

Cholesterol: A chemical of life and death

Parvez I. Haris

Faculty of Health and Life Sciences, De Montfort University, Leicester, United Kingdom

E-mail: pharis@dmu.ac.uk

A Google search for “*cholesterol*” (December 2016) returned 73,300,000 hits. This is much higher compared to 9,680,000 and 14,500,000 hits for “*haemoglobin*” (UK spelling) and “*hemoglobin*” (USA spelling), respectively. There is little doubt that cholesterol is one of the most well known biochemical substances in the world. Unfortunately, to the vast majority of the people, it is associated with death due to its connection with cardiovascular disease (CVD) which is the number one cause for death globally [2]. A Google search (December 2016) for “*death*” and “*cholesterol*” returned 32,700,000 hits in contrast to 37,400,000 hits when “*life*” and “*cholesterol*” was combined. The huge number of hits linked to death is surprising, although it is understandable considering the association of cholesterol with CVD. The Google results should be treated with caution but there is no doubt that cholesterol has a negative image and it is seen by many as a molecule of disease and death, and everything possible should be done to reduce its intake through the diet. Unfortunately, this link to disease and death leads people to overlook the fact cholesterol is also essential for human life. It plays a pivotal role in the structural organisation of biological membranes, tissue repair and as a precursor to a range of hormones and synthesis of vitamin D.

Cholesterol was first identified in gallstones in about 1758 by the French scientist François Poulletier de la Salle. However, it was another French scientist, Michel-Eugène Chevreul (see Fig. 1), who first named this compound as “*cholesterine*” at a meeting of the French Academy of Sciences on August 26, 1816 [5]. Subsequently, it was identified to be an alcohol and was called cholesterol. Chevreul was born in Angers, France in 1786 and died in Paris in 1889. He is credited with being the founding father of research on fats and oils. This year (2016) marks the 200th anniversary of the naming of this compound and to celebrate this notable occasion, I chose to produce a special issue of *Biomedical Spectroscopy and Imaging* devoted to cholesterol research. The issue is dedicated to the memory of my former PhD supervisor, the late Professor Dennis Chapman FRS, who was one of the first to demonstrate the role of cholesterol in modulating membrane fluidity [4,7]. It contains a number of articles from researchers who are applying diverse techniques, including spectroscopic and imaging methods, to explore the structure and function of cholesterol. Ever since it was named in 1816, numerous scientists have engaged in research to understand the structure and function of this small hydrophobic molecule. It is worthy of being described as the “*the most highly decorated small molecule in biology*” [3]. The scientific community have certainly appreciated the value of this molecule and 13 Nobel Prizes have been awarded to scientists who have worked on cholesterol [3]. The first of these prizes was awarded in 1928 to Windaus and Wieland who determined the structure of cholesterol. The most recent prize was awarded to Brown and Goldstein for their discoveries concerning the regulation of cholesterol metabolism [3].

In a recent article, Brown and Goldstein [6] highlighted the role of cholesterol in CVD in the following manner: “*One-fourth of all deaths in industrialized countries result from coronary heart disease. A century of research has revealed the essential causative agent: cholesterol-carrying low-density lipoprotein*

