

Nathan Smith (1762-1828)

Surgical Consultant to Joseph Smith

LeRoy S. Wirthlin

One of the more touching episodes in the life of Joseph Smith was his bout with a serious illness as a young boy when the Smith family lived in Lebanon, New Hampshire, from 1811 through 1813. His mother, Lucy Mack Smith, described a long siege of typhus and vividly recalled a serious operation performed in their home on Joseph's leg for a bone infection (osteomyelitis).¹ The operation originally recommended by the "Council of Surgeons" was an amputation that both the boy and the mother refused. One develops great sympathy for the young man beset by country physicians who had to be dissuaded from amputating his leg. There follow the details of a seemingly gruesome operation performed at home without benefit of anesthesia or aseptic technique. Joseph's mother recalled that the bone of the leg was drilled and fragments of the bone were removed.² Lucy Smith's description of the operation is the first clue that young Joseph received unusual surgical care as the drilling of long bones in the leg was not described or published in medical literature until a later date. The combination of drilling and removing bony fragments as treatment for osteomyelitis was suggested in the late 1800s and was finally standardized following the First World War surgical experience.³ It is most curious that young Joseph would receive such treatment in the early 1800s in a remote area of New Hampshire.

There is a second account of Joseph's boyhood illness and operation contained in the manuscript history of Joseph Smith dictated in 1838.

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¹Lucy Mack Smith, *Biographical Sketches of Joseph Smith, the Prophet and his Progenitors for Many Generations* (Liverpool: Published for Orson Pratt and S. W. Richards, 1853), pp. 62-66. Dictated in 1845, this manuscript was later revised and published and is now available as Lucy Mack Smith, *History of Joseph Smith* (Salt Lake City: Bookcraft, 1958).

²Smith, *Biographical Sketches*, p. 65.

³Abraham O. Wilensky, *Osteomyelitis: Its Pathogenesis, Symptomatology and Treatment* (New York: Macmillan, 1934), p. 189.

When I was five years old or thereabouts I was attacked with the Typhus Fever, and at one time, during my sickness, my father despaired of my life. The doctors broke the fever, after which it settled under my shoulder, and Dr. Parker called it a sprained shoulder and anointed it with bone ointment, and freely applied the hot shovel, when it proved to be a swelling under the arm which was opened, and discharged freely, after which the disease removed and descended into my left leg and ankle and terminated in a fever sore of the worst kind, and I endured the most acute suffering for a long time under the care of Drs. Smith, Stone and Perkins, of Hanover. At one time eleven Doctors came from Dartmouth Medical College, at Hanover, New Hampshire, for the purpose of amputation, but, young as I was, I utterly refused to give my assent to the operation, but consented to their Trying an experiment by removing a large portion of the bone from my left leg, which they did, and fourteen additional pieces of bone afterwards worked out before my leg healed, during which time I was reduced so very low that my mother could carry me with ease.⁴

To our knowledge these are the only two accounts of Joseph's surgery.⁵ This brief account, however, identifies three physicians who provided care and reveals that eleven doctors came from Dartmouth Medical College to assist with the surgery.⁶ Mr. Kenneth C. Cramer, Archivist, Baker Memorial Library, Dartmouth College, suggested that for time and circumstance Smith and Perkins might have been Nathan Smith and Cyrus Perkins, both of Dartmouth Medical School and partners in medical practice.⁷ Although there were no operative notes or patient records, the mention of Smith and Perkins together with the eleven medical students who carried out an operation for osteomyelitis solidly identifies Nathan Smith as a contributor to young Joseph's surgical care. It was Nathan Smith who years before had developed the techniques of drilling, sawing, and removing dead bone in cases of osteomyelitis, thus preventing the unnecessary amputation of extremities.

It should be of interest to members of The Church of Jesus

⁴Joseph Smith, "Manuscript History of the Church," Book A-1, Note C, p. 131, Church Historian's Office, The Church of Jesus Christ of Latter-day Saints, Salt Lake City, Utah. The manuscript history was dictated by Joseph Smith in 1838-1839. The original is in the handwriting of Willard Richards, Church Historian during the 1850s (Leonard J. Arrington to LeRoy S. Wirthlin, 15 November 1976), and has been reprinted in Reed C. Durham, "Joseph Smith's Own Story of a Serious Childhood Illness," *BYU Studies* 10 (Summer 1970):480-82.

⁵Leonard J. Arrington to LeRoy S. Wirthlin, 15 November 1976.

⁶The majority of the eleven "Doctors" would have been medical students at Dartmouth as there were only two doctors on the staff at the time, Dr. Nathan Smith and Dr. Cyrus Perkins. Lucy Smith reported that there were seven physicians. (Draft manuscript for the *Biographical Sketches*, Church Archives.)

⁷Larry C. Porter, "A Study of the Origins of the Church of Jesus Christ of Latter-day Saints in the States of New York and Pennsylvania, 1816-1831," (Ph.D. diss., Brigham Young University, 1971), p. 28.

Christ of Latter-day Saints to learn that Dr. Nathan Smith was the only physician in the United States at the time who had the vision, knowledge, and necessary surgical experience to deal successfully with Joseph Smith's medical problems. The purpose of this paper is to present a sketch of Nathan Smith's professional life which will illuminate the accounts we have of Joseph Smith's boyhood illness and surgical treatment.

Nathan Smith was one of New England's finest physicians, surgeons and medical educators. He founded Dartmouth Medical School and participated in the founding of Yale and Bowdoin Medical Schools. His published works, *Practical Essay on Typhous Fever* and *Observation on the Pathology and Treatment of Necrosis*,⁸ the former dealing with the recognition and treatment of typhoid fever and the latter concerning the surgical treatment of osteomyelitis, were the first substantial American contributions to the understanding and rational treatment of these disorders. Both works remain classics in medical literature. During his Dartmouth years Nathan Smith wrote little; as an extremely busy physician and teacher, he had no time for personal journals or histories. The information we have on his work is gleaned from lecture notes recorded verbatim by medical students at Dartmouth and later at Yale Medical School, from letters to former students, from correspondence to his lawyer, from letters of students to their families, and from his daily account ledgers.⁹ A great deal of research and compilation of material concerning the life of Nathan Smith has been done by Oliver S. Hayward, M. D., who has written extensively on Smith's life and medical contributions.¹⁰ Although a biography is now in progress, no definitive biography has yet been published.

