

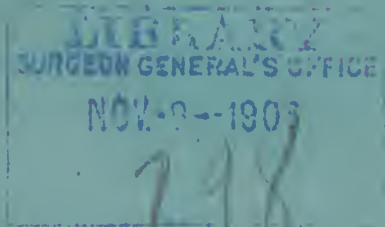
VAUGHAN (V. C.)

WILLIAM BEAUMONT AND
HIS WORK.

BY
VICTOR C. VAUGHAN, M. D.
ANN ARBOR, MICH.

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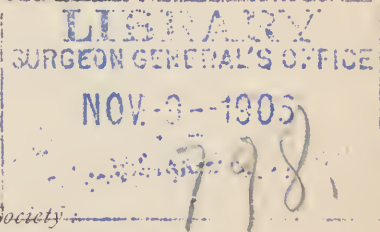
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WILLIAM BEAUMONT AND HIS WORK.

VICTOR C. VAUGHAN, M. D.
Ann Arbor.



Fellow Members of the Michigan State Medical Society:

In our busy lives as practitioners of medicine and surgery, we too seldom think of those whose labors have placed certain departments of medicine among the exact sciences. The healing art had its origin in the priestly superstitions of primitive men. From what it then was to what it now is, medicine has been advanced by the patient labor and persistent toil of many men, who have devoted their lives searching for the truth. We are better able to cope with disease than were the medical priests of ancient Egypt, the astrologers of Chaldon and the theorists of two hundred years ago, because certain men have pursued the experimental study of physics, chemistry and biology with earnest purpose and well directed skill. It is my intention to devote the time allotted to this address, which your favor, well appreciated by its recipient, permits

me to give, in calling your attention to one of our honored dead, and to his work which was of great service in the development of physiological knowledge. I have chosen for the subject of this paper, William Beaumont and his work. I have been induced to make this selection because, in the first place, his studies were begun in the then Territory of Michigan; secondly, American medical biographers have not, in my opinion, done the memory of this man justice; and thirdly, the fact that he accomplished so much under great difficulties may cheer some of us in carrying our burdens, which at times grow exceedingly heavy, and may lead some of our younger members to realize that it is the duty, as it should be the pleasure, of every medical man, however limited his facilities may be, to add something to the sum of that knowledge which surpasses all other, inasmuch as it is utilized in the saving of human lives.

William, the son of Samuel Beaumont, a New England farmer, was born at Lebanon, Connecticut, in 1785. I have been unable to find any record of the student life of the young man. However, that he was diligent in the pursuit of knowledge is evidenced by the fact that soon after reaching his majority he became a school teacher at Champlain, Clinton County, N. Y. At the same time he began the study of Medicine, which he continued later under the direction of Dr. Benjamin Chandler, of St. Albans, Vt. There is no evidence, so far as I can find, that Beaumont ever attended a medical school. On December 2nd, 1812, he enlisted, as surgeon's mate, in the 16th Infantry, and was transferred to the 6th Infantry, June 6th, 1813.* A few months later the young medical assistant saw something of the wounds of war at the capture and destruction of York (now Toronto), where the retreating English exploded a magazine containing a hundred barrels of powder under the feet of the advancing Americans.

At the close of the war in 1815, Dr. Beaumont resigned his commission and began the practice of medicine at Plattsburg.

*In giving these data, I have two sources of information: (1) The records of the Surgeon General's office, kindly furnished me by Surgeon General Geo. M. Sternberg and Asst. Surgeon General Chas. Smart, to both of whom my best thanks are due; (2) "A Memoir of the late William Beaumont" by Thomas Reyburn, M. D., St. Louis Medical and Surgical Journal, 1854. There are several contradictions, all of minor importance, in these authorities. In such cases I have followed the official records from the Surgeon General's office.

During his service as surgeon's mate he had won the esteem and friendship of Dr. Joseph Lovell, who in 1818 became the first Surgeon General of the U. S. Army. The first of Beaumont's letters on file in the Surgeon General's office is dated at Plattsburg, N. Y., Dec. 18th, 1818, and it expresses thanks for the offer of a thousand dollar clerkship in the office at Washington, which was at first accepted, but later declined. In 1820 Dr. Beaumont again entered the medical service of the army. This time he had the rank of Post-Surgeon, and was assigned to duty at Michillimackinac, (now Mackinac Island), where he reported to General Macomb in June.

