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At the forefront of biomaterials

1. **Novel biological tissues for regenerative medicine (Bioscaffold)**
2. **Cell-specific capture and release technology for immunological regulation**
3. **Regulation of stem cells by controlling cellular microenvironments**
4. **Elucidation of the physiological effects of basement membrane structures and applications to tissue restructuring**

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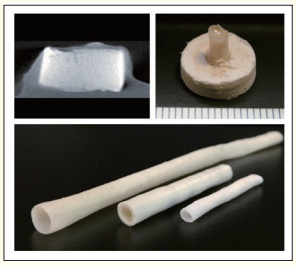
The policies of our department are "Contribution to medical care" and "Exploration of basic science". Based on the policies, our research field extends from basic research of biomaterials as raw material, to the research and development of therapeutic equipment, leading to creating useful medical devices. We observe biological reactions to biomaterials and explore the mechanisms that control those reactions, and based on our findings, we are aiming to create new biomaterials. We are conducting research on developing decellularized tissues and organs with high biocompatibility, methodologies to achieve immune response regulation through surface modification techniques, stem cell control, and control of the process of tissue reconstruction. We believe our work can bear fruit in the form of new therapeutic biomaterials.

Novel biological tissues for regenerative medicine (Bioscaffold)

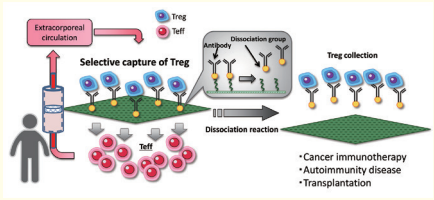
Decellularized tissue can be made from various tissues and organs from humans and animals by removing cells. Such tissue has attracted attention for various purposes: as a material that can substitute for natural tissue, as a scaffold material for regenerative medicine, and as a material to promote tissue repair. We undertake analysis of the fundamental physical properties of decellularized tissue, *in vivo* analysis of function, and the creation of composites with dissimilar materials, and apply the results to creating new biomaterials for medical implants.



Top left: Application of decellularized bone to dental prosthetic material
Top right: Percutaneous device made from decellularized skin
Bottom: Fiber-composite small-diameter decellularized blood vessel

Cell-specific capture and release technology for immunological regulation

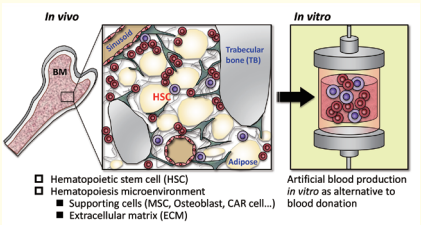
Regulatory T cells (Tregs) are known to be a controlling factor in inhibiting cancer immunotherapy. When Tregs are removed from tumor-bearing organisms, anti-tumor immune responses are enhanced and cancer can be rejected. Tregs also play an important role in transplantation immunity and autoimmune diseases. Techniques for induction and collection of Tregs are attracting attention for applications of Tregs. We are developing technology to capture and recover intact Tregs in a specific and highly efficient manner.



Selective cell capture and release system through extracorporeal circulation

Regulation of stem cells by controlling cellular microenvironments

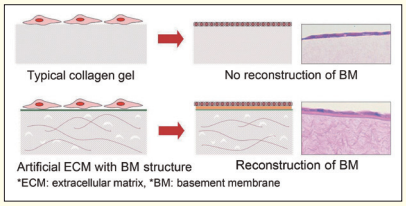
When decellularized tissue is transplanted into a living body, a phenomenon occurs called "cell homing", in which the cells originally present in the tissue invade and return to their original form. When decellularized bone marrow cells are implanted subcutaneously, they form bone marrow-like tissue ectopically. We are investigating such phenomena to clarify the cause of cell recruitment and "homing" *in vivo*, which will contribute not only to regenerative medicine, but also to wound healing and the embryology of organs and tissues.



Construction and application of hematopoietic environment based on bone marrow-like matrix

Elucidation of the physiological effects of basement membrane structures and applications to tissue restructuring

Epithelial and endothelial cells are present in tissue such as blood vessels, skin, cornea, etc. They are located at the boundaries with the outer environment and with other tissues, and they perform functions such as antithrombogenicity and moisture management. These epithelial cells exist on a special extracellular matrix called the basement membrane. We study the function of the basement membrane, which is an important factor in tissue remodeling. We also conduct basic research in order to establish the basement membrane function on biomaterial surfaces, and enable the creation of new biomaterials.



Reconstruction of basement membrane structure