Observation of movements of individual symbiotic algae in *Paramecium bursaria*

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SUMMARY

A ciliate *Paramecium bursaria* harbors several hundreds of endosymbiotic algae in its cytoplasm, and its cytoplasmic streaming is suggested to be involved in the proliferation of the algal cells (Takahashi et al., 2007). However, relatively little is known about the movements of individual symbiotic algae within the *Paramecium* cells that contain a large number of the symbionts. To reveal the movements of these individual symbionts, we have extracted the algal cells and labeled them with carboxyfluorescein diacetate succinimidyl ester (CFSE). The CFSE molecules were well incorporated into the algal cells and cleaved by intracellular esterases to yield highly fluorescent derivative molecules. *Paramecium* cells were fed with the CFSE-labeled algal cells so that the host cells contained one to several fluorescent symbionts per host. Fluorescent microscopy visualized the rotational movements of the individual symbionts in these cells for up to 10 minutes. The microscopic observations showed that the mean period of one rotation cycle was 1 min with the standard deviation ~6 sec, suggesting that the cycles were regular. Also, we observed that some algal cells infrequently escaped from the rotational movements and remained in a posterior region of the host cells.