Plastic protein protects bacteria from stomach acid's unfolding power

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A tiny protein helps protect disease-causing bacteria from the ravaging effects of stomach acid, researchers at the University of Michigan and Howard Hughes Medical Institute have discovered.

Their findings were scheduled to be published online in the *Proceedings of the National Academy of Sciences* the week of March 23.

Stomach acid aids in food digestion and helps kill disease-causing bacteria. One way that acid kills bacteria is by causing the proteins in them to unfold and stick together in much the same way that heating an egg causes its proteins to form a solid mass. Just as it is virtually impossible for a cook to unboil an egg, it is also very difficult for bacteria to dissolve these protein clumps, so bacteria and most living things can die when exposed to acid or heat.

However, disease-causing bacteria such as the notorious *E. coli* are protected from stomach acid by a tiny protein called HdeA. In the *PNAS* paper, James Bardwell and coworkers describe how this protein works to protect bacteria. Like other proteins, HdeA unfolds and becomes more flexible when exposed to acid. But in a clever twist, the unfolding process that inactivates most other proteins activates HdeA. Once unfolded, this plastic protein molds itself to fit other bacterial proteins that have been made sticky by acid- induced unfolding.

"Just as plastic wrappers prevent candies from sticking together, HdeA prevents the unfolded proteins from sticking together and forming

clumps," said Bardwell, a professor of molecular, cellular and developmental biology and of biological chemistry, as well as a Howard Hughes Medical Institute Investigator.

Postdoctoral fellow Tim Tapley, who spearheaded the research, said: "HdeA directly senses acid and changes from its inactive to active form within a fraction of a second." Instead of becoming completely unfolded in response to acid and sticking to itself, HdeA is only partially unfolded. It then uses the flexibility it gains through partial unfolding to rapidly become plastic enough to adapt to and bind various damaged proteins. This helps *E. coli* evade the otherwise deadly effects of stomach acid.

Source: University of Michigan (news : web)