

SMBWO: Immunology Programme Regulations

Regulations for the Immunology programme in connection with the General Regulations of the Foundation for Biomedical Scientific Research Training (SMBWO).

I. IMMUNOLOGY PROGRAMME GENERAL TERMS AND REGULATIONS

1. Objective

The programme is intended to train scientifically educated and methodologically trained immunologists for immunological research in Medicine, Biomedical Sciences and Medical Biology, within the context of 'continuing education', i.e. after a university '*doctoral*' or Master's degree has been obtained. The general training requirements, the specific training requirements (including the conditions set for the local Immunologists responsible for the education) and the establishment of a Board of Inspection and Assessment (CTB) will be provided for in accordance with Articles D, E and F respectively of the SMBWO's General Requirements.

2. Preparatory training

The SMBWO Immunology programme is open to candidates who have obtained a doctoral or university Master's degree in a specialisation related to Life Sciences.

If the degree was obtained in a foreign country, the candidate must demonstrate that the degree is equivalent to the degree of the corresponding university programme at a Dutch university according to the applicable international agreements. If such an agreement is not applicable, the Immunology CTB will take a binding decision on whether the candidate may be admitted to the programme based on a detailed description to be provided by the candidate of the training received in the required supporting subjects and the general scientific education.

Explanation

PhD students (appointed by universities or research centres, and including students on scholarship and clinical research trainees) working in an institute with a recognised Immunology training unit will primarily be eligible for the Immunology programme.

If a degree obtained in a foreign country must be evaluated, the candidate will utilise Nuffic (the Dutch organization for internationalisation in education) for this. Any costs associated with this evaluation will be paid by the candidate. If necessary, the Immunology CTB will also obtain information from Nuffic about evaluating university degrees obtained in foreign countries.

3. Curriculum

The SMBWO programmes are profession-oriented programmes to train individuals as biomedical scientific researchers. The Immunology programme is one of the SMBWO-recognised programmes and ties in with university doctoral or Master's degrees related to the Life Sciences. The SMBWO Immunology programme is given by several university medical (or other) centres in the Netherlands, under the guidance of a local Immunologist responsible for the education. who has been appointed by the SMBWO on the Immunology CTB's recommendation.

The Immunology biomedical scientific researcher programme consists of three elements;

- 1: potential extra training in supporting subjects and supplementary general scientific education (see Article 3.1);
- 2: theoretical and experimental training in Immunology (see Article 3.2); and
- 3: a period for scientific research in Immunology (see Article 3.3).

After a total programme duration of at least three years, the programme will be completed with the candidate's writing a PhD thesis and obtaining a PhD degree.

Explanation

'Continuing education' in Immunology can be obtained at every university. An Appendix to these Regulations includes an overview of the university medical (or other) centres where the SMBWO Immunology programme is given and of the local Immunologist responsible for the education. This overview will be updated regularly. With regard to the first two elements of the Immunology programme mentioned above, each candidate must be supervised by a local Immunologist responsible for the education, who will monitor the training programme and the progress and will report to the Immunology CTB on this.

3.1 Training in supporting subjects and general scientific education

Insofar as this did not occur (or not sufficiently) as part of the doctoral programme or university Master's programme (see under Article 2), the candidate will need to be trained in the supporting subjects Human Physiology, Cell Biology and Histology, Biochemistry, Genetics, Microbiology, General Pathology and Statistics and in elements of general scientific education, such as writing research proposals, giving oral and written presentations in English, and Epidemiology (see Part II: Learning Outcomes, Section 2). This training in supporting subjects and the general scientific education need not be completed before the specific training in Immunology and the scientific research have begun.

Before a candidate starts the programme, the candidate will provide the a local Immunologist responsible for the education with detailed information about the training received during the university preparatory programme in the supporting subjects and the general scientific education. The candidate will complete the SMBWO Immunology programme registration form. The a local Immunologist responsible for the education will make sure that the registration form is complete and will send it to the Immunology CTB. The CTB will assess this information and will indicate for which components additional training is necessary.

Explanation

Obviously, this training programme is differentiated in nature, being determined by the candidate's preparatory training programme. For purposes of the required training in supporting subjects and elements of general scientific education, the specialisation 'Research' of the Dutch university preparatory programmes in Biomedical Sciences and Medical Biology will be used as a frame of reference.

