

# JEAN-BAPTISTE AND ANSELME PAYEN, CHEMICAL MANUFACTURERS IN GRENELLE NEAR PARIS (1791-1838)

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## Introduction

French scientist Anselme Payen discovered cellulose in 1838 after having been a manufacturer of chemical products for more than twenty years. His memory is honored annually by an award of the American Chemical Society's Cellulose and Renewable Materials Division (1).

The study of Payen's family and professional notarial acts (2) gives a new vision of their industrial activities, how they were developed through partnerships with other manufacturers, and how and why they ended. The present paper is based on the analysis of close to thirty acts from 1791 to 1863 coming from seven Parisian notarial offices. These notarial acts about Anselme Payen and his family members and industrial partners report births, marriages, deaths, inheritances, sales of properties and factories, and creations, mergers and dissolutions of companies. By focusing on how these chemical product companies were organized and run, this work complements two papers dealing mainly with the scientific and technical activities of Anselme Payen (3).

## The Payen Family

Although not a proper biography of Anselme Payen, several hagiographic papers written a few months after his death inform us about his family and his youth (4). Jean-Baptiste, the father of Anselme, was a magistrate

who studied law but also science and founded a chemical manufacture in 1791. It was located in the Grenelle plain in the town of Vaugirard, currently in southwest Paris. The same year, he married Marie-Françoise Janson or Jeanson depending of the notarial acts. Anselme, born in 1795, was educated at home by his father. During his youth, Anselme met famous scientists who were friends of his father, among them, Claude-Louis Berthollet, Jean-Antoine Chaptal and Louis-Nicolas Vauquelin. Anselme was invited to visit their laboratories and spent time daily in the factories of his father where he started to work at the age of nineteen. The factory was managed by Anselme Payen after the death of his father in 1820 until 1838 and became one of the main manufactures of chemical products of its time (5).

## Constitution of Land and Industrial Properties by Jean-Baptiste Payen

In 1791, Jean-Baptiste Payen bought a mansion, called *la Maison Blanche*, and the surrounding land in the Grenelle plain on the Seine river's left bank (6). When married, he lived there and started a chemical factory in those buildings (7). During the next twenty years, he continued to buy land properties in the same area, mainly former *biens nationaux*, which were properties confiscated during the French Revolution. In 1820, at the end of his life, Jean-Baptiste Payen owned 7 hectares of land in Grenelle, extending about 500 meters along the

Seine river left bank and mainly dedicated to chemical industry (8).

Two days after his marriage, Jean-Baptiste joined his brother Pierre and Jean Carny to form a company called *Payen frères et compagnie* to produce soda in Grenelle (9). Carny was a chemist involved in gunpowder manufacturing who held a patent on obtaining soda (10). The patented process was based on a reaction between iron sulfate and sea salt to obtain crystallized sodium sulfate which was then reduced with coal powder to produce sodium sulfide. The next step was to make sodium sulfide react with sodium plumbate after the dissolution of both products in water, and then to finally obtain soda after separation from solid lead sulfide. The company was dissolved before two years of existence probably due to poor economic results (11), because Carny's process to manufacture soda was far less effective and profitable than the Leblanc process which prevailed from this time for close to the next century (12).

This industrial failure did not stop Jean-Baptiste from investing in chemical industry. Following unsuccessful attempts by Antoine Baumé to produce sal ammoniac (13), both Jean-Baptiste in Grenelle and the Pluvinet brothers in Clichy (a town touching Paris at the northwest) restarted its manufacturing process from 1797 (14). Their process was based on distillation of animal waste. Sal ammoniac manufactured in both plants was sold by a joint company between Payen and the Pluvinet brothers. Total quantities between 25 and 80 tons were manufactured annually in both plants, occupying between 50 and 120 workers (15). In 1820, the inventory at the death of Jean-Baptiste indicated that 14 tons of sal ammoniac were stored by this joint company for a value of 40,000 francs (16). The same notarial act assessed the quantity of chemical products stored by Jean-Baptiste in his own factory at 107 tons, among them 78 tons of crystallized sodium sulfate valued 9,400 francs and 26 tons of ammonium sulfate valued 14,000 francs.

