

In Memoriam

Bob Kadner



Robert J. Kadner (Bob to his friends, and Rendak or variations thereon to some of us fortunate to know him well) passed away suddenly on Sunday, 7 August 2005. We will miss him.

Bob's scientific career began in the mid-1960s with a very detailed examination of an alkaline phosphatase in *Neurospora crassa*. This seems to have been Bob's only incursion into studies of eukaryotes: his next project, with Werner Maas on arginine biosynthesis regulation in bacteria, was the first of a career that was dedicated to prokaryotes in general and to *Escherichia coli* K-12 in particular.

After arriving at the University of Virginia in Charlottesville, where he put down roots in the early 1970s, Bob forged a long-term association with Clive Bradbeer, who was already interested in vitamin B12 uptake. Together, they isolated with first *E. coli* mutants defective in uptake of this vitamin (Di Girolamo *et al.*, 1971). The partnership, and the project, lasted over 30 years, with Clive doing most of the physiology and biochemistry (he was still doing experiments in Bob's lab long after his 'official' retirement), and Bob the genetics. At the same time, Bob forged another formative collaboration with Herb Winkler, then in the same department, on project on hexose phosphate uptake that was also destined to last for more than 30 years, Bob also contributed to pioneering studies on the regulation and function of methionine transport in *E. coli* (there is a link here between vitamin B12 and

methionine, as those of you familiar with bacterial metabolic pathways will recognize) but this project didn't last so long, probably because Bob realized the difficulties of running three separate projects in a relatively small laboratory. Bob initiated other projects too, most recently on the control of virulence gene expression on the *Salmonella enterica* sv Typhimurium virulence plasmid, but he will be remembered most for his major contributions to unravelling the intricacies of the control of the hexose phosphate uptake by a two-component sensor-kinase system, and, especially, of the TonB system.

The TonB system continues to fascinate and frustrate many groups more than 30 years after the first studies were carried out in the labs of Salvador Luria, Peter Reeves and Volkmar Braun. It was soon realized that TonB might 'couple' the latent energy of the membrane electrical potential to the release and inward movement of ligands such as vitamin B12 or iron-siderophore complexes from their bound sites on the outer surface of their cognate outer membrane receptors (such as Bob's vitamin B12 receptor, BtuB). We know much more about these systems than we did 30 years ago, such as the crystal structures of many of the receptor proteins, including BtuB (except, frustratingly, the 'TonB' box, where TonB is supposed to interact (Gudmundsdottir *et al.*, 1989), and the 3D structure of parts of TonB. From these and other studies we know that the receptors are plugged channels, that receptors undergo conformational changes when they bind their ligands (Fanucci *et al.*, 2003), and that TonB also undergoes conformational changes and enters into direct contact with the receptors (Cadieux and Kadner, 1999). Many models have been proposed to explain TonB action, including some that Bob considered highly fanciful. Bob would have loved to know how it really works, and when we do, it will be in large part due to his superb contribution.

Bob was a strange mixture of personalities: sometimes gruff but always warm-hearted, quick-tempered and quick-witted, severe and generous. Many of these traits came out in his work as editor of the *Journal of Bacteriology*, a task he undertook with dedication and performed to perfection. Many authors thought him too demanding, but I can't think of another journal editor who spent so much time trying to tease, cajole or bully authors into doing what the referees thought best. And, of course, the

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finished product was always much better, thanks to Bob. Authors should not play the game of 'spot the referee', but Bob's cynical refereeing style was a giveaway. I'm pretty sure that he refereed one of my *J. Bacteriol.* articles in the mid-1970s, just before I went to Charlottesville, and noted in his report that the bacterial doubling times I calculated at 68 min, 72 min, etc. (instead of showing growth curves) were all very good golf scores. I often wondered whether Bob had just taken up golf on the green links in the rolling hills of the Virginia Piedmont and was struggling with much higher numbers. He denied it all, of course.

We became sparring partners, each praising and damning in turn *Mol. Mic.* and *J. Bactee.*, just like others sparred with him about TonB. On hearing of his death, Kotty Postle, one of his favourite TonB sparring partners, wrote 'I feel abandoned', and 'he was a careful experimentalist whose published data were always believable', even though they did not always fit with the way she saw things (Postle and Kadner, 2003). We all met regularly at the Gordon Bacterial Cell Surfaces conferences in New England, where Bob once managed the not-inconsiderable feat of eating three lobsters at the final dinner. Bob loved eating. The last time I met Bob was earlier this summer when I accompanied him and his wife Carole to dinner in a small Parisian restaurant. My lasting memory

of Bob will be of sitting opposite and watching him relish the delights of provençal cuisine.

Tony Pugsley

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References

- Cadieux, N., and Kadner, R.J. (1999) Site-directed disulfide bonding reveals an interaction site between energy-coupling protein TonB and BtuB, the outer membrane cobalamin transporter. *Proc Natl Acad Sci USA* **96**: 10673–10678.
- Di Girolamo, P.M., Kadner, R.J., and Bradbeer, C. (1971) Isolation of vitamin B12 transport mutants of *Escherichia coli*. *J Bacteriol* **106**: 751–757.
- Fanucci, G.E., Cadieux, N., Kadner, R.J., and Cafiso, D.S. (2003) Competing ligands stabilize alternate conformations of the energy coupling motif of a TonB-dependent outer membrane transporter. *Proc Natl Acad Sci USA* **100**: 11382–11387.
- Gudmundsdottir, A., Bell, P.E., Lundrigan, M.D., Bradbeer, C., and Kadner, R.J. (1989) Point mutations in a conserved region (TonB box) of *Escherichia coli* outer membrane protein BtuB affect vitamin B12 transport. *J Bacteriol* **171**: 6526–6533.
- Postle, K., and Kadner, R.J. (2003) Touch and go: tying TonB to transport. *Mol Microbiol* **49**: 869–882.