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**Jean Antoine Chaptal (1756-1832) – The Eminent French chemist
of the second half of the eighteenth century and the first half of the nineteenth
century
(To the 190 th Anniversary of His Death)**

*Jean Antoine Chaptal (1756-1832) - El eminente químico francés
de la segunda mitad del siglo XVIII y la primera mitad del siglo XIX
(Al 190 aniversario de su muerte)*

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ABSTRACT

Jean Antoine Chaptal (1756-1832) was one of the important chemists of the second half of the 18th century and the first half of 19th century. He wrote a number of works dealing with various branches of applied chemistry. The purpose of this paper is to familiarize readers with the important events in the life of Chaptal and his writing activities, in particular with his chemistry textbooks and books on applied chemistry, well-known in different countries. In addition, his research activities is briefly described.

Keywords: J. A. Chaptal, Applied chemistry, Chaptal's textbooks on chemistry, French – XVIII-XIX centuries.

RESUMEN

Jean Antoine Chaptal (1756-1832) fue uno de los químicos importantes de la segunda mitad del siglo XVIII y la primera mitad del XIX. Escribió una serie de trabajos relacionados con diversas ramas de la química aplicada. El propósito de este artículo es familiarizar a los lectores con los acontecimientos importantes en la vida de Chaptal y sus actividades de escritura, en particular con sus libros de texto de química y libros de química aplicada, conocidos en diferentes países. Además, se describen brevemente sus actividades de investigación.

Palabras claves: J. A. Chaptal, Química aplicada, Libros de texto de Chaptal sobre química, Francés - siglos XVIII-XIX.

INTRODUCTION

The important events in the Chaptal's life

He was called a man who “applied chemistry to industry and agriculture” (Smith, 1949, p. 48) as well as “ a famous chemist of the Napoleonic era” (Francis, 1964, p. 202). One hundred and eighty-nine years have passed since his death, but in that time very little has appeared in the literature about this very interesting man. He went down in the history of chemistry as a “manufacturer of saltpeter, soda, and beet sugar”(Week, 1960, p. 739), as a man “devoted himself to the application of scientific principles to industry to decrease France's dependence on imports” (Wisniak, 2003, p. 159) and was known for his very good books on chemistry, published in several languages.

Jean Antoine Chaptal (Figure 1) was born “in the hamlet of Nojaret in Gévaudan (today the Lozère Department) on the banks of the Lot, 10 kilometers from the town of Mende” (de Garale, 1892, p. 46) on June 5, 1756, and he was the son of Antoine Chaptal (1718-1772) and Françoise, née Brunel. In his Memoirs included in the introduction to the book entitled *Mes Sur Napoléon* (1893) he wrote about his parents as follows:

“My parents were rich and honest landlords who enjoyed public esteem and reverence: their house was the asylum of the poor; their conduct, the rule and example of the country, and their councils were always the supreme law for the inhabitants. For 150 years, the eldest of the family had remained attached to the culture of the estates, and the younger ones embraced the ecclesiastical state, the profession of lawyer or that of doctor.

The profession of doctor was generally preferred, and this vocation was mainly decided by several works of medicine and natural history which existed in the house and in which one read in preference to any others“ (pp. 9-10).



Fig. 1. *Portrait of Count Jean Antoine Chaptal (1756-1832) from 1824 by the French painter Antoine-Jean Gross (1771-1835) (“Portrait of Count”, 1824).*

In 1767, at the age of eleven, he entered the Collège de Mende. His education there lasted five years. In 1772, he began his study at Collège de Rodez which graduated with the Bachelor of Art degree. Two years later, in September 1774, he was admitted to the Université de Médecine de Montpellier, where he spent the next two years. After completing his studies, he received his bachelor degree in medicine (November 5, 1776) on the basis of a dissertation written in Latin (Feuchtwanger, 1834; Wisniak, 2003). Figure 2 shows the title page of his medical dissertation (Chaptal, 1776).

