



Title of Project : Molecular Engine: Design of Autonomous Functions through Energy Conversion

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【Purpose of the Research Project】

In this research area, we define a molecular device that causes a mechanical structural change by receiving external energy and converts it into another form of energy, as "molecular engine." It is aimed at establishing basic scientific disciplines for building molecular engines. For this purpose, experts in synthetic chemistry, molecular biology, biophysics, soft matter physics, computer science, which have been developed independently as different fields, work together to unite wisdom and thereby create a new research field for nanoscale molecular devices and systems. Looking to construct social implementable devices, we explore the availability of various energy sources (Figs. 1 and 2).

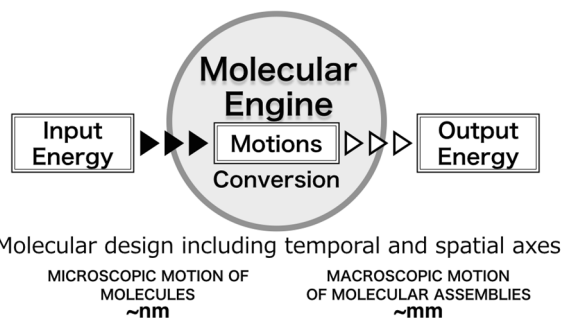


Fig. 1 Concept of "molecular engine."

【Content of the Research Project】

In this area, in order to establish the concept of "molecular engine", small molecules with a relatively simple structure, macromolecules capable of forming a higher order structure such as a protein, molecular aggregates in which these are integrated. In each of the different hierarchies, we aim to construct disciplines to realize energy conversion via mechanical motion. For this purpose, the following four research groups are organized, including experimental, computational, and theoretical science with artificial molecular machines, biomolecular machines and molecular assemblies. A01: Rational design of molecular units for energy conversion, B01: Movement of molecular assemblies with energy conversion function, C01: Detection and measurement of

molecular engines, C02: Theoretical analysis of energy conversion by molecular engines.

【Expected Research Achievements and Scientific Significance】

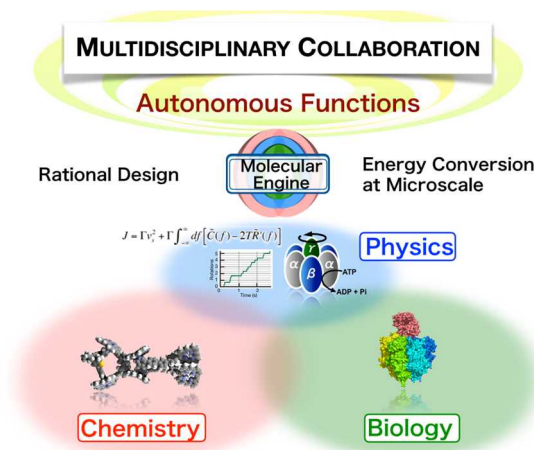


Fig. 2 Multidisciplinary collaboration.

Design principles for the energy conversion by the mechanical motion of molecular systems, that highly efficiently converts various energies such as chemical-bond, electrical, mechanical and, light energy to other usable energies is established. It is expected that new possibilities of energy conversion systems will be proposed.

【Key Word】

Molecular Machine: molecule that moves physically like a machine by applying external stimuli

【Term of Project】 FY2018-2022

【Budget Allocation】 1,193,600 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.molecular-engine.bio.titech.ac.jp>