Researchers discover molecular machinery for bacterial cell death

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Researchers at the Hebrew University of Jerusalem and the University of Vienna have revealed for the first time a stress-induced machinery of protein synthesis that is involved in bringing about cell death in bacteria.

Their work opens a new chapter in the understanding of protein synthesis under stress conditions, which are the conditions bacteria usually are faced with, both in humans and otherwise in nature, and could pave the way for the design of novel, new antibiotics that would help to overcome serious public health problems, the researchers believe.

In the last 50 years, the biological machinery responsible for protein synthesis has been extensively studied, in particular in the gastric bacteria *Escherichia coli* (*E. coli*). The machinery of protein synthesis operates primarily through ribosomes -- small particle present in large numbers in every living cell whose function is to convert genetic information into protein molecules -- and messenger RNAs (mRNAs), which transfer the genetic information from the genome to the ribosomes and thereby direct the synthesis of cell proteins.

In an article in a recent issue of the journal *Cell*, Prof Hanna Engelberg-Kulka of the Institute for Medical Research Israel Canada (IMRIC) at the Hebrew University–Hadassah Medical School and her students describe the discovery of a novel molecular machinery for protein synthesis that is generated and operates under stress conditions in *E. coli*.. The work described in the *Cell* article was done in collaboration with the laboratory of Prof. Isabella Moll of the University of Vienna.

Their study represents is a breakthrough since it shows, for the first time, that under stress conditions, such as nutrient starvation and antibiotics, the synthesis of a specific toxic protein is induced that causes a change in the protein-synthesizing machinery of the bacteria. This toxic protein cleaves parts of the ribosome and the mRNAs, thereby preventing the usual interaction between these two components.

As a result, an alternative protein-synthesizing machinery is generated. It includes a specialized sub-class of ribosomes, called "stress ribosomes," which is involved in the selective synthesis of proteins that are directed by the sliced mRNAs, and is responsible for bacterial cell death.

Practically speaking, the discovery of a "stress-induced protein synthesizing machinery" may offer a new way for the design of improved, novel antibiotics that would effectively utilize the stress-inducing mechanism process in order to more efficiently cripple pathogenic bacteria.

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