

12. Developmental Biology and Regenerative Medicine

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The Course of Developmental Biology and Regenerative Medicine

Special Lecture "Tokuron" on Developmental Biology and Regenerative Medicine I

(Compulsory: 2 credits)

Subject Code 22140

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Instructors : Takumi Era (Cell Modulation TEL: 373-6589) tera @kumamoto-u.ac.jp
Kenji Shimamura (Brain Morphogenesis TEL: 373-6583) simamura@kumamoto-u.ac.jp
Teru Ogura (Molecular Cell Biology TEL: 373-6578) ogura@gpo.kumamoto-u.ac.jp
Kunitoshi Yamanaka (Molecular Cell Biology TEL: 373-6579) yamanaka@gpo.kumamoto-u.ac.jp
Hiroyuki Nakanishi (Molecular Pharmacology TEL: 373-5074) hnakanis@gpo.kumamoto-u.ac.jp
Kunimasa Ohta (Developmental Neurobiology TEL: 373-5293) ohta9203@gpo.kumamoto-u.ac.jp
Ryuichi Nishinakamura (Kidney Development TEL: 373-6615) ryuichi@kumamoto-u.ac.jp
Satomi Tanaka (Kidney Development TEL: 373-6617) stanaka@kumamoto-u.ac.jp
Mitsuyoshi Nakao (Medical Cell Biology TEL: 373-6800) mnakao@gpo.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. This course serves as introductory for those in the Course of Developmental Biology and Regenerative Medicine, and will also be useful for those in other programs, as you obtain essential knowledge of cell differentiation and growth, cell adhesion and cell-cell interactions essential for the organogenesis, body patterning, developmental mechanism of organogenesis derived from ectoderm, endoderm and mesoderm and the molecular basis of epigenetic cell regulation in development and human diseases.

【Content Description】 Following topics including the most recent progresses will be shown and discuss in addition to reading original papers.

- Stem cell and regenerative medicine
- Development of hematopoietic stem cells
- Development and regeneration of the nervous system
- Cell lineage and developmental regulation of the nematode *C. elegans*
- *C. elegans* as a model for human diseases
- Membrane dynamics
- Neurogenesis and neural circuit formation
- Kidney development and regeneration
- Development of germ cells
- Epigenetic cell regulation in cell differentiation and transformation

【Keywords】

See course description, cell adhesion, neural induction, knockout mice, polarization and asymmetric cell division, programmed cell death, RNA interference, life span and aging, disease model, epigenetics, gene expression, chromatin, development and regeneration, stem cell, cancer, organogenesis, regionalization.

【Class Style】 PowerPoint and/or OHP will be used in the lectures, and active participation in the discussion is encouraged. Reports 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)
- "C. ELEGANS II" (ed. D.L. Riddle, T. Blumenthal, B.J. Meyer, & J.R. Priess) CSHL Press (1997)
- "Hematopoiesis: A Developmental Approach" (edited by Leonard I. Zon) Oxford University Press (2001)
- "EPIGENETICS" (edited by David Allis et al.) Cold Spring Harbor Laboratory Press (2007)

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

【Evaluation for Grades and Credits】 Grading will be based on the student's understanding of the course subject matter as well as participation in class discussions. The students' understanding will be evaluated on the basis of reports or exams to be scored from 0 to 100 for each session. Final grades will be based on the average of the top 10 scores.

【Learning before classes】 It is recommended for you to read the syllabus and indicated text books in advance.

【Learning after classes】 It is recommended for you to review the handout materials distributed in the lectures and your notebooks well. If you want to ask any questions to the lecturers, "Office Hour" is available for you. It is also recommended to review the lectures by using e-learning contents if available.

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

Session	Date & time	Instructors	Topics
1. eE-O	Oct 9(Thu) 4th period	Takumi Era	Pluripotent and tissue stem cells
2. eE-O	Oct 16 (Thu) 4th period	Takumi Era	Stem cell, disease and clinical application
3.	Oct 23 (Thu) 4th period	Minetaro Ogawa	Development of the hematopoietic system
4.	Oct 30 (Thu) 4th period	Minetaro Ogawa	Development of hematopoietic stem cells
5.	Nov 6 (Thu) 4th period	Kenji Shimamura	ES cells as a tool for developmental and regenerative neurobiology
6.	Nov 13 (Thu) 4th period	Kunitoshi Yamanaka	Cell lineage and developmental regulation of the nematode <i>C. elegans</i>
7.	Nov 20 (Thu) 4th period	Teru Ogura	<i>C. elegans</i> as a model for human diseases
8.	Nov 27 (Thu) no schedule	Annual Meeting of the Molecular Biology Society of Japan	
9. eE-O	Dec 4 (Thu) 4th period	Hiroyuki Nakanishi	Membrane dynamics
10.	Dec 11 (Thu) 4th period	Kunimasa Ohta	Neural stem cells, neurogenesis, and their clinical application
11.	Dec 18 (Thu) 4th period	Kunimasa Ohta	Neuronal circuit formation and regenerative medicine
12. eE-L	Jan 8 (Thu) 4th period	Ryuichi Nishinakamura	Development of the kidney
13. eE-L	Jan 15 (Thu) 4th period	Satomi Tanaka	Development of primordial germ cells
14. eE-O	Jan 22 (Thu) 4th period	Mitsuyoshi Nakao	Epigenetic medicine I
15. eE-O	Jan 29 (Thu) 4th period	Mitsuyoshi Nakao	Epigenetic medicine II

4th period : 15:00-16:30

The Course of Developmental Biology and Regenerative Medicine

Special Lecture "Tokuron" on Developmental Biology and Regenerative Medicine II

(Compulsory: 2 credits)

