



The Rhythm of Many: Biological Rhythms in the Marine Environment, From Macro-Scale Planktonic Ecosystems to Micro-Scale Holobionts

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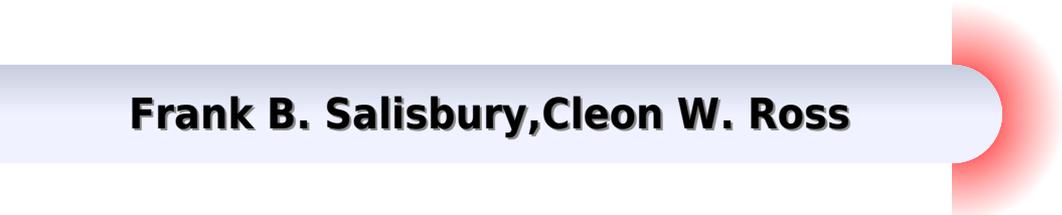
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Daily environmental oscillations that follow Earth's rotation around the Sun set a metronome for life, under which all organisms have evolved. Entrainment to these cues allow organisms to rhythmically set the pace of their own endogenous biological clocks with which the timings of diverse cellular activities are coordinated. In recent years, our knowledge of biological rhythms has extended across all domains of life. This includes both free-living and symbiotic life forms. With the insurgence of metagenomic sequencing tools, the field of holobiont chronobiomics (encompassing chronobiology of host and its associated microbiota) has recently opened and gained significant traction. Here, we review current knowledge regarding free-living prokaryote rhythmic regulation before exploring active areas of research that consider the coordinated rhythmic regulatory activities of hosts and their symbionts as a single entity, i.e., holobiont, and even the extent to which rhythmicity influences virus-host interactions. We describe rhythmicity within non-photosynthetic bacteria, cyanobacteria, and archaea, before investigating the effect of light, and, thus, diel cycle, on viral life cycles and host-virus population dynamics in marine planktonic ecosystems along with their potential to influence host cyanobacterial circadian clocks. We then explore current evidence outlining coordinated rhythmic regulation within marine holobionts and the significance of this for holobiont health and adaptive fitness that, in turn, optimizes their success within their local environments. Finally, we assess the critical role of circadian regulation for holobiont innate immunity and metabolism within well-studied non-marine mammalian systems, and, thus, assess how this can guide us within understudied marine chronobiomics research.

Keywords: circadian clock, chronobiomics, microbiome, rhythmic regulation, marine plankton, viruses, symbiosis, nested ecosystems

Biological Rhythms In The Marine Environment

Frank B. Salisbury, Cleon W. Ross



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Biological Rhythms in the Marine Environment P. J. DeCoursey, 1976 **Biological Rhythms in the Marine Environment. Proceedings of a Symposium., South Carolina, 1974** P. J. De COURSEY, 1974 **Biological Rhythms** Jurgen Aschoff, 2013-03-09 Interest in biological rhythms has been traced back more than 2 500 ears to Archilochus the Greek poet who in one of his fragments suggests i VWO KE o olos pv J tos txv pW7rOVS XH recognize what rhythm governs man Aschoff 1974 Reference can also be made to the French student of medicine J J Virey who in his thesis of 1814 used for the first time the expression horloge vivante living clock to describe daily rhythms and to D C W Hufeland 1779 who called the 24 hour period the unit of our natural chronology However it was not until the 1930s that real progress was made in the analysis of biological rhythms and Erwin Bunning was encouraged to publish the first and still not outdated monograph in the field in 1958 Two years later in the middle of exciting discoveries we took a breather at the Cold Spring Harbor Symposium on Biological Clocks Its survey on rules considered valid at that time and Pittendrigh s anticipating view on the temporal organization of living systems made it a milestone on our way from a more formalistic description of biological rhythms to the understanding of their structural and physiological basis **Chronobiology of Marine Organisms** Ernest Naylor, 2010-02-04 Do intertidal organisms simply respond to the rise and fall of tides or do they possess biological timing and navigation mechanisms that allow them to anticipate when conditions are most favourable How are the patterns of growth development and reproduction of some marine plants and animals related to changes in day length or to phases of the moon The author describes how marine organisms from single cells to vertebrates on sea shores in estuaries and in the open ocean have evolved inbuilt biological clockwork and synchronisation mechanisms which control rhythmic processes and navigational behaviour permitting successful exploitation of highly variable and often hostile environments Adopting a hypothesis testing and experimental approach the book is intended for undergraduate and postgraduate students of marine biology marine ecology animal behaviour oceanography and other biological sciences and also as an introduction for researchers including physiologists biochemists and molecular biologists entering the field of chronobiology **ICYMARE - Early Career Researchers in Marine Science** Simon Jungblut, Carolin Müller, Lena Rölfer, Yvonne Schadowell, 2025-06-05 The International Conference for Young Marine Researchers ICYMARE is a recently founded bottom up driven networking initiative ICYMARE conducts an annual on site conference event as well as a monthly Online Forum to foster international exchange and networking among marine early career researchers In both cases on site conference and Online Forum the early careers organize and conduct the whole event but also identify the conference topics and prepare and moderate their topical sessions This Research Topic aims to feature articles authored by early career researchers who were involved as a conference or Online Forum session hosts in the ICYMARE initiative As emerging experts in their respective fields of marine science they are invited to contribute review articles on specific topics within the topical frame of their ICYMARE conference

