Analysis of Fatty Acid Transport in *Caulobacter crescentus*

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**Abstract**

Fatty acids are a key component in cell membranes and are essential for all organisms, including bacteria. These lipid compounds are important because of their ability to produce large amounts of ATP when metabolized. Fatty acids, which are carboxylic acids with a hydrophobic tail, often diffuse through the cell membrane with the help of transport proteins. This project focuses on characterizing the genes responsible for making these proteins, as well as using DNA cassettes to disrupt these genes.

**Introduction**

Fatty acids are a type of lipid composed of a carboxylic acid and a hydrophobic tail. They are important because of their ability to produce a large amount of ATP when metabolized, as well as being a key component to cell membranes. Major role in fatty acid uptake in bacterial cells. The uptake of long chain fatty acids is assumed to be facilitated by fatty acid transport proteins, which enhance long-chain fatty acid uptake and are produced in all fatty acid-utilizing cells, including bacteria.

**The Mechanism of Fatty Acid Transport**

Studies suggest that uptake of long chain fatty acids (fatty acids with chain lengths longer than 12 carbons) in *Caulobacter crescentus* is an energy-dependent protein-mediated process. However, not much is known about this process. These gram-negative bacteria exhibit evidence of long-chain acyl CoA synthetase activity, which supports the hypothesis that the formation of acyl CoA is corresponded to uptake, therefore suggesting that proteins are involved in the transport of fatty acids, which can be used as a source of energy during cellular respiration or as phospholipid units in the cell membrane. While this system has been well characterized in *E. coli*, there is likely a wide variety of mechanisms being used in other bacteria such as *C. crescentus*.

**Knocking Genes Out**

Gene knockout is a process by which a gene is made inactive in order to determine its function. Bacterial genes can be cloned on a plasmid, and an interrupting segment of DNA can be inserted into the cloned gene. The interrupted, non-functional gene can then be introduced back into the bacterium being studied, replacing the original copy of the gene. Then, the effect of the gene “knock out” can be analyzed. This project focuses on characterizing the genes responsible for making these proteins, as well as using DNA cassettes to disrupt these genes.

**Summary**

Studies are underway on genes and gene products involved in bacterial fatty acid transport. Future goals include knockout of the FATP gene and further characterization of fatty acid transport in *Caulobacter crescentus*.

**References**


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**Figure 1:** The outer membrane, peptidoglycan layer, and cell membrane (inner membrane) of a typical gram negative bacterial cell such as *Caulobacter crescentus*. From J. Pomerville, *Alcamo's Fundamentals of Microbiology*, 8th ed., 2007, Jones and Bartlett Publishers, Inc.

**Figure 2:** Life cycle of *C. crescentus*. From Lucy Shapiro Lab, Stanford University.

**Figure 3:** Fatty acid transport. From Baggott, James. University of Utah Department of Biochemistry.