

# **Objectives of Training and Specialty Training Core Curriculum in Allergology and Clinical Immunology**

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## **I. INTRODUCTION**

### **EDUCATIONAL PROGRAM**

The basic requirements for training in allergology and clinical immunology are defined in Chapter 6 of the UEMS Charter on Training of Medical Specialists in the EU. This charter states the overall rules for institutions, teachers, trainees, common trunk and duration of training. The UEMS Allergology and Clinical Immunology Core Curriculum specifies in detail the theoretical and practical competencies that should be reached during the training period. The Core Curriculum defines competencies for **Good Clinical Practice** for a common European training in allergology and clinical immunology. In individual European countries, as well as in individual institutions, special focus on various elements of the specialty is allowed as long as it does not reduce the quality of the training. The Logbook is the instrument to define the level of competencies, to document the progression of the training and to form the tool for the final evaluation of competence. The Logbook consists of requirements defined by the UEMS Allergology and Clinical Immunology Section and Board and national adaptations and clarifications. It is sensible to individualize the Logbook for the trainee and to include such elements as follows:

- Educational plan
- Description of structure of educational institute
- Evaluation of clinical work
- Description of learning processes
- Check list

The trainee will fill out the Logbook in cooperation with the tutor/educational institute in accordance with the UEMS guidelines and national regulations.

### **DEFINITION AND SCOPE OF SPECIALTY**

Allergies are multi-organ, systemic hypersensitivity diseases which include rhinoconjunctivitis, asthma, urticaria/angioedema, atopic and non-atopic eczema, food allergy, drug allergy and anaphylaxis, etc. Allergic diseases may be divided according to the pathogenesis in IgE and non-IgE-mediated hypersensitivity. Allergology is a medical specialty concerned with the prevention, diagnosis, management, and rehabilitation of patients with allergic diseases. Clinical immunology relates to immune system dysfunctions and immunological diseases specified in the Core Curriculum. Patients with clinical immunologic diseases are often handled in cooperation with other specialists. An allergologist/clinical immunologist is a specialist who has acquired the defined level of competencies in the diagnosis and management of allergic and immunologic diseases.

In some European countries the specialty includes both allergology and clinical immunology. In others, allergology and clinical immunology is practised as two separate specialties or it has been implemented in such organ-specific specialties as dermatology, pneumonology, ENT, etc.

The Core Curriculum deals with both the theoretical and the practical aspects of the training.

- The theoretical aspects of the Core Curriculum will provide the trainees with the basic and scientific knowledge essentials for the specialty.
- The practical aspects of the Core Curriculum will qualify the trainees with the knowledge and practical skills required to diagnose, prevent and treat allergic and immunologic diseases.

## **II. OBJECTIVES OF TRAINING PROGRAM**

### **GENERAL OBJECTIVES**

The main objective of the training in allergology and clinical immunology is to provide the trainee with the acquisition of the appropriate knowledge and essential techniques for the competent practice of the specialty. The trainee optimally may receive education in both adult and pediatric allergy and must have cross-training in both out-patient and in-patient populations.

On completion of the allergology and clinical immunology training program the allergologist/clinical immunologist can function as a specialist in the essential roles and key competencies of allergologist/clinical immunologists: medical expert/clinical decision maker, communicator, collaborator, manager, health advocate, scholar, and professional. The graduate allergologist/clinical immunologist will have achieved the following general educational objectives and must be able to:

- Provide excellent, comprehensive, and evidence-based diagnosis and management for patients with allergic and immunologic disorders.
- Counsel patients and the broader community on prevention and rehabilitation of allergic and immunologic diseases.
- Communicate effectively and compassionately with patients and their families.
- Communicate constructively and effectively with other physicians (especially referring physicians) and other health care professionals.
- Function as a member of the health care team and coordinate the team as appropriate.
- Contribute to the education of students, other physicians, other health care professionals, and patients and their families.
- Perform necessary technical skills specific to management of patients with allergic and immunologic diseases.
- Maintain complete and accurate medical records.
- Undertake accurate self-appraisal, develop a personal continuing education strategy, and pursue lifelong mastery of allergology and clinical immunology.
- Evaluate the allergology and immunology literature critically and apply pertinent information to patient management.

