# Course Syllabus

<table>
<thead>
<tr>
<th>Course Title (in English)</th>
<th>Immunology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Title (in Russian)</td>
<td>Иммунология</td>
</tr>
<tr>
<td>Lead Instructor(s)</td>
<td>Chudakov, Dmitry</td>
</tr>
<tr>
<td>Status of this Syllabus</td>
<td>The syllabus is a final draft waiting for form approval</td>
</tr>
<tr>
<td>Contact Person</td>
<td>Dmitry Chudakov</td>
</tr>
<tr>
<td>Contact Person's E-mail</td>
<td><a href="mailto:chudakovdm@gmail.com">chudakovdm@gmail.com</a></td>
</tr>
</tbody>
</table>

## 1. Annotation

### Course Description

The purpose of this course is to lay the foundation for understanding the principles behind the development, organization and functioning of the immune system. Such basis is necessary for further professional growth either in the field of fundamental immunology or applied research and development in medical immunology and oncology. This course will also be important for those who want to professionalize in medical practice, pharmaceutical industry, epidemiology and health services management, engineering and business in the field of biomedicine.

The course is focused on the human immune system. The main medical aspects related to the functioning of the immune system will be considered, including autoimmune diseases, allergies, tumor-immune system interactions, immunotherapy, vaccinations and transplantation.

Particular attention will be paid to the adaptive branch of the immune system, immunogenomics and state-of-art approaches for immune repertoire studies, such as: application of the novel sequencing technologies and corresponding bioinformatic data analysis, novel approaches for the studying of the antibody and T-cell receptor repertoires in health and disease.

### Course Prerequisites

Basic knowledge of molecular and cell biology is highly desirable. However, we will try to make the course useful for the more computational people as well.

## 2. Structure and Content
### Course Academic Level
Master-level course suitable for PhD students

### Number of ECTS credits
6

<table>
<thead>
<tr>
<th>Topic</th>
<th>Summary of Topic</th>
<th>Lectures (# of hours)</th>
<th>Seminars (# of hours)</th>
<th>Labs (# of hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T-cell world, functional T-cell subsets: cytotoxic T-cells, helper T-cell subsets: Th1, Th2, Th17, Tfh; regulatory T-cells. T-cell activation, metabolism, tissue-resident T-cells. Landscapes of T cell receptor repertoires. Antigen presentation and MHC. TCR profiling with high-throughput sequencing. A workshop in applied bioinformatics.</td>
<td>6</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>B cell world. B-cell development and biology from the naive to memory B-cell and plasma cell. Antibody effector functions. Immunoglobulin massive parallel sequencing, tracking of somatic hypermutations in antibodies. Antibodies use and applications in biotechnology and medicine.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final exam</td>
<td>Exam.</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

### 3. Assignments

<table>
<thead>
<tr>
<th>Assignment Type</th>
<th>Assignment Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report</td>
<td>Homework-based presentations on particular paper or deeply revealing the particular problem in immunology.</td>
</tr>
<tr>
<td>Test/Quiz</td>
<td>Homework Tests.</td>
</tr>
<tr>
<td>Test/Quiz</td>
<td>Final Exam.</td>
</tr>
</tbody>
</table>
4. Grading

<table>
<thead>
<tr>
<th>Type of Assessment</th>
<th>Graded</th>
</tr>
</thead>
</table>

**Grade Structure**

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Activity weight, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report</td>
<td>30</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>30</td>
</tr>
<tr>
<td>Final Exam</td>
<td>40</td>
</tr>
</tbody>
</table>

**Grading Scale**

- A: 75
- B: 60
- C: 55
- D: 40
- E: 20
- F: 0

**Attendance Requirements**

Mandatory

5. Basic Information

**Maximum Number of Students**

<table>
<thead>
<tr>
<th>Overall:</th>
<th>Maximum Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Group (for seminars and labs):</td>
<td>34</td>
</tr>
</tbody>
</table>

