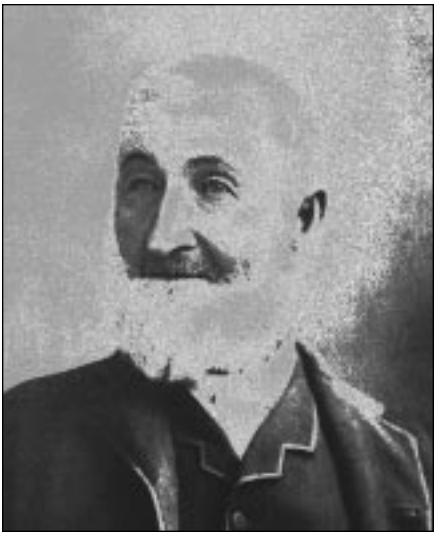
chapter 1

Childhood and Education

The world might never have heard of Thomas Alva Edison if his family had not been forced to leave their home in the small village of Vienna in Upper Canada (what is today the province of Ontario). The young Edison would have found a more sedate economic and industrial environment in Canada than he did in the United States, one that did not emphasize invention and innovation. "The problem of Canadian invention and technology," wrote one scholar after surveying its history, "lies not in the area of individual creativity, but in the much simpler areas of public education and means of capital formation . . . individually and in groups we resist innovation, and our institutions for the production of risk capital do not work."[1] Whatever innate abilities might have contributed to his success, even Thomas Edison could not have flourished in an environment that did not provide the intellectual and economic resources necessary for invention.

The Edison family left Canada for the United States primarily for political reasons. They had been among the early settlers in western Upper Canada when they arrived there in 1811 from Nova Scotia, where they had originally fled with other loyalist families after the American Revolution. The Edisons were drawn to Upper Canada by the mild climate and fertile land they found in the area around the northern shore of Lake Erie known as the Talbot Settlement. The provincial government encouraged settlement in this section through Colonel Thomas Talbot, who received an additional 200 acres of land for each 50 acres of his original 5,000-acre land grant that was settled by others. The Edison family, consisting of John, his wife Sarah, and their seven children with their spouses and children, were settled by Talbot in Bayham township, one of twenty-seven under his control, where they helped establish the village of Vienna. The family primarily engaged in farming and lumbering, which were the principal enterprises of the region.[2]

Edison's mother and father, Nancy and Samuel Edison.

The western section of the province also contained a large number of American settlers who were attracted by its land prices, cheap in comparison with those in the United States. Bayham was one of the many townships in the region that remained predominantly American throughout the 1830s. Although Americans in the province remained loyal to the Crown during the War of 1812, they did not have the same attachment to the empire as did the British settlers who arrived later. Indeed, as provincial politics splintered into conservative and reform factions in the 1830s, support for conservatives in the region was strongest among recent British immigrants who found the views and actions of many of those already in the province too egalitarian. Growing up in Bayham, Samuel Edison Jr. was infected by this egalitarian impulse, which was reinforced by his marriage to the American-born Nancy Elliott. Her family was among those from the United States attracted by cheap land prices and perhaps by a sense of religious ministry—her father was a Baptist minister from upstate New York. The Edisons were also nominally Baptist. Samuel's parents were both baptized into the Baptist Church when he was fifteen, although they were later excluded from the congregation for nonattendance and for refusing to obey church doctrine. Religious issues played an important role in the political life of the province where the Church of England received special privileges, including a large portion of land set aside as the Clergy Reserve.

An innkeeper by trade, Samuel doubtless participated in political debates, and his own reading included the works of Thomas Paine. Thomas Edison

later said of his father that he "has always been a rebel, a regular red-hot copperhead Democrat, and General Jackson was his hero."[3] Andrew Jackson's reputation as a strong but populist and egalitarian leader who attacked entrenched privilege would have presented a striking contrast to the province's political leaders and perhaps served as a model for the young supporter of constitutional reform.

Political conflict arose in the province as the government became dominated by a small group known as the Family Compact. They acted to preserve their own privilege and to recreate an elite British society by maintaining the power of the appointed executive branch in opposition to the elective assembly; by giving the Church of England its privileged position; and, according to the reformers, by promoting such projects as the Welland Canal and the Bank of Upper Canada at the expense of local improvements such as schools and roads. American egalitarian ideology became the basis for political opposition as a reform-conservative split emerged in the province. By the 1830s the reformers were an identifiable group who demanded constitutional reform to extend political participation. According to a leading scholar, they tended "to equate democracy and prosperity" and often contrasted the "lack of popular participation in state affairs and the economic backwardness of Upper Canada with the 'popular sovereignty' and prosperity" of the United States.[4] Reformers also drew on the example of British radicalism with its political unions and calls for constitutional reform.

When the provincial governor disbanded the assembly in 1836 and helped conservatives gain an overwhelming victory in new elections, many in the reform movement were radicalized. Led by the fiery newspaper editor William Lyon MacKenzie, who began to agitate for a new political union with reformers in Lower Canada (present-day Quebec province), they began to organize meetings throughout the province. Economic hardships created by a poor harvest and the tightening of credit caused by a commercial depression throughout the Anglo-American world further exacerbated this volatile political environment. By the fall of 1837 armed meetings had taken place and MacKenzie was moving increasingly toward rebellion, although his activities were largely confined to the provincial capital of Toronto. News of rebellion in Lower Canada led to an ill-planned insurrection by MacKenzie during the first week of December. Although MacKenzie's troops were easily dispatched by provincial forces, early news of the insurrection seemed to indicate success, and radicals in the western part of the province led by Charles Duncombe quickly gathered to join the rebellion after hearing rumors that he and other leaders would be arrested by local officials. By December 12, news of MacKenzie's defeat finally reached the west and Duncombe's revolt dissipated as he advised his followers to return to their homes while he and rebel leaders fled to the United States. Among the rebel leaders who joined Duncombe in flight across the border to Detroit was Samuel Edison Jr. Not much is known about Samuel in the period immediately after the rebellion. He may have joined Duncombe in his

attempts to organize an invasion from Detroit and perhaps in a failed attack in late February 1838 on Fighting Island in the Detroit River.

