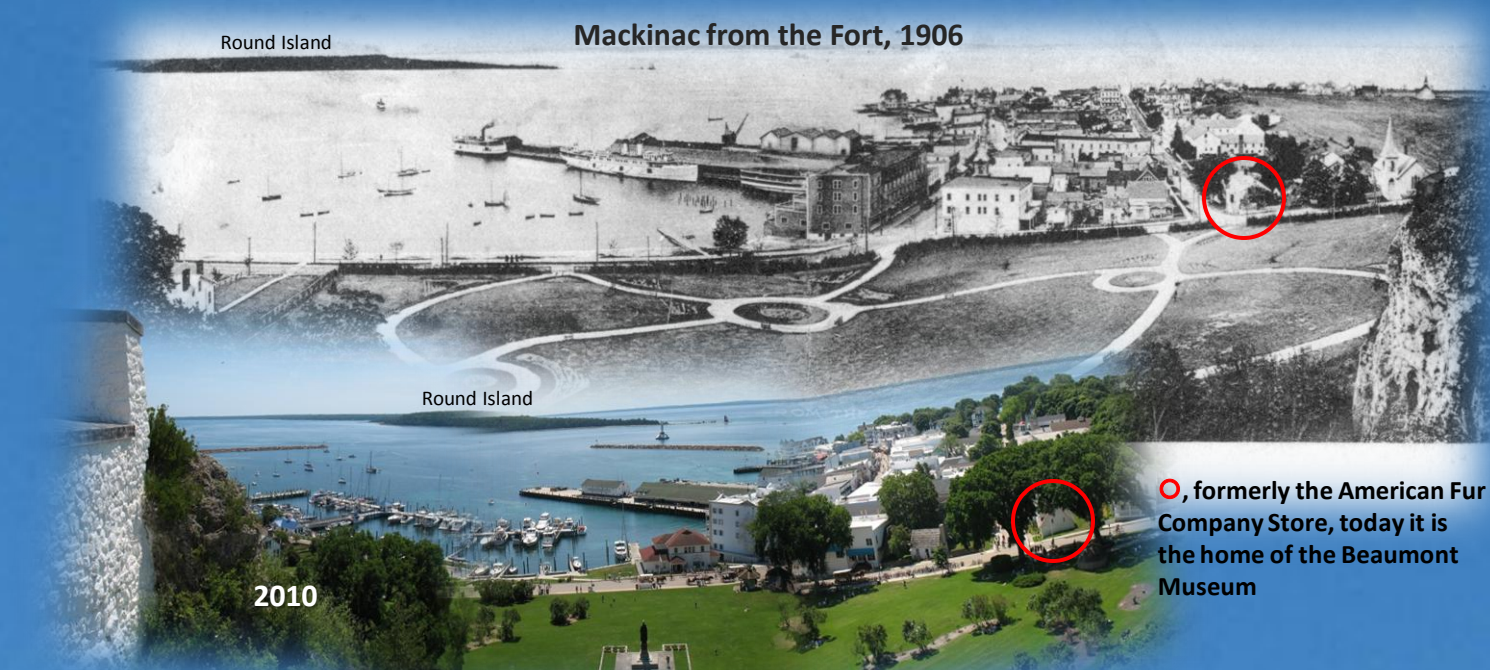


INQUISITIVE DOCTOR, RELUCTANT PATIENT: The Story of Alexis St. Martin's Gastric Fistula & America's First Physiologist, Dr. William Beaumont, Who Discovered Gastric Juice & the Physiology of Digestion (1822-1833)

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1 No matter how spelled there is but one correct pronunciation of "Mackinac", and that is "Mackinaw"

