



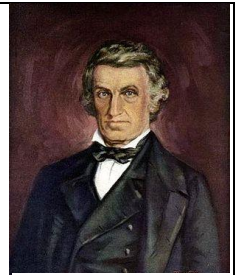
Stories of Science: The "Miraculous Wound": Dr William Beaumont and Alexis St Martin

The story of the 'father of gastric physiology' and his 'unwilling' subject.

Dr William Beaumont (1785-1853) was an American physician who worked as a surgeon in the American Army. In 1822 he was stationed on Mackinac Island in Lake Huron Michigan, when an unfortunate accident led to huge advances in our understanding of the working of the digestive system. On the 6th of June, an employee of the American Fur Company, Alexis St. Martin, also based on Mackinac island, suffered near fatal injuries when a shotgun was accidentally discharged at close range. St. Martin suffered considerable damage to his stomach and ribs and was brought to Dr Beaumont in the hope that his life could be saved, within thirty minutes Beaumont was operating on the misfortunate man. Beaumont treated the wound but was not optimistic for St Martin's survival but survive, he did. Dr Beaumont's surgical skills has saved his life but there remained a hole or *fistula* in his stomach. Unable to continue working for the American Fur Company, Beaumont hired St Martin as a handyman.



Alexis St. Martin



Dr William Beaumont

"Handyman" or experimental "Guinea Pig"?

In 1825 Beaumont was transferred to Fort Niagara in New York, he was accompanied by St Martin. It was here, that Beaumont began a series of bizarre experiments which would be certainly deemed to be unethical by modern standards. Beaumont recognised that the fistula remaining in St Martin's stomach would allow him to investigate the role of the stomach in digestion *in vivo*. It had previously been assumed that the process of digestion was a purely mechanical one. Beaumont tied small pieces of food to a string and dangled them into St Martin's stomach through the fistula. The samples of food were removed every few hours and observed. This led Beaumont to the conclusion that the food was 'digested' not by the mechanical action of the churning of the stomach but through a chemical process involving 'gastric juices'. Beaumont also extracted samples of gastric juice from St Martin in order to digest samples of food outside the body. Whereupon it was concluded that different types of food digested at different rates in the stomach. Or at least they did in Alexis St Martin's stomach with its unfortunate but convenient fistula, which Tanner (2000) describes as Alexis St Martin's "miraculous wound".

The significance of the miraculous wound:

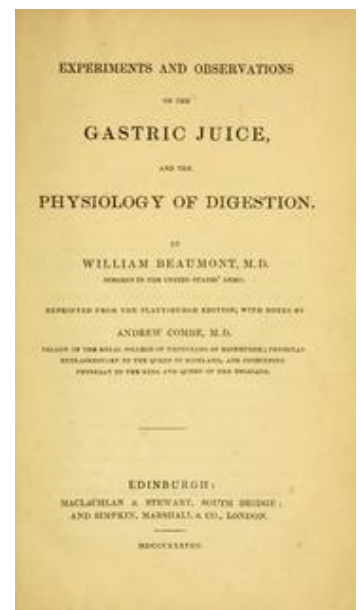
It could be assumed that all these experiments were carried out without St Martin's consent as he ran away from Beaumont returning to his native Canada. Beaumont had him recaptured and was ordered to serve as Beaumont's 'handyman'. In early 1831, Dr Beaumont carried out a series of further experiments on St Martin in which he widened his enquiry to consider the role of temperature, exercise and even emotional state on the process of digestion.

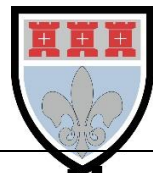
In 1938 Dr Beaumont published his findings as *Experiments and Observations on the Gastric Juice, and the Physiology of Digestion*.

In today's more ethically enlightened age it is likely that Dr Beaumont's work would face severe criticism from the scientific community, on ethical grounds and for the fact that his experiments consisted of a single experimental subject. However, it remains one of the most astounding books on human biology. For example, albeit in archaic terms, Beaumont was the first person to describe gastric juices as being 'muriatic' in nature, in contrast to the nature of 'salivary secretions'.

Modern (more ethical) science has confirmed that many of Dr Beaumont's speculations were in fact correct.

In a 1990 review of a re-issue of Beaumont's book D L Wingate, Professor of Gastrointestinal Science, recognises the seminal nature of the work," yet the fact is Beaumont got it (almost) right." (Wingate, 1990). St Martin and Beaumont finally parted company, with the former finally escaping to his native Quebec. Beaumont died in 1853, after slipping on ice covered steps. Alexis St Martin passed away in 1880, his family delayed his burial until the body began to decompose, in order to prevent him being exhumed by the "medical men".





Comprehension and Reflection Questions

1. What do you think the term 'muriatic' used to describe gastric juices might mean? How does the text inform your answer.

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2. What does the fact that Dr Beaumont found that different foods digested at different rates in the stomach, suggest about the digestive system as a whole?

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3. The picture below is from a painting dating from 1768 An Experiment on a Bird in the Air pump, by Joseph Wright of Derby. What are the similarities and differences between what is being depicted and the Beaumont, St Martin story?



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Extension Activities

Ideas for things to do next:

Write an account of how the function of the digestive system meets its functions, you should consider how and why the digestive systems of animals who eat predominately one type of food, might be different.

Further Reading

Ideas for things to read next:

Tanner, D.E., 2000, June. Narrative, Ethics, and Human Experimentation in Richard Selzer's "Alexis St. Martin": The Miraculous Wound Re-Examined. In *Hec Forum* (Vol. 12, No. 2, pp. 149-160). Springer Netherlands.

Wingate D. L. (1990). Experiments and Observations on the Gastric Juice and the Physiology of Digestion. *Journal of the Royal Society of Medicine*, 83(12), 816.