シンポジウム　Symposium

第 1 日目（9/22（土））／ Day1(Sep. 22, Sat.)

9:00~11:30　A 会場：理学南館 1 階 坂田・平田ホール／ Room A: Sci. south bldg. 1F Sakata Hirata Hall
新学術領域研究　「少数性生物学－個と多数の狭間が織りなす生命現象の探求－」共催
1SA　1 分子生物学と生化学の狭間に潜むナノシステム動作力学の理解を目指して
Bridging single molecule biology and biochemistry to understand operation principles of bio-nanosystems

オーガナイザー：石島　秋彦 (東北大), 永井　健治 (阪大)
Organizer: Akihiko Ishijima (Tohoku Univ.), Takeharu Nagai (Osaka Univ.)

Cooperative function/behavior in biological nanosystems consisting of small number of molecular elements is one of the most important aspects in biological phenomena. Although so many studies in terms of biochemistry and single molecule biology, which deal with Avogadro's number of molecules and single molecule, respectively, have been reported, there is almost no report showing elementary process of cooperative function/behavior among small number of molecules in living cells. In the symposium, we will focus on the methodology and biological phenomena to approach this issue and will discuss the prospect of biological nanosystems research.

はじめに
永井 健治 (阪大・産研)
Takeharu Nagai (ISIR, Osaka Univ.)

1SA-01　細胞内反応ネットワークと「少数性」問題～理論と計算によるアプローチ
Cracking Reaction Networks Involving "Minorities" in the Cell: Theoretical and Computational Approaches
冨樫 祐一 (神戸大・院システム)
Yuichi Togashi (Grad. Sch. Sys. Informat., Kobe Univ.)

1SA-02　1 分子デジタル ELISA
Single-Molecule Digital ELISA
野地 博行 (東大工・応用化学)
Hiroyuki Noji (Applied Chem. U-Tokyo)

1SA-03　遺伝子にコードされた発光型プローブ
Genetically encoded luminescent probes
永井 健治 (阪大・産研, JST・さきがけ)
Takeharu Nagai[1,2] ([1]ISIR, Osaka Univ., [2]PRESTO, JST)

1SA-04　**Coordinated reversal of flagellar motors on a single Escherichia coli cell**
石島 秋彦 (東北大学多元物質科学研究所)
Akihiko Ishijima (Tohoku University)

1SA-05　ヒトゲノム DNA の収納とそのダイナミクス
Human genome organization and dynamics
前島 一博 (国立遺伝学研究所構造遺伝学研究センター生体高分子研究室)
Kazuhiro Maeshima (Structural Biology Center, National Institute of Genetics)

1SA-06　哺乳類概日時計のシステム生物学・合成生物学
Systems and Synthetic Biology of Biological Timings
上田 泰己 (理化学研究所　発生・再生科学総合研究センター, 理化学研究所　生命システム研究センター)
Hiroki Ueda[1,2] ([1]RIKEN, CDB, [2]RIKEN, QBiC)

1SA-07　細菌べん毛形成の分子機構とその制御
Molecular mechanism of bacterial flagellar construction and its regulation
今田 勝巳 (阪大・院理・高分子)
Katsumi Imada[1], Tohru Minamino[2] ([1]Dept. Macromol. Sci., Grad. Sch. Sci., Osaka Univ., [2]Grad. Sch. Frontier BioSci., Osaka Univ.)

9:00~11:30　B 会場：多元数理科学棟 5 階 509 ／ Room B: Mathematics bldg. 5F 509

1SB　身体ー細胞ダイナミクス連関：やわらかさの階層と連携
Body-cell dynamic linkage: softness, flexibility, fluctuation and controllability

オーガナイザー：跡見　順子 (東大), 竹森　重 (東京慈恵医大)
Organizer: Yoriko Atomi (Univ. of Tokyo), Shigeru Takemori (Jikei Univ.)

After 3.11, we all need to acts with sense of responsibility and re-think the science. The aim of this symposium is to explore an innovative and sustainable biophysical research area based on the platform of human body and mind flexibility and free will inspired by Fumio-Osawa's finding that biological macro molecules such as F-actin in muscle is more flexible when its in action. Unique ideas to linking with flexibility such as exercise science, protein and DNA structural dynamis, extracellular matrix and also control of soft but unstable body under the gravity will be presented.

身体ー細胞ダイナミクス連関：やわらかさの階層と連携
跡見 順子 (東京大学アイソトープ総合センター)
Yoriko Atomi (Radioisotope Center The University of Tokyo)

1SB-01　DNA の硬さと柔らかさ：高次構造転移が生み出す時空間秩序
Synergy between Stiffness and Softness on DNA: Spatiotemporal Order Organized through the Higher-Order Structural Transition of DNA
武仲 能子 (産総研・ナノシステム)
Yoshiko Takenaka (Nanosystem Research Inst., AIST)

1SB-02　**Proteins as Mechano-Chemical Transducer**
赤坂 一之 (近畿大・先端研・ 高圧センター)
Kazuyuki Akasaka (Inst. Adv. Tech, Kinki UNIV.)

1SB-03　身体ー細胞能動 / 受動メカノケミカル連携：身体に生きる細胞のニッチとしての柔らかな細胞外基質環境が支配するやわらかさの階層と連携
Body-cell dynamic mechano-mechanical linkage: softness, flexibility, fluctuation and controllability derived from ECM environment as "niche for cells in our body"
跡見 順子 (東京大学アイソトープ総合センター)
Yoriko Atomi[1], Miho Shimizu[2], Eri Fujita[2], Tomoaki Atomi[3], Noboru Hirose[3], Katsuya Hasegawa[4] ([1]Radioisotope Center The University of Tokyo, [2]Dept. of Mechano-Informatics, Univ. of Tokyo, [3]Teikyo University of Science, [4]JAXA)

1SB-04　多分節立位を可能にした身体の冗長性：柔らかさの制御と破綻
Flexibility of human body with multi-segmental structure enabling bipedal standing
跡見 友章 (帝京科学大学, 首都大学東京大学院)
Tomoaki Atomi[1,2], Noboru Hirose[1], Miho Shimizu[3], Yoriko Atomi[3] ([1]Teikyo Univ. of Sci., [2]Grad. Sch., Univ. Tokyo Metropolitan, [3]Univ. of Tokyo)