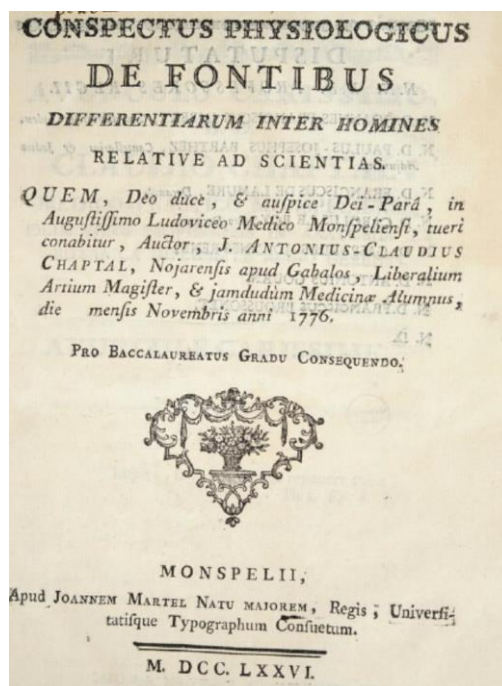


Fig. 2. Title page of J. A. Chaptal's dissertation (Monspelii: Apud Joannem Martel Natu Majorem, Regis, Universitatisque Typographum Confuetum, 1776).

Then, at the age of twenty five, in 1781, he became professor of chemistry in the School of Medecine in Montpellier (de Peyster, 1896, p. 30; Herivel, 1975, p. 93). In the same year, on September 11, he married Anne-Marie-Rose, née Lajard (1761-1844). The spouses had one son, Jean-Baptiste Marie (1872-1833) (Robert, Bourlonton, & Coughy, 1891, p. 48).

In 1782, Chaptal actively worked in the chemical industry. Jaime Wisniak (2003) wrote about it like this:

“ ... 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 ...” (p. 160).

On December 24, 1793 he was appointed Inspector General of Gunpowder and Saltpetre, and on April 22, 1794, he became Director the Agency of Revolution for Gunpowder and Saltpetre. In April 1798, he replaced the chemist Claude-Louis Berthollet (1748-1822) in the chair of chemistry at the École polytechnique, before his departure to Egypt. On December 24 of the same year Napoléon Bonaparte (1769-1821) named him to the Council of State (Coulston Gillispe, 2004, p. 613).

On January 21, 1801, Bonaparte appointed him Minister of the Interior (Aravena, 1957, p. 186). The Baron de Claude-François Méneval (1778-1850) in his

Memoirs Illustrating The History of Napoleon I from 1802 to 1815 (Volume 1, 1894) wrote about Chaptal as a minister:

“He was not only a very distinguished savant. His varied knowledge of agricultural and commercial matters, his application of chemistry to the industries and the arts, his talents as administrator, and his studies on public education, had pointed him out as the right man to direct a ministry so wide and so varied in its duties” (pp. 140-141).

On August 5, 1804, he resigned from his position, and Bonaparte accepted it. In a letter to him, published in his memoirs (1893), he wrote:

“Sire, when you called me to fill successively the functions of State Councilor and those of Minister of the Interior, I did not consult that my whole devotion to your august person.

I gave up studies that had the goal the prosperity of our arts and the progress of our manufacturing industry.

Today that I believe I have shown zeal, today that, by your care and by the effect of your constant concern, everything is organized in the administration, I beg Your Majesty Imperial to go to my first occupations.

I am ... Chaptal” (p. 103).

The next day, on August 6, Napoléon, in his letter sent to Chaptal from Calais, informed him that he had accepted his resignation and that he appointed him a senator. He wrote:

“I can hardly see your intention to leave the Ministry of the Interior, to deliver yourselves entirely in the sciences. But I give in to your desire. ... Desiring to give you proof of my satisfaction with your services, I appointed you senator. In these functions eminent, which gives you more time to give to your work for the prosperity of our arts and progress of our manufacturing industry, you will render useful services to the State and to me “ (pp. 103-104).

In 1810, he was unanimously reelected treasurer of the Senate (Chaptal, 1893, p. 131). In the same year, Napoléon made him Count of Chateloup. Now he spent part of his time outside of Paris on his estate where he devoted himself to agricultural activities (Wisniak, 2003, p. 162).

He was a friend of Berthollet and belonged to the Society of Arcueil. The founding members of this Society were Berthollet and the mathematician Pierre-Simon Laplace (1749-1827). The name of this Society comes from the village in which they lived as neighbors (Sztejnberg, 2020, p. 141). He became a member of this Society in 1813 (“Mémoires De Physique”, 1813, p. 5).