⁸Nathan Smith, *Practical Essay on Typhous Fever* (New York: E. Bliss and E. White, 1824); Nathan Smith, "Observations on the Pathology and Treatment of Necrosis," *Philadelphia Monthly Journal of Medicine and Surgery*, 1827, pp. 11-19, 66-75 (reprinted in Nathan Smith, *Medical and Surgical Memoirs* [Baltimore: William A. Francis, 1831], pp. 97-121).

⁹This material is located in the archives of Dartmouth Library and Yale Medical School.

¹⁰Oliver S. Hayward, "Dr. Nathan Smith (1762-1829) - American Pioneer," *New England Journal of Medicine* 261 (3 September 1959):489-94; Hayward, "A Search for the Real Nathan Smith," *Journal of the History of Medicine and Allied Sciences* 35 (July 1960):268-81; Hayward, "Two Nineteenth Century Medical Professors: Nathan Smith and his Son, Ryno," *Bulletin of the School of Medicine, University of Maryland* 48 (October 1963):39-58; Hayward, "A Student of Dr. Nathan Smith," *Connecticut Medicine* 24 (September 1960):553-59; Hayward, "Nathan Smith's Medical Practice or Dogmatism Versus Patient Inquiry," *Bulletin of the History of Medicine* 36 (1962):260-67; Hayward, "The Basis in Sydenham, Rush and Armstrong for Nathan Smith's Teaching," *Annals of Internal Medicine* 56 (February 1962):343-48; Mather Cleveland and Oliver S. Hayward, "Nathan Smith (1762-1829) on Amputations," *Journal of Bone and Joint Surgery* 43-A (December 1961):1246-54.

Little is known of Nathan Smith's early life. He was born in Rehoboth, Massachusetts, in 1762, and grew up in Chester, Vermont. He acquired an ordinary country education but did not have opportunity to attend college. His initial interest in pursuing a medical career was sparked when he assisted a country physician, Josiah Goodhue, in performing an amputation.¹¹ On the spot he wished to become apprenticed to this surgeon.

The opportunities to obtain an American medical education in the last quarter of the eighteenth century were limited. The usual method was to apprentice under a practicing physician without a formal college education. With the introduction of American medical schools in the late 1700s, one could, in addition to the apprenticeship, obtain courses in anatomy, chemistry, and current drug treatment.¹² Opportunities for hospital and practical clinical experience were minimal. The long periods of medical school study combined with substantial periods of hospital training characteristic of modern medical education only evolved during the late nineteenth and early twentieth centuries. There were few physicians prior to the 1800s who had received training beyond an apprenticeship, and there were only a few hundred physicians in the entire country who had obtained a degree in medicine by 1800.¹³

Before Josiah Goodhue accepted Nathan Smith as a pupil, he insisted that the young man should broaden his education under the training of a Reverend Whiting of Rockingham, Vermont. After several months study, Smith returned to Dr. Goodhue for three years as an apprentice before beginning practice in Cornish, New Hampshire, in 1787. After three years of practice and recognizing his lack of suitable education, he entered Harvard Medical School for a course of lectures. He graduated with an M. B. (Bachelor of Medicine) from Harvard in 1790, the school's fifth graduate since its beginning.¹⁴ He then returned to Cornish, New Hampshire, and practiced as a circuit-riding country physician and surgeon.

¹¹When an amputation was to be performed, the news would spread and the village would gather for the event. Since there were no trained assistants, volunteers from the crowd were called to assist and restrain the patient for the minute or two required for amputation without anesthesia.

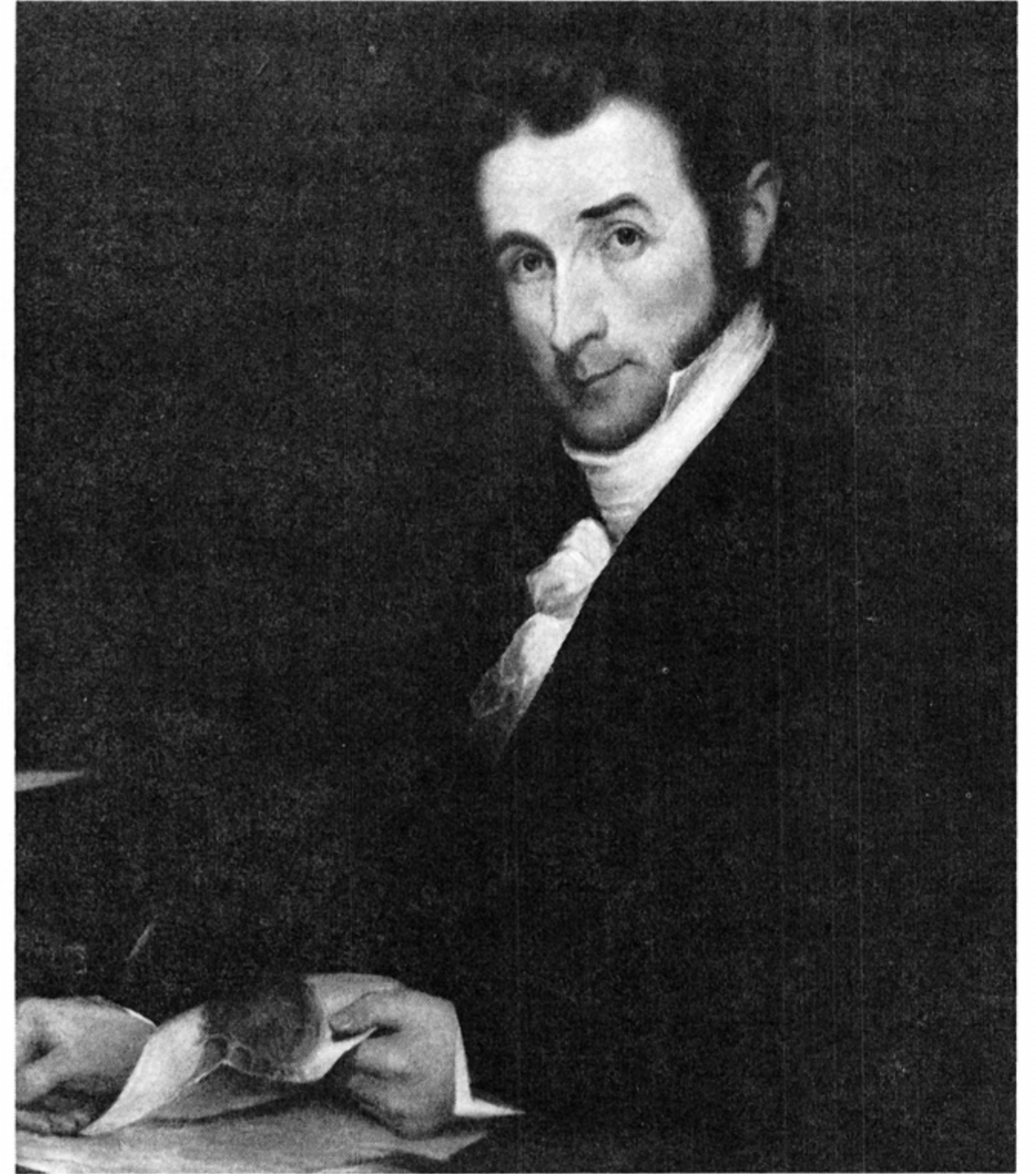
¹²The first medical school was organized as a department of the University of Philadelphia in 1764. A second medical school was begun in New York at Kings College but was disorganized by the British occupation of the city in 1776. Harvard Medical School in Cambridge, Massachusetts, established in 1783, was the third.