During the allergology and clinical immunology training program, the trainee must undertake a broad range of practical clinical experiences including acute and chronic allergic and clinical immunologic care, ambulatory care, and prevention and rehabilitation. The trainee must be involved in a program of formal educational activities, and have exposure to and

involvement with current research activities. The trainee must demonstrate the knowledge, skills and attitudes relating to gender, culture and ethnicity pertinent to allergology and clinical immunology. In addition, all trainees must demonstrate an ability to incorporate gender, cultural and ethnic perspectives in research methodology, data presentation and analysis. Gradually, the trainee must assume responsibility for clinical decision making and patient care, and be able to function as an independent clinical decision maker at graduation.

## **SPECIFIC OBJECTIVES**

The knowledge, skills, and attitudes essential in the training of the allergologist/clinical immunologist are detailed in the educational objectives.

### **Medical Expert/Clinical Decision-Maker**

#### ***General Requirements***

- Demonstrate diagnostic and therapeutic skills for ethical and effective patient care.
- Access and apply relevant information to clinical practice.
- Demonstrate effective consultation services with respect to patient care, education, and legal opinions.

#### ***Specific Requirements***

Allergologists/clinical immunologists must be experts in all aspects of the diagnosis and management of allergic and clinical immunologic diseases. The allergologist/clinical immunologist must be able to practice contemporary evidence-based, and cost-effective medicine, and must avoid investigations or management which are unnecessary or harmful. Furthermore, the allergologist/clinical immunologist must demonstrate specific technical skills in diagnostic and therapeutic techniques.

Allergologists/clinical immunologists must be able to provide care to diverse communities. Trainees must demonstrate the appropriate knowledge, skills, and attitudes relating to gender, culture, and ethnicity, and must understand the importance of these perspectives in research methodology, data presentation, and analysis.

### **Communicator**

#### ***General Requirements***

- Listen effectively.
- Establish therapeutic relationships with patients and families.
- Obtain and synthesize relevant history from patients, families and their communities.
- Discuss appropriate information with patients and families and the health care team.

#### ***Specific Requirements***

The allergologist/clinical immunologist must establish effective relationships with patients and their families, as well as with other physicians and health professionals, in order to provide the best possible care. Good communication skills are essential in order to obtain patient histories, to convey information to patients and their families, and to establish a relationship characterized by trust, understanding, and compassion.

The trainee must demonstrate the ability to:

- Listen carefully, obtain and synthesize relevant history from patients and families.
- Be caring, compassionate, understanding, and confidential.
- Present relevant information clearly, concisely, and accurately, in both written and

verbal formats, and maintain appropriate records.

- Educate patients, families, and other health professionals in formal and informal settings with regard to the patient's condition, management, risk factors, and secondary prevention.
- Understand the impact of such factors as age, gender, disability, ethnocultural background, and socioeconomic background on the patient's history, relationships, and ability to comply with a therapeutic program.

## **Collaborator**

### ***General Requirements***

- Consult effectively with other physicians and health care professionals.
- Contribute effectively to other interdisciplinary team activities.

### ***Specific Requirements***

Allergologists/clinical immunologists must be able to work in partnership with other health professionals involved in the care of their patients. Therefore, it is essential for them to be able to collaborate effectively with a multidisciplinary team of health care workers.

The trainee will demonstrate the ability to:

- Consult with other physicians and other health care professionals, and to understand their roles and contributions.
- Contribute effectively and constructively to multidisciplinary team activities, contribute to team development, recognize areas of expertise and value opinions of other team members.

## **Manager**

### ***General Requirements***

- Use resources effectively to balance patient care, learning needs, and outside resources.
- Allocate finite health care resources wisely.
- Work effectively and efficiently in a health care organization.
- Use information technology to optimize patient care, lifelong learning, and other activities.

### ***Specific Requirements***

Allergologists/clinical immunologists must be able to function as managers when making decisions in their practice involving co-workers, resources, and policies. Allergologists/clinical immunologists must prioritize and execute tasks, work effectively with colleagues, and make appropriate decisions regarding the location of finite health care resources.

The trainee must demonstrate:

- Practice-management and time-management skills, including punctuality, planning, prioritization, and triage skills.
- Understanding of the advantages and disadvantages of health care in a variety of settings, including hospitals, ambulatory care clinics, offices, and home care.
- Understanding of the cost and cost-effectiveness of therapeutic and preventive health programs, and the ability to make appropriate decisions based on evidence of benefit to the patient and population served.
- Understanding of quality-management programs, and the ability to develop

appropriate programs in their respective areas of responsibility.

- The ability to use information technology as an important tool in optimal patient management.
- The ability to organize and to coordinate the work of the health care team, as the patient's physician who is the most responsible for overseeing the care.

