

講座大師何志明專題演講

Enriching Human Life with bio-nano-information System Technologies

In the next decade or two, the feature size of microelectronic devices will continue to decrease and is eventually expected to reach fabrication and material limits. With microelectronics approaching the end of its roadmap, the National Nanotechnology Initiative (NNI) was created for the purpose of creating new technologies and to maintain the momentum of continuous progress.

A universal goal of technological development, including nanotechnology, is the enrichment of human life. A disparity of nine orders of magnitude separate the length scales of a human (a meter) and the nanometer, presenting significant technical challenges. This goal will ultimately be achieved through the development of a definitive pathway that uses existing and future technology to paint the new roadmap from the nanoscale to human life. In the area of bio-nanotechnologies concerns that of biological molecules, such as DNA, the molecule that serves as the blueprint of all living organisms. Harnessing the intrinsic functionality of these nano-sized biological molecules, i.e. DNA/RNA and proteins, will yield enormous potential for biomedical applications.

The human body is an extremely intelligent and complex adaptive system. The DNA/RNA and protein molecules, which drive its natural processes possess dimensions on the nanometer range. The challenges in exploring the governing mechanisms across a wide span of length scales are obviously challenging. For example, a cell fuses genetic informatics with nanoscale sensors and actuators to result in perhaps one of the most efficient and autonomous micron-scale “factories”. The richness in the science within the three orders of magnitude difference in length scale is far beyond our full understanding. The question of how we will span the length scales of these nano-scale capabilities which will eventually enable us to enrich human lives is a not an obvious, but a key task. These basic processes that occur at the molecular level have opened up a world where the integration of individual components can eventually derive higher-order functionalities, or *emergent properties*. This leads us towards a compelling approach by fusing biotechnology, nanotechnology, and information science, which will enrich the development of revolutionary application-specific technologies.