Pulling backwards

One-cell worm embryos pull harder on their posterior centrosome, thus displacing the spindle toward the posterior and creating a smaller posterior cell. Now Stephan Grill, Joe Howard, Anthony Hyman (Max Planck Institute, Dresden, Germany), and colleagues have tracked centrosome fragments and determined that individual force generators at the anterior and posterior pull with equal strength, but that there are more of them at the posterior.

The fragments were liberated by ablating the central, anchoring portion of the centrosome. The fragments from the posterior centrosome flew out toward the cell cortex faster than did those from the anterior centrosome. They did not, however, fly toward a single focal point, which was a feature of some earlier models.

Reprogrammed by a frog

Dolly, Polly, and friends proved that somatic cells are potentially totipotent, but the reprogramming that a somatic cell nucleus must undergo during cloning remains an error-prone black box. James Byrne, John Gurdon, and colleagues (University of Cambridge, UK) have now shown that the biochemically tractable frog oocyte system can be used to model reprogramming. A modified version of their protocol might allow the isolation of elusive reprogramming factors and, eventually, the reprogramming of somatic human cells for self-transplantation of stem cells.

The Cambridge group chose frog oocytes because, unlike most eggs, oocytes are not at all active in replication but very strongly so in transcription. To see if this transcriptional activity extended to reprogramming, Gurdon microinjected the oocytes with various cells: first mouse fetal fibroblasts, then mouse adult thymic cells, and finally human lymphocytes. All cell types eventually showed robust expression of oct4, whose expression is specific to and preserves the fate of stem cells.

Transcriptional activity not associated with stem cells, such as that of β-actin and the thymus marker thy-1, was reduced or extinguished by the transfer. But the extent of the transformation is not yet clear. "It’s possible that what we are doing is turning everything into an oocyte," says Gurdon. But he believes that oct4 expression is a good sign that the cells are at least headed toward becoming stem cells.

Stem cell characteristics may develop only through sequential inductive events. But the optimists are hoping that there is a single extract that will do the entire conversion. The success of the current experiments, says Gurdon, is "one of the more compelling reasons for believing that to be true."

Surviving heat through destruction

Canonical heat shock proteins (Hsps) help fold proteins. So it is easy to presume that, when Hsps are compromised, heat shock does its damage by depleting the cell of functional, folded proteins. But now Sylvie Friant, Karsten Meier, and Howard Riezman (University of Geneva, Switzerland) find that it is the toxicity of the denatured proteins that is the death knell for severely heat shocked cells, and that destruction of the damaged proteins via ubiquitination can rescue the cell from death.

The ubiquitination connection arose when the group found the polyubiquitin gene UBI4 as a high copy suppressor of lcb1, a mutant in heat shock induction. UBI4 did not restore Hsp expression to the cells, but did reduce death and protein aggregation at high temperature and bring