Chapter 6. The interaction between the environment and chronological and developmental time

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Reproductive strategies of eukaryotes are largely influenced by environmental stimuli. Life histories may be well synced to season, time of day, the lunar cycle and other physical events in the environment, which occur with rhythm. Less predictable environmental stimuli can also act as stressors, influencing the timing of reproductive events and subsequent development of the next generation. After fertilization, environmental cues strongly and differentially influence the maturation of phenotypes that collectively make up the expected physiological and morphological bauplan, at any given stage of development. A phenotypic trait may not only develop in time with environmental demands, but can appear as a prosynchronotrophy where a trait can appear ahead of its necessity, like the early heartbeat of vertebrate embryos. Conversely, if the emergence of a phenotype is delayed, the result could be maladaptive. So, even though a species’ development is optimized for its environment, stressors such as temperature or hypoxia can profoundly alter developmental trajectory, and such a change may belie a phenotypic mismatch associated with the adaptive response to the environment. And so, we do see that development can become altered in response to environmental cues, such that varying arrangements of resultant phenotypes present at a given life stage. Here we draw upon the changing environment within the context of developmental time, to illustrate the plasticity of emergence of phenotypes during development, and illustrate that the ability to responsively alter developmental time can dictate differential survival. Further, as we see that developmental timing is set and reset by the environment, and we also see that the chronology of an individual’s phenotype is thus dictated by the imposed conditions. Within these confines, we will illustrate how studies of developmental environmental biology should not only be considerate of the physiology of model species, but should be tempered with consideration that alterations of chronology of phenotype during development may arise under experimental conditions.