Two years later, on June 6th, 1822, the accident which permanently opened the walls of the stomach of Alexis St. Martin, and enabled Beaumont to satisfactorily study gastric digestion, happened. The wound is described as follows: "The charge, consisting of powder and duck shot, was received in his left side, he being at a distance of not more than one yard from the muzzle of the gun. The contents entered posteriorly, and in an oblique direction, forward and inward, literally blowing off the integuments and muscles for several inches in circumference, fracturing and carrying away the anterior half of the sixth rib, fracturing the fifth, lacerating the lower portion of the left lobe of the lungs, as well as the diaphragm on the left side."

This wound was carefully treated by Dr. Beaumont, and finally, as is well known, it healed, leaving a permanent gastric fistula, which was ordinarily closed by a valvular flap of the mucous membrane. In May, 1825, nearly three years after the accident, the first experiments were made. In June of the same year Dr. Beaumont was ordered from Mackinac to Fort Niagara. He took St. Martin with him and continued the studies. In August the two visited Burlington and Plattsburg, and at the latter place the patient, doubtless feeling that he was now of more service to the doctor than the doctor was to him; departed without ceremony.

At Fort Niagara in June and July, 1825, there happened the events which led to the trial of Lieut. E. B. Griswold by court martial, in which Dr. Beaumont was the principal wit-

ness. The most important charge against Lieut. Griswold was that he had attempted to shirk duty by falsely reporting himself sick. This charge was substantiated by the evidence of Dr. Beaumont. The court found Lieut. Griswold guilty, and sentence was passed in conformity with this finding. The President reversed the finding of the court, and in doing so took occasion to criticize the testimony of the surgeon. Dr. Beaumont replied, in a circular written tersely but with dignity, to the President's criticism, which may be found in General Order (No. 9) of Feb. 18th, 1726. I cannot forbear quoting one paragraph from Dr. Beaumont's circular. Suspecting that Lieut. Griswold was feigning illness, he prescribed a mixture of 15 or 20 grains of calomel and 5 or 6 grains of tartar emetic. It seems that the Lieutenant, having been informed of the nature of the prescription, returned to duty in preference to taking the medicine. The doctor was criticized for this treatment, and to this criticism he replied as follows: "Whether the plan adopted, either in a moral or professional point of view, be justifiable or not, I leave for medical men and candid judges to decide; it was salutatory and had the intended effect of returning Lieut. Griswold to his duty without prejudice to his health or constitution; neither is it of very great moment with me whether a successful experiment be of *less* or *more* than doubtful propriety, that speedily returns a soldier from the *sick report* to the effective service of the government, be he *private, non-commissioned* or *commissioned officer*; neither do I think it of very great consequence whether it be done *secundum artem, secundum naturam* or *terrorem*, provided it be *well done*."

In May, 1826, Dr. Beaumont was transferred to Fort Howard, on Green Bay, and in 1828 to Fort Crawford, on the Upper Mississippi. During these years the doctor was constant in his endeavor to locate his truant patient. Finally he learned that St. Martin had become the possessor of a wife, and the father of two children, and was domiciled in lower Canada, nearly two thousand miles from Fort Crawford. At his own expense he induced agents of the American Fur Company to transport the family through this distance, and

in August, 1829, after an interruption of four years, the experiments were again begun. The work was continued until the spring of 1831, when St. Martin and his family were allowed to go to lower Canada, with the promise that he would return when required. In August, 1832, Dr. Beaumont was granted a leave of absence; he proceeded to Plattsburg where he met St. Martin by agreement, and the time from November, 1832, to March, 1834, was spent in Washington in carrying on the experiments. In the fall of this year the first edition of "The Physiology of Digestion with Experiments on the Gastric Juice," was published.

Early in 1834 Dr. Beaumont was ordered to Jefferson Barracks, now St. Louis. He had but recently started for his new post when the Secretary of War, Louis Cass, received from Edward Everett the following petition, signed by more than two hundred members of Congress: "Being informed that Dr. Charles E. Jackson, an eminent chemist of Boston, is successfully prosecuting an analysis of the gastric fluid of Alexis St. Martin, the Canadian boy attached to Dr. Beaumont, Surgeon of the U. S. Army, and that the analysis cannot be satisfactorily accomplished without the presence of Dr. Beaumont and St. Martin; and regarding the case as furnishing a rare and fortunate opportunity of demonstrating important principles in physiology by which credit may be conferred on the medical science of our country, and important benefits accrue to humanity; also, understanding that several foreign national scientific bodies are anxious to draw St. Martin from this country, for the purpose of prosecuting the investigations now making by one of our countrymen, who is in every way competent to the work; and persuaded that the opportunity now afforded, if neglected, will be lost to our country forever, we request that the Hon. Secretary of War will station Dr. Beaumont at Boston, or in the vicinity, for the term of four months, or longer if necessary for the object."

