

How the body becomes asymmetric

by World-science.net

Researchers say they've learned a surprising fact about cell division that might help explain how we become asymmetric—with the heart on the left, and two different brain halves, for instance.

It seems that when cells divide, they sometimes distribute their DNA differently among daughter cells, said Amar J. S. Klar of the National Cancer Institute at Frederick, Md. The left-right dynein is one of 12 proteins forming the dynein motor, a tiny machine that performs transport tasks in a cell. The motor is shown schematically above. Its two green, egg-shaped ends grab onto a "microtubule," a type of structural cable within a cell. The opposite end of the molecule complex attaches itself to some "cargo." The green ends then "walk" along the cord to move the cargo. (Courtesy ORNL.) He and a colleague presented a study on the subject in the Jan. 5 issue of the research journal Science. When cells reproduce, they first replicate each of their chromosomes, which contain the genes. One copy of each chromosome, called a chromatid, then goes to each daughter cell. Scientists traditionally thought that for a given chromosome, which cell gets which chromatid is random. But Klar and Athanasios Arakopoulos, now at the Hippokratia Hospital of Athens, found that in mice, this distribution is random in some cell types but not others. When it's not, the distribution depends on the presence of a protein molecule called left-right dynein, the researchers said. This is part of a small motor complex believed to drag chromosomes to their destinations in daughter cells. The new findings thus suggest the protein may also help decide which chromatid goes to which daughter cell, Klar argued. How it might do this is unknown, but it's suspected that a dynein motor protein family [of proteins] whose members are involved in chromosome movement affect chromatid segregation, wrote Carmen Sapienza of Temple University Medical School in Philadelphia, in a commentary published with Klar's paper in the journal. Previous studies also found that left-right dynein affects the asymmetry in both orally or gans, said Klar. In 1959, American researchers found that mice with mutations in the gene for left-right dynein had a randomized structure: half developed in sides that were mirror images of the normal. It thus seems "every likely" that the asymmetric cell replication, due to this motor, helps determine the organ asymmetry, Klar said. "The plot comes around in a circle; it is too good to be a mere coincidence," he wrote in an e-mail. In addition, though, each dynein-mutated mouse was still asymmetric, the 1959 study found. That is, organs in one individual would be slightly different on the left and right. Thus, the dynein gene seems to determine the distribution of asymmetry "not the fact of asymmetry itself," Klar said. Several other genes are known to affect the latter, he added, though these don't relate to motor proteins.

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