

George K. Batchelor – An obituary

George Keith Batchelor (1920–2000), a distinguished fluid dynamicist and founding editor of the *Journal of Fluid Mechanics*, passed away on 30 March 2000. In the early decades after the Second World War, Batchelor's studies of turbulent flows helped in defining the nature of the subject and the problems that it raised, and in introducing the ideas of Kolmogorov to the English speaking world (and, it is said by some, to many Russians as well!). Batchelor's book on *Homogeneous Turbulence*, published in 1953, has become a classic and is still illuminating to read, nearly fifty years after it was written. In the 1970s his interest shifted away from turbulent flows to sedimentation and micro-hydrodynamics, subjects to which he again made fundamental contributions. The *Journal of Fluid Mechanics*, which he founded in 1956 and edited till his death, has had a profound influence on the growth of the subject and the style in which research in it has been conducted and reported all over the world. Batchelor was also instrumental in establishing the Department of Applied Mathematics and Theoretical Physics at Cambridge, at a time when mathematics was taught and done in the colleges and was not seen as requiring a separate department. He proceeded to make the department a leading international centre of research in fluid dynamics as well as in many other subjects, and one which attracted a large number of bright students and distinguished scholars from everywhere.

George Batchelor was born on 8 March 1920 in Melbourne, Australia, where he obtained his M Sc in 1941 and worked at the Aeronautical Research Laboratory for four years thereafter. Some of the reports that he published at that time on rather down-to-earth engineering problems seem a far cry from the kind of studies that brought him such renown in later years. He concluded at that time (correctly, of course) that the major problem in fluid dynamics was turbulence, and so went to Cambridge to work with the celebrated G. I. Taylor on the subject. By then however Taylor's research interests had moved away from the subject, but he had no objection to Batchelor (and his

countryman Townsend who joined him at Cambridge) continuing to do research on turbulence. After the publication of *Homogeneous Turbulence* (which incidentally won for him the Adams Prize), Batchelor worked on such subjects as the dispersion of plumes, small-scale temperature fluctuations in turbulent flows (leading to the definition of what is today known as the Batchelor scale) and on rapid distortion of turbulence. During a lecture at Stanford around 1980 Batchelor regretted that he had spent so much of his professional life on turbulence! He had by then already started working on flows in disperse media, and actively encouraged his colleagues in the department to branch out into a variety of different areas in fluid dynamics – the oceans, the atmosphere, volcanoes, the environment, animal locomotion, building ventilation, etc.; everything that involved flowing fluids seemed to be of interest. Indeed a very lively and authoritative group with wide interests in fluid mechanics came into being under Batchelor's leadership, with Taylor and his methods providing the inspiration, at least in the first few decades of the group.

In 1967 he wrote *An Introduction to Fluid Dynamics*, a textbook that once again has been most influential in the way the subject is perceived and taught; I do not see any other textbook on the subject, among the hundreds written in the second half of this century, that will last longer than Batchelor's book.

Apart from the books and his scientific research, however, Batchelor's major contributions were institutional. The *Journal of Fluid Mechanics (JFM)* that he founded has moulded both the content and style of research in the subject, and, indeed, the value systems of its practitioners, in such a subtly powerful way that it should be the envy of the wealthiest patrons of science. I have heard stories that, in the early years, Batchelor (cooped up in his Cambridge cubby-hole) read every word of what was going to appear in the journal and was very particular about the way in which papers were written. A second institution that owes its existence to him is the Department of Applied Mathematics and Theoretical

Physics (DAMTP), which Batchelor succeeded in establishing after several years of strenuous effort. In 1964, seven years after it was founded, the department moved to the old Cambridge University Press buildings, where it is now housed. The Department is not only known for its very influential research in fluid dynamics, but also for the work carried out in astro- and geophysics, statistics and other subjects. (Stephen Hawking is one celebrated faculty member of the same department.) Batchelor was also the founder of the well-known series of conferences called Euromech Colloquia, which got together European scientists working in mechanics to a large number of small, effective meetings held in various European cities, and has undoubtedly done much to form a well-knit European network and community.

Batchelor was clearly strongly influenced by Taylor's ideas and methods of thinking and working. He was an unabashed admirer (like most other fluid dynamicists) of that great man, and edited his collected papers in four volumes. He wrote two articles on Taylor in *JFM* (1975, 70, 625–638 and 1986, 178, 1–14). He organized a symposium at Cambridge on '*Fluid Mechanics in the spirit of G.I. Taylor*'. He raised funds to establish a chair named after him at Cambridge, and in 1996 wrote a most interesting life of his mentor. Batchelor was the *sisya* who propagated his *guru's* teachings across the world.