The reply of the Secretary to this petition was as follows: "I should have considered it due to the very respectable signers of the recommendation to comply with their request in this instance, had I not ascertained that another engagement

had been made by the Surgeon General, with the consent of Dr. Beaumont, which is more acceptable to him than the proposed measure of sending him to Boston. Before I received your letter he was on his route to St. Louis, the place of his destination, and under these circumstances I trust that you will accord with me in opinion that it is not advisable to change his station at present." Dr. Lovell, the Surgeon General, wrote on the back of this paper: "Dr. Beaumont already understands that he cannot conveniently be stationed at Boston, so he has stated that this application was made without his knowledge or desire. He has gone to his station without any desire to leave it at present."

It would seem from the petition and the answers that the former was drawn in the interests of Prof. Jackson, rather than at the request of Dr. Beaumont. However, the interest manifested by Hon. Edward Everett in this interesting work was intelligent and real. Dr. Beaumont had often expressed a desire to take St. Martin to Europe, where the best chemists and physiologists might utilize the opportunity for the study of gastric digestion to the fullest extent, and Mr. Everett introduced an amendment to the appropriation bill of 1834 calling for \$10,000 for further experimentation, but the amendment was lost.

Dr. Beaumont reported his arrival at Jefferson Barracks July 1st, 1834, but one month later he asked to be relieved and sent to Fort Crawford, with permission to delay three months in changing stations. The leave was granted. He went to Plattsburg, but was soon ordered to return to Jefferson Barracks as a witness in a court martial. In 1835 he was made Purveyor of Medical Supplies for the Western Military District and Surgeon to the St. Louis Arsenal. Here his military duties were so light that he was permitted to open an office and give his attention to private practice. A fellow practitioner, Dr. Thomas Reyburn, says of Dr. Beaumont at this time: "His mature age and ripe experience, the reputation he had acquired in the army and by the publication of his work on the gastric juice, together with the fact that society was in large part composed of military men and their families,

tended no doubt to give him that preeminence in the profession which few could contest with him on the score of superiority, skill and experience."

In 1837 Dr. Beaumont wrote to a friend in Washington, as follows: "I have no wish or intention of resigning my appointment in the army at present, though the professional encouragement I meet with here might seem sufficient inducement to do so, were avarice or professional fame the motive of my ambition. I have a very handsome, lucrative and respectable private practice, reputation far above my merits, and professional popularity more than commensurate with my best practical skill or abilities."

In March, 1839, he requested a leave of absence, and suggested a tour of inspection of the upper river and lake posts. These requests were not considered favorably by the War Department, and instead of their being granted Dr. Beaumont was ordered to proceed immediately to Florida for duty in the field. Against this order he remonstrated, pleading advanced age, length of service, and claiming that the order was contrary to the usual regulations. The order was repeated in most positive form, and was this time met by resignation. It might be remarked here, that the first Surgeon General, Dr. Joseph Lovell, who had greatly aided Beaumont by obtaining books on the subject of digestion for him, and by allowing him to change posts, and by granting short leaves of absence, when the experimental work could be benefited thereby, died October 17th, 1836, and it is altogether probable that the man who had so long been regarded as somewhat a favorite of the Surgeon General, should be made to feel the insults of those less honored, as soon as the highest authority passed into other hands.

Dr. Beaumont continued to practice medicine in St. Louis, favored by a large clientage, and honored and beloved by his fellow practitioners. One of the latter speaks of him as follows: "He was gifted with strong natural powers, which, working upon an extensive experience in life, resulted in a species of natural sagacity, which, as I suppose, was something peculiar in him, and not to be attained by any course

of study. His temperament was ardent, but never got the better of his instructed and disciplined judgment ; and whenever or however employed, he always adopted the most judicious means for attaining ends that were always honorable. In the sick room he was a model of patience and kindness, his intuitive perceptions, guiding a pure benevolence, never failed to inspire confidence, and thus he belonged to that class of physicians whose very presence affords nature a sensible relief."

During the cholera epidemic of 1849 Dr. Beaumont, then sixty-four years of age, devoted his days and nights to the most arduous professional duties which fall at such times upon one known to be possessed of sound judgment, ripened by experience and approved by success.

