

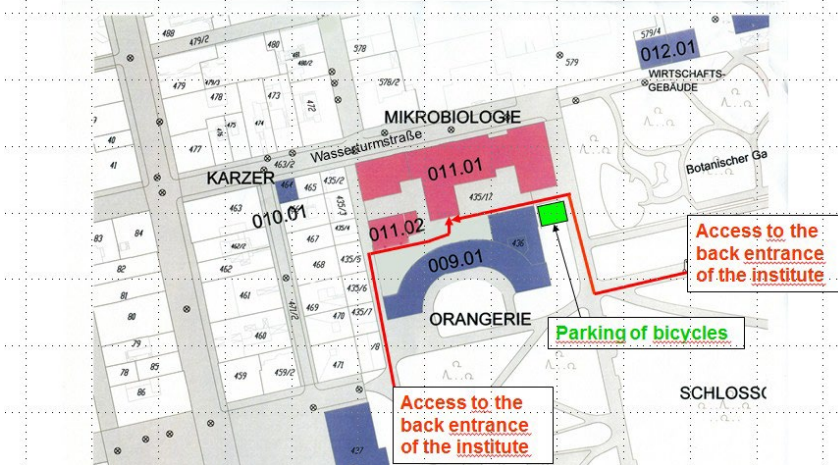
# Advanced Lectures in Molecular Medicine (Molecular Medicine, Master of Science) Part 1: „Immunology“

**Location: Seminar room** of the Institut für klinische Mikrobiologie, Immunologie und Hygiene, Wasserturmstraße 3, 91054 Erlangen (**entrance to the Microbiology lecture hall building**: opposite of the backside of the Orangery building in the Schlossgarten, please go up two flights of stairs to the seminar room).

**Time:** The lectures will take place **every Thursday from 2.15 p.m. until 3.45 p.m.** (except for the first lecture, which will take place on **Wednesday, October 23, 2.15 pm until 3.45 p.m.**)

All lectures in the winter term 2024/2025 will be given **in person**.

## Access to the seminar room of the Institute of Clinical Microbiology, Immunology and Hygiene



### Lecturers:

CB: Prof. Dr. med. Christian Bogdan  
 DV: Prof. Dr. rer. nat. David Vöhringer  
 KS: PD Dr. med. Kilian Schober  
 SU: Prof. Dr. med. Stefan Uderhardt

Lectures	Lecturer	Date
<b>1. Introduction: Evolution – Components – Function – Dysfunction</b> <ul style="list-style-type: none"> <li>• Evolution of the immune system</li> <li>• Tissues, cells, humoral components and functional anatomy of the immune system (including historical account)</li> <li>• Overview: Function of the immune system (anti-infectious defense – anti-tumor-defense – transplant rejection)</li> <li>• Overview: Dysfunction of the immune system (Autoimmunity – Autoinflammation – Immunopathology – Allergy - Immunodeficiency)</li> </ul>	CB	<b>Wednesday,</b> 23.10.2024 (2.15 p.m.)
<b>2. The anti-infectious immune response (I): The basics of innate immunity</b> <ul style="list-style-type: none"> <li>• dermal and epithelial barriers</li> <li>• soluble factors: complement, cytokines, chemokines</li> <li>• myeloid cells: types, development, diversity (granulocytes, macrophages, dendritic cells)</li> <li>• concepts of pathogen recognition; pathogen recognition receptors</li> <li>• antimicrobial effector functions of phagocytes</li> <li>• natural killer cells, innate lymphoid cells</li> <li>• principles of innate antiviral responses (type I IFNs)</li> </ul>	CB	Thursday 31.10.2024 (2.15 p.m.)

<p><b>3. The anti-infectious immune response (II): The basics of T cell-mediated immunity</b></p> <ul style="list-style-type: none"> <li>• principle modes of thymic T cell development</li> <li>• antigen processing and presentation by MHC molecules</li> <li>• signals for T cell activation (TCR signaling, costimulatory molecules, cytokines; signals 0, 1, 2, 3)</li> <li>• T cell differentiation and T cell subpopulations (CD4; CD8; Th1, Th2, Th17, Tregs; memory T cells)</li> <li>• Functions of T cells (B cell help [follicular T helper cells]; macrophage activation [IFN-g, TNF]; cytotoxicity; regulatory)</li> </ul>	DV	Thursday 07.11.2024 (2.15 p.m.)
<p><b>4. The anti-infectious immune response (III): The basics of B cell- and antibody-body mediated immunity</b></p> <ul style="list-style-type: none"> <li>• principles of B cell- and plasma cell development; B cell-driving cytokines</li> <li>• types and functions of B cells (B1a, B1b; innate response activator B cells; B2; follicular B cells; marginal zone B cells; B cells with regulatory function; memory B cells)</li> <li>• long-lived plasma cells</li> <li>• antibody diversification and affinity maturation</li> <li>• antibody classes and functions</li> <li>• signals for B cell activation (T cell-dependent vs. –independent antigens), BCR signaling</li> </ul>	DV	Thursday 14.11.2024 (2.15 p.m.)
<p><b>5. Methods for phenotypic and functional characterization of immune responses</b></p> <p><b>5.1. in vitro and ex vivo methodologies</b></p> <ul style="list-style-type: none"> <li>• flow cytometry and cell sorting, immunophenotyping</li> <li>• cell proliferation (3H, CFSE) following antigen-specific or polyclonal stimulation</li> <li>• mixed lymphocyte reactions</li> <li>• cytotoxicity assays</li> <li>• determination of antigen-specificity using tetramer technology</li> <li>• cytokine expression analysis: intracellular cytokine staining; cytokine secretion assays; ELISPOTs; ELISA</li> <li>• signal transduction analyses (immunoprecipitations, Western blots)</li> </ul> <p><b>5.2. in vivo methodologies</b></p> <ul style="list-style-type: none"> <li>• genetic mouse models (knock-out, cell-specific knockouts [Cre/lox], BAC transgenics; reporter-mice; fate-mapping)</li> <li>• mixed bone marrow chimeras</li> </ul>	DV	Thursday 21.11.2024 (2.15 p.m.)
<p><b>6. The anti-tumor response of the immune system</b></p> <ul style="list-style-type: none"> <li>• immune surveillance</li> <li>• tumor antigenicity</li> <li>• effector cytokines (type I IFNs, IFN-g, TNF)</li> <li>• effector cells: NK cells (activation vs. inhibition); CTLs; NKT cells; macrophages, dendritic cell subtypes</li> <li>• tumor associated macrophages, myeloid suppressor cells and regulatory T cells block anti-tumour immune responses</li> </ul>	KS	Thursday 28.11.2024 (2.15 p.m.)
<p><b>7. Dysfunction of the immune system/immune-related diseases (I): Allergies</b></p> <ul style="list-style-type: none"> <li>• Mechanisms of type I hypersensitivity reactions (IgE reactions)</li> <li>• role of mast cells</li> <li>• role of leukotrienes</li> <li>• atopy, allergic rhinitis, bronchial asthma, food allergies: mechanisms of disease and treatment</li> <li>• genetic factors</li> </ul>	DV	Thursday 05.12.2024 (2.15 p.m.)