In 1819, the King of France Louis XVIII (1755-1824) created him a peer of France. He died on July 30, 1832 in Paris (Chaptal, 1893, p. 162; Partington, 1962, p. 557).

Chaptal's works

He is the author of “eighty single different treatises in Chemistry” (Feuchtwanger, 1834, p. 129). The list of his works given by Marie Jean Pierre Flourens (1794-1867), Perpetual Secretary of the Royal Academy of Sciences, includes 27 papers that appeared in print for twenty-three years from 1776 to 1799. He published the most of his articles in 1798 (Flourens, 1838, pp. XLI-XLIII).

His papers were published mainly in *Annales de Chimie, ou Recueil de Mémoires Concernant la Chimie, et les Art qui en Dépendent*. Among them are his original articles in the field of applied chemistry. For instance, he wrote about the

manufacture of de l'acétite de cuivre (copper acetite) (Chaptal, 1798a; Chaptal, 1798b). In 1816, his memory on beet sugar was published (Le Comte Chaptal, 1816).

He observed the differences between l'acide acéteux (acetous acid) and l'acide acétique (acetic acid) (Chaptal, 1798c). He wrote about his chemical observations on the l' épiderme (epidermis) (Chaptal, 1798d), on the effect of mordants in the red dyeing of cotton (Chaptal, 1798e) as well as on the use of iron oxides in cotton dye (Chaptal, 1798f). He compared of the four main kinds of alum known in commerce and conducted observations on their nature and use (Chaptal, 1797a). He wrote about le savon de laine (wool soap) and its uses in the arts (Chaptal, 1797b).

Chaptal's other works in chemistry

Chaptal became famous for two of his textbooks. In the first, he supported the anti-phlogistic theory and the second was in field of applied chemistry. They were published first in French and later in other languages.

Chaptal's textbook *Elémens de Chimie*

In 1790, the first edition of his three-volume textbook *Elémens de Chimie* was published in Montpellier (Chaptal, 1790a; Chaptal, 1790b; Chaptal, 1790c). In the first volume of this textbook (Figure 3), he proposed the name gaz nitrogène (nitrogen gas), instead of gaz azote used in France for the residue after the removal of oxygen from the air (Chaptal, 1790a, p. xl). In this textbook, he “adopted the new chemical language” (Bensaude-Vincent, 1990, p. 441). The next three French editions appered in Paris in 1794, 1796 (Chaptal, 1796a; Chaptal, 1796b; Chaptal, 1796c) and 1803 (Chaptal, 1803a; Chaptal, 1803b).

The first English edition of the Chaptal's *Elements of Chemistry* was published in 1791 (Chaptal, 1791a; Chaptal, 1791b; Chaptal, 1791c) and the second in 1795 (Chaptal, 1795a; Chaptal, 1795b; Chaptal, 1795c). The translator was the English chemist William Nicholson (1753-1815). In a brief preface, written on April, 1791 in London, he (Chaptal, 1791a) wrote:

“The great experience of M. Chaptal, his unaffected candor, and the perspicuity which is seen in every part of the following treatise, cannot but render it extensively useful. I have been particularly careful not to diminish this last merit, by deviating in any respect from that scrupulous attention to accuracy which is indispensably required to give authority to the translation of a work of science” (p. 3).