**Course Stream**

Science, Technology and Engineering (STE)

**Course Term (in context of Academic Year)**

Term 3

**Course Delivery Frequency**

Every year

**Students of Which Programs do You Recommend to Consider this Course as an Elective?**
## 6. Textbooks and Internet Resources

### Required Textbooks


### Recommended Textbooks


## 7. Facilities

## 8. Learning Outcomes

### Knowledge


### Skill

Ability to process and interpret the information from modern scientific literature in the area of molecular immunology. Students are expected to be able to extract information from original articles and present it in the form of oral presentation, been able to comprehensively, clearly describe a particular problem.
Experience
Oral presentation followed by in depth discussion.

9. Assessment Criteria

Input or Upload Example(s) of Assignment 1:

Select Assignment 1 Type
Test/Quiz
Homework Test

Input Example(s) of Assignment 1 (preferable)
1. Fill the gaps with one of the following terms:
Protein kinases, CD28, CD8, CD4, lymph node, IL-2, Class II MHC, B7, CTLA-4, Tfh cell.
Lck and ZAP-70 are __.
Class switching occurs in the __ and requires the direct contact between B-cell and the __.
The costimulatory signal needed for complete T-cell activation is triggered by the interaction of __ on the T cell and __ on the APC.
Knockout mice lacking MHC class I molecules fail to produce thymocytes bearing ___ coreceptor.
T-cells bearing __ are absent from the lymph nodes of knockout mice lacking class II MHC molecules.
Signaling from ___ inhibits T-cell activation.
Macrophages express these molecules only after activation: __.
Activated T-cells start to secrete __ and express its receptor which leads to autocrine proliferation stimulus.

2. Make a list of 3-4 examples of the systemic and organ-specific autoimmune diseases. Briefly describe the manifestation syndromes.

Assessment Criteria for Assignment 1
Completeness and correctness of answers.

Input or Upload Example(s) of Assignment 2:

Select Assignment 2 Type
Report

Input Example(s) of Assignment 2 (preferable)
Homework-based presentations on particular paper or, in advanced variant, deeply revealing the particular problems in immunology.

Basic mode is paper presentation. Each student will choose one of the suggested recent papers in molecular immunology. A ~20 minutes powerpoint presentation is expected, followed by answers to questions and a brief class discussion facilitated by the presenter, for a total of up to 40 minutes. For multidisciplinary papers, the focus should be on the immunological aspects and methods section of the article.

Advanced mode:

"Antigens and signals - the ways immune cells employ to exchange information and make decisions"

"B cells role in cancer immunology"

"Tissue-resident T cells"

"Immune cells in development and regeneration"

Assessment Criteria for Assignment 2

Quality of presentation and further discussion.

For maximum grade, the student is expected to present the background, the basics of the methods, main results, and their significance, and to understand the details of the methods and results of the paper.

In advanced mode, the whole problem must be clearly revealed within the talk and discussion.

Input or Upload Example(s) of Assignment 3:

Select Assignment 3 Type

Test/Quiz

Final exam (free response and multiple choice): up to 15 questions each weighting 3 to 15 points, for a total of maximum 100 points.

Examples:

1. Patients with X-linked agammaglobulinemia are deficient of mature B-cells and therefore are susceptible to the broad variety of pathogens. Based on your knowledge of modern biotechnology and methods of tuning the immune system suggest several possible treatment types or interventions which could substitute the adaptive humoral immune response in the patients.

2. Explain why not all the lymphocytes with self-reactive antigen-recognising receptors are eliminated in the thymus or bone marrow. Describe the potential mechanisms which can prevent the damage from the self-reacting cells activity.

3. You have fluorescein-labeled anti-CD4 and Phycoerythrin-labeled anti-CD8 antibodies. You use these antibodies to stain thymocytes from normal mice and from RAG1-/- mice. In the forms below, draw the FACS plots you would expect.

Assessment Criteria for Assignment 3

Completeness and correctness of answers.
10. Additional Notes