

## BERNARD COURTOIS (1777-1838), FAMED FOR DISCOVERING IODINE (1811), AND HIS LIFE IN PARIS FROM 1798

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### The Family in Dijon (1)

Bernard Courtois was born in 1777 in Dijon, the handsome provincial capital of Burgundy, France with a population of about 20,000. He grew up there and learned about the saltpeter industry from his father's work but he had no formal schooling. His father Jean-Baptiste Courtois came from a family of cobblers in that region, and his mother Marie Blé was the daughter of a village laborer. When they married in 1771, Jean-Baptiste was a valet to M. Bouchin de Grandmont aged 82, the first president of Dijon's Chamber of commerce and the owner of a grand hotel in the town. After their first son died in 1772 Marie and Jean-Baptiste had six children, a daughter Catherine followed by sons Pierre, Bernard, Jean-Baptiste, then in 1780 the twins Anne-Marie and Pierre (second of the name). Thus Jean-Baptiste, who was skilful and adaptable, had to support his young family during the final years of the *ancien régime* and the French Revolution (1789-1794). He became a wine merchant after M. Bouchin de Grandmont's death in 1772 when the hotel was sold to the Dijon Academy for scientific activities. That was at the time Guyton de Morveau, the well-known chemist and Dijon lawyer, successfully appealed to the provincial government for financial support to provide a free chemistry course at the Academy (2). Soon a new chemistry laboratory opened in the former hotel, situated directly opposite Bernard's birthplace, and in 1775 Jean-Baptiste became a laboratory assistant (3).

In January 1776 Bernard's father became a full-time demonstrator to Guyton, whose annual chemistry course was formally opened on April 28 (3, 4). Three years later he was fortunate to be able to rent accommodation in the Academy buildings, where the family lived for the next ten years. Thus the infant Bernard was raised in the prestigious surroundings close to his father's work, at a time when the Dijon Academy chemistry department was well-known largely due to Guyton's distinguished reputation. The well-equipped laboratory needed for the practical science demonstrations was also used for other purposes, as Guyton had predicted. It served as a small pharmacy from 1778, managed by Jean-Baptiste who was even called the '*pharmacien de l'Académie*' by his family (3). As well as keeping the accounts he purchased small quantities of chemicals to make medicines, wine vinegars, and inks which he sold to surgeons, apothecaries, retailers, other academy departments, and private individuals (5). He also developed an improved white paint for buildings, replacing the usual lead carbonate with zinc oxide (6).

The French authorities at that time were urgently seeking ways to increase the country's saltpeter production for gunpowder. In Dijon, as a result of a partnership which included Guyton and the Burgundy powders commissioner Champy, work began in 1778 to build an experimental plant to make saltpeter artificially. It was on ten acres of unused land near an old saltpeter refinery outside the town gates, just over a mile from the

Academy. When this nitrary opened in 1780 it was named the *Saint-Médard Nitrary* and Jean-Baptiste was the manager, on Guyton's recommendation. However he still kept his post at the chemistry laboratory and the family lived at the Academy until three months after the outbreak of the Revolution.

Jean-Baptiste and his wife bought the *Saint-Médard Nitrary* on June 25, 1788 from Guyton and Champy (7). The following year, when Bernard was twelve years old, they moved to the residence after leaving their Academy accommodation on October 31 (8). Bernard with his elder brother Pierre began to learn about the saltpeter industry and in due course were able to assist their father. Pierre eventually remained in that trade in the region, whereas chemistry was to influence Bernard's choice of career. Meanwhile the violence and terror of the Revolution raged until July 1794 when the worst excesses ended after the execution of Robespierre in Paris. Dijon became the principal town of the *département* of the Côte d'Or when the National Assembly reorganised local government in 1789, and in 1793 the former provincial Academies were suppressed by the National Convention which led to the closure of Dijon's Academy. Jean-Baptiste's laboratory position ended when Guyton left for Paris on being elected to the Legislative assembly in 1791. He then concentrated on his saltpeter industry and later profited from events by buying some national land made available by new legislation (7, 8).