### **Manufacture Management by Anselme Payen and his Mother**

After the death of Jean-Baptiste Payen on February 20, 1820, his widow inherited all properties located in Grenelle. They included the sal ammoniac factory and a strong glue factory which were both evaluated at 110,000 francs. Anselme, his brothers and sisters inherited other properties. Anselme received shares of two houses in Paris for a value of about 65,000 francs.

Anselme who wished to become a manufacturer, had for the time being to share the factory management with his mother. Together they created a company called *Veuve Payen et fils* in which they each invested 80,000 francs. This investment was done in cash by the son and mainly in raw materials, products and equipment by the mother. Anselme was in charge of manufacturing and his mother dealt with accounting. Pursuant to article 9 of the company statutes, in case of death of one of the associates, the other one became owner of the company and had only to pay cash to the heirs of the deceased associate for the shares to which they were entitled (17). After his mother's death, Anselme Payen paid to her heirs a total amount of 1,999 francs and became in April 1823 the only owner of the chemical products manufacture located in Grenelle (18).

### **Manufacture Development by Anselme Payen and his Associates**

The first partnership of Anselme Payen was dedicated to producing and marketing *noirs* which were black powders, generally of organic materials, mostly bones, but sometimes of vegetable matter, which all were first carbonized and then ground. These *noirs* were initially used as coloring agents, the highest quality being made from ivory. A new application of these powders was developed by Pierre Figuier in the first years of the 19<sup>th</sup> century for the discoloration of beet juice and then sugar cane juice in the sugar industry (19). These new markets drastically increased the demand, pushing Julien Lecerf and Antoine Didier, both already associated with each other as manufacturers of *noirs*, to join Anselme Payen and create the *Payen, Lecerf et Didier* company on January 28, 1824. Both moved their factories from Paris to Grenelle to merge them with Payen's. The merger enabled the company to invest in a steam machine to replace horse power for grinding carbonized bones (20). At that time, it was a rare piece of equipment, the number of steam machines being estimated at only 625 in all France in 1830 (21). The use of this steam machine enabled them to complete the entire process in Grenelle, eliminating the need to transport carbonized bones to a grinding mill located on the Bièvre river, a few miles from Grenelle.

The next steps of partnership were mergers concluded with *Salmon, Lupé et compagnie*. This company was founded by Louis-Joseph Salmon and the Lupé family (Pierre-Augustin the father, Charles-Auguste the son and Pauline the daughter), to produce *noirs*, sal ammoniac and fertilizers in a factory also located in Grenelle. The

company's foundation and both the following mergers occurred in September 1832.

The first merger was made between *Salmon, Lupé et compagnie* and *Payen, Lecerf et Didier* to give birth to *Payen, Salmon et compagnie*. This company rented the factory belonging to Payen, Lecerf and Didier for an annual fee of 5,400 francs and manufactured the following there: *noirs*, Glauber salt (22), Epsom salt (23), *eau de Javel* (24) and volatile alkali.

The second merger was made between *Salmon, Lupé et compagnie* and Anselme Payen himself to create the *Salmon, Payen et Lupé* company. Manufacturing was done in the Salmon and Lupé factories and in one of the Payen factories. The products were mainly *noirs* and sal ammoniac.

Borax manufacturing in Grenelle by Payen was kept outside of these joint ventures and operated directly by him.

The management of both joint ventures was similar. All manufacturing was under the management of Louis-Joseph Salmon, also including the responsibility of purchasing, logistics, maintenance and human resources. Both Lupé father and son were in charge of payments and accounting. All associates including Payen, Lecerf and Didier were in charge of sales. Two new functions appeared which are now common in most industrial companies. Antoine Didier was in charge of product applications including testing in the factory and customer assistance for *Payen, Salmon et compagnie*. Anselme Payen was responsible for external communications with the mission of promoting success of the *Salmon, Payen et Lupé* company by demonstrating products' utility and environmental safety of the factories (25).

On November 6, 1833, Anselme Payen and his wife Zélie, borrowed 100,000 francs at 5% interest. This loan was secured by a mortgage on fifteen properties, in fact all land and factories belonging to them on the Grenelle plain. A part of this loan was to be invested in the Payen companies: 25,000 francs in the merged company *Payen, Lecerf et Didier* to develop *noirs* manufacturing, and 15,000 francs in *Salmon, Payen et Lupé* company to develop fertilizer manufacturing (26). A few months later, both companies were in trouble. Following unknown disagreements between associates, the Lupé family left both companies on January 25, 1834. The choice of a new partner to replace them caused a conflict between the remaining associates leading Lecerf to also quit both

companies on March 14, 1834. Finally, on March 31, 1834, both companies were dissolved (27).

