Towards the Development Advanced Nanomedicine by new Biomaterials

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Clinical trials on humans could begin in as little as four years, said the company, which hopes to help supply an estimated $6-billion market for organs and a similar market for cellular therapies to treat diseases such as diabetes. Every day thousands of people of all ages are admitted to hospitals because of the malfunction of some vital organ. Because of a dearth of transplantable organs, many of these people will die. In perhaps the most dramatic example, the American Heart Association reports only 2,300 of the 40,000 Americans who needed a new heart in 1997 got one. Lifesaving livers and kidneys likewise are scarce, as is skin for burn victims and others with wounds that fail to heal. It can sometimes be easier to repair a damaged automobile than the vehicle's driver because the former may be rebuilt using spare parts, a luxury that human beings simply have not enjoyed. The ever-growing demand for donor organs to meet the needs of individuals on waiting lists will likely never be met. While roughly 100,000 people have transplants in the United States, more than 10 million have implants. There are 20,000 transplants annually, but 2 million implants. In short, the need for organs cannot be met by traditional methods of transplantation. Stem cells technology in combination with tissue engineering may change that.

As the third surgical therapy following the reconstruction surgery and organ transplantation, a new therapeutic trial based on the natural potential of tissue regeneration induction has been expected. However, only by using such cells, it is practically difficult to induce tissue regeneration. This is because basically, cells survive and biologically function interacting with their local surrounding environment which has been demonstrated to be comprised from growth factors and extracellular matrix. In this case, the combination with cells and/or growth factors is required. One practically possible way to enhance the *in vivo* activities expected is to make use of drug delivery system (DDS). We have prepared biodegradable nanoparticles for the controlled release of bioactive growth factors to demonstrate the successful regeneration repairing of various tissues. This release system can be combined with cells and/or the cell scaffold to induce the regeneration repairing of tissues and organs. This presentation overviews our several experimental data of tissue regeneration on the basis of nano-biomaterials and DDS technology.