1SB-05　人工制御した細胞基盤の柔らかさと細胞応答
Softness of the artificial cell niche and its active interplay of forces
清水 美穂 (東京大学大学院情報理工・知能機械)
Miho Shimizu[1], Yuki Katsurada[2], Toshiyuki Watanabe[2], Eri Fujita[1], Tomoaki Atomi[3], Noboru Hirose[3], Katsuya Hasegawa[4], Yoriko Atomi[5] ([1]Dept. of Mechano-Informatics, Univ. of Tokyo, [2]Tokyo Univ. of Agri. & Tech., [3]Teikyo University of Science, [4]JAXA, [5]Radioisotope Center The University of Tokyo)

1SB-06　培養基盤の硬さとの整合性が心筋拍動パターンを最適化する
Rigidity Matching between Cells and the Extracellular Matrix Leads to the Stabilization of Cardiac Conduction
Marcel Hoerning (神戸研究所 発生・再生科学総合研究センター フィジカルバイオロジー研究ユニット)
Marcel Hoerning (RIKEN, Center for Developmental Biology, Physical Biology Unit)

1SB-07　アクチン繊維のゆらぎを基盤とした生理機能
Physiological functions of an actin filament based on its fluctuation
本多 元 (長岡技術科学大学・生物系)
Hajime Honda (Dep. Bioeng. Nagaoka Uni. Tech.)

1SB-08　生命の神秘に迫る多次元アプローチ
Multidimensional Approaches to the Secrets of Life
竹森 重 (慈恵医大・分子生理)
Shigeru Takemori (Jikei Univ. Sch. Med.)

9:00~11:30　C 会場：多元数理科学棟 4 階 409 ／ Room C: Mathematics bldg. 4F 409

1SC　生物学における数学的手法の最前線
Frontiers in mathematical methods in biology

オーガナイザー：宇沢　達 (名大), 大平　徹 (名大)
Organizer: Tohru Uzawa (Nagoya Univ.), Toru Ohira (Nagoya Univ.)

In these lectures we explore frontiers of mathematical methods in biology. Phenomenon of varied time/space-scale will be examined, ranging from variations in enzyme concentrations, to bird-flocking.

1SC-01　特異極限解析：生物システムに現れるパターンを捉える
Singular limit analysis: Understanding of biological pattern formation
三村 泰昌 (明治大学大学院先端数理科学研究科)
Yasumasa Mimura (Graduate School of Advanced Mathematical Sciences, Meiji University)

1SC-02　鳥の群れの集団動力学
Collective dynamics of flocking
早川 美徳 (東北大学教育情報基盤センター)
Yoshinori Hayakawa (Center for Information Technology in Education)

1SC-03　バクテリアのコロニー形成―細胞の集団運動―
Colony Formation in Bacteria -Collective Movement of Cells-
松下 貢 (明治大学先端数理科学インスティテュート)
Mitsugu Matsushita (Meiji Institute for Advanced Study of Mathematical Sciences (MIMS), Meiji University)

1SC-04　生命ネットワークにおける動的ロバスト性の数理的解析
Mathematical analysis of dynamical robustness in biological networks
田中 剛平 (東京大学 生産技術研究所, 東京大学 情報理工学系研究科)
Gouhei Tanaka[1,2], Kai Morino[2], Kazuyuki Aihara[1,2] ([1]Institute of Industrial Science, The University of Tokyo, [2]Graduate School of Information Science and Technology, The University of Tokyo)

1SC-05　自律的酵素量制御による時間スケール調整；ホメオスタシスと記憶
Homeostasis and memory by autonomous regulation of time-scales through enzyme abundances
金子 邦彦 (東大総合文化)
Kunihiko Kaneko (University of Tokyo, Center for Complex-Systems Biology)

9:00~11:30　D 会場：多元数理科学棟 3 階 309 ／ Room D: Mathematics bldg. 3F 309

1SD　核内分子動態から観る遺伝子発現機構
Molecular Dynamics in the Nucleus and Gene Regulation

オーガナイザー：河野　秀俊 (日本原子力機構), 寺川　剛 (京大)
Organizer: Hidetoshi Kono (JAEA), Tsuyoshi Terakawa (Kyoto Univ.)

Advances in single molecule measurements and molecular imaging techniques enable us to directly observe molecular dynamics in the nucleus. The recent increase of computational power, which is demonstrated by the K super computer, now allows us to simulate behaviors of single molecules as well as complexes at different spatial and temporal resolutions. In this symposium, we will discuss how such molecular phenomena observed by experiment and simulation are associated with gene regulation.

1SD-01　**Characterization of Protein-DNA complexes dynamics related to Chromatin structure regulation using Single-Molecule Techniques**
韓 龍雲 (京都大学物質―細胞統合システム拠点)
Yong-Woon Han, Yoshie Harada (iCeMS, Kyoto University)

1SD-02　**The mechanism of nuclear protein searching on DNA: Coarse-Grained simulation study**
寺川 剛 (京都大学大学院)
Tsuyoshi Terakawa (Grad. Sch. Sci., Univ. Kyoto)

1SD-03　**Differences in dissociation free-energy profiles between cognite and non-cognite protein-DNA complexes**
米谷 佳晃 (日本原子力研究開発機構)

Yoshiteru Yonetani, Hidetoshi Kono (Japan Atomic Energy Agency)

1SD-04　線虫初期胚における染色体ダイナミクスの定量的解析
Quantitative analyses of chromosome dynamics in C. elegans early embryos
菅原 武志 (国立遺伝学研究所)
Takeshi Sugawara, Ritsuko Arai, Akatsuki Kimura (National Institute of Genetics)

1SD-05　蛍光相関分光法を用いた細胞内グルココルチコイド受容体の動態解析
Inside view of molecular dynamics of Glucocorticoid Receptor by using Fluorescence Cross Correlation Spectroscopy in living cell
金城 政孝 (北大 先端生命)
Masataka Kinjo (Faculty of Advanced Life Science, Hokkaido University)

9:00~11:30　E会場：多元数理科学棟 1 階 109 ／ Room E: Mathematics bldg. 1F 109
1SE　コンフォメーション動力学：フォールディングから機能まで
Conformational dynamics: Folding to function

オーガナイザー：高田　彰二 (京大), 笹井　理生 (名大)
Organizer: Shoji Takada (Kyoto Univ.), Masaki Sasai (Nagoya Univ.)