Bernard lived at the *Saint-Médard Nitrary* until he was eighteen, and it seems likely he had an untroubled boyhood despite the difficult times. He would have been welcomed on visits to his parents' relatives and there was much to enjoy in the lovely surrounding countryside, including bathing and fishing in the rivers Suzon and Ouche. His father's brother Zacharie lived in nearby Plombières, where Bernard sometimes stayed during holidays from his pharmacy apprenticeship (3). It was about 1795 that he left home to begin this apprenticeship in the town of Auxerre 80 miles north of Dijon, under M. Frémy who was the future grandfather of the distinguished chemist Edmund Frémy (1814-1894). Bernard spent three years at the Frémy pharmacy and also became interested in practical chemistry during this period. Thus on completing his apprenticeship about 1798 he was pleased to obtain a position in the chemistry laboratory of Antoine François de Fourcroy (1755-1809) at the *École Polytechnique* in Paris (9). This was achieved with the help of his godfather Bernard Maret who had gone to Paris as a journalist in 1788 and was

destined for a brilliant career as a diplomat and statesman. He was the son of Jean-Baptiste's friend Dr Hugues Maret, former permanent secretary and lecturer in applied science at the Dijon Academy before his death in 1786 (8).

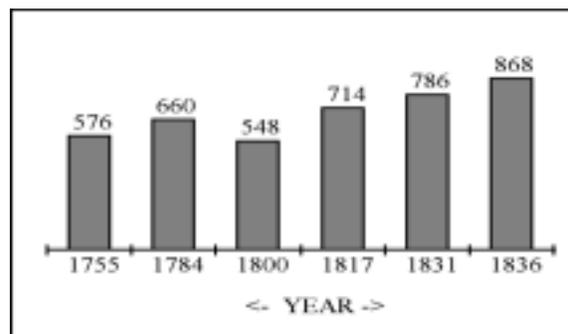


Figure 1. Chart showing Paris populations to the nearest thousand, before and after the 1789 Revolution (10)

### At the *École Polytechnique*

The capital was the city of opportunities and its population was increasing rapidly again after a fall during the Revolution (Fig.1). In December 1794 the *École Centrale des Travaux Publics* opened (renamed the *École Polytechnique* in September 1795) in the former Palais-Bourbon, to provide the republic with skilled engineers. Students studied the necessary basic sciences and mathematics for three years before going on to graduate from a specialist school of engineering. The chemistry courses were taught by three distinguished full professors of chemistry, Fourcroy, Guyton de Morveau, and Berthollet (11), who also had their own laboratories for research (12). Among *Dijonnais* who left for Paris were two of Bernard's contemporaries, Charles-Bernard Désormes (1777-1862) and Nicolas Clément (1779-1841). Désormes was a student admitted to the *École Centrale des Travaux Publics* when it opened. He remained there on completing his course, becoming a demonstrator for Guyton de Morveau. Clément had a modest library post near Dijon which he left when a wealthy relation offered an opportunity to work and study in the capital. After winning a lottery he became a scientist and began industrial chemistry research at the *École Polytechnique* in 1801, collaborating with Désormes (13).

Two years before Bernard entered the *École Polytechnique* it was reorganized, with considerable economies adversely affecting the staff employment,

student numbers, and laboratory provision. By 1799 the students were following a two-year course of study instead of three, although the chemistry courses continued as before (11). Nicolas-Louis Vauquelin (1763-1829) the assistant professor of chemistry, who often substituted when Fourcroy was busy with appointments outside the college (14), was not replaced when he left in 1797. A year later about the time Bernard arrived, Louis-Jacques Thénard (1777-1857), previously a laboratory assistant, was appointed *préparateur de chimie* (15). Thénard formed a friendship with Bernard and soon recognized his abilities before both men were required for military service in 1799, under a new conscription law. Thénard was posted to the mining corps at the military engineering school at Metz (16). Bernard served as a pharmacist in military hospitals and then returned to the *École Polytechnique* in 1801 to work in Thénard's laboratory (9). About that time Armand Séguin (1767-1835) (17), former aide to Lavoisier, opened a research laboratory at the college (18). As director of a tanning industry at Sèvres which supplied boot leather for Napoleon's armies, Séguin was a wealthy man and able to pursue his scientific interests (19). One of his several research projects was a study of opium, which became Bernard's work in 1802 when he moved to Séguin's laboratory (20).

