

# OMAN MEDICAL SPECIALTY BOARD




المجلس العماني للاختصاصات الطبية

## RESIDENCY TRAINING PROGRAM OMAN FELLOWSHIP IN HEMATOPATHOLOGY CURRICULUM

2007

# OMAN FELLOWSHIP IN HEMATOPATHOLOGY

 <b>Table of Content</b>	<b>Page #:</b>
1. Introduction	1
2. Overall Scheme of Program	2
3. Vision	3
4. Mission	
5. General Objectives	
6. Specialty Admission Requirements	
7. Structure of Training Program	4-42
▪ Duration of Program	
▪ Outline Rotations	
▪ Specific objectives for each rotation	
▪ Graded responsibilities for each academic year as outlined above.	
▪ Contents of the Program & detailed Syllabus of the Training program.	
▪ Log Book	
8. Courses, Conference & Workshops Required	42
9. External Electives	
10. Research Requirements	
11. Participating Training Centers	
▪ Sultan Qaboos University	
▪ Royal Hospital	
▪ Central Blood Bank	
12. Members of Teaching Faculty	43
13. Examination Outline	
▪ Board Examinations	44
▪ Details	
▪ End of Year Examination	
14. Evaluation	45
15. Exit Qualifications	
16. Specific Requirements for OMSB Accreditation for Training.	46
▪ Laboratory Hematology	
17. Resident Evaluation Forms	47-51
▪ Monthly Residents Evaluation	
▪ Rotation Monthly Evaluation	
▪ Rating	
▪ Consultant/Staff Evaluation	

# OMAN FELLOWSHIP IN HEMATOPATHOLOGY

## CURRICULUM

### 1. Introduction and Definition of Hematopathologist:

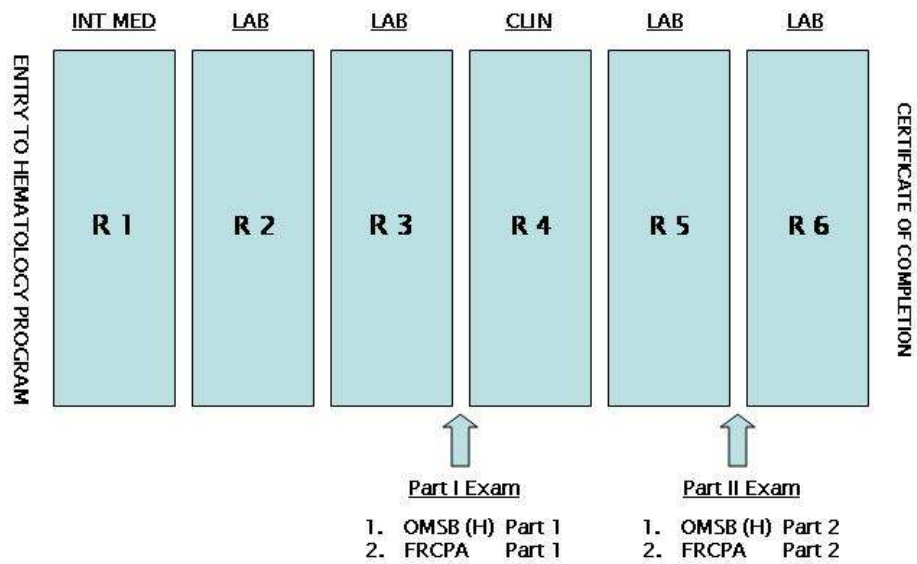
Hematopathology is that domain of laboratory medical practice and science involved with the study, investigation, diagnosis and therapeutic monitoring of diseases of the blood, blood-forming elements, hemostasis and immune function in adults and children. The specialty also encompasses the direction and supervision of transfusion medicine services both at hospital and blood center level, ensuring safe and effective transfusion management for patients. The practice of hematopathology requires an in depth knowledge of the basic sciences (immunology, biochemistry, molecular biology, molecular pathology, genetics) related to the specialty which are an essential foundation for the provision of expert knowledge in the morphology of blood and hematopoietic/lymphoid organs, immunohematology, hemostasis and general hematology. The specialty also encompasses expertise in instrumentation, quality management systems, administrative and regulatory guidelines related to the directorship and management of diagnostic laboratory resources.