All candidates wishing to follow the programme must provide the a local Immunologist responsible for the education with a detailed overview of their training in the supporting subjects and the general scientific education. Based on this overview, the Immunology CTB will assess whether, and if so, for which supporting subjects and/or elements of general scientific education supplementary training is needed. If the amount of necessary supplementary training is considerable, the Immunology CTB can ask the candidate to consider not taking part in the SMBWO Immunology programme.

If applicable, it is recommended that the general portion of the programme, that is, supplementary training in the supporting subjects (if necessary) and general scientific education (insofar as this was not part of the university preparatory programme) be concentrated on during the first two years of the 'continuing education'.

3.2 Theoretical and experimental training

The programme includes extensive theoretical training in Immunology at a higher level than discussed in the university preparatory programme, and training in immunological techniques. A thorough, broad knowledge of Immunology will be gained through studying a comprehensive textbook. Integration of this knowledge and dealing with it in a critical, creative manner will occur during various activities for the scientific training in Immunology. The theoretical knowledge will be broadened through the acquisition of skills in performing techniques used in immunological research.

After the programme ends, the candidate must possess the level of theoretical knowledge in Immunology and of technical skills described in the Learning Outcomes for the 'continuing education' programme in Immunology (see Part II: Learning Outcomes, Section 3/4).

3.3 Scientific research

Besides the elements referred to under Article 3.2, the scientific education in Immunology consists of conducting scientific research in Immunology for a period of at least three years. The research project (PhD research) need not be performed in whole or in part within one of the training units for SMBWO Immunology. In addition, before the programme starts, the assistant researcher's research project will be submitted by the a local Immunologist responsible for the education to the Immunology CTB for an assessment of the immunological character of the project. The title of the research project and a brief description of the research question and the experimental approach will be stated in the registration form for the SMBWO Immunology programme. The research must result in a PhD thesis and several publications in internationally recognised scientific journals in accordance with Article D.2 of the SMBWO's General Regulations.

Explanation

The scientific education will be obtained during a period of active scientific research as a PhD student or otherwise. The research may be fundamental or applied research, but must be of such a theoretical, experimental and innovative nature that scientific immunological education is guaranteed. The Immunology CTB will review this before the programme starts. The candidate can thereby be informed at an early stage of the research whether the research period may be considered part of the SMBWO Immunology programme. It should be noted that the CTB cannot and does not want to exert any influence whatsoever on the content and programming of the research. The project manager or PhD supervisor will be fully responsible for this.

The candidate must have published at least four articles as the lead author, or three articles as the lead author and two articles as a co-author, in Immunology in international, peer-reviewed scientific journals (see Part II: Learning Outcomes, Section 5). Proof of acceptance must be submitted for publications which have been accepted, but not yet published, at the time that the application for recognition as an SMBWO Immunologist is submitted. Together, the candidate and a local Immunologist responsible for the education will check whether there are enough articles before the application for recognition is sent.

The PhD thesis needs to have been defended before the final application for recognition as an SMBWO Immunologist is submitted.

4. Assessment

After the programme is completed, the candidate will fill in the application form for recognition as an SMBWO Immunologist and will go through it with the a local Immunologist responsible for the education . The Immunologist, who will have been appointed by the SMBWO on the Immunology CTB's recommendation, will check whether the statement by the candidate about the theoretical and scientific immunological training and the training in immunological techniques is accurate and complete. The form, together with a copy of the PhD thesis, will be sent by the a local Immunologist responsible for the education to the Immunology CTB. In a cover letter, the he/she will state that he/she supports the application, thus implicitly indicating that, in his/her judgment, the application form has been filled in completely and truthfully. The Immunology CTB will assess whether the training in the supporting subjects and the general scientific education fulfils the SMBWO Immunology programme's Learning Outcomes. The Immunology CTB will also assess whether the theoretical and scientific immunological training and the training in immunological techniques fulfil the Learning Outcomes. Finally, the Immunology CTB will assess whether the scientific research is sufficiently immunological in nature and whether the publications satisfy the requirements articulated in the Learning Outcomes (see Part II).