¹³Carlton P. Frost, "Medical Education in New Hampshire," *New Hampshire Medical Society Centennial Anniversary 1791-1891* (Concord, New Hampshire: Republican Press Association, 1891), p. 157.

¹⁴T. F. Harrington, "Nathan Smith" in *The Harvard Medical School: A History, Narrative and Documentary: 1782-1906*, ed. J. G. Mumford, 3 vols. (New York:



Professor Nathan Smith, by Samuel Finley Breese Morse,
Gift of the Medical Class of 1828.
(Courtesy of Yale University Art Gallery.)



Cyrus Perkins, M. D. (Courtesy of Dartmouth Medical School.)

Recognizing the poor training of local physicians, and the inability of young men in rural New England to attend medical schools in Cambridge, New York, or Philadelphia, Nathan Smith proposed to the Board of Trustees of Dartmouth College in Hanover that a medical school should be founded and that he should become Dartmouth's fourth professor.¹⁵ The Board of Trustees delayed the decision, and Nathan Smith left for Edinburgh and London where he broadened his clinical experience by working in hospitals where medical experience was concentrated. He became a member of the London Medical Society.

After one year he returned with books and equipment to begin medical lectures in Hanover in 1797. Dartmouth conferred an honorary degree of Master of Arts in 1798. A professorship of Anatomy, Surgery, Chemistry, Materia Medica, and Theory and Practice was created, and Nathan Smith began the unbelievable task of single-handedly teaching all the courses offered by the medical school, which he continued to do for many years. A review of notes taken during these lectures reveal that the courses were not superficially taught; substantial material was presented in all lectures.¹⁶ Thus at age thirty-five with no college degree, with a seven month course of study at Harvard Medical School, and with a year's study in England, he established the country's fourth medical school which has remained organized ever since. With only casual assistance he continued to teach all the courses until 1810 when the New Hampshire State Legislature agreed to appoint Cyrus Perkins, a former student of Dr. Smith's, as Professor of Surgery and Anatomy. Dr. Oliver Wendell Holmes, who later occupied the Chair of Anatomy at Dartmouth, said of Smith's professorial responsibilities that he occupied not simply a "Chair, but a whole settee" of professorships.¹⁷ Nathan Smith received an M. D. from Dartmouth in 1801 and the degree of M. D. from Harvard in 1811. In 1812 he became president of the New Hampshire Medical Society.¹⁸

Lewis Publishing Company, 1905), 1:339. See also "Alumni Roll," *Harvard Medical School*, 3:1449.

¹⁵Nathan Smith to Board of Trustees, Dartmouth College, 23 August 1796, Nathan Smith Correspondence, Dartmouth College Library.

¹⁶J. S. Goodwin, Lecture Notes taken at Dartmouth, delivered at Dartmouth Medical Theater 1812-1813, Dartmouth College Library.

¹⁷As quoted in Hamilton S. Putnam, *New Hampshire Medical Society* (Milford, New Hampshire: Cabinet Press, 1966), p. 70.

¹⁸The New Hampshire Medical Society was founded in 1791 by Josiah Bartlett, then president of New Hampshire. (He was later elected governor.) This was the fourth medical society established in the United States. Josiah Bartlett was also a signer of the Declaration of Independence. (*New Hampshire Medical Society Centennial Anniversary*, pp. 97-104.)

During his Dartmouth years Nathan Smith was extremely busy. He received no salary from the college but depended on tuition from his students and also on his active medical practice for financial support. He had none of the conveniences that we now associate with a modern medical practice: no private office; no hospitals with specified care facilities; no highly trained medical colleagues with whom he could confer. All patients were seen, treated, and operated on in their own homes. To accomplish this, Nathan Smith traveled in a fifty mile radius by horseback with a few instruments and medications packed in saddlebags. A review of his account ledgers reveals that he saw many patients each day. His busy practice, however, also afforded medical students opportunities to gain practical experience as there was no hospital in this rural area. Medical students followed their professor on his rounds throughout the countryside; often an entire entourage of students would accompany Nathan Smith on horseback and assist him in his operations.¹⁹ This arrangement also provided Dr. Smith with reliable surgical assistance. Ezekiel Dodge Cushing wrote to his father in 1809, describing his schedule as one of Nathan Smith's medical students:

