Secrets of a heat-loving microbe unlocked

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Scientists studying how a heat-loving microbe transfers its DNA from one generation to the next say it could further our understanding of an extraordinary superbug.

Sulfolobus is part of the Archaea kingdom - a single-cell organism similar to bacteria - which was isolated in hot springs on the island of Hokkaido, Japan.

Some Archaea live ordinary lives in mundane environments such as lakes, seas and insect and mammal intestinal tracts, while others live extraordinary lives pushed to extremes in incredibly harsh habitats such as deep sea hydrothermal vents, volcanic mud and the Dead Sea.

Archaea have been instrumental in evolutionary studies on the origins of life and have revealed to scientists that the boundaries of life as we know it can be pushed much further than previously thought.

However, a fundamental biological question that remains virtually unexplored is how Archaea transfer their genetic material to new cells during cell division.

The research, which involved collaboration between scientists in the Department of Biology at the University of York and Duke University in the USA, focused on the role of three proteins (AspA, ParB and ParA), whose three-dimensional structure has now been solved.

Dr Daniela Barillà said: "*Sulfolobus* is a superbug that grows at 80°C in

highly acidic and sulphur containing environments".

"These are extremely harsh conditions, where other organisms would literally melt due to the breakdown of cellular membranes and disintegration of their proteins".

"We were interested in the factors and mechanisms used by this organism to transfer a portion of its genome, a small loop of DNA called plasmid, from one generation to the next during the process of cell division."

"*Sulfolobus* uses a protein to separate and segregate its DNA that is not normally used by bacteria. That was a surprise. Many bacteria use only two proteins. Instead *Sulfolobus* has a system with three".

"We discovered that AspA forms an unusual structure. It binds to a specific site on the DNA and then it spreads from there forming a continuous superhelix which wraps around the DNA."

"Studying Archaea is interesting because it can provide information about the origins of life. It is quite astonishing that some can live at 80 C and above and can endure being boiled and still remain alive".

"Investigating Archaea has also rejuvenated hopes of finding life in inhospitable environments, finding life on other planets in which the conditions are very different from ours."

More information: Structures of Archaeal DNA segregation machinery reveal bacterial and eukaryotic linkages: www.sciencemag.org/content/349/6252/1120

Provided by University of York