In March, 1853, he fell in descending the steps of a house to which he had been called professionally. At first but little importance was attached to his injuries, but later a carbuncle appeared on the back of his neck, and he died on the 25th of April.

I have now finished my brief sketch of the life of Dr. Beaumont, and I desire to make some comments upon his work. In undertaking this part of my theme, I desire, in the first place, to call attention to the clear, unequivocal style in which Dr. Beaumont wrote. As I have already stated, I have been unable to give any definite information concerning the extent and character of his education, but his little book on "Digestion" should now be considered as a classic. His writings show that he possessed the following qualifications which should belong to every man who attempts scientific research : (1) He knew what others before him had done in the same line of work. He was thoroughly familiar with the important literature of the subject. When we recall the fact that he was only an Assistant Surgeon stationed at an isolated post in the then wilderness of the Territory of Michigan, we must admit that it required energy and zeal for him to obtain and familiarize himself with the works of Spallanzani, Magandie, Tiedmann and Gmelin, Leuret, Lassaigue, Carminiti, Viridet, Werner, Hunter, Marquart and Vanquelin, Montegre, Prout,

Broussais, and others. That he did acquaint himself thoroughly with the writings of these authors is shown in his book, and is conclusive proof that he was a student, earnest and intelligent in his labors. (2) His experiments were made in the simplest and most natural way possible. He did not forget, as too many experimentors do, that conclusions are worthless when the observations are made under artificial and unnatural conditions. No better example of the inutility of experimentation under abnormal conditions need be offered than that furnished by the work of Montegre, who could vomit at will, and who chose to vomit during the intervals of digestion. From the examination of the fluid thus obtained from the stomach Montegre concluded that what had been supposed to be gastric juice is, in fact, nothing but saliva; that the principal use of the gastric juice is to dilute the food; and that the only action of the stomach is "une absorption vitale et elective." Beaumont saw the fallacy of these conclusions, and demonstrated that the gastric juice is secreted only when the walls of the stomach are stimulated by the presence of food. (3) His experiments are recorded in the simplest terms, and his conclusions are never forced but necessarily follow from the observations. Take, for instance, his conclusion that the gastric juice contains free muriatic acid and some other active *chemical* principle. He easily ascertained that the fluid was acid, and Duglison and Emmett demonstrated for him the presence of free hydrochloric acid; but his observations led him to conclude that, in addition to the free acid, some other active chemical agent was present. He did not weaken the value of his work by theories as to the nature of the other chemical substance, and the discovery of pepsin remained to be worked out by the researches of Schwann, and to be confirmed by Wasmann.

There are at least two early experimental works on digestion which every student of physiology should read. These are the works of Spallanzani and Beaumont.

It is, I think, quite generally supposed that Beaumont's good fortune as an investigator was solely dependent upon what we must regard as the fortunate accident to St. Martin. This

is partially true. Had the accident never happened, Beaumont could not have rendered the great service to physiology and to medicine that he did render, but proper credit should be given him. St. Martin's was not the first case of permanent gastric fistula in man. On this point Dr. Reyburn makes the following statement: "In order to estimate properly the professional zeal and enthusiasm of Dr. Beaumont, we must remember the untoward circumstances under which he struggled in the case of St. Martin, and compare his labors and its results with those of similar cases presented to the observation of physiologists in Europe. Burrows, in the fourth volume of the Transactions of the Royal Irish Academy, relates a case of fistulous opening into the stomach, and a similar case is noted by Schenkien. Louis refers to other cases which occurred to Foubert and Covillard. Helm, of Vienna, publishes another case, and one other occurred at La Charite in Paris. To what important scientific uses were these cases applied? What experiments are recorded in connection with them? What fact observed in them has been referred to by physiologists, to decide the nature and laws of the animal functions? With the exception of some brief references made by authorities to a few experiments connected with the case at La Charite, science can draw no deduction and derived no benefit from them. It was left to the unpretending genius of the Army Surgeon of isolated frontier military posts to turn to its scientific uses a case more important than which has never been presented to the searching eyes of the medical philosopher. To his zeal and ambition, to his sacrifices, to his patient perseverance and research, is due a boon to science, to which even Europe, when the opportunity presented itself, advanced no claims."