On that same day, Anselme Payen shared his borax activity with Guillaume Buran by creating a new company with him. As mentioned above, Payen had always kept the borax factory located in Grenelle separate from other manufacturers. This partnership may be seen as a need for cash by Payen who brought his factory and equipment to the company when Buran brought 15,000 francs in cash. At the beginning of the 19<sup>th</sup> century, sodium borate known as borax was used for its melting properties in welding products and in enamel compositions (28). Both associates brought to the company the market shares of borax they had in France, mainly in Lyon and Marseille, and equally shared profits and losses (29).

Another thing occurred on that fateful day of March 31, 1834: Payen and Salmon associated with Buran (we think he was the partner Lecerf refused to work with) to create a new company called *Salmon, Payen et Buran*. This company, whose starting date was January 1, 1834, was organized in three branches: patent management, manufacturing, and sales.

The first mission of this new company was to exploit, sell or grant patents, mainly on *noirs* and fertilizers, which were previously the property of *Salmon, Payen et Lupé* and of *Payen, Salmon et compagnie* and were taken by the new company. The job definition of the clerk in charge of patents' management included to conclude agreements, to sell or grant patents and to monitor their application in factories, to pursue counterfeiters for damages and for destruction of counterfeited products (30).

The second mission under the supervision of Salmon was to run the factories which the company rented to their owners Payen, Lecerf, Didier and Salmon. For example, the plant owned by Payen which produced sal ammoniac and bitumen was rented annually for 600 francs, and the plant owned by Payen and Salmon which produced fertilizers was rented annually for 2,000 francs.

The third mission ensured by Payen and Buran was to sell products manufactured by Salmon according to a contract among all of them which defined the annual quantities to be sold. These forecasted quantities, which had to be updated every year, are listed in table 1 for the whole year 1834.

Payen and Buran being responsible for increasing sales, Salmon engaged by contract to produce up to three times the above quantities if he was alerted three months in advance and if Payen and Buran were reliable for three years on the new quantities.

Selling prices and net profits were given in this contract for some products. Let's take the example of ammonium sulfate which was the product with the highest annual profits according to the forecast in the contract. The selling price was 1 francs/kg with a usual discount of 3% giving a real selling price of 0.97 francs/kg. The net profit was estimated at 0.27 francs/kg giving a margin of 28%. Calculations for 60 tons of ammonium sulfate manufactured and sold according to year 1834 forecast indicate 58,200 francs in receipts and 16,200 francs of net profit. These forecasted profits for one product were significantly higher than the rent of the factories where several other products were also manufactured.

### Environmental Conflict

In addition to the products above mentioned, Payen and Salmon planned to start production of a new fertilizer. *Noirs* after being used to discolor syrups in the sugar industry were mostly recycled as fertilizers first in England and then in France. The quantities of this fertilizer were limited by the sugar industry needs of discoloration products, but the market demand for such fertilizers was growing. To answer this high demand, Salmon filed two patents on new fertilizers. The first one filed on May 14, 1829, was dedicated to a fertilizer made from a mixture of carbonized sludge and waters with organic residues, for example from tallow plants (31). The second patent

filed on December 19, 1831 intended to replace those waters by human fecal matter through a process which was claimed to be odorless (32). This process had two main advantages. First, the use of human fecal matter as a

raw material was a solution to its treatment which was a huge problem for large cities such as Paris (33). Secondly, carbonization of sludge used the same process and equipment as the *noirs* manufacturing: vertical iron cylinders with a small hole on the top which were placed in a furnace and heated. When the cylinders were incandescent a small flame appeared at the hole and the treatment was finished when the flame disappeared. The fertilizers obtained by these processes had the same attractive appearance of the recycled *noirs* which facilitated their sales.

To manufacture these fertilizers Payen and Salmon wanted to create two new factories in Grenelle, a rendering one, and another one for the heat treatment of sludge and the mixing of the fertilizers' components. According to the decree from

October 15, 1810, on uncomfortable and unhealthy odors, factories which were listed in the first category needed to be authorized by the *Conseil d'État* before starting (34). Payen and Salmon finalized their authorization request in 1833.