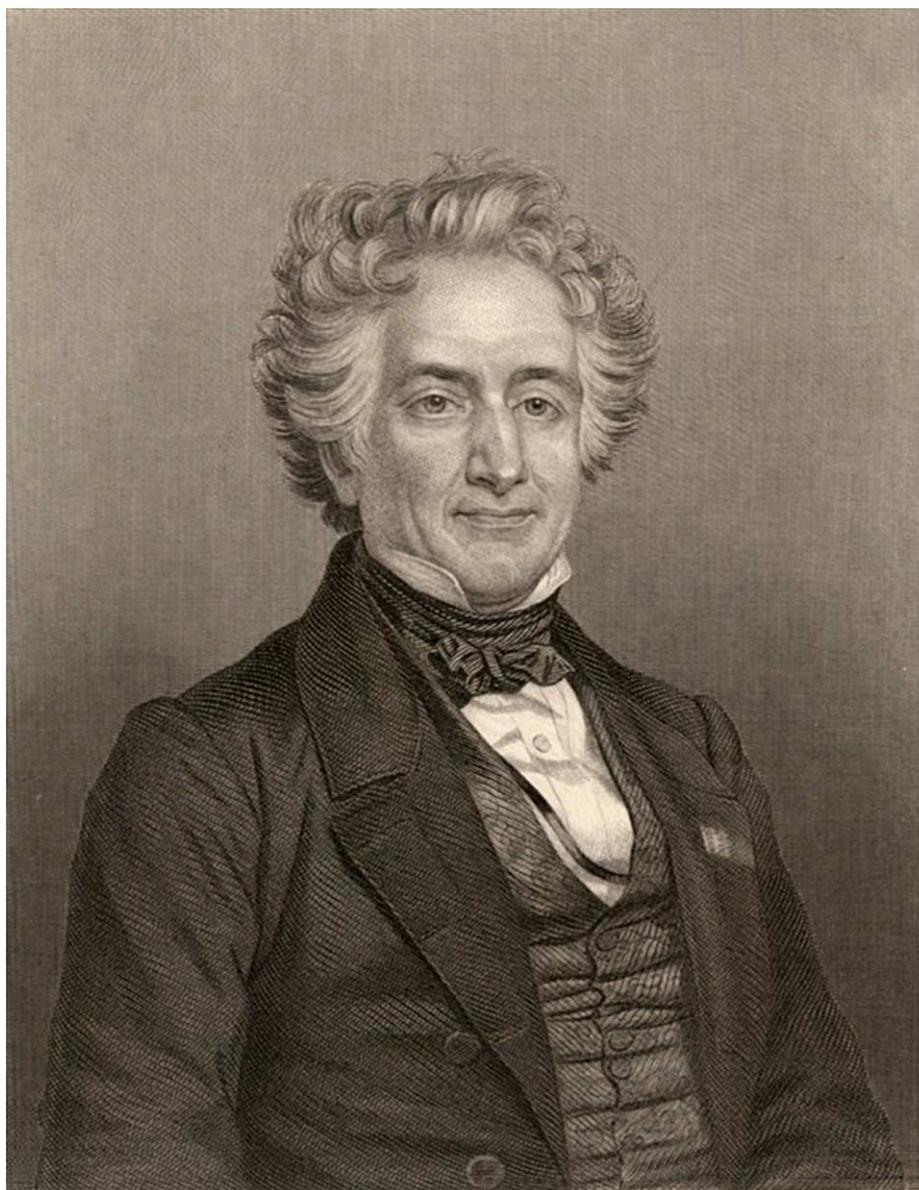


Fig. 1. Michel-Eugène Chevreul.

(LDL)". According to these Nobel laureates and many other scientists, lowering LDL (often called "*bad cholesterol*") as opposed to high density lipoprotein which is called "*good cholesterol*") is essential for eliminating coronary heart disease [6]. There are, however, some scientists who strongly dispute the cholesterol hypothesis and argue against the use of cholesterol lowering drugs [8]. Due to the media attention given to heated debates between scientists who are supporters and opponents of the cholesterol hypothesis [1], the public are often left confused about who to believe. Debate between scientists is certainly necessary to establish the truth but more effort could be made to establish joint research projects that bring together opponents and supporters of the cholesterol hypothesis to address key areas of con-

flict. This will provide a positive image of the scientific community to the general public by showing that scientists, with differing views, can unite and work together. Such co-operation may also result in a better understanding of the role of cholesterol in health and disease by combining the skills and expertise of leading researchers in the field. Refraining from establishing such types of joint projects could potentially have serious implications for public health since people will continue to be in a dilemma as to if they should or should not lower their cholesterol levels.

Although 200 years has passed since cholesterol was named by Michel-Eugène Chevreul, it continues to intrigue scientists and non-scientists alike. There is no doubt that much more work needs to be done before we can fully understand the role of this small, but fascinating, molecule in life and death. Progress in this area requires interdisciplinary research and greater collaboration between scientists.

References

- [1] <http://www.dailymail.co.uk/health/article-3969692/Now-experts-claim-statins-waste-time-say-studies-cutting-bad-cholesterol-fails-slash-heart-risk.html>, Last Accessed 14 December 2016.
- [2] <http://www.who.int/mediacentre/factsheets/fs317/en/>, Last Accessed 14 December 2016.
- [3] M.S. Brown and J.L. Goldstein, A receptor-mediated pathway for cholesterol homeostasis, *Science* **232**(4746) (1986), 34–47. doi:10.1126/science.3513311.
- [4] D. Chapman, Phase transitions and fluidity characteristics of lipids and cell membranes, *Quarterly Reviews of Biophysics* **8**(2) (1975), 185–235. doi:10.1017/S0033583500001797.
- [5] M. Chevreul, Examen des graisses d’homme, de mouton, de boeuf, de jaguar et d’oie, *Ann. Chim. Phys.* **2** (1816), 339–372.
- [6] J.L. Goldstein and M.S. Brown, A century of cholesterol and coronaries: From plaques to genes to statins, *Cell* **161**(1) (2015), 161–172. doi:10.1016/j.cell.2015.01.036.
- [7] Y. Ozaki and P.I. Haris, Dennis Chapman, FRS (1927–1999): A pioneering biospectroscopist, *Journal of Spectroscopy* **16**(3–4) (2002), 105–106. doi:10.1155/2002/562069.
- [8] U. Ravnskov, D.M. Diamond, R. Hama, T. Hamazaki, B. Hammarskjöld, N. Hynes, M. Kendrick, P.H. Langsjoen, A. Malhotra, L. Mascitelli and K.S. McCully, Lack of an association or an inverse association between low-density-lipoprotein cholesterol and mortality in the elderly: A systematic review, *BMJ Open* **6**(6) (2016), e010401. doi:10.1136/bmjopen-2015-010401.