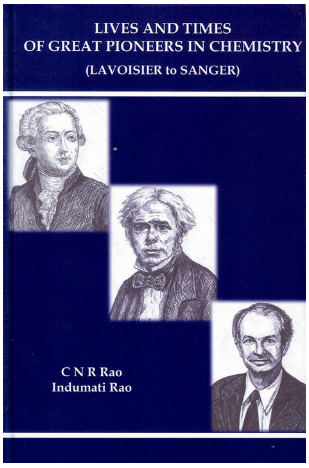

Lives and Times of Great Pioneers in Chemistry. C. N. R. Rao and Indumati Rao. World Scientific Publishing Co. Pte. Ltd, 5 Toh Tuck Link, Singapore 596224. 2016. x + 312 pages. Price not mentioned.

Integrating history and biographies of great pioneers of chemistry as a part of chemistry curricula can indeed be inspirational for the young students and researchers, because it will be exciting for them to follow how the original concepts in chemical science were generated from extreme hard work and zeal of these great scientists. In this book, the authors vividly describe and explain how the basic concepts emerged in real time and how theoretical knowledge and practical skills were gained in those days. The book covers the lives and times of 21 great chemists belonging to different nationalities, starting from the 18th century and ending with the beginning of the 21st century. We are reminded of Humphry Davy's words: 'Science belongs to the world and is of no country, no age' (p. 35) and 'Berzelius lists 24 Swedes and 21 foreigners who worked in his laboratory' (p. 66).

The title of the book itself reveals the fact that it is not only the narration of biography of these great chemists, but the 'times' in which they lived to bring about their remarkable achievements, which makes the readers feel the ambience of doing science under various circumstances and environment.

In a novel attempt, the contents page highlights the significant contributions of a chemist for which the world pays tribute to him.

A remarkable smooth flow of historical events can be observed when we move from one chapter to the next, as this book is structured and organized in chronological order of those events.

The authors have taken special care to show, that in spite of differences in the family background, these great personalities could overcome many obstacles to discover the secrets of nature, because of the following qualities: continuous hard work, endless enthusiasm, serious mindedness, creativity and, in some cases, serendipity (Wohler's synthesis of ammonia). Some of them were child prodigies too (Arrhenius with numbers).

On one hand, Lavoisier, Sanger, Kekule, Emil Fischer and few others were blessed with wealthy parents who could provide them with holistic and liberal education. On the other hand, there were many others born in extremely poor and ordinary families, but despite the difficult circumstances excelled in their scientific achievements.

- Mendeleev, who formulated the periodic table, had to walk all the way from Siberia to Moscow along with his mother and sister with the aim of getting a 'better chance of university education'. 'They were too poor to afford any other transportation'. Unfortunately, Mendeleev could not get admission because he was an outsider and his family had to move to St. Petersburg.
- Berzelius lost both his parents before he was ten years of age and had to work as an 'unpaid assistant at the College of Medicine'. Ingold lost his father when he was five years old.
- Willstatter's mother moved to Nuremberg with her two sons when his father had to be away from them in New York 'to have better economic prospects'. Willstatter did not do well in Latin, because of his changed environment in the new school where anti-Semitism was prevailing.
- Colour-blind Dalton and his brother could get no formal education, but had to self-educate themselves.
- Woodward's mother was a young widow and she had to raise him under financially difficult situations.
- 'The Paulings lived in poverty', but Linus Pauling's father Herman took great interest to encourage his son 'to develop the reading habit'.

The authors have also pointed out in their own style some of the peculiar and eccentric behaviour of a few scientists as given below.

- G. N. Lewis, a chain smoker, ordered his secretary to buy all the stock of cigars from his suppliers fearing that soon after Pearl Harbour attack by the Japanese, he would have to buy cigars from the Philippines.
- The first Nobel laureate in Chemistry, Van't Hoff used to enter the chemistry laboratory of his school 'after school hours and during vacation by slipping through basement windows'.
- Humphry Davy used to pinch chemicals from the shop where he worked to make crackers and also used to ruin his sister's clothes in his experiments. Similarly, to illustrate the intoxicating effect of laughing gas, nitrous oxide, he himself inhaled it under supervision.
- G. N. Lewis and Linus Pauling were voracious readers. Lewis was very 'fond of reading detective stories and books of history'.
- Robinson used to scribble complex chemical formulae on whatever was available at that time such as 'blank edges of table cloth, papers used to roll cigarettes and back of used envelopes'.
- Faraday never had any students helping him in research. He was a man of few words.

A careful reader cannot miss the subtle sarcastic remark of the authors that Lewis 'the 20th century chemical genius missed the Nobel Prize' and Ingold 'joined the club of distinguished chemists who did not get the PRIZE'. Mendeleev also missed the Nobel Prize in 1906.

