RESEÑA BIOGRAFICA

Jean Antoine Chaptal

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RESUMEN: Jean Antoine Chaptal (1756-1832) fue un químico aplicado que no nos dejó ningún principio teórico que lleve su nombre. Se dedicó totalmente a aplicar los principios científicos a la industria con el fin de disminuir la dependencia de Francia de las importaciones, primero al nivel local en los Estados de Laguedoc y luego a nivel nacional. Se transformó en político y ocupó muchos cargos públicos de importancia que lo ayudaron a alcanzar sus metas industriales. Fue Ministro del Interior de Napoleón y difícilmente escapó tres veces de ser guillotinado. En la cima de su carrera alcanzó gran riqueza para perderla más tarde y vivir una vida modesta hasta su muerte.

ABSTRACT: Jean Antoine Chaptal (1756-1832) was an applied chemist who did not leave us with any theoretical achievement that bears his name. He devoted himself to the application of scientific principles to industry to decrease France's dependence on imports, first at the local level of the Estates of Languedoc and then at the national level. He became a politician and served in many high public offices that helped him achieve his industrial goals. He was Minister of Interior of Napoléon and scarcely escaped the guillotine three times. At the zenith of his career he was extremely rich, later he lost most of his fortune and lived a modest life until his death.

Life and career[1,2]

Jean Antoine Chaptal was born in Nojaret, Lozère, France, on September 5, 1756, the son of Antoine Chaptal (1718-1772) and Françoise Brunel, relatively well-off landowners. At the age of 10 he was taught rudiments of Latin by Jean-Antoine Carylar de Bardon to allow him to enter, in 1767, the religious *Collége de Mende*, (managed by the *Pères de la Doctrine Chrétienne*) where he spent the next five years. In 1772 he was admitted to *Collége de Rodez*, to finish his basic education and obtain the Bachelor of Arts, the basic admission requirement to a university.

Jean Antoine's father passed away on May 10, 1772, at the age of 64 and the eldest sons took charge of the family business. His uncle, Claude Chaptal (1699-1787), was a very successful and prosperous physician that had graduated from the *Université de Médecine de Montpellier*. Claude was childless and probably this is the reason why he took his 16-years old nephew under his protection and became more than a tutor to him; he was truly a foster father. Although Claude was not a royal professor, he was senior vice-professor of anatomy and botany at the University and a well-known and appreciated person in Montpellier. All he did to help the advancement of his nephew was a typical example of the nepotism common to many societies.

In September 1774, the young Chaptal registered at the Université de Médecine from where he received his bachelor degree in medicine on November 5, 1776, and his medical license on April 11, 1777. On April 24 he was admitted to the *Societé Royale des Sciences de Montpellier* (Note 1) as *adjoint anatomiste*, (assistant anatomist) and on May 1 he received his diploma of *docteur en médecine*. In the same year he read his first memoir *Le Mécanisme de la Respiration* (The mechanism of respiration). In 1787 he transferred to the chemical section also as assistant, and in 1789 he was promoted to associate member in the mathematics section of the Society.

Chaptal never forgot what his uncle had done for him. He dedicated him his medical thesis "*Conspectus Physiologicus de Fontibus Differentiarum Inter Homines, Relative ad Scientias*" (A Physiological Treatise on the Origin of Differences Between Humans Based on Science), a 62-page tract, written in Latin, presented on November 5, 1776. This thesis was later reedited, a fact that "ce que ne s'etait jamais vue" (never seen before in Montpellier).[2] About ten years later, when he was already very famous, he wrote to the *Société Royale de Médecine* de Paris recommending that they publish his uncle's work.

In spite of his medical studies, Chaptal was never inclined to practice the profession, for this reason, on the fall of 1977; he

departed for Paris with Jean-Jacques Régis Cambacérès (1753-1824) (Note 2). There he took courses of obstetrics with Jean-Louis Baudelocque (1746-1810) and courses of chemistry and mineralogy with Jean-Baptiste Bucquet (1746-1780), Pierre Mitouard (Note 3), Balthazar-Georges Sage (1740-1824), and Jean-Baptiste Romé de l'Isle (1736-1790). While in Paris, Chaptal continued to contribute scientific memoirs to the *Societé*, on different medical subjects.

On September 11, 1781, he married Anne-Marie-Rose Lajard at the Notre-Dame des Tables church. This marriage was extremely beneficial for Chaptal not only because of the dowry contributed by the bride but also because her family was extremely well related in society and industry.

