# Creation of 3D biomaterial by fusion of cells and tissues



Regenerative medicine, biomaterials, tissue engineering, bone regeneration, drug delivery system

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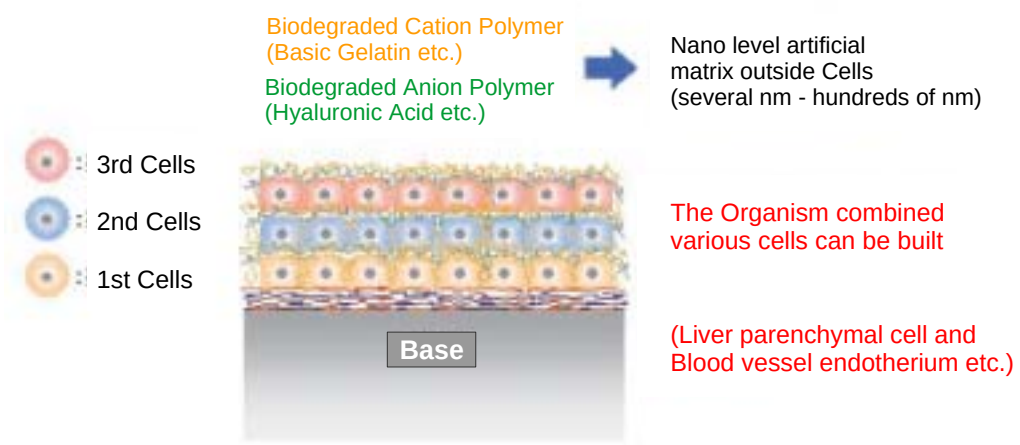
## 1 Construction of 3-dimensional tissue consisting of various cell types

Organs and tissues in the body consist of various types of cells, not a single type, and cells supply humoral factors such as proteins, hormones, and cytokines to each other as a function of the tissue.
We aim at in vitro construction of 3-dimensional tissues consisting of multiple cell types, not a single type, by combination of alternate adsorption method, which prepares polymer membranes at a nanolevel, and cells and cell growth factors. No 3-dimensional tissue consisting of various cell types has been produced, and this study may become a basic technique in regenerative medicine.




Three dimensional organization body image

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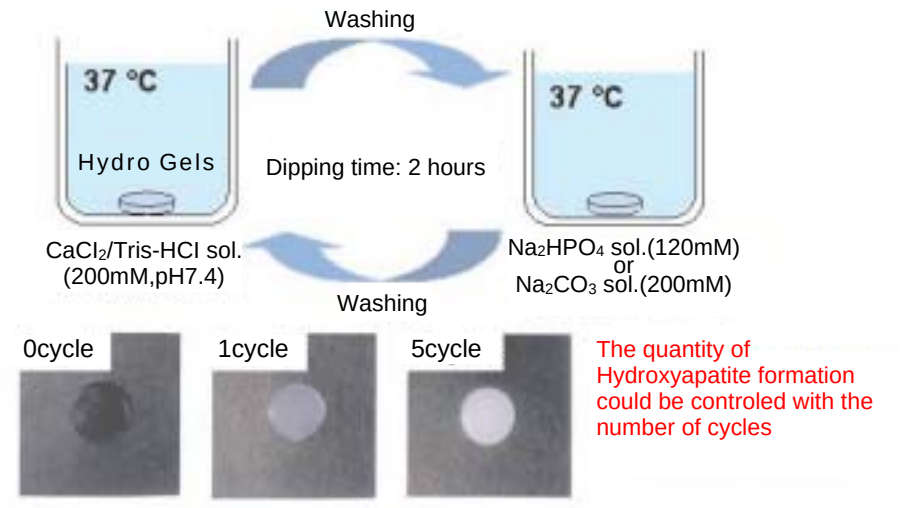
## 2 Preparation of organic-inorganic complexed material by alternate immersion and application for bone regenerative medicine

For hydroxyapatite frequently used in bone regeneration, bovine bone-derived hydroxyapatite is used in many cases, and antigenicity is a concern. Our laboratory has developed an alternate immersion method that forms hydroxyapatite 100 times faster than the current method, and reported that complexes with various organic compounds and metal materials can be prepared using this method.
We have reported that agarose gel-hydroxyapatite complex is a superior dental material to the commercial materials, and platinum coil-hydroxyapatite complex is useful for treatment of cerebral aneurysm. In this study, organic-inorganic complex materials will be prepared using the alternate immersion method, and developed for use as a material for bone regeneration .