. . . I am tired to death and have seen more real service since I have been here than ever I did before. In attending the lectures I find more than sufficient to employ my whole time. I have been employed in the lecture room with five others in performing chemical experiments till three o'clock in the morning two thirds of the time since the lectures have begun. . . . Last Monday afternoon the Dr. was sent for a man that had a burst in which the intestines had broke through the muscles on the belly. . . . Nineteen students with the Dr. at their head set out from Hanover about four o'clock in the afternoon, we stopt twice and arrived at Barre about four o'clock Tuesday morning, the operation was performed about twelve, we started from Barre at one and arrived at Hanover just at three, all the way on horseback, next day we had two lectures, I went to bed early Wednesday night, but all hands were called up at ten to go to see a boy that had broke his leg twelve miles off. I got home about 3 o'clock in the morning. Friday noon all hands were called to go with the Dr. to a boy that had fallen off his horse upon his head. The Dr. thought best to trepan him. . . .²⁰

The trips to care for the critically ill were often longer than fifty miles, and several operations might be done on one trip. In a letter to his sister, Cushing mentioned traveling to operate for osteomyelitis:

¹⁹Hayward, "A Search for the Real Nathan Smith," pp. 272-73.

²⁰Ezekiel Dodge Cushing to his father, 30 October 1809, Oughterson Collection, Yale Medical Library.

. . . I have been a journey of ninety-five miles up Connecticut River in which I saw four operations successfully employed, three of them were the removing a portion of the bones which had perished in the limb, the other which was the most difficult one that I ever saw, was what I mentioned in my letter home. It took Dr. Smith above an hour to perform it. . . . Have likewise been to Walpole to see an important operation. . . . Your loving brother.²¹

There was at least one student who recorded disinterest in traveling with a "concourse" of students, in the long tiring rides, cost of horse rentals, and the weariness produced by such a strenuous schedule.²²

This schedule continued for years and provided Nathan Smith with considerable experience. Because of his work at Dartmouth, he was recognized as an able organizer, medical educator, physician, and surgeon. These talents were attractive to Yale University in New Haven, Connecticut, where a new medical school was planned. He was offered the position of the first Professor of Surgery and Medicine at the newly organized medical school which he accepted in 1813.

He did not leave Hanover immediately, however. One of the serious matters which prevented his leaving was the great typhoid fever epidemic which spread through the Connecticut River Valley. In a letter to Professor Benjamin Silliman of Yale University dated 31 March 1813, he commented,

Dear Sir . . . According to my promise to Dr. Cogswell, I intended to have visited you at New Haven last January, but before I was ready to set off on my journey, we were visited by a very fatal epidemic and instances of sickness and mortality became so frequent that I was afraid to leave my family in such perilous times; and my fears were not groundless . . . four of my children have lately been affected by the prevailing epidemic, but by the Divine Goodness have nearly recovered. I believe this country has never before been visited by sickness which has carried off so great a number of adult persons in so short a time. In some towns of this vicinity which contain perhaps from 1000 to 1500 inhabitants they have buried over fifty persons since the first of last January. The disease has not yet much abated either in its violence or frequency of attack. We hear of new cases every day, and almost every day brings me an account of the death of some friend or acquaintance. How long this dreadful calamity will be suffered to afflict us, no one

²¹Ezekiel Dodge Cushing to Mehetibal Cushing, undated, Oughterson Collection, Yale Medical Library.

²²Hayward, "A Student of Nathan Smith," p. 553.

can tell; but we hope and pray that when the winter is over the disease will disappear. . . . The winter here has been long and severe. . . . Your obedient servant, Nathan Smith.²³

The disease which swept the Connecticut River Valley has been known by several names. It was called typhus fever at the time as the distinction between Old World typhus and what we know as typhoid fever was not well understood. In 1838 the first clear differentiation between the two diseases was made.²⁴ In 1824 Nathan Smith had published a detailed description of typhoid fever; however, he did not distinguish between typhus and typhoid.²⁵ This paper is one of the best early accounts of the disease and stands as a classic of American medical writing.²⁶ His great experience was due to the prevalence of typhoid fever along the Connecticut River Valley.²⁷

This same epidemic of typhoid fever struck the home of Joseph

²³Nathan Smith to Professor Benjamin Silliman, 31 March 1813, as cited in Emily A. Smith, *The Life and Letters of Nathan Smith, M. R., M. D.* (New Haven: Yale University Press, 1914), pp. 85-86.

²⁴Thomas McCrae, "Typhoid Fever," *Modern Medicine: Its Theory and Practice*, ed. William Osler, 4 vols. (Philadelphia: Lea Bros. and Co., 1907), 2:74.

²⁵Smith, *Typhous Fever*.

²⁶Nathan Smith's greatest contribution to the management of typhoid fever was his rational approach to treating a disorder he could not alter. He wrote, "Indeed . . . during the whole course of my practice I have never been satisfied that I have cut short a single case of Typhus, that I knew to be such; nor have I seen a solitary instance of its having terminated within fourteen days from its first attack" (Smith, *Typhous Fever*, p. 45). He taught that one would cause great mischief by using current treatment programs. Benjamin Rush, a great early American medical educator in Philadelphia, taught that vigorous bleeding should be used. Smith wrote, "So far as I can judge from my experience, bleeding does not generally produce any considerable change in this disease" (Ibid., p. 52). He taught, "In fact I feel well convinced that all powerful remedies and measures, adopted in the early stages of Typhous fever are very liable to harm, and those patients who are treated with them in the beginning, do not hold out so well in the latter stages of the disease" (Ibid., p. 48). "It does not follow, because we have no expectation of arresting the disease, that we are to neglect doing anything" (Ibid., p. 46).

His teaching would be influential in New England; at least Lucy Mack Smith did not record that any of her children were bled during their bout with typhoid fever.

²⁷Prior to 1910 typhoid fever was very prevalent in the United States. Estimates varied, but it was thought that 35,000 people died of the disease each year with an estimated 350,000 total number who recovered. Typhoid fever was the great killer of soldiers before World War I—in the Civil War there were 80,000 cases of typhoid fever among the Union troops with a mortality rate of 37%. Typhoid fever is a febrile illness of several weeks duration caused by infection with *Salmonella typhosa*. The infecting bacteria are transferred from the intestinal tract (fecal discharge) of one person to the mouth of another. Great epidemics raged because of contaminated water, milk, and other food supplies. The epidemiology was discovered between 1850-1875. Sanitation efforts were improved, and in 1910 prophylactic vaccination was begun. With a wide-scale vaccination program and improved sanitation, the disease became less common after 1910. (See McCrae, "Typhoid Fever," pp. 71-77). The discovery of the antibiotic chloramphenicol brought about a change in the duration and prognosis of the disease.