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Biological Clocks in Marine Organisms John D. Palmer,1974 *The Biological Rhythms and Clocks of Intertidal Animals* John D. Palmer,1995 Biochemical mechanisms within the bodies of plants and animals program almost all their activities to specific phases of periodic events such as the time of day the state of the tide and the season of the year Those organisms living within the intertidal zone the area between high and low tides face many environmental challenges that are eased tremendously by such chronobiological means This monograph provides an authoritative up to date account of research on the workings of intertidal animals biological clocks The book begins with a description of how tides are generated and how the difficulties involved in studying organismic tide associated rhythms may be overcome The rest of the work focuses on rhythms and their properties and the nature of the clocks that govern them Comprehensive in scope the book synthesizes over 350 research papers and contains over 129 figures It is intended as a sequel to the author's well known 1974 monograph *Biological Clocks in Marine Organisms* incorporating the many advances in the field since the publication of the earlier volume Aquatic ecologists animal behaviorists comparative physiologists marine biologists chronobiologists and interested general readers will all want to read this important new work

Marine Research ,1969 *Marine Research, Fiscal Year 1968* National Council on Marine Resources and Engineering Development (U.S.),1969 **Catalogs of the Scripps Institution of Oceanography Library** Scripps Institution of Oceanography. Library,1980 **Handbook of Behavioral Neurobiology** Jürgen Aschoff,1978 **Circadian Clocks and Ecology; Proceedings of the Third Sapporo Symposium on Biological Rhythm, 1988** □□□,□□□,1990 **Journal of Crustacean Biology** ,1987 **Perspectives in Experimental Biology: Zoology** Society for Experimental Biology (Great Britain),1976 **Experimental Biology at Sea** Alister Gordon Macdonald,I. G. Priede,1983 **Plant Physiology** Frank B. Salisbury,Cleon W. Ross,1985 The text provides a broad explanation of the physiology for plants their functions from seed germination to vegetative growth maturation and flowering It presents principles and results of previous and ongoing research throughout the world

Biological Effects of Contaminants in the North Sea A. R. D. Stebbing,M. Carr,V. Dethlefsen,1992 *Intrinsic Clocks* Timo Partonen,Daniela D. Pollak,2018-03-19 Intrinsic Clocks

presents an array of current research activities on intrinsic clocks and their contributions to biology and physiology It elucidates the current models for the intrinsic clocks their molecular components and key mechanisms as well as the key brain regions and animal models for their behavioral analysis It provides a timely view on how these clocks guide behavior and how their disruption may cause depressive like behavior and impairment in cognitive functions Thereby any specific method by which the mood related functions of the intrinsic clocks might be influenced bears therapeutic potential and has clinical interest The importance of some of these mechanisms was highlighted by the 2017 award of the Nobel Prize in Physiology or Medicine to Jeffrey C Hall Michael Rosbash and Michael W Young for their discoveries of the genetic control of the daily biological rhythm The key to the explanation was the discovery of transcription translation feedback loops of the so called clock genes Marine Research ,1969

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