

THE CIRCUMSTANCES OF KEKULÉ'S “MOLECULAR DREAM” IN LONDON IN 1854

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Among the more famous ‘dreams’ or reveries in the history of science are two instances attributed to August Kekulé (later Kekulé von Stradonitz) in the second half of the 19th century. He developed the ideas that single carbon atoms could combine with each other to form chains and subsequently that chains of carbon atoms could become rings by combination of their ends, resulting in attribution of the special 6-membered ring structure to the benzene molecule (1, 2, 3, 4, 5). This was a fundamentally important step in our understanding of organic chemistry and molecular structure.

Kekulé himself did not mention the occasions in public until 1890, neither the first and perhaps more novel event in 1854 nor the second in 1861-2, when he gave limited descriptions of them during a special congress in his honor in Berlin, the ‘Benzolfest’ (6); the German text and various translations are reproduced in Ref. 1, 4, 6 and 7. There has been controversy about the reality

and nature of Kekulé’s dreams on historical and chemical grounds (2, 3, 4, 5). Many psychological and psychoanalytical interpretations have been offered, despite the limited information available about these events (3, 6), and in turn they have generated controversy (2, 6).

No independent account of the physical circumstances at the time of his dreams has been reported, which might aid understanding of the *post-factum* accounts of the events. I have recently been able to explore the setting in which his first purported dream occurred in 1854.



Knifeboard omnibus (C.H. Moore, Omnibuses and Cabs, Chapman Hall, LD., London, 1902, p 75.)

Circumstances of Kekulé’s Dream in 1854

Kekulé (7; see diverse translations in 2, 4, 6 and 8) describes how in 1854 he was living in south London, in the Clapham Road near Clapham Common. On a fine summer evening he visited Hugo Müller, his close friend and fellow chemist from Germany,

in Islington, and then caught the last omnibus home. He sat outside, on the top of the omnibus and fell into a 'dream' or 'reverie' ["Traumerei"] in which he 'saw' in his mind atoms in a whirling dance that formed strings that grew by adding smaller strings at their ends (7).

In the same report he recalled how one evening in 1861, while living in Ghent, he again had a vision of atoms (6, 7):

... in motion, winding and turning like snakes. One of the snakes grabbed its own tail (translation from Ref. 6 and 8).

These dreams are the basis of his claim to priority in proposing the ring structure of the benzene molecule.

What was the nature of his bus ride in 1854 when he first realized how carbon atoms could combine into organic chemical molecules? There was no regular public transport from Islington to Clapham, but there was a horse-drawn omnibus that ran from Islington via Goswell Road, Aldersgate Street, the GPO, and London Bridge to the Kennington Turnpike, which is the start of the Kennington Road (9, 10). The end of the journey at Kennington Road is the start of Clapham Road, which still passes along the north side of Clapham Common. The service ran every 8-9 minutes until 10:30 – 11:00 p.m. The ride was timed to take about 1 hour at that time of night, over a distance of about 13 km.

Where Kekulé lived in London has not previously been known except that he was helped to come there by his wealthy step-brother, Karl, who is described as a 'Merchant living and working in London' (1). Inspection of public records shows that there was a Charles Kekulé living in No. 3, Dudley Villa, Clapham Common in 1854 (11). The entry reads:

Clapham Road 'Gentry', Kekulé Chas. Esq. 3, Dudley Villas, The Road.

The British National Census record for 1861 (12) shows a Charles Kekulé, of German birth, living at 3, Dudley Villa, on the north side of Clapham Common. He is described as a 'Merchant,' with a household of three women comprising a housekeeper, a servant, and a telegraph office clerk. Charles Kekulé also appears in the Post Office London directory for 1854 (13):

Charles Kekulé, Merchant, 60 Mark Lane in the Corn Exchange Tavern, London

On that evening in 1854, therefore, it is a reasonable assumption that Kekulé would have taken the omnibus

and then walked along the Clapham Road to stay in his brother Charles' house at 3, Dudley Villas, Clapham Common.

