

On June 6, 1822, an army surgeon at Mackinac Island, on Lake Huron, recognized a unique opportunity to learn how the stomach works. A French-Canadian trapper, Alexis St. Martin, arrived with a shotgun wound to his stomach. The surgeon, William Beaumont, pushed back protruding parts of the lung and stomach, and cleaned the wound. Upon healing, the stomach lining had fused to the outer body wall, leaving an opening directly to the stomach.

Beaumont found that he could look directly through this “window” and observe and perform tests on the stomach in action.

Beaumont’s discoveries marked the start of a new understanding of human digestion. In this activity, you will infer some of what Beaumont discovered based on excerpts from the journal he kept.

Procedure

During a period of several years, Beaumont gathered gastric juice, had its components identified, introduced food into the hole in Alexis St. Martin’s stomach with a string attached so he could retrieve the food particles that were partially digested, and observed the effect of emotion on digestion. Much of what Beaumont discovered was new to science—and contrary to the accepted teachings of the time. He recounted many of his observations and experiments in his journal.

The following are selections from that journal. Note: You might be wondering how Alexis St. Martin felt about serving as a human guinea pig in these experiments. For a while, he submitted to them. He was, after all, receiving free room and board. Boredom eventually took its toll, and St. Martin returned to Canada, where he married and resumed his former life as a trapper. He lived until the age of 83, having spent over 60 years of his life with a hole in his stomach.

Excerpt A: I consider myself but a humble inquirer after truths—a simple experimenter. And if I have been led to conclusions opposite to the opinions of many who have been considered luminaries of physiology, and in some instances, from all the professors of this science, I hope the claim of sincerity will be conceded to me, when I say that such difference of opinion has been forced upon me by the convictions of experiment, and the fair deductions of reasoning.

Excerpt B: But from the result of a great number of experiments and examinations, made with a view to asserting the truth of this opinion, in the empty and full state of the organ, . . . I am convinced that there is no alteration of temperature.

Excerpt C: I think I am warranted, from the result of all the experiments, in saying, that the gastric juice, so far from being “inert as water,” as some authors assert, is the most general solvent in nature of alimentary [food-related] matter—even the hardest bone cannot withstand its action.

Excerpt D: The gastric juice does not accumulate in the cavity of the stomach until alimentary matter is received and excites its vessels to discharge their contents for the immediate purpose of digestion.

Excerpt E: At 2 o’clock P.M.—twenty minutes after having eaten an ordinary dinner of boiled, salted beef, bread, potatoes, and turnips, and drank a gill [about 142 mL] of water, I took from stomach, through the artificial opening, a gill of the contents. . . Digestion had evidently commenced, and was perceptually progressing, at the time.

Excerpt F: To ascertain whether the sense of hunger would be allayed without food being passed through the oesophagus, he fasted from breakfast time, til 4 o’clock, p.m., and became quite hungry. I then put in at the aperture, three and a half drachms [about 13 mL] of lean, boiled beef. The sense of hunger immediately subsided, and stopped the borborygmus, or croaking noise, caused by the motion of the air in the stomach and intestines, peculiar to him since the wound, and almost always observed when the stomach is empty.

Analysis

1.) The prevailing view of Beaumont’s time was that the stomach heated up when people ate. Does the stomach heat up?
Yes No

2.) It was believed that once food had been ingested the stomach remained idle for an hour or more before digestion began. Does the stomach remain idle before digestion starts?
Yes No

3.) Many scientists before Beaumont’s time asserted that stomach fluid is essentially water. Although some evidence had been produced to disprove this assertion, the belief proved strong enough to persist to the 1800s. What evidence did Beaumont cite in response to this belief?

4.) When does gastric juice get released into the stomach?

5.) Summarize the significance of the discoveries Beaumont describes in Excerpt F.

6.) Based on what you have learned about the stomach and its actions, how accurate do you think Beaumont’s observations and conclusions were? Support your answer with a reason.

7.) Beaumont was a surgeon by profession. In what ways was he also a research scientist? Justify your answer.

8.) How do these events illustrate the process of scientific inquiry?
