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General Introduction of Our Recent Research

Dear Sirs,

Our paper submitted to Angewandte Chemie has been published.

The interests of the chemical research are not only for chemists, but also physicist, biologist, mathematicians, philosophers, and people who love science and think about the border of living things and non-living things.

This study is about “dissipative self-organization” of artificial molecular assembly.

Dissipative self-organization is known as a key principle of life (cf. “What is life” by Erwin Schrödinger, and “Self-Organization in Nonequilibrium Systems” by Ilya Prigogine).

In the life system, molecular motors create the dissipative feature of life. And the molecular motors also work in dissipative manner, which is known as chemical ratchet mechanism (cf. R. D. Astumian, *Science* **1997**, *276*, 917 and his recent reviews and explanatories).

Our self-assembly swam in water by autonomous bending-stretching motion with dissipation of light-energy (Figure 1 and 2). The bending-stretching motion of the material is functionalized by a molecular ratcheting mechanism (Figure 3), in which both of reaction of substrate and shape of assembly change repeatedly. The autonomous repetitive feature is the novelty of this study.

Molecular motors that work with molecular ratcheting can be applied to active transporters. Further studies on this category of science must create new concepts in molecular pumps for water purification and dialysis, and molecular transporters for drug delivery systems.

Our research is not perfected, and our study is on-going. Our target is construction of highly functional molecular systems mimicking biological principle.

Thank you for your reading this paper.

Regards,
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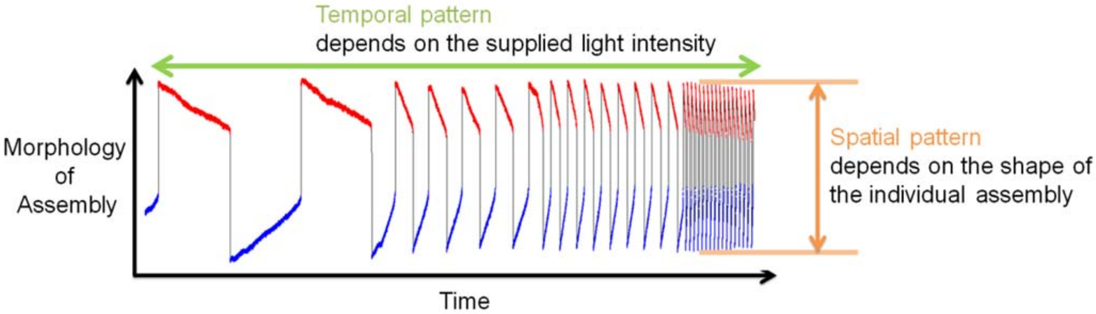

Fig. 1. Dissipative and autonomous profile of the motion of the assembly.

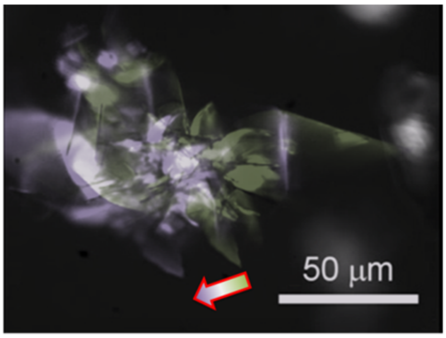

Fig. 2. Bending/unbending motion of the assembly to swim in water (please watch Movie S1, which can be downloaded from the publisher).

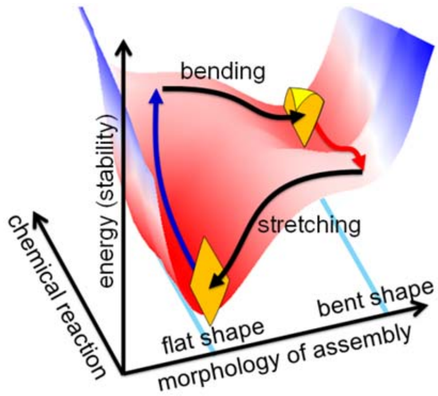

Fig. 3. Schematic (but roughly) illustration of the relationship between isomerization ratio and morphology.