## **Health Advocate**

### ***General Requirements***

- Identify the important determinants of health affecting patients.
- Contribute effectively to improved health of patients and communities.
- Recognize and respond to those issues where advocacy is appropriate.

### ***Specific Requirements***

Allergologists/clinical immunologists play an important role in advocating health promotion for individual patients, both in their own practice, and in the broader community. Health advocacy is undertaken by individual allergologists/clinical immunologists and their professional organizations.

The trainee will:

- Be able to identify the biologic, psychosocial, environmental, and economic determinants of health, use this information in a management and prevention plan, and ensure that the patient is able to access appropriate health and social services in the management of individual patients.
- Be able to identify patient groups within their practice who are at risk for allergic/immunologic disease and its complications, and apply available knowledge regarding primary and secondary prevention.
- Be able to identify issues and opportunities for contributing to the improvement of allergic/immunologic health care in the broader community.

## **Scholar**

### ***General Requirements***

- Implement, and monitor a personal continuing education strategy.
- Critically appraise sources of medical information.
- Facilitate learning of patients, staff, students and other health professionals.
- Contribute to the development of new knowledge.

### ***Specific Requirements***

Allergologists/clinical immunologists must undertake a lifelong pursuit in the mastery of allergology and clinical immunology. They must take the responsibility for ongoing, self-directed learning. They must contribute to the education of students, patients, and colleagues, and must contribute to research and its appraisal and application.

The trainee will:

- Be able to develop and use a self-directed continuing education strategy.
- Know and be able to apply the principles of critical appraisals to sources of medical information.
- Know and be able to apply the evidence-based standards of care to allergic and clinical immunologic diseases.
- Understand the importance of ongoing research in allergic and clinical immunologic disease, participate and contribute to clinical and/or basic research, and demonstrate a

- questioning and inquisitive approach to medical information.
- Contribute to the education of students, patients, and other health professionals.

## **Professional**

### ***General Requirements***

- Deliver highest quality care with integrity, honesty, and compassion.
- Exhibit appropriate personal and interpersonal professional behaviours.
- Practice medicine ethically consistent with the obligations of a physician.

### ***Specific Requirements***

Allergologists/clinical immunologists have a unique role in society as professionals dedicated to improving the health of allergic and clinical immunologic patients in their communities. Allergologists/clinical immunologists are committed to the highest standards of excellence in clinical care and ethical conduct.

The trainee will:

- Understand and apply the basic principles of medical ethics including informed consent, advanced directives, research ethics, patient autonomy, and justice.
- Understand the nature of professional, interpersonal relationships and boundaries regarding patients, co-workers, and students.
- Understand legal and professional obligations that apply to allergology and clinical immunology including the preparation of timely and accurate medical-legal reports, responses to regulatory bodies, notification of coroners, etc.

## **III. SPECIALTY TRAINING CORE CURRICULUM**

### **Theoretical knowledge**

The trainee will demonstrate the following knowledge necessary for excellent patient care:

#### ***KNOWLEDGE***

These objectives are based on the major disease processes encountered in allergology and clinical immunology. Objectives are listed once in the most appropriate category. Each section includes specific domains of knowledge and clinical problems that should be mastered by the graduate allergologist/clinical immunologist.

1. Mastery of all theoretic aspects of the allergic and clinical immunologic evaluation including prevention, diagnosis and treatment, and systemic manifestations of allergic and clinical immunologic disease.
2. Problem solving and clinical decision making, including the ability to correlate, evaluate, and prioritize information acquired by clinical assessment; formulate an appropriate problem list; and develop and implement a diagnostic and therapeutic plan using appropriate knowledge derived from clinical appraisals of relevant literature.

Theoretical knowledge is divided in three levels of competence:

- level 1 indicates a level of knowledge comparable with internal medicine or pediatrics

trainees (Common trunks)

Level 2 indicates that the trainee knows the fundamental basic immunologic background, aetiology and pathogenesis for the relevant diseases

Level 3 indicates that the trainee knows, in detail, the immunologic background, aetiology and pathogenesis for the relevant diseases

The level of competencies in relation to specific clinical problems is defined in the Logbook.