Proteins, and more generally biomolecules, are intrinsically flexible and change their conformations in multiscales both in time and space. In this symposium, we explore various recent studies on flexible conformational dynamics both in experiments and theories. We discuss recent studies on protein folding, molecular recognition, allosteric conformational change upon some reactions, and conformation-dependent aggregation.

1SE-01　蛋白質構造の整合性原理とその拡張
Consistency principle of protein conformation and its extension
笹井 理生 (名古屋大学, 岡崎統合バイオサイエンスセンター, KIAS)
Masaki Sasai[1,2,3] ([1]Nagoya University, [2]Okazaki Institute for Integrative Bioscience, [3]Korea Institute for Advanced Study)

1SE-02　**Dynamic mechanism for the transcription when responses to activators**
Wei Wang (National Lab. Solid State Microstructure and Dept. Phys., Nanjing Univ.)
Yaolai Wang, Feng Liu, **Wei Wang** (National Lab. Solid State Microstructure and Dept. Phys., Nanjing Univ.)

1SE-03　保存アミノ酸に着目したジンクフィンガーの構造と分子認識
New Functions of Zinc Fingers Revealed by Substitution of Conserved Residues
今西 未来 (京大・化研)
Miki Imanishi (ICR, Kyoto Univ.)

1SE-04　ドメインスワッピングによるシトクロム *c* の多量化
Oligomerization of cytochrome *c* by domain swapping
廣田 俊 (奈良先端科学技術大学院大学物質創成科学研究科)
Shun Hirota (Grad. Sch. Mat. Sci., Nara Inst. Sci. Tech.)

1SE-05　マルチドメインタンパク質のフォールディングとコンフォメーション動力学
Folding and conformational dynamics of multi-domain proteins
高田 彰二 (京大理生物物理)
Shoji Takada (Dept. Biophys, Kyoto Univ.)

9:00~11:30　F会場：理学 B 館 5 階 501 ／ Room F: Sci. bldg. B 5F 501
1SF　生物の動きと変形への理論的アプローチ
Theoretical Approaches to Biological Motion and Deformation

オーガナイザー：石原　秀至 (東大), 澤井　哲 (東大)
Organizer: Shuji Ishihara (Univ. of Tokyo), Satoshi Sawai (Univ. of Tokyo)

Motion and deformation observed in living cells emerge from their intrinsic active nature and interaction with the environment. Are there physical principles that could integrate and unify these rich and intriguing phenomena? One of key physical approaches is the framework of active matters that addresses cooperativity of motions at various length and timescales. The symposium will highlight recent progress in this direction with an emphasis on physical and theoretical approaches.

1SF-01　細胞の変形と運動：理論と実験の挑戦
Deformation and motion of cell: theoretical and experimental challenges
佐野 雅己 (東大院理)
Masaki Sano (Grad. Sch. Sci. U. Tokyo)

1SF-02　マウスの左右決定の過程に見られるノード繊毛の回転運動の同調
Synchronization of rotaional movement in mouse node cilia during left-right determination
高松 敦子 (早大・電気・情報生命)
Atsuko Takamatsu[1], Kyosuke Shinohara[2], Takuji Ishikawa[3], Hiroshi Hamada[2] ([1]Dept. Elec. Eng. and Biosci., Waseda Univ., [2]Grad. Sch. Frontier Biosci., Osaka Univ., [3]Dept. Bioeng. and Robotics, Tohoku Univ.)

1SF-03　鞭毛や繊毛の流体力学相互作用による同期：ミニマルアプローチ
Synchronization of flagella and cilia by hydrodynamic interactions: minimal approach
内田 就也 (東北大・理物理)
Nariya Uchida[1], Ramin Golestanian[2] ([1]Dept. Phys., Tohoku Univ., [2]Cent. Theor. Phys., Univ. of Oxford)

1SF-04　興奮性化学進行波に駆動される遊走細胞の形態ダイナミクスの数理モデル
Modeling morphological dynamics of migrating cells governed by self-organized excitable waves
石原 秀至 (東大・院総合文化)
Shuji Ishihara[1], Daisuke Taniguchi[1], Satoshi Sawai[1,2] ([1]Grad. Sch. Arts & Sciences, Univ. Tokyo, [2]JST PRESTO)

1SF-05　細胞の力学と、人工システムにおける自発運動
Mechanics of gels and spontaneous motion of droplets as biologically-motivated systems
義永 那津人 (東北大 WPI-AIMR)
Natsuhiko Yoshinaga (WPI-AIMR, Tohoku Univ.)

1SF-06　這行による移動運動の理解に向けて
Towards understanding the locomotion of animals by limbless crawling
小林 亮 (広島大学, 科学技術振興機構, CREST)
Ryo Kobayashi[1,4], Toshiya Kazama[1,4], Kentaro Ito[1,4], Yoshimi Tanaka[2], Toshiyuki Nakagaki[3,4] ([1]Hiroshima University, [2]Yokohama National University, [3]Future University Hakodate, [4]JST, CREST)

9:00~11:30　H 会場：理学 C 館 5 階 517 ／ Room H: Sci. bldg. C 5F 517

1SH　レチナール蛋白質と光遺伝学
Retinal proteins and optgenetics

オーガナイザー：神山　勉 (名大), 村上　緑 (名大)
Organizer: Tsutomu Kouyama (Nagoya Univ.), Midori Murakami (Nagoya Univ.)

Optogenetics, a new research field in which retinal proteins are utilized for functional analyses of the nervous systems, has recently attracted lots of attention. New technologies have been explored to express light-gated ion channels (channelrhodopsin) and light-driven ion pumps (halorhodopsin) in a specific region of the nervous system, making it possible to control nerve action potentials by light illumination at various wavelengths, or to regulate the intracellular concentrations of second messengers by light stimuli. In this symposium, current progresses in optogenetics will be reported.

1SH-01　ハロロドプシンの構造と分子機能
Structure and Molecular Function of Halorhodopsin
出村 誠 (北大・院先端生命)
Makoto Demura (Fac. Adv. Life Sci., Hokkaido Univ.)

