the annual meeting of the Royal College of Physicians and Surgeons of Canada, held on October 30, 1937, Dr. D. W. G. Murray and the author presented a summary of their recent work on the effect of heparin on thrombus formation. A preliminary account of this investigation appeared in this *Journal*.[1]

The anticoagulant heparin was discovered in 1916 by Howell and Holt. When the work on this substance was begun in the Department of Physiology of the University of Toronto (1929) it appeared that two problems had to be solved before its effect on thrombus formation in human subjects could be investigated. It was necessary to secure a pure, non-toxic form of heparin and to prove that the anticoagulant prevented the formation of thrombi in experimental animals. The problem of the purification of heparin was attacked by Dr. Arthur Charles and Dr. D. A. Scott in the Connaught Laboratories. Each new preparation of heparin which they prepared was tested on experimental animals, and later some of the purer ones were administered to a group of human subjects. A detailed report of an

Canadian Medical Association Journal, 38 (Jan 1938), p. 59

Testing Heparin:
Pioneering Surgical Science

- Best's heparin team had opened the door to such operations as organ transplants and open-heart surgery, as well as the artificial kidney that was pioneered by Murray

Globe & Mail, Nov 2, 1939, p. 13

Organs May Be Transplanted, Using New Drug, Says Graham

Cambridge, Mass., Nov. 1 (AP).—Advances in surgery and post-operative treatment made public with the drug heparin, which is obtained from the lung of the ox, were described today by Dr. Roscoe R. Graham of the University of Toronto.

(Today, in the journal of the American Medical Association, other investigators told of the possibility of using heparin, which prevents clotting of blood, in the treatment of acute endo-

was the exact cause," he said, "we found that in 400 cases treated with heparin following operations, pulmonary embolism failed to occur. I believe heparin has some merit here."

He declared the drug, by keeping blood fluid and preventing clots, had made possible an operation involving the cutting away of a section of artery, and substituting in the gap a section of vein, an operation which previously had been dangerous because of blood clots.

Moreover, he said, the effectiveness of the substance now estab-

Globe & Mail, June 14, 1939, p. 2

Success With Heparin in Toronto Is Welcomed by British Surgeons

London, June 13 (CP). — Use of heparin to prevent blood-clotting was described to the Royal College of Surgeons today by Dr. D. Gordon Murray of Toronto, who told of success in purifying the drug in the departments of physiology and surgery of the University of Toronto.

Heparin, extracted from liver, lung and other tissues, never has been successful because of the toxic reaction it produced when administered to living animals. The University of Toronto's laboratories have produced it in a non-toxic, crystalline powder form.

Dr. Murray's experiments showed that in addition to prolonging blood-clotting, heparin can prevent thrombosis in injured or diseased blood vessels. By continuous administration of the drug, through a needle tied into a vein, injured blood vessels can be healed, Dr. Murray said.

The practical value of the studies has been demonstrated on a series of persons suffering from embolism of the peripheral arteries, the Toronto doctor announced. It has also been possible to excise a segment of a large artery and replace it with a segment of vein obtain elsewhere in the patient's body, still maintaining a normal circulation through the damaged vessel, Dr. Murray said.

Producing Heparin

- Connaught continued to prepare Heparin and developed methods to increase its potency and reduce its price.

- Ironically, this work made heparin more easily produced elsewhere and by the early 1950s, Connaught had stopped producing a crucial life-saving product that it had pioneered.

Globe & Mail, Oct 14, 1939, p. 17

Cites Value of Heparin To Prevent Thrombosis

Minneapolis, Oct. 13 (AP).—Partial success in preventing coronary thrombosis, a fatal clotting of the heart's main artery and a common cause of death, through use of a compound called heparin, was reported today by Dr. Charles H. Best of Toronto, co-discoverer of insulin.

Dr. Best's paper dealing with his work was read at a meeting of scientists in connection with observance of the University of Minnesota Medical School's fiftieth anniversary.

While saying that many more cases must be studied before the matter is settled, Dr. Best declared: "While it will perhaps be almost impossible to secure scientific proof of the effects of heparin under these conditions (referring to certain operative procedures), the results have not been unfavorable."

Sure Dalai Lama Is Reincarnation

(Wireless to The New York Times and The Globe and Mail.)