Bernard must have been a useful chemistry assistant although there are no *École Polytechnique* documents mentioning his name. As a young man from the provinces with no previous experience it seems likely he was given a low-grade position, undoubtedly obtained due to Guyton de Morveau's influence. The latter, who was director of the *École Polytechnique* in 1798 and 1800-1804 (21), could recommend the son of his former assistant at the Dijon academy, Jean-Baptiste Courtois, despite the economies and redundancies of 1797 (22). Guyton, Fourcroy, Berthollet and others had provided revolutionary courses on saltpeter, powder, and cannon manufacture (23), and they were consulted about the use of chlorine bleaching to manufacture paper for the *assignats* currency. Guyton became particularly interested in the value of chlorine as a disinfectant and his *Traité sur les moyens de désinfecteur l'air* appeared in 1801. His successful investigations led to new methods of fumigation which were taken up by the medical authorities (24). However, Bernard was probably not directly involved with laboratory work on chlorine since Fourcroy and Thénard had other research interests.

Fourcroy was particularly interested in plant and animal chemistry. His research at this period was mostly

with his collaborator Vauquelin and included some inorganic chemistry on reactions of sulphites and phosphites. The two analyzed many animal and vegetable substances and investigated urine, urea, and urinary calculi. They found that sulfuric acid can remove the elements of water from vegetable substances and they also studied its reaction with alcohol to form ether. Thénard was influenced by the work of Fourcroy and Vauquelin since he was their laboratory assistant before his appointment as *préparateur de chimie*. He therefore began his own research with an interest in organic chemistry, which led to the discovery of sebacic acid in 1801. He was also gaining a reputation as a skilful analytical chemist at the period when Bernard was with him. Thénard was interested in the proportions in which elements combine in compounds, particularly in the metal oxides. He examined oxides of nickel, cobalt, antimony, iron, as well as other compounds and showed that two series of mercury compounds exist. Soon he was to achieve fame following his discovery in 1804 of the cobalt aluminate pigment ( $\text{CoAl}_2\text{O}_4$ ) named *Thénard's Blue*, a substitute for ultramarine and a colorant for porcelain (25).

Thus, in the laboratories of Fourcroy and Thénard, Bernard acquired a good knowledge of the practical techniques used for research in organic and analytical chemistry. He was intelligent, enthusiastic, and a competent laboratory worker; hence as well as performing routine chemical tasks he could assist with some of the research (9). In this way Bernard gained valuable experience, enabling Armand Séguin to entrust his research on opium to him in 1802. Séguin presented his *first* memoir on opium to the French Institute on December 24, 1804, but it was not published until 1814 (26). One of the *principles* isolated in this research was morphine; thus in 1816 it became of particular interest to French chemists when Vauquelin tried to claim priority for Séguin, over Sertürner, for the discovery of this alkaloid (9). As Bernard's name is not mentioned in Séguin's memoir it is from biographical sources that his contribution is known. P. A. Cap wrote in 1850 (19):

Dans la répartition des travaux que Séguin voulait entreprendre, Courtois fut désigné pour l'étude de l'opium. Il se consacre avec dévouement à ces recherches et il parvint à isoler de l'opium un corps cristallisé, doué de réactions alcalines, et susceptibles de se combiner avec les bases. Cependant, comme il obtenait cette substance par l'intermédiaire de l'ammoniaque, il n'osa pas affirmer que celle-ci fût étrangère aux propriétés alcalines qu'il accusait. Plus hardi que lui, Sertuerner donna le nom d'alcali végétal à la substance cristalline que Courtois avait

découverte, que n'était autre chose que la morphine, et il eut l'honneur de mettre la science sur une voie nouvelle, en révélant l'existence d'une série de corps, aujourd'hui désignée sous le nom d'alcaloïdes.

