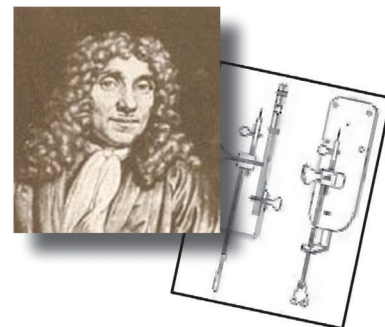


MicroscopyPioneers

Scanning Electron Microscope Pioneers Dennis McMullan (1923–2015) and Ken Smith (1928–2020): SEM, Whisky, Chocolate, and Fast Cars



Peter Hawkes*

CEMES-CNRS, B.P. 94347, F-31055 Toulouse cedex, France

Editor: Cameron Varano, The Pennsylvania State University, 201 Old Main, University Park, PA 16802

*peter.hawkes@cemes.fr

The scanning electron microscope has a prehistory, in Germany and the USA, but the instrument we know today began life in Cambridge in 1948, when Charles Oatley gave “Construction of a scanning electron microscope” to Dennis McMullan as his PhD project.

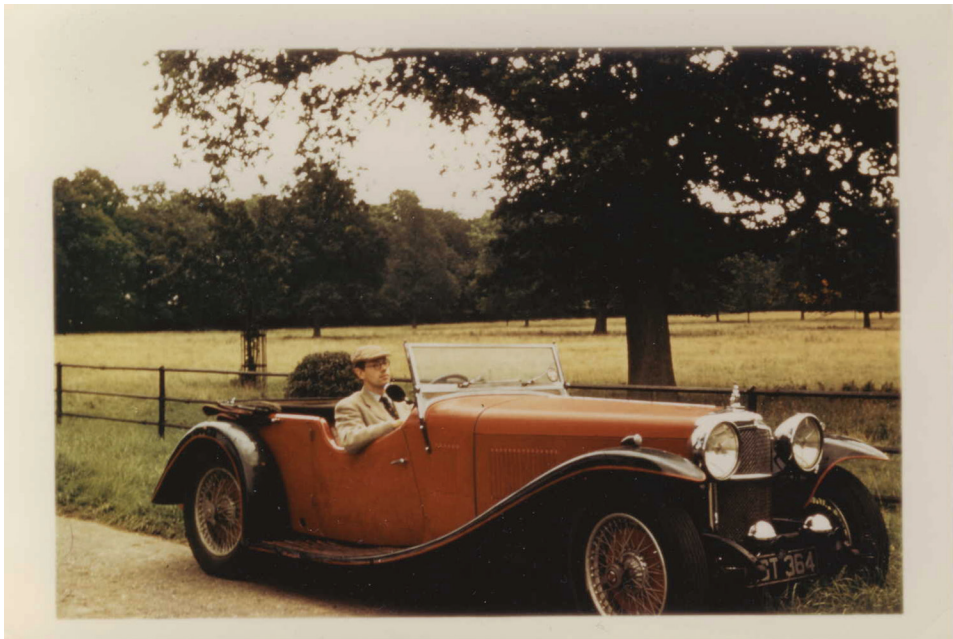
Dennis was born in Reading, England on May 3, 1923, son of a doctor, and graduated from Cambridge University in 1943. After war service working on radar, and a few years in industry, he joined the Cambridge University Engineering Department (CUED) as Oatley’s first PhD student and brought his project to a brilliant conclusion. That first instrument contained all the essential features of the sophisticated instruments we know today. In particular, he designed and built a stabilized power supply and CRT display with a nonlinear video amplifier and introduced double-deflection, which is now standard. He passed on his know-how to K.C.A. (Ken) Smith before leaving Cambridge in 1953. The years passed, with a high point in 1959 when he married his beloved wife Otti (née Ottilie Sander in Frankfurt, 1917–2004). Among his various posts, he spent several years at the Royal Greenwich Observatory in Herstmonceux where he developed the “electronographic camera,” a device for enhancing the faint images of distant galaxies. He then returned to Cambridge, to the Cavendish Laboratory, where he spent several happy and very productive years, working on accessories for the scanning transmission electron microscope (STEM). He was a pleasant, very intelligent, cultivated man, modest concerning his many achievements and at ease with all generations. In old age, life became difficult, but he would have loved the words of his niece at the Mortlake crematorium: “Surely Dennis must be an inspiration to us all for living to 91 years old on a diet heavily influenced by whisky and chocolate!”

