

creas) had failed because the insulin was always destroyed by the enzyme trypsin (the "external secretion" of the pancreas) before the insulin could be removed from the animal body. Roberts contended that Banting's hypothesis — upon which all of the animal work had been based — was simply false. "Now it is one of the best established facts in physiology," Roberts wrote, "that the proteolytic enzyme exists in the pancreas in an inactive form — trypsinogen — which is activated normally on contact with another ferment, enterokinase, secreted by the small intestine."² In other words, there was no possible way that trypsin could be the reason that all prior attempts to isolate insulin had failed because trypsin itself does not even exist in the pancreas. Trypsin could not possibly be destroying the insulin. Given these facts, Roberts said, "there was no physiological basis at all for Banting and Best's duct-ligation experiment. They had undertaken a cumbersome, time-consuming process to forestall enzyme action which would never take place."³ Roberts concluded that Banting and Best had succeeded in reawakening interest in the possibility that a diabetes-fighting substance exists in the pancreas. They did manage to convince the medical community that insulin did actually exist in the pancreas and that it could eventually be of value to human diabetics. But, Roberts pointed out, they did so by completely misinterpreting the results of their own animal experiments. Indeed, if Banting and Best had been truly competent scientists, they would have realized that their animal experiments did not in any way shape or form prove that insulin exists. Roberts wrote:

The production of insulin originated in a wrongly conceived, wrongly conducted, and wrongly interpreted series of experiments. Through gross misreading of these experiments interest in the pancreatic carbohydrate function has been revived, with the result that apparently beneficial results have been obtained in certain cases of human diabetes . . . whatever success the remedy will have will be found to be due to the fact that the hormone has been obtained free from anaphylaxis-producing and other toxic substances. The experiments of Banting and Best show conclusively that trypsin . . . has nothing whatever to do with it.⁴

²Roberts, F. "Insulin." British Medical Journal, p. 1193, 1922.

³Ibid.

⁴Ibid, p. 1194.

Thus, the research that actually led to the discovery of insulin was stimulated by Banting and Best's enthusiastic reports, but Banting and Best's conclusions were not based on the results of their own animal experiments. Banting and Best's claim to have isolated insulin was really a statement of their own conviction that insulin exists and could be eventually discovered. Banting's mentor, the aforementioned then world-renowned expert on carbohydrate metabolism, Dr. J.J.R. Macleod, Professor of Physiology at the University of Toronto, responded to Roberts' criticisms. It is even clear from Macleod's response, however, that Roberts was absolutely correct. Macleod wrote:

The criticism has been made that Banting and Best's experiments, in which simple extracts of duct-ligated pancreas were used, formed no essential step in the investigations that have given us insulin. I need scarcely reply to this criticism. They were apparently made without any appreciation of the real obstacle that stood in the way of development of the subject — namely, convincing evidence that an antidiabetic hormone does actually exist in the pancreas — and to Banting and Best is due the credit of furnishing this by experiments of a different type from those of their predecessors.⁵

"In Macleod's mind," Bliss writes, "the whole importance of Banting and Best's experiments had been in convincing Macleod and the others of the team that the internal secretion was there to get. They then went and got it."⁶ From this historical evidence, it is clear that the main function of animal experimentation is to convince disbelievers.

Not only did Banting and Best vastly exaggerate the effectiveness of their pancreatic extract on "diabetic" dogs, but the extract was a failure when it was used to treat human diabetes — contrary to the popular perception that Banting and Best's pancreatic extract was an immediate success against human diabetes. In fact, Macleod had not originally intended that the pancreatic extract used in dogs should be used on actual human diabetics, because the results were so unclear. He had assigned to the team biochemist Dr. J.B. Colip the job of isolating and purifying insulin from ox pancreas to be used for the first human test.

Banting, however, was determined to try the

⁵Macleod, J.J.R. "Insulin." Lecture to the XIth International Physiological Congress, July 24, 1923. British Medical Journal August 4, 1923: 165-172.

⁶Bliss, p. 205.