L. G. Toraude adds an informative *Note* at the end of his biography (27). A translation :

There is one point, I am afraid, which seems to me has not been extended or explained sufficiently in the course of this study. It is about the participation of Courtois in the discovery of morphine. Although Courtois had been, on this occasion, his direct collaborator, Séguin nevertheless did not name him ... Yet, two testimonies of totally different character seem right to confirm it: one, a testimony from the scientist Frémy who relates in one of his letters, *that he has seen Courtois trying to produce the organic alkalis artificially*; the other, a testimony of an illiterate person, who is none other than the widow of Courtois and who writes twenty years after the death of her husband : *He was a saltpêtrier under the reign of Napoléon. For a long time, he gave himself up to serious work on morphine.* These are two testimonies of great significance in our eyes and not to be disregarded.

Séguin's promising opium research nevertheless came to an end, at a time when the *École Polytechnique* was undergoing many changes. Emperor Napoleon issued a decree in July 1804 for the militarization of the school, then another in March 1805 for its transfer to a new building, the former College de Navarre in the Latin Quarter of Paris (28). Séguin, it appears, was in trouble with Napoleon and was forced to return much of his massive fortune. For Bernard, too, 1804 was a turning point because he left the college to assist in a saltpeter business his father had recently set up in Paris (9).

### Jean-Baptiste Courtois moves to Paris

It was towards the beginning of 1802 that Bernard's 54-year-old father journeyed from Dijon to Paris and took lodgings with M. Lamy, a courier, at 5 rue Montorgueil. Since he wanted to start a saltpeter business in the capital he proceeded to buy a house at 29 rue Sainte-Marguerite in the east-end suburb of Saint-Antoine, a busy working class district. By June 15 he had signed the legal documents for purchasing the property for 12,236 francs, jointly with his wife. This contract was despatched to Mme Courtois in Dijon, who unreservedly ratified it on June 20 and the conveyance was recorded in Paris on July 4, 1802 (29). Jean-Baptiste had agreed to settle the purchase eleven months later, so with this in mind he travelled back to Dijon to sell some of his

national property (9). When he returned to the capital to commence trading, his wife Marie, then aged 60, remained with the family in Dijon.

Rue Sainte-Marguerite (renamed rue Trousseau in 1894) came within the city boundary towards the western side of the suburb, in a populated area near the parish church of Sainte-Marguerite. The road, extending from rue du Faubourg Saint-Antoine to rue de Charonne, had opened in 1622 when a chapel dedicated to Sainte-Marguerite was built. This chapel became the church in 1721 and by the 19<sup>th</sup> century its parish had about 90,000 inhabitants, one reason why the church cemetery had to close in 1804. Skilled craftsmen had dwelt and traded in the locality since the reign of Louis XIV (1643-1715), many of whom were trade guild dissenters tolerated within the confines of the Royal Abbey of Saint-Antoine. The district, which extended from the place du Trône (named place de la Nation in 1880) to place de la Bastille, had always been quick to rise in support of any rebellion, as it did when a revolutionary mob stormed the Bastille prison on July 14, 1789.

Place du Trône, covering an area of about 12 acres, was designed to commemorate the grand occasion when Louis XIV and Marie-Thérèse passed through to enter Paris after their marriage in 1660. In the 1770s it became one of about 60 entrances at the wall of the *fermiers généraux*, the unpopular administrative boundary built to facilitate tax collection on goods entering the city. However in 1789, renamed place du Trône-Renversé (until 1805), it resembled a field after the revolutionary National Assembly reorganised local administration and the city *département* extended along rue du Faubourg Saint-Antoine no further than the abbey. A guillotine was placed there in July 1794, which claimed 1306 victims in just six weeks. Also another guillotine was put up at place de la Bastille, although it was only allowed to remain for three days because residents protested (30). Three hundred of those executed were buried at the cemetery at the church of Sainte-Marguerite (31).

The violent history of the locality had not deterred *Dijonnais* Jean-Baptiste in 1802 when he purchased the house in rue Sainte-Marguerite for his saltpeter business. At that time, although only until August 1803, Europe was at peace after the signing of the Treaty of Amiens on March 27, 1802. The capital of France was now calm and the regime's authoritarian First Consul Napoléon Bonaparte was made a Consul for life. Also that same year, following a concordat with Pope Pius VII in 1801 the Roman Catholic church was restored to

a place in French society again after its banishment during the revolution.