Specialists in hematopathology will have the knowledge and understanding of clinical medicine required in order to provide appropriate consultation in relation to the investigation and monitoring of clinical disorders affecting the blood elements, blood forming organs, hemostatic function and transfusion therapy. In order to understand and contribute to the development of standards and guidelines for optimal utilization of diagnostic laboratory investigations and blood / blood product transfusions, specialists in hematopathology will have particular competence in critical appraisal using clinical and medical informatics literature and utilization data. Those working in the discipline must be committed to its advancement through research and advocacy, to the maintenance of the highest quality service, and to the provision of continuing education for physicians, laboratory personnel, other health care workers, patients and the public.

2. OVERALL SCHEMA OF PROGRAM

OMSB: Oman Fellowship in Hematopathology

OVERALL SCHEME OF PROGRAM



3. **VISION**

The hematology training program will develop and strive to produce well qualified specialists who will provide the highest quality hematological services to the country.

4. **MISSION STATEMENT**

To develop specialists who will be able to diagnose, manage and prevent blood diseases in the individual and the community with competence, compassion, effective communication and management skills. These specialists will also be committed to excellence and be motivated to continuously upgrade themselves and conduct useful research in their discipline.

5. **GENERAL OBJECTIVES**

The general objectives of the Oman hematopathology fellowship program are to graduate a competent hematopathologist who will:

- a. Acquire knowledge and skills in the diagnosis and interpretation of hematological laboratory investigations.
- b. Be able to diagnose and manage common hematological disorders.
- c. Acquire skills required for teaching and research.
- d. Work as a team person liaising with the clinical and laboratory staff.
- g. Acquire sound management skills

6. **SPECIALTY ADMISSION REQUIREMENTS**

- 6.1 Successful completion of undergraduate medicine (MD or equivalent).
- 6.2 Completion of internship.
- 6.3 Pass a written entrance exam if deemed necessary by the Scientific Committee.
- 6.4 Pass an interview.

7. **STRUCTURE OF TRAINING PROGRAM**

7.1 Duration of Program

The duration of the program will be 6 years.

7.2 Outline of Rotations

**YEAR 1 (R-1) Internal Medicine**

Infectious Disease	2 months
Respiratory Disease	2 months
Oncology	2 month
Others	5 months
Leave	1 month

**YEAR 2 -Lab. (R-2)**

1. General Hematology	4 months
2. Hemostasis and Thrombosis	2 months
3. Hemoglobinopathies	2 months
4. Transfusion Medicine	3 months
Leave	1 month

**YEAR 3 -Lab. (R-3)**

1. General Hematology	3 months
2. Flowcytometry	1 month
3. Cytogenetics & Molecular Medicine	2 months
4. Histopathology	2 months
5. Biochemistry	1 month
6. Transfusion Medicine	2 months
Leave	1 month

#### **YEAR 4- Clinical. (R-4)**

Adult Clinical Hematology	6 months
Thalassemia Program	1 month
Pediatric Clinical Hematology	3 months
Bone Marrow Transplant Service	1 month
Leave	1 month

#### **YEAR 5- Lab. (R-5)**

1. Research	6 months
2. Transfusion Medicine	1 month
3. General Hematology	2 months
4. Hemostasis, Thrombosis and hemoglobinopathies	2 month
5. Leave	1 month

#### **YEAR 6 –Lab. (R-6)**

#### **LABORATORY (Mandatory Abroad)**

#### **7.3 Specific objectives and contents of each rotation**

##### **7.3.1 *YEAR 1 Internal Medicine (R1)***

#### **OBJECTIVES**

The objective of this rotation is to provide the candidate with an exposure to the relevant specialties of internal medicine. Specifically the candidate should acquire a broad knowledge of internal medicine, be able to recognize and manage general medical emergencies and appreciate the hematological manifestations of systemic disease.

#### **DURATION**

The duration of this rotation is 12 months

#### **INSTITUTIONS**

SQUH & RH

#### **DETAILS**

As per general medicine R1 program. However rotations should include infectious disease, respiratory disease and oncology.

## 7.3.2 YEAR 2- Laboratory (R2)

### 7.3.2.1 General Hematology

#### **OBJECTIVES**

During this training period the trainee will understand the functioning of the general hematology laboratory, learn the special investigations done in this section, develop a clear understanding of automated blood cell analyzers and acquire basic skills in morphology so as to be able to interpret peripheral blood and bone marrow slides.

