

Proteins strangle cell during division

November 25 2008

A Swedish research group has discovered a new mechanism for cell division in a microorganism found in extremely hot and acidic conditions. The results of the research offer insights into evolution, but also into the functioning of the human body. The research has been recently published in *PNAS*, the magazine of the American National Academy of Sciences. Thijs Ettema, member of the research group, received a Rubicon grant from NWO in 2006 to gain experience abroad.

The new mechanism for cell division was discovered in *Sulfolobus acidocaldarius*, a microorganism found in hot springs in Yellowstone National Park. The organism is a member of the third main group of life on earth, the Archaea. Archaea, like bacteria, are unicellular organisms but in terms of evolution they are more closely related to another main group of living things, the eukaryotes (humans, animals, plants, fungi, etc).

Strangler proteins

Until now little was known about the proteins that control cell division in the Archaea. With the use of immunofluorescence the researchers determined the location of these proteins in the cell and in doing so discovered that three proteins play a crucial role in the cell division of *Sulfolobus acidocaldarius*. Once the whole chromosome has been replicated, these three proteins form a band-like structure over the cell equator. One chromosome is then found on each side of this band. The band then squeezes the cell into two so that two new daughter cells are formed. At first it looks like mitosis, as discussed in many a biology

lesson. However, mitosis is the process whereby the chromosomes are distributed between the two daughter cells. Cell division is the process whereby the two daughter cells are separated.

It is striking that these cell division proteins are not related to other proteins known to be involved in cell division. Some of the proteins in the new type of cell division are similar to proteins in other eukaryotes that have a completely different function. The study shows that the proteins involved in cell division in *Sulfolobus acidocaldarius* are related to the so-called ESCRT proteins. In eukaryotes, and therefore also in humans, these proteins are involved in protein transport within the cell. It has recently been shown that the HIV virus makes use of the ESCRT transport system to escape from the host cell. Studying the process of cell division in *Sulfolobus acidocaldarius* could therefore lead to new insights into the processes involving ESCRT proteins, such as HIV particle release.

Evolution

Some theories suggest that in evolutionary terms the Archaea are the predecessors of eukaryotes. This is confirmed by the fact that genes involved in cell division in *Sulfolobus acidocaldarius* are related to eukaryotic genes. In one way or another, these organisms are related to us humans. The study shows that this resemblance is possibly somewhat closer than at first thought.

Among other things, microbiologist Thijs Ettema has taken a closer look at the resemblance between the cell division proteins and the ESCRT proteins. Ettema carried out his research in Sweden at the University of Uppsala. Ettema obtained his doctorate from Wageningen University and Research Centre in 2005. He was awarded a Rubicon grant from NWO in 2006. Rubicon offers post-docs who have recently gained their doctorate the possibility of gaining experience at a centre of excellence

abroad.

Citation: Ann-Christin Lindås, Erik A. Karlsson, Maria T. Lindgren, Thijs J. G. Ettema, and Rolf Bernander, A unique cell division machinery in the Archaea, PNAS, November 5, 2008

Source: Netherlands Organization for Scientific Research

Citation: Proteins strangle cell during division (2008, November 25) retrieved 27 April 2024 from <https://phys.org/news/2008-11-proteins-strangle-cell-division.html>

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