E. coli Biosynthesis of Cadmium Sulfide Nanocrystals

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Semiconductor nanocrystals, which have unique optical and electronic properties, have potential for applications in the emerging field of nano-electronics. We have been exploring the use of biological methods for the production of nanocrystals. We have found that *E. coli*, incubated with cadmium chloride and sodium sulfide, synthesize intracellular cadmium sulfide nanocrystals. The nanocrystals were determined to be wurtzite crystal phase with a size distribution of 2-5nm. Nanocrystal synthesis is both strain and growth phase dependent. Upon entrance to stationary phase, nanocrystal formation increased about 50-fold compared to late logarithmic phase cells. Synthesis of cadmium sulfide nanocrystals appears to depend on the physiological state of the cells, including intracellular glutathione levels and cadmium uptake. By understanding the important parameters controlling nanocrystal formation in unaltered cells, it may be possible to genetically enhance *E. coli* for nanocrystal synthesis.