Smith. His mother records that all the children in the family suffered the disease.²⁸

Joseph Smith developed typhoid fever and recovered. During the convalescence he developed pain in the arm and shoulder region from an abscess under his arm. This was wrongly diagnosed; but when it became large enough and fairly obvious, a Dr. Parker drained a quart of purulent material from the collection. Shortly thereafter Joseph developed a "fever sore"²⁹ in the left leg. Prior to antibiotics, both soft tissue abscesses and osteomyelitis were not uncommon complications of typhoid fever.³⁰ Joseph developed what we now call an acute hematogenous osteomyelitis or an acute bone infection caused by seeding of bacteria into the bone via the blood stream. To appreciate what Joseph Smith experienced and to understand the unusual contribution to the treatment of osteomyelitis made by Dr. Nathan Smith, it is necessary to explain at least in a general way the changes that occur with acute osteomyelitis in the long bones of the lower leg and to briefly review the history of the treatment of this disorder.

Bacteria reach the interior of the bone through the nutrient artery (principal artery to the bone) and through other vascular channels surrounding the membranous covering of the bone (periosteum). With bacteria in the shaft of the bone and under the periosteum a process of abscess formation and suppuration (breakdown of tissue with the formation of pus) begins. The purulent material (pus) builds up pressure within the bone and under the periosteum causing severe pain. If contained under the periosteum, the purulent material may break through and enter the soft tissues and finally dissect its way to and through the skin forming a chronically draining sore, if the afflicted person survives the acute stages of the disease.³¹ With the development of suppuration a second process, bone death or necrosis, occurs. As the circulation of the bone is compromised by the buildup of pressure within the bone and for other reasons, death of rather long segments of bone

²⁸Smith, *Biographical Sketches*, pp. 60-61. We are not sure of the exact date as there were typhoid epidemics in 1812 and in 1813. Nathan Smith recorded that he and his partner, Cyrus Perkins, treated fifty cases of typhoid in Hanover in the autumn of 1812. However, the epidemic of 1813 was of a larger scale. (See Nathan Smith, *Typhous Fever*, p. 53.)

²⁹A colloquial term in New England at the time for the local signs and symptoms of osteomyelitis.

³⁰McCrae, "Typhoid Fever," pp. 166-67, 169. See also Wilensky, *Osteomyelitis*, pp. 262-67.

³¹There are no accurate figures for the mortality rate of osteomyelitis in the early 1800s. However, in the preantibiotic era of the 1900s mortality varied from 2-26%. (See Wilensky, *Osteomyelitis*, p. 237.)

occurs. The separation of the dead bone (sequestration) begins when attachments to the living ends are interrupted. In the presence of infection the dead bone (sequestrum) stimulates the formation of new bone (involucrum) which envelopes the dead fragments so that the end result is a segment of dead bone entrapped and enveloped by a cylinder of new bone. A portion of dead bone might penetrate the surrounding new bone and work its way to the surface through the skin causing a chronically draining discharge that may persist for years.

Since Hippocrates and until the nineteenth and twentieth centuries the treatment of osteomyelitis consisted of applying poultices and other preparations to the diseased part to reduce inflammation.³² When a fragment of bone presented itself through the skin it was merely plucked out.³³ Sir Benjamin Brodie, of London, whose work was published in 1832, is usually given credit for the first drilling of long bones of the leg to drain a bone abscess;³⁴ however, William Heys, of Leeds, England, published an account of his experience which began in 1786 with the direct surgery for osteomyelitis in three patients and was able to save the extremity in each case.³⁵ This involved drilling, sawing, and removing bony fragments that were infected and dead. These attempts, however, were unknown in general and specifically unknown to Dr. Nathan Smith, who began independently and aggressively to operate for osteomyelitis in 1798 and perhaps had greater experience than the two English surgeons as this disorder was so common in early New England.

³²A poultice was a hot, moist mass of linseed, bread, mustard or soap, and oil between two pieces of muslin applied to the skin to relieve pain and inflammation. Poultices were of all sorts.

³³Hippocrates also taught that free-lying bony particles could simply be removed, a concept that continued to be taught through the Middle Ages and up to the eighteenth century. See Edgar M. Bick, "Orthopedic Surgery before the 19th Century, The Middle Ages," in *Source Book of Orthopaedics* (New York: Hafner, 1968), p. 33. The simple removal of loose bone presenting at the skin surface is to be distinguished from the operative exposure of bone, drilling, and removing any dead fragments, a technique which was to come later.

³⁴Benjamin C. Brodie, "An Account of some Cases of Chronic Abscess of the Tibia," *Medico Chirurgical Transactions* 17 (1832):239-49.

³⁵William Heys, "Abscess in the Tibia with Caries," in *Practical Observations in Surgery* (Philadelphia: James Humphreys, 1805), pp. 22-25. His instructions to his first patient in 1786 should be mentioned. "Nothing more remained to be done, which could afford a rational hope of curing this disease except amputation of the limb, or a bold attempt to explore fully the extent of the internal caries, and to remove the diseased part of the bone. I explained the case fully to my patient who submitted entirely to my judgment. . . . I was satisfied that she would not reproach me on account of my ineffectual endeavors to preserve her limb, if my attempt to remove the diseased part of the bone should prove unsuccessful" (Ibid., pp. 23-24). This same rationale would be used in Joseph Smith's case.

Smith's work is classic in the history of treatment of osteomyelitis as he was generations ahead of his time. Amputation continued to be the general method of late treatment until 1874 when principles described clearly by Smith in 1827 were independently rediscovered and applied.³⁶ However, it was not until after the First World War that the treatment became standardized throughout the modern medical world.³⁷ Prior to antibiotics, the overall prognosis even in the twentieth century was poor.³⁸

Nathan Smith's clear understanding of the pathology of osteomyelitis and the principles of treatment are illustrated in lecture notes taken verbatim by a student, J. S. Goodwin, at Dartmouth in 1812.

