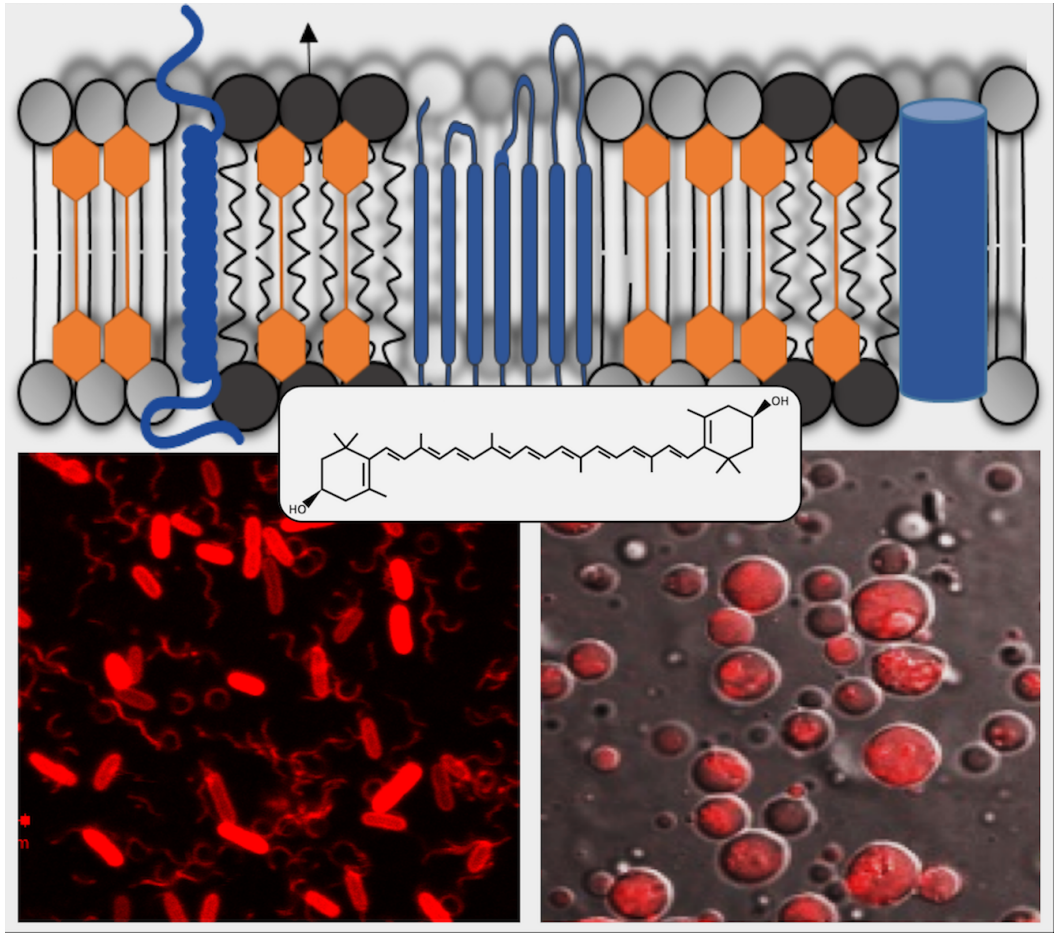
PMI SFA Publication Highlight

U.S. DEPARTMENT OF ENERGY | Office of Science

Project Results: Carotenoids stabilize lipid composition and membrane fluidity in bacteria.

Objective	• Investigate how carotenoids influence lipid composition and membrane fluidity in bacterial cells.
New science	• We utilized a carotenoid mutant in *Pantoea sp*. YR343 and found that the mutant has increased amounts of unsaturated fatty acids compared to wildtype (WT). • We also examined membrane fluidity in WT and mutant cells, in spheroplasts lacking a cell wall, and in vesicles prepared from lipids extracted from WT and mutants. In intact cells, mutant membranes were less fluid than WT; in spheroplasts, membrane fluidity was similar between WT and mutant; and vesicles derived from the mutant were more fluid than WT. • These observed changes in membrane properties in the carotenoid mutant correlate to defects in root colonization, indole-3-acetic acid (IAA) secretion, and in biofilm formation in *Pantoea* sp. YR343.
Impact	• Our data suggests that results from model lipid systems cannot be easily extrapolated to predict cellular behavior and points to the importance of membrane proteins, in addition to lipids and carotenoids, for modulating membrane fluidity in *Pantoea* sp YR343. • This study illustrates both the challenges and importance of studying membrane dynamics in living systems.



Bacterial membranes are complex mixtures of lipids (grey and black), proteins (blue), and carotenoids (orange). Carotenoids are lipophilic pigments (middle) and their effect on membrane properties has been studied primarily in model membranes. Using a carotenoid-deficient mutant, we examined the effect of carotenoids on membrane fluidity in intact cells (bottom left) and compared results to spheroplasts and vesicles (bottom right). These studies indicate that cells modulate membrane fluidity using a combination of lipids, carotenoids, and membrane proteins.

Loss of carotenoids from membranes of *Pantoea sp.* YR343 results in altered lipid composition and changes in membrane biophysical properties.

S Vijaya Kumar, G Taylor, S Hasim *et al.,* (2019). *BBA-Biomembranes, accepted.*
https://doi.org/10.1016/j.bbamem.2019.05.009

OAK RIDGE National Laboratory

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