Subject Code 22150

Course Director: : Shoen Kume	(Stem Cell Biology TEL: 373-6620) skume@kumamoto-u.ac.jp
Instructors: Takaaki Ito	(pathology TEL: 373-5086) takaito@kumamoto-u.ac.jp
Kanako Niimori	(pathology TEL: 373-5086) kitakana@kumamoto-u.ac.jp
Fumio Endo	(Pediatrics TEL: 373-5188) fendo@gpo.kumamoto-u.ac.jp
Kimitoshi Nakamura	(Pediatrics TEL: 373-5188) nakamura@kumamoto-u.ac.jp
Yukio Ando	(Neurology TEL: 373-5686) andoy709@kumamoto-u.ac.jp
Hirofumi Jono	(Clinical Pharmaceutical Sciences TEL: 373-5823) hono@fc.kuh.kumamoto-u.ac.jp
Hironobu Ihn	(Dermatology and Plastic Surgery TEL:373-5233) ihn-der@kumamoto-u.ac.jp
Eiji Yumoto	(otolaryngology TEL:373-5255) yu6167@gpo.kumamoto-u.ac.jp
Ryosei Minoda	(otolaryngology TEL:373-5253) minoda@gpo.kumamoto-u.ac.jp
Michio Kawasuji	(Cardiovascular surgery TEL:373-5202) kawasuji@kumamoto-u.ac.jp
Hisashi Sakaguchi	(Cardiovascular surgery TEL:373-5205) kouki134@gmail.com
Yukihiro Inomata	(pediatrics surgery TEL: 373-5616) yino@fc.kuh.kumamoto-u.ac.jp

【Objectives】

Developmental and regenerative medicine aims at curing diseases by revealing molecular mechanisms of organ development and the origin of diseases in order to develop a diagnosis and treatment for the diseases. Furthermore, this course will up-to-date with the present status of the regeneration medicines, the on going investigations on replacement of lost cells, tissues or organs. In this course, you will obtain essential knowledge on embryonic stem cells, tissue stem cells, their properties and application on regenerative medicine, mechanisms of development and repairs of epithelial tissues, methodologies in the regenerative medicine of sensory and circulatory organ, tissue injury and restoration surgery, genetic defects and their treatments, status and problems in transplant medicine.

【Content Description】

In this course, lectures on the following fields will be given:

- Regenerative medicine using embryonic stem cells and tissue stem cells
- properties and application of endodermal tissue stem cells
- growth, differentiation and abnormalities of epithelial cells
- damage, repair and mechanisms of tissue reconstitution
- pathological analyses of hereditary amyloidosis
- development of treatment for hereditary amyloidosis
- development and regeneration of skin (recovery of injury)
- denervation and reinnervation of the larynx
- regeneration of cochlear hair cells
- basic and clinic on vascular neogenesis
- treatment of ischemic heart disease
- pathological analysis and treatment of genetic diseases
- tissue and organ grafts in general, present status and problems of liver transplant

【Keywords】

ES cells, tissue stem cells, differentiation, proliferation, pancreas, liver, neural disease, cardiac disease, lung epithelium, larynx, the middle/inner ear, epidermis, cellular injury and restoration, regeneration, liver transplantation, genetic defects

【Class Style】

PowerPoint and/or OHP will be used in the lectures, and active participation in the discussion is encouraged. Reports 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, 3rd edition" by Slack JMW., Blackwell Publishing, 2012.

【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.

Grading will be based on the student's understanding of the course subject matter. The students' understanding will be evaluated on the basis of papers and quizzes related to the topics dealt with in class to be scored from 0 to 100.

Final grades will be based on the average score of the papers and quizzes as well as participation in class discussions.

【Learning Before classes】 It is recommended for you to read a syllabus and indicated text books in advance.

【Learning After classes】 It is recommended for you to review the handout materials distributed in the lectures and your notebooks well. If you want to ask any questions to the lecturers, "Office Hour" is available for you. It is also recommended to review the lectures by using e-learning contents if available.

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

【1st grade】

Session Date & time	Instructors	Topics
1. Feb 23 (Mon) 4th period	Shoen Kume	embryonic stem cells and tissue stem cells
2. Mar 2 (Mon) 4th period	Shoen Kume	applications in regenerative medicine
3. Mar 9 (Mon) 4th period	Takaaki Ito	growth, differentiation and morphological abnormalities of epithelial cells
4. Mar 16 (Mon) 4th period	Takaaki Ito (Kanao Niimori)	mechanism of neural differentiation and its involvement in cancer differentiation and proliferation
5. Mar 23 (Mon) 4th period	Fumio Endo (Kimitoshi Nakamura)	endodermal tissue stem cells

【2nd grade】

Session Date & time	Instructors	Topics
6. Feb 23 (Mon) 4th period	Yukio Ando	pathological analyses of hereditary amyloidosis
7. Mar 2 (Mon) 4th period	Hirofumi Jono	development of treatment for hereditary amyloidosis
8. eE-0 Mar 9 (Mon) 4th period	Hironobu Ihn	development and regeneration of skin (recovery of injury)
9. eE-0 Mar 16 (Mon) 4th period	Eiji Yumoto	neuropathy and treatment of larynx paralyses
10. eE-0 Mar 23 (Mon) 4th period	Ryosei Minoda	regeneration of cochlear hair cells

【3rd grade】

Session Date & time	Instructors	Topics
11. eE-0 Feb 5 (Thur) 4th period	Michio Kawasuji	Basic and clinic on vascular neogenesis
12. eE-0 Feb 12 (Thur) 4th period	Hisashi Sakaguchi	Treatment of ischemic heart disease
13. Feb 19 (Thur) 4th period	Fumio Endo (Kimitoshi Nakamura)	pathological analysis and treatment of genetic diseases
14. Feb 26 (Thur) 4th period	Yukihiro Inomata	present status and problems of organ transplants
15. Mar 5 (Thur) 4th period	Yukihiro Inomata	liver grafts from brain-dead and living donor