Chaptal made a very fast career, already in 1789, under the kingdom of Louis XVI, he was appointed to the chemistry chair created in 1780 in Montpellier by the Estates of Languedoc; he was director of many mining and manufacturing enterprises; a member of the Royal Order de Saint-Michel, and after May 12, 1788, a member of the nobility.

Chaptal (the same as Le Châtelier did later) tried to conciliate industry and science. He believed was that by the use of chemistry in manufacturing processes it would be possible to liberate France from the tribute she was paying every year by importing products for which there was no reason she could not manufacture herself. He used to criticize manufacturing chemists who complained of the arbitrary progress of certain operations, saying: "Nature...obeys invariable laws; and the inanimate substance which we make use of in our manufactures exhibits necessary effects in which the will has no part and consequently in which caprices cannot take place."[2]

In 1782 he installed in Le Paille, near Montpellier, an industry for manufacturing sulphuric, nitric, and hydrochloric acids, alums, sodium sulfate, red and brown colors, red of Andrianopolis, colors for cotton, enamels for bricks, copper sulfates and copper acetate, glass for bottles, and pozzolans (Figure 1). His principal collaborator was Etienne Bérard (1764-1839) who was also his *préparateur* for the chemistry course he gave at Montpellier. This factory continued to be prosperous even after Chaptal's death. In was managed first by Etiene Bérard and then by the son of the latter, Jacques-Etienne (1789-1869), who closed it in 1863. An interesting item is that when years later a railroad was built in the area the station next to the chemical factory was named *Gare Chaptal.*

In 1788, the Estates of Languedoc petitioned and obtained from Louis XVI that Chaptal be awarded him nobility at the Cross of Saint-Michel, as a reward for what he done to his province.

Chaptal studied many applications of chemistry to industry; he published his book *Eléments de Chimie* that eventually would become *Chimie Appliquée aux Arts*[3], the first French work on industrial chemistry. Two important industrial projects realized by Chaptal were the production of red brown pigment and sulphuric acid. At that time the pigment was imported from England and Spain. The sulphuric acid he began manufacturing was of better quality and cheaper than the one imported from England. Within ten years Chaptal established himself as talented entrepreneur that put the results of his chemical research into industrial acts. All these projects made Chaptal very rich and he invested his fortune wisely. Among his investments was purchasing the Hotel Joubert in Montpellier.

In 1789 he became infected with enthusiasm by the reforms that would take France away from a regime hated by everyone, but the way in which the Assemblies put in practice the revolution ideas, which were generous and just in theory, transformed him eventually into a counter revolutionary.[4] During the first months of 1793 he was appointed *Président du Comité Fédéraliste du Midi*, a committee that congregated the delegates of thirty-two Departments and during the siege was located in Montpellier. He took under his responsibility the organization of the troops, which were to fight those of the Convention.

In the early 1790's war was desolating Lozére and the North-west of France. Chaptal was denounced and imprisoned. Fortunately he was released from prison and being liberated he hid safely in the Cévennes. It was there that his family sent him an edict from the Committee of Public Health, dated December 24, 1793, appointing him *Inspecteur Général des Poudres et Saltpêtres* (General Inspector of Gunpowder and Salpetre) for the Midi of France: "Le besoin de saltpetre se fait sentir par toute la République. La chimie est une des occupations humanes don't la République doit tirer un des ses plus puissants secours pour sa défense. ... C'est au nom de la Patrie que nous t'invitons et qu'au besoin, même, nous t'enjoignons de te render a Paris"[1] (There is a need of saltpetre in all of the Republic. Chemistry is a profession from which the Republic should obtain the most powerful aids for its defence... It's in the name of your country, who in her out of necessity looks to you, that we command you to come to Paris). This order was signed by Lazare Carnot (1753-1823) and Prieur de la Côte-d'Or (1763-1832).[2] Under the pressure of his friends, Chaptal accepted the appointment. After reporting to Maximilien Robespierre (1758-1794) he started working in the general inspection until three months later a second edict arrived, issued on April 22, 1794, appointing him *Directeur de l'Agence Révolutionnaire des Poudres et Saltpêtres* (Agency of the Revolution for Gunpowder and Saltpeter) and ordering him to organize the manufacture of explosives (see below).

