# Redundant System Keeps Embryo in Stitches

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(PhysOrg.com) -- A universal system in animal cells that plays a key role in wound-closure and embryonic development can be quickly replicated by other cells if the original system is damaged, Duke University researchers report.

"The process is so important that when you delete it, a backup appears," said Dan Kiehart, chairman of biology at Duke and senior author of a new paper about embryonic development in fruit flies. "If one system goes awry, you need another one to kick in."

Alice Rodriguez-Diaz, a post-doctoral fellow in Kiehart's biology lab, is the lead author of the latest paper on the system. The study appears online in the HFSP Journal and was funded by the National Institutes of Health.

A multi-disciplinary team that includes members of Glenn Edwards' lab in Duke's physics department and Stephanos Venakides' and John Harer's groups in mathematics are investigating this system. Together, they have manipulated, measured and modeled a gap-closing system in fruit fly embryos that Kiehart likens to a purse string.

The purse strings are found at the leading edges of a sheet of epithelial cells that pull together to close an opening. Along these leading-edge cells, a cable-like structure develops that is made of myosin and actin, the same molecules that help muscles contract. Once assembled, this cable pulls itself tighter and tighter, closing the gap, just like the drawstring on a gym bag or coin purse.

The Duke research team has taken time-lapse movies of rapidly developing fruit fly embryos to understand how the purse strings work.

Even though fruit flies lack a skeleton or spinal cord and probably parted ways from humans about a billion years ago on the tree of life, they are remarkably similar to us in many aspects of basic biology, Kiehart said. This purse string mechanism can be found across all orders of animal life, pulling the edges of a wound together and zipping up sheets of cells to form new organs in a developing embryo, he said. Aspects of human birth defects like spina bifida and cleft palate are probably the result of the failure of comparable processes, he added.

The Duke collaboration uses microscopes and precisely focused laser light to study a phase of embryo development called dorsal closure, in which an eye-shaped opening on the back of the miniature blimp-like fruit fly embryo is drawn tight and sealed shut in just a few hours.

Their latest round of experiments represents a detailed analysis of how the purse strings contribute to dorsal closure, Kiehart said.

In these experiments, the Duke team deliberately destroyed the cells supporting the purse string with laser microsurgery and then watched what happened. In rapid succession, undamaged cells recoiled from the site of the damage. Then these cells assembled a new purse string to replace the one that was destroyed and closure resumed. "When you cut it out, new cells find a way to do the job," Kiehart said.

The new purse string forms in cells that wouldn't normally do this job, but somehow they call on inner resources to assemble a backup purse string, Kiehart said. Laser zapping of the secondary purse string didn’t deter yet another set of cells from stepping up to the plate and forming a new structure either, he said. "They're renewable and redundant."

Kiehart wants to know how a row of cells not normally fated to make a purse string knows it must take up this role and how it coordinates the assembly of a new purse string. Such insights could be invaluable to understanding wound-healing and birth defects, he said.

"Now the holy grail is what coordinates all of this," Kiehart said.

Other authors on the latest study include former Duke undergraduate students Daniel Abravanel and John Wiemann, graduate student Adrienne Wells, and post-doctoral fellows Yusuke Toyama and Serdar Tulu.

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