1SH-02　**Structural basis for light-gated cation conductance by channelrhodopsin**
石谷 隆一郎 (東京大学大学院理学系研究科)
Osamu Nureki, **Ryuichiro Ishitani** (Graduate School of Science, The University of Tokyo)

1SH-03　チャネルロドプシンによる神経細胞ネットワーク素子の制御
Control of neural network devices by channelrhodopsin
宇理須 恒雄 (名古屋大学革新ナノバイオデバイス研究センター, 科学技術振興機構,CREST)
Tsuneo Urisu[1,2] ([1]Nagoya University, FIRST Research Center for Innovative Nanobiodevices, [2]Japan Science and Technology Agency, CREST)

1SH-04　オプトジェネティクスを用いた睡眠覚醒調節に関わる神経回路の動作原理解明
Optogenetics reveals function of neural network involved in the regulation of sleep/wakefulness

山中 章弘 (名古屋大学 環境医学研究所)
Akihiro Yamanaka (Research Institute of Environmental Medicine, Nagoya University)

1SH-05 レチナールタンパク質の進化と機能多様性
Evolution and functional diversity of animal opsin-based pigments
寺北 明久 (大阪市大・理)
Akihisa Terakita (Grad. Sch. Sci., Osaka City Univ.)

1SH-06 イカロドプシンの光活性化機構
Photo-activation mechanism of squid rhodopsin
村上 緑 (名大・院理・物理)
Midori Murakami, Tsutomu Kouyama (Grad. Sch. Sci., Nagoya Univ.)

1SH-07 GPCR の細胞内シグナル伝達を制御する構造特徴
Structural elements which control the signal transduction pathway of GPCRs
諏訪 牧子 (青学大 ・理工, 産総研 生命情報工)
Makiko Suwa[1,2], Minoru Sugihara[2] ([1]Colledge, Sci. Eng. AGU., [2]CBRC, AIST)

9:00~11:30 I会場：理学 E 館 1 階 131 ／ Room I: Sci. bldg. E 1F 131

1SI 分子モーター複合体の力発生機構を探る：1 分子～細胞の架け橋
Exploring force-generating mechanism of molecular motor ensembles; building bridges between single molecules and cells

オーガナイザー：茅　元司 (東大), 矢島　潤一郎 (東大)
Organizer: Motoshi Kaya (Univ. of Tokyo), Junichiro Yajima (Univ. of Tokyo)

Single molecule studies have been extensively developed for the last 20 years and revealed the force-generating mechanism of molecular motors, forming their ensembles to contribute to the force generation in various cellular activities. In this symposium, young frontier scientists, studying in two contrasting perspectives, molecular basis and cell basis approaches, will exchange their unique interpretations of the force-generating mechanism of various molecular motor (dynein, kinesin and myosin) ensembles in cells.

はじめに
茅 元司 (東大)
Motoshi Kaya (Univ. of Tokyo)

1SI-01 分子複合体フィラメントにおける骨格筋ミオシン 1 分子の力発生メカニズム
Force generation mechanism of single skeletal myosin molecules in myofilaments
茅 元司 (東京大学・院理物理, 科学技術振興機構・さきがけ)
Motoshi Kaya[1,2], Hideo Higuchi[1] ([1]Grad. Sch. Sci, Univ. Tokyo, [2]JST, PRESTO)

1SI-02 ダイニンモーター運動発生機構の構造的基盤
Structural basis of dynein motility
昆 隆英 (阪大・蛋白研)
Takahide Kon (Institute for Protein Research, Osaka Univ.)

1SI-03 **Microtubule corkscrewing motion driven by multiple non-processive motors**
矢島 潤一郎 (東京大学大学院総合文化研究科広域科学専攻生命環境科学系)
Junichiro Yajima (Department of Life Sciences, Graduate School of Arts and Sciences, The University of Tokyo)

1SI-04 微小管系分子モーターの複数分子による機能を計測する
Measuring ensemble functions of microtubule-based molecular motors
古田 健也 (情報通研, バイオ ICT)
Ken'ya Furuta (Bio ICT Lab, NICT)

1SI-05 **A cellular funicular: one active force generation drives two directional organelle movements**
木村 暁 (国立遺伝学研究所・細胞建築研究室, 総研大・遺伝学専攻)
Akatsuki Kimura[1,2] ([1]Cell Architecture Laboratory, National Institute of Genetics, [2]Dept. Genetics, SOKENDAI)

1SI-06 ミオシンの力生成・応答特性による上皮パターン形成
The emergence of epithelial pattern through force-generating and force-responding properties of myosin

杉村 薫 (京大・iCeMS)
Kaoru Sugimura[1], Shuji Ishihara[2] ([1]Kyoto Univ., [2]The Univ. of Tokyo)

第 2 日目（9/23（日））／ Day2(Sep. 23, Sun.)

9:00~11:30　A 会場：理学南館 1 階 坂田・平田ホール／ Room A: Sci. south bldg. 1F Sakata Hirata Hall
2SA　海外招聘シンポジウム：生物物理学最前線
Invited symposium from abroad: Forefront of biophysics

オーガナイザー：小嶋　誠司 (名大), 千見寺　浄慈 (名大)
Organizer: Seiji Kojima (Nagoya Univ.), George Chikenji (Nagoya Univ.)

The Biophysical Society of Japan will celebrate the 50th annual meeting this year. This symposium is planned as one of the anniversary events organized by the annual meeting organizing committee. In this symposium, we invite four speakers from abroad who have been recognized as their distinguished studies in the field of biophysics. We do not focus on the particular subject of biophysics, but instead we would like to include different topics with various techniques (structural analysis of proteins, (EM, X-ray), systems biology, single molecule biophysics). The aim of this symposium is to overview the forefront of the biophysics in the world, and to enjoy their outstanding studies by the omnibus style.

はじめに
小嶋 誠司 (名大)
Seiji Kojima (Nagoya Univ.)

2SA-01　**The Mechanism of Cytoplasmic Dynein Motility**
Ahmet Yildiz (University of California Berkeley)
Ahmet Yildiz (University of California Berkeley)

2SA-02　**Architecture of the Flagellar Switch Complex**
Brian R. Crane (Cornell University)
Brian R. Crane[1], R. Sircar[1], G. Gonzalez-Bonet[1], Koushik Paul[2], D. Blair[2] ([1]Cornell University, [2]University of Utah)

2SA-03　**Imaging Water at the Nanoscale and Protein in Water by TEM**
Paul T. Matsudaira (Department of Biological Science, National University of Singapore)
Paul T. Matsudaira (Department of Biological Science, National University of Singapore)

2SA-04　**Function dictates topology in biochemical networks**
Chao Tang (Peking University, University of California, San Francisco)
Chao Tang (Peking University, University of California, San Francisco)

9:00~11:30　B 会場：多元数理科学棟 5 階 509 ／ Room B: Mathematics bldg. 5F 509
2SB　若手オーガナイズシンポジウム：生命科学の新しい地平を切り開く若手研究者たち
Symposium organized by younger generation: Young scientists pioneering future life sciences

オーガナイザー：藤井　高志 (理研), 小山　昌子 (名大)
Organizer: Takashi Fujii (RIKEN), Masako Koyama (Nagoya Univ.)

