Louis Pasteur in Arbois

Portrait of Louis Pasteur (1822–1895) a French biologist, microbiologist and chemist. Dated 19th century. World History Archive, Alamy contributor

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"If there is no Arbois, there is no Pasteur."[1]

—Erik Orsenna

The quaint French village of Arbois sits nestled in the rolling hills of the Jura, near where the nose of Switzerland juts westward into France. Montbéliardes and Simmental cows, the source of milk for the region's Comté and Morbier cheeses, browse in the nearby meadows, and vineyards of uniquely Jural grapes (Poulsard, Troussard, Savagnin) stripe the slopes between patches of forestland. In addition to its wineries, restaurants, ancient stone buildings, and a company that makes screwdrivers, Arbois is home to the vine-covered brick house where Louis Pasteur, one of the most influential scientists of modern times, grew up.[2]

Only three thousand people currently live in Arbois, about half as many as in 1827, when the Pasteur family, including five-year-old Louis, moved from their previous home in Marnoz.[3]

Louis was born in 1822 to Jeanne Etiennette Roqui, daughter of a long-established family in the region, and Jean Joseph Pasteur, an orphan who was raised by his paternal grandmother and two aunts. Joseph Pasteur was described by Louis's biographer and son-in-law, René Vallery-Radot, as "reserved, almost secretive, with a slow and careful mind, apparently absorbed by his inner life." Louis's mother, on the other hand, was described as "modest, intelligent, and kind" as well as "very active, full of imagination and enthusiasm."[3]

The Pasteurs were not well educated; Louis's father was a third-generation tanner, and his mother descended from a long line of vineyard workers. According to Vallery-Radot, young Louis was a mediocre student who most enjoyed reading, drawing, and catching fish in the river that ran past his house and his father's tannery in the backyard.

> [He] liked buying lesson books, on the first page of which he wrote his name…During holidays he enjoyed his liberty. Some of his school fellows—Vercel, Charrière, Guillemin, Coulon—called to him to come out with them and he followed them with pleasure. He delighted in fishing parties on the Cuisance [River] and much admired the net throwing of his comrade Jules Vercel. But he avoided bird trapping; the sight of a wounded lark was painful to him.[3]

Vallery-Radot surmised that Louis was considered slow at school because his mind worked so carefully; he never spoke of anything unless he was absolutely sure it was true. Yet, he exhibited a keen imagination, fed by his fascination with "the siege of Arbois under Henry IV when the Arboisians held out for three whole days against a besieging army of 25,000 men." He daydreamed about the morality of patriotism and about the glory of the French Empire.[3] He also treasured language and kept notes in his beloved book of words.

The people of Arbois were considered different from both Parisians and the French from further south. The Arboisians were said to never doubt themselves but to be skeptical of others. They were viewed as an enigmatic mix of heroic courage and ironic good humor that non-Arboisians interpreted as naiveté. During a local rebellion against the status of the Republic, the

Cascades on the Cuisance near the birthplace of Pasteur. Gilles Lansard/Hemis, Alamy contributor

protesting citizens of Arbois were asked to identify their leader. In unison they responded, "We are all leaders."[3]

A strong influence on young Louis was M. Romanet, the headmaster of Arbois College, where the boy attended primary school. Romanet "was the first to discover in Louis Pasteur the hidden spark that had not revealed itself by any success in the hard-working schoolboy."[3] During their strolls through the school yard, Romanet recognized Louis's strength and caution, along with the lad's vivid imagination, and the teacher took pleasure in awakening Louis's otherwise veiled circumspection and enthusiasm. In addition, he spoke with Louis about his future and introduced him to the possibility of attending École Normale Superieure, a college in Paris founded by Napoleon I to train professors. Joseph Pasteur was leery of his sixteen-year-old son going so far away from Arbois—nearly ten hours by train—but was ultimately convinced of its wisdom by an old friend of the family.[3]