Among those who stayed behind was Samuel's brother Marcellus, who was imprisoned briefly before being released on bail on December 21. Although some of those most closely associated with the rebel leaders were treated harshly and a few executed (particularly after a series of failed invasions led by the exiled rebels), the authorities were generally lenient toward the majority of those arrested. In the London district, which included Bayham, no action was taken against most of the followers, including Marcellus Edison. Samuel, on the other hand, was indicted for high treason and his estate seized. Unable to return to Canada, Samuel spent some time in Detroit and Peru, Ohio, before settling between 1838 and 1839 in Milan, Ohio, where he was finally joined by his family.[5]

What attracted the Edison family and many others to Milan were the economic opportunities expected to follow the opening of the Milan Canal on July 4, 1839. The 3-mile canal between Milan and the navigable portion of the Huron River gave the "dull inland village" (population 600–700) an outlet on Lake Erie, and, according to the local newspaper, it soon became, after Cleveland, "probably the first town in value of its exports, between Buffalo and Detroit."[6] During the 1840s Milan was one of the leading grain-shipping ports in the world. It also became an important shipbuilding and regional manufacturing center with a population of over 1,500. Along with the growing city, during these years the Edison family prospered. Samuel, who apparently also speculated in land, supported the family as a shinglemaker; his brother Thomas operated a ship that brought shingle bolts from Canada. Although they were not one of the town's leading families, the Edisons were well-off and associated with some of Milan's more prominent citizens. In August 1841 Samuel obtained a plot of land on the bluff overlooking the canal basin on which he built the seven-room brick house in which Thomas Alva Edison was born on February 11, 1847. The last of Samuel and Nancy Edison's seven children, he was the fourth to be born in Milan, but the only one of the four who survived early childhood (the last died in 1847). His three surviving siblings—eighteen-year-old Marion, sixteen-year-old William (known by his middle name Pitt), and fourteen-year-old Harriet Ann (called Tannie)—had all been born in Vienna.[7]

In the year of Thomas's birth, Milan reached its peak as a grain port, shipping over 900,000 bushels of wheat and nearly 138,000 bushels of corn. However, grain shipments soon began a precipitous decline as farmers began to bring their products to Mansfield, which was on the newly opened rail line between Sandusky and Cleveland; wheat shipments from Milan declined by over half in 1848 and fell to under 282,000 bushels in 1849. Milan's economic decline eventually affected the Edison family, who moved to Port Huron, Michigan, in the spring of 1854.

Little is known of Thomas Edison's life in Milan, but from all accounts it was unexceptional and included typical boyhood activities. There is some evi-

dence that young Thomas, usually called Alva or Al while growing up, was a sickly boy. One of his friends from Milan claimed that he had a catarrhal infection that bothered him at times. He also recalled that among Thomas's playmates was Mary Taylor, who lived nearby and "would go to bed with him" when he was not feeling well. Another playmate, who was born the same year as Edison, later wrote him of "things we boath remember of the old cannal whear we went boating and swimming in summer scating and playing [shinny?] in winter and of the hills we coasted down in winter and of the ships they built in Milan."[8] Edison's own recollections included a visit to Vienna to see his grandfather; the covered wagons of a Milan gold rush party that included his uncle Snow Edison, who died soon after his arrival in California in the fall of 1849; the marriage of his sister Marion to Homer Page on December 19, 1849; and the drowning death of his playmate George Lockwood. Other accounts tell of his "fondness for building little plank roads out of the debris of the yards and mills," of his learning "the songs of the lumber gangs and canal men," and of his copying store signs in the village square.[9]

Perhaps because of illness, Thomas did not attend the local public school, although his older siblings did, but his mother no doubt taught him to read and write. As a former schoolteacher she would have been well prepared to do so. There was at that time a general expectation in American society that mothers would teach their children to read before they began attending school.[10]

While Milan was Edison's birthplace and his home for the first seven years of his life, the lumber town of Port Huron was where he grew up and received most of his early education. It is not known why the Edisons came to Port Huron, but the town had a sizeable Canadian-born population and Samuel was likely aware of its booming lumber industry. It was twice the size of Milan and had a population of 3,100. Edison later recalled that "The town in its pristine youth was a great lumber center, and hummed to the industry of numerous sawmills. An incredible quantity of lumber was made there yearly until the forests nearby vanished and the industry with them. The wealth of the community, invested largely in this business and in allied transportation companies, was accumulated rapidly, and as freely spent during those days of prosperity in St. Clair County, bringing with it a high degree of domestic comfort."[11]

Although Samuel Edison's fortunes waxed and waned over the years, the family lived comfortably in a large, two-story house that had been built by the first purveyor to the Fort Gratiot military reservation in a pine grove on the north side of Port Huron. According to a later resident of the house, it had six bedrooms on the second floor (at various times the Edisons had boarders in the house) and downstairs "a wide hall ran from north to south through the house, on either side of which were two large, high ceilinged rooms with wide fireplaces."[12] From the house one could see Lake Huron and the St. Clair River, as well as the abundant woodlands. Sometime after moving into the house Samuel took advantage of its location and built a 100-foot observation tower to

the south and charged twenty-five cents for the view. This apparently became a paying proposition as a tourist attraction for railroad excursions to the lake.