In this symposium, young speakers actively working in diverse research fields introduce recent topics in their own research areas and talk about their progress and potential in addressing important biological questions.

2SB-01　遺伝子発現ノイズの起源
Examining origins of noise in gene expression
谷口 雄一 (理化学研究所生命システム研究センター)
Yuichi Taniguchi, Yutaka Ogawa, Masae Johmura (Quantitative Biology Center, RIKEN)

2SB-02　細胞環境下におけるタンパク質の NMR 計測
Protein NMR spectroscopy in the cellular environment
猪股 晃介 (独立行政法人理化学研究所生命システム研究センター)
Kohsuke Inomata[1], Shuhei Murayama[2], Shiro Futaki[3], Hidekazu Hiroaki[4], Yutaka Ito[5], Hidehito Tochio[2], Masahiro Shirakawa[2] ([1]Quantitative Biology Center, RIKEN, [2]Graduate School of Engineering, Kyoto University, [3]Institute for Chemical Research, Kyoto University, [4]Graduate School of Pharmaceutical Sciences, Nagoya University, [5]Graduate School

of Science and Engineering, Tokyo Metropolitan University)

2SB-03 高速原子間力顕微鏡による生体分子の構造ダイナミクスの直接観察
Direct observation of structural dynamics of biological molecules by high-speed atomic force microscopy
古寺 哲幸 (金沢大・理工・バイオ AFM 先端研究センター)
Noriyuki Kodera[1], Takayuki Uchihashi[1,2], Toshio Ando[1,2] ([1]Bio-AFM Frontier Research Center, Inst. Sci. & Eng., Kanazawa Univ., [2]Sch. Math. & Phys., Inst. Sci. & Eng., Kanazawa Univ.)

2SB-04 中心小体 9 回対称構造の謎を解く
Cracking the mystery of nine-ness: mechanisms of centriole formation
北川 大樹 (遺伝研・新分野創造センター)
Daiju Kitagawa (Nat. Inst. of Genetics, Cent. for Front. Res.)

2SB-05 低温電子顕微鏡法によるらせん複合体の高分解能構造解析
Recent advances in CryoEM high-resolution structural analysis for helical filaments
藤井 高志 (理化学研究所 生命システム研究センター)
Takashi Fujii (Qbic Riken)

2SB-06 **Kinetic and X-ray crystallographic studies of assembly/disassembly of the CRM1 nuclear export complex**
小山 昌子 (名古屋大・理・生命理学)
Masako Koyama[1], Natsuki Shirai[1], Yoshiyuki Matsuura[1,2] ([1]Grad. Sch. Sci., Nagoya Univ., [2]Strl. Biol. R. Ctr., Nagoya Univ.)

9:00~11:30 C 会場：多元数理科学棟 4 階 409 ／ Room C: Mathematics bldg. 4F 409
2SC 非平衡リビングマター：DNA から細胞骨格、細胞へ
Living matter far from equilibrium: from DNA to cytoskeletons and cells

オーガナイザー：島本 勇太 (ロックフェラー大), 前多 裕介 (京大)
Organizer: Yuta Shimamoto (The Rockefeller Univ.), Yusuke Maeda (Kyoto Univ.)

Essential understanding of complex biological systems requires revealing the underlying molecular processes and verifying how they follow the laws of physics. In this symposium we spotlight young researchers who see biological systems as living “matter” and are tackling fundamental problems in biology, using new tools and methodologies that allow for measuring quantitative physical parameters. Topics focus on the single and collective behavior of dynamic polymer systems, from genetic materials to cytoskeletal networks in cells. We believe that such collaborative interactions would facilitate deeper understanding of living systems as well as the development of physics for systems that are out of thermodynamic equilibrium.

2SC-01 有糸分裂紡錘体の構造形成と機能の物理的理解に向けて
Toward a physical understanding of spindle assembly and function
島本 勇太 (ロックフェラー大学)
Yuta Shimamoto (Rockefeller Univ.)

2SC-02 ダイニンに駆動されたマイクロチューブによる巨大渦の格子形成
Large-scale vortex lattice of microtubules driven by dyneins
永井 健 (東京大)
Ken Nagai[1], Yutaka Sumino[2], Kazuhiro Oiwa[3,4] ([1]Univ. Tokyo, [2]Aichi Univ. Edu., [3]NICT, [4]Univ. Hyogo)

2SC-03 **Non-Gaussian athermal fluctuations in active cytoskeletons**
水野 大介 (九州大学理学研究院)
Daisuke Mizuno (Kyushu University)

2SC-04 植物器官にみられるねじれた成長の弾性力学的および幾何学的な起原について
Elastic and geometric origin of the twisted growth of plant organs
和田 浩史 (立命館・物理)
Hirofumi Wada (Dep. Phys. Ritsumeikan Univ.)

2SC-05 **Visualizing Chromosome Structure with Superresolution Microscopy**
Peter Carlton (京都大学 物質ー細胞統合システム拠点 (iCeMS))
Peter Carlton (Kyoto University, iCeMS Institute)

2SC-06 DNA・RNA の輸送と選択：生命の起源への接近
Transport and selection for DNA and RNA: An approach to the origin of life

前多 裕介 (京大・白眉センター, 京大・理・物理, 科学技術振興機構さきがけ, ロックフェラー大)
Yusuke Maeda[1,2,3,4], Albert Libchaber[4] ([1]The Hakubi Center for Advanced Research, Kyoto Univ., [2]Dept. Phys., Grad. Sch. Sci., Kyoto Univ., [3]PRESTO, JST, [4]The Rockefeller Univ.)

