Chapter 40

Evolutionary Aside 40.1--Convergent Evolution of Circadian Clocks

Circadian clocks evolved independently in many organisms, ranging from plants to animals. Convergent evolution appears to have occurred at the level of clock parts, the genes, not simply overall function. The central plant clock protein, TOC1, must be localized in the nucleus to keep a normal rhythm. It modulates when up to a third of the *Arabidopsis* genes are expressed. In the absence of TOC1 protein, the circadian clock runs too quickly. Humans have a *TOC1* ortholog with a similar circadian phenotype, and this ortholog can substitute for the *Arabidopsis TOC1*.

Not only does *TOC1* play a central role in animal and plant circadian clocks, the protein that is necessary for nuclear transport of TOC1 protein is also conserved across plant and animal kingdoms. Plant and animal circadian clocks evolved after the two kingdoms diverged from a common ancestor. Despite the unusual similarity in genes recruited for the plant and animal clocks, they evolved independently. It is quite surprising that the same parts were used to assemble clocks in plants and animals.