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Journal club

ACTIN ASSEMBLY: NEVER FORGET RATE CONSTANTS

In 1994, I was a second year Ph.D. student, and when searching for the values of the rate constants of actin filament assembly, I came across a 1986 paper by Tom Pollard, which had a huge impact on my scientific interests and career. Here, Tom, the sole author of the paper, used isolated actin-rich protrusions from *Limulus* (horseshoe crab) sperm and electron microscopy to measure actin filament lengths at various times and conditions after adding actin monomers. As these protrusions are composed of parallel actin bundles with all filaments oriented in the same direction, by measuring how rates of filament growth at each end depended on the actin monomer concentration, Tom could determine elongation rates from both ends of the filament.

> “This was really a technical ‘tour de force’”

This was really a technical ‘tour de force’ and it took as many as 15 years to measure these rate constants in real time using total internal reflection microscopy (an experimental approach that was also pioneered by Tom). I feel that this hallmark paper should be given to all students and postdoctoral researchers interested in actin assembly. Driven by reading this and other papers from Tom’s laboratory, I applied for a postdoctoral position in his group.

For years, the association rate constant at the barbed (fast-growing) ends of actin filaments was thought to be diffusion limited. This dogma fell apart when certain formins — actin nucleation and elongation factors — were reported to increase this rate and to synergize with actin disassembly factors to increase the rate of actin turnover. Until lately, it was also thought that plants hold the world record for the fastest barbed end association rate constant. However, the Goode laboratory recently found that actin assembly in the presence of regulatory proteins can occur at even faster rates and that, unexpectedly, this process is triggered at microtubule ends.

We are now in a very exciting time for discovering the complexity of the regulation of actin filament elongation and the effects of these processes on cell physiology — the quantitative appreciation of which started with Tom’s 1986 paper.

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ORIGINAL ARTICLE Pollard, T. D. Rate constants for the reactions of ATP- and ADP-actin with the ends of actin filaments. *J. Cell Biol.* **103**, 2747–2754 (1986)