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Corrigendum

Due to a regrettable technical error parts of the multi-author review (Phylogeny and Function of the Pineal/Experientia 45/10) contribution, 'The pineal and melatonin: Regulators of circadian function in lower vertebrates' by H. Underwood, were misplaced in the final text. We are therefore reprinting the corrected article in its entirety. When citing, please refer to both publications:

Experientia 45 (1989) 914–922; 46 (1990) 120–128.

The pineal and melatonin: Regulators of circadian function in lower vertebrates

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Summary. The pineal has been identified as a major circadian pacemaker within the circadian system of a number of lower vertebrates although other pacemaking sites have been implicated as well. The rhythmic synthesis and secretion of the pineal hormone, melatonin, is suggested as the mechanism by which the pineal controls circadian oscillators located elsewhere. Both light and temperature cycles can entrain the pineal melatonin rhythm. The pineal, therefore, acts as a photo and thermoendocrine transducer which functions to synchronize internal cycle with cycles in the environment. A model is presented which portrays the pineal as a major component of a 'multioscillator' circadian system and which suggests how these multiple circadian clocks are coupled to each other and to cycles of light and temperature in the external world.
Key words. Pineal; melatonin; circadian rhythm.

Organisms, from unicellulars to vertebrates, are structured in time as well as in space. Many, if not most, biochemical, physiological and behavioral parameters exhibited by organisms show daily fluctuations. Significantly, most of these daily rhythms will persist under constant conditions, with periods near 24 h in length, showing that they are driven by an internal daily or 'circadian clock'. Under natural conditions these rhythms are 'entrained' by environmental stimuli (such as light and temperature) so that the 'right' events occur at the 'right time of day'.

The use of the term 'circadian clock' does not mean that a single discrete 'clock' is responsible for driving all of an organism's daily rhythms. In recent years it has become appreciated that multicellular organisms are multi-oscillator in nature; that is, more than one circadian clock may exist within a single organism. Normally, however, all of an organism's multiple circadian rhythms exhibit fixed phase relationships with each other under both entrained and freerunning conditions. Accordingly, when multiple clocks exist within an individual organism, they must be coupled together in some manner.

Several areas have been implicated as being important to circadian organization in vertebrates; these include the pineal organ, the suprachiasmatic nuclei (SCN) of the hypothalamus, and the lateral eyes. Interesting similarities, as well as significant differences, seem to exist between species in the relative roles that these areas play within an animal's circadian system.

Among lower vertebrates most of the studies to date have focused on the role of the pineal organ. Embryologically, the pineal arises as an evagination of the roof of the