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# Obituary

## Walter Deuber (1942–1999)

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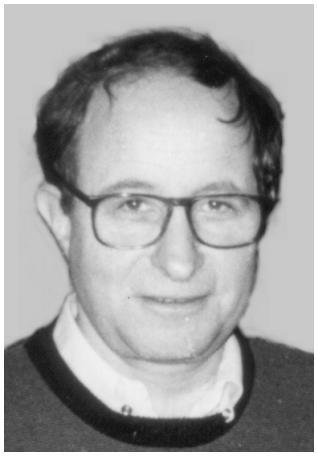

Walter Deuber, Professor of Mathematics at the University of Bielefeld, died on 16th July 1999 at the age of 56 after a one-and-a-half year struggle with cancer. He was born on 6th October 1942, in Bern, Switzerland, where he grew up, went to school, and spent the first 20 years of his life until he went to Zürich to study.

Walter was a mathematician with far-ranging interests, but his mathematical love was Ramsey theory. When I talked to him for the last time, about two weeks before his untimely death, he asked me 'What is new in mathematics?'. I started talking about some results in random graph theory which we had recently obtained. However, he immediately interrupted me, saying 'No, I meant in Ramsey theory, of course.' Rota's dictum *Ramsey's theorem tells more about the nature of sets than all the axioms of set theory!* was spoken from the bottom of Walter's heart.

Walter studied mathematics and physics at the Eidgenössische Technische Hochschule (ETH) Zürich — originally, to become a high school teacher. He first came across Ramsey theory in his Ph.D. thesis, written under the guidance of Ernst Specker in Zürich, which in its core contains a remarkable extension of a famous result of Richard Rado. In his thesis *Studien zur Kombinatorik* from 1933, Rado had studied systems of homogeneous linear equations and had addressed the following question: which systems of homogeneous linear equations that have a solution in $\mathbb{N}$ have the property that for every partition of $\mathbb{N}$ into finitely many classes at least one of these classes must contain a solution of this system of equations. Rado gave a complete characterization of these systems of equations and called them *partition regular systems*. Going one step further, one calls a set $X \subset \mathbb{N}$ *partition regular* if and only if it contains a solution of every partition regular system. Obviously, Rado's result then says that whenever $\mathbb{N}$ is partitioned into finitely many classes at least one of these classes is partition regular. Already in his thesis Rado conjectured that

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whenever *any* partition regular set is partitioned into finitely many classes, then at least one of these classes is partition regular *again*. This conjecture remained open for 40 years until Walter settled it in his thesis. The tool that Walter invented in order to prove the conjecture has become even more popular than the result itself. He gave a description of the arithmetic structure of the sets of solutions of partition regular systems, calling them $(m, p, c)$-*sets*. Now *Deuber sets* seems to be the proper name for them. He proved a general partition theorem for $(m, p, c)$-sets that in particular yields a proof of Rado's conjecture. The main results of his thesis are published in the paper *Partitionen und lineare Gleichungssysteme*.[†]

Partition regular systems of equations and $(m, p, c)$-sets became a constant companion throughout his entire mathematical life. As with many mathematicians, he often came back to the results he proved in his Ph.D. thesis. An excellent account of the developments based on Rado's and on his dissertation — which is, to quote Graham, Rothschild and Spencer,[‡] on the shoulders of Rado — was given by Walter in the *Surveys in Combinatorics* 1989.[§] In spring 1998, already being aware of his deadly illness, he witnessed one of his last scientific satisfactions. Meike Schröder, his last Ph.D. student, was awarded the 'Richard Rado Prize for Discrete Mathematics' for her outstanding thesis. In her thesis, Schröder used Walter's $(m, p, c)$-sets to prove an analogue of Rado's theorem for systems of homogeneous linear *inequalities*, showing once more the power of this concept.

