Innovative Research And Technologies in Life Sciences -2023

Starting from Aristotle and Charles Darwin to Svante Pääbo, "the 2022 Nobel prize winner for Medicine, for uncovering the genomes of extinct hominins and human evolution," life scientists study living organisms, processes and interactions with the environment for the betterment of the world. Considering the pioneering Life science discoveries of 2023, publication in the Journal, 'Aging', could be considered ground breaking in regenerative medicine, disclosing rejuvenation by age reversal is not limited to genetics but is also achieved chemically, without deleting the cells' identity. Another finding is to differentiate between young, old, and senescent cells (cells that do not multiply), developing an innovative quantitative fluorescence-based system, the nucleocytoplasmic compartmentalization assay (NCC). The two articles on lung research published in the journal 'Cell Stem Cell' are a new beginning in treating lung diseases resulting from alveolar damage or genetic diseases by engrafting differentiated murine Pluripotent stem cells (PSCs) into the injured distal lung epithelium.

mRNA is of primary interest to many researchers in 2023, such as chemically modifying RNA to be used in plants to increase crop yield and climate tolerance and develop ribozymes and aptamers. As proteins execute most biological functions, accurate prediction of 3-fold protein structures from the linear amino acid sequences is vital. Database of Interacting Protein Structures (DIPS) -Plus is an enhanced database with a rich dataset of 42,112 complexes for machine learning of protein interface predictions (PIP). At the same time, DeepTMP is a deep transfer learning method for predicting inter-chain contacts of transmembrane protein complexes. It was announced that from 4800 unknown human protein structures, algorithms such as AlphaFold2, RoseTTAFold and trRosettaX-Single algorithms predicted the structures for almost every unknown except for 29. Tools to convert bioelectricity into light, a new class of fluorescent protein indicators of membrane potential, which allow one to visualize electrical dynamics in neurons, heart cells, and bacteria, have been developed.

Other important research findings in different disciplines include the coordinated migration of leukocytes, the genomic potential of the viruses to control the metabolic marker production of phototrophic sulfur bacteria, identifying new species, including leaf insects, nursery pollination in orchids (mycoheterotrophic plants), the impact of carbohydrate metabolism and insulin resistance by gut microbiota and disclosing of 26 common epilepsy risk loci, how cells breakdown proteins, bioelectronics devices and sensors from bacteria and also the new arrangement of myofibrils within the fibres of a sonic muscle of fish *Parophidion vassali*.

For the continuous evolution of the life science industry and to make revenue, it has to keep pace with cutting-edge research and significant life science findings. They have understood the necessity of a customer-centred digital ecosystem and are moving forward by utilizing revolutionary technologies such as Cloud computing services in data storage, with systematized procedures and the possibility of access from any device. Blockchain technology (distributed database or stores data in multiple computers that maintain a continuously growing list of records systematically, termed as blocks) is also being used to store and manage life science data, including patients' data and drug traceability, and the ability of Artificial Intelligence (AI) to cost-effectively analyze large data sets promptly and accurately in drug designing and development, management of digital clinical trials and population health, diagnostics and in precision medicine. Another emerging technology is wearable technology with biosensors, smart watches, fitness trackers and many more. Real-world data (RWD) is another tool operating in many areas, including drug development and patient care, with AI and machine learning.

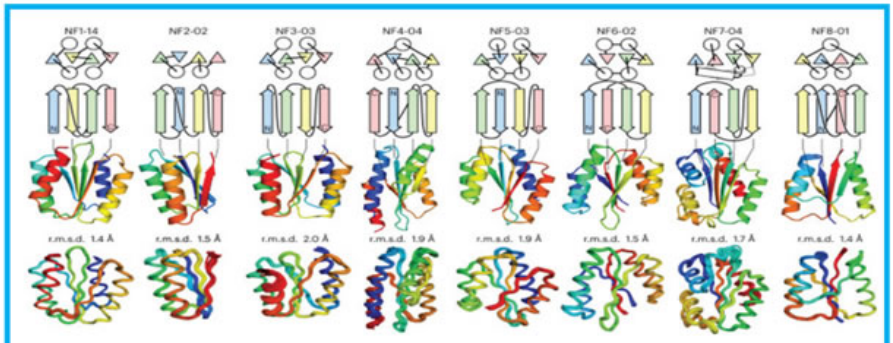

Fig. Comparison of computational models with experimentally determined structures

Top, the top two rows show designed novel αβ-folds from NF1 to NF8. The tertiary arrangement of α-helices (circles) and β-strands (triangles) and their connections are shown at the top, the β-sheet topologies below. Middle, computational design models. Bottom the NMR structures. The r.m.s.d. between the design model and NMR structure for backbone heavy atoms is indicated. The design models are available in Supplementary Data 1, the NMR structures are available in the PDB: NF1-14 (PDB 7BPL), NF2-02 (7BPM), NF3-03 (7BQE), NF4-04 (7BQC), NF5-03 (7BPP), NF6-02 (7BQB), NF7-04 (7BPN) and NF8-01 (7BQD).[Minami, S., Kobayashi, N., Sugiki, T. et al. Exploration of novel αβ-protein folds through de novo design. Nat Struct Mol Biol 30, 1132–1140 (2023). https://doi.org/10.1038/s41594-023-01029-0]

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