Reminiscences
by
Charles H. Best, C.B.E.
Your Editorial Committee was wise indeed to suggest that possibly an article of about 2000 words would be sufficient! When reminiscing it is very difficult to know what to include and with more than 40 years of medical research and teaching behind one it would be easy to write several volumes instead of pages. Of course all these years have not been spent entirely in the laboratory or behind a desk. With my wife, I have travelled to many parts of the world in an effort to learn more about how diabetics, particularly, live under diversified conditions. This has given me the opportunity of discussing problems with them personally as well as talking to medical men who anxiously await news of the latest developments in research which may prove beneficial to their patients. The time has gone so quickly that it seems incredible to me that so many years have elapsed since I first joined the staff of the University of Toronto as a Fellow in Physiology. I expect this is one criterion by which to judge a happy life.

To reminisce one should begin at the beginning but I only wish to say that, among other things, I inherited from my Maritime forebear a love of the sea and fast horses. Early in this century my father brought a racing mare from his father’s farm in the Annapolis Valley, Nova Scotia, to our home on the Maine-New Brunswick border where he practised for 46 years. Since then there has always been a Best colt until a few months ago when the 7th generation sired by a Hanover, ended his carefree life on our farm near Toronto. We now have two handsome police horses, always ready for the saddle, and my sons and I enjoy a ride whenever possible.

My father was one of the last of the “country doctors” described by Robert P. Tristram Coffin in his poem of the same name:

“Under the midnight thunderheads,
When lesser men were in their beds,
He drove his mare by lantern light
Of chain-lightning splitting night.”

Often, as a boy, I accompanied him on cases and sometimes helped him with anaesthetics, accident patients, etc., thus, at an early age I developed an abiding interest and curiosity about medicine in general.

During the last year of World War I, I enrolled at the University of Toronto and joined the O.T.C. but left a short time later to enlist in the Artillery. Here, at age 19 I rose to the rank of Sergeant due, I am sure to the fact that I showed a certain skill in the gentle art of horse-back wrestling! At the end of the War I returned from England to the University and proceeded with a course then called Physiology and Biochemistry. Before graduating, however, I had decided to spend the following year in research in Physiology before going into Medicine. I was particularly interested in the problem of diabetes as one of my father’s sisters died of this disorder shortly before the discovery of insulin. When I learned of Fred Banting’s proposed quest for the hidden hormone, to be carried out during the summer of 1921, I was very eager to join him. We started our work the day
following my final examinations (May 17, 1921) and this was the beginning of a lasting friendship and a partnership which provided excitement beyond our dreams. As if it were yesterday I can recall the planning, the work, the suspense, the disappointments and, finally, the jubilation when, after 75 consecutive occasions without failure, we were able to secure an extract which successfully lowered the blood sugar and produced dramatic improvement in our depancreatized animals. During that terribly hot summer we worked entirely alone in the deserted Physiology Department and it seemed to us that our progress was extremely slow. Our youth energy and perseverance stood us in good stead, however, as we had many roles to play besides those of investigators. We were constantly busy, working without any scientific or technical assistance. We cared for the animals, washed the cages, scrubbed the operating equipment, sterilized the glassware and did all the other general tasks as well. Very often we ate and slept in the laboratory. By August we were completely convinced that success had been achieved and were most impatient to apply our extract to human patients. In September Professor J. J. R. Macleod, then Head of the Department of Physiology, returned from Scotland and on November 14th Banting and I presented our findings to the members of the Medical Faculty for the first time. Almost immediately we found ourselves confronted by two great pressures. The first, quite naturally, was exerted by the diabetics themselves and their relations. We received hundreds of letters begging for insulin. Certainly our material was not as potent as present day preparations and it contained impurities but, as stated above, it had caused dramatic reduction in the blood sugar of our diabetic animals. I have often told of how we went through the ceremony of giving each other an injection of the material without suffering any ill effect. On January 11, 1922, under the supervision of Dr. Walter Campbell, the first clinical dose of insulin was given to a young diabetic patient in the Toronto General Hospital. There had been little hope for the boy so, quite needless to say, it was a wonderful day for Banting and for me when the lad showed a rapid and marked improvement upon receiving insulin. The second pressure soon caused us many sleepless nights. We had given all our information concerning the preparation of insulin to Dr. J. B. Collip who joined us in the autumn of 1921 with the object of purifying our crude material. He did a fine piece of work in the further purification but there were a great many things unknown to us at that time, such as the insolubility of insulin in water around pH 5. Its absorbability on almost anything it touched — particularly at that pH — constituted the main difficulty which prevented us from making adequate amounts of insulin for clinical use during the early stages. Before Dr. Collip left Toronto to return to his post in the University of Alberta great difficulty had been encountered in repeating the early so-called "large scale" experiments and in securing enough insulin to supply even the few patients who were under treatment. When Dr. Collip left I was recalled from the problem I was investigating preparatory to writing my M.S. thesis, and there followed the most anxious and hectic time of my life in the desperate attempt to find the lost art of production again. The knowledge that several patients succumbed during this period added to the general strain of those days. I will never forget the tremendous relief of "rediscovering" the secret and once more being able to produce material for those who so desperately needed it. Soon things were greatly changed with the production being taken over by the Connaught Laboratories in the University. I became Director of the Insulin Division of the Laboratories and have been associated with them ever since, now holding the position of Honorary Consultant. It is well known how rapidly the work advanced from this stage, and with the publication of reports came a wave of interest from research groups the world over, as well as from physicians who were particularly interested in the field of carbohydrate metabolism. It is only natural, I expect that I should savour the memory of "the good old days" when insulin was young. However the future is full of promise because, in addition to its clinical importance, insulin has proved to be an important tool for the use of medical investigators and we cannot predict what new light may suddenly emerge to illuminate the whole field.