#### **DURATION**

The duration of this rotation in the second year will be 12 weeks.

#### **INSTITUTIONS**

SQUH & RH

#### **DETAILS**

##### Week 1 & 2

#### **Introduction to the laboratory service**

1. Work flow procedures related to 'routine', urgent and out-of-hours work.
2. Specimen collection, identification, acceptance criteria, storage and disposal.
3. Turn-around time of reports.

#### **General hematology analyzer**

1. Principles and methods of analysis of the automated blood cell analyzer.
2. Specimen analysis.
3. Daily running of the machine.
4. Interpretation of scatter plots.
5. Quality control.
6. Calibration.
7. Reagent used.

## Week 3-10

### **Blood film and bone marrow reporting**

1. Identify all normal blood cells in peripheral blood films, bone marrow, smears and trephine biopsy.
2. Make peripheral blood films and marrow smears with manual & automated staining.
3. Recognize the staining properties of the Romanovsky stains in blood films.
4. Perform and interpret special stains such as SBB, PAS, double esterase and other cytochemical methods useful in diagnosis.
5. Prepare and interpret thick and thin blood films for demonstration of Malaria parasites.
6. Perform bone marrow aspiration and trephine biopsies.
7. Formulate reports of blood pictures, bone marrow and trephine biopsies.

## Week 11-12

### **Miscellaneous general hematology tests**

1. ESR.
2. G6PD and other enzymopathy assays.
3. Monospot test.
4. Laboratory investigations for hereditary spherocytosis.
5. Laboratory investigation of malaria.

#### 7.3.2.2 Hemostasis and Thrombosis

### **OBJECTIVES**

During this training period the trainee will understand the functioning of the coagulation laboratory, learn the specific tests involved in the work up of patients with bleeding and thrombotic disorders and acquire skills in the clinical evaluation and management of patients with hemophilia and deep vein thrombosis.

### **DURATION**

The duration of this rotation in the second year will be 8 weeks.

### **INSTITUTIONS**

SQUH & RH

## Week 1-8

### **Hemostasis and thrombosis lab**

1. Manual and automated PT and aPTT.
2. International Normalised Ratio.
3. Thrombin time, heparin reversal and reptilase.
4. Anti-Xa assay.
5. Coagulation factor assays and inhibitor studies.
6. Plasma fibrinogen measurement.
7. Fibrinogen degradation products and cross-linked fibrin assays.
8. D-dimer assays.
9. Platelet aggregation studies.
10. Von Willebrand factor studies.
11. Protein C, Protein S, Antithrombin.
12. Antiphospholipid antibody testing (eg. Lupus anticoagulant, anticardiolipin antibodies, etc.)
13. Euglobulin clot lysis time.
14. Tests for Heparin associated thrombocytopenia.
15. Molecular testing, eg. Factor V Leiden, Prothrombin G20101A gene mutation, methyl tetrahydrofolate reductase.
16. Plasma homocysteine.
17. Coagulation testing using point-of-care instrumentation.

### **Supervised consults, hemophilia center and clinics**

1. Consultations from other departments.
2. Manage patients with bleeding disorders with regard to specific treatment, complications, prophylaxis, psycho social issues and health education.
3. Exposure to patients with thrombotic disorders.

### 7.3.2.3 Hemoglobinopathies

#### **OBJECTIVES**

During this training period the trainee will understand the functioning of the hemoglobinopathy laboratory, learn and interpret specific tests in the evaluation of hemoglobin disorders and acquire an in-depth knowledge of the inherited and acquired hemoglobinopathies.

#### **DURATION**

The duration of this rotation in the second year will be 8 weeks

#### **INSTITUTIONS**

SQUH & RH

#### **DETAILS**

Week 1-8

#### **Hemoglobinopathy Laboratory**

1. Principles of laboratory tests for haemoglobinopathies.
  - a. Sickledex test .
  - b. Hemoglobin electrophoresis (alkaline & acid).
  - c. High Performance Liquid Chromatography (HPLC)
  - d. Iso electric focusing(IEF).
  - e. Molecular diagnosis of common hemoglobin disorders.
2. Interpretation of all the above tests in the context of case-based data.
3. Detailed theory and clinical aspects of inherited and acquire hemoglobinopathies.

