

Chapter 1

The Circadian Rhythms in Plants: An Introduction



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1 Introduction

Imagine walking through a dense forest at dawn—the leaves of certain plants begin to unfurl, flowers open to greet pollinators, and the morning sun triggers a cascade of metabolic changes deep within plant cells. These movements and physiological shifts are not random; they are orchestrated by a sophisticated internal timekeeping system known as the circadian rhythm.

Unlike animals, which can migrate, hibernate, or seek shelter, plants remain rooted in place, fully exposed to environmental fluctuations. Their survival hinges on their ability to anticipate rather than merely react to changes in light, temperature, and resource availability. By doing so, plants optimize their biological processes to align with the most favorable conditions.

Some of the most crucial plant functions controlled by circadian rhythms include:

Photosynthesis → Initiates precisely at dawn, maximizing light energy capture. [72]

Metabolism and Energy Storage → Ensures sugars and starch are synthesized during the day and consumed at night [8, 51].

Growth and Development → Hypocotyl elongation, leaf expansion, and root growth are all regulated by circadian-controlled genes [72]

Flowering and Reproduction → Plants synchronize flowering time with seasonal photoperiods to align with pollinators and favorable conditions [30, 68].

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