4th period : 15:00-16:30

Development and regenerative medicine**Subject code 22160****Lecture Series "Tokuron": Transplantation immunology****(Required: 2 credits)**

Course Director:	Yasuharu Nishimura (Immunogenetics	TEL: 373-5310)	mxnishim@gpo.kumamoto-u.ac.jp
Instructors:	Satoru Senju (Immunogenetics	TEL: 373-5313)	senjusat@gpo.kumamoto-u.ac.jp
	Atsushi Irie (Immunogenetics	TEL: 373-5313)	airie@gpo.kumamoto-u.ac.jp
	Nobuo Sakaguchi (Immunology	TEL: 373-5134)	nobusaka@gpo.kumamoto-u.ac.jp
	Kazuhiko Maeda (Immunology	TEL: 373-5135)	kazmaeda@gpo.kumamoto-u.ac.jp
	Yukihiro Inomata (Transplantation	TEL: 373-5616)	yino@fc.kuh.kumamoto-u.ac.jp

【Objectives】

The aims of the lecture "Transplantation Immunology" are to understand the followings: (1) The mechanism of rejection in allo-transplantation, (2) Allo-antigens that induce allo-reactivity, (3) The structure and function of human major histocompatibility complex (HLA), (4) Basic immunology and clinical immuno-regulation therapy to avoid graft-rejection, (5) Current status and future direction of transplantation medicine

【Content Description】

To treat the patients with functionally impaired cells, tissues, and organs, transplantation of the cells, tissues, or organs obtained from donors is broadly carried out. Basic research on the regenerative medicine, where cells or tissues derived from allogeneic somatic stem cells or pluripotent stem cells are used, is in progress and the application to clinical medicine is expected.

Immune system has originally developed as a defense system to exclude exogenous pathogenic microbes, foreign materials, and toxins. There are structural differences of proteins, lipids, and sugars between different individuals of the same species, due to genetic polymorphism. Therefore, following the transplantation of a graft obtained from an allogeneic donor, the recipient immune system is activated by such polymorphic molecules and work to reject the graft. Among such allogeneic antigens, Major Histocompatibility Antigens encoded by Major Histocompatibility Complex (MHC) gene are the strongest in stimulating allo-reactive immune response. MHC are the trans-membrane proteins and their role is to present oligo peptides derived from protein antigens to T cells. They are highly polymorphic and exist in the Cyclostomes and higher vertebrates. T cells and B cells of the immune system recognize MHC and other allogeneic antigens and reject allogeneic cells.

In the lectures, we will explain the molecular mechanisms of rejection of allogeneic cells by immune system and the characteristics of allogeneic antigens. We will also lecture on the basic and clinical immunology related to the methodology to avoid such rejection. In addition, we will provide the latest information on the issue of clinical transplantation and regenerative medicine.

We will lecture on the transplantation immunology at the level of cells, tissues, and organs, from the viewpoint of both basic and clinical medicine, including recent advances in the research by the instructors.

【Keywords】 organ and cell transplantation medicine, allogeneic antigens, human major histocompatibility antigen (HLA), minor histocompatibility antigens, rejection, allogenicity, Graft versus Host Reaction (GVHR), immune-suppression therapy, immune suppressants, immunological tolerance

【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】

- "The Immune System" by Peter Parham. Garland Publishing Inc. New York and London, 2004
- "Janeway's Immunobiology Seventh Edition" by Kenneth Murphy, Paul Travers, Mark Walport. Garland Science, Taylor & Francis Group LLC. New York and Abingdon, 2008.
- "A history of transplantation immunology" (Leslie Brent) Academic Press 1997

【Office Hour】 If you have any questions on topics or specific research fields, please contact the instructors listed above by telephone, e-mail, or visiting them at the laboratories.

【Evaluation for Grades and Credits】 Achievement of the Objectives will be evaluated by active class participation and the reports of which the theme will be specified after the lectures. Grading will be based on the student's understanding of the course subject matter. The students' understanding will be evaluated on the basis of the reports and brief examinations related to the topics dealt with in the class to be scored from 0 to 100. Final grades will be based on the average of the best 10 scores of the reports and brief examinations as well as the participation in class discussions.

【Learning before classes】 It is recommended for you to read a syllabus and indicated text books in advance

【Learning after classes】 It is recommended for you to review the handout materials distributed in the lectures and your notebooks well. If you want to ask any questions to the lecturers, "Office Hour" is available for you. It is also recommended to review the lectures by using e-learning contents if available.

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

The e-learning contents are available for the sessions marked with "e". 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-0 eJ-0 eEJ-0	Oct. 6 (Mon) 4th period	Yasuharu Nishimura	Structure and function of HLA class I
2 eEJ-0 eE-0	Oct. 20 (Mon) 4th period	Yasuharu Nishimura	Structure and function of HLA class II
3	Oct. 27 (Mon) 4th period	Atsushi Irie	Polymorphism of MHC and T cell- activation signals
4 eEJ-L	Nov.10 (Mon) 4th period	Satoru Senju	Recognition of alloantigens by T cells
5 eE-0 eJ-0 eEJ-0	Nov.17 (Mon) 4th period	Yasuharu Nishimura	HLA and anti-tumor immunity
6	Dec. 1 (Mon) 4th period	Atsushi Irie	Major and minor histocompatibility antigens
7 eE-L	Dec. 8 (Mon) 4th period	Satoru Senju	Immune response and dendritic cells
8 eE-L	Dec. 15 (Mon) 4th period	Satoru Senju	Pluripotent stem cells and immune therapy
9 eE-0	Dec. 22 (Mon) 4th period	Nobuo Sakaguchi	Graft versus Host reaction (GVHR)
10 eE-L	Jan. 5 (Mon) 4th period	Nobuo Sakaguchi	Immune-suppression
11	Jan. 19 (Mon) 4th period	Kazuhiko Maeda	Transplantation immunology and NF-κB
12	Jan. 26 (Mon) 4th period	Kazuhiko Maeda	Transplantation immunology and Stem cell
13 eE-0	Feb. 2 (Mon) 4th period	Kazuhiko Maeda	Steroid receptors and immune-suppression
14	Feb. 9 (Mon) 4th period	Yukihiro Inomata	Transplantation in Japan and the world
15	Feb. 16 (Mon) 4th period	Yukihiro Inomata	Liver transplant from living donor

