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Synchronization of eukaryotic flagella *in vivo*: from two to thousands[1]

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From unicellular organisms as small as a few microns to the largest vertebrates on Earth, we find groups of beating flagella or cilia that exhibit striking spatiotemporal organization. This may take the form of precise frequency and phase locking, as frequently found in the swimming of green algae, or beating with long-wavelength phase modulations known as metachronal waves, seen in ciliates such as *Paramecium* and in our own respiratory systems. The remarkable similarity in the underlying molecular structure of flagella across the whole eukaryotic world leads naturally to the hypothesis that a similarly universal mechanism might be responsible for synchronization. Although this mechanism is poorly understood, one appealing hypothesis is that it results from hydrodynamic interactions between flagella. This talk will summarize recent work using the unicellular alga *Chlamydomonas reinhardtii* and its multicellular cousin *Volvox carteri* to study in detail the nature of flagellar synchronization and its possible hydrodynamic origins.

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