Leaving the ETH Zürich in 1972 (one year before he formally obtained his Ph.D. from there) Walter went on to become Oberassistent at the Technische Universität Hannover. At this time he started studying partition properties of finite graphs and wrote his probably most cited paper: *Generalizations of Ramsey's theorem*.[¶] This paper, published in the proceedings volume dedicated to the 60th birthday of Paul Erdős contains a far-reaching generalization of Ramsey's theorem to colouring edges in finite graphs. This result, obtained independently by Rödl and by Erdős, Hajnal and Pósa, opened up new vistas in Ramsey theory. In his second thesis, his Habilitationschrift, which Walter defended in 1974 in Hannover, he then extended the edge-colouring theorem for finite graphs to a colouring result for general cliques. This result was published in the paper *Partitionstheoreme für Graphen*.[‖] His wife Kathy and his son François, who was three years old at the time, joined him when he visited the University of California at Los Angeles in 1974–1975. There he worked with Bruce Rothschild, among other problems, on the investigation of Categories without the Ramsey property.[**] It was during this stay in California that his daughter Odette was born.

In 1976, Walter became Professor of Mathematics in Bielefeld where he remained from then on. He liked to talk about mathematics, and he liked to work in company. So he often visited colleagues and friends around the world and many of them will remember an inspiring time enjoying his hospitality in Bielefeld. In 1981 he started organizing the 'Colloquium on Combinatorics' a series of annual meetings which took place in Bielefeld for ten years. This meeting is by now in its nineteenth year, presently held in Braunschweig. During his time in Bielefeld, Walter also served his university and the mathematical community in many other respects: as chairman of the department of mathematics, as the speaker of a Sonder-

[†]W. Deuber, Math. Z. **133** (1973), 109–123.

[‡]R.L. Graham, B.L. Rothschild, and J.H. Spencer, Ramsey Theory, 2nd edn., John Wiley & Sons, New York, 1990

[§]W. Deuber, Surveys in Combinatorics (J. Siemons, ed.), London Mathematical Society Lecture Notes Series (1989), **141**, 52–74.

[¶]W. Deuber, Infinite and finite sets (A. Hajnal, R.Rado, V.T. Sós, eds), *Colloq. Math. Soc. János Bolyai* **10** (1975), 323–332.

[‖]W. Deuber, Comment. Math. Helvetici **50** (1975), 311–320.

[**]W. Deuber and B.L. Rothschild, Combinatorics, Colloq. Math. Soc. János Bolyai **18** (1978), 225–249.

forschungsbereich, and as the coordinator of a European network on Discrete Mathematics, just to name a few of his many activities.

Mathematically, he always came back to Ramsey's theorem and he contributed substantially to shape modern Ramsey theory.

However, his work has many facets besides Ramsey theory. I will, *pars pro toto*, mention only one area to which Walter contributed during the last years. He was always very interested in how combinatorics relates to other parts of mathematics, in particular to set theory, and how to bridge finite and infinite mathematics. In the beginning of the 1990s, he became fascinated in Laczkovich's solution of the Tarski circle squaring problem, and started studying the combinatorial ideas behind the notion of uniformly spread sets which were used by Laczkovich in his proof. Walter investigated so-called wobbling mappings between metric spaces and paradoxical subsets. A wobbling mapping is, intuitively speaking, just a mapping on a metric space which does not move any point too far and a metric space $(M, d)$ is paradoxical if there exists a decomposition of $M$ into two parts $M_1$ and $M_2$ such that $M_1, M_2$ and $M$ are pairwise equivalent with respect to wobbling mappings. Considering these general notions led him to study analogues of the spectacular Banach–Tarski phenomenon in arbitrary metric spaces. Some results in this area which Walter obtained with co-authors are contained in *A note on paradoxical metric spaces*[†] and in the paper *Geometrical bijections in discrete lattices*.[‡]

Walter was a mathematician by passion, both as a researcher and teacher. In addition, outside mathematics Walter was an inspiring man of excellent taste. He liked art and he liked to cook and to eat well. He liked to enjoy a glass of good wine together with a stimulating conversation. I had the great privilege of first knowing him as a teacher, then as a researcher, and finally as a friend. His passing away undoubtedly leaves a large void for everybody who knew him.

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[†]W. Deuber, M. Simonovits, and V.T. Sós, Stud. Sci. Math. Hungarica **30** (1995), 17–23.
[‡]H.-G. Carstens, W. Deuber, W.Thumser, and E. Koppenrade, J. Comb. Probab. Comput. **8** (1999), 109–129.