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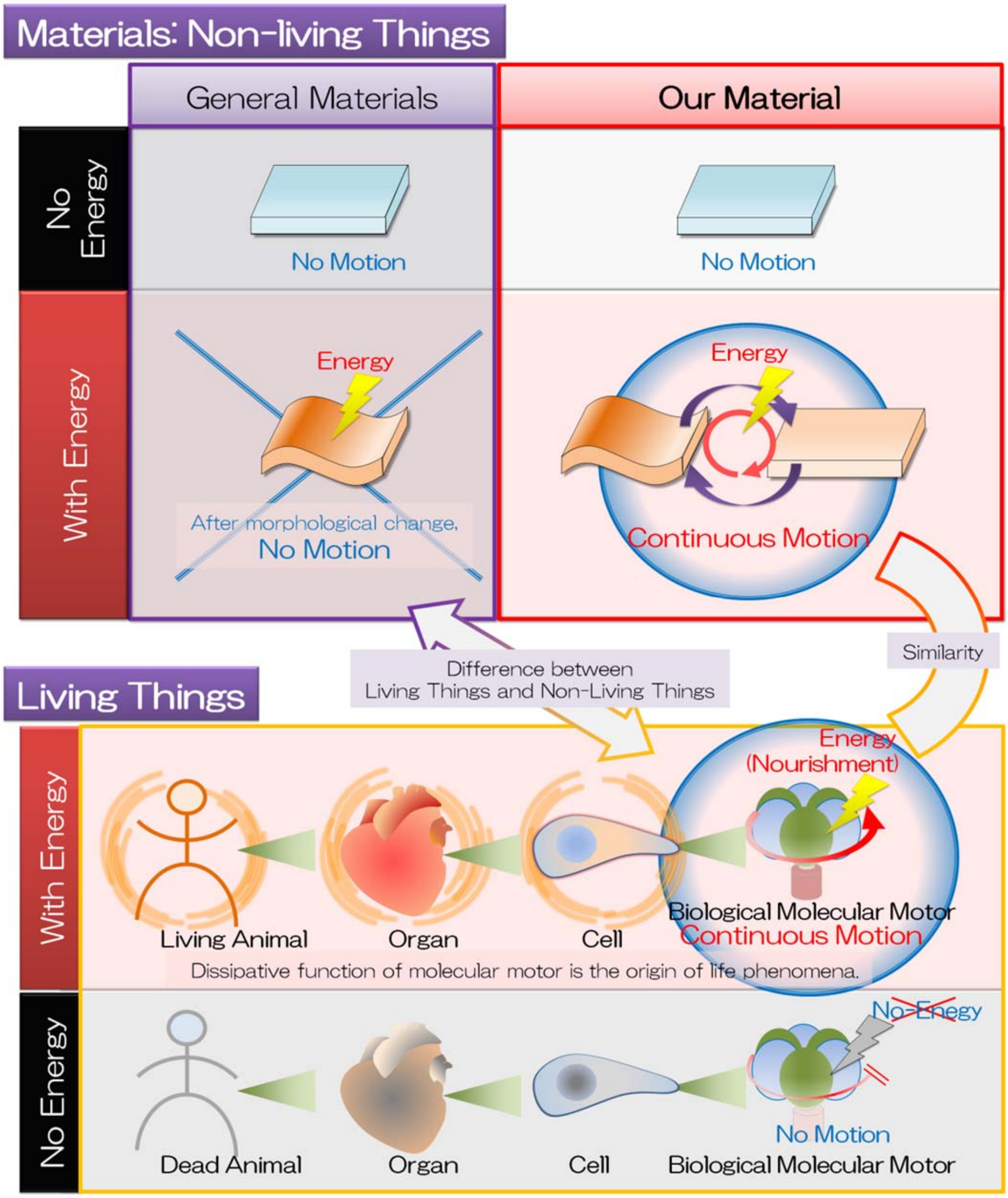

This figure is for general public. General stimulus-responsive materials change their shapes once by external stimuli. On the other hand, our material repetitively changes its shape autonomously under continuous stimuli. The dissipative and autonomous feature is similar to the molecular motor in biological cell.

And I have one remark. After our paper being accepted, I read a study reported in *Nature Nanotechnology* (vol. 10, p.161) by Giuseppone's group. Even though we had not cited the paper in our report, the study includes an important concept for artificial dissipative systems.