## **Practical knowledge**

The trainee must demonstrate the following skills necessary for excellent patient care:

### *SKILLS*

1. For each clinical problem, the graduate allergologist/clinical immunologist must be able to perform a complete and accurate history and physical examination, formulate appropriate differential and provisional diagnoses, develop an appropriate plan of investigation and be able to interpret the results. The graduate must also be able to develop a therapeutic plan, develop plans for primary, secondary and tertiary prevention, and be able to demonstrate appropriate clinical judgement considering such factors as the patient's age and status of health, as well as the risks, benefits, and costs of diagnostic and therapeutic strategies.
2. The trainee must be able to understand the indications, contraindications, complications, and interpretation of diagnostic and provocation tests and must have experience in the technical performance of such tests.
3. The trainee must be able to understand the indications, contraindications, complications, and interpretation of allergen avoidance, pharmacotherapy, allergen-specific immunotherapy and other procedures for immunomodulation.
4. Patient education is an integrated part of allergology and clinical immunology treatment, and the trainee must be able to formulate appropriate patient education programs.
5. The trainee must demonstrate consultation skills, which include the ability to present clear and pertinent assessments and recommendations in both written and verbal forms, participate constructively as part of a team of other physicians and other health professionals, ensure appropriate follow-up and reassessment of the patient's progress, and ensure maintenance of appropriate records.

Practical knowledge is divided in three levels of competence:

Level 1 indicates that the trainee will be able to work in the relevant area under supervision

Level 2 indicates that the trainee has attained considerable knowledge of the diagnostic and therapeutic possibilities for the relevant tests and diseases. The trainee must be able to apply this knowledge in the diagnosis and treatment of uncomplicated cases without supervision

Level 3 indicates that the trainee knows, in detail, the diagnostic and therapeutic possibilities for the relevant tests and diseases. The trainee must be able to function in all areas of the specialty without supervision

The level of competencies in relation to specific clinical problems is defined in the Logbook.

## **Basic Sciences**

Strategies and resources for acquiring the body of knowledge within the Basic Science Core Curriculum will vary among institutions but should include structured, didactic programs (courses, lectures, and seminars), recommended textbooks, reading lists, and regional and national seminars. The fund of knowledge obtained through the Basic Science Core Curriculum should serve as the foundation for understanding allergic diseases, immunodeficiencies, immunoregulatory disorders, immunodiagnostics, and therapy for allergic and immunologic disorders.

### **A. Anatomy and Cellular Elements of the Immune System**

1. Lymphoid organs - anatomy and functions
2. Cells of relevance to the immune response, their unique identifying features, and positive and negative selection during ontogeny

### **B. Immune Mechanisms**

1. Innate and acquired immunity
2. The major histocompatibility complex - molecular structure and function
3. Antigens - processing and presentation
4. Allergens - structure, epitopes
5. Immunogenetics
6. T cell mediated immunity
  - a. T cell activation - T cell receptor, epitope recognition and accessory molecules in signal transduction
  - b. Cytokines and co-stimulatory molecules in T cell activation
  - c. T cell-mediated immune responses - participating cells
7. B cell-mediated immunity
  - a. B cell activation - T cell interaction and signal transduction
  - b. Immunoglobulin production and epitope recognition
  - c. Antibody isotype and maturation of the antibody response
  - d. Biologic processes initiated by antibody. IgM, IgG, and IgA mediated, e.g. opsonization, complement fixation, antibody dependent cell-mediated cytotoxicity
  - e. IgE - structure, function, synthesis, regulation, receptors
  - f. IgE mediated immediate and late phase reaction

- g. Immune complexes - physical properties, immunologic properties and mechanisms of clearance
- h. Immunodeficiencies

8. Other immune mechanisms

- a. Natural killer cells
- b. Lymphokine activated killer cells
- c. Complement and complement deficiencies

9. Receptor ligand interactions in immune functioning - adhesion molecules, complement receptors, IgE receptors, Fc receptors. Signal transduction resulting from receptor ligand interaction. Genetic polymorphisms producing gain or loss of function.

- a. Immunologic Memory

**C. Immunomodulation in the Immune Response**

1. Cytokines, chemokines, adhesion molecules and growth factors

2. Inflammation and its modulation

- a. Mediators - preformed and newly generated
- b. Effector cells in inflammation - allergic and other
- c. Mast cells and basophils - structure, activation, preformed mediators, arachidonic acid metabolisms, prostaglandins, leukotrienes, PAF
- d. Eosinophils - structure, activation, mediators

**D. Mucosal Immunity**

1. Non-immunologic - enzymes, acids, glycocalyx, normal flora, etc.

2. Immunologic - mucosa associated lymphoid tissue, antigen processing, antibody and cellular production, cell trafficking and homing