I had the good fortune of meeting Batchelor several times, beginning in 1962 when the fluid dynamics/applied mathematics group was still located in the old Cavendish Laboratory. An early encounter with him as an editor occurred when a paper submitted from Bangalore was rejected on the grounds that another author in Britain had submitted a paper on the same subject before we did. As in this case the paper came out of a thesis which had been refereed in Britain, and the referee had explicitly mentioned how he had shown the thesis to one of his colleagues, I wrote back to Batchelor explaining the situation, and asking him to make enquiries with the referee. I heard nothing from him for a long time and had as-

sumed that the matter was dead, but one day about a year later a long letter appeared retracting the earlier decision and asking us to submit the paper for reconsideration, promising that it would now be refereed very quickly. This was one instance which showed how such matters were handled carefully, fairly and firmly by Batchelor.

When we started the Asian Congresses of Fluid Mechanics, I had the opportunity to mention the idea to Batchelor, and was dismayed when he said that he thought a Pacific Rim group may be a more practical proposition. However, after reports of the first Congress, held in Bangalore in 1980, trickled back to him from the participants, and in particular after he saw the proceedings of the Congress (which was handsomely reviewed by him for *JFM*), his view changed very rapidly. He gave an invited lecture in 1983 at the Second Congress in Beijing, and visited India the following year with his wife Wilma. He seemed to have enjoyed the visit very much, and spent considerable time looking at experiments in the different

laboratories and talking to people about fluid dynamics, about how to do research, about what the interesting problems were, about how IUTAM was governed and so on. When I asked him about the Euromech Colloquia he sent me the statutes for the meeting – all written down by him on one page. This provided a model for the statutes that I myself drew up thereafter for the Asian Fluid Mechanics Committee – and I must say that these brief statutes have stood the test of time and have served us very well indeed.

Batchelor set exacting standards for the quality of research in the subject, in part by being meticulous about his own work but in part also by using the influence he wielded as a very clear-headed editor. Julian Hunt, his long-time colleague at DAMTP, says that Batchelor's writing style reflected his admiration for Henry James. His philosophy at DAMTP, where he insisted that applied mathematicians should make and could learn from experiments, has changed the way that the subject has been perceived in many mathematics departments

around the world. I remember his taking visitors around with great pride to show the very interesting and not-always-so-simple experiments that had been set up in the basement of his department, and also to display the pioneering experiments that he had made himself in the use of computers for instruction in fluid dynamics or mathematics.

I cannot forget the evening spent at his home with a large number of scientists from all over the world, talking about fluid dynamics, science and his garden. He once told me that his most vivid image of India was that of its remarkable women, in their extraordinarily colourful dresses: they reminded him, he said, of an English garden in spring.

He was elected to the Royal Society in 1957, and won the Royal Medal in 1988. He was widely honoured by universities and academies elsewhere in the world as well.

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David G. Crighton – An obituary

By a tragic combination of circumstances, David George Crighton (1942–2000), who succeeded Batchelor as the Head of the Department of Applied Mathematics and Theoretical Physics in 1986, passed away on 12 April this year (within weeks of his predecessor), while still holding the position. Crighton, also a distinguished fluid dynamicist who came to be well known for his work in aeroacoustics, began as a Research Assistant with Ffowcs Williams at Imperial College (where he went giving up a lucrative position he already held in a college less congenial to his research interests). In 1974, he went directly from this position to that of a Professor of Applied Mathematics at Leeds (would it be conceivable in India for a person to jump to a Professorship from a Research Assistantship?). In Cam-

bridge he became Master of Jesus College in 1997; he was elected to the Royal Society in 1993.

The Department grew under his leadership, which was in particular known for the way that he won support for the work that was being carried out by himself and by his colleagues. His extraordinary human qualities, which included an unfailing enthusiasm and the ability to talk to a variety of people, conveying to everybody a warm human appreciation, won him many friends. In Cambridge all students, but I believe foreign students in particular (not only Indian), felt very easy talking to him and therefore sought his criticism and help on a wide variety of different issues. At the time he died he was editor of the *Journal of Fluid Mechanics*, having succeeded Batchelor in this position as

well. He showed great personal courage as he kept working almost till the last day of his life even though he (and everybody around him) knew that he did not have much longer to live. He was once assaulted in Brussels and as a result completely lost his hair. So when I met him in a conference soon thereafter I could not recognize him till he actually introduced himself to me once again. I remember the patient and even cheerful way he explained what had happened to him when I made a misplaced joke about his changed hair style.

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