The microscope that Ken Smith, Oatley’s second PhD student, inherited was a remarkable proof-of-concept instrument, but it required many improvements if it was to be taken seriously by the electron microscope community, initially very hostile to this newcomer. In particular, he pursued Dennis’s ideas about imaging with secondary electrons and redesigned the specimen chamber in such a way that electrons could travel directly from the specimen surface to the electron multiplier. So successful was his work that an improved model was

ordered by the Canadian Pulp and Paper Research Institute in Montreal. This was installed by Ken, who trained the technical staff who would be responsible for this first commercial use of a SEM. A happy side effect resulted from the need to learn specimen preparation techniques and in particular to compare SEM images with those obtained in TEM by the replica technique. Ken was instructed in these by Sheila Smith in a completely dark room (dark-adapted vision was essential in those days). This was enough to make him wish to see Sheila in daylight, and they were married in 1957. Space does not allow me to describe their happy life in a thatched cottage in a Cambridgeshire village, but I must mention the other love of Ken’s life, his 1933 Alvis Speed 20 Tourer (successor to his Triumph Twin 350 cc motorbike). On his return to Cambridge from Canada, Ken joined the Electron Microscopy Group in the Cavendish Laboratory, headed by V.E. Cosslett, where he was soon invited to direct the construction of the first British high-voltage electron microscope (750 kV) in a site adjacent to the original Cavendish Laboratory in the city center. This consisted of a large ground-floor room, in which the Cockcroft-Walton generator and the accelerator unit of the microscope were housed, above a vaulted Victorian cellar, high enough to



Dennis McMullan. Photo: Finn Johannessen.



Ken Smith [1]

receive the column of the microscope. In August 1965, a tension of 700 kV was achieved and duly celebrated! In that same year, Ken was appointed to a tenured post in the CUED, and the project was then brought to a successful conclusion by Ken's successors. The instrument was exploited commercially by AEI, who sold several EM7 HVEMs. Ken was also intimately involved in a later project launched by Cosslett, jointly with the CUED, to construct a high-resolution transmission electron microscope with a maximum tension of 600 kV. The success of this was largely due to the devotion of two of Ken's colleagues, John Cleaver and John Catto, and later to David Smith. Among the many ways in which his work was recognized was the award of the Duddell Medal and Prize of the (London) Institute of Physics together with Ellis Cosslett, Honorary Fellowship of the Royal Microscopical Society (1984) and the Distinguished Scientist award (1993) of the MSA.

Ken made several attempts to exploit his work commercially. Three start-up companies were launched: the short-lived Cambridge Western, Granta Electronics, and Synoptics. Granta Electronics furnished a widely used software suite for lens design and was wound up only in 2012. Synoptics was the most successful, but Ken was obliged to withdraw from his role of Chairman by severe back problems.

We have seen Ken the successful professional electrical engineer; it is time to say a few words about his origins. He was born on March 20, 1928 in Birmingham, England where his father ran a shop selling and repairing "wireless sets," as we called radios in those days, and bicycles. Behind the shop was a large garage in which cars were stored and their batteries recharged, and it was there that Ken saw his first Alvis. Owing to the Depression, Ken's father had to leave his business and joined a firm in Coventry. This deprived Ken of an education at a Birmingham grammar school, but he was soon enrolled in the Coventry Junior Technical College, which led to an apprenticeship at the British Thomson Houston Company. Here he spent

his wartime years. The war over, he was awarded a technical state scholarship, which enabled him to go to university. He was lucky enough to be accepted by Fitzwilliam House, Cambridge (after a crash course in Latin, indispensable for entry into the university). I give all these details to show how difficult it was for a boy from a modest background to have such an impressive career. On graduation, he was invited by Oatley to become his second PhD student. But his life was not all work; the music of the great ukulele player George Formby, whose songs are just as catchy today as they were 80 years ago, inspired him to take up that instrument as well as the guitar. He remained a melomane all his life, Bach and organ music being his favorites. He died on March 15, 2020 at his home in Cambridge with his wife Sheila and son Laurence.

Reference

- [1] Reprinted from *Advances in Imaging and Electron Physics*, volume 177, KCA Smith, "Electron microscopy at Cambridge University with Charles Oatley and Ellis Cosslett," p. 189 (2013), with permission from Elsevier.

MT

Microscopy TODAY

Free Subscriptions



Individuals may request a personal copy at:

https://www.microscopy.org/publications/microscopy_today.cfm