(Copyright.)

Delhi, India, Oct. 13.—A telegram received by the political officer at Sikkim from the Kashag (Tibetan Cabinet) expresses the conviction that the boy now figuring in the ceremonies at Lhasa is the "true reincarnation of the Dalai Lama without a shadow of doubt." The message thanked the British Government and the Viceroy and Government of India for

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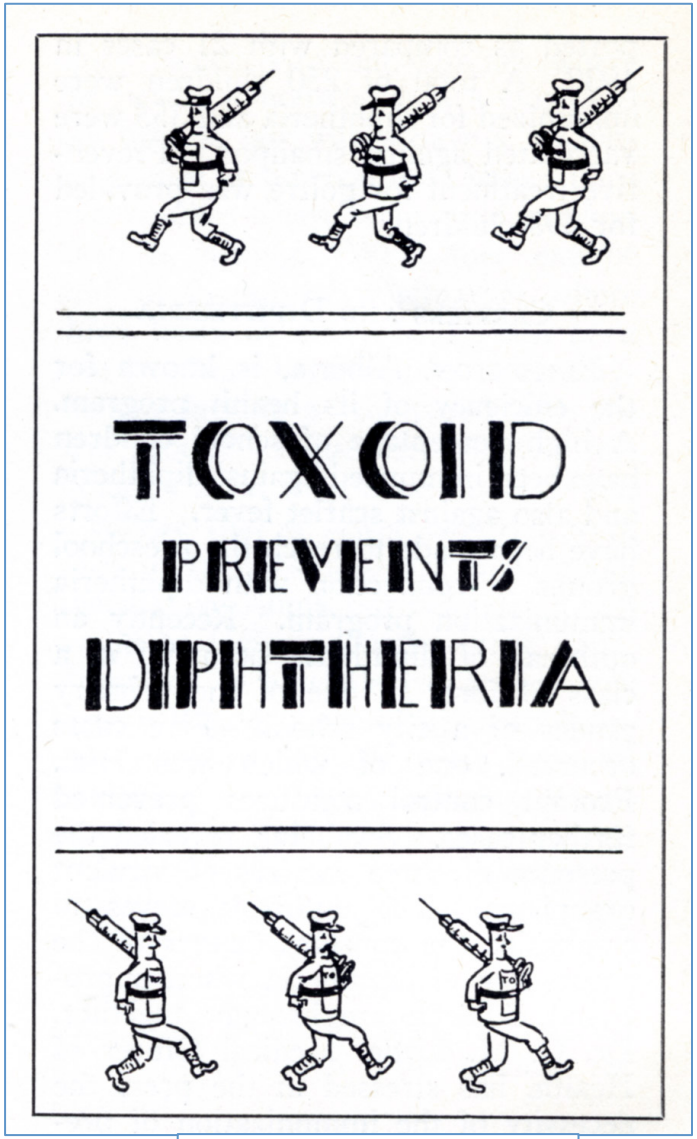
Public Health Transformations: 1920s to 1930s & The Eve of War

- As was emphasized at the end of the last class, much had changed and progressed in Canadian public health between the start of the 1920s and the end of the 1930s

- From the perspective of preventing infectious diseases, the key driving force of such progress was Canada's pioneering attack on diphtheria with diphtheria toxoid



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Public Health Transformations: 1920s to 1930s & The Eve of War

- As we've seen in today's class, the other key driver of public health progress in Canada during the same two decades, from the perspective of controlling a non-infectious but inevitably deadly disease with a biological product, was Insulin