9:00~11:30　D 会場：多元数理科学棟 3 階 309 ／ Room D: Mathematics bldg. 3F 309

2SD　スーパーコンピューティング：分子ネットワークと細胞内ダイナミクス
Supercomputing in Molecular Network to Cellular Dynamics

オーガナイザー：木寺　詔紀 (横市大), 杉田　有治 (理研)
Organizer: Akinori Kidera (Yokohama City Univ.), Yuji Sugita (RIKEN)

K computer (the ten Peta FLOPS supercomputer installed in Kobe) provides an enormous enhancement of the capability in computational life science. This symposium intends to bring forth the possibility of supercomputing in life science fully utilizing K computer. Particularly, it focuses on the multi-scale descriptions of molecular networks and cellular dynamics by integrating the molecular and the cellular simulation methods.

2SD-01　**Dynamics and stability of proteins in cellular environments**
Michael Feig (ミシガン州立大学)
Michael Feig (Michigan State University)

2SD-02　スーパーコンピュータは細胞生物学をどう変えるか
How supercomputing can help change cell biology
高橋 恒一 (理化学研究所 QBiC, 慶大・先端生命研, 阪大・生命機能)
Koichi Takahashi[1,2,3] ([1]RIKEN QBiC, [2]Keio Inst. Adv. Biosci., [3]Osaka Univ. Grad. Sch. Front. Biosci.)

2SD-03　細胞内の場を考慮したシミュレータ RICS の開発
Development of the cell simulator in consideration of space
横田 秀夫 (理研 基幹研, 理研 次世代生命体統合シミュレーション)
Hideo Yokota[1,2], Yasuhiro Sunaga[2], Sigeho Noda[3] ([1]ASI, Riken, [2]iSLIM, Riken, [3]ACCC, Riken)

2SD-04　「京」による大規模遺伝子ネットワーク推定
Large scale gene network estimation with K computer
玉田 嘉紀 (東京大・院情報理工)
Yoshinori Tamada[1], Teppei Shimamura[2], Rui Yamaguchi[2], Atsushi Niida[2], Ayumu Saito[2], Yuto Kataoka[1,2], Seiya Imoto[2], Masao Nagasaki[3], Satoru Miyano[1,4] ([1]Grad. Sch. Info. Sci. Tech., Univ. Tokyo, [2]Inst. Med. Sci., Univ. Tokyo, [3]Tohoku Med. Megabank, Tohoku Univ., [4]CSRP, RIKEN)

2SD-05　データ同化法にもとづくデータ統合・生体シミュレーション技術
Biological system modeling and data assimilation
吉田 亮 (情報・システム研究機構 統計数理研究所)
Ryo Yoshida (The Institute of Statistical Mathematics, Research Organization of Information and Systems)

9:00~11:30　E 会場：多元数理科学棟 1 階 109 ／ Room E: Mathematics bldg. 1F 109

新学術領域研究　「運動超分子マシナリーが織りなす調和と多様性」共催

2SE　運動超分子マシナリーが織りなす調和と多様性
Harmonized supramolecular machinery for motility and its diversity

オーガナイザー：宮田 真人 (阪市大), 南野　徹 (阪大)
Organizer: Makoto Miyata (Osaka City Univ.), Tohru Minamino (Osaka Univ.)

"Motility" observed inside and outside of cells has long been an important biophysical research subject. In the last decade, we have learned a lot about many motile systems, including conventional motor proteins and ATP synthetase and so on. However, the mechanisms of many motility systems are still unclear. In this symposium, we discuss the possibilities for new research subjects through six presentations.

はじめに
南野 徹 (阪大)
Tohru Minamino (Osaka Univ.)

2SE-01　細菌べん毛モーターの回転方向変換制御機構の解明
Elucidation of the directional switching mechanism of the bacterial flagellar motor

宮田 知子 (大阪大学大学院生命機能研究科)
Tomoko Miyata[1], Takayuki Kato[1], Takasi Fujii[1,2], Shuichi Nakamura[4], Yusuke Morimoto[1,2,3], Tohru Minamino[1], Hideyuki Matsunami[5], Keiichi Namba[1,2] ([1]Grad. Sch. Frontier Biosci., Osaka Univ., [2]QBiC, RIKEN, [3]Grad. Sch. Sci., Osaka Univ. Department of Applied Physics, [4]Tohoku Univ. School of Engineering, [5]OIST, Initial Research Project)

2SE-02 磁性細菌の超分子複合体ーマグネトソーム，細胞骨格そしてベン毛ーの構造的組織化
Structural Organization of Macromolecular assemblies -Magnetosome, Cytoskeleton and Flagella- in Magnetotactic Bacteria
福森 義宏 (金沢大学理工研究域)
Yoshihiro Fukumori, Azuma Taoka (College Sci. Eng., Kanazawa Univ.)

2SE-03 アクチンフィラメントの構造多型と機能分化
Structural polymorphism and functional differentiation of actin filaments
上田 太郎 (産総研・バイオメディカル)
Taro Q.P. Uyeda[1], Nobuhisa Umeki[1], Saku Kijima[2], Yusuke Nishikawa[3], Kiyotaka Tokuraku[3], Akira Nagasaki[1], Taro Q.P. Noguchi[2] ([1]Biomedical Res. Inst., AIST, [2]Miyakonojo Natl. Col. of Tech., [3]Muroran Inst. of Tech.)

2SE-04 マイコプラズマ滑走運動の謎にせまる
New foci to clarify *Mycoplasma* gliding
宮田 真人 (大阪市大・院理・生物地球)
Makoto Miyata (Grad. Sch. Sci., Osaka City Univ.)

2SE-05 バクテロイデスにおける分泌と滑走
Secretion and Gliding in Bacteroides
佐藤 啓子 (長崎大学医歯薬総合研究科)
Keiko Sato[1], Daisuke Nakane[1], Hirohumi Wada[2], Katsumi Imada[3], Mark J. McBride[4], Koji Nakayama[1] ([1]Graduate School of Biomedical Sciences, Nagasaki University, [2]Department of Physics Sciences, Ritsumeikan University, [3]Graduate School of Science, Osaka University, [4]Department of Biological Sciences, University of Wisconsin-Milwaukee)

2SE-06 **Molecular motor driven self-organization in Myxococcus xanthus**
Joshua W. Shaevitz (Princeton University, Departments of Physics and Genomics)
Joshua W. Shaevitz (Princeton University, Departments of Physics and Genomics)

総合討論
宮田 真人 (大阪市大・院理・生物地球)
Makoto Miyata (Grad. Sch. Sci., Osaka City Univ.)

