1P334 任意素子構造における分子シャトルシミュレーション—素子構造の最適化に向けて
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1aK11 Molecular shuttle simulation for modules of arbitrary structure - towards optimization of module structures
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Molecular shuttles are bio-inspired transportation systems for Lab-on-a-Chip devices in which biological and chemical analysis are performed. Functionalized microtubules loaded with nano-scale cargo are driven by kinesin motors fixed on the surface along predetermined tracks on the chip. Modules, such as rectifiers and sorters, are connected to each other by tracks and integrated as a circuit on the chip. They function by guiding molecular shuttles into the desired output of the modules. Occasionally, when molecular shuttles come to a module boundary they may detach from the surface and cannot be transported anymore. This detachment leads to loss of cargo and lower module performance. Hence, the detachment rate should be minimized. To design module structures which minimize the detachments, we have developed a computer simulation which reproduces the detachment of molecular shuttles. In our previous work only straight lines and circles were used to define module structures, which restricted accessible module structures to be examined for the most functional designs. Expanding accessible structures is expected to allow discovery of structures with optimum performance. For this purpose, we defined module structures by using a series of spline curves, which are formed by interpolating two points with a cubic function. By combining splines with our previous simulation, it is possible to create and test numerous arbitrary modules and select the best structure for a predefined objective.

1P336 微細加工基板上を運動するマイコプラズマ・モービルの軌跡の統計解析
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Statistical Analysis of *Mycoplasma mobile* Trajectories in Microfabricated Patterns
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The fish pathogen *Mycoplasma mobile* adheres to solid surfaces and glides it over at the speed of several micrometers per second. In addition, *M. mobile* moves along microfabricated walls when it encounters them. Owing to these characteristics, *M. mobile* is used as a living transporter; *M. mobile* is loaded with cargo and moves down along guiding tracks to the destination to delivery the cargo. The structures of the guiding tracks determine the efficiencies of the cargo transports. To construct guiding tracks with high efficiencies, their structures have to be selected in accordance with *M. mobile* trajectories in microfabricated patterns. Here, we performed statistical analysis of *M. mobile* trajectories in microfabricated patterns. Motions of *M. mobile* in a microfabricated pattern consist of motions when *M. mobile* moves around on planar surface and that when *M. mobile* moves along microfabricated walls. For *M. mobile* motions on planar surfaces, we analyzed them as two-dimensional random walks. Time-averaged velocity, motional diffusion coefficient, time-averaged biased angle and persistence length of *M. mobile* trajectory were measured. For *M. mobile* motions along microfabricated walls, based on experimental observations of *M. mobile* motions along curved track walls, the rate of *M. mobile* detachments from the walls was determined as a function of the curvature of guiding tracks. Based on the analysis, off-lattice Monte-Carlo simulations were carried out to reproduce trajectories of *M. mobile* in microfabricated patterns.

1P335 試験管内のタンパク質合成分子オートマトンの作成
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Construction of *in vitro* proteosynthesis molecular automaton
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Cells regulate gene expression patterns for survival and reproduction using functional networks made up of interacting molecules. We were motivated by the excellent mechanism of regulation in cells to construct an *in vivo* molecular automaton, which detects the cell state through gene expression patterns, and controls the cell conditions with output proteins. Aiming at this goal, we first engineered an *in vitro* proteosynthesis molecular automaton composed of RTRACS and cell-free translation system. The RTRACS is an autonomous molecular computer based on reverse transcription and transcription. It consists of a set of molecular functions that accept input RNA and return output RNA. The RTRACS cannot perform protein synthesis alone. We that combined the RTRACS with a cell-free translation system, which is an *in vitro* protein synthesis system reconstituted from translation factors expressed in *E. coli*. As an example, we constructed a AND function of RTRACS that accepted two input RNA strands and produced one output mRNA strand of green fluorescent protein (GFP). Experimental results demonstrate that GFP was expressed only when both of the two input RNA strands were present. *In vitro* proteosynthesis molecular automaton will provide a useful tool in discovery of biomarkers, such as markers that indicate a particular disease.

1P337 千年色の冗長性：六角形タイルから成るタマムシの翅のモザイク色
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Redundancy in Millennium Green: Mosaic Color composed of Hexagonal Tiles on the Elytron of Japanese Jewel Beetle
Eiki Adachi

A jewel beetle attracts many people since ancient times, because of the brilliant color. The origin of the coloration is simply attributed to interference phenomena produced by a multilayer structure covering the beetle body. Because the structure has been clearly observed by electron microscopes, further consideration for the origin had been probably stopped with respect to physical structures. Recently it was found that the millennium green of Japanese jewel beetle can be changed to blue or red by applying heat or bromoform to the elytra, even though the unusual environments. These changes gave us information about thermal stability of the color; the wavelength of reflection peak responds to temperature at ca. - 0.6 nm /°C. This stability partially proves the fact that the original green has been maintained for over 1000 years at usual environments. Although the stable coloration comes from the robustness of the materials composing the multilayer, it probably also comes from a patchwork structure composed of small mosaic tiles (~ 10µm in size) covering the whole elytron surface. The color distribution of mosaic tiles in RGB space indicates that each tile color surely comes from a multilayer structure. The mosaic structure achieves a kind of hardware redundancy in comparison with a horizontally continuous multilayer structure. This is another origin of the long-term stability of millennium green.