Horse-drawn omnibus travel in the 1850s was accepted as uncomfortable and physically demanding. The vehicles were made of wood, they had wooden wheels, shod with iron tires, there were only two weak leaf springs and they were pulled by three horses. They were called 'knifeboard omnibuses' because the solid wooden seats on each side of the open top, which were not protected by a roof or side walls, were separated by a long plank of lightly padded wood, like a knife board. Passengers sat on the right and left sides both downstairs and on top. The left was favored because the tilt produced by the camber of the road at least kept the passenger in his seat. Contemporaneous accounts of riding in such omnibuses described the vehicles as swaying, reeling and crawling in a crab-like fashion, and passengers, especially those on top, as experiencing "abrupt jerking motion, violent in proportion to the velocity of movement, and with rapid and sustained concussions" as the omnibus wheels rattled over roads made of rough granite slabs, macadam with potholes, and irregular muddy patches (14). There would have been a lot of noise and vibration from the iron shod wheels on the road, the horses, the bell and shouts by the conductor and passengers to tell the driver to stop, and the general hubbub of a busy city, even at that time of night.

A Reverie?

Given the nature of Kekulé's journey in 1854, even late in the evening, it is intriguing that he was able to experience such a dream as he described, albeit 36 years later (1, 7). Unless physically very fatigued, many people would experience difficulty in falling into such a state of external unawareness and deep internal concentration in so noisy and uncomfortable a setting.

The physical circumstances of Kekulé's molecular dream in 1854 may appear unpromising in terms of high level thought and a productive mental state, but they can be pictured now in perspective as he eventually reconstructed the legendary event.

REFERENCES AND NOTES

1. R. Anschütz, *August Kekulé. Leben und Wirke*, Verlag Chemie, Berlin, 1929, 49-50.
2. J. H. Wotiz and S. Rudofsky, "Kekulé's Dreams: Fact or Fiction?" *Chem Brit.* **1984**, 20, 720-723.

3. J. Wotiz, Ed., *The Kekulé Riddle: A Challenge for Chemists and Psychologists*, Cache River Press, Clearwater, FL, 1993.
4. T. O. Benfey, "August Kekulé and the Birth of the Structural Theory of Organic Chemistry," *J. Chem. Educ.*, **1958**, 35, 21-23.
5. J. Buckingham, *Chasing the Molecule*, Sutton Publishing, Stroud, Glos, 2004.
6. A. Rothenberger, "Creative Cognitive Processes in Kekulé's Discovery of the Structure of the Benzene Molecule," *Am. J. Psychol.*, **1995**, 108, 419-438.
7. A. Kekulé, in G. Schultz, "Bericht über die Feier der Deutschen Chemischen Gesellschaft zu Ehren August Kekulé's," *Ber. Dtsch. Chem. Ges.*, **1890**, 23, 1265-1321 (pp 1302-1306).
8. F. R. Japp, "Kekulé Memorial Lecture," *J. Chem. Soc.*, **1898**, 73, 97-108.
9. E. Mogg, *Moggs's Omnibus Guide and Metropolitan Carriage Time Table*. 1847, London. Although antedating Kekulé's journey, this timetable is accepted as applicable to 1854, London's Transport Museum, personal communication, January 2005.
10. Anon., *The Illustrated Omnibus Guide*, Simpkins and Co., W. H. Smith & Co., London, 1855, reprinted 1971 for Railwayana Ltd., Oxford Publishing Company; Ref. 13 and 18.
11. Watkins Commercial and General London Directory for 1854. Longman, Brown and Green, London. 3rd ed.. 1854, 273.
12. British National Census 1861. Parliamentary Borough of Lambeth, Ecclesiastical District of St. Michael, p 12. Public Record Office London, R.G. 9/353.
13. Post Office London Directory 1854. 55th edition. Printed and published for F. Kelly by Kelly and Co., London, 1854 121.
14. J. Thompson, *Horse-Drawn Omnibuses*, John Thompson, Fleet, Hampshire, 1986.

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