The Course of Developmental Biology and Regenerative Medicine
Special Lecture "Tokuron" on Bioethics

(Compulsory: 2 credits)
Subject code 22170

Course Director: Atsushi Asai (part-time lecturer)

【Objectives】

The special lecture of Bioethics will deal with bioethical issues including organ transplantation, human stem cell research, iPS cell research, cell fate regulation, and genetic diagnosis and therapy, and so on. This course is aimed to provide life science researchers with adequate knowledge and understanding concerning major bioethical issues.

Specific objectives include:

1. To recognize various ethical, legal, and social issues and implications (ELSI) and classic cases in the field of bioethics.
2. To understand intrinsic problems involved in healthcare and medical research and discuss their significance.
3. To acquire fundamental theoretical knowledge about bio-medical ethics.
4. To write and present their own bioethical arguments in a plausible manner.
5. To read and critically analyze papers published in international journals in ethics and bioethics.

【Content Description】

Research Ethics and Ethics Committee

Highly Advanced Medicine: Brain Death and Organ Transplantation, regenerative medicine and human cloning, Genetic medicine, Assisted Reproductive Technology and Enhancement, and Neuroethics.

Science and Society: Professionalism of Life Science Researchers, Social responsibilities of Scientists, and Science Communication and dual-use research

【Keywords】 Bioethics, Research Ethics, Professionalism, Social Responsibility

【Class Style】

The course will consist of lectures concerning important bioethical issues and principles, small group discussion, and students' presentation. Participating students are required to critically read bioethical papers and present their own arguments. Various pedagogic strategies will be utilized including lectures, video, and e-learning. E-learning concerning research ethics (CITI e-learning system) will also be used.

【Textbooks】 Textbooks are not specified.

【Recommended Readings】

- Carl Mitcham (Editor in Chief) *Encyclopedia of Science, Technology, and Ethics*. Volume 1-4, Macmillan Reference USA, Thomson/Gale, 2005.
- Bonnie Steinbock (Edition) *The Oxford handbook of Bioethics*. Oxford University Press, 2007.
- Timothy F. Murphy *Case Studies in Biomedical Research Ethics*. The MIT Press, 2004.
- Karen F. Greif, Jon F. Merz *Current Controversies in the Biological Science*. The MIT Press, 2007.
- V. Ravitsky, A. Fiester, A. L. Caplan (eds). *The Penn Center Guide to Bioethics (171-180)*, New York: Springer Publishing Company, 2009.

【Office Hour】 Questions regarding the course will be handled by telephone, e-mail and direct meeting.

【Evaluation for Grades and Credits】 Students are evaluated for their course grades and credits based on the course hours completed, their understanding and knowledge earned about information on recent progress in the research for bioethics, ability of summarizing and presenting bioethical deliberation of their own themes, and quality of hand-in essays. Grading will be based on the student's understanding of the course subject matter. The students' understanding will be evaluated on the basis of papers and quizzes related to the topics dealt with in class to be scored from 0 to 100. Final grades will be based on the average score of the papers and quizzes as well as participation in class discussions.

【Learning Before classes】 It is recommended for you to read a syllabus and indicated text books in advance.

【Learning After classes】 It is recommended for you to review the handout materials distributed in the lectures and your notebooks well. If you want to ask any questions to the lecturers, "Office Hour" is available for you. It is also recommended to review the lectures by using e-learning contents if available.

【Lecture Schedule】 All lectures will be held by Atsushi Asai

Session	Topics	Date & time
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【First grade】 Highly Advanced Medicine
CITI e-learning system will be used for research ethics education (5topics) .

【Second grade】 Advanced Medicine One-day intensive course will deal with following 5 topics. The date will be announced when determined.

6. Transplantation
7. Regenerative medicine and cloning
8. Genetics and enhancement
9. Artificial reproductive technology
10. Neuroethics

【Third grade】 Science and Society One-day intensive course will deal with following 5 topics. The date will be announced when determined.

11. Professionalism
12. Social Responsibilities of Scientists
13. Scientific communication
14. Society and medicine 1 (healthcare policy, etc.)
15. Society and medicine 2 (Public health, etc.)

The Course of Developmental Biology and Regenerative Medicine

Practice "Enshuu" on Developmental Biology and Regenerative Medicine I

(Compulsory: 2 credits)

Subject Code 22180

Course Director: Minetaro Ogawa (Cell Differentiation TEL:373-6591) ogawamin@kumamoto-u.ac.jp

Instructors:

Shoen Kume	(Stem Cell Biology TEL: 373-6620)	skume@kumamoto-u.ac.jp
Nobuo Sakaguchi	(Immunology TEL: 373-5134)	nobusaka@gpo.kumamoto-u.ac.jp
Mitsuyoshi Nakao	(Medical Cell Biology TEL: 373-6800)	mnakao@gpo.kumamoto-u.ac.jp
Yasuharu Nishimura	(Immunogenetics TEL: 373-5310)	mxnishim@gpo.kumamoto-u.ac.jp
Takaaki Ito	(Pathology and Experimental Medicine TEL: 373-5086)	takaito@kumamoto-u.ac.jp
Yukihiro Inomata	(Pediatric Surgery TEL: 373-5616)	yino@fc.kuh.kumamoto-u.ac.jp
Fumio Endo	(Pediatrics TEL: 373-5191)	fendo@gpo.kumamoto-u.ac.jp
Eiji Yumoto	(Otolaryngology-Head and Neck Surgery TEL: 373-5255)	yu6167@gpo.kumamoto-u.ac.jp
Atsushi Asai	(Bioethics TEL: 373-5534)	aasai@kumamoto-u.ac.jp

【Objectives】

Developmental and regenerative medicine is an extremely interdisciplinary science that involves embryology, cell biology, molecular biology, genetics, immunology, histology, reconstructive surgery, bioethics and other broad fields of biosciences. Characterizing pathological conditions and etiology and developing medical treatment for diseases from the viewpoint of developmental biology, as well as establishing regenerative medicine in an effort to repair ageing and injured tissues and organs, may need to surmount various critical problems that should be related to above interdisciplinary fields. Based on the knowledge learned in the special lectures "Tokuron", this practice intends to enhance the ability of approaching solution of problems from a multilateral perspective by advancing quest for an arbitrarily-selected issue through successive examinations of literatures and discussions.

【Content Description】

Topics of the practice may encompass full range of issues that are related to developmental biology and regenerative medicine.

【Keywords】

【Class Style】

Students form a small group and raise an issue related to developmental and regenerative medicine. (An example of the issue might be finding a way to recover kidney function avoiding relying on dialysis treatment.) Students then find obstacles to settlement of the issue and examine literatures cooperatively with the group members and make discussions in order to explore methodology and strategy to solve the raised problems. The instructors listed above appropriately support the group work to facilitate learning. Results of the study are summarized in a report. Students will also have opportunities for the presentation of the results.

【Textbooks】

【Recommended Readings】

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

【Evaluation for Grades and Credits】 Grading will be based on active participation in the group work as well as the final report and presentation. Focus of evaluation are (i) whether problems are appropriately raised from the selected issue, (ii) whether strategies to solve the problems are appropriately presented, (iii) whether both technical and ethical aspects are considered.

The Course of Developmental Biology and Regenerative Medicine

Practice "Enshuu" on Developmental Biology and Regenerative Medicine II

(Elective: 2 credits)

Subject Code 22190

Course Director: Minetaro Ogawa (Cell Differentiation TEL:373-6591) ogawamin@kumamoto-u.ac.jp

Instructors:

Shoen Kume	(Stem Cell Biology TEL: 373-6620)	skume@kumamoto-u.ac.jp
Nobuo Sakaguchi	(Immunology TEL: 373-5134)	nobusaka@gpo.kumamoto-u.ac.jp
Mitsuyoshi Nakao	(Medical Cell Biology TEL: 373-6800)	mnakao@gpo.kumamoto-u.ac.jp
Yasuharu Nishimura	(Immunogenetics TEL: 373-5310)	mxnishim@gpo.kumamoto-u.ac.jp
Takaaki Ito	(Pathology and Experimental Medicine TEL: 373-5086)	takaito@kumamoto-u.ac.jp
Yukihiro Inomata	(Pediatric Surgery TEL: 373-5616)	yino@fc.kuh.kumamoto-u.ac.jp
Fumio Endo	(Pediatrics TEL: 373-5191)	fendo@gpo.kumamoto-u.ac.jp
Eiji Yumoto	(Otolaryngology-Head and Neck Surgery TEL: 373-5255)	yu6167@gpo.kumamoto-u.ac.jp
Atsushi Asai	(Bioethics TEL: 373-5534)	aasai@kumamoto-u.ac.jp

【Objectives】

Developmental and regenerative medicine is an interdisciplinary science that is rapidly evolving as a new field of life science. This practice consists of lectures from researchers who work on developmental biology and regenerative medicine in Japan and overseas. Researchers committed to cutting-edge research will be invited and present latest developments of their own. Students are encouraged to attend the seminars to acquire up-to-date knowledge of regenerative medicine and related fields that may not be covered in the special lectures "Tokuron".

【Content Description】

Topics of the seminars may encompass full range of issues that are related to developmental biology and regenerative medicine, including cell engineering, genetic engineering, biomedical materials, reproductive medicine and bioinformatics.

【Keywords】

【Class Style】

Students attend the seminars that are authorized by the course and write reports. The reports should include summary of the lectures and his/her own discussion about the topics. In principle, one hour seminar is suitable for one report.

【Textbooks】

【Recommended Readings】

【Evaluation for Grades and Credits】 Students are obligated to attend 15 or more lectures and submit reports. The attendance can be extended to four years at maximum. Grading will be based on the reports.

The Course of Developmental Biology and Regenerative Medicine

Practice "Enshuu" on Developmental Biology and Regenerative Medicine III

(Elective: 2 credits)

Subject Code 22200

Course Director: Minetaro Ogawa (Cell Differentiation TEL:373-6591) ogawamin@kumamoto-u.ac.jp

Instructors:

Shoen Kume	(Stem Cell Biology TEL: 373-6620)	skume@kumamoto-u.ac.jp
Nobuo Sakaguchi	(Immunology TEL: 373-5134)	nobusaka@gpo.kumamoto-u.ac.jp
Mitsuyoshi Nakao	(Medical Cell Biology TEL: 373-6800)	mnao@gpo.kumamoto-u.ac.jp
Yasuharu Nishimura	(Immunogenetics TEL: 373-5310)	mxnshim@gpo.kumamoto-u.ac.jp
Takaaki Ito	(Pathology and Experimental Medicine TEL: 373-5086)	takaito@kumamoto-u.ac.jp
Yukihiro Inomata	(Pediatric Surgery TEL: 373-5616)	yino@fc.kuh.kumamoto-u.ac.jp
Fumio Endo	(Pediatrics TEL: 373-5191)	fendo@gpo.kumamoto-u.ac.jp
Eiji Yumoto	(Otolaryngology-Head and Neck Surgery TEL: 373-5255)	yu6167@gpo.kumamoto-u.ac.jp
Atsushi Asai	(Bioethics TEL: 373-5534)	aasai@kumamoto-u.ac.jp

【Objectives】

During the process of conducting research on developmental and regenerative medicine, it is necessary to present research findings and discuss with other scientists at domestic and international conferences. This practice aims at expanding capability to make a productive discussion on a subject presented by other researchers and to present and discuss own findings in an effective manner at an academic conference.