It is hard to explain how Chaptal, thus compromised, was able in the middle of the Terror regime, to evade the scaffold and receive these high functions (his dossier had been presented three times to a committee of the Revolution). The second edict was signed by Louis-Bernard Guyton de Morveau (1737-1816), Prieur, and Lazare Carnot. Although these members of the Convention were not ardent *Montagnards* (Note 4), for them national defens e was more important than politics; France was invaded and in need of gunpowder. Chaptal had good friends among the members of the Committee of Public

Committee of Public Health, particularly Antoine François Fourcroy (1755-1809), Gaspar Monge (1746-1818), and Amédée-Barthélemy Berthollet (1748-1822). He was also a high functionary of the franc mason society, although the latter had lost much power.

FIGURE CAPTION

1. Example of the price list of the chemicals manufactured by Chaptal.

FABRIQUE D'ACIDES
ET SELS MINÉRAUX
ÉTABLIE A MONTPELLIER.

LE Commerce très-étendu de la Province de Languedoc manquoit encore d'un établiſſement, où l'on fabriquât les matieres premieres des Arts, qu'on retire à grands frais de l'Etranger : Mr. Chaptal, Profeſſeur de Chimie des Etats généraux du Languedoc, Inſpecteur honoraire des Mines, Membre de pluſieurs Académies, &c. &c. &c. vient de former une Manufacture, dans laquelle il a réuni tous les objets dépendans de la Chimie. Cet établiſſement, encouragé par les Etats, dirigé par des Perſonnes inſtruites, doit former une des baſes de notre Commerce. L'intelligence & la probité préſident à la fabrication de tous les objets. Et cette Manufacture préſente deux avantages bien précieux ; celui de réunir dans la même Fabrique preſque tous les objets de premiere néceſſité pour les Arts & la Médecine, & celui de garantir la bonté & la fidélité de tous les produits qui en ſortent.

TARIF des principaux Articles de cette Fabrique.

	la livre.
Huile de vitriol.	» l. 10 ſ.
Eſprit de vitriol.	» l. 6 ſ.
Eau de rabel.	» l. 15 ſ.
Eau Forte, depuis une juſqu'à trois livres, ſelon le degré de concentration & de pureté.	
Eſprit de Nitre dulcifié.	1 l. » ſ.
Eſprit de Sel, ou acide marin fumant.	2 l. » ſ.
Eſprit de Sel dulcifié.	1 l. 10 ſ.
Vinaigre radical.	8 l. » ſ.
Alkali volatil fluor, ou Eſprit volatil de Sel ammoniac.	5 l. » ſ.

After the *Dix-Huit Brummaire* (Note 5) Napoléon Bonaparte appointed him State Counsellor and ten months later, Minister of the Interior. Now, Chaptal extended to the national level what he had started to do not long ago in Languedoc, that is, the transformation of industry by science. In 1801 he founded the Society for the Encouragement of National Industry that he directed until the day of his death in 1832. Louis-Jacques Thénard (1777-1857) succeeded him in this post. Chaptal created the first School of *Arts et Métieres* (School of Crafts and Trades), and the School of Mines, he enlarged the *Collége de France* and the Museum of Natural History.

While in Paris Chaptal undertook large public works: Rue Rivoli, the quais of the Rue Gauche, the Ourcq channel, and the bridges of the Saint-Louis isle. He improved the prison system and that of the hospitals; he put the nuns *Files de la Charité* in charge of a hospital at the *Hotel Dieu* and set up a Maternity ward there. In his job of Minister of the Interior he undertook the high supervision of all imperial industries. It is under his orders that Thénard looked and found the blue color necessary for the *Manufacture de Sèvres*. Being in charge of public instruction he proposed that Thènard be appointed professor at the *Collége de France*.

Chaptal was also in charge of *Beaux Arts* and used this position to insure the admittance of his lover to the *Comédie Française* (she failed in her efforts to have an affaire with Napoléon).