A detailed plan of Paris (32), although made some sixty years before Bernard's father arrived, nevertheless indicates what rue Sainte-Marguerite was like when he started his saltpeter business (Fig.2). His premises had a front opening onto rue Sainte-Marguerite which provided access for horse-drawn transport of materials for the factory. It had once been two separate houses and consisted of a courtyard, several buildings, cellars, sheds and stables, with entrances into the three adjacent properties at the rear and both sides (29). In 1804 information on the saltpeter factory belonging to Jean-Baptiste Courtois was shown in de la Tynna's *Almanach du commerce de Paris*, and it was there again in 1805 and 1806 although the business was failing (9). Indeed it was a sad state of affairs, for in 1805 Jean-Baptiste was bankrupt and it appears that he spent 26 months detained in the *Sainte-Pélagie* debtors' prison, from about November 1805 until his release in December 1807 (33). For Bernard, too, who had to manage the situation of the saltpeter business at rue Sainte-Marguerite, this was a very difficult time.

### Bernard Courtois in the Saltpeter Industry

Bernard's life and work were greatly affected by Jean-Baptiste's business affairs once he left the *École Polytechnique* in 1804. It was presumably for the saltpeter business that, towards the end of that year, he borrowed 32,528 francs in solidarity with his father to be paid back over a period extending to 1816. Their four creditors were MM. Desgouges, a salpêtrier; Lamy, a merchandise courier; Bourlier, a chemicals manufacturer; and Guyton de Morveau who loaned 4,000 francs (34, 35). Bernard may have been unaware of his father's precarious financial circumstances when he entered into these agreements. In fact it seems that Jean-Baptiste owed creditors for his purchase of 29 rue Sainte-Mar-

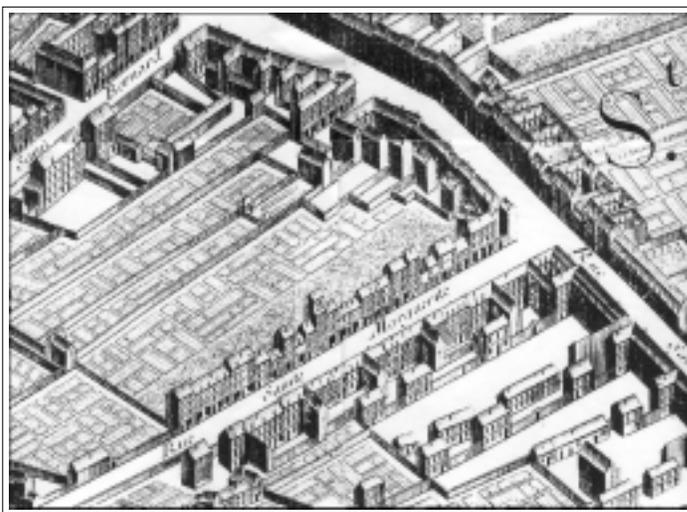


Figure 2. Houses in Rue Sainte Marguerite from Turgot's plan of Paris (1734-39).

guerite, which he had originally agreed to settle by 1803 (36). In Dijon also, although his ownership of the *Saint-Médard Nitrary* was completed in 1794 he still had other debts on the property. These debts were taken over by the purchaser when Bernard's elder brother Pierre, as his father's proxy in Dijon, sold the nitrary for 24,000 francs on October 12, 1805 (37). Unfortunately the proceeds from this sale did not prevent Jean-Baptiste's insolvency.

Thus it came about that the first official record for Bernard Courtois as a Paris businessman was a financial statement deposited with the Seine Tribunal of Commerce on February 26, 1806. It was for a factory at 39 rue Sainte-Marguerite belonging to Bernard Courtois Fils, *salpêtrier* (34). This indicated that Bernard was in charge under the unfortunate circumstances, shortly before his father's legal representative sold the property on May 28 (36). Some nineteen months later Jean-Baptiste's bankruptcy discharge document recorded his address as 9 rue Saint-Ambroise (33), a road just less than a mile north of rue Sainte-Marguerite, in the Popincourt district. *L'Almanach du commerce de Paris* showed that a M. Lamirau managed a saltpeter works there in 1807 and 1808 (38). Nevertheless no details are known about the life of Jean-Baptiste after his discharge.