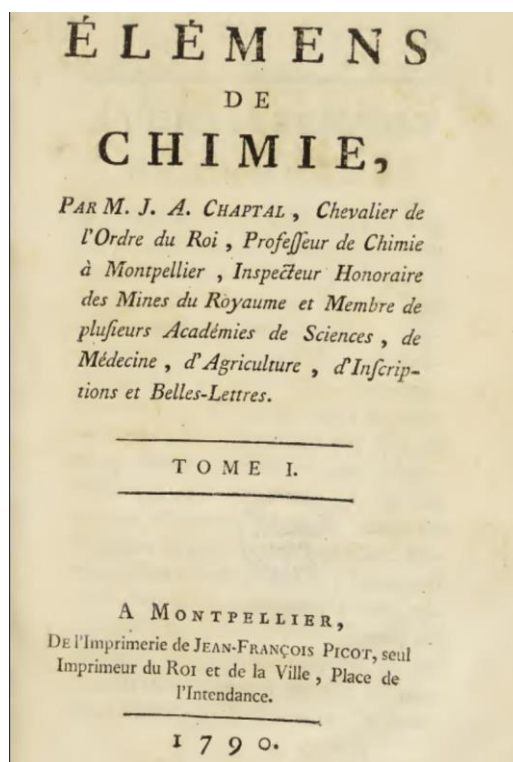


Fig. 3. Title page of the first volume of J. A. Chaptal's textbook in the French edition (A Montpellier: De l'Imprimerie de Jean-François Picot, 1790).

In 1792, the first Italian four-volume edition of the Chaptal's textbook *Elementi Di Chimica* was published in Naples. The translator was Niccolò Dallaporta, Doctor in Philosophy, and Medicine (Chaptal, 1792a; Chaptal, 1792b; Chaptal, 1792c; Chaptal, 1792d).

The first Spanish edition of Chaptal's textbook *Elementos De Química*, translated by Hygynio Antonio Lorente, was published in 1793 and 1794 in Madrid (Chaptal, 1793; Chaptal, 1794a; Chaptal, 1794b). The second Spanish edition appeared in 1802 (Chaptal, 1802) and 1803 (Chaptal, 1803c; Chaptal, 1803d). José Ramón Bertomeu Sánchez and Rosa Muñoz Bello, from the Institute for the History of Medicine and Science "López Piñero" at the University of Valencia, consider this textbook to be "one of the most popular late-nineteenth-century textbooks" as well as "an important vehicle for new ideas and the new chemical terminology" (Sánchez and Bello, 2009, pp. 27-28).

In 1796, the first American edition of Chaptal's textbook *Elements of Chemistry* appeared in Philadelphia. All three volumes of the original French edition of Nicholson's translation were combined into a single volume (Chaptal, 1796). The next three American editions were published in 1801 (Chaptal, 1801), 1806 (Chaptal, 1806), and 1807 (Chaptal, 1807a; Chaptal, 1807b).

Chaptal's textbook *Chimie Appliquée Aux Arts*

In 1807, a four-volume French edition of Chaptal's textbook *Chimie Appliquée Aux Arts* was published in Paris (Chaptal, 1807a; Chaptal, 1807b; Chaptal, 1807c; Chaptal, 1807d). All four volumes of this textbook are 2,070 pages. The four pages of the first volume of the textbook (1807a), right after the title page,

are addressed to the Emperor of the French and the King Napoléon Bonaparte. His words are quoted below:

“TO HIS MAJESTY THE EMPEROR AND KING.

SIR,

France has greeted you with the name of Grand, and soon grateful nations will proclaim you the Peacemaker of Europe.

Then, YOUR MAJESTY, realizing the wishes dearest to your heart, will be able to protect, from all the activity of your genius, the progress of agriculture, the prosperity of commerce and the glory of the arts.

Admitted, as Councilor of State or as Minister, for six years, in the secrecy of your advice; having had the honor of accompanying YOUR MAJESTY to the workshops of our factories, I was able to judge of his esteem for the arts and his tender solicitude for all that interests French industry. Convinced that after having secured the independence and the glory of the Empire, who after having conquered the freedom of commerce, the genius of YOUR MAJESTY would be applied to the means of making all the branches of national prosperity flourish again, I asked for the mission of supporting his generous projects.

My whole life had been consecrated the study of the arts, my work with YOUR MAJESTY had made me better acquainted with my needs and resources: I begged her to return to my first occupations; she deigned to appreciate my design, and to encourage it in the honorable title with which she rewarded my poor services. Faithful to the condition under which you have permitted me to lay down the burden of public affairs, I bring to the feet of YOUR MAJESTY a first tribute of my zeal.

If, in this Work, entirely devoted to the means of reestablishing and ensuring the prosperity of our factories, one finds some reflection of these brilliant glimpses, of these useful conceptions and of these profound combinations, which make up the habitual thought of YOUR MAJESTY, and which she transmits more immediately to those of her subjects who are fortunate enough to approach her closer, the success of this part of my work would still be a blessing to YOUR MAJESTY.