Necrosis [i.e., osteomyelitis] - This is a disease of considerable importance but surgical writers have said little about it. Bell in his treatise on ulcers says a little, but it amounts to nothing. When matter is found within the bone, it should be punctured with a trephine³⁹ a little below the center so that the matter may be discharged. Sometimes it is punctured with a common perforating instrument with a point. When this is used, there should be a number of holes made, that it may discharge freely. . . . Nature begins to form new bone, which generally surrounds the decaying part, the dead bone is sometimes thrown out by the surgeon keeping the wound open. . . . The new formed bone is much larger than the original and confined both ends of the dead part within its walls. In this case, the dead bone should be cut with a trephine or Heys saw in the middle and extracted with a pair of common forceps. Sometimes the new bone may be cut with either of these instruments or a pair of strong cutting forceps. There is scarcely any case where the affected part may not be removed by the surgeon if he be skillful except in the bones of the hands and the feet. In the thigh or the leg the dead bone may be easily removed. Much perseverance is required in this disease. When the bone of any limb be removed, the limb should be kept in proper situation, that it may not be deformed. Some regard to time in this operation should be observed, for instance in the thigh, the operation should not be performed until new bone is formed in order that the limb may be kept in its proper length - the operation should not be

³⁶Wilensky, *Osteomyelitis*, p. 189.

³⁷Bick, *Source Book of Orthopaedics*, pp. 223-25.

³⁸E. T. Crossan, "Hematogenous Osteomyelitis: Collective Review of the Literature from 1932 to 1937," *Surgery Gynecology and Obstetrics* (International Abstracts) 66 (1938):176. He writes, "The survey of the literature on acute hematogenous osteomyelitis from January 1932 to June 1937, established one fact, and it is the only fact established clearly; namely, the disease has a poor prognosis." The course of acute hematogenous osteomyelitis was to change radically with the discovery and use of systemic antibiotics.

³⁹A trephine is a small cylindrical saw used to cut a circular piece of bone, usually from the skull.

deferred until the bone rots away, for in this case, the patient generally becomes a cripple the remainder of his day. By operating in the right time, a small piece being taken out it generally saves the loss of a large portion.⁴⁰

Smith gave more detailed advice in his published paper:

Respecting the operation, the cases which occur are so peculiar, and require such different methods, that nothing more than general directions can be given. - The object, however, in every case is the same; that is to remove a piece of dead bone, which has become a foreign body as it relates to the living.

The instruments which may be wanted in this operation are a probe, knife, round saw, and one or more of Heys saws, several pair of strong forceps and a pair of cutting forceps. . . . When we undertake this operation, we should be provided with all the instruments named, as we cannot always foresee at the commencement of the operation, what instruments we shall need before it is finished.⁴¹

Nathan Smith comments on his success:

When I first began to perform operations of this kind, I was under the apprehension lest so much bruising and handling of the soft parts, as is sometimes necessary, to dislodge a large sequestra unfavorably situated, might be followed with bad consequences, and some of these operations have been most laborious and tedious to myself and the patient, which I have ever performed, yet I have never known any untoward circumstances to follow such operations, of which I have performed a great many.⁴²

That he was successful was also further attested by his insistence that amputation was unnecessary. In every notebook of class lectures reviewed, Nathan Smith taught that amputation was to be avoided. A student recorded:

. . . In the beginning I mentioned Necrosis [i.e., osteomyelitis] as a disease which frequently was the cause of amputation; true it is a lamentable fact. This is the cause of many limbs being taken off. When in all cases there is hardly need of a single operation of this kind, when the surgeon understands the use of medicine. When a piece of bone is dead or matter is within the bone, I have described what is to be done in a previous lecture.⁴³

In another set of notes, further condemnation of amputation for osteomyelitis is stressed.

⁴⁰Goodwin, Lecture Notes, p. 58.

⁴¹Smith, "Treatment of Necrosis," *Medical and Surgical Memoirs*, pp. 118-19.

⁴²Ibid., pp. 120-21.

⁴³Goodwin, Lecture Notes, p. 71.

It is not an uncommon thing for some surgeons to amputate for necrosis (or fever sore). When this is absolutely necessary, it acknowledges ignorance or bad practice in the former treatment as they can most always be cured by the modern mode of practice.⁴⁴

In his published work Nathan Smith described the various stages of osteomyelitis and gave clear instructions in how to handle each combination of difficulties.⁴⁵ He wrote with the authority of one having had significant experience. We do not know what his amputation rate was, but it must have been low. Subsequent amputation for failure is not mentioned in his lectures or his published writings. From letters of medical students we know that Nathan Smith was invited to amputate seriously affected legs; but when other methods could be employed, amputation was unnecessary. In a letter to his father a medical student at Dartmouth College wrote, "I went to Concord with Doct. Smith and upward of twenty of his students to see a limb taken off but when he got there he concluded that he could cure it without taking off the limb. . . ."⁴⁶

Little is said of the aftercare of the wound. He recommended that one treat it as a simple wound with dressings, making certain that the skin edges did not heal until the wound healed from below.⁴⁷ On occasion he prescribed an irrigant solution if the drainage were foul. Apparently there were few problems with an open wound containing exposed bone, which was certainly not the case for future generation of surgeons.⁴⁸ That he was able to carry out the procedure and the postoperative care without antiseptic operative techniques and without broad spectrum antibiotic coverage is truly a marvel.

Such was the care that Joseph Smith received. He developed

⁴⁴Notes taken from Dr. Smith's lectures, 1815, author unknown, p. 59, Dartmouth College Library.

⁴⁵Smith, "Treatment of Necrosis," *Medical and Surgical Memoirs*, pp. 112-15.

⁴⁶Alexander Boyd to William Boyd, 26 November 1810, Dartmouth College Library.

⁴⁷Smith, "Treatment of Necrosis," *Medical and Surgical Memoirs*, p. 120.

