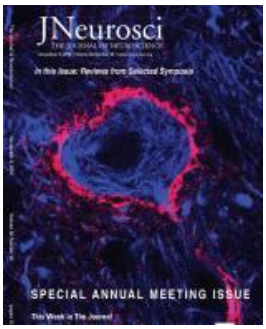
Department of Molecular Biology and Biochemistry

The **extracellular matrix (ECM)** plays a major role for supporting cells. ECM macromolecules are secreted locally by the cells to wear “tailor-made” ECMs for their suitable conditions in a tissue-dependent or a time-dependent manner.

The Department of Molecular Biology and Biochemistry is addressing the role of ECM during physiological situations such as development and tissue repair and pathological situations. To reach this goal we alter ECM molecules-functions *in vivo* using genetically altered mice. In particular we modify the molecular assembly of ECM components by deleting the core assembling molecules, introducing site-specific mutations into molecules and deleting proteolytic enzymes etc. We hope to develop our basic findings into clinical outcomes in future.

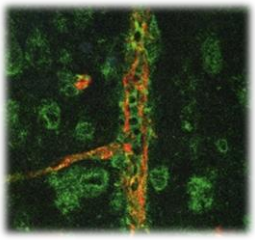
• *Role of perineuronal nets (PNN) in the control of plasticity and pathogenesis of psychiatric disorders*



PNNs are unique extracellular matrix structures that wrap around certain neurons in the CNS during development and control plasticity in the adult CNS. They appear to contribute to a wide range of diseases/disorders of the brain and are altered during aging, learning and memory, and after exposure to drugs of abuse (Sorg et al., J Neurosci 2016).

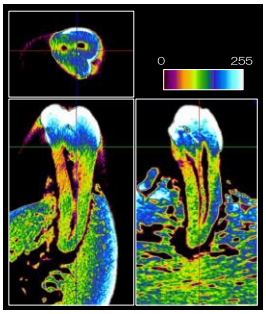
Our focus is on how the condensation of PNN is important during development and on the protective role of PNN in neural functions that may relates to synaptic pathology.

• *Role of basement membrane in tissue repair*



Basement membrane (BM) have been recognized as important regulator of cell behavior, rather than just structural features of tissue. BMs are crucial for tissue homeostasis and are implicated in important biological processes such as development, regeneration and repair. We are focusing on physiological tissue repair. Understanding the molecular underpinnings of these process is expected to offer insights into new treatment approaches for tissue repair.

• *Role of basement membrane during tooth development*



We have recently demonstrated the possibility of regenerating lost teeth themselves. In a first large-animal study, bioengineered tooth germs were transplanted into the jawbone of dogs. Like a regular tooth, the growing cells formed a bioengineered tooth that erupted through the gum, and could be orthodontically moved with brackets. This result suggests whole-tooth regeneration using tooth germ cells derived from a patient’s own cells may become possible. Now our focus is to understand the tooth development from the point of view of basement membrane.

• *Therapy for bone regeneration using E. coli-BMP-2*

Bone morphogenetic protein 2 (BMP-2) is one of most attractive cytokine to regenerate bone. In order to overcome the costly treatment using the currently available cell-derived BMP-2, we are collaborating with a Japanese start-up company to develop a low-cost *Escherichia coli*-based system to produce BMP-2. Recent studies in large animals have demonstrated the safety and efficacy of this recombinant BMP-2 for regenerating alveolar bone. We are close to completing the requirements for the use of E. coli-BMP-2 in a clinical trial with human subjects.

Department of Molecular Biology and Biochemistry (Toshitaka Oohashi, 大橋俊孝)
Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences
2-5-1 Shikata-cho, Kita-ku, Okayama City, Okayama 700-8558, Japan
E-mail: oohashi@cc.okayama-u.ac.jp TEL: +81-86-235-7127 FAX: +81-86-222-7768