In August 1804, Chaptal resigned all of the sudden from his position. According to his great-grandson the reason for the demission were political differences with Napoléon, but others claim that the real reason was jealousy. At that time Thérese Bourgoin was Chaptal's lover. Thérese was a young woman with strong character with talent and spirit and who did not show respect for any of the important persons of her time; for example, she called Chaptal, the Minister, *papa clystère* (daddy enema). Eventually she became one of Napoléon's many lovers. After Napoléon dropped her, she never did hide her loathing for the Emperor's behavior. Under the Restoration she became an aggressive royalist and showed an unlimited scorn for the prisoner of Sainte-Hélène.[2]

Napoléon accepted Chaptal's resignation but could not do without the services of such a distinguished administrator. He appointed him senator and then Count of Chateloup, after the name of a castle near Amboise. Chaptal now spent part of his time in Paris and the rest in his estate where he dedicated to agricultural activities. He published his works on chemistry applied to agriculture and to the professions[5-8], and wrote the draft of a book, *Mes Souvenirs Sur Napoléon*[9], narrating his life while at the service of the Emperor. Eventually, one of his grandchildren published the book in 1893 adding a biography of Chaptal.

Chaptal was a friend of Berthollet and belonged to the *Societé d'Arcueil*. He belonged to the *Académie des Sciences* and the *Chambre des Pairs*, to where Napoléon had appointed him during the Hundred-Days and Louis XVIII, Charles X, and Louis Philippe had kept after the Restoration. Ruined at 66 years of age, Chaptal was forced to sell Chanteloup and his hotel in Paris to pay the debts that his children had incurred in the chemical industry. Afterwards he lived modesty in Paris from the income of his other properties, until his death on July 30, 1832.

One hundred years after his death, the government of the Republic and the French scientific societies inaugurated a statue in his memory, erected in Gévaudan, his native town. On the occasion of the bicentenary of Chaptal's birthday, the Archives of the Lozère Department held an important exhibition of his documents.

As a suitable final remark we can mention that when Gustave Eiffel (1832-1923) built his famous tower in 1889, he decided to honor 72 distinguished French scientists by putting their names in the structure. This 'invocation of science", as Eiffel called it, reflected his worry over accusations that the tower was useless and waste less. There are eighteen names per side of the tower, all positioned just below the first platform of the structure, on the outside. The letters in the names are 60 cm high. Chaptal's name is located on the first façade, opposite the Trocadero.

Academic and political positions

Chaptal served in many positions showing the esteem he was held in the different political and academic circles: In 1794 the Committee of Public Instruction put him in charge of reorganizing the teaching of medicine in France; in 1798 he was nominated as *Instituteur de Chimie*, at the *École Polytechnique*; replacing Berthollet. He was appointed *Grand Officier* de la *Legion d'Honneur* (1804); treasurer of the Senate of the Republic (1804); member of the Council of Commerce and Manufacturing (1810); Member of the High Council for Prisons (1818); appointed by Louis XVIII as member of the Chamber of Paris (1819); elected to the *Académie de Médecine* (1820); etc.

Contributions

During his teaching tenure at Montpellier Chaptal published a large number of research memoirs on a wide variety of subjects. These works included: The pyrites of Languedoc; the extinct volcanoes of d'Adge, of Sainte-Thibéry, and of Gabian; the petroleum well of Gabian; the coal mines of Alès, Uzès, and Yeuset; decomposition of nitrous acid by phosphorus; generation of CO_2 by the fermentation of grapes and its conversion into acetic acid; crystallization of vitriolic acid[10]; influence of light and air on the vegetation of salts; combustion of sulfur; manufacture of glass without the help of soda; bleaching of old prints and books by the action of oxygenated muriatic acid (chlorine)[11,12]; etc.

The work on the crystallization of vitriolic (sulfuric) acid is interesting because it illustrates very well Chaptal's methodic approach to observation of phenomena. His workers reported him that they had found crystals in a sulfuric acid vessel that had been left in an outside storeroom of the factory.

Chaptal observed the presence of solids that had crystallized as a hexahedral prism ending on a hexahedral pyramid (the paper contains a drawing of the same), a phenomenon that he could not understand. He then performed a large number of experiments using sulfuric acid of different concentration and taking advantage of the fact that it was winter and the outside temperature was below freezing. Some of the samples corresponded to the liquid obtaining by melting of the crystals; others were the mother liquor left after crystallization and the liquid obtained by distilling the latter. He concluded that crystallization was possible only within a certain concentration range (expressed as weight percent of acid). Highly concentrated acid did not crystallize.

In the early 1800's Chaptal began manufacturing chlorine bleach at his factory. He was the first to use it for whitening paper using a solution of chlorine in water. This procedure was used for the restoration of valuable books in the French National Library.