Most Edison biographers describe Samuel as a grain merchant, but a November 1856 credit report indicates that he operated a grocery, was a "fair bus[iness] man," and that the family had "$5000 or $6000, mainly R[eal] E[state]." However, by the following February he was "not largely engaged in business," and a December report noted he had been "indicted for selling R.E. not his own." It went on to say that "his reputation has suffered & rumor has his [property] in his wifes name," and concluded "should not like to trust largely." By February 1858 he was out of business, having "totally failed."[13] Samuel's grocery business may well have been affected by the Panic of 1857. During these years he also engaged for a time in the lumber business. To make ends meet the family took in boarders and Edison remembered helping his father with a truck garden: "After my father moved to Port Huron, he engaged in lumbering and also had a 10 acre field of very rich land which was used for truck gardening. After the field was ploughed I, in conjunction with a German boy of about my age, did the planting. About eight acres were planted in sweet corn, the balance in radishes, onions, parsnips, and beets, etc.; I was very ambitious about this garden and worked very hard. My father had an old horse and wagon and with this we carried the vegetables to the town which was $1\frac{1}{2}$ miles distant and sold them from door to door. One year I remember turning in to my mother 600 dollars from the farm."[14]

Whatever economic difficulties the Edison family experienced was probably ameliorated by assistance from the eldest son William Pitt, who operated what the local newspaper described as "one of the most commodious and spacious livery stables in the State. . . . The building is 60 feet wide and 100 feet long, with a carriage repository 25 feet wide, and extending the entire length of the building, on the north side. The main building is two stories high, and is finished externally in such good style as to render it a pleasing feature in the appearance of that prominent part of the village. The internal arrangements are on a liberal scale, and complete in every particular. Mr. Edison keeps sixteen horses, with vehicles to match, and we are glad to know that he is doing a good business."[15] Pitt's successful experience in the livery business later led to his involvement with the city's first horse-railway streetcar line.

Financial difficulties afflicting the Edison family may have affected Thomas's schooling. Standard accounts of his school career indicate that he was taken out of school by his mother because a teacher considered him to be "addled." Whether or not this story has any truth behind it, there is evidence that economic difficulties played a role in his limited school attendance. Thomas was known to have briefly attended both the private school of Reverend George Engle and the Port Huron Union School, although the exact dates of his attendance are unknown. In 1885 Reverend Engle wrote Edison to ask for financial assistance, reminding him that when he attended the school, "Your father, not being very flush with money, I did not urge him to pay the school bill."[16] In

1855 the annual tuition for Engle's school was $130, which included board, fuel, lights, and English instruction. An 1854 fee schedule indicates that an eleven-week term cost about $30. Additional annual charges included $12 per year for instruction in Latin and French and $40 for music instruction by a Miss D. Edson, from whom Thomas took music lessons while at the school (the Edisons had a piano at home).

Most biographers assume that Thomas attended Engle's school shortly after the family moved to Port Huron and that his attendance at the Port Huron Union School occurred soon after. However, the reminiscences of those who knew him as a boy in Port Huron indicate that he was twelve or thirteen when he attended the public school. P. L. Hubbard, who apparently was Thomas's teacher at the school, and N. W. King, a playmate, both recalled that he attended in 1860. Ambrose Robinson, who boarded at the Edison home in 1858–1859, remembered Thomas going to school during construction of the Grand Trunk railway line to Fort Gratiot.[17] The cost of attending the public school may well have delayed his enrollment. Although supported in part by taxes, Michigan schools also required parents to pay an additional rate bill based on the number of days a student attended, which included fuel costs and assessor's fees. While this probably did not amount to more than $5 to $10 per year, economic difficulties between 1857 and 1858 may have caused Samuel and Nancy to decide that she should teach him at home. Tannie's marriage to Samuel Bailey in June 1855 meant that none of the other Edison children were living at home and would have allowed Nancy to devote her full attention to her young son.

Thomas's attendance at the Union School in 1859–1860 may, in fact, have been a result of his growing interest in science, a subject in which Nancy could have given him little guidance. The school was noted for its teaching of mathematics, science, and drawing. Edison later stated that he first learned physical science from Richard Parker's *A School Compendium of Natural and Experimental Philosophy*, the principal science textbook used at the Union School.[18]

Whatever limited experience he had in Port Huron schools, Edison's mother was clearly his most important teacher. He later recalled, "My mother taught me how to read good books quickly and correctly, and as this opened up a great world in literature, I have always been very thankful for this early training."[19] The only specific information that we have about Edison's education is found in lists of books he was known to have read around the ages of twelve or thirteen. We can, however, speculate about the sorts of books that he might have read as a young boy. As a former schoolteacher, Nancy probably used standard primers, spellers, and readers in teaching her son to read and write. A religious woman who attended churches in both Milan and Port Huron, Nancy no doubt also taught her son with Bible readings, and Edison later remembered attending Sunday school at his mother's church in Port Huron, where he would have received additional Bible instruction.