I have already made mention of the fact that Dr. Beaumont desired to carry St. Martin to Europe in order that the most renowned physiologists and chemists might see and study this case. This illustrates the broad views that Dr. Beaumont had. He was not working simply for personal fame, but he desired that the greatest benefit might be secured from the case under his charge. Not being able to take his patient to

Europe, he wrote and sent samples of the gastric juice to several scientists. He was very desirous that a complete and accurate analysis of the fluid should be made. One European chemist to whom some of the gastric juice had been sent wrote as follows: "Animal analysis is the most difficult department of chemistry, and there are not now living many chemists who could perform a complete analysis of the gastric juice. Alexis Thenard in France, Prout in England, and Berzelius in Sweden are the best analysts we have in this department, and I advise you to send specimens of the juice to them." Dr. Beaumont did attempt to send a sample of the gastric juice to Berzelius. The package, accompanied by a history of the case of St. Martin, was entrusted to the captain of an American vessel sailing for northern Europe, with instructions that it be left with the quarantine officer at Gothenburg, with the request that it be forwarded to Berzelius at Stockholm, but the package never reached its destination. However, it is not probable that the great Swedish chemist could have done more in the way of a satisfactory analysis than was done by Prof. Duglison and Emmett at the University of Virginia. These gentlemen distilled the fluid, and demonstrated the presence of free hydrochloric acid in the distillate. This had previously been done by Prout, working with the contents of the stomach of dogs killed during digestion, but the analysis of Duglison and Emmett was made upon the juice obtained by the mechanical irritation of the walls of the stomach, and, notwithstanding the subsequent criticism of Lehmann that the free hydrochloric acid found in the distillate was due to the decomposition of chlorides by lactic acid, which he held to be the normal acid of the juice, the results of the American chemists have proved to be correct.

In order to properly estimate the value of Beaumont's work, it will be necessary to give a brief resume of the history of the views held by scientific men concerning gastric digestion. In doing this we will not go back further than the middle of the eighteenth century, when the experimental study of the subject was begun by Reaumur, who caused a tame buzzard to swallow metallic tubes closed at one end and covered with

muslin at the other end and filled with food. When these tubes were regurgitated by the bird, it was found that the enclosed food was, to a greater or less extent, dissolved. This disposed of the theory previously held, that the stomach effected solution solely by a process of grinding. In 1777 Dr. Stevens, of Edinburgh, availed himself of the services of a man who was accustomed to amuse the people and gather a few pennies by swallowing bits of stone. Stevens prepared small silver balls made in halves, fastened together with a screw, and perforated by minute holes. These were filled with different articles of food, and swallowed by the performer. When these balls were evacuated, their contents were found to be digested and often had disappeared altogether. These experiments supplied additional evidence against the mechanical theory, since the food enclosed in the silver balls was protected against the grinding action of the walls of the stomach.

The brilliant Abbe Spallanzani who, by the way, is said to have received his enthusiasm for scientific research from the celebrated woman professor Laura Bassi, of Bologna, wrote his celebrated and valuable dissertations on digestion during the last quarter of the eighteenth century. These writings consist of the records of numerous experiments, the atrocities of which the antivivisectionists of to-day would take great pleasure in detailing. He repeated, multiplied and varied the investigations of Reamur. He obtained gastric juice by causing animals to swallow bits of sponge attached to strings by which the sponge was withdrawn at pleasure. The fluid thus obtained was mixed with food, and the mixture carried in the arm pit until the food was digested. He recognized the acidity of the gastric secretion, but made no attempt to ascertain the nature of the acid.

Beaumont comes next in the list of those who studied the gastric juice taken from the stomach during life, and was the first to make researches on the gastric secretions of man.

He accurately described the appearance of the mucous membrane of the stomach in health and disease, during fasting and in digestion. He studied and recorded very clearly

the movements of the stomach from the moment of the reception of the food until the last bit passed through the pylorus. He showed that the flow of the fluid is intermittent, and occurs only when the walls of the stomach are stimulated by the presence of food, and that during the hours of fasting the stomach contains only a small amount of mucus which is neutral or feebly alkaline in reaction. He demonstrated that contrary to the teaching of Magandie bile does not normally flow into the stomach. He studied the relative effects of the gastric juice on different kinds of food, and made records of the comparative digestibility of different foods, and did this so accurately that his results are now utilized by us in selecting the diet of our patients. He made such an exact study of the physical and chemical natures of the gastric juice that, with the exception of the discovery of pepsin, the closest research of modern times has added but little to the work done by him.

Every physician who prescribes for digestive disorders, and every patient who is benefited by such a prescription, owes gratitude to the memory of William Beaumont, who, in 1825, on the island of Mackinaw, began his studies of digestion, which he pursued with great labor and skill for the benefit of mankind.