### 7.3.2.4 Transfusion Medicine

#### **OBJECTIVES**

During this training period the trainee will become familiar with the detailed functioning of a blood transfusion service and its requirements, acquire skills in carrying out specific tests related to cross matching and immuno-hematology, gain competence in data interpretation and investigation of incompatibility and understand the principles of component preparation, processing and apheresis.

#### **DURATION**

The duration of this rotation will be 12 weeks

#### **INSTITUTION**

CBB and RH

## **DETAILS**

### **Weeks 1-2**

#### **Safe Blood Donation**

1. Recruitment of blood donors, donor selection and deferral.
2. Blood collection process from donation to final product.
3. Donor phlebotomy.
4. Medical problems related to voluntary donors.
5. Autologous blood donation and transfusion.
6. Donor counseling.

### **Weeks 3-6**

#### **Basic Principles and Techniques in Blood Banking**

1. Basic principles of transfusion.
2. Molecular techniques in transfusion medicine.
3. Essential immunology for transfusion medicine.
4. Blood Group Genetics.
5. Human platelet and neutrophil antigens.
6. Basics of red cell immunology and compatibility testing.
7. ABO blood groups and antibodies.
8. RhD antigen and antibody.
9. Red cell antigen-antibody reactions and their detection.
10. Other red cell antigen/antibody systems.
11. Compatibility procedures.
12. ABO-incompatible red cell transfusion.

### **Weeks 7-8**

#### **Immunoematology**

1. Serologic Principles and Transfusion Medicine.
2. Pretransfusion Testing.
3. Initial Detection and Identification of Allo-antibodies to Red Cell Antigens.
4. The DAT (Direct Antiglobulin Test).

5. Immune-mediated Hemolysis.
6. Serologic Problems with Auto-antibodies.
7. Drug-induced Immune Hemolytic Anemia.

#### Week 9

#### **Infection screening and Transfusion complications**

1. Diagnosis and management of transfusion complications.
2. Screening blood for transfusion transmissible infections.
3. Storage and quarantine at the Central Blood Bank.
4. Issue of blood and blood components at the Central Blood Bank.

#### Weeks 10-11

#### **Component Preparation and Clinical use of blood and blood components**

1. Component processing.
2. Manufacture of plasma derivatives.
3. Clinical Considerations in Transfusion Practice.
4. Indications and Administration of Blood and Components.

#### **Blood Transfusion in Infancy**

1. Perinatal Issues in Transfusion Practice.
2. Neonatal and Paediatric Transfusion Practice.

#### Week 12

#### **Apheresis and Cryopreservation**

1. Principles of apheresis and functioning of apheresis machines.
2. Apheresis for blood components.
3. Therapeutic apheresis.
4. Cryopreservation of marrow and peripheral blood stem cells.
5. Cord Blood banking.

### 7.3.3 *YEAR 3 Laboratory (R3)*

#### 7.3.3.1 General Hematology

##### **OBJECTIVES**

During this rotation the trainee will consolidate what was learnt in R2, gain knowledge in the principles and practical aspects of quality systems and acquire more skills in the handling of the automated cell analyzer.

##### **DURATION**

The duration of this rotation in the third year will be 12 weeks.

##### **INSTITUTIONS**

SQUH & RH

##### **DETAILS**

###### Week 1-9

##### **Morphology and Reporting**

1. Blood film reporting.
2. One marrow and trephine biopsy reporting.

###### Week 10

##### **Quality systems**

1. Methods of continuous quality monitoring.
2. Quality control - pre-analytical.
  - a. Sample handling, collection, identification, acceptance in laboratory.
  - b. Storage & disposal.
3. Quality control – internal.
  - a. Reference ranges and applications- principles and use of SI units.
  - b. Basic statistics as applied to quality control.
  - c. Measurement of uncertainty.
4. External quality assurance.
  - a. Laboratory accreditation as specified by relevant body.
  - b. Adverse reaction reporting.
  - c. Audit and quality improvement.
5. Notification, documentation, analysis and action on incidents, errors and adverse events.

## Week 11-12

### **General hematology analyzer and miscellaneous tests**

1. Running of the automated hematology analyzer.
2. Troubleshooting.
3. Setting up of normal and therapeutic reference ranges.
4. Waste disposal.
5. Cost per test.
6. Maintenance and service.
7. Record keeping.