9:00~11:30　F会場：理学B館5階501 ／ Room F: Sci. bldg. B 5F 501

2SF　生命システムのばらつきと情報処理
Inherent variability and information coding in biological systems

オーガナイザー：黒田　真也 (東大), 柴田　達夫 (理研)
Organizer: Shinya Kuroda (Univ. of Tokyo), Tatsuo Shibata (RIKEN)

Biological systems can process information and exert functions in the presence of inherent variability in expression levels and activity of molecules. Such variability generates diversity of biological functions including early embryonic development and wiring of neural circuits. In this symposium, inherent variability and information coding in biological systems will be discussed by having speakers from experimental and theoretical sides.

2SF-01 **Inconsistency between population and single cell growth rates revealed by dynamics cytometer**
若本 祐一 (東大・複雑系生命システム研究センター，JST さきがけ)
Yuichi Wakamoto[1] ([1]Research Center for Complex Systems Biology, Univ of Tokyo, [2]JST PRESTO)

2SF-02 **Information Processing via Noisy Biochemical Channels**
小林 徹也 (東京大学 生産技術研究所, 科学技術振興機構 さきがけ)
Tetsuya J. Kobayashi[1,2], Atsushi Kamimura[3,4] ([1]Institute of Industrial Science, the University of Tokyo, [2]JST PRESTO, [3]Graduate School of Arts and Sciences, The University of Tokyo, [4]JSPS)

2SF-03 ERK 経路の情報コード
Information coding of ERK signaling networks
黒田 真也 (東大・理・生物化学)
Shinya Kuroda, Shinsuke Uda, Takeshi Saito (Dept. Biophys. Biochem., Univ. Tokyo)

2SF-04 **Fluctuating signals in cellular signal transduction systems**
柴田 達夫 (理化学研究所 発生再生科学総合研究センター)
Tatsuo Shibata (RIKEN Center for Developmental BiologyE)

2SF-05 **Symmetry breaking in mouse development**
柊 卓志 (EMBL, iCeMS Kyoto University)
Takashi Hiiragi[1,2] ([1]EMBL, [2]iCeMS Kyoto University)

2SF-06 **Stochastic expression of cell adhesion molecules in individual neurons**
八木 健 (大阪大学, 科技振興機構)
Takeshi Yagi[1,2] ([1]Osaka University, [2]CREST-JST)

9:00~11:30　G 会場：理学 B 館 2 階 212 ／ Room G: Sci. bldg. B 2F 212

2SG　染色体場のダイナミクス
Dynamics of chromatin as the physicochemical field for genetic activities

オーガナイザー：徳永　万喜洋 (東工大), 木村　宏 (阪大)
Organizer: Makio Tokunaga (Tokyo Inst. of Tech.), Hiroshi Kimura (Osaka Univ.)

Spatial organization of DNA molecules within the nucleus contains potentially important, and yet mystifying genetic information. Such information includes physical properties, shapes, and spatio-temporal positioning of DNA and regulatory molecules, comprehensively providing the "physicochemical field" that ensures arranged storage, timely expression and faithful transmission of genetic materials. We will discuss the structure and function of DNA and protein complexes that are formed transiently and locally. Understanding of the physicochemical field will provide a tool to control and reconstitute various cellular functions.

2SG-01 生細胞における RNA ポリメラーゼ II による転写活性化の動態
Kinetics of RNA polymerase II transcription in living cells
木村 宏 (大阪大学生命機能研究科)
Hiroshi Kimura, Timothy J. Stasevich (Grad. Sch. Frontier Biosci., Osaka. Univ.)

2SG-02 染色体場の 1 分子イメージング定量解析
Quantitative analysis of single molecule imaging of the physicochemical field for genetic activities
十川 久美子 (東工大・院生命理工, 理研・免疫セ)
Kumiko Sakata-Sogawa[1,2], Makio Tokunaga[1,2] ([1]Grad. Sch. Biosci. Biotech., Tokyo Inst. Tech., [2]RCAI, RIKEN)

2SG-03 ヒストンバリアントによるヌクレオソームの構造多様性とダイナミクス
Structural versatility, dynamics, and functions of human nucleosomes containing histone variants
胡桃坂 仁志 (早稲田大学 理工学術院)
Hitoshi Kurumizaka (Waseda University, Faculty of Science and Engineering)

2SG-04 細胞のパターンをうみだす遺伝子回路の作製
Construction of genetic circuits underlying cell pattern formation
戎家 美紀 (京都大学生命科学系キャリアパス形成ユニット)
Miki Ebisuya (Career-Path Promotion Unit for Young Life Scientists, Kyoto Univ.)

2SG-05 細胞分裂と染色体分配のメカノバイオロジー
Mechanobiology of Cell Division and Chromosome Segregation
石渡 信一 (早大・理工, 早大・WABIOS)
Shin'ichi Ishiwata[1,2] ([1]Fac. Sci. Engn., Waseda Univ., [2]WABIOS, Waseda Univ.)

2SG-06 減数分裂特異的な非コード RNA が相同染色体の対合を促進する
Meiosis-specific non-coding RNA mediates robust pairing of homologous chromosomes in meiosis
平岡 泰 (大阪大学大学院生命機能研究科, 情報通信研究機構　未来 ICT 研究所)
Yasushi Hiraoka[1,2], Da-Qiao Ding[2], Tokuko Haraguchi[1,2] ([1]Graduate School of Frontier Biosciences, Osaka University, [2]Advanced ICT Research Institute Kobe, NICT)

9:00~11:30　H 会場：理学 C 館 5 階 517 ／ Room H: Sci. bldg. C 5F 517

2SH　先端顕微計測が照らす生命の輝き
Star of life shined by frontier microscopies

オーガナイザー：井上　圭一 (名工大), 今村　博臣 (京大)
Organizer: Keiichi Inoue (Nagoya Inst. of Tech.), Hiromi Imamura (Kyoto Univ.)

Microscopic techniques have continued to increase their presence in biological field as outstanding research methods to directly observe the spatiotemporal behaviors of various biological materials and phenomena in recent years. In this symposium, seven leading researchers will introduce their cutting-edge microscopic techniques and provide topics for discussing what will be possible with microscopic techniques in future biological science.

はじめに
今村 博臣 (京大)
Hiromi Imamura (Kyoto Univ.)

