CRISMER, Léon Maurice

Born: October 23, 1858 – Stavelot
Died: June 25, 1944 – Stavelot

He is the youngest of eight and after his secondary studies at Stavelot, he reads pharmacy at the Université de Liège and graduates in 1879 summa cum laude as a pharmacist.

A multicultural and polyvalent schooling

Having obtained a scholarship he pursues his studies at the University of Strasburg (at that time still German) where he meets the biochemist Ernst Felix Hoppe-Seyler (1825-1895) and Henri Gall (1862-1930), one of the founders of the French electrochemical industry. His next stop is Bonn where he studies with Ludwig Claisen (1851-1930) a problem in organic chemistry under the mentorship of August Kekulé (1829-1896) and concludes his foreign academic schooling in Leipzig at the department of physical chemistry led by Wilhelm Ostwald (1853-1932).

On his return to Liège in 1882, he becomes assistant of analytical chemistry to Lucien-Louis De Koninck (1844-1921), followed by his assistantship pharmaceutical chemistry under Alfred Gilkinnet (1845-1925) and toxicology (Théodore Chandelon – 1851-1921). In the evening he is in charge of the Peters-Vaust pharmacy of the university, named in honour of the first professor of pharmacy G.P.N. Peters-Vaust (1804-1867) who was appointed in 1835 when the University was founded. Crismer befriends the bacteriologist Ernest Malvoz (1862-1938) and they live together for many years.

In 1886 he becomes a member of the *Société médicochirurgicale de Liège* and contributes a number of articles for its *Annales*. In 1888 he becomes the co-founder of the *Gazette médicale de Liège.*

A broad scientific interest
During his stay in Bonn he looks into Perkin's synthesis: the formation of unsaturated aromatic acids as a result of the condensation between an aromatic aldehyde and acid anhydride using the basic salt of this acid (Sir W.H. Perkin – 1837-1907). He proves that the same C-atom of the anhydride loses 2 protons. (Claisen condenses benzaldehyde and ethyl acetate using sodiumethylate for the synthesis of ethyl cinnamate, C_6H_5-CH=CH-COO-C_2H_5).

Crismer studies the spontaneous oxidation of the essential oils of turpentine, lemon and eucalyptus in the presence of water. The reaction forms H_2O_2 and aldehydes. He puts forward a personal view of the spontaneous oxidation which stands midway between the theory of active oxygen (Hoppe-Seylor) and Ludwig Traube's (1818-1876) primary intervention theory of the reaction between water and an auto-oxidizing reagent. Crismer believes that the reaction leads in the first place to a peroxide linked to the unsaturated bond of the hydrocarbon molecule. This molecule splits up and forms two aldehyde molecules or reacts with water and ends up as hydrogen peroxide and a diol (1888).

It comes as a surprise to Crismer to discover that Nessler's reagent (1852) is a very sensitive test also for aldehydes (Julius Nessler, 1827-1905): traces of aldehydes form a precipitate which turns black due to the reduction of the mercury salt in the reagent (1889). In 1877 James Alfred Wanklyn uses Nessler's reagent originally for the determination of ammonia, ammonium and organic nitrogen, followed in 1883 by the Danish chemist Johan Gustav Kjeldahl (1849-1900).

Concentrated hydrogen peroxide is extracted from water with ether and its presence is confirmed by using a solution of basic cobalt salts and tartaric acid or by ammonium molybdate in citric acid (1891)

Crismer's reagent or the zinc chloride-bihydroxylamine complex is obtained through the reaction of zinc on a solution of hydroxylamine hydrochloride. It is the ideal starting reagent for the synthesis of oximes (R_2-C=N-OH) and hydroxamic acids.

Crismer investigates the peptones (polypeptides) that can be reversibly precipitated and fractioned by ammonium sulphate. Peptones in meat may be distinguished from fibrin peptones by Nessler's reagent. Dilute solutions of acid at the temperature of a hot water bath lead to the peptonification of meat (the breakdown of the larger peptone molecules). A sensitive reagent for gelatin is chromic acid.