Most attention has been focused on a select list of books that Thomas later recalled he and his mother read together. The two most commonly mentioned books are Edward Gibbon's *Decline and Fall of the Roman Empire* and David Hume's *History of England.* Neither of these difficult works would have been typical reading for a mother and her preadolescent son (they supposedly read these before Thomas was twelve), and, surprisingly, no one has thought to ask why Nancy chose these books. The most likely explanation is that these, as well as many other books they read together, were in Samuel Edison's library. Nancy's role in educating her son was the primary parental influence on his intellectual development, but Samuel clearly influenced his son's reading matter. Considered in this light, Samuel's political activities and his participation in the Canadian rebellion take on new significance for his son's intellectual development.

The books that Thomas recalled reading at home were by authors of the Enlightenment and were concerned with politics and religion. Besides Gibbon and Hume, he also recalled reading the works of Thomas Paine: "My father had a set of Tom Paine's books on the shelf at home. I must have opened the covers about the time I was 13. And I can still remember the flash of enlightenment which shone from his pages. It was a revelation, indeed, to encounter his views on political and religious matters, so different from the views of many people around us. Of course I did not understand him very well, but his sincerity and ardor made an impression upon me that nothing has ever served to lessen."[20] All three of these writers tended toward skepticism and anticlericalism and argued that natural law rather than authority or religious revelation was the primary source of true knowledge. Their works had been widely read and influential during the American Revolution and continued to have some popularity in the early republic and among radical reformers in Britain and Canada.

Paine's *Age of Reason* especially influenced both Samuel Edison and his son. Samuel was an advocate of religious free thought, which drew heavily on Paine's scientific deism and his critique of organized religion. Whether through discussions with his father or through his reading of Paine and other anticlerical works, Thomas, too, became imbued with freethinking and had little interest in his mother's more traditional religious beliefs. He would later write that "my mother forced me to attend [her church]—my father gave me Paine's Age of Reason."[21] As an adult he would become an admirer of Robert Ingersoll, the leading American freethinker of the late nineteenth century, of whom he wrote, "Some day when the veil of superstition is lifted Ingersoll will stand out as a great personality."[22] He also maintained a lifelong esteem for Paine, writing an introduction to his collected works in 1925. Edison wrote of Paine that he

> suffered then, as now he suffers not so much because of what he wrote as from the misinterpretation of others. He has been called an atheist, but atheist he was not. Paine believed in a supreme intelligence, as representing the idea which other men often express by the name of deity.

> His Bible was the open face of nature, the broad skies, the green hills. He disbelieved the ancient myths and miracles taught by established creeds. But the attacks on those creeds—or on persons devoted to them—have served to darken his memory.[23]

When Edison wrote those words in 1925 he could have been describing his own experience following an interview that appeared in the October 2, 1910, edition of the *New York Times Magazine* in which he denied the existence and immortality of the human soul. He explained his views by stating that "Nature is what we know. We do not know the gods of religions. And nature is not kind, or merciful, or loving. If God made me—the fabled God of the three qualities of which I spoke: mercy, kindness, love—He also made the fish I catch and eat. And where do His mercy, kindness, and love for that fish come in? No; nature made us—nature did it all—not the gods of the religions." These ideas struck many readers as atheistic, and ministers and others spoke out against him. Edison refused to be drawn into a public controversy, but defended himself privately in words that echoed his later defense of Paine: "You have misunderstood the whole article, because you jumped to the conclusion that it denies the existence of God. There is no such denial, what you call God I call Nature, the Supreme intelligence that rules matter. All the article states is that it is doubtful in my opinion if our intelligence or soul or whatever one may call it lives hereafter as an entity or disperses back again from whence it came . . . scattered amongst the cells of which we are made."[24]

As a freethinker Edison followed Paine and Ingersoll in expressing skepticism toward traditional religion and in urging that clerical authority and biblical myths be replaced by the truths of nature uncovered through scientific investigation. He argued that "Scientific men as a rule do not believe in the immortality of the soul because the more they investigate the works of nature the more firmly they reach that conclusion." At the same time for those who believed "the religion of the Bible they better not try to shake the belief as it is certainly more consoling. However if we all carry out the golden rule in this life we have little to fear from the hereafter no matter what our belief may be."[25] Edison's support for the Golden Rule followed from what a historian of American freethinking described as the belief that "Whatever truth Christianity did contain . . . had existed in the book of nature long before the coming of Christ. Therefore, the morals of Christianity were good . . . because of their harmony with nature."[26] Although attacked by religious believers for his freethinking ideas, Edison remained optimistic that the "old order of things are rapidly passing. The schoolhouse, the newspaper, and the advancement of scientific investigation, will in not many years make these beliefs seem ridiculous."[27] Nonetheless, his attachment to the Golden Rule and his own conventional moral values, as well as his adherence to the Protestant work ethic, suggest the continuing importance of his mother's moral teachings.

Just as his later religious views followed from ideas learned through his father, Edison's ideas regarding another subject that concerned him throughout his life were also influenced by Samuel. Toward the end of his life Edison

wrote of his views on diet and health that "my family for three generations, have followed the teachings of Cornaro. His principles were taught me from childhood, and I have always followed them."[28] Although unknown today, Luigi Cornaro's *The Temperate Life* was reprinted in numerous British and American editions during the eighteenth and nineteenth centuries. First published in Italy in 1558, when Cornaro was ninety-four, it described how at the age of forty he rejuvenated himself by adopting an abstemious diet. After successfully regaining his health, he then set out to establish the natural laws of diet and health, which were the main subject of his treatise. Cornaro's basic rules concerning food and drink were to "take only the quantity which my stomach can easily digest and only the kinds that agree with it."[29] Edison recalled that his father and grandfather were so impressed "with the belief that the secret of long life lay in little eating that the idea was dinned into my head from my earliest boyhood. Morning, noon, and night I was told to leave the table while still hungry. I do not remember whether, in the beginning, it was hard to do this, but, in any event, I soon became accustomed to it."[30] Edison, in turn, sought to impress his own children with this idea and eventually convinced his second wife to adopt an abstemious diet.