5. Diploma

Candidates with a suitable preparatory training programme who fulfil the requirements mentioned under Articles 3.1 and 3.2, have received scientific education as stated under Article 3.3 and have been given a positive assessment by the a local Immunologist responsible for the education as provided for under Article 4 will be issued an Immunology biomedical scientific researcher diploma by the SMBWO on the Immunology CTB's recommendation.

The Immunology CTB will recommend a candidate to the SMBWO after a positive assessment of the recognition application. This assessment will be based on the Learning Outcomes for the Immunology biomedical researcher 'continuing education' programme (see Part II).

6. Exceptions

Candidates with a university preparatory training programme who, after obtaining a PhD, enter into the field of Immunology must likewise fulfil all the Learning Outcomes, including a demonstrable period of at least three years in which the candidate was intensively and actively involved in Immunology research. Related to this, a list of publications must be provided which satisfies the conditions referred to under Article 3.3.

At the Immunology CTB's discretion, candidates who have completed a preparatory training programme at the higher professional education (HBO) level may be admitted to the programme in exceptional situations. It must be emphasised that they, too, must have received training in the supporting subjects and general scientific education (see Part II: Learning Outcomes, Section 2) at the doctoral or university Master's level in one of the two programmes mentioned under Article 2 (Biomedical Sciences and Medical Biology). Proof of such training in the supporting subjects at university level and of the scientific education must be provided. Before the programme starts, the a local Immunologist responsible for the education will submit the entire training programme, including the university training taken and to be taken in the supporting subjects and general scientific education, to the Immunology CTB for approval.

At the Immunology CTB's discretion and on its recommendation, the SMBWO may recognise as an Immunology biomedical scientific researcher a person who does not satisfy all of the components

referred to under Article 5 if the candidate has exceptional theoretical knowledge and practical skills in this field.

Explanation

The SMBWO may recognise people as Immunologists who have not had the training stated under Article 3 of the SMBWO Immunology Programme Regulations and as further specified in the Learning Outcomes (see Part II). This pertains to individuals for whom the Immunology CTB has recommended recognition based on the fact that they have gained thorough and sufficiently differentiated theoretical knowledge and practical skills in Immunology through their positions and also have conducted outstanding scientific research in this area that has led to publications in international, peer-reviewed scientific journals. This option may likewise be applied by way of exception to people who have received training in foreign countries which, in the Immunology CTB's judgment, is equivalent to the training described under Article 3.

7. Updating of curriculum

Every four years, each of the requirements stated in the SMBWO Immunology Programme Regulations and the Learning Outcomes will be reassessed by the Immunology CTB in light of new developments and will, where necessary, be adjusted. After approval by the SMBWO, any changes in the Regulations and the Learning Outcomes will apply to candidates commencing the programme from that date.

8. Miscellaneous

Any regulations about the programme, training institutes and local Immunologists responsible for the education will be formulated in accordance with the SMBWO's General Regulations.

II. LEARNING OUTCOMES FOR THE IMMUNOLOGY BIOMEDICAL RESEARCHER 'CONTINUING EDUCATION' PROGRAMME

1. Introduction

At the end of the SMBWO Immunology 'continuing education' programme, the candidate needs to have brought his/her training in the supporting subjects and general scientific education up to the level reflected in Article 2. Additionally, the candidate must have broad theoretical and practical knowledge of Immunology (see Articles 3 and 4) and must have specific scientific education in the Immunology field (see Article 5). This must be apparent from the formulation of a PhD thesis (relating to Immunology), resulting in the candidate's obtaining a PhD degree, and from the publication of articles in international, peer-reviewed scientific journals with an immunological bent.

The Learning Outcomes indicated below for the SMBWO Immunology programme will be evaluated periodically by the Immunology CTB and may be revised based on developments in the university education.

