

**Lecture Series “Riron”: B7 Developmental and Regenerative Medicine****Subject Code 20080****(Elective: 2 credits)**

Course Director: Ryuichi Nishinakamura (Kidney Development TEL: 373-6615) ryuichi@kumamoto-u.ac.jp

Instructors:

Katsushi Kawai (Anatomy TEL: 373-5041)	kawai@kumamoto-u.ac.jp
Satoru Honma (Anatomy TEL: 373-5041)	shonma@kumamoto-u.ac.jp
Masatake Araki (Bioinformatics TEL: 373-6501)	maraki@gpo.kumamoto-u.ac.jp
Naomi Nakagata (Reproductive Engineering TEL: 373-6570)	nakagata@gpo.kumamoto-u.ac.jp
Yuji Yokouchi (Pattern Formation TEL: 373-6621)	yokouchi@kumamoto-u.ac.jp
Shoen Kume (Stem Cell Biology TEL: 373-6807)	skume@kumamoto-u.ac.jp

**【Objectives】**

Developmental and regenerative medicine aims at curing diseases by revealing molecular mechanisms of organ development. In this course, you learn basic concepts and techniques used in this field, including knockout mice, which have now become essential for any area of research. This course serves as introductory for those in the Developmental and Regenerative Researcher Program, and will also be useful for those in other programs, as you obtain essential knowledge on genetic engineering techniques.

**【Content Description】**

In order to explain basic principles of genetic engineering techniques, it is discussed how the molecular mechanisms of organ development have been revealed by using these techniques. Trials for regenerating organs based on these findings are also introduced. More specifically, you are expected to understand the followings: (1) Establishment and application of stem cells including ES and iPS cells; (2) Reproductive engineering including in vitro fertilization, freezing of embryos and sperms, embryo transfer, intracytoplasmic sperm injection, and nuclear transfer; (3) Methods to generate transgenic and knockout mice; (4) Comprehensive mutagenesis projects in mice and how to use the resources; (5) Gene modification using Cre-loxP technology; (6) Anatomy of each organ in the aspects of ontogeny and phylogeny; (7) Axis formation and patterning at the initial stages of development; (8) Molecular mechanisms of organ development including the liver, pancreas and kidney; (9) Trials for regenerating organs.

**【Keywords】** ES cells, iPS cells, stem cells, reproductive engineering, knockout mouse, transgenic mouse, gene trap, Cre-loxP, ontogeny, phylogeny, pattern formation, liver development, pancreas development, kidney development

**【Class Style】** PowerPoint and/or OHP will be used in the lectures, and active participation in the discussion is encouraged. Extra classes or video lectures are considered for those who are regularly absent for unavoidable reasons.

**【Textbooks】** Textbooks are not specified, and handouts will be distributed.

**【Recommended Readings】**

- “Essential Developmental Biology, 2nd edition” by Slack JMW., Blackwell Publishing, 2005.
- “Manipulating the Mouse Embryo: A Laboratory Manual, 3rd edition” by Nagy A., Gertsenstein M., Vintersten K., Behringer R., Cold Spring Harbor Laboratory Press, 2002.
- “Human Embryology, 3rd edition” by Larsen WJ., Churchill Livingstone, 2001.

**【Office Hour】** If you have any questions on topics or schedule of the classes, please contact the instructors listed above.

**【Evaluation for Grades and Credits】** Grading will be based on active class participation, paper summaries, and the final report.

**【Lecture Schedule】** Please also refer to the timetable shown in the Section 5.

The sessions marked with “e” are under preparation of e-learning contents. In some cases, the session that is not marked with “e” will be done by utilizing e-learning system, as soon as the e-learning contents are ready for use. Therefore, you must check the updated syllabus cited on the home page of the Graduate School of Medical Sciences, Kumamoto University to check the current status of the session before you take a session. If you cannot obtain enough information from the home page, please make contact with the instructors of the sessions.

There are six types of e-learning, those marked with “eE0”, “eEL”, “eJ0”, “eJL”, “eEJ-0” and “eEJ-L”. To know the meanings of these six markings and to learn how to use e-learning system, please see the section explaining about the e-learning system in this syllabus.

Session	Date & time	Instructors	Topics
1 . eE-L	Jun 11 (Thu) 6th period	Ryuichi Nishinakamura	ES cells, iPS cells
2 . eJ-L, eE-L	Jun 18 (Thu) 6th period	Naomi Nakagata	Reproductive engineering I
3 . eJ-L, eE-L	Jun 25 (Thu) 5th period	Naomi Nakagata	Reproductive engineering II
4 . eJ-L, eE-L	Jul 2 (Thu) 5th period	Naomi Nakagata	Reproductive engineering III
5 . eJ-L	Jul 9 (Thu) 5th period	Masatake Araki	Transgenic mouse, Knockout mouse
6 . eJ-L	Jul 16 (Thu) 5th period	Masatake Araki	Gene trap system
7 . eJ-L	Jul 23 (Thu) 5th period	Masatake Araki	Resources of genetically engineered mice
8 .	Jul 30 (Thu) 5th period	Katsushi Kawai	Ontogeny and phylogeny
9 .	Aug 5 (Thu) 5th period	Katsushi Kawai	Anatomy of digestive tracts and lung
10 .	Aug 20 (Thu) 5th period	Satoru Honma	Anatomy of cardiac and urogenital systems
11 . eE-L	Aug 27 (Thu) 5th period	Shoen Kume	Pancreas development I
12 . eE-L	Sep 2 (Wed) 5th period	Shoen Kume	Pancreas development II and regeneration
13 . eJ-L	Sep 10 (Thu) 5th period	Yuji Yokouchi	Body patterning
14 .	Sep 17 (Thu) 5th period	Yuji Yokouchi	Liver development
15 . eEJ-O	Oct 1 (Thu) 5th period	Ryuichi Nishinakamura	Kidney development

**【Reference】**

2) Classification of e-learning

Please note that the lectures by e-learning are classified into 6 types: eE-O, eE-L, eJ-O, eJ-L, eEJ-O and eEJ-L.

1. Classified according to the language used in the lecture.

eE: e-learning content in English

eJ: e-learning content in Japanese

eEJ: e-learning content in both Japanese and English

2. Classification according to the use of e-learning for the lecture.

-O: Lecture only by e-learning; no face-to-face class will be conducted.

-L: In principle, a face-to-face lecture; if unable to attend the lecture, a student may participate in the lecture through e-learning as supplementary lecture.

3. Regarding a lecture with e-learning content prepared only in Japanese (eJ-O or eJ-L), if an international student, who cannot understand Japanese, has registered for such lecture, the face-to-face lecture will be conducted in English (+ Japanese). This lecture may be recorded to be used for an e-learning content as eE or eEJ in future.

4. Example of e-learning classification:

eJ-L means “students are requested to attend the face-to-face lecture in principle, but if unable to do so, they can participate in the e-learning lecture prepared in Japanese language as supplementary lecture”. If an international student, who cannot understand Japanese, has registered for the course, a face-to-face lecture will be conducted in English (+Japanese).