⁴⁸When surgeons after 1870 discovered again the fact that necrotic bone should be removed surgically, there were considerable differences of opinion as to how the wound should be treated, and a great volume of literature concerning this was produced up to the 1930s. Wounds were: kept open; closed under plaster casts; irrigated with chemicals; scraped in the depths of the wound and bone cavities; not scraped. In the period between 1920-1930 there was even a great fad for purposefully placing maggots in the wound as maggots were found to generally keep such wounds clean. See Bick, *Source Book of Orthopaedics*, pp. 226-27. Techniques to cover open wounds with skin grafting were developed, and the techniques of wound closure were finally standardized after World War II. That Nathan Smith's patients were kept at home and not in hospitals, where cross contamination of the wounds might occur, as well as the fact that few persons dressed the wounds, undoubtedly contributed to the successful result.

osteomyelitis following the drainage of an abscess during his recuperation from typhoid fever. His mother's account states that his leg began to swell and caused great pain for two weeks or more; finally, after a good three weeks, a surgeon was called.⁴⁹ The surgeon incised the left leg from knee to ankle through the soft tissues.⁵⁰ Joseph experienced great pain during these several weeks as the wound healed and underlying pressure from undrained purulent material increased. The surgeon was again called and a second incision was made, this time down to bone, perhaps through the periosteum.

Nathan Smith taught that perhaps in the very early stages such an incision as Joseph received might be enough; but Nathan Smith made it clear that by the time he was usually called, there was always suppuration so that he never had the opportunity to test this idea in his practice.⁵¹ He explained, however, that it was possible to treat this condition early without loss of bone:

The second stage of this disease, when matter is formed between the periosteum and the bone, still admits cure without any loss of bone. If in this stage of the disease, an incision is made through the soft parts, and the periosteum be divided as far as it is separated from the bone, and a portion of the bone be cut out with a saw or several perforations be made in the bone which has been denuded, down to medullary substance, so as to allow the matter collected between that substance and the walls of the bone to escape, the necrosis or death of bone will be prevented. By this mode of treatment I have succeeded perfectly in arresting the further progress of the disease in the bone, and the patient has recovered without loss of any portion of it.⁵²

During the second attempt on Joseph's leg, an incision was made down to bone; but the bone was not removed or perforated to allow the egress of pus, and bone death occurred. Obviously Nathan Smith did not perform either of these procedures. As Joseph became worse and was wracked with pain, a surgical consultation was obtained ("Council of surgeons"). Dr Stone was mentioned by Joseph's mother as being the principal surgeon up to this point.⁵³

⁴⁹Smith, *Biographical Sketches*, pp. 62-63.

⁵⁰This would have been directly over the tibia, common site for osteomyelitis.

⁵¹Smith, "Treatment of Necrosis," *Medical and Surgical Memoirs*, pp. 111-12. Nathan Smith lamented that he was never called early: "Persons often prefer their family physician although ignorant of surgery and therefore a surgeon is not usually called till the bone is dead and there is foreign matter in the place of it" (Samuel Farnsworth, Lecture Notes, 20 October 1812, Dartmouth College Library).

⁵²Smith, "Treatment of Necrosis," *Medical and Surgical Memoirs*, pp. 113-14.

⁵³Smith, *Biographical Sketches*, p. 64.

Although Stone is not further identified, it is probable that he had studied under Nathan Smith at Dartmouth as the two procedures performed suggest familiarity with Smith's teachings although they were timidly and inadequately applied.

It is likely that Stone contacted Dr. Smith and explained that his treatment was getting nowhere, the disease was advanced, and that an amputation would be necessary. Amputations were not numerous, and this might be a good opportunity to teach young doctors. Nathan Smith excelled in his techniques of amputation and practiced modern concepts also in this area;⁵⁴ however, he was prepared to deal with whatever situation he found in Joseph Smith's home.

Thus Nathan Smith, professor and founder of Dartmouth Medical School, graduate of Harvard Medical School, president of the New Hampshire Medical Society, newly appointed professor at Yale, and the busiest physician with perhaps the largest practice in New England, saddled up with his partner, Cyrus Perkins, and their cavalry of medical students and rode the five miles from Hanover to Lebanon and the humble Smith residence. Joseph's mother later recalled their conversation as follows:

"Gentlemen, what can you do to save my boy's leg?" They answered, "We can do nothing; we have cut it open to the bone and find it so affected that we consider his leg incurable, and that amputation is absolutely necessary in order to save his life."⁵⁵

Exact conversations are poorly remembered thirty years later, but there is little question that an amputation was suggested as the situation may have indeed seemed hopeless. This may have been stressed, however, to obtain permission or informed consent to carry out an alternate procedure for which there was no known precedent in medical teaching at that time. In this sense they obtained permission to carry out an experimental operation.⁵⁶ Joseph Smith recalled,

⁵⁴Cleveland and Hayward, "Nathan Smith on Amputations," pp. 1246-54.

⁵⁵Smith, *Biographical Sketches*, p. 63.

⁵⁶Medical litigation was not as common in 1813 as it is now; however, it did exist, as Nathan Smith was called to testify in defense of other physicians. See Hayward, "A Search for the Real Nathan Smith," pp. 274-75. From reading Joseph's mother's account one might think that she originated the operation as she remembers, "Can you not by cutting around the bone, take out the diseased part . . . and by this means you will save his leg?" (See Smith, *Biographical Sketches*, p. 64.) She was certainly aware that this operation was being done as it was common enough along the Connecticut River Valley, and she may have known of good results. It is of course better to have the patient or family suggest the "experimental" procedure rather than the surgeon insist on its being done.

But young as I was, I entirely refused to give my assent to the operation [i.e., amputation] but consented to their trying an experiment by removing a large portion of the bone from my left leg, which they did. . . .⁵⁷

There were no anesthetics for the procedure; the operation was carried out on an awake young man restrained by his father.⁵⁸ Joseph's mother provided a vivid description of the operation:

The Surgeons commenced operating by boring into the bone of his leg, first on the one side of the bone where it was affected, then on the other side, after which they broke it off with a pair of forceps or pincers. They thus took away large pieces of the bone. . . . Joseph immediately commenced getting better, and from this onward, continued to mend until he became strong and healthy.⁵⁹

We do not know who performed the surgery; perhaps Nathan Smith guided the hands of Dr. Stone, but more likely he did the operation himself, as the operation was as aggressive in degree as the two previous attempts had been timid. The procedure as described by the mother and son did, however, follow the teachings and principles laid down by Nathan Smith, and indeed it was successful.

