The Nihon University "*N.*" Research Project

Joe Otsuki on behalf of the project members

Our project *Nanotechnology Excellence, Nihon University —Nanomaterial based Photonic, Quantum and Bio Technologies—* has been launched this year 2009, as the first project in the scheme of *the Nihon University Strategic Projects for Academic Research*, aka *the Nihon University "N." Research Project,* which itself also started this year. The title is crowned with "*N.*", which is the symbol representing Nihon University, as it is hoped that this research project also represents the University as well.

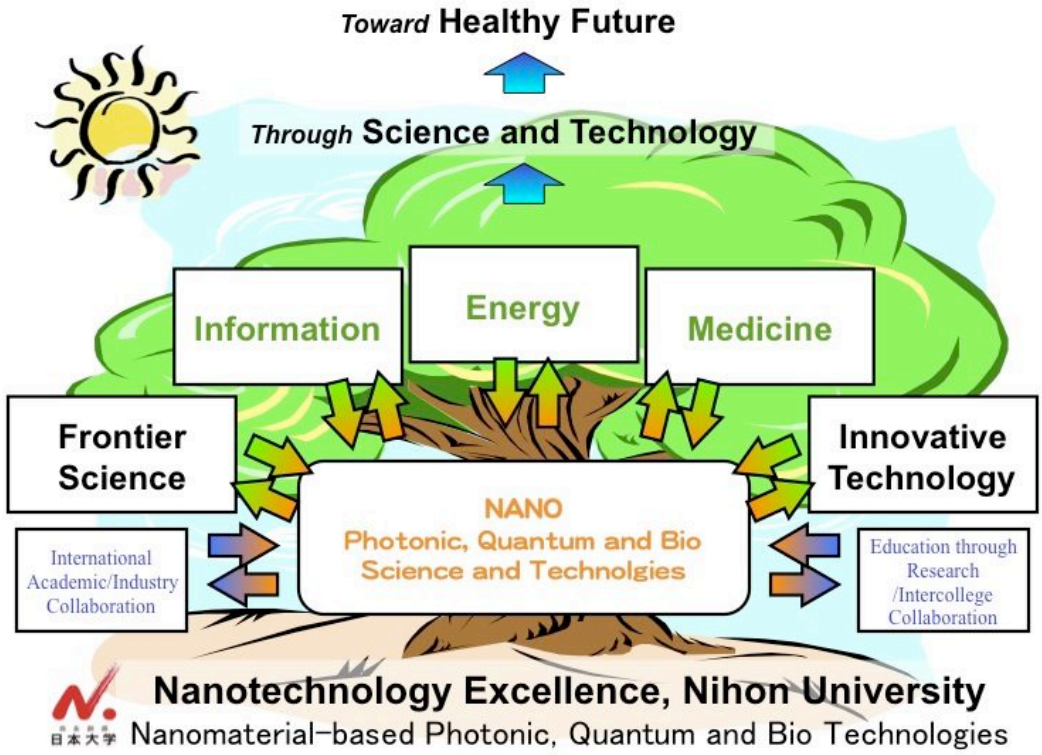
Our team of researchers includes experts in the areas of information, energy, and medicine. We have serious problems in each of these fields: we will have to process increasing amount information at a tremendous rate; we will soon be faced with energy shortage; and it is likely that some of us will die of cancer. If there is a promising technological approach to address these issues in these apparently unrelated areas, it is through deep understanding and better control of matter from its smallest elements, i.e. atoms and molecules, at the nanoscale. Each of the members has a different background, from basic science such as chemistry, physics, biology to more application-oriented technologies including information, materials, quantum communication, and also from basic medical research to practicing medicine. As we, otherwise working in different campuses, get together for the project, we have found, to a pleasant surprise, that we have many things in common.

Here I will give two cases that a common issue is the key to be applied in the diverse areas that I mentioned. A first example is *self-assembly*. Nanoscale materials may have information within their structure such that they spontaneously assemble themselves into some ordered entities. Ito, a member in the project, has grown magnetic particles with a high density deposited on a surface by employing self-assembled nanopore or nanoparticle arrays as templates. The high density magnetic particles are expected to store more information packed into smaller area than conventional materials. Matsushita has prepared a solar cell with a photonic crystal structure, which was made through self-assembly of colloidal particles. The efficiency of the solar cell is higher because the energy may not be dissipated as light as the photonic crystal can prohibit certain light from emitting. Self-assembly manifests its power in biological systems. Molecular recognition is a form of self-assembly that a molecule binds to a specific molecule in a specific way. Nagase and Fukuda are developing a family of polyamide compounds that interact with DNA in a sequence specific manner. They are developing diagnostic and treatment technologies on the basis of the molecular recognition of DNA by the polyamides.

Another example I will mention here is chromophores that absorb and emit light in a red to near IR wavelength region. Information may be transmitted as near IR light in the optical communication, as loss of light within the optical fiber is minimum in this region of the electromagnetic spectrum. Materials that emit single photons in a red to near IR region are important for quantum optical communication. One of the next generation solar cells is the dye-sensitized solar cells (DSSCs). More efficient use of red to near IR light by DSSCs with better dyes is the major issue to further improve the energy conversion efficiency. Near IR chromophores and fluorophores may also find use for in vivo imaging or treatment of deseases

such as cancer in the medical area, as tissue in the body is relatively transparent to red or near IR light.

These examples demonstrate that we, each of whom has a different background, have common issues, which we might have not noticed as these issues may be divided into highly specialized areas. In this project, we facilitate communication among scientists from different fields to help their collaborative research thereby promoting innovation for the development of new technologies, hoping that something really new would arise from a crucible of different ideas and people with different backgrounds.



日本大学“*N.*”研究プロジェクト

大月穣

日本大学“*N.*”研究プロジェクトの第一弾として本年度スタートした「ナノ物質を基盤とする光・量子技術の極限追求」は，物質と光の量子的な相互作用を本質から捕らえ，ナノメートルスケールで制御することによって，情報，エネルギー，医療分野が抱える問題の解決を図る技術を創りだそうという研究プロジェクトです. 基礎科学から応用技術までに渡り，かつ，広い分野の技術開発のために，５学部の研究者からなる共同研究チームによって本プロジェクトに取り組みます.

第１回目の本シンポジウムでは，私達の研究の最新結果を含めて報告，議論し，それぞれの研究者のシーズとニーズを出し合い，これを今後のさらなる研究の発展のための契機とすることを期待しています.