Happy if, at the moment when it descends from the chariot of victory to enter the modest asylum of manufacturing industry, YOUR MAJESTY could find there any result of my efforts!

I am with respect,

SIR,

OF YOUR IMPERIAL AND ROYAL MAJESTY,

The very - humble, very - submissive and very - faithful subject,

CHAPTAL” (pp. v-viii).

The first English edition of his *Chemistry Applied to Arts and Manufactures*, like the French edition, also appeared in 1807 (Chaptal, 1807e; Chaptal, 1807f; Chaptal, 1807g; Chaptal, 1807h). In 1807-1808, the first Italian four-volume edition of his *Chimica Applicata Alle Arti* was published by Dalla Stamperia Orsiniana in Naples (Chaptal, 1807ag; Chaptal, 1807bg; Chaptal, 1807cg; Chaptal, 1808a). The first Spanish edition of his *Química Aplicada Á Las Artes* appeared in 1816 and 1821 in Barcelona. The translator was Francisco Carbonell Y Bravo (1758-1837) (Chaptal, 1816a; Chaptal, 1816b; Chaptal, 1816c; Chaptal, 1821).

Other Chaptal's books

In 1783, his book entitled *Tableau Analytique Du Cours De Chymie, Fait à Montpellier*, with his lectures was published in Montpellier (Chaptal, 1783). In 1807, his *L'Art de la Teinture du Coton en Rouge* (The Art of Dyeing Cotton in Red) appeared in Paris. He dedicated this book to Berthollet. He wrote: "To C. L. Berthollet, Member of the Senate and of the Institute. Homage To Virtues, To Friendship, To Talent. His Friend and Colleague, J. A. Chaptal" (Chaptal, 1807i).

His *Kunst Baumwolle türkischroth zu färben* (Art to Dye Turquoise Red Cotton) appeared in 1807 in Aarau (Chaptal, 1807j). In 1808, his 32-page book entitled *Osservazioni Chimiche Sull'arte Di Levare Le Macchie Dalle Stoffe E Di Ristabilirne I Colori Alterati* (Chemical Observations on the Art of Removing Stains From Fabrics and Restoring the Altered Colors) was published in Florence. The translator was Giuseppe Moretti (Chaptal, 1808b). In the same year, his book under the title *Principes Chimiques Sur L'Art Du Teinturier-Dégraisseur* (Chemical Principles on the Art of the Dye-Degreaser) was published in Paris (Chaptal, 1808).

The first (1819) French edition of his two-volume book under the title *De L'Industrie Française* appeared in Paris (Le comte Chaptal, 1819a; Le comte Chaptal, 1819b). His book entitled *L'Art De Faire Le Vin* (The Art of Wine Making) was published in the same year in Paris (Le comte Chaptal, 1819c).

In 1823, a two-volume French edition of his *Chimie Appliquée À L'Agriculture* was published in Paris (Le comte Chaptal, 1823a; Le comte Chaptal, 1823b). The second, extended edition of this book appeared six years later in 1829.

In 1824, the first Italian edition of his *Chimica Applicata All'Agricoltura* was published in Milano. The translator was Giralomo Primo (Chaptal, 1824). The first German edition of his *Die Agriculturchemie*, translated by F. Eisenbach and G. Schübler, was also published in the same year in Stuttgart (Grafen Chaptal, 1824a; Grafen Chaptal, 1824b).

The first (1835) American edition entitled *Chymistry Applied to Agriculture* appeared in Boston (Chaptal, 1835). The book was re-published four years later (Chaptal, 1839). In 1840, this book was published in New York in a translation by William P. Page (Le comte Chaptal, 1840) and re-published in 1845 (Le comte Chaptal, 1845).

CONCLUSION

Jean Antoine Chaptal was one of the outstanding French chemist of the second half of the XVIII century and the first half of the XIX century. "He early adopted [Antoine-Laurent] Lavoisier's [(1743-1794)] new theory of chemistry which he expounded with great clarity and power. He made many important contributions to applied chemistry" (Herivel, 1975, p. 93).