The mayors of Auteuil and Passy (two towns close to Grenelle but on the other side of the Seine river) and most of the neighbors of the projected factories living in Grenelle and Vaugirard opposed the project. They all feared pestilential odors coming first from transportation and storage of dead animals and fecal matters, but also from preparation and use of these materials. One additional fear of the opponents was that if such a polluting industry was authorized on the Grenelle plain, it would open the doors to the installation of other polluting fac-

**Table 1.** Amounts of products to be manufactured by Salmon and sold by Payen and Buran for year 1834.

Product	Quantity (ton)
Sal ammoniac (grey)	31
Sal ammoniac (white)	5
Ammonium sulfate	60
Bone tallow	36
Muscle flesh	24
Desiccated blood	4
Liquid ammonia	18
Sodium sulfate (raw)	36
Sulfates (crystallized, half Epsom salt, half Glauber salt)	18
<i>Noirs</i> from bones (granulated and ground, for the 3 first months of the year)	60
<i>Noirs</i> from bones (granulated and ground, for the 9 last months of the year)	315
Fertilizers	24
Ivory <i>noirs</i>	24
Vegetal <i>noirs</i>	24
Coal (ground)	60

tories in the same area. Indeed, manufacturers favored this kind of grouping because it enabled them to hide the origin of one nuisance behind another one when they addressed complaints from the surrounding neighborhood.

Technical experts were opposed to the way both patents would be applied practically at large scale to guarantee that the process of mixing carbonized sludge and organic residues would be really odorless. Payen and Salmon demonstrated it on small amounts of products by having respected the ratio of sludge versus organic matter which was explained in the patents. Some opponents argued that for larger quantities of organic matters to be treated, the respect of this ratio would be too costly and would impact too negatively the whole economic balance of the process to be maintained (35).

The *Conseil consultatif des arts et métiers* which had the official mission of counselling the *Conseil d'État* concluded that its six members who were consulted on this topic disagreed on the authorization of both factories. Half of its members were in favor of authorizing the factories if the organic matters were covered during their transport and storage and if the ratio of carbonized sludge versus organic matters was strictly respected. The other half of the members opposed the authorization of the factories with the arguments that manufacturers never respect recommendations because of economic interest or negligence by the factory workers (36).

Finally, in 1837, the *Conseil d'État* did not authorize the rendering factory and the other one for the heat treatment of sludge and the mixing of the fertilizer components, depriving Payen and Salmon of a new source of income (37).

### **Guillaume Buran and the *Manufacture de produits chimiques de Grenelle***

Salmon left the *Salmon, Payen et Buran* company, which was renamed as *Payen et Buran*, in July 1834, to focus on manufacturing fertilizer in several regions of France (38). On May 3, 1838, the *Payen et Buran* company went bankrupt and was dissolved, showing that the forecasted turnover and profits (shown above for year 1834) were highly too optimistic. Both associates agreed that Buran had to cover the company losses with 40,000 francs in cash and that in exchange Payen had to abandon all his patents, equipment, raw materials and finished products. On the same day Payen and his wife had also to sell to Buran 2.5 hectares of their land in Grenelle for 70,000 francs (39).

To host all the factories he possessed himself and that he recovered from Anselme Payen, Buran immediately founded *Buran et compagnie*, one of the first French private limited companies. This kind of company had the advantage of opening the capital to an extended number of shareholders with a responsibility limited to the shares amount and was one of the first of the large industrial companies (40). The company's capital was fixed at 1,000,000 francs and divided in 1,000 shares of 1,000 francs each. Buran who possessed 550 shares of the company had the whole responsibility of the operation for it and was entitled to receive 30% of its profits.

The commercial brand of the company was *Manufacture de produits chimiques de Grenelle*. It manufactured and sold numerous chemical products: borax, enamels, *noirs*, ammonium sulfate, ammonium chloride, volatile alkali, quicksilver salts, refined camphor and sulfur. It also prepared and used animal flesh and blood for the manufacturing of fertilizers and prussiates.

Buran kept Payen in the company as manufacturing expert, giving him 25 shares with 5% of the company's profits and the use of a house and a laboratory located in the plant.

