

# Caulobacter Encyclopedia Article

## Caulobacter

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# Caulobacter

*Caulobacter crescentus* is a Gram-negative rod-like bacterium that inhabits fresh water. It is noteworthy principally because of the unusual nature of its division. Instead of dividing two form two identical daughter cells as other **bacteria** do (a process termed binary division), *Caulobacter crescentus* undergoes what is termed symmetric division. The parent bacterium divides to yield two daughter cells that differ from one another structurally and functionally.

When a bacterium divides, one cell is motile by virtue of a single flagellum at one end. This daughter cell is called a swarmer cell. The other cell does not have a flagellum. Instead, at one end of the cell there is a stalk that terminates in an attachment structure called a holdfast. This daughter cell is called the stalk cell. The stalk is an outgrowth of the cell wall, and serves to attach the bacterium to plants or to other microbes in its natural environment (lakes, streams, and sea water).

*Caulobacter crescentus* exhibits a distinctive behavior. The swarmer cell remains motile for 30 to 45 minutes. The cell swims around and settles onto a new surface where the food supply is suitable. After settling, the flagellum is shed and the bacterium differentiates into a stalk cell. With each division cycle the stalk becomes longer and can grow to be several times as long as the body of the bacterium.

The regulation of **gene** expression is different in the swarmer and stalk cells. Replication of the genetic material occurs immediately in the stalk cell but for reasons yet to be determined is repressed in the swarmer cell. However, when a swarmer cell differentiates into a stalk cell, replication of the genetic material immediately commences. Thus, the transition to a stalk cell is necessary before division into the daughter swarmer and stalk cells can occur.

The genetics of the swarmer to stalk **cell cycle** are complex, with at least 500 genes known to play a role in the structural transition. The regulation of these activities with respect to time are of great interest to geneticists.

*Caulobacter crescentus* can be grown in the laboratory so that all the bacteria in the population undergoes division at the same time. This type of growth is termed **synchronous growth**. This has made the bacterium an ideal system to study the various events in gene regulation necessary for growth and division.