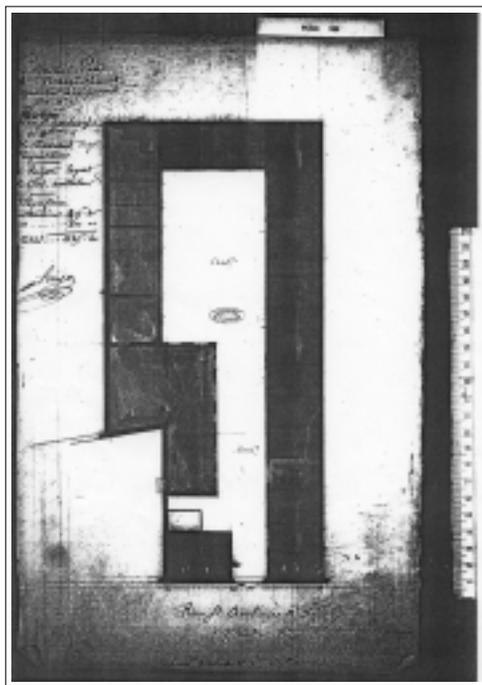
In 1808 Bernard married Madeleine Morand the daughter of a Paris hairdresser, but his address and occupation from 1807 to 1809 are not known (9). However, except for the three years 1815 to 1817, details of his saltpeter factory at 9 rue Saint-Ambroise appeared in *L'Almanach du commerce de Paris* from 1810 until 1821 (38). This road had opened in 1783 on land belonging to the former convent *des Annonciades de Popincourt*. The convent's chapel of *Notre-Dame de Protection*, at the west end of the road near rue Popincourt, was the parish church from 1791 until the new Saint-Ambroise church was built in the 1860s (39). Rue Saint-Ambroise was still relatively undeveloped in 1810 when Bernard commenced trading, with just a few houses on the side opposite the church. This was soon

to change, since land adjacent to the church buildings was earmarked for one of five large abattoirs to be built in Paris according to the Emperor's decree of 1810. However, the project was delayed, so for a few years Bernard was spared the inconvenience of a major development near his property; but eventually the large, attractively designed abattoir *Ménilmontant* opened in September 1818. It occupied the rectangular area bounded by the rues Saint-Maur, Saint-Ambroise, de Chemin-Vert, and a new road linking the two latter—part of Avenue Parmentier (40). Some years later when the Paris land registry plans were produced (Fig.3), the house at 9 rue Saint-Ambroise was shown to occupy about 0.25 acres, with a good sized courtyard surrounded by outbuildings (41).

### Iodine

Meanwhile, with France at war until 1815 and the saltpeter trade largely government controlled, there was a shortage of wood ashes for obtaining potassium nitrate from nitre-bed mother-liquors. As an alternative source of potassium salts the manufacturers turned to cheap soda kelp made from ashes of Normandy and Brittany seaweeds. This raw material also contained another very important chemical, as yet undiscovered, which was to make Bernard famous soon after he began using the kelp in his manufacturing process. It all began one day towards the end of 1811 when he was investigating corrosion of his copper vessels and noticed an unusual purple vapor given off, an event later recorded by Humphry Davy (42) :

... This substance was discovered accidentally, 2 years ago by M. Courtois, a Paris manufacturer. In the course of the procedure by which he obtained soda from seaweed ash, he found that the metal vessels he used were corroded and he looked for the cause, when he discovered the new substance. It appeared when a little sulfuric acid was added to the ash after extracting carbonate of soda. When the acid is concentrated enough to produce a strong heat the new substance



**Figure 3.** Plan from the Paris Land Registry for the house at 9 Rue Saint-Ambroise in the Popincourt district (about 1840).

appears as a beautiful violet vapour and condenses in crystals which are the colour and lustre of graphite.