#### 7.3.3.2 Flowcytometry

### **OBJECTIVES**

During this training period the trainee will understand the functioning of the flowcytometry laboratory, learn the principles of flowcytometry and acquire skills in data interpretation in relation to patients with hematologic disorders.

### **DURATION**

The duration of this rotation in the third year will be 4 weeks.

### **INSTITUTIONS**

SQUH or RH

### **DETAILS**

#### Weeks 1 - 4

1. Principles of flowcytometry.
2. Pre-analytical phase (specimen processing, antibody choice, antibody staining, surface versus intra-cytoplasmic staining).
3. Analytical phase (acquiring data, gating strategies).
4. Post-analytical phase (data analysis and interpretation, taking into consideration morphology, cytochemistry, cytogenetics and molecular analyses).
5. Use of the essential cellular markers commonly applied to the benign hematological conditions and hematological malignancies.
6. Clonality and specific subtypes of hematopoietic malignancy.
7. Diagnostic applications, limitations and prognostic impact of immunophenotyping by flow cytometry in benign and malignant disorders.

8. Detection and quantification of minimal residual disease in hematologic malignancies.
9. CD34 count for stem cell quantification.
10. Anti-D detection.

### 7.3.3.3 Cytogenetics, Molecular Medicine and HLA

#### **OBJECTIVES**

During this training period the trainee will learn the basic principles of karyotyping, molecular biology and tissue typing and acquire skills in data interpretation with relation to clinical hematology.

#### **DURATION**

The duration of this rotation in the third year will be 8 weeks.

#### **INSTITUTIONS**

SQUH and MOH

#### **DETAILS**

1. Chromosomes and gene structure.
2. The role of deoxyribonucleic acid (DNA), ribonucleic acid (RNA) and proteins in normal cellular processes.
3. Basic concepts of transcription and translation as well as the normal cellular processes, such as signal transduction, cell cycle regulation and apoptosis.
4. Use and limits of conventional cytogenetics (i.e., banding techniques) and fluorescent in situ hybridization (FISH) as well as definition of chromosomal changes according to the International Nomenclature of aberrations (e.g. reciprocal translocation, deletion, inversion, monosomy, trisomy, etc.).
5. Standard techniques to evaluate cellular processes at the DNA, RNA and protein level by understanding, in general terms, the laboratory procedures of Northern blot, Southern blot, Western blot, polymerase chain reaction (PCR), reverse transcription-polymerase chain reaction (RT-PCR) and microarrays.
6. Major genetic features occurring in hematological diseases (e.g., structural and numerical chromosomal changes, gene mutations) for understanding molecular events and clonality, diagnosis, definition of biologic and prognostic subgroups, and detection of minimal residual disease.

## Week 1-2

### **Cytogenetic and FISH Laboratory**

1. Techniques, indications and clinical application of conventional cytogenetics.
2. Definition of chromosomal changes according to the International Nomenclature of aberrations (reciprocal translocation, deletion, inversion, monosomy, trisomy, etc.).
3. Fluorescent in situ hybridization (FISH).

## Week 3-7

### **Molecular Biology Laboratory**

1. General principles of molecular biology.
2. DNA and RNA extraction, quantification and storage.
3. Polymerase Chain Reaction (PCR).
4. Chimerism.
5. Sequencing.

## Week 8

### **HLA Laboratory**

1. General principles of HLA typing.
2. HLA typing by serology and molecular methods.
3. Interpretation of HLA data.

## 7.3.3.4 Histopathology

### **OBJECTIVES**

During this rotation the trainee will learn the basic techniques used in the preparation of bone marrow trephine and lymph node specimens for histopathological examination, acquire skills in the analysis and reporting of bone marrow trephine biopsies and be able to appreciate relevant lymph node histopathology with relevance to lymphomas.

### **DURATION**

The duration of this rotation in the third year will be 8 weeks

### **INSTITUTIONS**

RH& SQUH

## **DETAILS**

### **Week 1-8**

1. Processing of bone marrow biopsy and lymph node specimens.
2. Special stains.
3. Bone marrow trephine reporting.
4. Basic lymph node histopathology in hematologic malignancy.

### 7.3.3.5 Biochemistry

## **OBJECTIVES**

During this training period the trainee will learn the principles of relevant biochemical tests with relevance to hematological disorders and acquire skills in data interpretation.

## **DURATION**

The duration of this rotation in the third year will be 4 weeks.

