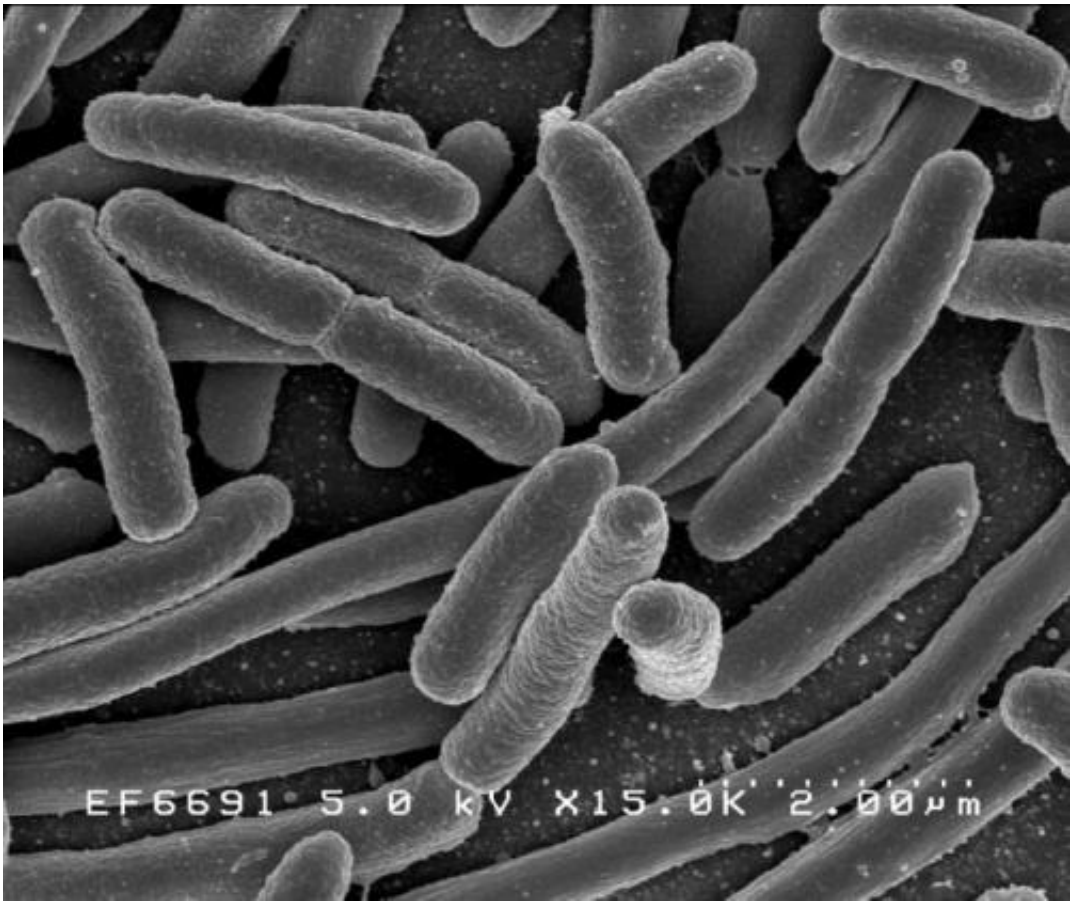
Specialized cellular compartments discovered in bacteria

July 20 2020



Escherichia coli. Credit: Rocky Mountain Laboratories, NIAID, NIH

Researchers at McGill University have discovered bacterial organelles involved in gene expression, suggesting that bacteria may not be as simple as once thought. This finding could offer new targets for the

development of new antibiotics.

The study, published in *Proceedings of the National Academy of Sciences*, is the first to show that E. coli uses similar strategies to regulate gene transcription as other more complex cell types.

Just like the human body is made up of organs that perform specialized functions, individual cells contain specialized compartments—such as energy-producing mitochondria—called organelles. Complex cells contain many different organelles, most of which are enclosed by a membrane that holds them together. Because bacteria do not have membrane-bound organelles, they were assumed to lack them altogether.

Stephanie Weber, an assistant professor in McGill's Department of Biology, and her team are the first to show that bacteria do in fact have such specialized compartments.

"Our paper provides evidence for a bacterial organelle that is held together by "sticky" proteins rather than a membrane," says Weber, who is the study's senior author.

The bacterial organelles described in the study are formed in a similar fashion to membraneless cellular compartments found in more complex eukaryotic cells (cells with a nucleus) through a process called phase separation, the same phenomenon that causes oil and vinegar to separate in salad dressing.

"This is the first direct evidence of phase separation in bacteria, so it may be a universal process in all cell types, and could even have been involved in the origin of life," explains Weber.

Because of the small size of the bacterial cells they were studying, Weber's team used an imaging technique—photo activated localization

microscopy—to track the organelle-forming proteins.

Weber is now trying to understand exactly how the proteins assemble into organelles. Because they're involved in the first steps of gene expression—transcription—she believes they might also be an interesting target for the development of a new generation of antibiotic drugs, which are urgently needed to combat drug resistance.

More information: Anne-Marie Ladouceur et al, Clusters of bacterial RNA polymerase are biomolecular condensates that assemble through liquid–liquid phase separation, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.2005019117

Provided by McGill University