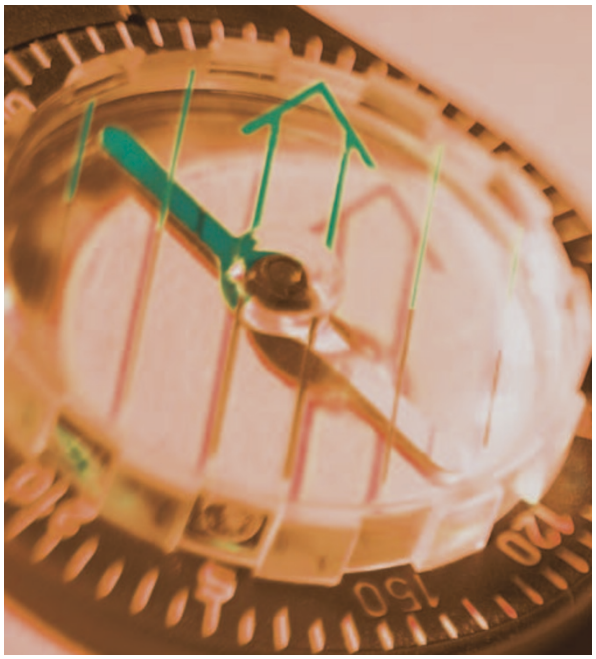
CELL DIVISION

Giving directions



Nucleoporins are the protein components of the nuclear pore complex (NPC), which is required for the transport of macromolecules across the nuclear envelope. Schetter *et al.* now report a new role for a subclass of nucleoporins in the proper orientation of the mitotic spindle in *Caenorhabditis elegans* embryos.

While analysing the RNA interference (RNAi) phenotype of the nucleoporin NPP-1, the authors noted a spindle-orientation defect in early *C. elegans* embryos. The microtubule organization in these embryos did not seem visibly different to control embryos, so NPP-1 might direct spindle orientation by a mechanism that does not affect the microtubule organization.

The spindle-orientation defects of *npp-1*(RNAi)-treated embryos resembled general cell-polarity defects. To understand the functional relationship between NPP-1 and the anterior polarity protein PAR-3, Schetter and colleagues studied the *npp-1*(RNAi) phenotype in a *par-3*-mutant back-

ground. They noticed that most of the doubly compromised embryos showed a spindle-orientation defect typical of an NPP-1 defect, whereas this type of defect is never seen in the *par-3* single-mutant embryos. This indicates that the contributions of NPP-1 and PAR-3 to the mechanism of spindle orientation are at least partially independent.

In further analyses of the *npp-1*(RNAi) phenotype, the authors showed that the early spindle-orientation defects have far-reaching consequences. They noted that so-called P granules, which are asymmetrically distributed to the posterior of the zygote, are properly localized in *npp-1*(RNAi)-treated embryos at the two-cell stage, but become missegregated in subsequent divisions. Also, terminally differentiated *npp-1*(RNAi)-treated embryos lack pharynx and gut cell types, presumably as a result of improper early segregation events.

The RNAi phenotypes of four other nucleoporins, NPP-3, NPP-4, NPP-11 and NPP-13, showed spindle-orientation defects similar to those of *npp-1*(RNAi)-treated embryos. The five nucleoporins physically interacted in a two-hybrid analysis, which indicates that this subclass of nucleoporin is likely to function as a complex in a common process that is required for proper spindle orientation.

So, is the effect of NPP-1 on spindle orientation direct or indirect? The fact that *npp-1*(RNAi) treatment causes some defects in NPC function indicates that the spindle-orientation defects could be indirect. However, the nuclear-transport function of NPC is not severely compromised, so the role of NPP-1 in controlling spindle orientation could also be direct. The authors speculate that certain nucleoporins in the NPC might interact with the dynactin complex or with OOC-3 and the torsin-related OOC-5, all of which are required for proper spindle positioning.

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ORIGINAL RESEARCH PAPER Schetter, A. *et al.* Nucleoporins NPP-1, NPP-3, NPP-4, NPP-11 and NPP-13 are required for proper spindle orientation in *C. elegans*. *Dev. Biol.* 2 Dec 2005 (doi:10.1016/j.ydbio.2005.10.038)

Links:
NPP-1
http://www.wormbase.org/db/seq/protein?name=npp-1;class=protein

PAR-3
http://www.wormbase.org/db/seq/protein?name=par-3;class=protein

NPP-3
http://www.wormbase.org/db/seq/protein?name=npp-3;class=protein

NPP-4
http://www.wormbase.org/db/seq/protein?name=npp-4;class=protein

NPP-11
http://www.wormbase.org/db/seq/protein?name=npp-11;class=protein

NPP-13
http://www.wormbase.org/db/seq/protein?name=npp-13;class=protein

OOC-3
http://www.wormbase.org/db/seq/protein?name=ooc-3;class=protein

OOC-5
http://www.wormbase.org/db/seq/protein?name=ooc-5;class=protein