### **Indebted Anselme Payen**

After May 1838, Anselme Payen was no longer a manufacturer but became an employee of his former associate Guillaume Buran. In addition to having lost all his factories, he and his wife had accumulated significant debt.

They both had difficulties repaying the mortgage loan of 100,000 francs contracted in November 1833. This loan had to be repaid in November 1837 but was rescheduled at least until 1851 (26). In March 1842 they were obliged to again borrow 40,000 francs, through a new mortgage loan. As all their properties were already mortgaged Anselme Payen had to ask his sister Amélie and her husband who was a forge master to grant them an absolute guarantee (41). In January 1843 Anselme Payen and his wife had to borrow again 55,000 francs (42).

In addition to borrowing money, Anselme Payen sold most of his remaining land properties in Grenelle. These properties were mostly sold to craftsmen who already rented them. Between 1839 and 1863 Payen sold properties for an amount of at least 240,000 francs (43).

## Conclusion

Although Anselme Payen's life as a manufacturer ended in a bankruptcy and in a failure which forced him to sell all his factories and land properties, this rich experience of manufacturing gave him an advantage over most of the scientists of its time: "M. Payen had had this singular fortune of being a learned industrialist before being an industrial scientist (44)." That manufacturing experience enabled him to develop industrial skills which, combined with his scientific knowledge, allowed him to create the first industrial chemistry teaching chair in France in 1839 at the *Conservatoire des arts et métiers de Paris*, and finally enter the *Académie des sciences* in 1842.

## References and Notes

1. The Anselme Payen Award is presented by the American Chemical Society to honor and encourage outstanding professional contributions to the science and chemical technology of cellulose and its allied products.
2. Almost all Parisian notarial acts, regardless of the political regime changes, since the end of the 15<sup>th</sup> century up to the beginning of the 20<sup>th</sup> century, are kept at the Archives Nationales in Paris which is abbreviated as AN in the references.
3. (a) J. Mertens, "Anselme Payen (1795-1871), Learned Manufacturer of Chemical Products," *Ambix*, **2003**, *50*, 182-207. (b) J. Wisniak, "Anselme Payen," *Educación Química*, **2005**, *16*(4), 568-580.
4. (a) J.-A. Barral, "Éloge biographique de M. Anselme Payen," *Mémoires publiés par la Société centrale d'agriculture de France*, **1873**, 67-87. (b) A. Girard "Éloge de M. Payen," *Annales du Conservatoire des Arts et Métiers*, **1871**, *9*, 317-331. (c) "Nécrologie de M. Payen avec discours funèbre de M. Chevreul," *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, **1871**, *18*[ser. 2], 246-251.
5. F. Jarrige and T. Le Roux, *La contamination du Monde, une histoire des pollutions à l'âge industriel*, Seuil, Paris, 2017, p 71.
6. AN, MC/ET/LXXXIV/643.
7. AN, MC/ET/LXXV/879.
8. AN, (a) MC/ET/LXXV/926. (b) MC/ET/LXXV/1035.
9. AN, MC/ET/LXXV/879.
10. French Patent Nr 1BA1373, *Fabrication de la soude et du sulfate de soude, extrait du sel marin*, filed Jan. 31, 1792, granted Feb. 12, 1792.
11. AN, MC/ET/LXXV/896.
12. J. G. Smith, *The Origin and Early Development of the Heavy Chemical Industry in France*, Clarendon Press, Oxford, 1979, p 209.
13. T. Le Roux, *Le laboratoire des pollutions industrielles: Paris 1770-1830*, Albin Michel, Paris, 2011, p 139.
14. Ref. 5, p 250.
15. Ref. 12, p 311.
16. AN, MC/ET/LXXV/1035.
17. AN, (a) MC/ET/CIII/243. (b) AN, MC/ET/LXVII/958.
18. AN, MC/ET/LXVII/947.
19. L. Figuiet, "Pierre Figuiet et la découverte des propriétés décolorantes du noir animal," *Moniteur scientifique - Quesneville*, **1895**, *9*[ser. 4], 5-14.
20. AN, MC/ET/LXVII/950.
21. Ref. 5, p 65.
22. Glauber salt: sodium sulfate.
23. Epsom salt: magnesium sulfate.
24. *Eau de Javel*: aqueous solution of sodium hypochlorite.
25. AN, MC/ET/CIII/289.
26. AN, MC/ET/LXVII/990.
27. AN, MC/ET/LXVII/991.
28. A. Payen, *Précis de chimie industrielle: à l'usage des écoles préparatoires aux professions industrielles et des fabricants*, 1<sup>st</sup> ed., L. Hachette, Paris, 1849, pp 228-229.
29. AN, MC/ET/LXVII/992.
30. AN, MC/ET/LXVII/996.
31. French patent Nr 1BA3208, *Nouvel engrais*, filed May 14, 1829, granted June 13, 1829.
32. French patent Nr 1BA3845, *Composition d'un nouvel engrais*, filed Dec. 19, 1831, granted Jan. 27, 1832.
33. L. Roux, *De Montfaucon, de l'insalubrité de ses établissements et de la nécessité de leur suppression immédiate*, Delaunay, Paris, 1841, p 3.
34. The decree from October 15, 1810, on uncomfortable and unhealthy odors defined three categories of activities producing industrial nuisances. Industrial sites of the first category had to be away from homes and needed to be authorized by the *Conseil d'État*, the highest French administrative authority, after a *commodo* and *incommodo* investigation. Second-category industrial sites could be authorized close to homes by regional administrative authorities after a *commodo* and *incommodo* investigation. Third-category industrial sites could be authorized close to homes directly by regional administrative authorities after the mayor's opinion. For more information on this decree see G. Massard-Guilbaud, *Histoire de la pollution industrielle: France 1789-1914*, EHESS, Paris, 2010, pp 43-46.