L.G. Torauode notes that Davy does not actually state that Courtois was using sulfuric acid to remove this corrosion product in his metal vessels. He considers that Bernard may have noticed the violet vapor for the first time, as a result of the reaction of the acid on this *calfatage*, and it then appeared again when he added sulfuric acid to his seaweed ash (27). Davy's record of the discovery can be interpreted this way.

Bernard investigated this interesting substance in his laboratory for a few months although busy running his business. He determined many of its properties including its reaction with ammonia to form a fulminating powder (43). The French chemists knew nothing of the discovery until he informed his former colleagues Nicolas Clément and Charles-Bernard

Désormes about May 1812, and asked them to continue his research. They too had other commitments so it was not until November 29, 1813 that Clément, the professor of chemistry at the Conservatoire des Arts et Métiers, was able to announce it to the Institute. Clément presented the paper a week later on December 6, with Bernard as author, and the name *Iodine* proposed by Gay-Lussac was used. Gay-Lussac's on-going research on iodine and his opinion that it was a simple substance analogous to chlorine were also mentioned (44, 45).

Prior to the announcement of Bernard's discovery, Clément had invited Gay-Lussac to do some research on the new substance which he also showed to the scientists Chaptal and Ampère (43). Thus it came about that when the distinguished chemist Humphry Davy arrived in Paris he received a sample from the physicist Ampère. Davy, who in 1813 was "...going to the Continent upon a journey of scientific inquiry," was only in the capital from October 15 until December 23 (45). Nevertheless, during this short visit he did many experiments on his sample, concluding that it was a new undecomposable substance with similar chemical properties to chlorine and it formed a new acid with hydrogen (46). In fact Davy's results were published in December 1813, at almost the same time as Gay-Lussac's first two papers on iodine (47, 48) before his lengthy memoir of 1814 (43).

Bernard was clearly acknowledged as the discoverer of iodine by these distinguished chemists, two years after the important event. Meanwhile he had generously provided samples and discussed the substance with pharmacist friends, and articles began to appear in the journals of pharmacy (49). He was rewarded for this loyalty some years later about 1820 when German doctors visiting Paris told him about the numerous valuable medicinal properties that iodine possessed (50). This was known from medical research by the Swiss doctor Jean-Francois Coindet (1774-1834), who found that iodine was an effective remedy for goitre and several other ailments (51). Soon afterwards, hoping to

profit from his discovery, Bernard decided to change his business and manufacture iodine and its salts. However he was still a *salpêtrier* when his son Louis was born in 1816, for although his business at 9 rue Saint-Ambroise was not in *L'Almanach du commerce de Paris* from 1815-1817, it appeared from 1818-1821.

The Napoleonic wars were over, and importation of cheap Indian saltpeter began in 1815, making manufacturing less profitable. Bernard realized there would be a demand for iodine so, helped by Clément and Désormes, he developed an industrial process using chlorine to extract iodine from mother liquors of seaweed ashes (52). He first appeared as a manufacturer of high quality iodine and its salts in 1822, at a new address in the old historic center of Paris, 3 Quai de la Cité (now part of Quai la Corse). However the next year he was back in the district of Popincourt, a short distance north of rue Saint-Ambroise, at 36 rue des Trois-Couronnes from 1823-1824, then at number 26 from 1825-1833 (38). This district became inconveniently isolated from the city center when the nearby canal Saint-Martin was completed in 1825. However, from 1814, he also sold his products from depots at addresses in other districts, shown in the Table.

Bernard's business remained small although inevitably, demand increased as more was known about the medicinal properties of iodine. As early as 1824 another



**Figure 4.** View along Rue Saint-Ambroise near the church. The white van is parked near number 9. (photo by the author, 1997)

factory opened producing relatively large quantities, managed by M. Tissier for Baron d'Aigremont. Then Tissier joined Couturier's Cherbourg soda manufacturing company to set up a factory for the manufacture of iodine and salts from seaweed ashes. This was soon producing 400 kg of iodine a year at a price of 100 francs a kilogram (Bernard charged 600 francs). In 1830 Tissier was a co-founder of a factory at Conquet, Finistère, which became well-known for its iodide of potassium. Nevertheless Bernard's modest business survived until it was taken over by Couturier & Company in 1835. He then went to live in lodgings at number 12 l'Impasse des Récollets (38).