After several months in Paris, Louis wrote a wrenching letter to his parents expressing his despair and regrets. He was extremely homesick. His father fetched him back to Arbois, where he returned to drawing with his precious-colored chalks and enrolled in the local college. There he earned a Bachelor of Letters in 1840. At the end of the summer holiday, he accepted an offer for further study at the Royal College of Bescançon, located only forty kilometers from Arbois, where he studied philosophy, science, and mathematics. He earned a Bachelor of Science in 1842. In 1843, he returned to the École Normale Superieure in Paris for additional studies in chemistry. Subsequently, he went on to faculty positions in Dijon, Strasbourg, and Lille. Ultimately, he returned to the École Normale Superieure as a faculty member. For most of his professional career, he remained in Paris, where he established the Pasteur Institute, until his death in 1895.[3]

As an adult with a growing reputation as a scientist, Louis spent every August and September, his summer vacation time, in Arbois. While it was a place of rest for Pasteur, it was also a place of pain. Of his five children, only two survived beyond childhood; three beloved daughters—Jeanne, Camille, and Cécile—are buried in the old cemetery of Arbois. During the Franco-Prussian War in 1870–71, Louis, his wife Marie, and their daughter Marie-Louise moved to the Arbois house for several months fearing the dangers of conflict in Paris.[4]

The following, written by Pasteur's son Jean-Baptiste to his future brother-in-law, René Vallery-Radot, summarizes Louis Pasteur's affection for Arbois:

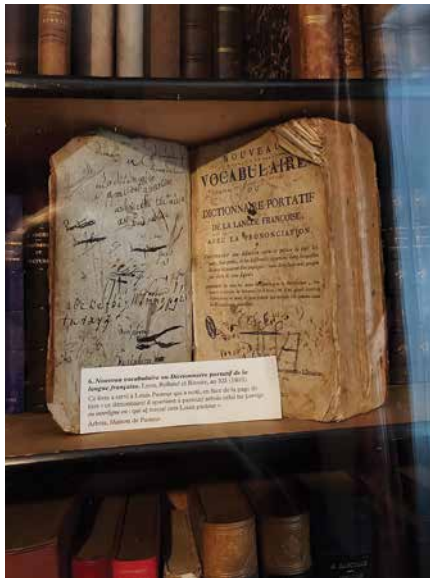
> Our shady alleys are everyone's paths, our green corners are the woods of the surrounding mountains, our mossy banks exist only in your imagination, the cooing brooks are reduced to a torrent that crosses Arbois under the name of the Cuisance, and our castle is none other than the most modest of dwellings located in the middle of a small town, without the slightest garden either in front or behind. It is here that my father spent all his childhood and this house, partly inhabited by my father's sister and her family, he always wanted to see it again, to meet there every year with us, to keep it, by a feeling of pity for the venerated memory of the grandfather Pasteur.[5]

The lab bench in Pasteur's laboratory.

By 1860, Pasteur was interested in disproving what was called "spontaneous generation," the notion that biologic growths appeared in sterile liquids spontaneously without exposure to the outside environment. Pasteur suspected the spontaneous generation theory to be incorrect and believed that the growths appeared because of an external factor, which he called the ferment. Specifically, he wished to study the effect of exposure to the air at different altitudes. He decided to continue these studies during his summer vacation in Arbois. He transported 73 glass flasks of broth (likely sterilized yeast-water) from Paris and opened 20 of them along an old road not far from his father's tannery. Later, upon examination, eight of the vessels contained "organized bodies." He then repeated the experiment with 20 more flasks, which he opened on Mount Poupet, 850 meters above sea level. Five of the 20 flasks contained those bodies. As a control, he broke the sealed glass on 20 additional flasks with nippers sterilized in an alcohol flame and resealed the flasks immediately. Only one of those flasks contained the organized bodies. He concluded that dusts in the air were the origin of life in the infusions in the flasks, thus establishing (about the same time as Robert Koch) the germ theory.[3] This observation became the foundation for our current understanding of the pathogenesis of infectious diseases.

The fruits of the surrounding vineyards and the diseases of wine that made them acid, bitter, ropy, or sour had always fascinated Pasteur. The next summer, August 1864, in order to continue his studies on the transformation of grape juice into wine, he set up a small laboratory in a coffee room near the entrance to Arbois. Before leaving Paris for his summer vacation, he wrote up the plans for the upcoming experiments with one of his students:

> From the 20th to the 30th [August] preparation in Paris of all the vessels, apparatus, products, that we must take. Sept 1, departure for Jura; installation: purchase of the products of a vineyard. Immediate beginning of tests of all kinds. We should hurry; grapes do not keep long.[3]



A French dictionary with notes in Pasteur's handwriting.