【Content Description】

Topics of the practice may encompass full range of issues that are related to developmental biology and regenerative medicine.

【Keywords】

【Class Style】

Students attend domestic or international conferences on developmental biology, regenerative medicine and other related research fields. In addition to discuss on the subjects presented by other researchers, students will present findings obtained from their own research in poster or oral sessions. The instructors listed above appropriately support discussions and preparations of presentation. Students finally write a report that includes the state of achievement of the activities at the conferences.

【Textbooks】

【Recommended Readings】

【Evaluation for Grades and Credits】 Students are obligated to attend and make a presentation in domestic or international conferences on developmental biology and regenerative medicine. Length of the activities at the conferences should be 4 days or more in sum total. Student should present their own research findings at least once in any of the conferences they attend. The attendance can be extended to four years at maximum. Grading will be based on the final report.

The Course of Developmental Biology and Regenerative Medicine
Practical Training "Jisshuu" on Developmental Biology and Regenerative Medicine
(Elective: 2 credits)
Subject code 22210

Course director : Minetaro Ogawa (Cell Differentiation TEL: 373-6591) ogawamin@kumamoto-u.ac.jp
Instructors : Hiroshi Sakamoto (Cell Differentiation)
Kiyomi Tamura (Cell Differentiation)
Kenji Shimamura (Brain Morphogenesis TEL: 373-6583) simamura@kumamoto-u.ac.jp
Jun Hatakeyama (Brain Morphogenesis)
Shoen Kume (Stem Cell Biology TEL: 373-6620) skume@kumamoto-u.ac.jp
Nobuaki Shiraki (Stem Cell Biology)
Nobuo Sakaguchi (Immunology TEL: 373-5134) nobusaka@gpo.kumamoto-u.ac.jp
Masahiro Kitabatake (Immunology)
Kunimasa Ohta (Developmental Neurobiology TEL: 373-5293) ohta9203@gpo.kumamoto-u.ac.jp
Mitsuyoshi Nakao (Medical Cell Biology TEL: 373-6800) mnakao@gpo.kumamoto-u.ac.jp
Noriko Saitoh (Medical Cell Biology)
Shinjiro Hino (Medical Cell Biology)
Yasuharu Nishimura (Immunogenetics TEL: 373-5310) mxnishim@gpo.kumamoto-u.ac.jp
Satoru Senju (Immunogenetics)
Atsushi Irie (Immunogenetics)
Takaaki Ito (Pathology and Experimental Medicine TEL: 373-5086) takaito@kumamoto-u.ac.jp
Kanao Niimori (Pathology and Experimental Medicine)
Kohki Hasegawa (Pathology and Experimental Medicine)
Hiroyuki Nakanishi (Molecular Pharmacology TEL: 373-5074) hnakanis@gpo.kumamoto-u.ac.jp
Kazuaki Umeda (Molecular Pharmacology)
Koji Kikuchi (Molecular Pharmacology)
Yasuhisa Sakamoto (Molecular Pharmacology)

【Objectives】

Various experimental methods and techniques are applied in the field of developmental biology and regenerative medicine, which is an interdisciplinary research based on cell biology, molecular biology, immunology and histology. For researchers in the field, it is required to learn such experimental methods and techniques practically. Even for researcher outside the field, it is important to understand a background of the experimental methods and techniques, since it gives us a multilateral viewpoint and would support to resolve various problems in specific research fields. Principles and practical procedures for several important experimental methods and techniques were trained in practical training of Developmental Biology and Regenerative Medicine.

【Content Description】

Following methods and techniques are trained:

- Ultrastructural analysis: Scanning electron microscopy (Brain Morphogenesis)
- Cell motility analysis: Time-lapse imaging of living culture cells (Molecular Pharmacology)
- Stem cell culture 1: Principle of ES cell culture (Stem Cell Biology)
- Stem cell culture 2: Induction of immunocytes from ES cells (Immunogenetics)
- Tissue culture: Handling of developing neural tissues and cells (Developmental Neurobiology)
- Histological analysis: Histological stain and its interpretation (Pathology and Experimental Medicine)
- Immunocytochemistry: Indirect fluorescence antibody method (Immunology)
- Flow cytometric analysis: Fractionation and isolation of cells by FACS (Cell Differentiation)
- Quantitative PCR: Isolation of RNA/DNA and quantification by PCR (Medical Cell Biology)

In this course, sessions in Practical Training of Metabolism and Cardiovascular Medicine could also be selected.

【Key Words】

Scanning electron microscope, Time-lapse fluorescence microscopy, FACS (Fluorescence-activated cell sorter), Quantitative PCR, ES cells, Cell Culture, Primary culture, Indirect fluorescence antibody method, Isolation of RNA and DNA

【Class Style】

Each training course will be held in a laboratory in charge. First, the principle of a method or a technique will be lectured, then practical handling will be trained. Results and discussions must be summarized in a report.

【Textbook】 Textbooks are not specified, and handouts for each practice will be distributed

【Recommended Readings】 Not specified.