Probably it would be difficult to equal the excitement and elation of the insulin work but I must admit that I have enjoyed tremendously working in other fields as well. With the exception of Frederick Banting no scientist has given me more stimulus and inspiration than Sir Henry Dale (who recently celebrated his 90th birthday). Just after obtaining my medical degree from the University of Toronto in 1925, I went to England to work for my D.Sc. in the University of London. Dale, then Director of the National Institute for Medical Research, went to a great deal of trouble to get himself appointed a recognized teacher at the University of London so that, while registered there, I could work with him as a graduate student. The periods spent with him in 1925-26 and later in 1928, were very happy ones for me. In his laboratory I learned physiological and pharmacological techniques as well as chemical procedures which proved essential in my future investigations. While with him I played a small part in isolating histamine for the first time from tissue which did not have the opportunity of becoming contaminated bacteriologically. As an outcome of this work I was keenly interested for several years in an enzyme system which destroyed histamine and which I named histaminase.

At this time I was interested also in the respiratory quotient of the excess metabolism of muscular exercise and the dynamics of sprint running. This provided me with an excellent excuse
to attend the 1928 Olympic Games held that year in Amsterdam. Fortunately our Canadian sprinters were phenomenally successful and I was able — later, in Toronto — to carry out a series of tests (some on the Hart House track) on Percy Williams, Myrtle Cook and other members of our team. The Games also provided me with an opportunity of studying the blood sugars of Marathon runners.

At about this period I became very preoccupied with the anticoagulant heparin, discovered by J. McLean in Howell's Laboratory at Johns Hopkins in 1916. It was obvious that a much purer and more active substance was needed and when I returned to Toronto in the autumn of 1928 I initiated work on the purification of heparin and we were soon able to establish its role in the prevention of many types of experimental thrombosis and witnessed its successful clinical application. The Second World War interrupted these fascinating researches but since that time there has been a great revival of interest in extending this work. There are still a great many avenues to be explored in this field.

Choline and its precursors, the lipotropic agents, have been of constant interest to me for many years. When working in Dale's laboratory in 1928 I learned how to isolate choline from tissues, to acetylate it and to assay the acetylcholine. Later, with my colleagues in Toronto, we identified choline as the main lipotropic substance in crude egg yolk lecithin. From previous experiments we knew that lecithin exerted the same dietary protective effect on liver as did something contained in, or made available by, fresh beef pancreas. Choline has been well-established as one of the B vitamins and methionine is its main dietary precursor. The effects which we observed in animals, due to lack of choline, were dramatic. I will not attempt to outline the present position of what we called the lipotropic effect of choline, protein, etc. We do not know what effects inadequate dietary amounts of lipotropic factors have on man — it would be most interesting to have this information.