Production of red of Prussia pigment (brown-red pigment)

The economic development policy that Chaptal put into action in the Estates of Languedoc led to such an economic boom that in 1780 the local authorities instituted for him a chair in chemistry in Montpellier.

Chaptal's first contribution to local industry was the development of a process for the manufacture of the brown-red pigment. This material was imported from Spain in large quantities and used for coloring the bricks and pavements of houses, for painting doors and windows of country houses, and for coating the barrels used by the French Navy. Yellow clay bole (limonite clay) was abundant in Languedoc; Chaptal had tested the material by heating it in a furnace at medium heat and obtained a beautiful brown-red, superior to that purchased from England and Spain, which required addition of minium to hold the color. On the basis of his experiences Chaptal proposed manufacturing the material by heating the yellow bole in a reverberation furnace until it achieved a brown color, which on cooling turning into red.[13] He described his procedure in a talk he gave to the *Societé Royale des Sciences* on December 27, 1780. He justified the project by pointing out that the Dutch bought yellow bole from the locality of Berry at 16 sols per quintal and sold the finished pigment at 10 to 12 livres per quintal.

Interesting enough, no local entrepreneur became interested in the manufacture of the pigment. Its production had to wait until 1782 when Chaptal decided to install a chemical factory on a piece of land he had bought at La Paille. Passing from laboratory scale to industrial production proved that the large scale manufacturing of the pigment was not economical because heating in the furnace was not homogeneous and the raw material had to go through expensive purification processes. He actually made the whole process economical when he found that the residues of the raw material could be sold as cements. Once again, his practical approach succeeded and made a fortune for him.

Manufacture of gunpowder[14]

In 1774 Anne-Robert-Jacques Turgot (1727-1781), comptroller general of finance under Louis XVI (1754-1793), the last King of France, instituted a crash program to develop the saltpeter industry and engaged the help of the *Académie des Sciences* to achieve its objectives. He revoked the contracts of the Powder Farmers and replaced them by a new administration, *Régie royale des poudres et saltpêtres* (Royal Gunpowder and Saltpeter Company).

Four *régisseurs* (governors) were appointed to manage the operation: Le Faucheux and Barbault de Glatigny, who were experienced in industry, and Jean François Clouet (1751-1801) and Antoine Laurent de Lavoisier (1743-1794), who were experienced chemists. The *Académie* was also ordered to draw up a detailed work program that included a literature survey on what was known about the formation of saltpeter and the experimental routines to follow in order to test the different ideas. At the same time, the *Régie* was given three years to turn the project into reality. Eventually, the project would fail not because of chemistry but of incentives. The risks were too large for a single entrepreneur, the scale too large for the crown.

The leading part in reforming the munitions industry was played by Lavoisier. He made the munitions industry his main occupation and proceeded to revamp it by installing new administrative, technological, and research policies that would eventually turn it into a financial success. He constructed new factories, mills, refineries, and warehouses, reinforced the methods for checking the quality of production, and organized courses in physics, chemistry, and mathematics for the personnel. He also looked into the possibility of enlarging saltpetre production by building artificial nitrate works (*nitrières*). In addition, he published a manual giving potential investors very detailed instructions on how to look for soils containing saltpeter and how to extract, refine, evaporate, and crystallize the product.

In 1775, at the beginning of the crash program, the Gunpowder Farm was producing about 800 tons/year whereas 1600 tons were needed. The measures taken by Lavoisier brought about a dramatic increase in gunpowder production, to 1,000 tons/year in 1777 and 1750 tons in 1787. Thanks to all the improvements introduced by Lavoisier, French gunpowder became the best in Europe. The tables were now reversed, and part of the production was exported to Holland and Spain, as well as to America for use by the Revolutionaries. In thirteen and a half years the *Régie* was a resounding financial success. It had paid the sums owned to the original Powder Farms under their contract, and on the eve of the Revolution it had restored the French munitions industry with large profits and savings.