【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】

Students must participate in at least 8 sessions and submit reports for each session. Grading will be based on the student's understanding of the subject matter as well as activities in the classes. The students' understanding will be evaluated on the basis of reports to be scored from 0 to 100 for each session. Final grades will be based on the average of the top 8 scores.

【Learning Before classes】 It is recommended for you to read a syllabus and indicated text books in advance.

【Learning After classes】 It is recommended for you to review the handout materials distributed in the lectures and your notebooks well. If you want to ask any questions to the lecturers, "Office Hour" is available for you. It is also recommended to review the lectures by using e-learning contents if available.

【Lecture Schedule】 Schedule of each session will be forwarded to you separately.

Session	Division in charge	Practical topics
1. Primary culture	(Developmental Neurobiology)	Neural cells and tissue isolation and culture
2. ES cell culture	(Stem Cell Biology)	Cell culture, cell treatment, feeder cell preparation
3. Differentiation of ES cells	(Immunogenetics)	Cell culture, Cell differentiation and its estimation
4. Timelapse microscopy	(Molecular Pharmacology)	Low fluorescence cell culture and image processing
5. Histological analysis	(Pathology and Experimental Medicine)	Fixation, section, stain and image processing
6. SEM	(Brain Morphogenesis)	Sample preparation, observation and image processing
7. Indirect immunofluorescence	(Immunology)	Sample preparation, observation and image processing
8. FACS	(Cell Differentiation)	Cell labeling and fractionation
9. Quantitative PCR	(Medical Cell Biology)	Nucleic acid extraction and quantification

(Practical Training of Metabolic Medicine)

1. Introduction of epidemiology	Public Health	Basic statistical analysis
2. Introduction of metabolic analysis	Neurology	Metabolic disease
3. Metabolic analysis 1	Pharmacology and Molecular Therapeutics	Blood flow measurement
4. Metabolic analysis 2	Medical Biochemistry	ELISA
5. Metabolic analysis 3	Molecular Genetics	Whole body metabolism, CT
6. Metabolic analysis 4	Cardiovascular Medicine	Cardiovascular disease model
7. Histological analysis	Cell Pathology	IHC, EM
8. Oxidative stress analysis	Microbiology	Tandem mass spectrometry

13. Endocrinology and Metabolism Course

The Course of Metabolism and Cardiovascular Medicine
Practical training of Metabolism and Cardiovascular Medicine

Subject code 22250
(Elective: 2 credit)

Course director : Yuichi Oike (Molecular Genetics) TEL: 373-5142 oike@gpo.kumamoto-u.ac.jp
Instructors : Takahiko Katoh (Public Health) TEL: 373-5112 katoht@gpo.kumamoto-u.ac.jp
Kazuya Yamagata (Medical Biochemistry) TEL: 373-5068 k-yamaga@kumamoto-u.ac.jp
Shokei Mitsuyama (Pharmacology and Molecular Therapeutics) TEL: 373-5082 kimmitsu@gpo.kumamoto-u.ac.jp
Motohiro Takeya (Cell Pathology) TEL: 373-5095 takeya@kumamoto-u.ac.jp
Yukio Ando (Neurology) TEL: 373-5686 andoy709@kumamoto-u.ac.jp
Hisao Ogawa (Cardiovascular Medicine) TEL: 373-5175 ogawah@kumamoto-u.ac.jp

【Objectives】

Various experimental methods and techniques are applied in the field of Metabolism and Cardiovascular Medicine, which is an interdisciplinary research based on epidemiology, internal medicine, pathology, pharmacology, histology and cell biology. For researchers in the field, it is required to learn such experimental methods and techniques practically. Even for researcher outside the field, it is important to understand a background of the experimental methods and techniques, since it gives us a multilateral viewpoint and would support to resolve various problems in specific research fields. Principles and practical procedures for several important experimental methods and techniques were trained in practical training of Metabolism and Cardiovascular Medicine.

【Content description】

Following methods and techniques are trained:

- Introduction of epidemiology: Epidemiological and statistical analysis (Public Health)
- Introduction of metabolic analysis: Method of analyzing metabolic disease (Neurology)
- Metabolic analysis 1: Blood pressure and cardiac rate (Pharmacology and Molecular Therapeutics)
- Metabolic analysis 2: Blood insulin (Medical Biochemistry)
- Metabolic analysis 3: Whole body metabolism, CT (Molecular Genetics)
- Metabolic analysis 4: Cardiovascular disease model (Cardiovascular Medicine)
- Histological analysis: Histopathology, Immunohistochemistry (Cell Pathology)

In this course, sessions in Practical training of Developmental Biology and Regenerative Medicine also could be selected.

【Key words】

Metabolic syndrome, obesity, epidemiology, statistics, mouse, insulin, hypertension, cardiovascular disease, oxidative stress, pathology, proteomics, immunohistochemistry, transmission electron microscopy,

【Class Style】

Each training course will be held in a laboratory in charge. First, the principle of a method or a technique will be lectured, then practical handling will be trained. Results, which will be discussed, must be summarized in a report.

【Textbook】 Textbooks are not specified, and handouts for each practice will be distributed

【Recommended Readings】 Not specified.

【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 and discussion and the final report. In the report, results and comments concerning at least 8 sessions could be summarized in one or two A4 sheets.

【Lecture Schedule】 Schedule of each session will be forwarded to you separately.