In 1939, at the outbreak of the Second World War, both the Departments of which I was then Head (i.e., Physiological Hygiene and Physiology) began the preparation of dried human serum for military use. We are proud of the fact that the first 500 blood donors were members of the staff and student body. We recall very vividly our early and rather primitive arrangements where the donors lay uncomfortably on lab benches between the gas jets! The Dominion Government soon realized the imperative need of this service and, with the aid of the Canadian Red Cross Society, undertook the handling of the project, which provided over 2,000,000 contributions of blood serum which was dried in the Connaught Laboratories and shipped to England for use in the Allied Medical Services.

In 1940, after the Blood Project was well launched I joined the Royal Canadian Navy and became Director of its Medical Research Division which was made up, in large part, of colleagues from our own and other universities. This active group made scores of practical contributions, not only to the Navy but to other branches of the Services — contributions such as red lighting for preserving night vision, life saving equipment, improvement in nutrition, etc., etc.

When Fred Banting so tragically met his death in February, 1941, I became the second director of the Department which bears our names. I resigned as Head of Physiological Hygiene and from an Associate Directorship of the Connaught Laboratories. For the duration of the War both the Banting and Best Department of Medical Research and the Department of Physiology continued to carry on research problems which bore some relation to military medicine. At the end of hostilities the activities of the two Departments were reorganized and many problems on insulin, heparin, choline and liver damage, nutrition, the anterior pituitary gland, glucagon, cancer, etc., etc., have been attacked. Many of these experiments have given us moments of excitement and pleasure and a great many interesting results have been established by the fine groups working in these fields.

Over the years I have been unusually fortunate in my colleagues. While it is not possible to mention each one by name I would like to stress my continued indebtedness to them for their loyalty and never-failing support. I believe it is quite accurate to say that, as I do myself, they all take pride in the past and have great faith in the future.
NEW YORK — (AP)

“Our greatest asset was that we were young and uninhibited and had nothing to lose,” said Dr. Charles H. Best, 80 years after he helped discover insulin, which has helped perhaps 130 million diabetics.

A robust 72, Best, of the University of Toronto, looked back 50 years in an interview on the eve of World Health Day, which honors the discovery by Best and the late Sir Frederick Banting.

“I had just finished my five-year course in medical science when I met Fred Banting in the autumn of 1920,” Best said. “He was a surgeon and I was a biochemist and it was a combination approach — it needed both good surgery and good biochemistry.

“We made dogs diabetic by taking out the pancreas. We then studied their chemistry and they reacted like a child with diabetes, very severely. They only lived a week or 10 days. Then we began making extracts from the pancreas.

“Oh, things went wrong. The operating room was not very good, it was a very hot summer. The diabetic animals got infected and the infections made them very resistant to anything that might help them.”

DIABETES develops when the pancreas, a large gland behind the stomach, fails to produce enough good insulin to convert the sugars and starches in the blood to the sugar form called glucose. The blood, aided by the insulin, carries the glucose to the body cells where it becomes energy or is stored for later use.

The work began in a Toronto laboratory in May 1921. By July, Banting and Best began giving diabetic dogs the first extracts from the pancreas.

“The extract of pancreas brought the blood sugars back to normal,” Best continued. “Throughout July, August, September, we worked alone. All the chemical signs of diabetes were eliminated in the dogs. Equally dramatic was the clinical improvement. They had been listless, weak. They got well, frisked about the lab. And stayed alive as long as we gave the insulin.”

THE TWO scientists gave their first report of the discovery in a talk before the university staff and graduate students at the medical school in November. “They were tremendously enthusiastic, they weren’t convinced,” Best recalled. But the story somehow found its way into a newspaper, touching off a deluge of letters and visits to Toronto by diabetics.

“It was Jan. 11, 1922 before patients were treated. We gave each other good, big injections first and it was safe. The first person treated was a 15-year-old boy, a severe diabetic who had only a short time to live. He lived 15 years, and died in a motorcycle accident.” The boy’s name was Leonard Thompson.

The first U.S. citizen to be treated was James Havens, Rochester, N.Y., who became a celebrated artist, married, had a family and died a few years ago. He was noted for woodcuts. The most famous patient was Dr. George R. Minot of Boston, who later won a Nobel Prize in medicine for his work in the treatment of anemia.

WHILE MANY other scientists were also working in the field, Best said one advantage they had was in working with tiny amounts of the pancreas, so they could perform many experiments with less material.

For this, Banting won a Nobel Prize, sharing it with John J. R. Macleod, the department chairman. The American Diabetes Association said it was a “great misfortune that Banting did not share the award.” Banting died Feb. 21, 1941 in a plane crash in Newfoundland.