How do we know that Smith and Perkins mentioned by Joseph were the Nathan Smith and Cyrus Perkins of Dartmouth Medical School? There were no journals or patient files; there were no operative notes, operative logs, or daily listings of operations or other services. What was recorded was the service and the professional fee rendered. If no fee was rendered, there would not have been a record of the service.⁶⁰ Careful search of the Smith and Perkins day-

⁵⁷Smith, "Manuscript History of the Church," A-1, p. 131.

⁵⁸The sawing of bone and the drilling of bone was not painful in itself; however the dislodgement of the fragments with ends attached to living tissue produced acute pain. William Heys commented on this pain in his first patient: "The pain was so great during this operation of nature [i.e., development of osteomyelitis] that my patient assured me, . . . that she had suffered more pain during the whole of the six weeks . . . than I had caused during the operation necessary for removing the unsound bone" (see William Heys, "Abscess in the Tibia with Caries," p. 25).

⁵⁹Smith, *Biographical Sketches*, p. 65. Lucy Smith did not view the procedure as she was repeatedly excused from the room; however, the details she records are highly accurate. Perhaps the description of the procedure presented by the surgeon or perhaps communicated by Joseph's father, who restrained the boy during the operation, was detailed enough to be branded into her memory.

⁶⁰The letter of Ezekiel Dodge Cushing to his father dated 30 October 1809, mentioned three medical events: an operation for hernia in Barre, Vermont; treatment of a broken leg in a young boy; and an operation for trepanning in another young boy. Smith's ledger of 1809 contains a fee for two of the three operations: a fee for \$25 for the hernia to a Mr. Parker of Barre, Vermont (23 October 1809); and a fee of \$20 to Samuel Brown for trepanning his boy (27 October 1809). There was no fee for the treatment of the broken leg and hence no mention of it in his ledger. (See account ledger of Nathan Smith 1809, p. 185, Dartmouth College Library.) Nathan Smith's fee for surgery for osteomyelitis was \$11.

books and ledgers from 1811 through 1814 did not reveal a fee for the service recorded by Joseph Smith and hence no listing of the service.⁶¹

The identification by Joseph Smith of a Dr. Smith and a Dr. Perkins, in addition to the reporting of other doctors from Dartmouth Medical School, leaves little doubt as to the identity of the physicians involved. In addition, there was not another surgeon in New England who traveled with a concourse of medical students. Finally, the operation described by both Joseph and his mother is as good as a signature to an operative note, as this was an operation developed and perfected by Nathan Smith.

Joseph Smith's wounds gradually healed, and his ordeal came to an end following proper treatment. Joseph, however, continued to walk on crutches for three years and walked with a limp during his adult life. When sickness finally left the Smith home, Joseph Smith's family moved to Norwich, Vermont.

In the fall of 1813 following the typhoid epidemic, Nathan Smith moved to New Haven, Connecticut, and accepted his appointment as Professor of Medicine, Surgery and Obstetrics at the Yale Medical School. He continued, however, to give lectures at Dartmouth until 1816. In 1817 he moved his family to New Haven, Connecticut, where a tenth child was born. In 1821 a medical school at Bowdoin College in Maine was opened with Nathan Smith consulting in the development of the school and giving the bulk of the medical lectures. His son, Nathan Ryno Smith, had in the meanwhile become a physician and was appointed Professor of Surgery and Anatomy at the new medical department of the University of Vermont in Burlington. Nathan Smith also gave lectures in this school. He continued an active career as a surgeon, lecturer, and writer until his death in 1828 in New Haven.

Much more could be said about his life. He was an expert in many areas of surgery and medicine, a master surgeon; there were few his equal in early America; his influence was felt throughout New England.

⁶¹There were listings, however, of services to a Mr. Smith, father of Joseph Smith. In the daybook of Smith and Perkins 1812-1813, p. 184, there begins on 2 April 1813 a listing of fees to a "Mr. Smith, father of Joseph Smith, of this town." This would refer to a Joseph Smith of Hanover and not Lebanon. The daybook, November 1812 through May 1815, lists nine visits to a Joseph Smith beginning in April of 1813. Joseph Smith was certainly a common name in New England; the 1810 census of Hanover, Grafton County, New Hampshire, lists two Joseph Smiths. It is probable that the Joseph Smith mentioned in the Smith and Perkins daybooks was not the same Joseph Smith of Lebanon, New Hampshire.

William Henry Welch, in commenting on Nathan Smith's role at Yale Medical School, wrote the following:

Dr. Nathan Smith, when he came to New Haven from Dartmouth, was already a star of the first magnitude in the medical firmament. . . . Nathan Smith shed undying glory upon the Yale Medical School. Famous in his day and generation, he is still more famous today, for he was far ahead of his times, and his reputation, unlike that of so many medical worthies in the past, has steadily increased as the medical profession has slowly caught up with him. We now see that he did more for the general advancement of medical and surgical practice than any of his predecessors or contemporaries in this country. He was a man of high intellectual and moral qualities, of great originality and untiring energy, an accurate and keen observer, unfettered by traditions and theory; fearless and above all, blessed with an uncommon fund of plain common sense.⁶²

For members of The Church of Jesus Christ of Latter-day Saints it is important to realize that Joseph Smith received treatment that was generations ahead of current practice and was attended to, on at least one occasion, by the most highly trained and experienced physician in northern New England who was also the only physician in the United States who aggressively and successfully operated for osteomyelitis and thereby prevented amputation. Thus Joseph received the best of care that was available for many years to come from a giant of a man who lived, taught, and practiced in Hanover, New Hampshire, only a few miles from Joseph Smith's home.

⁶²William Henry Welch, "The Relation of Yale to Medicine," address at the Two Hundredth Anniversary of the founding of Yale, 21 October 1901, cited in Harrington, *The Harvard Medical School*, 1:349.