Vials to demonstrate the phenomenon of fermentation.

Rabies vaccine among the vials of other reagents.

Pasteur was a committed and valued mentor, keenly interested in the success of his students, and he demonstrated to them the discipline, organization, and persistence necessary for conducting sound science.

Following the deaths of their parents, Louis and one of his sisters took over the Pasteur house in Arbois. In 1883, the house was enlarged, a renovation that included the addition of a library and a laboratory. There he read scientific papers and letters from his laboratory associates in Paris, wrote scientific papers and letters back to Paris, relaxed with his wife and children, and met with and supervised the work of students and collaborators on his projects. He spent the mornings visiting with anyone who came by seeking advice, recommendations, interviews, etc. In addition to welcoming local politicians, journalists, and scientists, he also welcomed the workers from nearby vineyards who sought a "cure" for their bad wine. Although he was often stressed and cranky while in Paris, he was more patient and accommodating while in the Jura.[3] He considered his summers there as a time for thought and renewal.

During the 1880s, Pasteur worked on a vaccine against porcine erysipelas in his Paris laboratory, and its ongoing preparation continued in Arbois in the summer of 1883 with the assistance of his technicians Louis Thuillier and Adrien Loir (his nephew-in-law), and a regional veterinarian.[5] Loir recorded in his notes that he inspected each lot of vaccine for purity before shipment, using the lab's microscope before the availability of oil immersion lenses or tissue stains.[6]

At this time, Pasteur was also working on a vaccine to protect against rabies. In 1885, his vaccine was first used in a human to treat nine-year-old Joseph Meister, who had been mauled by a rabid dog.[3] Although the vaccine had been tested extensively in animals, Pasteur was extremely anxious about using it in the boy. Little Joseph appeared to do well following the series of injections, but Pasteur continued to worry about him. After he left Paris for his summer vacation in Arbois, returning the child to the care of the physician who had administered the shots, Pasteur learned that Joseph continued to do well. On August 8, Pasteur wrote to his son Jean-Baptiste, "Very good news last night of the bitten lad. I am looking forward with great hopes to the time when I can draw a conclusion. It will be thirty-one days tomorrow since he was bitten."[3] Although Pasteur was not a physician, he was profoundly anxious about "doing no harm" to patients who received the products of his research.

In recent years, the Pasteur home in Arbois and its furnishings have remained as they were when Louis and his family vacationed there. The Maison de Louis Pasteur is now open to the public as part of the Jura Museum Network.[2] The front door of the home opens into the reception room, where Pasteur met visiting students and guests. Adjacent is the family living room, which is dominated by a billiard table, and beyond is the dining

room. In the back, a porch overlooks Pasteur's garden and the Cuisance River that burbles over rocks and weeds as it wanders through the village. The kitchen, which was the original house of Louis's youth, is in the lowest level, with a custom-made dumbwaiter to ferry the food up to the dining room.

To scientists, the most magical part of the house is Pasteur's laboratory, a large room that occupies part of the second floor. Sun pours in the windows on clear days, and the air seems to sing with Pasteur's genius. There, perplexed by the transition of grape juice from nearby vineyards into wine, he demonstrated that that seemingly mystical process occurred when an invisible ferment (yeast) turned the sugar in the grape juice into alcohol. The swan-necked glass vessels in which he conducted those experiments, now filled with muddy orange liquid and labeled in his handwriting, sit on the laboratory shelves. Vials of his rabies vaccine stand among glass-stoppered bottled and cotton-stoppered test tubes.

The latent researcher in young Louis had been nurtured in this home. If its walls could speak, they would tell the thousand stories of how he loved to draw and of the pastel sketch he made of his mother as she left for the market wearing a white cap and a blue and green tartan shawl; how his endless curiosity was encouraged by the people around him; how little Louis explored the river, the vineyards, and the surrounding woods to understand his world.[3] The walls would tell the secrets of raising a boy to become one of the most important scientists of all time. From simple beginnings in little Arbois, a seemingly ordinary young fellow followed his inquisitive mind to discoveries that changed the course of medicine forever and continue to echo through the halls of medical schools, scientific institutes, and hospitals even today.

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