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## Margaret E Rayner

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Margaret Rayner, who has died at the age of 89, was a respected mathematician and much loved tutor, a highly valued member of both St Hilda's College as well as the wider academic community in Oxford, who was known nationally and internationally for her work on school examinations.

She was the only child of Ridgway and Fanny Rayner who farmed near Stratford-upon-Avon. An early influence was an aunt, the headmistress of a village school and the only one of her relations not to be engaged in farming. With her aunt's encouragement, she went from the King's High School for Girls, Warwick to Westfield College, part of London University, where she took her first degree and stayed on to gain an MSc by Research. Given a tip-off about the vacancy by the new Principal of Westfield, who had previously been Vice-Principal of the College, she obtained a temporary lectureship in Mathematics at St Hilda's College, Oxford, a joint appointment with St Anne's College. She was elected to a Tutorial Fellowship in Mathematics at St Hilda's seven years later. As well as her tutoring responsibilities in those years, she also worked towards a D Phil, which she obtained in 1960, her thesis being on 'Some problems in unsteady heat flow'.

She became a central figure in College life, particularly during the eight years she served as Vice-Principal. Not just within the College but more widely in the University, she was valued for her calmness, her willingness to take on extra burdens, her staunch common sense, elegant drafting, and ability to keep objectives clearly in mind.

In an interview with *The Oxford Times* in 1984, she explained that she loved to see things work, and this was exemplified throughout her life whether in research, teaching, fund-raising or administration and whether at local, university, national or international level. She regarded the development of the pupil's own mathematical skill as an essential part of a mathematical education. A former student describes her tutorial technique as 'an expertly guided and challengingly accompanied journey of exploration ... [over time] you gradually found that, slowly but surely, you were actually

becoming increasingly likely to find the way through yourself'. To students, her naturally dignified presence precluded frivolity but she was always completely approachable, giving kindly support and care for their welfare.

The chance came in 1965 for her to travel to the United States to visit the University of Maryland and Cornell University. There she was able to collaborate with Lawrence Payne. A joint paper, published some years later, introduced the Payne-Rayner inequality, an isoperimetric inequality for the first eigenfunction of the Laplacian. More specifically, it gives an exact lower bound of the first eigenvalue by means of some integral norms of the first eigenfunction, and also says that the first eigenfunction satisfies a reverse Hölder inequality. This paper and a second which extended the result to higher dimensions stimulated further advances in isoperimetric problems by others.

Graeme Wake, now Professor Emeritus of Massey University, New Zealand, who visited Oxford in the early 1970s, was introduced to Margaret by his local mentor Alan Tayler. He writes "Alan quite correctly believed our common research interests would ensure joint work would eventuate. That worked exceedingly well of course. Our joint paper and best work on 'Variational Methods for Nonlinear Eigenvalue Problems associated with Thermal Ignition' was, in a strange way, an early forerunner of the now common path-following techniques for such problems. It led me, with others, to develop algorithms to characterize, and estimate, thresholds for self-ignition. Margaret was also a wonderful teacher and mentor."

During the 1970s Margaret moved away from research into administration. An account of her many roles both within and outside the University is given in a memoir she wrote in 1993, extracts from which are quoted below.

"Although she modified her earliest ambition to teach in a school, she never lost her interest in school education. One of her first University committees was at the Department of Educational Studies and she had her first training in chairing a large meeting in connection with teacher training in the Area Training Organisation. Her concern with school education was kept alive by work with the Mathematical Association and by membership of a number of governing bodies of schools, both independent and state maintained. For many years she was chief examiner in mathematics for the International Baccalaureate and so became aware of developments in curricula and in assessment in Europe and North America. She found this an exciting task, drawing up syllabuses that would be acceptable to universities all over the world. It was an experience of the greatest value when she later joined the Secondary Examinations Council (and even later the School Examinations and Assessment Council) and took part in approving syllabuses for GCSE and A-level."

Her Presidential Address to the Mathematical Association "On Examinations" grew out of this work for the IB and the SEAC. It explores in

an interesting way the similarities between historic debates and dilemmas and the issues surrounding school examinations in the 1970s and 1980s.

Her work with schools examinations and as Vice-principal of St Hilda's was recognised in the award of a CBE in the Queen's Birthday Honours of 1990.

Her enthusiastic involvement in fundraising attests to her willingness and ability to take on any role. When in the late 1960s St Hilda's needed money to erect a new building to house undergraduates, Margaret volunteered as a fund raiser and, as she later wrote, had a splendid year drawing up plans, arranging meetings, talking to Senior Members, writing letters and acting as chauffeur for the Principal on a round-the-country campaign. It was also a successful year.

This experience was invaluable when later she became involved with appeals for other organisations. She was chair of the sub-committee of The Mathematical Association that oversaw the raising of funds – which was outstandingly successful – for the purchase of a house in Leicester that was to become its headquarters. Her love of the theatre, fostered by the rich theatrical experiences of Stratford and London, led to a close involvement with the Oxford Playhouse and, as vice-chairman of the curators, an active part in the successful appeal for £250,000 in the 1980s. To quote again from her memoir:

“That year of fund raising [1968] was the start of two decades of administrative activity; a year as University Assessor preceded a short stint on the General Board [of Faculties] and a longer stint on Hebdomadal Council, which lasted until 1989. On Council, Margaret's main interests were the Staff Committee and the Accommodation Committee, on both of which she served as chairman. For the Oxford Colleges, she chaired the Admissions Office Committee and this, again, brought her in constant contact with schools.”

She also served as Chairman of the Board of Governors of Oxford Polytechnic (now Oxford Brookes University) and as a lay member on the Council of the University of Reading. With retirement came another change of direction when she was invited to write the Centenary History of St Hilda's. This project was tackled with her customary energy, thoroughness and organisation. She produced on time a definitive and succinct history and a book with lasting value. She later described it as “one of the most enjoyable tasks she had ever undertaken”. It led on to contributions to the *Oxford Dictionary of National Biography* and to a chapter on 20th century mathematicians in *Oxford Figures* (edited by Fauvel, Flood and Wilson).

The characteristics that come to mind most immediately when thinking about Margaret are her intellectual curiosity, her energy, her capacity for making friends and her generous hospitality. She cared about people and, in return, they cared about her and were fond of her. She will be much missed.

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IRENE AULT

83 Romway Road, Leicester LE5 5SE