As he aged Edison conducted irregular dietary experiments, following Cornaro's admonition "that any man may, by dint of experimenting, acquire perfect knowledge of his own constitution and of its most hidden qualities, and find out what food and drink, and what quantities of each, will agree with his stomach," and, like Cornaro, as he got older he reduced the quantity of food in his diet.[31] For many years Edison had "no special diet, I eat every kind of food, but in very small quantities, 4 to 6 oz to a meal." However, during the last decade of his life he developed a rather peculiar diet that usually consisted of a piece of toast, one or two glasses of milk, one tablespoon of cooked oats, one tablespoon of spinach, one sardine, and four Uneeda biscuits, although he varied the sardines "with a lamb chop and also I vary the vegetables."[32] In 1930 he shifted to a milk diet consisting of "about 7 glasses of milk per day divided into 7 meals—each glass 300 cubic centimeters—twice a day I eat ½ of a small orange nothing else. I do not lose weight."[33] With habits formed in boyhood, Edison continued to follow Cornaro's teachings throughout his life, striving always to maintain dietary habits that would keep his weight constant.

While the books in his father's library helped form Edison's ideas regarding religion and diet, perhaps the two most important books he read were Parker's *Natural Philosophy* and an English translation of a textbook authored by the German chemist Carl Fresenius. Richard Parker was a Boston high school principal who wrote a number of textbooks on subjects ranging from grammar to history to science. His *Natural Philosophy* was, as the full title indicated, a compendium that drew on standard scientific works of the day. Whether the young Edison read Parker as part of his course work at the Union School or on his own, he would have received basic instruction in what we would today call physics, which included, according to the title page, "mechanics, hydrostatics,

hydraulics, pneumatics, acoustics, pyronomics, optics, electricity, galvanism, magnetism, electro-magnetism, magneto-electricity, and astronomy" as well as "a description of steam and locomotive engines, and of the electro-magnetic telegraph." The editions from the late 1850s, which Edison most likely read, contained an expanded discussion of telegraphy, including the Morse code, and its frontispiece illustrated the electric telegraph. He also would have learned the basics of electricity and something about batteries. Edison later recalled that when he was twelve years old, about the time he probably read Parker, he built a one-half-mile telegraph line between his house and that of his friend James Clancy.[34]

Whereas Parker had no special training or knowledge in the subject matter of his textbook, Carl Fresenius was a prominent German chemist whose textbooks were standards in the field of analytical chemistry. According to both an early magazine biography and his official biography, Edison obtained a copy of Fresenius's "*Qualitative Analysis.*"[35] This was probably Fresenius's *System of Instruction in Qualitative Chemical Analysis;* but it is possible he had the less detailed *Elementary Instruction in Chemical Analysis,* which included both qualitative and quantitative analysis. Both of these books, as well as the *System of Quantitative Analysis,* were available in editions translated by the English chemist J. Lloyd Bullock.

Just what chemical experiments Thomas undertook is unknown, but Fresenius provided practice exercises and experiments in his books. These were concerned with methods of determining the chemicals found in a particular compound through precipitation and reactions with reagents (qualitative analysis) and in what proportions they were found based on weight measurements (quantitative analysis). Thomas's boyhood friend James Clancy remarked upon "what chances you and I used to take at your old home and how your good Mother used to talk to us and say we would yet blow our heads off."[36] And his former teacher P. L. Hubbard recalled how when Edison and "some other boys were trying some experiments in an old wooden telegraph office and in mixing some acids and other chemicals an explosion took place that wrecked a corner of the building and burned you and some of the other boys."[37]

Edison does seem to have had a large collection of chemicals. An archaeological study at the site of the Edison home turned up a wide variety of glass fragments, supporting evidence for his having an extensive collection of chemicals, although probably not the 200 accorded him in legend. Many of the fragments were from the crucibles, test tubes, beakers, flasks, dishes, funnels, and other equipment he would have needed to carry out Fresenius's experiments. Although it is not known what chemical apparatus Thomas had, Fresenius recommended such items as a spirit burner, blowpipe, mortar, metal spoons and pincers, and a filtration stand. Edison later said that he had apparatus made at the Pullman shops in Detroit while he was working as a newsboy on the Grand Trunk Railway. For a time he was allowed to carry out experiments in the baggage car of the train, until a bottle of phosphorus broke and set

the car on fire. According to his official biography, Edison later "wondered how it was that he did not become an analytical chemist instead of concentrating on electricity, for which he had at first no great inclination."[38] Yet, when his career is seen in retrospect, what stands out is how often his researches involved chemistry, as retired chemist Byron Vanderbilt noted in 1971 when he published a study titled *Thomas Edison, Chemist.*

Books could "show the theory of things," but, as Edison noted in a 1911 *Century Magazine* interview, "doing the thing itself is what counts." In that interview he also claimed that at the age of twelve most boys were "interested in knowing how things are done."[39] This was certainly true of his own experience. The chemical laboratory and the telegraph line did not exhaust his youthful interest in science and technology. Ambrose Robinson remembered that he "used to love to get hold of a mechanical journal to study" and that after school the twelve-year-old Thomas would often make things in his workshop, often "knock[ing] it all to pieces and again mak[ing] it over until it suited [him]."[40] Among the things that he built were "water mills . . . cannon, and many other articles of experiment."[41] He also built a little steam engine railroad in one room of the family home.