**E. Transplantation Immunology**

1. Mechanisms of allograft rejection

2. Graft versus host reactions (GVHR)

**F. Tumor Immunology**

1. Antigens of tumor cells - unique tumor specific antigens and tumor associated antigens.

2. Oncogenes, translocations and tumor suppressor genes

3. Mechanisms of immunosurveillance

**G. Immunoregulatory Mechanisms**

1. Tolerance mechanisms

2. Idiotypic networks

3. Apoptosis

## **Clinical Sciences**

The specialty of allergy and clinical immunology encompasses three major clinical areas: allergic diseases, immunoregulatory disorders, and immunodeficiency disease. It is the intention of allergy and clinical immunology training programs to train the trainees as expert consultants and accomplished practitioners in these areas. Moreover, the scholastic approaches to maintaining the understanding and updating of the current concepts of the specialty over a professional lifetime must be instilled during the training program. It is required that each trainee be accomplished in the basic knowledge and clinical and laboratory skills required to diagnose and effectively treat allergic, immunodeficiency and immunoregulatory diseases.

The following is an outline of the diseases about which allergy and clinical immunology trainees must be knowledgeable. Training programs may vary their emphasis on the basis of mission, expertise, and resources. Each trainee must have sufficient exposure to allergic and immunologic disease entities to eventually serve as an expert consultant in the diagnosis and treatment of these disorders. It is expected that all trainees will be trained in the physiology, pathology, diagnosis, differential diagnosis, and treatment of such diseases with an understanding of the use of therapeutic modalities including mechanisms of action, dosing, adverse effects, and costs of therapy. Explicit recognition should also be given to the importance of behavioural studies and bioethics with relationship to clinical trials and appropriate use of diagnostic and therapeutic techniques.

Strategies and resources for acquiring the body of knowledge within the Clinical Science Core Curriculum will vary among institutions but should include structured, didactic programs (courses, lectures, and seminars), recommended textbooks, reading lists, and regional and national seminars. In accordance with Chapter 6 of the European Charter, it should be mixed with practical stages in the different units practising allergology and clinical immunology.

## **A. Allergic Disorders**

### **GENERAL ASPECTS**

- Epidemiology of allergic diseases - environment
- Prevalence and incidence of allergic diseases
- Risk factors for allergic diseases
- Genetics of allergic diseases
- Allergens - concept of protein families (profilin, lipocalins, PR proteins etc.), natural sources, physicochemical properties and relevance to disease, cross reacting allergens, haptens and small molecular compounds, recombinant allergens, aerobiology

### **DIAGNOSTIC PROCEDURES**

The level of competencies in relation to specific clinical problems is defined in the Logbook. In certain circumstances the number of procedures to perform will be defined in the Logbook. It is the responsibility of the tutor/educational institute to ensure the quality of the training and to make certain that the trainee fulfills the educational requirements. The list does not pretend to be complete and does not exclude other presently used or new tests.

## 1. Skin testing

- a. Skin prick test:
  - *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform skin prick tests
- b. Intradermal skin test:
  - *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness, immediate and late phase reaction
  - *Practical:* Perform intradermal skin tests
- c. Patch test:
  - *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness, immediate and delayed type reaction
  - *Practical:* Perform patch tests
- d. Delayed type skin tests with recall antigens:
  - *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness, immediate and late phase reaction
  - *Practical:* Perform intradermal skin tests

## 2. Nasal examinations

- a. Anterior nasal examination (speculum):
  - *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform anterior nasal examinations with speculum
- b. Nasal endoscopy examination:
  - *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness, immediate and late phase reaction
  - *Practical:* Perform nasal endoscopy examinations (optional)
- c. Rhinomanometry:
  - *Theoretical:* Principles of the test, indications, contraindications, interactions

by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness, immediate and late phase reaction

- *Practical:* Perform rhinomanometry (optional)

### 3. Pulmonary tests

a. Peak flow:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform peak flow registrations

b. Spirometry:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform spirometry registrations

c. Whole-body plethysmography, airway resistance, and diffusion:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform whole-body plethysmography registrations (optional)

d. Bronchoalveolar lavage:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform bronchoalveolar lavage (optional)

e. Induced sputum:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform induced sputum

### 4. Provocation tests

a. Conjunctival allergen provocation test:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform conjunctival allergen provocation tests

b. Nasal non-specific provocation test:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
- *Practical:* Perform nasal non-specific provocation tests

c. Nasal allergen provocation test:

- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform nasal allergen provocation tests
- d. Bronchial non-specific provocation test:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform bronchial non-specific provocation tests
- e. Bronchial allergen provocation test:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform bronchial allergen provocation tests
- f. Food challenges:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform food challenges
- g. Drug challenges:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform drug challenges
- h. Occupational allergen exposure test:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform occupational allergen exposure tests
- i. Living insect sting challenges:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform living insect sting challenges (optional)
- j. Exercise provocation tests:
- *Theoretical:* Principles of the test, indications, contraindications, interactions by food, drugs and diseases, side-effects, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform exercise provocation tests
- k. Physical provocation tests (cold, heat, pressure):
- *Theoretical:* Principles of the test, indications, contraindications, interactions by drugs and diseases, side-effects, reproducibility, sensitivity,

- *Practical:* specificity and predictive value, cost-effectiveness  
Perform physical provocation tests

## 5. Allergen environmental examinations

- a. Allergen environmental examinations (house dust mites, animal danders etc.):
  - *Theoretical:* Principles of the test, indications, reproducibility, sensitivity, specificity and predictive value, cost-effectiveness
  - *Practical:* Perform allergen environmental examinations

## LABORATORY MEASUREMENTS

1. Techniques: understanding of the principles and methodology of these techniques, particularly as they relate to measurement of immunoglobulin levels, immunoglobulin classes and subclasses, specific antibodies, lymphocyte phenotyping, cellular response to mitogens, antigens and allogenic cells, immune complexes, cryoprecipitable proteins, total serum complement activity, complement components, and histocompatibility typing.
  - a. Serologic: ELISA, radioimmunoassay, *in vitro* diagnostic tests (e.g., RAST, histamine release), radial immunodiffusion, nephelometry, immunoblots, high performance liquid chromatography, isoelectric focussing, immunoelectrophoresis, electroimmuno-diffusion, and protein electrophoresis.
  - b. Cellular: flow cytometry, assays of chemotaxis, phagocytosis, cytolysis, lymphocyte proliferation, immunoglobulin production
  - c. Immunofluorescence and immune histochemistry
  - d. Northern, Southern, Western blots; polymerase chain reactions; crossover break-point analysis; ligase chain reactions; in situ hybridization
  - e. Hybridomas and monoclonal antibodies
  - f. Other relevant tests
2. Test-performance characteristics: principles of sensitivity, specificity, and predictive value as well as cost-effectiveness

## THERAPEUTIC MODALITIES

- a. Allergen avoidance (reduction)
  - *Theoretical:* Rational for intervention, indications, cost-effectiveness
  - *Practical:* Perform allergen avoidance interventions
- b. Allergen-specific immunotherapy
  - *Theoretical:* Principles of the treatment, different induction regimens, allergen extracts, indications, contraindications, interactions by drugs and diseases, side-effects, preventive capacity, long-term capacity, cost-effectiveness
  - *Practical:* Perform induction and maintenance treatments (both patients allergic to inhalant allergens and *Hymenoptera* venoms)
- c. Pharmacotherapy with antihistamines, theophylline,  $\forall$  and  $\exists$  agonists, sympathomimetics, calcium channel blockers, cromones, anticholinergics, corticosteroids,

leukotriene antagonists, immunosuppressors, mucolytics, antibiotics, local dermatological therapy, and newly introduced drugs

- *Theoretical:* Principles of the treatment with drugs, indications, contraindications, interactions by other drugs and diseases, step up and step down treatment, side-effects, therapeutic capacity, cost-effectiveness
- *Practical:* Be responsible for the pharmacological treatment of patients including handling of adverse effects

d. Allergenic extract preparation

- *Theoretical:* Principles of the preparation of allergen extracts

## RESEARCH PRINCIPLES

1. Ethics, e.g. Declaration of Helsinki
2. Experimental design and good clinical practice
3. Data analysis and biostatistics
4. Epidemiology
5. Grant writing

## SPECIFIC DISEASES

Some of the mentioned diseases are diagnosed by allergologists/clinical immunologists but treated by other specialists or in cooperation with other specialists. The practical knowledge for all diseases mentioned includes treatment, management of possible treatment-related adverse effects, and patient education. The level of competencies in relation to specific clinical problems is defined in the Logbook. Diseases marked with an “\*” are only relevant in countries where allergology and clinical immunology is practised as a single specialty.