## **INSTITUTIONS**

RH or SQU

## **DETAILS**

### **Week 1-4**

1. Iron metabolism.
2. Iron studies in relation to relevant clinical disorders.
3. Vitamin B12 and folate metabolism.
4. Serum B12 and folate studies in relation to relevant clinical disorders.
5. Biochemical diagnosis of plasma cell dyscrasias.
6. Biochemical basis of Porphyrrias.
7. Laboratory investigation of the different subtypes of porphyries.

### 7.3.4 *YEAR 4 Clinical (R4)*

#### 7.3.4.1 **Adult Clinical Service**

##### **OBJECTIVES**

During this training period the trainee will function at registrar level to take responsibility of inpatients, outpatients and consultations. They will gain experience in the presentation and clinical manifestations of hematological disease, efficient use of laboratory and medical imaging techniques to work up patients, learn to interpret results and to manage patients based on evidence based medicine. Knowledge gained in the laboratory rotation will be used by the trainee to see and interpret blood films and bone marrow slides of his or her patients.

##### **DURATION**

The duration of this rotation in the fourth year will be 24 weeks

##### **INSTITUTIONS**

SQUH and RH

##### **DETAILS**

1. Inpatient service
2. Outpatient Service
3. Consultations

#### 7.3.4.2 **Thalassemia Program**

##### **OBJECTIVES**

During this training period the trainee will learn the organization and running of an established thalassemia care unit, manage patients on transfusion and chelation and understand the concept of comprehensive care in thalassemia.

##### **DURATION**

The duration of this rotation in the fourth year will be 4 weeks.

##### **INSTITUTION**

SQUH

##### **DETAILS**

1. Overview of the thalassemia program.
2. Transfusion regimens.
3. Chelation programs.
4. Data management.
5. Management of complications.
6. Counseling.
7. Bone marrow transplant.

### 7.3.4.3 Pediatric Hematology

#### **OBJECTIVES**

During this rotation the trainee will get specific exposure to pediatric patients with hematological disorders and primary immunodeficiency with respect to diagnosis and management.

#### **DURATION**

The duration of this rotation in the fourth year will be 12 weeks.

#### **INSTITUTIONS**

SQUH and RH

#### **DETAILS**

Weeks 1-8

#### **Pediatric Clinical Hematology**

1. Inpatient and outpatient rotations.
2. Acute leukemia, sickle cell anemia and other disorders.
3. Clinical procedures.

Weeks 9-12

#### **Pediatric Clinical Immunology**

1. Introduction to the common primary immunodeficiency states in Oman.
2. Principles in the diagnosis of primary immunodeficiency: Algorithms.
3. Management.

### 7.3.4.4 Bone Marrow Transplantation

#### **OBJECTIVES**

During this training period the trainee will understand the organization of a bone marrow transplant program and learn the basic aspects of pre-transplant workup, conditioning, transplant related complications, supportive care and follow up aspects of hematopoietic stem cell transplantation.

#### **DURATION**

The duration of this rotation in the fourth year will be 4 weeks.

#### **INSTITUTION**

SQUH

## **DETAILS**

1. Outpatient service including pre-BMT workup
2. In-patient service

### **7.3.5 YEAR 5 Laboratory (R5)**

#### **7.3.5.1 Research**

## **OBJECTIVES**

During this period the trainee will learn research methodology and design and execute a suitable project relevant to their training.

## **DURATION**

The duration of this rotation in the fifth year will be 24 weeks.

## **INSTITUTION**

SQUH or RH

## **DETAILS**

1. Research methodology.
2. Basic statistical methods for research.
3. Submit a project.
4. Conduct research.
5. Analysis of data.
6. Prepare for submission to a journal.

#### **7.3.5.2 Transfusion Medicine**

## **OBJECTIVES**

During this period the trainee will learn the practical aspects of clinical transfusion medicine including auditing.

## **DURATION**

The duration of this rotation in the fifth year will be 4 weeks.

## **INSTITUTIONS**

SQUH or RH

## **DETAILS**

1. Consolidation of skills in routine blood banking.
2. Therapeutic cellular apheresis.
3. Authorization of blood products.
4. Hemovigilance.

### 7.3.5.3 General Hematology

#### **OBJECTIVES**

#### **DURATION**

The duration of this rotation in the fifth year will be 8 weeks.