Many Americans first experienced machinery on farms and in small village shops. Gristmills, sawmills, drills, clocks, and other machines were prevalent throughout the society. As a youth in Port Huron, Michigan, Edison learned about these machines—as had generations of artisans—through direct observation. The industries of Port Huron provided many opportunities for him to become familiar with the gears, cams, ratchets, escapements, bearings, and other elements of nineteenth-century mechanical technology. An 1860 description of the town noted that besides the many lumbermills and shipyards, Port Huron also contained "foundries and machine shops, with numerous mercantile and mechanical establishments."[42] The telegraph office was in a jewelry store where two watch repairers could be seen working on the intricate mechanisms of timepieces. Steam engines were also common, including, of course, the new railroad. Like many boys his age Edison "was dead set on being engineer of a locomotive." As a newsboy on the train he would sometimes "employ a substitute so that I might take the trip in the engine. Often I was permitted to handle the machinery, to shovel coal and rub up the brass and steel work." He would have been the envy of many a boy when at the age of thirteen he ran "a freight train all alone for sixty-two and a half miles."[43]

Experiences such as these led Edison's father to say that "Thomas Alva never had any boyhood days; his early amusements were steam engines and mechanical forces."[44] Yet in most ways his boyhood was quite normal, and as Anthony Rotundo points out in his recent study of nineteenth-century "boy culture" even such things as "steam engines and mechanical forces" made up part of the ordinary American boy's experience. The same technological drive that existed in the general culture affected boy culture. As Rotundo notes, "The building of toy ships that would actually float, the construction of snow forts,

the performance of crude scientific experiments—these common boyhood activities taught youngsters the skills (and the habit) of mastery over nature in the service of human needs and knowledge."[45]

Edison engaged in other common forms of play as well. At the age of nine he spent "all my spare hours . . . organizing a secret service among my companions and digging in caves in which we met, suggested by my reading Sylvanus Cobb, Jr's. stories—particularly 'The Gunmaker of Moscow.' We dug a cave with a concealed trap door, and then from this dungeon, fitted up with a fireplace, table, chairs, papers, games and a stock of provender laid in from [his father's] garden."[46] Such clubs and gangs were common in nineteenth-century America, and rival groups were often divided by neighborhoods. Thomas's friends were probably the "north side boys" mentioned in a letter from his boyhood friend John Talbot.[47] Although there are no accounts of their fighting with the southsiders, Thomas was involved in at least one fight, which took place between the American boys of Port Huron and the Canadian boys of Sarnia during the visit of the Prince of Wales in 1860. Often boys would dare each other to undertake dangerous activities or to play pranks on adults, and Edison got into his share of scrapes through such activities. James Clancy recalled one incident "when we made a hole in the but[t] of a big pine tree near the Ice house, filled it with powder, drove a plug in then you told Mike Oates to put his cap over the plug and you put a match to it. Mikes cap went up to the top of the observatory and it blew the side out of the Ice house."[48] Edison himself told of a practical joke he played on the soldiers at Fort Gratiot. He and a friend imitated the sentries calling for the Corporal of the Guard and succeeded in rousing the corporal three nights in a row. However, the soldiers then set a trap that caught Edison's friend while he escaped by hiding in a potato barrel in the cellar of his house.[49]

Boy culture often existed in tension with the domestic culture of women, as mothers sought to "exert moral power" over their sons "by implanting an active conscience" through teaching, lecture, and discipline.[50] Mothers, rather than girlfriends, were the most significant female figures associated with boy culture, which often defined itself by opposition to maternal influence. Indeed, the beginning of romantic attachments often marked an important passage out of boyhood. Although it is known that during these years Edison had a girlfriend named Carrie Buchanan, this seems to have been more a childhood infatuation than a serious romance. It was Nancy Edison who clearly was the most important female influence in the life of her son. One of Edison's boyhood friends remembered "being in front of your house one day and seeing your mother standing at the door calling you to come into your lessons. We boys were just coming from the Pine Grove swimming place and I thought at the time it was pretty tough on you."[51] James Clancy also recalled how Edison's mother "used to look when she would come out on the big stoop of the house and call *Alva.*"[52] Edison himself related how after pulling the prank on the Fort Gratiot sentries he "received a good switching on the legs from my father, the

first and only one I ever received from him, although my mother kept a switch behind the old Seth Thomas clock that had the bark worn off. My mother's ideas and mine differed at times, especially when I got experimenting and mussed up things."[53]

Nancy may well have been overprotective of her son, particularly after the deaths of her other young children had left him as the only child in the household. Although her nurturing fostered the self-confidence that later helped him to find such great success, there is some evidence that Edison rebelled not only against her but also against female domestic culture in general. It is notable that from the time he went to work at the age of thirteen on the Grand Trunk Railway, he was largely on his own—leaving early in the morning and returning late at night. After leaving Port Huron at age seventeen, he made only brief visits back to his home.