### 1. Upper airway diseases

a. Rhinitis

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Assessment of nasal secretions; understanding of indications for and methodology of nasal challenges; assessment of ciliary function; rhinoscopy; nasal examination; assessment of radiographic examination including computerized enhancement, environmental assessment

b. Sinusitis

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Rhinoscopy; nasal examination; assessment of radiographic examination including computerized enhancement

- c. Nasal polyposis
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Assessment of ciliary function; rhinoscopy; nasal examination; assessment of radiographic examination including computerized enhancement
- d. Otitis media (bacterial and serous)
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Ear examination; assessment of radiographic examination including computerized enhancement, and tympanometry
- e. Laryngeal disorders
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Laryngoscopy

## 2. Eye diseases

- a. Conjunctivitis
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Inspection of the conjunctiva
- b. Iritis, iridocyclitis\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Eye examination in cooperation with an ophthalmologist
- c. Keratoconjunctivitis sicca\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Eye examination in cooperation with an ophthalmologist

## 3. Skin diseases

- a. Urticaria and angioedema
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Cutaneous examination, immediate hypersensitivity skin tests, tests for physical urticaria, autologous serum skin test, skin biopsy and immunohistology
- b. Atopic dermatitis

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Cutaneous examination, immediate hypersensitivity skin tests, atopy patch test and food challenge
- c. Contact dermatitis
- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Cutaneous examination, (photo) patch testing, intradermal skin tests and application test
- d. Mastocystosis
- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Cutaneous examination, skin biopsy, tryptase and histamine metabolites. Often treated in cooperation with other specialists.
- e. Drug rashes
- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Cutaneous examination, patch testing, drug skin testing and *in vitro* tests
- f. Hypersensitivity reactions (e.g., hypersensitivity vasculitis and other immunologic skin disease)
- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Cutaneous examination, patch testing, immediate hypersensitivity skin tests, skin biopsies

#### 4. Lower respiratory tract disease

- a. Asthma (allergic, exercise-induced, sulfite-related, aspirin-induced, occupational, menstrual cycle related, infection-related, and intrinsic)
- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Chest examination, pulmonary function testing, bronchial challenges, sputum analysis, and interpretation of bronchoscopy and bronchial lavage and of radiographs
- b. Allergic bronchopulmonary aspergillosis
- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Chest examination, precipitating antibodies test performance characteristics, pulmonary function testing, bronchial

challenges, sputum analysis, and interpretation of bronchoscopy and bronchial lavage and of radiographs

c. Hypersensitivity pneumonitis

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Chest examination, precipitating antibodies test performance characteristics, pulmonary function testing, bronchial challenges, sputum analysis, and interpretation of bronchoscopy and bronchial lavage and of radiographs

d. Chronic obstructive pulmonary disease

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Mostly treated by other specialists

e. Cystic fibrosis

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Mostly treated by other specialists

f. Immotile cilia syndrome

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Mostly treated by other specialists

g. Sarcoidosis

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Mostly treated by other specialists

h. Chronic cough syndrome

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Treated in cooperation with other specialists

## 5. Drug hypersensitivity

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
- *Practical:* Drug skin testing and *in vitro* tests, patch test, challenge tests (oral, intravenous, intramuscular, subcutaneous), desensitizing protocols

## 6. Adverse reactions to ingestants

- a. Food allergies and intolerance
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Food allergen skin testing, food allergen challenge tests (open and placebo-controlled, double-blind), combined food challenge and exercise tests, prescription of adequate diets
- b. Food-additive reactions
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Food-additive challenge tests (open and placebo-controlled, double-blind)
- c. Gluten sensitivity
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Diagnostic test for gluten enteropathy
- d. Gastrointestinal eosinophilic diseases
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Food allergen skin testing, food allergen challenge tests (open and placebo-controlled, double-blind)

## 7. Anaphylaxis

- a. Anaphylaxis (allergen-induced, related to blood products, exercise-induced, menstrual-related, idiopathic, drug-related, and radiocontrast media-induced)
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Emergency treatment, testing for responsible allergen, e.g. peanuts, penicillin, latex, etc., challenge tests, prophylaxis

## 8. Insect venom hypersensitivity

- a. Stinging insect reactions
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Venom skin testing, instruction in emergency treatment, allergen-specific immunotherapy
- b. Biting insect reactions
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, dosing, adverse effects, and costs of therapy
  - *Practical:* Venom skin testing, instruction in emergency treatment,

symptomatic treatment

## B. Immunodeficiency diseases

Knowledge of immunodeficiency diseases and relevant tests is an essential component of allergy/clinical immunology training programs, and allergy and clinical immunology trainees should be exposed to and be familiar with the following diseases, their pathophysiology, differential diagnosis and their treatment. Not all immunologic diseases are diagnosed and treated by allergologists and clinical immunologists but also by other specialists. The level of competencies in relation to specific clinical problems is defined in the Logbook.

