

Advanced Course in Biomaterials and Bioengineering

Lecture/Lab. Academic year 1,2 credits 2,4

[Keywords] Biomaterials; Aging in body, Foreign-body Biological Reaction, Allergic Reaction

[Academics] Takashi Nezu, Masatoshi Takahashi

[Course aims]

Various materials are utilized in our body and oral cavity to treat the loss of anatomic morphology and biological functions. Once these materials deteriorate owing to mechanical or chemical actions in the body, a series of foreign-body biological reactions occurs with inflammation. Thus, it is necessary to suppress material degradation in the body and to prevent such foreign-body reactions. This course aims to build a systematic understanding of the in vivo degradation of these materials and the prevention of such degradation, including metal corrosion, ceramic fracture, and polymer hydrolysis and wear. Students will learn and master material testing methods for quantitative evaluation of the degree of material degradation. This course aims to develop a better understanding of the onset of harmful side effects, such as allergies, caused by material degradation and their diagnosis and treatment.

[Course objectives]

At the end of this course, students will be able to:

- (1) Explain the characteristic degradation of biomaterials in the body, such as metal corrosion, ceramic fracture, and polymer hydrolysis and wear, and to explain the causative mechanisms.
- (2) Adequately execute material testing to investigate mechanical properties (such as strength and wear resistance) and perform corrosion testing.
- (3) Analyze the metal ions or resin monomers that might cause allergy.
- (4) Explain the onset mechanisms of allergic reactions as well as the diagnosis methods and treatment strategies for the delayed allergy that is a typical foreign-body biological reaction.
- (5) Explain the cytotoxicity and endocrine disruption action by substances eluted from dental materials (such as metal ions and resin monomers).

[Course content]

Class	Theme	Content	Academics
1	Corrosion of metallic materials and methods for its evaluation		Takashi Nezu Masatoshi Takahashi
2	Brittle fracture of ceramic materials		Takashi Nezu Masatoshi Takahashi
3	Degradation (hydrolysis and abrasion) of resinous materials		Takashi Nezu Masatoshi Takahashi
4	Effects of endocrine disruptor substances eluted from resinous materials		Takashi Nezu Masatoshi Takahashi
5	Outline of material testing and related mechanical properties		Takashi Nezu Masatoshi Takahashi
6	Practice of elemental analysis for solids and solutions		Takashi Nezu Masatoshi Takahashi
7	Degradation of materials and consequent foreign-body biological reactions		Takashi Nezu Masatoshi Takahashi
8	Mechanism of metallic allergy onset and its diagnosis and treatment		Takashi Nezu Masatoshi Takahashi

[Class implementation method]

Combination of face-to-face learning and distance learning

* Class implementation depends on the implementation policy of each department (graduate school), interdisciplinary studies, and school.

[Grading policies]

The students' overall grade in the class will be based on class attendance and reports.

[Textbook]

Students will be informed regarding the textbook.

[Reference book]

Same as above

[Preparation for course]

Students must understand the course objectives and prepare for the classes accordingly.