As an adult Edison made little accommodation to the demands of domesticity. Whereas according to Rotundo most of his contemporaries "accepted willingly the confinement of clothing that had once seemed like shackles" and "wiped away the once-treasured grime of outdoor activity" from their faces and hands, Edison was most commonly described by reporters as unshaved, indifferent to dress (frequently in clothes dirtied from experiments), and needing "brushing and combing and grooming all over."[54] Edison always seemed to be more comfortable in the masculine culture of the telegraph operating room, the machine shop, the laboratory, and the mine than he did in the feminine confines of the family parlor. A desire to avoid domestic concerns may well have contributed to his famous work style with the long hours that frequently kept him away from home. During the 1890s, when his second wife might well have begun to assert greater demands on him to conform to her genteel middle-class expectations, he remained away from home for weeks in the New Jersey hills where he delighted in the simple mining life. "Talking with the boys all night, sleeping on floors, clambering in and out of the giant machinery, and surrounded by dirt and equipment on all sides," notes historian Andre Millard, "Edison was in his element."[55] It is not surprising that reporters characterized his second wife as treating him with maternal as well as spousal affection, and that the unkempt Edison could be described, as in a 1913 article, as "this big, smiling, white-haired, blue-eyed, sixty-six-year-old boy of hers."[56]

The most significant rite of passage out of boyhood was entry into the world of work. Like many youngsters, Edison's boyhood ended in his midteens when he left home to begin working full-time as a telegraph operator, but even before then he had accumulated several years of working experience. Thomas's work in his father's truck garden would not have been unusual—many boys whose fathers were not farmers maintained some kind of garden—and for the Edisons the truck garden was an important source of income. Thomas, however, tired of this work, as "hoeing corn in a hot sun is unattractive," and after the Grand Trunk Railway was extended from Toronto through Port Huron to Detroit (the line opened on November 21, 1859), by, he recalled, "a great amount of per-

Thomas Edison at age 14.

sistence I got permission from my mother to go on the local train as a newsboy."[57] Nancy was doubtless reluctant to allow her son to take a job that required him to leave home early in the morning and to stay out until late at night.

While working on the train Thomas soon demonstrated an entrepreneurial talent that he probably learned by observing his father's efforts to make ends meet through a variety of enterprises. He certainly developed entrepreneurial sensibilities similar to those later ascribed to Samuel Edison by a close friend: "a lively disposition always looking on the bright side of things" and "full of most sanguine speculation as to any project he takes in his head."[58] Thomas also exhibited his father's fondness for storytelling. Unlike his father, however, Thomas's career would be profoundly affected by a new economic institution. The telegraph and the railroad companies for whom he worked as a young man were the first great American corporations. Although Thomas retained the entrepreneurial values of his father, he would achieve his success by taking advantage of the new opportunities they afforded.

Six months after going to work for the Grand Trunk Railway, Thomas started two stands in Port Huron. One sold periodicals and the other fruits and vegetables. He employed two boys to tend these enterprises, giving them a share of the profits, but soon closed the periodical store because he could not trust the boy in charge. He continued to run the vegetable store for nearly a

year and even got permission to have "two large baskets of vegetables from the Detroit market loaded in the mail car and sent to Port Huron" because they were better than the local produce. The railroad managers never asked Edison to pay freight for his produce and he later speculated that "I was so small and industrious and [had] the nerve to appropriate a U.S. mail car to do a free freight biz so monumental that it probably caused passivity." In addition to produce from the Detroit market, he bought butter and blackberries from farmers along the line, "buying wholesale and at a low price and permitt[ing] the wives of the engineers and trainmen to have the benefit of the rebate." When the railroad began running a daily immigrant train to transport Norwegians to Iowa and Minnesota, he also employed a boy to sell bread, tobacco, and candy.[59]

As news of the Civil War increased his newspaper sales Thomas decided to give up the vegetable store, and the Battle of Shiloh on April 6, 1862, proved this to be a good decision. As he later recalled:

> On the day of this battle when I arrived at Detroit, the bulletin boards were surrounded with dense crowds and it was announced that there were 60 thousand killed and wounded and the result was uncertain. I knew that if the same excitement was attained at the various small towns along the road and especially at Port Huron that the sale of papers would be great. I then conceived the idea of telegraphing the news ahead, went to the operator in the depot and by giving him Harper's Weekly and some other papers for three months, he agreed to telegraph to all the stations the matter on the bulletin board. I hurriedly copied it and he sent it, requesting the agents who displayed it on the blackboard, used for stating the arrival and departure of trains, I decided that instead of the usual 100 papers that I could sell 1000, but not having sufficient money to purchase that number, I determined in my desperation to see the Editor himself and get credit.

He explained to the editor of the *Detroit Free Press* what he had done about telegraphing the news, but indicated that he only had money for 300 papers. Taking a chance on the young entrepreneur, the editor gave him credit for the rest, and his faith was rewarded when Thomas's enterprise proved even more successful than he anticipated.

> The first station called Utica, was a small one where I generally sold two papers. I saw a crowd ahead on the platform, thought it some excursion, but the moment I landed there was a rush for me; then I realized that the telegraph was a great invention. I sold 35 papers; the next station, Mt. Clemens, now a watering place, but then a place of about 1000, I usually sold 6 to 8 papers. I decided that if I found a corresponding crowd there that the only thing to do to correct my judgement in not getting more papers was to raise the price from 5 cents to 10. The crowd was there and I raised the price; at the various towns there were corresponding crowds.

By the time he got to Port Huron he sold the few papers he had left at twenty-five cents each. Not only did he make "what to me was an immense sum of money," but he "started the next day to learn telegraphy and also printing."[60]

Edison's newspaper experiences provided valuable lessons that he later used in marketing himself and his inventions. The episode of the Battle of Shiloh taught him something of the power of the press. His father was also an avid newspaper reader, and Thomas later told of "forgetting" to bring the papers home so that his father would allow him to stay up receiving the news from his friend James Clancy over their telegraph line.[61] He learned more lessons while publishing his own newspapers.