### 1. Complement deficiencies

- a. Hereditary and acquired angioedema
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of quantitative and functional C-1-esterase inhibitor tests, complement C3, C4, C1q, investigation of mutations
- b. Complement-component deficiencies
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of complement test results

### 2. Primary immunodeficiencies

- a. Severe combined immunodeficiency, DiGeorge syndrome, adenosine deaminase deficiency, ataxia telangiectasia, Wiskott-Aldrich syndrome, Netherton syndrome, congenital X-linked agammaglobulinemia, selective IgA deficiency, IgG subclass deficiencies, hyper-IgE syndrome, hyper-IgM syndrome, common variable immunodeficiency\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Assessment for thymic shadow, assessment of recurrent serious infections, immunoglobulin level interpretation, functional antibody interpretations, lymphocyte subpopulation and function, and delayed skin test performance and interpretation.

### 3. Acquired immunodeficiencies

- a. Acquired immunodeficiency syndrome, chromosomal defects, metabolic defects, immunosuppression, viral infections, parasitism, malnutrition, malignancies, autoimmune diseases, burns, splenectomy, and radiation\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of human immunodeficiency virus tests (ELISA

and Western blot), PCR testing, lymphocyte subpopulation and function

#### 4. Phagocytic cell disorders

- a. Chronic granulomatous disease of childhood, myeloperoxidase, deficiency, leukocyte-adhesion disorder (types 1 & 2), Chediak-Higashi syndromes, hyper-eosinophilic syndromes, and mastocytosis\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Assessment of leukocyte function, chemiluminescence test interpretation, surface glycoprotein tests (e.g. CD11a, b, c, and CD18) phenotype interpretation, chemotaxis assay interpretation, and absolute neutrophil count interpretation, superoxide generation, NBT testing

### C. Immunoregulatory Disorders

#### 1. Autoimmunity

- a. Organ and non-organ autoimmune diseases such as: systemic lupus erythematosus, other collagen-vascular diseases (connective tissue disease), immune endocrine-pathies, inflammatory gastrointestinal diseases, immunologic neuropathies and neuromuscular diseases, immuno-hematologic diseases, and immunologic eye diseases, etc.\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of physical findings; interpretation of autoantibody test results (including but not limited to) antinuclear antibody, anti-DNA, anti-Rho, and anti-La, anti-intrinsic factor, anti-parietal cell antibody, anti-receptor antibodies, anti-myelin antibody, anti-neutrophil antibody, and anti-phospholipid antibodies

#### 2. Vasculitis

- a. Small vessel disease, medium vessel disease, large vessel disease, pulmonary and renal immune disease, and cryoproteins\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of physical findings, interpretation of biopsy specimens of skin, kidney, and lung (immunofluorescence), interpretation of circulating immune complex levels, interpretation of cryoglobulins and autoantibodies

#### 3. Transplantation and GVHRs

- a. Pharmacologic modulation and Immunomodulation of GVH reactions following transplant\*

- *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
- *Practical:* Diagnosis and treatment normally undertaken by other specialists

#### **4. Immune-related malignancies**

- a. Plasma cell dyscrasia, multiple myeloma and gammopathies\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of serum protein electrophoresis, interpretation of immunoelectrophoresis, interpretation of serum immunoglobulin levels, and interpretation of lymphocyte subset data. Treatment normally undertaken by other specialists

#### **5. Immune reproductive defects**

- a. Infertility (male and female), abortion (chronic), Rh incompatibility, ABO incompatibility, secondary reproductive defects\*
  - *Theoretical:* Physiology, pathology, diagnosis, differential diagnosis, and treatment including mechanisms of action, adverse effects, and costs of therapy
  - *Practical:* Interpretation of anti RH/AB antibody levels and interpretation of appropriate autoantibodies

#### **6. Immunomodulation**

- a. Immunosuppressants
- b. Immune reconstitution
- c. Gammaglobulin and monoclonal antibodies
- d. Cytokine receptors and receptor antagonists
- e. Vaccines
- f. Plasmapheresis and cytopheresis
- g. Recombinant molecules