Those precipitation reactions are the foundation of his research on the *critical solubility temperatures* (TCS) of compounds. They are specific physical constants depending on the presence the impurities (for example, the presence of water in ethanol, of erucic acid in oils) and the pH (the acidity of fats). TCS is the temperature (in °C) when a substance forms a clear and homogeneous solution in its solvent (usually ethanol) or turbidity appears. Crismer develops this technique to check the adulteration of butter when over 35% of margarine is incorporated: there is an outspoken difference between the TCS value for butter (of animal origin) and margarine (of animal or vegetable origin). The "Crismer number" is actually still an internationally accepted standard for investigating the falsification of butter and by extension to check the quality of vegetable and industrial oils, for explosives and for measuring some reaction rates. Between 1891 and 1906 Crismer wrote 16 reports about this subject. At first there was a strong doubt about the conservation of 100% pure ethanol because it was feared that it was hygroscopic, which proved to be ungrounded.

For those tests the absolute alcohol, i.e. 100% pure ethanol he needs, he obtains by boiling ethanol with lime (CaO) followed by a slow distillation on a hot water bath till the TCS of the sample remains unchanged (1906). The results match the values D. Mendeleev (1834-1907) found through the determination of the density (up to 5 decimals). Crismer applies his technique to a number of homologous alcohols.

He writes about subjects related to the history of science: "*Les Frontières de la Physique et de la Chimie"* (1897), "*The Science of the Matter in Belgium"* (1905), *"Walthère Spring"* (1912), *"La Loi de Berthollet"*, etc.

During the meeting of the International Union for Chemistry in Rome in 1921, he proposes to establish a bureau for the study of pure compounds. His idea leads to the foundation of the International Bureau of Standards.

Over the years he becomes an acknowledged expert concerning the quality control of food and drugs. He insists that the consumer must be informed about the components in his food. A true precursor of labeling…

An excellent teacher becomes thwarted

In 1893 Crismer is appointed to the Royal Military Academy (KMS) in Brussels. He becomes acquainted with the botanist Léo Errera, professor at the ULB (Free University of Brussels). From

1904 till 1905 he teaches the BA and MA-students of the ULB and motivates them through his enthusiasm and masterly way of teaching. But the minister of Defense puts a stop to this combination of offices and he is allowed to teach at the military academy only. Life doesn't become easier for Crismer because general Leman (defender of the fortresses of Liège in 1914) imposes (quite unsuccessfully) a number of rules.
During World War I, the laboratory closes down and Crismer volunteers to become a forester in the Zoniënwoud. Shortly after he flees Belgium, takes refuge in the neutral Netherlands and joins the Belgian government who appoints him director of the laboratories of the Belgian armed forces, housed at the Sorbonne in Paris for the duration of the war

After the armistice Crismer takes up teaching again and improving his instruments.

A charming personality

His elegant figure, his aquiline nose, fringe of beard and ever present pipe determine his features. His joviality and exuberance are proverbial. On his long walks in the Hoge Venen (Hautes Fagnes) he is easily spotted by his numerous cousins. An expert alpinist he inspires a number of young mountaineers.

In 1912 he is selected as corresponding, in 1920 as permanent member and in 1933 as president of the "Class of Sciences" of the *Académie Royale de Belgique*.

Since 1890 he is a member of the *Association Belge des Chimistes,* and spurred on by his connections with the Belgian sugar industry, he has its name changed into the *Société Chimique de Belgique* and establishes new rules allowing the members of the *Académie* to publish in the *Bulletin.*

The *Société Chimique de Belgique* (SCB) honours him in 1927 with a special issue of Belgian and foreign contributions and a medal. He receives the award during a solemn session in the Palais des Académies, in the presence of the future king Leopold III.
Crismer is also member of the *Société chimique industrielle de France*.

Crismer is an analytical chemist who realizes the importance of physical chemistry for analytical purposes.

Paul Balduck (18/12/2009) - Eng. vert. Yves De Cock (21/03/2010)