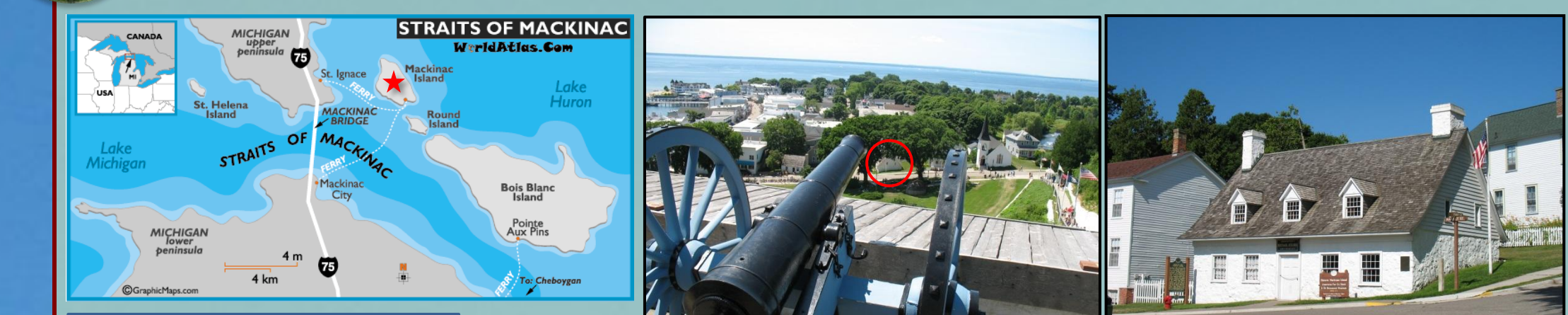
Abstract
On June 6, 1822, inside the American Fur Company's store on Mackinac Island, epicenter for the fur trading enterprise in the Great Lakes region, a French Canadian voyageur named Alexis St. Martin (1794-1880) was accidentally shot in the stomach. Dr. William Beaumont (1785-1853), Post-Surgeon at Fort Mackinac (1820-1825), attended to St. Martin's injuries over the next 3 years, but his stomach wound never closed resulting in a permanent gastric fistula. Recognizing a serendipitous opportunity to study digestion, the doctor began tying small bits of food to string and lowering them through the fistula into St. Martin's stomach, recording how long it took to digest the food. Beaumont conducted 238 experiments intermittently over 8 years at Fort Mackinac, MI (1825); Fort Niagara, NY (1825); Fort Crawford, WI (1829-31), and Washington D.C. (1832-33). In 1833 he published his discoveries in "Experiments and observations on the gastric juice and the physiology of digestion". Beaumont's pioneering studies established the field of digestive physiology, identifying HCl as the important element in gastric juice along with 50 other conclusions from his experiments (5.5 min video will be shown; supported by USF Mol. Pharm. & Physiol.).

Purpose
To retell the story of America's 1st Physiologist, Dr. William Beaumont, and honor the memory of his contributions to medicine in the field of gastric physiology on the 125th anniversary of the American Physiological Society, which is being celebrated at the Experimental Biology 2012 meeting, San Diego, California (April 21-25, 2012).

Resources Used
♦ JBD visited the Beaumont Memorial, Mackinac Island State Park, Michigan, in 2010 & 2011.
♦ Mr. David Kronberg, Exhibit Designer, Mackinac Island State Park Commission, assisted JBD in 1) procuring digital copies of movies shown at Beaumont Museum on Mackinac Island and 2) in getting permission to show the "Inquisitive Doctor, Reluctant Patient" at EB2012 (THANKS Dave!).
♦ Used reference books on the lives of Dr. William Beaumont & Alexis St. Martin, including the following:

Beaumont, William (1833) *Experiments and Observations on the Gastric Juice and the Physiology of Digestion*; reprinted on the occasion of the XIIIth International Physiological Congress, Boston, MA (1929), pp. 280
Myer, Jesse S. (1912) *Life and Letters of Dr. William Beaumont (including hitherto unpublished data concerning the case of Alexis St. Martin)*. C.V. Mosby Co., St. Louis, pp. 317
Mumey, Nolie (1933) *William Beaumont (1785-1853) The Centenary of the Publication of His Contributions to Medicine*; privately printed, Denver, pp. 71
Cannon, Walter B. (1933) *Some Modern Extensions of Beaumont's Studies on Alexis St. Martin*. Beaumont Foundation Lectures, The Journal of the Michigan State Medical Society, March-May, 1933, pp. 87
Pekham, Howard H. (1937) *Four Letters of Alexis St. Martin*; William L. Clements Library, Bulletin XXVI, University of Michigan, Ann Arbor, pp. 8
Miller, Genevieve (1946) *William Beaumont's Formative Years, Two Early Notebooks 1811-1821*. Henry Schuman, NY, pp. 87
Rosen, George (1942) *The Reception of William Beaumont's Discovery in Europe*. Schuman's, NY, pp. 97
Selleck, Henry B. (1961) *Beaumont and "The Mackinac Island Miracle"*. Beaumont Memorial Fnd., East Lansing, pp. 40
Hubbard, Gurdon S. (1969) *The Autobiography of Gurdon Saltonstall Hubbard*. The Citadel Press, NY, pp. 182
Widder, Keith R. (1975, 2006) *Dr. William Beaumont. The Mackinac years*. Mackinac Island State Park Commission, Mackinac Island, MI, pp. 40

4 6 June 1822, a French Canadian voyageur, Alexis St. Martin, is accidentally shot at close range inside the American Fur Company on Mackinac Island (Michigan)



(Beaumont Museum)

AMERICAN FUR COMPANY STORE
On June 6, 1822, Alexis St. Martin (1804-1880), a French Canadian voyageur, was accidentally shot in the American Fur Company Store located on this site. Dr. William Beaumont (1786-1853), the Fort Mackinac post surgeon, nursed St. Martin back to health. St. Martin's wound healed leaving a permanent opening into his stomach. Through this opening Beaumont compared the digestibility of foods, recorded the temperature of the stomach under different conditions, and extracted and analyzed gastric juice. Beaumont conducted the first of 250 experiments with St. Martin in 1825 in the Officers' Stone Quarters at Fort Mackinac. Eight years later he published a groundbreaking book on his discovery of the digestive process.

