

Obituary*

Andrew Keller FRS 1925–1999

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Andrew Keller died last year whilst on a skiing holiday in the Alps. He was one of the founding fathers of Polymer Physics and, working first at ICI and then at the University of Bristol, he established the field of microstructural analysis of polymers.

Pivotal to Andrew's career was his discovery in 1957 of the structure of polymer single crystals. An advance made possible by the new technique of electron microscopy. First there was the observation that crystals of polyethylene took the form of exceedingly thin platelets. However, Keller also measured the direction in which the chain molecules lay inside the crystals, leading to the totally surprising discovery that the chains were aligned perpendicular to the platelet crystals, even though they were up to 100 times as long as the crystals were thick. The molecules could thus only fit in if they were folded backwards and forwards, rather in the style of a 'jumping cracker.' From that point onwards, chain folding became a central feature of polymer science, and although there have been later modifications and revisions, many of them due to Keller himself, the impact of his discovery has never dimmed.

He lived his science, and much of his inspiration to others stemmed from animated and utterly absorbing conversations when words, beginning to fall behind the pace of ideas, were supported by sketches and gesticulations. The author remembers an exciting car journey through Bristol one wet day with Keller at the wheel, when the misted windscreen of the car served as the blackboard necessary to the conversation in hand, and the outside world seemed only to intrude as isolated moments of sheer terror.

As a Hungarian teenager, Keller, escaped first from a German camp and then a Russian. Taking up his University education in Budapest, he seized a last opportunity in the deteriorating political situation of 1948 to escape to Britain, leaving his PhD studies in Chemistry complete, but unexamined. He worked first for ICI Dyestuffs in Manchester where his interest in the structure of polymers was kindled. He moved to Bristol under Charles Frank and never looked back. There was of course a new thesis to complete, this time on polymers, and the chain folding discovery followed soon afterwards. The Bristol school of Polymer Physics grew from strength to strength, and it became a place of pilgrimage for many visitors from around the world. He

was a founding member and subsequent chairman of the British Polymer Physics Group.

Keller's research extended to polymer gels and solutions, especially in the presence of flow, and he made significant contributions in linking his science into that of the emergent modern biology. Although he worked with a wide range of different polymers, his first love was for polyethylene; so simple chemically, yet so rich in physical structure. His chain-folding model was challenged at a memorable meeting in Cambridge in 1979, although it was really the perfection of the folding which was under scrutiny rather than its existence *per se*. However, while the different research communities from around the world dug trenches, Keller appeared to remain in no-mans land, simply waiting for new truth to emerge from the heated debate.

The calendar dictated that he should retire in 1991 and there was an appropriate meeting to mark the date. His paper, "My Perambulations in Polymer Physics," ventured three precepts for research: "to read the *original* publications," "to challenge the status quo" and "to employ all the senses." He illustrated this last advice with reference to his original Hungarian thesis research on cuprous formate where the solution to the problem had apparently depended on the judicious use of smell!

His "retirement" coincided with a second wind, as he led the understanding of polymer crystallisation into new territory, seemingly leaving many colleagues around the world breathless in pursuit. He demonstrated the key role in polymer crystallisation that is played by transient structures called meso phases. Immediately, earlier observations which had needed complicated theories to explain them, yielded to a simpler, more elegant, understanding, and his last seminar given in the Cavendish Laboratory, Cambridge, just days before his death, reviewed this recent work.

Andrew Keller was a deeply cultured man. Sometimes, conversation would move to the arts and one uncovered a different world in which he would talk with authority and passion, but always on the basis of his own first hand experience. His wife, Eva, who completed his enjoyment of living, died in 1997. Afterwards, he travelled continuously between different polymer research groups, giving unstintingly of his knowledge, intellect and friendship. He is remembered with respect and affection by the world-wide community of polymer science. He is survived by a son and a daughter.

* Adapted from a similar obituary in *Physics World*.