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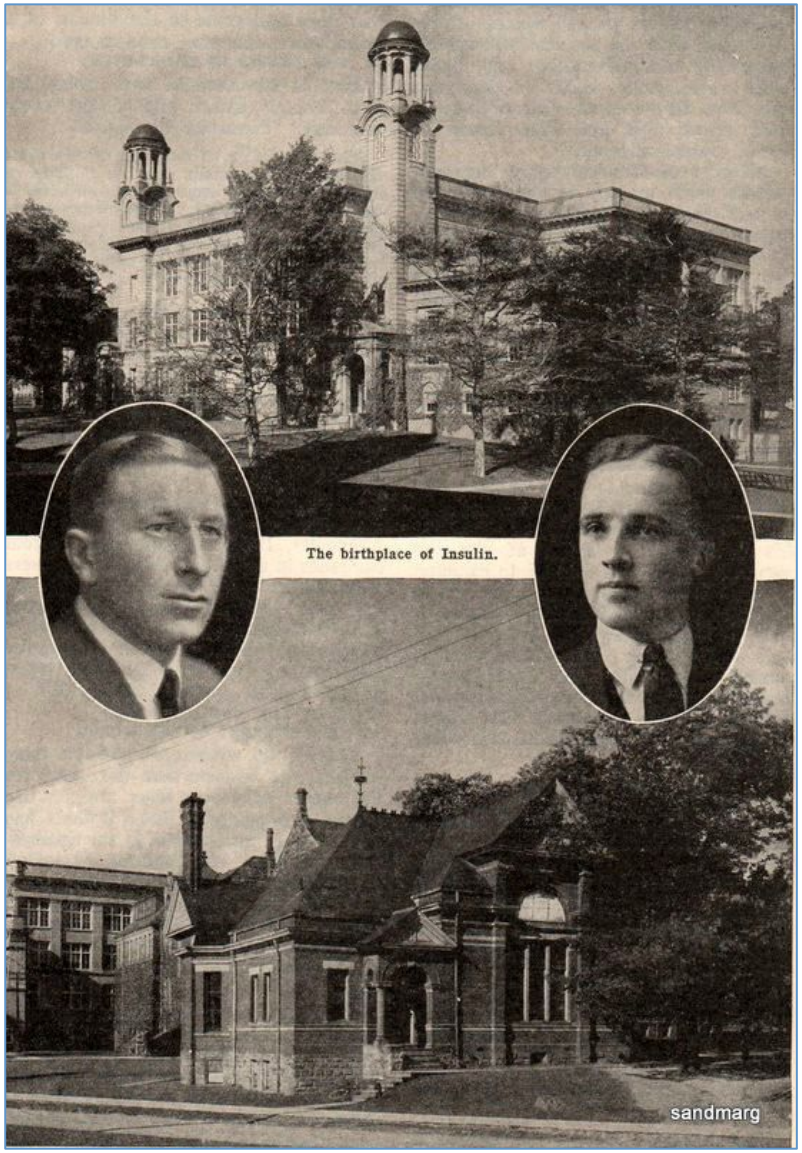

Public Health Transformations: 1920s to 1930s & The Eve of War

- Not only did the discovery of insulin at the University of Toronto revolutionize diabetes treatment, almost literally resurrecting the dead, its development at Connaught Labs fuelled the rapid expansion and consolidation of Canada's public health infrastructure during this period that was based in the School of Hygiene

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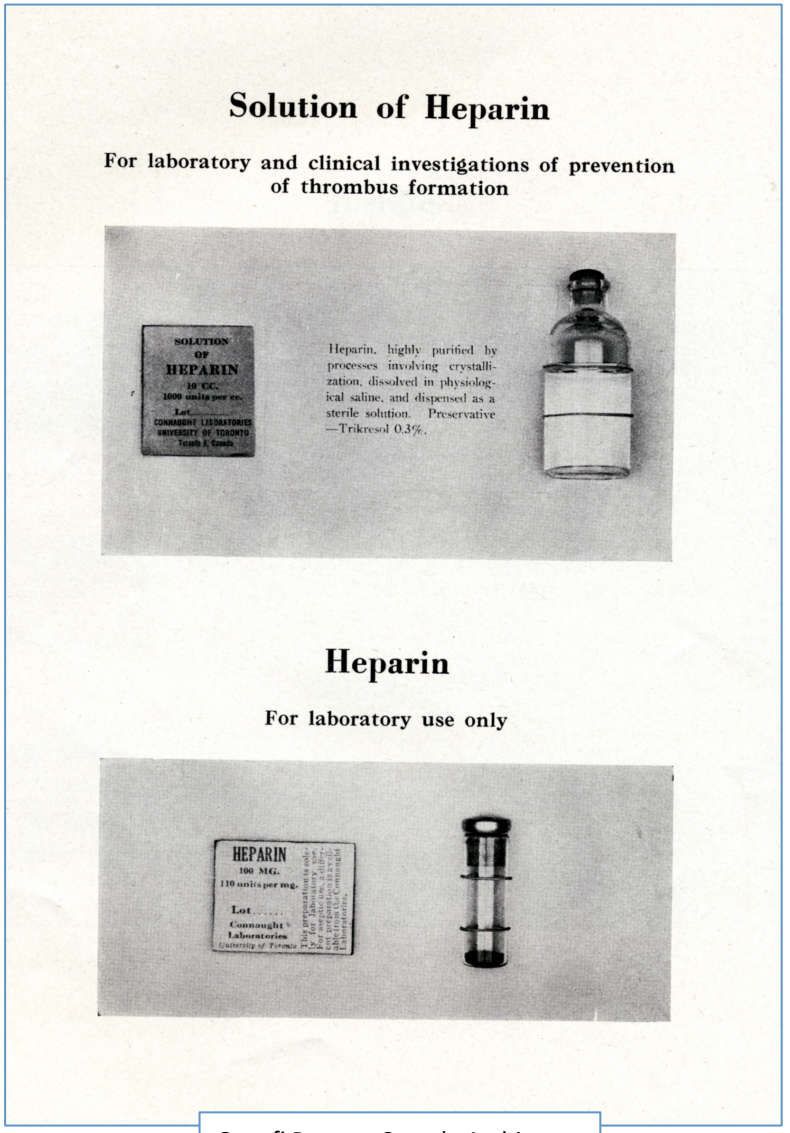
Public Health Transformations: 1920s to 1930s & The Eve of War