On May 24, 1796, he became a resident member of the Académie des sciences de Paris (Academy of Sciences of Paris) ("Institut de France", n.d.). He was elected an honorary member of

the Imperial St. Petersburg Academy of Sciences on November 1, 1820 ("Shaptal' de Shantelu", 2017). The Royal Society of London elected him a Foreign Member on June 9, 1825 ("List of Fellows", 2020, p. 27).

Chaptal's books have been published in France, Great Britain, Germany, U.S.A., Italy and Spain. Some authors also wrote about his life and work. For instance, the *Éloge Historique De Jean-Antoine Chaptal* (Historical Praise of Jean-Antoine Chaptal) was read by Flourens in a public session on Monday, December 28,

1835. It was published in 1838 (Flourens, 1838). Le Gabale wrote a 16-page article about him in *Les Contemporains* in 1892 (Le Gabale, 1892). One year later, the personal memoirs of Count Chaptal was published by his great-grandson Anatole Emmanuel Chaptal (1861-1943) in the introduction (pp. 9-102) to the book entitled *Mes Souvenirs Sur Napoléon Par Le C^{TE} Chaptal* (My Souvenirs about Napoleon by Comte Chaptal) (Chaptal, 1893). Jean Pigeire's 58-page biographical book about Chaptal was published in 1931 (Pigeire, 1931). In the same year, the Russian historian of chemistry Maks Abramovich Blokh (1882-1941) presented Chaptal's biographical note in his book (Blokh, 1931, p. 118). In 1957, Horacio Aravena wrote his biographical book in Spanish and published it in Santiago de Chile (Aravena, 1957a). His 25-page article about him was also published in the *Anales de la Universidad de Chile* in the same year (Aravena, 1957b). Michel Peronnet's book on Chaptal in French was published in Toulouse in 1988. In 2003, Jaime Wiśniak published his article about life and work of Chaptal (Wisniak, 2003). Paul Mazliak is the author of the book *Parmentier, Chaptal, Chevreul. Trois grands pionniers de la chimie alimentaire* (Parmentier, Chaptal, Chevreul. Three Great Pioneers in Food Chemistry), which was published in Paris (Mazliak, 2011).

After Chaptal, not only his papers and books survived. In addition, several of his lithographic portraits and Flourens were produced. His portrait was made by the French litographer Jean Jacques François Monanteuil (1785-1860) ("Jean-Antoine-Claude", n.d.). Two his lithographic portraits are from the Edgar Fahs Smith Chemistry Collection ("Chaptal. Part of", 1790; "Le Comte Chaptal", 1799). His portraits are also depicted in two engravings ("Chaptal. Engraving. Part", 1790; "Chaptal (Jean Antoine)", 1780). His portrait can also be found in a book written by the American chemist Henry Monmouth Smith (1868-1950) (Smith, 1949, p. 48).

In addition to lithographic portraits and engravings, the bust of Chaptal was made by the French sculptor Jean-Baptiste Comolli (1775-1830) in 1803. It is located at the Faculty of Medicine at the University of Montpellier. It was carved in white marble. Its height is 63.0 cm. There is an inscription on the pedestal: "J. A. CHAPTAL / 1756-1832". The sculptor's name as well as date appear on the reverse: "COMOLLI FECIT ANNO XI R." ("buste de Jean", 2009).

On August 21, 1932, a monument was erected in honor of Chaptal in Mende, not far from Nojaret, the village where he was born. It was made by French sculptor Auguste Ottin 1811-1890. Upon the front of statue on the marble slab was the following inscription in French, "Jean-Antoine CHAPTAL / 1756 - 1832 / Precursor of Industry / Chemical in France / Senator - Minister / Peer of France" (Cauchy, 2017).

It is also worth mentioning here the decision of the French engineer Gustave Eiffel (1832-1923), who built his tower in Paris, to honor seventy-two outstanding French scientists, indicating their names in the tower's structure. Among them is the name of Chaptal, and the height of the capital letters is 60 cm (Wisniak, 2003, p. 162; Whose are the", 2020).

During his lifetime, Chaptal did a lot for the development of the chemical industry in France. He was also an excellent author of chemistry textbooks and books on applied chemistry. Therefore, the great fame that he gained thanks to his achievements in the field of chemical science and as a politician is well deserved.

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This article has no conflict of interest