<p><b>8. Dysfunction of the immune system/immune-related diseases (II): Autoimmunity</b></p> <ul style="list-style-type: none"> <li>• central and peripheral T cell tolerance</li> <li>• central and peripheral B cell tolerance</li> <li>• organ-specific autoimmune diseases (diabetes, thyroiditis, multiple sclerosis)</li> <li>• systemic autoimmune diseases (rheumatoid arthritis, systemic lupus erythematoses)</li> <li>• mechanisms of pathogenesis (infection breaks tolerance: antigenic mimicry vs. by-stander activation, lowering T cell receptor thresholds; defective phagocytosis of apoptotic cells; TLR9-BCR-crosstalk)</li> <li>• mechanisms of tissue damage (type II, type III, type IV hypersensitivity)</li> </ul>	SU	Thursday 12.12.2024 (2.15 p.m.)
<p><b>9. Dysfunction of the immune system/Immune-related diseases (III): Graft vs. host diseases</b></p> <ul style="list-style-type: none"> <li>• principles of tissue compatibility and transplantation immunology</li> <li>• Autografts, isografts, allograft, xenograft</li> <li>• pregnancy as a case of natural transplantation (mechanisms of tolerance)</li> <li>• organ transplantation and transplant rejection (examples: solid organs vs.</li> </ul>	KS	Thursday 19.12.2024 (2.15 p.m.)
<p><b>10. Dysfunction of the immune system/immune-related diseases (IV): immunodeficiencies</b></p> <ul style="list-style-type: none"> <li>• T cell disorders</li> <li>• B cell/antibody disorders</li> <li>• myeloid cell disorders</li> <li>• cytokine (receptor) deficiencies</li> <li>• signalling defects</li> </ul>	KS	Thursday 09.01.2025 (2.15 p.m.)
<p><b>12. Dysfunction of the immune system/immune-related diseases (V): Chronic inflammatory and autoinflammatory diseases</b></p> <ul style="list-style-type: none"> <li>• chronic inflammatory bowel diseases (IBD; e.g. Crohn´s disease): role of genetics. vs. microbiota</li> <li>• autoinflammatory diseases: micromilieu triggers (e.g. gout); environmental triggers (e.g. silicosis, asbestosis); genetic (hereditary periodic fevers: gain of function mutations); inflammasomes: composition, types, function; mechanisms of inflammasome activation</li> </ul>	SU	Thursday 16.01.2025 (2.15 p.m.)
<p><b>13. Termination of immune responses and immunotherapy</b></p> <p><b>13.1. Resolution of inflammation and tissue repair</b></p> <ul style="list-style-type: none"> <li>• macrophage deactivation and alternative macrophage activation</li> <li>• regulatory T cells (and their effectors)</li> <li>• lipoxins, resolvins</li> <li>• transforming growth factor b</li> <li>• protease inhibitors (e.g. SLPI)</li> <li>• reactive oxygen and nitrogen intermediates</li> </ul> <p><b>13.2. Immunotherapy of allergic, autoimmune, GvH and malignant diseases</b></p> <ul style="list-style-type: none"> <li>• desensitization</li> <li>• Immunosuppressants (e.g. CsA, FK506, steroids, mycophenolat)</li> <li>• cell transfer (dendritic cells, T cells, B cells)</li> <li>• antibodies (biologicals)</li> </ul>	SU	Thursday 23.01.2025 (2.15 p.m.)
<p><b>14. Vaccination</b></p> <ul style="list-style-type: none"> <li>• types of vaccines</li> <li>• mechanisms of vaccine-induced immunity and protection</li> <li>• role of B cell, plasma cell and T cell memory depending on the vaccine antigen</li> <li>• mechanisms of action of adjuvants (e.g. Al(OH)3: induction of cell death and DNA release; release of uric acid; direct activation of inflammasomes)</li> </ul>	CB	Thursday 30.01.2025 (2.15 p.m.)

<p><b>Written examination (joint exam together with imaging and neuroscience)</b> 180 minutes (60 minutes per subject) mixture of MC questions and open questions (free text answers) <b>Examination site: Lecture Hall of the Institute of Biochemistry, Fahrstraße</b></p>		<p><b>Friday, 07.02.2025,</b> 10 a.m. to 1 p.m.</p>
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