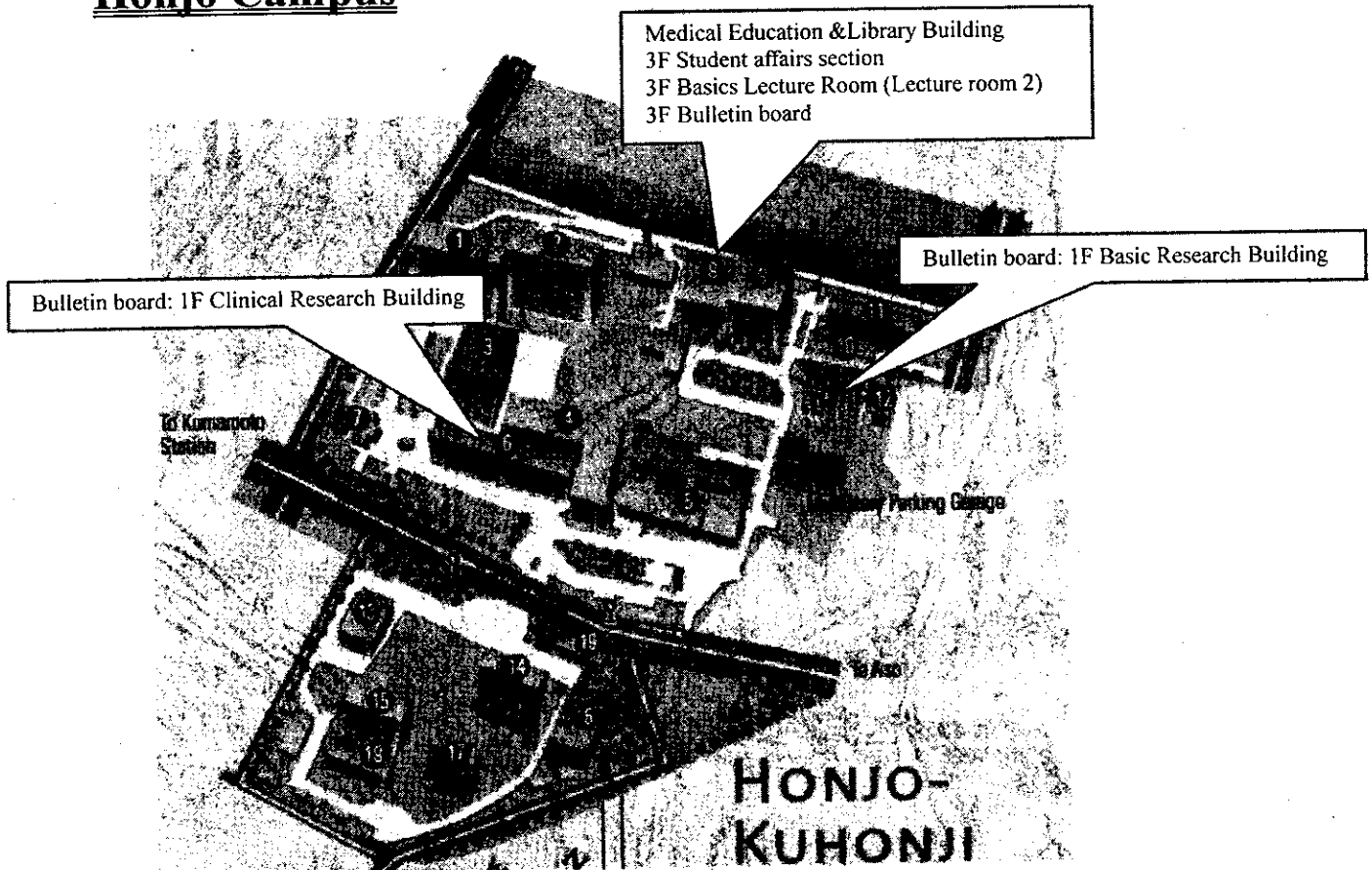
Session	Division in charge	Practical topics
1. Introduction of epidemiology	Public Health	Basic statistical analysis
2. Introduction of metabolic analysis	Neurology	Metabolic disease
3. Metabolic analysis 1	Pharmacology and Molecular	Therapeutics Blood flow measurement
4. Metabolic analysis 2	Medical Biochemistry	ELISA
5. Metabolic analysis 3	Molecular Genetics	Whole body metabolism, CT
6. Metabolic analysis 4	Cardiovascular Medicine	Cardiovascular disease model
7. Histological analysis	Cell Pathology	IHC, EM

(Practical training of Developmental Biology and Regenerative Medicine)

1. Primary culture	Developmental Neurobiology	Neural cells and tissue isolation and culture
2. ES cell culture	Stem Cell Biology	Cell culture, cell treatment, feeder cell preparation
3. Differentiation of ES cells	Immunogenetics	Cell culture, Cell differentiation and its estimation
4. Timelapse microscopy	Molecular Pharmacology	Low fluorescence cell culture and image processing
5. Histological analysis	Pathology and Experimental Medicine	Fixation, section, stain and image processing
6. SEM	Brain Morphogenesis	Sample preparation, observation and image processing
7. Immunocytochemistry	Immunology	Sample preparation, observation and image processing
8. FACS	Cell Differentiation	Cell labeling and fractionation
9. Quantitative PCR	Medical Cell Biology	Nucleic acid extraction and quantification

14. Campus map and lecture room location

Honjo Campus



1. Hospital West Tower
2. Hospital East Tower
3. Central Examination Building
4. Outpatient Examination and Clinical Research Building
5. Administration Building
6. Clinical Research Building
7. Yamazaki Hall
8. Medical Educational & Library Building
9. General Medical Research Building
10. Basic Research Building
11. Dormitory for Nurses
12. The Center for Medical Education and Research
13. Lecture Building
14. Center for AIDS Research, Institute of Resource Development and Analysis
15. Institute of Resource Development and Analysis (Gene Technology Center / Radioisotope Center)
16. Institute of Resource Development and Analysis (Center for Animal Resources & Development)
17. Institute of Molecular Embryology and Genetics
18. Academic Common Honjo - 1
19. Higo Iku Monument Hall