35. Bessas-Lamegie, Breschet et Legrand, *Commission de salubrité du 10<sup>e</sup> arrondissement, rapport à monsieur le Conseiller d'état Préfet de police, sur l'établissement de MM. Salmon, Payen et Lupé, à Javelle, commune de Grenelle, banlieue de Paris, pour fabrication de noir animalisé, etc.*, E. Duverger, Paris, 1834.
36. AN, F/12/4797, *Avis du Conseil Consultatif des Arts et Manufactures*, 18 octobre 1835.
37. J.-B. Dumas, L.-J. Gay-Lussac, P.-L. Dulong, E. Chevreul, F. Savart, "Prix relatifs aux moyens de rendre un art ou un métier moins insalubres," *C. R. Séances Acad. Sci.*, **1837**, 5, 216-226 at 218.
38. AN, MC/ET/LXVII/993.
39. AN, MC/ET/XXI/938.
40. F. Braudel and E. Labrousse, Eds., *Histoire économique et sociale de la France*, PUF, Paris, 1976, vol. 3, p 528.
41. AN, MC/ET/LXVII/1032.
42. AN, MC/ET/LXVII/1036.
43. AN, (a) MC/ET/X/1189. (b) MC/ET/X/1219. (c) MC/ET/XXVIII/1109. (d) MC/ET/LXVII/1135. (e) MC/ET/LXVII/1143. (f) MC/ET/LXVII/1148. (g) MC/ET/LXVII/1149.
44. Ref. 4(b), p 318.

### About the Author

Paul Netter was educated as a chemical engineer. After working 35 years in industry, he gained a Master of History degree at EHESS in Paris (France) writing his thesis on the subject of Payen's factories.

### 2020 Partington Prize to Mike A. Zuber

The Society for the History of Alchemy and Chemistry (SHAC) is delighted to announce that the winner of the 2020 Partington Prize is Dr Mike A. Zuber of the University of Queensland for his article "Alchemical Promise, the Fraud Narrative, and the History of Science from Below: A German Adept's Encounter with Robert Boyle and Ambrose Godfrey."

Dr Mike A. Zuber is a Postdoctoral Research Fellow at the Institute for Advanced Studies at the University of Queensland. He obtained his doctorate with distinction at the University of Amsterdam in 2017 and subsequently received grant funding from the Swiss National Science Foundation for a postdoc project based at the University of Oxford. He has published on the scientific, religious, and intellectual history of the seventeenth century, with particular expertise in German-speaking contexts.

SHAC established the Partington Prize in memory of Professor James Riddick Partington, the Society's first Chairman. It is awarded every three years for an original and unpublished essay on any aspect of the history of alchemy or chemistry. The prize-winning article will appear in the Society's journal, *Ambix*, in due course.