

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 5, Issue 2, March 2025

## The Molecular Link Between Circadian Rhythms and Cancer: Implications for Therapeutic Interventions

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**Abstract:** This review examines the molecular mechanisms connecting circadian rhythms to cancer progression and explores potential chronotherapeutic approaches. Circadian rhythms regulate key cellular processes including cell cycle progression, DNA damage repair, metabolism, and immune function. Disruption of these rhythms has been linked to increased cancer risk and poorer outcomes across multiple cancer types. This paper systematically analyzes the molecular crosstalk between core clock components (CLOCK, BMAL1, PER, CRY, REV-ERB, and ROR) and cancer-related pathways, presenting evidence for bidirectional regulation. Current therapeutic strategies targeting these connections are evaluated, including timed administration of existing treatments, small molecule modulators of clock components, and lifestyle interventions. The emerging field of chronotherapy demonstrates promising preclinical and clinical results, suggesting that time-of-day-based treatment approaches may significantly enhance efficacy while reducing toxicity. Future research directions and challenges in translating chronobiology to clinical oncology applications are discussed.

Keywords: Circadian rhythm, Cancer, CLOCK, BMAL1, PER, CRY, Chronotherapy, Cell cycle