2. University preparatory training programme

2.1 Supporting subjects

The learning outcomes applicable to the doctoral or Master's programme for the university Biomedical Sciences or Medical Biology programmes in the Netherlands constitute the frame of reference for the supporting subjects. Candidates who have obtained a doctoraal or Master's degree in the 'Research' specialisation of one of these two university preparatory training programmes will be fully assumed to have sufficient knowledge in the supporting subjects. This will be true as well for candidates who have received degrees in foreign countries, provided the degrees have been deemed equivalent to the Dutch degrees in official, international treaties. With regards to candidates who have taken another university preparatory programme in Life Sciences in the Netherlands or elsewhere, or who have completed preparatory training in one of the two programmes mentioned in a foreign country where the programme has not been deemed equivalent to the one in the Netherlands, the Immunology CTB will determine whether supplementary training in the supporting subjects is needed and if so, for which subjects.

For each supporting subject for which supplementary training was necessary, the application form for recognition must be accompanied by proof that the training in question was completed successfully. This proof may consist of an exam slip, a certificate or a brief letter from the lecturer who administered the oral or other exam.

One or more textbooks are listed below for each supporting subject. This list is intended to indicate the required level and depth. In principle, textbooks currently indicated as mandatory core books for the relevant subjects in the study guides for Biomedical Sciences, Medical Biology or Medicine programmes at the university medical (or other) centres in the Netherlands will be sufficient.

Physiology

Principles of human physiology, as well as the physiology of blood and circulation, the respiratory system, the digestive system, the nervous system, endocrine organs and the urogenital system, as discussed, for example, in:

Medical physiology: a cellular and molecular approach, W. F. Boron and E. L. Boulpaep; Elsevier Saunders, or *Pathophysiology of disease: an introduction to clinical medicine*, S. J. McPhee, V. R. Lingappa and W. F. Ganong; McGraw-Hill.

Cell Biology / Histology / Molecular Biology

Principles of cell biology and histology, as discussed, for example, in: *Molecular biology of the cell*, B. Alberts *et al.*: Garland, or *Histology: a text and atlas with correlated cell and molecular biology*, M. H. Ross and W. Pawlina; Lippincott Williams & Wilkins.

Biochemistry

Principles of biochemistry, as discussed, for example, in: *Biochemistry*, M. K. Campbell and S. O. Farrell; Thompson Brooks/Cole.

Genetics

Basic principles of medical and molecular genetics, as discussed, for example, in: *Human molecular genetics 3*, T. Strachan and A. P. Read: Garland, or *Emery's elements of medical genetics*, P. Turnpenny and S. Ellard; Elsevier Churchill Livingstone.

Microbiology

Principles of microbiology, as discussed, for example, in: *Medical Microbiology*, P. R. Murray, K. S. Rosenthal and M. A. Pfaller; Elsevier Mosby, or *Sherris medical microbiology: an introduction to infectious diseases*, K. J. Ryan and C. G. Ray; McGraw-Hill.

Pathology

Basic principles of general pathology, including inflammatory reactions and abnormal growth. In addition, the specific pathology pertaining to auto-immune diseases, transplantation and diseases of the lympho-haematopoietic system (including leukaemias and lymphomas), as discussed, for example, in: *Robbins and Cotran pathologic basis of disease*, V. Kumar, A .K. Abbas and N. Fausto; Elsevier Saunders.

Statistics

Basic principles of medical statistics, as discussed, for example, in: *Medical Statistics at a glance*, A. Petrie and C. Sabin; Blackwell.

2.2 General scientific education

The candidate must have received demonstrable training in the following elements of general scientific education:

- **writing research proposals;**
- **giving oral and written presentations in English;**
- **research methodology: Statistics (see also 'Supporting subjects') and Epidemiology.**

If these elements were not part of the university preparatory programme, training will have to occur during the SMBWO Immunology programme.

It is desirable for the candidate to gain teaching experience in the form of theoretical and practical supervision of students regarding research internships and writing the initial draft for a student project.

3. Theoretical knowledge of Immunology

This general theoretical education in Immunology encompasses two aspects:

3.1 Thorough and integrated theoretical knowledge of Immunology

The candidate must have a thorough, integrated knowledge of Immunology, such that molecular and cellular mechanisms may be connected with the functioning (and malfunctioning) of cells and organs and with clinical pictures in which the immune system plays a role. This knowledge may be acquired at the desired level through integral study of the 'subject matter' dealt with in the most recent versions of textbooks such as:

- *The immune system*, P. Parham; Garland;
- *Immunology*, D. Male, J. Brostoff, D. B. Roth and I. Roitt; Elsevier Mosby;
- *Cellular and molecular immunology*, A. K. Abbas and A. H. Lichtman; Elsevier Saunders;
- *Immunobiology: the immune system in health and disease*, C. A. Janeway, P. Travers, M. Walport and M. Shlomchik; Garland.

