



Technological Frontiers in Cell Biology

Laxmikanth Matcha*

Commentary

Microscopy has revolutionized the understanding of cellular and molecular processes. Ever since the microscopic devices were invented there has been constant improvement in the technology and in fact the development of high resolution fluorescence microscope has resulted in conferring Nobel Prize in Chemistry in the year 2014. In the year 2017 the prize went to the development of cryo-electron microscope. Underlying working principles of these microscopes differ a great deal. In fluorescence microscope the fluorescent molecules are used to light the target proteins, cells, and other cellular components, and enable the biologists to visualize the living samples on a real time basis. However, there is a limitation that visible light cannot differentiate components closer than 200 nanometers. Therefore electron microscope was developed in order to achieve greater resolution. But however this technique required the vacuum that limited its use for visualizing live cells. Therefore old techniques of cryo-stallograph were replaced with the individual or combined usage of these microscopes.

Wide field microscope functions on the intense light source to illuminate the specimen. Confocal microscope was developed that uses a pin hole to illuminate the point of interest. This enables removal of background fluorescence and out of focus fields and hence a higher resolution and contrast is obtained in effect. Light sheet microscopy functions by scanning the samples based on a very thin plane of laser light and this technique allows real-time tracking of the living cells and tissues. Similarly the structured illumination microscope also allows the magnified visualization of the live cells. The most advanced electron cryo-microscope has the potential to reveal that atomic structures of biomolecules such as large protein. This has many advantages over X-ray cryo-stallograph because with this techniques the samples required to be fixed and a crystal form.

is improvement in the techniques of cell biology as demonstrated not possible without the involvement of physics. Open Access

Computer scientists and statisticians have also contributed for the improved image processing and analysis. The synergistic efforts of the cell biologists and the other professions have enabled the visualization of cellular trafficking pathways in the live cells at greater resolution.

The interactions between the different organelles could be seen by capturing three dimensional color footage of light sheet fluorescence microscope combined with confocal microscope. This has opened new vistas for the aspiring cell biologists to design new experiments and test the biological hypothesis. Several of the cellular processes including mitosis and meiosis were decoded using these advanced microscopic visualizations. Understanding of inter-molecular interactions has great relevance in the pharmaceutical sector. On an overall basis the imaging capabilities at sub-cellular levels has opened new avenues and far more attractive for the researchers who are interested in cell biology and its applications.

Genetic screening and editing have enabled the scientists to reengineer the cells and cellular processes and during these process the involvement of mathematical, statistical and computer science have been phenomenal. Due to advancements in the technology such as genetic engineering for experimental cell biology large scale experiments are possible and this has resulted in generation of huge volumes of complex and dynamic data that needed to be analyzed and interpreted. The diversity and the magnitude of the molecular and physiological processes necessitated the analysis of the data generated to derive logical interpretations. Genetic reprogramming is enabling the scientists to reengineer the cells such that they detect an abnormality in the early stage. The technique is also enabling regenerative medicine and cell regeneration and tissue reconstructions. The computation process, machine learning and modeling has enabled analysis of variables associated with thousands of genes and gene combination effects. All the technologies have facilitated synthesis and production of biological therapeutics such as monoclonal antibodies for various therapeutic applications. Cell biology is increasingly becoming more relevant to health science than ever before.

*Corresponding author: Laxmikanth Matcha, Department of Molecular Biotechnology, Uppsala University, Sweden, E-mail: lama.swedbio@gmail.com