His first paper was the *Weekly Herald*, which he published during the spring of 1862 with editorial assistance from conductor Alexander Stevenson. He printed the newspaper in a railway baggage car using discarded type and a galley proof press. It contained gossip, news, and advertisements of people and businesses in the towns along the rail line, including such items as the price of agricultural products, mail express and stage service information, and notices of births and military recruitments. He also published items about the Grand Trunk Railway and its employees, such as the account of a lost baggage swindle thwarted by a company detective. In another instance he endorsed a company engineer, recommending that he receive one of the company's premiums. The editorial tone he adopted also suggests how much his mother's moral teachings had become a part of his character. His strong work ethic is evident in an article headlined "The more to do the more to be done," which claimed that stations with only a single porter were kept in "first class order," whereas "at other stations where there is two Porters things are vise versa." He also called on Port Huron to enforce its "law requireing Saloons & Grog shops to close on Sunday . . . as they are a complete nuisance."[62] Although the paper was successful (Edison later claimed a circulation of 275 to 500 subscribers for his paper, which cost eight cents per month), he was forced to abandon it, apparently as a result of the mishap with his chemical laboratory that nearly burned the baggage car.

The accident with the chemicals may also have led to Edison's deafness. He recalled that the baggage master who put out the fire "got a bad burn and boxed my ears so severely that I got somewhat deaf thereafter."[63] But he also attributed it to another episode when a conductor helping him on to the train "took me by the ears and lifted me. I felt something snap inside my head, and my deafness started from that time and has ever since progressed."[64] Whether these episodes were coincidence or cause, Edison apparently first became aware of his hearing loss while working on the train. A doctor who treated him late in life thought that his deafness was a congenital degenerative disorder that could have been brought on early by a trauma. Throughout his life Edison would claim that his poor hearing was an advantage; that it reduced distractions by enabling him to concentrate. His private secretary during the last decades of his life believed that, although Edison "was wonderfully patient and philosophical about his affliction and seldom referred to it. . . . He also felt the loss of his hearing very much when he had visitors, and if they told funny sto-

ries among themselves and laughed hilariously, a wistful look came over his face, for he was very fond of humorous stories."[65]

Just as he continued to experiment with his chemicals in the cellar of the family house after having them removed from the train, so too Edison continued his publishing activities with the assistance of William Wright, an apprentice printer working at the *Port Huron Commercial*. Edison later called this paper *Paul Pry*, although Wright remembered it as the *Blowhard*. The paper was so filled with "hot stuff and so fixed with personalities," according to Wright, "that we knew it prudent to do the work on it quietly and at midnight" on Saturdays. He also recalled several incidents of outrage on the part of those who were the subject of the paper's stories, which caused Edison to "[run] the gauntlet of the well-deserved kicks and cuffings naturally incident to the circulation of such a sheet."[66] Edison's early experiences with the power of the press would be further reinforced by his work as telegraph operator.

Even before he went to work on the Grand Trunk, Edison had begun to learn telegraphy using the line he had built between his house and James Clancy's. It was while working on the railroad, however, that he gained new understanding of the telegraph's importance, not only for newspapers but also for its role in controlling traffic on the railroad line. A number of the telegraph operators along the line later recalled his spending time in their offices practicing telegraphy. John Thomas thought he was the first to teach Edison the rudiments of telegraphy, remembering that they used to practice at his office in the evenings. The station agent at New Baltimore, John Raper, reminisced about "the many times [Edison] came into my office to practice on my Telegraph Key and look at my specimens of Bugs Flies &c." Fred Betts, who was operator at the depot in Detroit, recalled how "Al Edison used to walk into our office and practice Telegraphy." Thus, when Edison rescued Mt. Clemens operator James MacKenzie's son from an oncoming railway car, which led to an offer of formal lessons, he probably already had some skill as an operator, a skill that MacKenzie then refined. Edison later stated that while studying with MacKenzie during the summer of 1862 he worked "about 18 hours a day" and "soon became quite proficient."[67] His ability to operate a telegraph key and sounder appears not to have been affected by the hearing difficulties he had begun to experience. This may even have proved of some benefit during his years as a telegrapher by allowing him to concentrate on the click of the telegraph sounder without distraction from other noises.

With his improved operating skills Edison obtained his first job as an operator in Port Huron. For a time he apparently operated his own telegraph line between Fort Gratiot and the train station, "but the business was small and the operator at Port Huron knowing my proficiency and who wanted to go into the US M[ilitary] Telegraph, where the pay was high, succeeded in convincing his brother-in-law (Mr. [Micah] Walker) that I could fill the position all right." The telegraph office was in Walker's jewelry and stationery store, and there Edison also had access to books and journals, as well as the tools and gear mechanisms

used in clock repair. Walker recalled that the "telegraphing did not take over 1/3 of Edison's time. He was no good to wait on customers, so had plenty of time to experiment and tinker. And in doing so, was a great annoyance to my workmen." Thomas often spent the night in the shop to practice taking press reports because "the goal of the rural telegraph operator was to be able to take the press."[68] After a time Edison applied for a job as operator with the Grand Trunk Railway and received a position as night operator at Stratford Junction, Ontario. This marked the beginning of his years as an itinerant telegrapher and a new period in his education as an inventor.