

**Lecture Series "Riron": B3 Hematopoietic and Immune Systems (Elective: 2 credits)**  
**Subject Code 20040**

|                  |                                       |                 |                               |
|------------------|---------------------------------------|-----------------|-------------------------------|
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**【Objectives】**

The aims of this lecture series are to understand the followings: (1) The mechanisms how the homeostasis of hematopoietic system is maintained as a stem cell system, (2) The origin of hematopoietic system and the mechanisms of development of hematopoietic stem cells, (3) The animal model bearing human hematopoietic system and applications of this animal model, (4) Cells, tissues, and organs of the immune system and their development, (5) Cell-cell interaction in the immune system, (6) The mechanism of antigen-recognition and the immune response

**【Content Description】**

Blood cells such as erythrocytes, platelets, granulocytes, macrophages, and lymphocytes are originated from hematopoietic stem cells in bone marrow. The hematopoietic system produces different types of blood cells with different life span. However, the total number of each type of blood cells is maintained in a certain range. This system is supported by the self-renewal ability and pluripotency of the hematopoietic stem cells, one of the best characterized stem cell system. In the lectures, we will explain the characteristics of hematopoietic stem cells, the methodology to identify and isolate hematopoietic stem cells, the mechanism maintaining hematopoietic stem cells in undifferentiated state, and genes and soluble factors involved in the differentiation of the hematopoietic stem cells to blood cells. We will also discuss the origin and the mechanism of development of hematopoietic stem cells in ontogeny, and the application of the humanized mice, in which human hematopoietic and immune system are reconstituted, to the development of vaccines.

Our bodies are continuously exposed to pathogenic microbes, foreign materials, and toxins, and the immune system plays the central role in protection of our bodies from them. Immune system protects our bodies in an antigen-specific manner. It does not react to components derived from self-tissues, while it attacks and excludes invading foreign substances. In the lectures, we will explain the cells, tissues, and organs of immune system and introduce the mechanisms of antigen recognition by immune system, activation of immune cells, and exclusion of foreign substances. We will also discuss the mechanism of production of immunoglobulin by B cells and immune response of T cells involved in exclusion of infectious microorganisms and cancer cells.

We will lecture on the hematopoiesis and immunity, at the levels of cells, tissues and organs, and the contents of the lecture include the results of our recent research.

**【Keywords】** hematopoietic stem cells, self-renewality, pluripotency, bone marrow niche, cell fate decision, embryonic hematopoiesis, humanized hematopoiesis model animals, antigens, innate immunity, acquired immunity, immune cells, immune molecules, antigen-specific recognition, immune response, 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】**

- "Hematopoiesis: A Developmental Approach" edited by Leonard I. Zon, Oxford University Press, Oxford and New York, 2001.
- "The Immune System" by Peter Parham. Garland Publishing Inc. New York and London, 2004
- "Immunobiology" by Charles A. Janeway Jr., Paul Travers et al. Garland Publishing Inc. New York and London, 2001.

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

**【Lecture Schedule】** Please also refer to the timetable shown in 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.                        | Jun. 12 (Fri) 5th period   | Minetaro Ogawa     | Ontogeny of hematopoietic system-1      |                            |                    |                                     |
| 2.                        | Jun. 19 (Fri) 5th period   | Minetaro Ogawa     | Ontogeny of hematopoietic system-2      |                            |                    |                                     |
| 3.                        | Jun. 26 (Fri) 4th period   | Minetaro Ogawa     | Ontogeny of hematopoietic system-3      |                            |                    |                                     |
| 4. eJ-L                   | Jul. 03 (Fri) 4th period   | Seiji Okada        | Differentiation of immune cells         |                            |                    |                                     |
| <b>eE-L</b>               |                            |                    |   |                            |                    |                                     |
| 5. eJ-L                   | Jul. 10 (Fri) 4th period   | Seiji Okada        | Humanized mice                          |                            |                    |                                     |
| <b>eE-L</b>               |                            |                    |   |                            |                    |                                     |
| 6.                        | Jul. 17 (Fri) 4th period   | Shinya Suzu        | Regulation of hematopoiesis             |                            |                    |                                     |
| 7.                        | Jul. 24 (Fri) 4th period   | Shigeo Ekino       | Phylogeny of immune system              |                            |                    |                                     |
| 8.                        | Jul. 31 (Fri) 4th period   | Shigeo Ekino       | Tissue and structure of immune system   |                            |                    |                                     |
| 9.                        | Aug.07 (Fri) 4th period    | Shigeo Ekino       | Intestinal bacterial flora and immunity |                            |                    |                                     |
| 10.                       | Aug.21 (Fri) 4th period    | Nobuo Sakaguchi    | B cell development-1                    |                            |                    |                                     |
| 11.                       | Aug.28 (Fri) 4th period    | Kazuhiko Kuwahara  | B cell development-2                    |                            |                    |                                     |
| 12.                       | Sep. 04 (Fri) 4th period   | Kazuhiko Kuwahara  | B cell development-3                    |                            |                    |                                     |
| 13. eE-L<br>eJ-L<br>eEJ-L | } Sep. 11 (Fri) 4th period | Yasuharu Nishimura | Antigen presentation to T cells         |                            |                    |                                     |
| 14. eE-L<br>eJ-L<br>eEJ-L |                            |                    |   | } Sep. 18 (Fri) 4th period | Yasuharu Nishimura | T cell-mediated anti-tumor immunity |
| 15. eJ-L<br>eE-L          |                            |                    |   |                            |                    |                                     |

**【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).