Some of the most common positive traits observed among the heroes of this book are their social commitment, and their intense love and serious involvement in teaching chemistry. A few of them like Kekule and Lewis worked till the end of their lives.

- Mendeleev quit his post from the University of Petersburg on a matter of principle, supporting 'a student protest' and 'petition'. He was equally dedicated to poor farmers and helped them solve their problems.
- Lavoisier was a 'social activist' who 'brought in many agricultural reforms'. He also tried to improve the

living conditions of the poor and 'fought for reforms in hospitals and prisons'.

The authors do not fail to throw light on a few negative qualities of some of the scientists, like jealousy towards their contemporary chemists, carelessness in projecting and publishing the results of their students in time and not acknowledging the efforts of their predecessors.

- For example, Lavoisier heard from Blagden (the former secretary of Cavendish) that Cavendish had repeated Priestley's experiment of heating calx of a metal with hydrogen in a tall flask and found a few drops of dew (water) on its walls. Both Cavendish and Priestley interpreted this reaction within the framework of Phlogiston theory and lost interest in further investigation. After getting this information, Lavoisier and Laplace almost with 'indecent haste' synthesized water by burning hydrogen and oxygen in a closed container in the presence of Blagden and reported their findings to the French Academy, the very next day. They did not acknowledge the contributions of Cavendish and Priestley (pp. 15–16).
- Although it was Robinson who introduced curly arrows to show movements of electrons in reaction mechanisms, Ingold who immediately accepted and applied this concept in his works, failed to acknowledge it.
- Arrhenius was given a 'Fourth Grade' by his thesis examiner Theodor Cleve for his dissertation dealing with the controversial subject of ionization. Because of this, Arrhenius could not get any suitable position initially. Even after Arrhenius was awarded the Nobel Prize, Cleve paid him only a 'left handed compliment' (p. 169) saying that his theories built only a bridge between physics and chemistry, because the physicists and chemists did not know where his theories belonged.
- Intrinsic value of Arrhenius was never appreciated in Sweden initially. However, Van't Hoff, Ostwald and Clausius were so greatly impressed by the same observations and conclusions.
- Kekule got the credit for proposing 'that carbon atoms had the capacity to link with other carbon atoms and thus form a chain'. His paper was published in May 1858 in Liebig's *Annalen der Chemie and Pharmacie*. Although Couper's paper on the same concept contained more examples in it compared to the work of Kekule, because Wurtz had delayed presenting Couper's paper to the French Academy in time, he did not get proper recognition. This resulted in a series of nervous break-downs for Couper, who 'gave up research completely'.

The authors also clearly bring out various examples of some of these outstanding scientists to illustrate the significant roles played by their wives in their professional lives.

- Young Marie Anne helped her husband Lavoisier in not only translating scientific documents from English into French, but also by making accurate drawings of apparatus and written records of his laboratory work. 'She became Lavoisier's invaluable collaborator, her drawings and illustrations added immense value to Lavoisier's writings.'
- Edith Hilda Usherwood who was married to Ingold worked with him for a few years, but later gave up her own research career and devoted herself only in assisting her husband.
- Ava Helen Miller, wife of Linus Pauling, herself a committed peace activist, supported her husband in all his academic and intellectual pursuits. Pauling called her a 'constant and courageous coworker' in his acceptance speech at the Nobel Prize Award function.

Even though many of these distinguished scientists were well known for their simplicity and modesty, they were full of self-confidence.

- When one of the friends of Sanger 'praised his characteristic modesty' where his colleagues had assembled after the announcement of his Nobel Prize, Sanger responded saying 'I want you all to know that I think that I am bloody good' (p. 209).
- Lavoisier made sure that he got the full credit for his discovery of the role played by oxygen in combustion. He announced, 'This theory is not as I have heard it called, the theory of the French chemists in general, it is *mine*'.
- Humphry Davy also declared 'What I am, I made myself'.

The book describes how certain institutions and universities provided impetus to bring about the best of creativity among the enthusiastic chemists. It is well-known that Germany's achievements in chemistry in the 19th and early 20th centuries were due to the support given by industry and the network of German universities. Scientific-state institutions such as Max Plank Society and various universities like Heidelberg, Munich, Gottingen, etc. have been mentioned occasionally in the book.

- 'Wohler graduated from the University of Heidelberg with the Doctor of Medicine and Surgery.' However, he was persuaded by Gmelin (professor of chemistry and medicine) 'to give up an uncertain career in Medicine' and pursue chemistry.
- Kekule began his career 'at the University of Heidelberg where he taught organic chemistry'.
- Mendeleev 'studied the workings of the spectroscope with Kirchhoff in Heidelberg'.

In short, this is an extremely well-written book in simple language and lucid style.

(From 'Dmitri Mendeleev', Wikipedia)

The scientist's sculpture next to his Periodic Table on a wall of D. I. Mendeleyev Institute for Metrology in Saint Petersburg.

