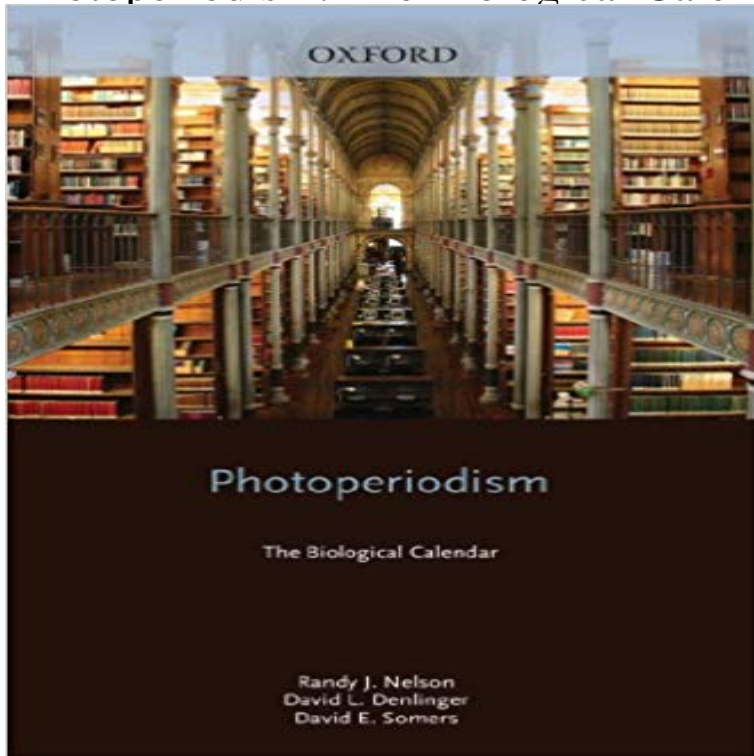


Photoperiodism: The Biological Calendar



Life evolves in a cyclic environment, and to be successful, organisms must adapt not only to their spatial habitat, but also to their temporal habitat. How do plants and animals determine the time of year so they can anticipate seasonal changes in their habitats? In most cases, day length, or photoperiod, acts as the principal external cue for determining seasonal activity. For organisms not living at the bottom of the ocean or deep in a cave, day follows night, and the length of the day changes predictably throughout the year. These changes in photoperiod provide the most accurate signal for predicting upcoming seasonal conditions. Measuring day length allows plants and animals to anticipate and adapt to seasonal changes in their environments in order to optimally time key developmental events including seasonal growth and flowering of plants, annual bouts of reproduction, dormancy and migration in insects, and the collapse and regrowth of the reproductive system that drives breeding seasons in mammals and birds. Although research on photoperiodic time measurement originally integrated work on plants and animals, recent work has focused more narrowly and separately on plants, invertebrates, or vertebrates. As the fields have become more specialized there has been less interaction across the broader field of photoperiodism. As a result, researchers in each area often needlessly repeat both theoretical and experimental work. For example, understanding that there are genetically distinct morphs among species that, depending on latitude, respond to different critical photoperiods was discovered separately in plants, invertebrates, and vertebrates over the course of 20 years. However, over the past decade, intense work on daily and seasonal rhythms in fruit flies, mustard plants, and hamsters and mice, has led to remarkable progress in understanding the

phenomenology, as well as the molecular and genetic mechanisms underlying circadian rhythms and clocks. This book was developed to further this type of cooperation among scientists from all related disciplines. It brings together leading researchers working on photoperiodic timing of seasonal adaptations in plants, invertebrates, and vertebrates. Each of its three sections begins with an introduction by the section editor, and at the end of the book, the section editors present a synthesis of common themes in photoperiodism, as well as discuss similarities and differences in approaches to the study of photoperiodism, and future directions for research on photoperiodic time measurement.

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