Although trading on his reputation as the discoverer of iodine, Bernard found it difficult to make a living as a manufacturer and salesman; but he persevered for many years. He received recognition for his valuable contribution to medicine in 1831, when *l'Académie royale des sciences* awarded him 6,000 francs as part of its Montyon prize, on the recommendation of his friend the distinguished chemist Louis-Jacques Thénard (19). Nevertheless when he died at his lodgings on September 27, 1838 at the age of 62, he left no assets for his widow and son. He was buried in a temporary grave for five years at the cemetery of the North, but what finally happened to his remains is not known. Madeleine, his widow, struggled against the misfortunes of poverty and ill-health for many years. At the time of her death in 1859 aged 70, she had a few possessions and a small pension (38). As the widow of Bernard Courtois, discoverer of iodine, she had received financial help, somewhat belated, from the Society for the Encouragement of National Industry and the Society of Pharmacy.

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3. Ref. 1, Ch. 1.

**Table 1** *Depots for Iodine and Salts produced by Bernard Courtois*

Year	Address	Reference
1814	rue de Vieille-du-Temple (with pharmacists MM Vallee & Baget)	(49)
1814	rue Saint-Victor	(49)
1827-1829	15 rue Jacob	(38)
1830-1832	17 rue Jean-de-l'Épine	(38); the road is now part of rue de la Coutellerie (30)
1833-1834	6 rue des Enfants-Rouges (chez Lecreux)	(38); this road, now part of rue des Archives, was near l'hôpital des Enfants-Rouges (30)

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14. W. A. Smeaton, "Fourcroy, Antoine François de," in C. C. Gillispie, Ed., *Dictionary of Scientific Biography*, Charles Scribner's Sons, New York, 1970-1979, Vol. 5, 89-93.
15. A collection of documents in a folder headed "Thénard - Préparateur de Chimie: 1798. Professeur de Chimie: 1810 -1836," is available at the École Polytechnique Bibliothèque Centrale Archives, Palaiseau, Paris.
16. Ref. 15, Thénard's posting is known from a letter dated, "25 August 1799 (*le 8 fructidor an 7*)," from "Le Ministre de la Guerre au C<sup>en</sup> Thénard préparateur de Chimie, à l'École Polytechnique à Paris."
17. S. Pierson, "Séguin, Armand," in Ref. 14, Vol.12, 286-287.
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28. M. Bradley, "Science Education versus Military Training: The Influence of Napoleon Bonaparte on the Ecole Polytechnique," *Annals Sci.*, **1975**, 32, 415-449.
29. Ref. 1, Annexes Pièce 2.
30. J. Hillairet, *Dictionnaire Historique Des Rues De Paris*, Les Editions de Minuit, Paris, 1963; see details for *Nation (place de la)*.
31. Historical details from two wall plaques in Paris: "Eglise et cimetière Sainte-Marguerite," on the wall inside the church of Sainte-Marguerite near the rue St. Bernard entrance, and "La paroisse du Faubourg," in rue St. Bernard on the wall outside the church.
32. Plan of Paris 1734-1739, commissioned by Michel Etienne Turgot.
33. Ref. 1, Annexes Pièce 9.
34. Ref. 1, Annexes Pièce 5.
35. Ref. 1, Annexes Pièce 6.
36. Ref. 1, Annexes Pièce 8.
37. Ref. 1, Annexes Pièce 7.
38. Ref. 1, Ch. 8.
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40. Ref. 30, see details for *Guilhem (rue)*.
41. Cadastre de Paris Microfilm Document F/31/61, "Pièce 144 Quartier Popincourt Maison Rue S<sup>t</sup> Ambroise N<sup>o</sup> 9," *Centre d'accueil et de recherche des Archives nationales (CARAN) Paris*. "En face de l'abattoir" is handwritten on Pièce 159 Maison Rue S<sup>t</sup> Ambroise N<sup>o</sup> 11.
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