Development of Techniques for Improvement of Silk Structure, Establishment of Mass Production, and Application to New Silk-based Materials for Bone and Teeth Regeneration

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【Outline of survey】

Although biomedical scaffold materials for bone and teeth regeneration are essential for aging society, those scaffold materials that satisfy the required properties have not been developed yet. Natural silk fiber exhibits excellent mechanical properties and its long history as silk sutures demonstrates its excellent biocompatibility. This leads us to expect that silk may be developed as promising biomedical scaffold materials.

The purpose of this research is to develop scaffold materials that satisfy the needs for bone and teeth regeneration using silk-based materials. Depending on the damaged parts and their sizes, however, the structure of materials and processing techniques need to be optimized. Therefore, in order to introduce various properties in the materials, genetic engineering techniques to transform the primary sequence of silk protein and techniques to control the highly ordered structure will be developed. In order to optimize the implantable scaffold for bone and teeth regeneration, systems to evaluate the scaffold materials in vivo, such as implantation in mouse, need to be developed. Finally, transgenic silkworm techniques can be utilized for mass production of transgenic silks. The distinctive feature of this research is to establish the systems for producing biomedical scaffold materials from production to optimization for tissue regeneration using silk-based materials.

【Expected results】

Biomedical scaffold materials for bone and teeth regeneration that satisfy the required properties can be prepared from silk-based materials. Especially, the structure of materials and processing techniques can be optimized depending on the damaged parts and their sizes. The case studies for optimizing the techniques in respect of the purpose are expected to contribute to the expand uses of silk-based scaffold materials other than bone and teeth. Production of transgenic silks by transgenic silkworms may greatly contribute the activation of sericultural and related industries.

【References by the principal researcher】

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