Journal club

FREEDOM VERSUS CONSTRAINT IN PROTEIN FUNCTION

The notion that cellular components are organized in orderly bodies or foci has long fascinated biologists — after all, we dislike the idea of chaos and purposeless diffusion. Yet, for many years, mRNA decay enzymes seemed to be distributed randomly throughout the cytoplasm. Therefore, when Sheth and Parker reported in 2003 that these enzymes localize in discrete foci in yeast, many felt relieved: finally there was order. The foci, which consist of RNA and proteins, were dubbed mRNA-processing bodies or P bodies.

The groundwork to this discovery was laid in 1997 when P bodies were described, but not named, by Bashkirov *et al*. These authors showed that the major 5′→3′ cytoplasmic exonuclease in eukaryotes, XRN1, localizes to discrete cytoplasmic foci. This discovery (and others) remained unappreciated for years. Then, working in yeast, Sheth and Parker reported that additional mRNA decay enzymes also accumulate in these same cytoplasmic foci. For RNA, commentators wrote in *Science*, P bodies are "a place to die, a place to sleep."

> "For now, it seems, we must accept that order and activity do not correlate."

These studies paved the way for considerable advances, but the role of P bodies in somatic cells remained elusive. In 2008, Aizer *et al*. assessed whether P bodies move around the cell, as they thought that P bodies might travel through the cytoplasm looking for RNAs to dispose of, much like a garbage truck. Instead, they found that P bodies are mainly stationary, and their role remained a mystery.

Accumulating evidence now shows that most of the processes thought to take place in P bodies, including mRNA decay and silencing, occur efficiently in the absence of P bodies. So, why do eukaryotic cells assemble these structures? P bodies might simply assemble as a consequence of the aggregating properties of their components, although P body components function equally well when they are diffusing unconstrained in the cytoplasm. For now, it seems, we must accept that order and activity do not correlate.

Elisa Izaurralde
Max Planck Institute for Developmental Biology, Spemannstrasse 35/II, 72076 Tübingen, Germany.
e-mail: Elisa.Izaurralde@Tuebingen.mpg.de

ORIGINAL RESEARCH PAPERS Bashkirov, V. I. *et al.* A mouse cytoplasmic exoribonuclease (mXRN1p) with preference for G4 tetraplex substrates. *J. Cell Biol.* **136**, 761–773 (1997) | Sheth, U. & Parker, R. Decapping and decay of messenger RNA occur in cytoplasmic processing bodies. *Science* **300,** 805–808 (2003) | Aizer, A. *et al.* The dynamics of mammalian P body transport, assembly, and disassembly *in vivo*. *Mol. Biol. Cell.* **19,** 4154–4466 (2008)