In 1794 Lavoisier was executed at the guillotine and Chaptal was called to Paris as his substitute. There he was put in charge of the Saint-Germain-des Prés gunpowder refinery and also of installing a large new refinery in Grenelle. These refineries operated actively under his command; Chaptal was under constant pressure from the Committee demanding an increase of the daily production. It was necessary, simultaneously, to

manufacture, to improve and construct. These exigencies lead to such a disorder that at a certain time (August 31, 1794) the Grenelle refinery exploded resulting in more than one thousand deaths. A week later (September 4, 1794) the Saint-Germain refinery caught fire, hardly three months after it had initiated its operations. Chaptal was not worried because of these difficulties because it was after *Thermidor* (Note 6). Anyhow, it is not clear if because of these industrial accidents or because political reasons he was dismissed from his position at the factories. He returned to Montpellier to teach chemistry for the next four years, and then returned to Paris to fund at Ternes, a large industry for the manufacture of chemicals. When moving to in Paris, he officially resigned his chemistry chair at Montpellier and Joseph-Guillaume Virenque replaced him.

In his diary, Chaptal described in this words his achievements at the post: "During eleven months we manufactured twenty-two million pounds of powder, an accomplishment so extraordinary that posterity will scarcely credit it."[2]

Combustion of sulfur[15]

In this publication Chaptal reported his experience on the burning of sulfur in his chemical factory, in order to help improve the links that existed between the new chemistry (after Lavoisier) and the art of manufacturing. He indicated that when sulfur was burned in a furnace caoted with lead then, by directing the fumes into another chamber, it was possible to obtain at will, sublimated sulfur, molten sulfur, sulfurous acid (SO_2), and sulfuric acid. To obtain sublimated sulfur it was necessary to pass a fast current of air; this decreased the amount of oxidation and sulfur vapors deposited without alteration. When the conditions were such that SO_2 was produced it was possible to condense it, using low temperatures, as had been described by Gaspar Monge (1746-1818). Production of sulfuric acid was not possible using air alone; it was necessary to mix previously the sulfur with saltpetre (KNO_3). Chaptal reported that use of saltpetre led to the generation of a red gas by the reaction between the nitrous gas (NO) and atmospheric oxygen. This nitrous gas was extremely corrosive to the lead coating of the furnace, it led to the appearance of a layer of lead white that could be used for manufacturing white lead.

Alums[16]

Chaptal compared the principal alums available at that time (alum of Rome, alum of Levant, alum of England, and manufactured alum) and commented about their nature and different uses. The most valuable alum was that of Rome, it commanded a price three times larger than those of the others. A made a thorough comparison among the different alum varieties, based on their calcination, dissolution in water, and sulfuric acid treatment of the insoluble residue.

French economic geography

In 1819 Chaptal published one of his most important books, *De l'Industrie Française*[17], which may be considered the most comprehensive and detailed exposition of France's industrial situation by the end of the XIX century. Its different chapters cover the international commerce of France with European countries and colonies, agriculture, manufacturing industries, administration of the industry (including all pertinent legislation), privileges, franchises, customs, and prohibitions. The book contained a very large number of statistical tables that allowed the reader to compare the industrial and economical situation before and after the Revolution, the relative importance of each activity, and the influence of Government on the industrial activity.

The book may be considered the first written exposition of the economical geography of France after the Revolution. The ultimate purpose of Chaptal's analysis may be expressed in his own words: " J'ai cru qu'il était de mon devoir de tracer la ligne qu'un gouvernement doit suivre, et de marquer la ligne où il doit s'arrêter" (I believe it was my duty to trace the road that a government must follow and to mark the line where it must stop).

The book was divided in two volumes, with a total of about 550 pages.

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Notes

1. The *Societé Royale des Sciences* was one of the oldest academies of the French Kingdom, having been recognized in 1706. It was affiliated to the *Académie des Sciences* in Paris, which gave the right to its senior members (*titulaires*) to attend its sessions.

2. Cambacéres played a more important role than Chaptal in the French Revolution. He was deputy of l'Herault to the Convention, member of the Council of the Five-Hundred, Minister of Justice, and played a very important role in the coupe de force of the 18th of Brummaire. The first Consulate was headed by Napoléon (Premier consul) and had Cambacérès and Charles François Lebrun (1739-1824) as additional consuls.

3. Pierre Mitouard was a Parisian pharmacist who offered chemistry courses at his establishment. He had reported that when phosphorus was burned to form acid, air seemed to be absorbed. Antoine-Laurent Lavoisier (1743-1794) verified this finding.

4. The Montagnards were thus called because they sat on the highest benches of the Assembly. After the Second Republic they were identified with the extreme right.

5. *Dix-Huit Brummaire* (November 9, 1799), the date when a *coup d'etat* took place that replaced the Directory with the Consulate and brought