

Journal club



HOW A PAPER ON RAC SET THE STANDARD

Modern cell biology is full of well-analysed signalling pathways that control every facet of a cell's life. To a student or postdoctoral researcher, it probably seems as if it has always been so, but it is a recent phenomenon. Twenty years ago, even actin, the most abundant and basic component of the cytoskeleton and the basis of most cell movement, was an unknown territory; vague ideas about how it was positioned and controlled involved the usual suspects (mostly calcium, phospholipids and kinases), but they were unclear, descriptive and often internally contradictory.

In 1992, two back-to-back papers from the same group changed the actin field overnight. They described how two small GTPases — RHO and RAC — behave like master switches for different patterns of actin cytoskeleton assembly. RHO controls cell adherence by initiating the

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formation of the structures that connect the outside world, the cell membrane and the internal actin structures. RAC causes the formation of dynamic actin-driven structures called ruffles at the edges of cells. The paper by Ridley *et al.* describing RAC is particularly beautiful. It clearly shows — with what seems to modern eyes like surprisingly few images — that RAC is necessary for actin ruffles to exist, sufficient for them to form, required for other signals that generate them and ahead of RHO in the ‘pecking order’. This paper became an intellectual template for the field — the one other papers want to be when they grow up. It makes a wonderful example when talking to students about how to construct a paper.

Papers like these drove the expansion of cell biology to the centre of the scientific mainstream. In a way, they have also become a millstone for the field. Journal editors measure new submissions against them, and referees can be critical of work that is not as clear and uncomplicated. But RAC and the

paper that established its role are very unusual. Most of biology, in reality, is messy, unclear and subjective. Authors often try to bridge the gap by using bizarre constructions, such as “protein X is absolutely essential for normal migration”, meaning that cells move a bit weirdly without it. It would be better to describe the complex truth in simple language. Ridley *et al.* is a splendid example of how lucid papers can be, but it is not a framework that dictates the shape of cell biology. It is good to enjoy a fine paper and just as good to appreciate the intricacy of real cells.

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ORIGINAL RESEARCH PAPERS Ridley, A. J. & Hall, A. The small GTP-binding protein rho regulates the assembly of focal adhesions and actin stress fibers in response to growth factors. *Cell* **70**, 389–399 (1992) | Ridley, A. J. *et al.* The small GTP-binding protein rac regulates growth factor-induced membrane ruffling. *Cell* **70**, 401–410 (1992)