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Bacterial cryotomography

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Electron cryotomography (ECT) is an emerging technique that allows thin samples such as small cells, viruses, or tissue sections to be imaged in 3-D in a near-native, “frozen-hydrated” state to molecular (~ 4 nm) resolution. Thus ECT fills a critical gap between light microscopy and higher resolution structural techniques like X-ray crystallography and NMR. In a combination of technology development and biological application, during the past few years our lab has been studying bacterial ultrastructure through ECT of intact, plunge-frozen cells. We have now collected over a thousand tomograms of more than ten different species. This work has revealed the surprising complexity of the bacterial cytoskeleton as well as the architectures of several important “supramolecular” complexes including the chemoreceptor array, the flagellar motor, and the cell wall peptidoglycan. Example results highlighting both the potential and limitations of this technology will be shown.