The Hydroxyapatite formation with alternate dipping method

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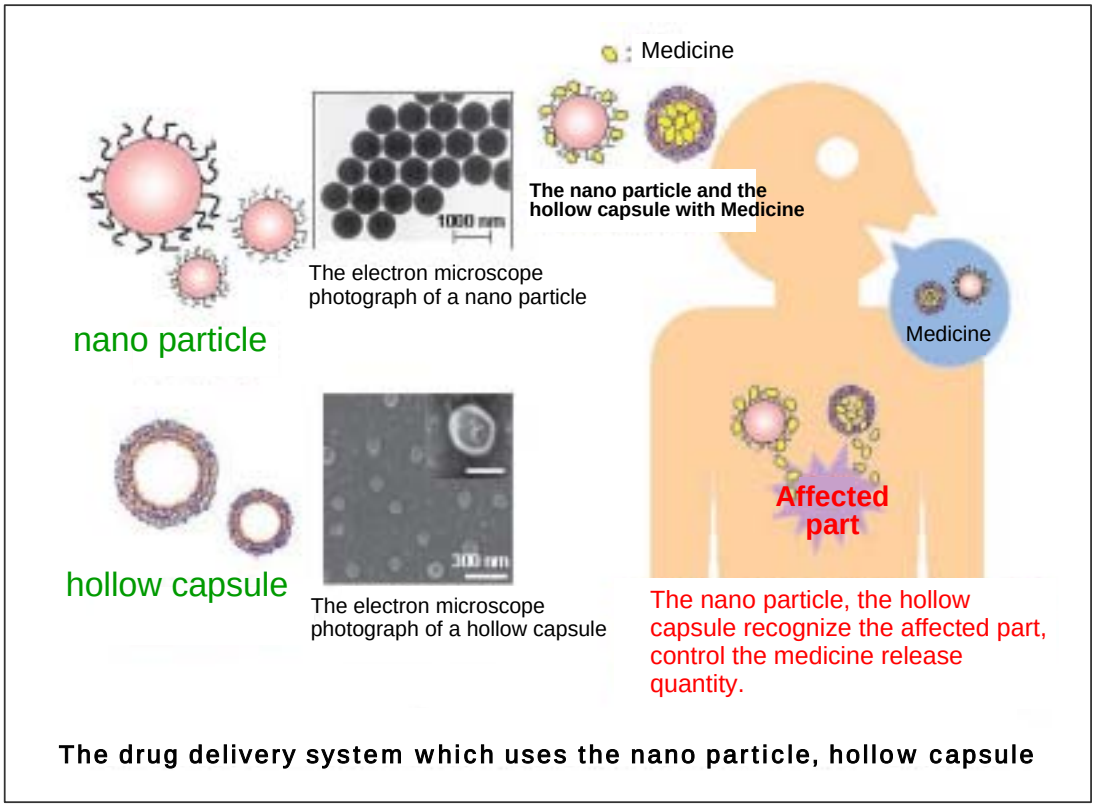
## Development of space-time controlled drug delivery system using nanoparticles and hollow nanocapsules

For regenerative medicine, a drug delivery system that slowly releases a specified amount of drug for a specified period at the target place (cells) is very important, but it has not yet been achieved. If it is possible to achieve the drug delivery system, it will be very useful not only for regenerative medicine but also cancer therapy.
Using nano-size particles and hollow capsules, our laboratory aims to develop a drug delivery system that is highly capable of controlling space and time factors such as initiation time, duration, and place of sustained release.




**The drug delivery system which uses the nano particle, hollow capsule**

**Other study contents of Akashi laboratory**

- Development of an anti-retrovirus vaccine utilizing nanoparticles
- Stereospecific template polymerization by alternate stacking
- Development of environmental recycling liquid crystalline engineering plastics using rigid linear natural substances
- Study of design and synthesis of functional compounds with molecule-recognizing ability
- Nano-coating of hydrogel surfaces with a polymer ultrathin membrane
- Development and application of a polymer oil gelating agent