2SH-01　KcsA カリウムイオンチャネルの溶液条件変化応答 1 分子開閉ダイナミクスの解析
Analysis of Single Molecular Gating Dynamics of the KcsA Potassium Channels Responding to Rapid Changes of Solution Conditions
清水 啓史 (福井大・医・分子生理)
Hirofumi Shimizu[1], Masayuki Iwamoto[1], Antoine Royant[2,5], Stetten David von[5], Laurent Guerin[3], Yoshimitsu Aoki[4], Michael Wulff[5], Shigetoshi Oiki[1] ([1]Mol. Physiol. & Biophys., Univ. Fukui. Fac. Med. Sci., [2]CEA-CNRS-Universite Joseph Fourier, [3]Universite de Rennes 1, [4]Keio. Univ. Sci. & Tech. Elec., [5]ESRF)

2SH-02　中赤外波長領域の観察が可能な赤外超解像顕微鏡の開発と生体試料への応用
Development of a mid-IR super-resolution microscope and its application to biological samples
酒井 誠 (東工大・資源研)
Makoto Sakai (Tokyo Tech.)

2SH-03　白色レーザーを用いた CARS 分光イメージングによる生細胞の動態追跡
Tracing dynamical behavior of a single cell by CARS microspectroscopy using a white-light laser source
加納 英明 (筑波大 数理物質科学研究科)
Hideaki Kano[1], Masanari Okuno[2], Hiroki Segawa[2], Hiro-o Hamaguchi[3] ([1]Tsukuba Univ., [2]The Univ. of Tokyo, [3]National Chiao Tung Univ.)

2SH-04　イメージングマススペクトロメトリーによって初めて明らかになった、細胞内の脂質分布の分子種特異的な極性について
Imaging mass spectrometry revealed the polarized intracellular distribution of specific lipid molecular species
瀬藤 光利 (浜松医科大学解剖学講座)
Mitsutoshi Setou (Hamamatsu University School of Medicine Department of Cell Biology and Anatomy)

2SH-05　随意運動中のマウス運動野 2 光子イメージング
Two-photon imaging of the mouse motor cortex during voluntary skilled movement
松崎 政紀 (基礎生物学研究所, CREST, 総研大)
Riichiro Hira[1,2,3], Fuki Ohkubo[1,3,4], Katsuya Ozawa[2,3], Yoshikazu Isomura[3,5], Kazuo Kitamura[2,3], Masanobu Kano[2], Haruo Kasai[2], **Masanori Matsuzaki**[1,3,4] ([1]National Institute for Basic Biology, [2]Graduate School of Medicine, University of Tokyo, [3]CREST, [4]SOKENDAI, [5]Brain Science Institute, Tamagawa University)

2SH-06　**Chemiluminescence imaging of flow-induced ATP release at caveolae in vascular endothelial cells**
山本 希美子 (東京大学 大学院医学系研究科 医用生体工学講座 システム生理学)
Kimiko Yamamoto[1], Joji Ando[2] ([1]Laboratory of System Physiology, Department of Biomedical Engineering, Graduate School of Medicine, University of Tokyo, [2]Laboratory of Biomedical Engineering, School of Medicine, Dokkyo Medical University)

2SH-07　バイオイメージング技術
New Fluorescent Probes and New Perspectives in Bioscience
宮脇 敦史 (理化学研究所　脳科学総合研究センター)
Atsushi Miyawaki (Brain Science Institute, RIKEN)

おわりに
井上 圭一 (名工大)
Keiichi Inoue (Nagoya Inst. of Tech.)

9:00~11:30　I会場：理学E館 1 階 131 ／ Room I: Sci. bldg. E 1F 131

2SI　一分子レベルで生体分子機械のエネルギーと機能効率を考える
The art of energetic and functional efficiency in biomolecular machines on the single molecule level

オーガナイザー：鎌形　清人 (東北大), 藤芳　暁 (東工大), Chun Biu Li (北大)

Organizer: Kiyoto Kamagata (Tohoku Univ.), Satoru Fujiyoshi (Tokyo Inst. of Tech.), Chun Biu Li (Hokkaido Univ.)

How single or a few biomolecules perform functions with high energetic efficiency in a fluctuating environment is an intriguing question that concerns the understanding of the general designing and operational principles of biological nano-machineries. By bringing together both experimental and theoretical experts from interdisciplinary fields, this symposium aims to explore: 1) Novel experimental techniques to probe the energetic and functional efficiency on the single molecule level; 2) New theoretical frameworks and analysis methods in modeling and explaining the biophysical mechanisms to achieve energetic and functional efficiency; 3) Applications of these biological inspirations in building efficient nano-devices.

2SI-01　生物には効率が大事なのだろうか？

Is high efficiency necessary for organisms?

工藤 成史 (東北大・院応用物理)

Seishi Kudo (Dept. Applied Physics, Grad. Sch. Eng., Tohoku Univ.)

2SI-02　F_1-ATPase モーターの一分子エネルギー論

Single molecule energetics of F_1-ATPase motor

宗行 英朗 (中央大学理工学部物理学科)

Shoichi Toyabe[2], Takahiro Watanabe-Nakayama[3], Hiroshi Ueno[1], Tetsuaki Okamoto[4], Hiroshi Taketani[1], Seishi Kudo[5], **Eiro Muneyuki**[1] ([1]Dept. Phys., Faculty of Science and Engineering, Chuo Univ., [2]Faculty of Physics, LMU Munich, [3]Interdisciplinary Graduate School of Science and Engineering, Tokyo Inst. Tech., [4]Environment Preservation Center, Kanazawa Univ, [5]Dept. Appl. Phys., Sch. Eng., Tohoku Univ.)

2SI-03　**Observation of vibrational absorption of single proteins at few Kelvins**

藤芳 暁 (東工大 物理)

Satoru Fujiyoshi (Tokyo Tech.)

2SI-04　揺らぎの定理によるミトコンドリア輸送の駆動力測定

Estimation of driving force acting on a mitochondrion transported in a living cell: Application of the fluctuation theorem

林 久美子 (東北大工)

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2SI-05　物質界面における構造と電荷移動を可視化する走査型プローブ顕微鏡法の開発

Development of scanning probe methods for investigating structures and charge transfers at material interfaces

木村 建次郎 (神戸大学 大学院理学研究科)

Kenjiro Kimura (Grad. Sch. of Sci., Kobe Univ.)

2SI-06　DNA 折り紙フレームを用いた一分子観察

Direct Observation of Single Molecular Event in DNA Origami Frame

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