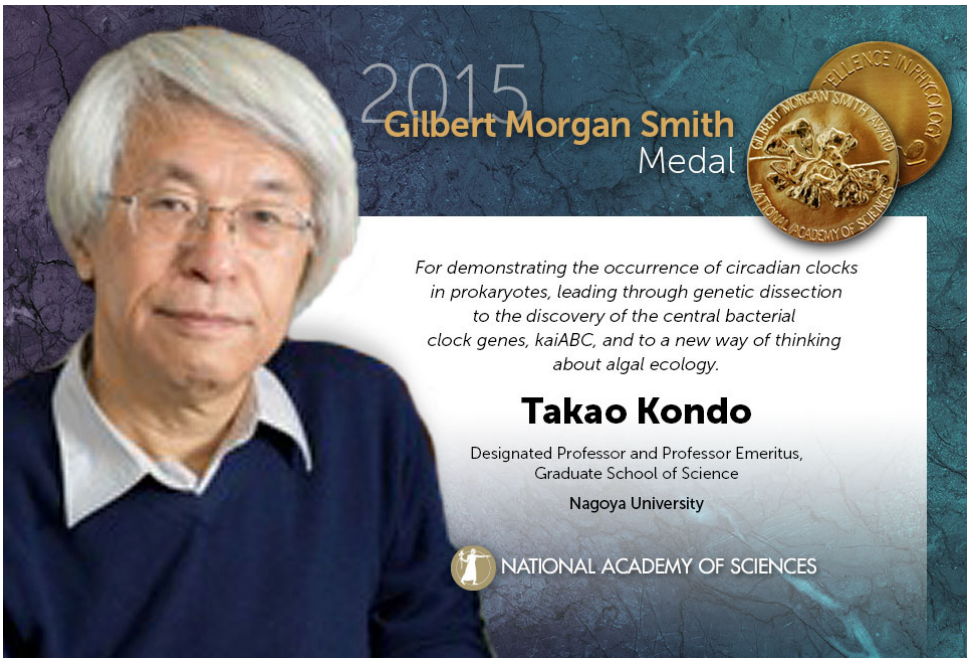

Most organisms have a circadian, or biological, clock that controls responses to the natural light-dark cycle of the 24-hour day. This clock is what causes a person to have jet lag when they travel across the country or helps a plant know when to flower. Before the mid-1980s, though, most researchers thought that prokaryotes—the simple, single-celled organisms that lack a nucleus or other organelles—did not have such clocks. Since most prokaryotes have lifespans of less than a day, scientists reasoned that they did not need circadian clocks. That assumption was overturned, however, by the discovery that a type of photosynthetic bacteria called cyanobacteria had such a biological mechanism. Kondo and his colleagues created a way to study the clock by genetically engineering the cyanobacterium *Synechococcus elongatus* to glow through bioluminescence. The glow, they found, oscillated robustly in the circadian period (about 24 hours) even under constant conditions. Kondo then developed a computer-based system that allowed him to monitor the rhythms of thousands of those glowing cyanobacteria, which let him identify clones that had mutated clocks. By studying those mutants, Kondo was able to identify three genes—*kaiA, kaiB* and *kaiC*—that control the circadian clock system of cyanobacteria. Kondo then demonstrated how this simple timepiece works by mixing the three Kai proteins and ATP (adenosine triphosphate, the molecule cells use to transport energy) in a test tube to reconstitute the circadian clock. In later studies, Kondo and colleagues showed that these proteins can tick a time by using a tiny amount of ATP. The oscillation of Kai proteins play key roles in the regulation of cyanobacterial gene expression and metabolism and also give the cyanobacteria a fitness boost. The knowledge that simple bacteria have biological clocks has led to a transformation in how scientists think about the mechanism of the biological clock and the ecology of these organisms, which sit at the base of the ocean food web.