3.2 Scientific training in Immunology

The knowledge acquired under 3.1 will be the basis for further scientific education in Immunology. This education will take the form of active participation in activities as indicated below:

- participation in courses in advanced Immunology organised at various training institutes;
- frequent participation in lecture series organised at various training institutes;
- participation in specific courses, courses in selected topics, mini-symposiums and master classes;
- conducting working visits to research groups in the Netherlands and foreign countries;
- participation in the Lunteren Symposium and the Annual Meeting organised each year by the Dutch Society for Immunology (NVVI);
- participation in national and international scientific conferences in areas overlapping with Immunology (preferably, active participation in the form of giving a poster or oral presentation).

The forms accompanying the application for recognition must include a detailed overview of the activities in connection with the general scientific training in Immunology. 'Credit points' will be associated with each activity. Broadly speaking, the rule of thumb will be that one credit point will be earned per hour and six credit points per day.

At least 176 credit points must be earned during the programme period of at least three years. The overview given below shows activities which fall under the scientific education in Immunology. There are mandatory and elective components. During the SMBWO Immunology programme period, the following components will be mandatory in the programme. A course in advanced Immunology (lasting at least two weeks) must be taken. The candidate must also participate in the NVVI's Lunteren Symposium or Annual Meeting at least twice. To achieve a balanced distribution across the various activities, the minimum required number of credit points for each activity is indicated.

- Course in advanced Immunology (30 points/week):	60
- Participation in Immunology lecture series (1 point/hour):	40
- Participation in specific courses, courses in selected topics, mini-symposiums and master classes (6 points/day):	24
- Participation in the NVVI Lunteren Symposiums (6 points/event):	12
- Participation in the NVVI Annual Meeting (12 points/event):	24
- Participation in national or international scientific conference (6 points/day):	36
- Active participation in the form of a poster (5 points/presentation):	10

The local Immunologist responsible for the education will be responsible for correctly indicating these activities in the application form for recognition.

4. Experimental knowledge of and skills in Immunology

Experimental skills and familiarity with a wide range of techniques will be acquired through brief internships, in which the candidate will learn about various immunological topics and will gain some practical experience with various techniques regularly used in immunological research. These brief internships may take place in different laboratories of the candidate's own immunological training unit or own training institute, as well as elsewhere. After completing these, the candidate must have an independent command of a sufficient number of techniques from each of the categories mentioned below. In addition, he/she must have gained course-related/practical or theoretical knowledge of the other techniques listed in the overview below.

4.1 Techniques associated with the experimental training in Immunology

During the programme, the candidate must acquire extensive theoretical and practical knowledge of a large number of techniques from the following categories. The local Immunologist responsible for the education must ensure that the candidate has gained the requisite degree of knowledge regarding the technique concerned, which can be differentiated into independent, practical performance of the technique and theoretical mastery of the technique; **(A)** the candidate has a theoretical understanding of the technique and has performed it himself/herself and **(B)** the candidate has a theoretical understanding of the technique and has seen someone else perform it.

Set of techniques which must be mastered theoretically and/or practically and theoretically:

I. Antibody detection and other serological/humoral analyses.		no	yes
ELISA, including antigen-capture (Sandwich) ELISA	A	-	+
Coombs test	B	-	+
Generation of monoclonal and polyclonal antibodies	A	-	+
Nephelometric techniques	B	-	+
Immunofluorescence (direct/indirect)	A	-	+
Confocal immunofluorescence microscopy	B	-	+
Immunohistochemistry	B	-	+
Immunoblotting (Western blots/Line blots)	A	-	+
Determination of circulating IgG, IgA, IgM, subclasses Ig	B	-	+
Free Light Chain assay	B	-	+
M-protein assay	B	-	+
Luminex-based assays	A	-	+
Determination of classical, alternative and lectin pathway; C3, C4, C1q	B	-	+
Cytokine assays	B	-	+
ANA detection and assessment of ANA patterns	A	-	+
Anti-dsDNA and anti-ENA detection	B	-	+
Rheumatoid factor and anti-CCP detection	B	-	+
ANCA detection	B	-	+
Detection of organ-specific antibodies (at least three organs)	B	-	+
II. Cellular techniques			
Flowcytometry	A	-	+
Detection of different lymphocyte subsets	A	-	+
ELISPOT assays	B	-	+
Cytokine staining using flowcytometry	B	-	+
Stimulation of lymphocytes, polyclonal or antigen-specific	B	-	+
Demonstration of antigen-specific T cells through HLA tetramers	B	-	+
Analysis of T-cell diversity	B	-	+
III. Molecular techniques			
Polymerase chain reaction (PCR)	A	-	+
Sequencing	B	-	+
Molecular HLA-typing (for example, B27, DRB1 'shared epitope')	A	-	+
Quantitative mRNA detection	B	-	+
Gene silencing (transcriptional & post-transcriptional)	B	-	+
Whole genome sequencing	B	-	+
SNP analysis	B	-	+

IV. Technical laboratory management

Setting up new technique / replacing old technique, including clinical and laboratory validation	B	-	+
Basic principles of internal and external quality assurance	B	-	+
Principles of applied diagnostic statistics	B	-	+

V. In vivo tests

Tuberculin test (also in relation to in vitro tests)	B	-	+
Immediate type hypersensitivity	B	-	+
Delayed type hypersensitivity	B	-	+
Arthus reaction	B	-	+
Vaccination response	B	-	+

4.2 Medical Immunology internship

An internship of at least 6 half-days (4 hours = 24 hours in total) in a medical immunological laboratory is a mandatory component of the experimental training in Immunology. This internship is not intended as a prelude to the Medical Immunologist programme. The purpose of this internship is two-fold: (a) providing a means to acquire theoretical and practical knowledge of some of the techniques referred to under Section 4.1 and (b) **interpreting diagnostic results in the context of a clinical question.**

The following elements must be part of this internship:

- Sample collection and routing of the sample to the medical immunological laboratory;
- receipt, processing and storage of materials;
- various tests which are common in medical immunological laboratories;
- processing results and reporting to clinic;
- quality assurance and accreditation.

The medical immunological laboratory may be an independent unit, but may also be a unit of a central clinical chemical/haematological laboratory.

4.3 Techniques for animal experiments/human clinical trials

The candidate will be considered to have sufficient expertise in this category if he/she has obtained the certificate in animal experimentation in accordance with Article 9 of the Dutch Experiments on Animals Act or successfully passed the examination of the Basic course for clinical investigators (BROK®).

Candidates who have not been able to obtain these certificates because of the discipline studied during their university preparatory programme or because of their HBO preparatory programme may suffice with proof of participation in relevant course/s.

5. Scientific education in Immunology

5.1 Publications

The candidate must have published at least four articles as the lead author, or three articles as the lead author and two articles as a co-author, in the Immunology field in international, peer-reviewed scientific journals (or have had such articles accepted by such journals). Candidates commencing the SMBWO Immunology programme after their PhD research must likewise furnish a list of publications regarding immunological research which satisfies the aforementioned conditions.

The Immunology CTB will assess the publications substantively for their immunological content. Of the articles included in the PhD thesis, at least 60% must be immunological in nature. The level of the scientific journals in which the articles were published will be looked at as well. As to the latter, the Journal Citation Reports adopted by the ISI Web of Knowledge will be the point of departure. The sum of the publications' impact factor must be at least 10.0.

5.2 PhD thesis

The application for recognition as an SMBWO Immunologist must be accompanied by a copy of the PhD thesis for obtaining the PhD degree.

These Learning Outcomes for the SMBWO Immunology programme will take effect on **1 May 2016**. Candidates who have registered with the Immunology CTB and have started the SMBWO Immunology programme prior to that date will fall under a transitional scheme. This scheme will apply for four years and will entail that the previous version of the Learning Outcomes will be utilised in assessing these people's applications for recognition as SMBWO Immunologists.

Appendix to SMBWO Immunology Programme;

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