- As we have also seen, Insulin's development at Connaught Labs very much made the development of Heparin possible, making it possible to save lives on an even broader scale



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Public Health Transformations: 1920s to 1930s & The Eve of War

- However, as the 1930s ended and as the Second World War began, there was an uncomfortable recognition within the public health community, as reflected by the editors of the *Canadian Public Health Journal*, that despite significant progress against many communicable diseases in Canada, there was a need to acknowledge "our imperfections, if not failures," and reassess public health strategies against infectious diseases

Canadian Public Health Journal, 30 (July 1939), p 348

EDITORIAL SECTION

HOW MUCH DO WE CONTROL COMMUNICABLE DISEASE?

At the annual meeting of the Ontario Health Officers Association in 1928 the late Dr. Wade Frost, Professor of Epidemiology, School of Hygiene and Public Health, Johns Hopkins University, discussed the control of communicable diseases. He directed attention to the fact that many high hopes of effectual control had not been realized; he pointed out the necessity for recognizing our failures, for casting off those methods which had proved to be of little or no value and for adopting, when possible, new methods based on adequately controlled observations and experience. He emphasized that public health work, including control of communicable disease, should be re-assayed in order to determine the current value of methods which might have been established and evaluated under other conditions. In short, he made a plea that health officials of all grades should keep an eye open to both success and failure and that practice should be based on previous results.

The fact that now, over ten years later, nearly one whole general session of the recent annual meeting was given over to presentation and very lively discussion of current practice in control of communicable disease is evidence at least that we are cognizant of our imperfections, if not failures. Some progress has been made since Dr. Frost indicated the serious limitations in our practices. Diphtheria is to a large extent controlled through active immunization with toxoid; the misconception of the "irreducible minimum" in typhoid fever has largely disappeared and the sporadic residual typhoid that still persists is receiving attention as well as the epidemic outbreaks; tuberculosis is treated, not merely spoken of, as a communicable disease and sources of infection are recognized and where possible, and as soon as possible, segregated or otherwise controlled. Gratifying results have been obtained, too, in other fields. Therein is encouragement.

But some features are less encouraging—especially the lack of factual information in regard to the value of current practice. Is it true, for instance, that whooping cough mortality in the United States has decreased very decidedly while in Ontario the level of thirty years ago is, for practical purposes, maintained? Has control been achieved south of the border and not achieved north of it? Have control measures been applied in the United States so much more effectually than here in Ontario? Or is the difference in the apparent decline

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Public Health Transformations: 1920s to 1930s & The Eve of War

- There was a need to see better results from many public health initiatives, and "in order to preserve respectability, or more important, self respect, public health practice must be based on fact; fancy, untested, is little better than fallacy"

- As we'll see in Class #5, the onset of World War II would severely limit available resources for many public health initiatives, but it would also provide new opportunities to test their effectiveness…

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