Selected scenes from the video "Inquisitive Doctor, Reluctant Patient", showing Alexis St. Martin lying on the floor of the American Fur Company Store after being accidentally shot in the abdomen. Film & diorama prepared by Mackinac Island State Park Commission.

"The [musket] muzzle was not over three feet from him—I think not more than two. The wadding entered, as well as pieces of clothing; his shirt took fire; he fell, as we supposed, dead."—G.S. Hubbard, eye witness

the old stone Officers' Quarters where Wm. Beaumont experimented with Alexis St. Martin's stomach.



5 Dr. Wm. Beaumont (1785-1853) and Alexis St. Martin (1794-1880)

A Most Unusual Wound

The shotgun blast severely injured the left side of St. Martin's upper abdomen. The charge shredded and burned his skin, fractured several ribs, tore open parts of his stomach, diaphragm and left lung, and damaged the surrounding muscles and tissues.

Although St. Martin recovered, the hole into his stomach remained open. The stomach lining attached to the external wound creating a "gastric fistula." For a while Beaumont had to bandage the hole to prevent St. Martin's food from leaking out. Eventually a portion of the stomach covered the hole from the inside. This served as a valve that kept food in the stomach. However, Beaumont could push the valve aside and pour directly into St. Martin's healthy, working stomach.

"gastric fistula"

6 In 1825, three years after St. Martin's accidental shooting, Dr. Beaumont began studying the physiology of digestion through Alexis' gastric fistula, lowering bits of food tied to string into the stomach and measuring how long it takes to be digested.

Mackinac's Medical Miracle

Recognizing a serendipitous opportunity to study digestion, the doctor began tying small bits of food to string and lowering them through the fistula into St. Martin's stomach, recording how long it took to digest the food. Beaumont conducted 238 experiments intermittently over 8 years at multiple "stone and log cabin labs" carved out of the wilderness at various frontier outposts. Beaumont experimented through St. Martin's gastric fistula at the following locations:

- Fort Mackinac, MI (1825)
- Fort Niagara, NY (1825)
- Fort Crawford, WI (1829-31)
- and Washington D.C. (1832-33).

In 1833 he published his discoveries in "Experiments and observations on the gastric juice and the physiology of digestion". Beaumont's pioneering studies established the field of digestive physiology, making more than 50 conclusions. For example, he identified the important element in gastric juice was HCl; he suggested the presence of a second digestive factor that later was identified to be pepsin; he observed the influence of mental disturbances on digestion; and he made tables of the relative digestibility of different foods (he was the pioneer of practical dietetics).

Chronology, Wm. Beaumont & Alexis St. Martin (Mumey 1933)

- 1820 Beaumont is assigned as Post-Surgeon to Fort Mackinac
- 1822 Beaumont is called to attend to Alexis St. Martin who was wounded in the abdomen by a gunshot inside the American Fur Co. Store, Mackinac Island
- 1823 Took St. Martin into his home and cared for him
- 1825 Began experiments on St. Martin at Fort Mackinac, Mackinac Island
- 1825 Ordered to Fort Niagara, NY (St. Martin leaves without notice)
- 1828 Transferred to Fort Crawford, WI
- 1829 Located St. Martin in Canada; had him transported to Fort Crawford, a distance of 2,000 miles
- 1829-30 Experiments on St. Martin
- 1831 St. Martin leaves for Canada
- 1832 Further experiments on St. Martin in Plattsburgh and Washington, D.C.
- 1833 Publication of his book, "Experiments and observations on the gastric juice and the physiology of digestion."

EXPERIMENTS AND OBSERVATIONS ON THE GASTRIC JUICE AND THE PHYSIOLOGY OF DIGESTION BY WILLIAM BEAUMONT, M.D. BOSTON: IN THE UNITED STATES ARMY. PUBLISHED BY CHARLES SCRIBNER'S SONS, 1929

(Beaumont Museum)



7 The Hawley estate, located in Bethesda, MD, near the NIH, was purchased by the APS and sold to the Federation in 1954. Christened the "Beaumont House", in honor of Dr. Wm. Beaumont, it served as the first permanent headquarters for FASEB.

Stem of clay smoking pipe inserted into opening to stomach

Beaumont Room, 2010

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