From Mother to Daughters: A Central Mystery in Cell Division Solved

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Researchers from the Ludwig Institute for Cancer Research at the University of California, San Diego School of Medicine have identified a key step required for cell division in a study that could help improve therapies to treat cancer. Their work describing the mechanism of the contractile ring – a structure that pinches the mother cell into two daughter cells – has been published in the December 5 issue of the journal *Science.*

The division of one cell into two is accomplished by the contractile ring, which is assembled from two protein filament types, actin and myosin, that are also used in muscle. During cell division, the genome is replicated and the two copies are separated to opposite sides of the cell by the mitotic spindle. The spindle then directs the assembly of a contractile ring, which forms a belt around the cell middle.

As happens during muscle contraction, the myosin filaments move along the actin filaments and constrict the ring. Constriction "tightens the belt," pinching the mother cell into two daughter cells.

"Normally, the contractile ring is built from long, straight actin filaments, which serve as tracks on which myosin filaments move along to drive constriction," said Karen Oegema, Ph.D, assistant professor at the Ludwig Institute and the Department of Cellular and Molecular Medicine at UC San Diego School of Medicine. "We discovered that a key step in ring constriction is turning off a pathway that would form branches on these long filaments, preventing them from being efficient tracks for myosin filament movement."

"This discovery will open the door to further studies of cell division that could improve chemotherapies for cancer," said first author Julie Canman, Ph.D., postdoctoral fellow in the areas of leukemia and lymphoma at UC San Diego and the Ludwig Institute. "Right now, drugs used in chemotherapy affect the division of all the body's cells, leading to adverse side effects, like sterility and death of the white blood cells that are essential for immunity," said Canman. "If we could specifically target the dividing cancer cells, we could improve on current chemotherapy to

treat cancer with fewer side effects, allowing patients to continue therapy with a higher quality of life."

This research was conducted as collaboration between Oegema's lab at the Ludwig Institute at UC San Diego and a lab at the University of Oregon's Institute for Molecular Biology, headed by Bruce Bowerman, Ph.D.

Addition contributors include Lindsay Lewellyn, Kimberley Laband and Arshad Desai, Ph.D., UCSD and the Ludwig Institute for Cancer Research; and Stephen J. Smerdon, Ph.D., National Institute for Medical Research, The Ridgeway, Mill Hill, London.

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