2P284 膜の分子透過性へのフィードバック制御のある非平衡系人工細胞の数理解析
Numerical analysis of non-equilibrium open artificial cell with a feedback control over molecular permeability of the cell membrane

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Recently, artificial cells have been attracted much attention as a model of living cells. The living cells are non-equilibrium chemically open systems and transport molecules in and out through their cell membrane in a controlled manner. However, artificial cells with a chemically open feature and a controlled transport of molecules have never been achieved yet. Here, we propose a chemically open artificial cell with a feedback control over molecular permeability of the cell membrane. To implement this feedback control system, diffusion coefficient inside the artificial cell is changed according to the concentration of inside chemicals. We believe that this numerical analysis will promote the understanding of dynamic chemical systems in artificial cells.

2P285 Oscillations of a genomic DNA in a cell-sized chemically open system

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Temporal self-organization such as biochemical oscillation is universally observed in non-equilibrium open systems including living cells; it is utilized to trigger and regulate time-dependent behaviors of gene expressions etc. However, temporal self-organization has still not been realized in artificial cells that are models to study dynamical aspects of living cells. Thus, generating an intrinsic oscillation is strongly desired in the study of artificial cells. Here we present two models of DNA structural oscillations in a cell-sized chemically open system. Our numerical analyses derive that DNA exhibits synchronized and self-excited oscillations. In the future, our study will promote the construction and regulation of temporal dynamics in artificial cells.

2P286 広帯域 X 線を用いた広角度域 X 線 1 分子追跡法の開発
Development of wide angle Diffracted X-ray Tracking (DXT) measurement using a focusing broad band X-ray

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Diffracted X-ray tracking (DXT) enables the tilting and twisting motions of single protein molecules to be monitored with microradian resolution using a highly brilliant and broad band X-ray source. We have developed a new technique to measure in-situ single molecule motion combined with a single X-ray toroidal mirror at the BL28B2 to SPring-8 in an energy range of 10 to 20 keV. In this study, we present the specification of wide angle DXT measurement system. The intramolecular motions of a human serum albumin and its complex with 2-anthracencarboxylic acid were investigated using wide angle DXT. The each random tilting and twisting intramolecular motions was shown to be directly linked.

2P287 オンチップ画像解析システムによる形状を制御した単一心筋細胞の収縮方向の計測
Measurement of contractile direction on single-shape-controlled cardiomyocytes by on-chip optical image analysis system

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Evaluation of mechanophysiological responses of cardiomyocytes has become more important for precise prediction of cardiotoxicity. For the accurate detection of cardiomyocyte contraction, we have developed an on-chip optical image analysis system that records the contractile motions of cardiomyocytes with noninvasive/nondestructive measurement. Using this system, we measured the displacement and direction of contraction of single circular and rectangular cardiomyocytes. The results indicated that the rectangular cardiomyocytes tend to contract along the longitudinal direction as in a real heart. This system enables the accurate measurement of cardiomyocyte contraction, and is expected to be applicable to the precise detection of irregular motions such as arrhythmia.

2P288 ビデオ解析による大腸菌回転特性の大量測定
Large-scale measurement of rotary motion properties of tethered Escherichia coli (*E. coli*) by video analysis

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E. coli modifies the way in which it swims, by switching directions of reversible rotary motors, which drive flagellum, in response to chemical compounds (attractants, repellents). Namely, *E. coli* functions as a chemical bio-sensor (input : chemical compounds, output : ratio of direction of reversible rotary motor). Focusing on the sensing functions, we have tried developing bio-sensor system with bacteria as an application of bio-materials. As a fundamental technology for developments of bio-sensor, we report construction of automated detection system for rotary motion of tethered *E. coli* under an optical microscope. With X20 objective, high speed camera (> 500 fps) and image analysis techniques, we accomplish analysis of ~500 cells in a screen automatically.

2P289 流体力学的絞込みを用いた一分子ソーターセルの開発
Development of hydrodynamic focusing system for single molecule sorting device

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Sorting of micro particles is widely used in life sciences; however, the sorting at the single molecule level is still difficult. We constructed the fluorescence detection and flow systems for the sorting of single proteins. To achieve single molecule sensitivity, the detection system was designed based on confocal alignment and avalanche photodiode. The flow system was constructed using mechanical valves and a microfluidic cell. The cell possesses a dam structure for the three-dimensional focusing of sample flow. We confirmed that the detection system can discriminate fluorescence signals from single fluorophores from background. We further verified that the hydrodynamic focusing enough for the detection of all the flowing samples at the single molecule level.