A multi-dimensional approach to chemistry is developed with gripping events in the lives of the contemporary professional chemists. The extensive citations meticulously chosen from various sources have been quoted skillfully in appropriate and relevant places to provide interesting and enjoyable reading. Considering the wide range of students, researchers and readers searching for a good read, as the authors themselves have mentioned, a few more pioneers could have been included. Probably in another volume of this book some of the great Indian chemists like Acharya, P. C. Ray and Shanti Swaroop Bhatnagar could also be included. The book definitely captures the enthusiasm and intensity of the chemists, who spent long hours of the best time of their lives in dark, smoky and smelling laboratories, just to understand and explain the mysteries of the unknown areas of chemistry. Hence one can expect that the readers will gain the intended outcome of skills like scientific reasoning, problem-solving, clear communication and ethical commitment.

The book is recommended to every science college and university library. I hope that the publishers will soon bring out a less expensive paperback edition. The authors should be complimented for writing this book as a 'labour of love' for chemistry.

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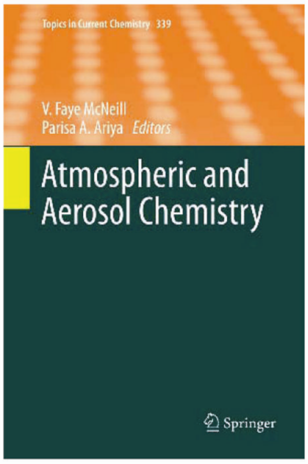

Atmospheric and Aerosol Chemistry. V. Faye McNeill and Parisa A. Ariya (eds). Springer International Publishing, Springer-Verlag, Berlin, Heidelberg. 2014. vii + 264 pages. Price: US$ 309.00. ISBN: 978-3-642-41214-1

Atmospheric chemistry of aerosols is important as it virtually implicate every single sectors like physico-chemical properties of aerosols, particle phase transformations, evolutions, interface interactions and scavenging mechanisms. Aerosol chemistry has long been studied due to its relevance to regulate regional and global climate. The complex chemical composition of aerosols especially in highly polluted regions like Indo-Gangetic Plain significantly induce modifications in regional climate[1,2]. A comprehensive assessment of air pollutants and their associated science includes transformation pathways which are fundamentally regulated by solar intensity and direct or indirect photochemistry of a molecule. Proper understanding of the mechanism behind these events provides opportunities to know more about the atmospheric processes and their association with the earth system. The Springer series on *Topics in Current Chemistry* is being published since 1949, with a staggering 402 volumes and is devoted to recognize past and contemporary chemical research, specifically explaining both conceptual and methodological aspects. Interestingly, aerosols chemistry has never been part of this book series, despite its explicit relevance in the era of aerosol-induced climate change. In this context, the book under review seems relevant and appropriate in emphasizing chemical behaviour of aerosols in regulating atmospheric chemical profiles. The book potentially addresses diverse readers like academics, researchers and industrial chemists, while it is relevant to scholars who wish to investigate aerosol photochemistry, tropospheric oxidation, aerosol organics and its role in mediating heterogeneous atmospheric chemistry. The editors have defined the scope of the entire book by discussing concepts in long-wavelength aerosol photochemistry, atmospheric chemistry of isoprene in remote areas, aerosol volatility, bio-organic chemicals and surface-active organics in atmospheric aerosols. We found the authors efforts as a balance between fundamentals, past results and recent advancements in the field of physical and chemical aspects of aerosols.

Discussion initiates with the chemical nature of atmospheric aerosols governed by long-wavelength photocatalytic mechanism in the gas phase, condensed phases and at environmental interfaces. Apart from the reaction mechanisms, the surface-initiated phenomena of aerosols are also elaborated. The wide range of these aerosols photolytic effects were only recently reviewed and have the potential to strengthen regional climate models. The authors also hypothesized about light-absorbing chemical constituents of aerosols which alter phase partitioning of intruding trace gases, which may well be significant in terms of photo-induced aerosol chemistry in an urban environment. Whalley *et al.* emphasize on reviewing recent advancements of biogenic volatile organic chemistry in forest areas through a combination of field measurements, laboratory experiments and modelling. Isoprene constitutes the major proportion of non-methane hydrocarbons and uncertainties in its oxidation, atmospheric chemistry constitute discrepancies in chemical transport model. The authors also highlight possible uncertainties associated with the isoprene oxidation mechanism which leads to difficulties in OH reactivity estimation and emission of secondary aerosols. Additionally, in lieu of differences in laboratory estimates and observation data, presence of multiple mechanisms regulating isoprene oxidation has also been hypothesized. Preceeding section deals with organic-aerosol phase partitioning and oxidative ageing of atmospheric organic aerosols. Aerosol volatility and phase partitioning are continuous evolving processes and thereby significantly interfere with aerosol