#### **INSTITUTIONS**

SQUH & RH

#### **DETAILS**

1. Generate systematic reports on blood films, bone marrow aspirates and trephine biopsies.
2. Laboratory Computer System.
  - a. Laboratory Information System.
  - b. Recording and reporting systems (including back-up).
3. Human Resource Management.
  - a. Organizational policies relating to personnel management.
  - b. Orientation for new staff.
  - c. Strategies for training and continuing education.
  - d. Performance assessment.
4. Laboratory safety
  - a. Management of chemical, physical, microbiological and radiation hazards in the laboratory.
  - b. Fire safety.
  - c. Disaster management plans.
  - d. Documentation of laboratory safety.

### 7.3.5.4 Hemostasis, Thrombosis and Hemoglobinopathies

During this training period the trainee will consolidate knowledge and skills learnt previously.

#### **DURATION**

The duration of this rotation in the fifth year will be 8 weeks.

#### **INSTITUTIONS**

SQUH or RH

#### **DETAILS**

1. Consolidate skills learnt in R2.
2. Comprehensive and systematic analysis of laboratory data.

### 7.3.6 *YEAR 6 Laboratory (R6)*

#### **OBJECTIVES**

The 6<sup>th</sup> year will be spent abroad in a center of excellence in laboratory hematology. The objective of this rotation is for the trainee to get exposure to advanced laboratory techniques. This may include research. The center and the program should be submitted to the scientific committee in advance for approval.

7.4 **Graded responsibilities for each academic year**  
as outlined above.

7.5 **Academic Seminars.**

#### **SEMINAR OPTIONS**

##### **LIST OF REPRESENTATIVE SEMINARS TO BROADLY COVER THE SYLLABUS.**

1. Topics can be modified at the discretion of the program directors.
2. Major seminars (2 hours) will be held once every 4 weeks.
3. Mini seminars (1 hour) will be held once every 2 weeks.
4. Attendance compulsory for all trainees.

#### **Basic Science**

##### **Seminar 1**

Hematopoiesis

- a. Stem cell model.
- b. Erythropoiesis.
- c. Granulocytopoiesis and monocytopoiesis.
- d. Thrombopoiesis.

##### **Seminar 2**

Immune system in Hematology.

- a. Overview of immune system.
- b. B, T and NK cell development.
- c. Approach to the diagnosis of a patient with primary immunodeficiency.

##### **Seminar 3**

Hemostasis

- a. Molecular basis of blood coagulation.
- b. Molecular basis of platelet function.

#### Seminar 4

General Principles in Oncology.

- a. Epidemiology of cancer in childhood.
- b. Molecular biology of Cancer.

### **Benign Hematological Disorders**

#### Seminar 5

Bone Marrow Failure.

- a. Aplastic Anemia.
- b. Inherited forms of marrow failure.
- c. Paroxysmal Nocturnal Hemoglobinuria.
- d. Pure Red Cell Aplasia

#### Seminar 6

Neonatal Hematology.

- a. Approach to Fetal and Neonatal Anemia.
- b. Causes and Management.

#### Seminar 7

Immune Hemolytic Disease in the Neonate.

- a. Pathogenesis of Maternal Rh immunization
- b. Rh Hemolytic diseases.
- c. Maternal alloantibodies causing fetal hemolytic disease.

#### Seminar 8

Disorders of Bilirubin Metabolism

- a. Diseases associated with unconjugated hyperbilirubinemia of the newborn.
- b. Conjugated hyperbilirubinemia of the newborn.

#### Seminar 9

Nutritional Anemias.

- a. Iron Deficiency Anemia.
- b. Megaloblastic anemia.

#### Seminar 10

Thalassemia.

#### Seminar 11

Sickle Cell Disease.

#### Seminar 12

Hemolytic Anemias.

- a. Overview and basis.
- b. Auto-immune hemolytic anemia.
- c. RBC enzymopathies.

### Seminar 13

#### Primary Immunodeficiency I.

- a. Classification and spectrum of primary immunodeficiency syndromes.
- b. Approach to the diagnosis of primary immunodeficiency.

### Seminar 14

#### Primary Immunodeficiency II

- a. Molecular biology and diagnosis of chronic granulomatous disease.
- b. Management of chronic granulomatous disease.

### Seminar 15

#### Primary Immunodeficiency III.

- a. Molecular biology and diagnosis of Familial Hemophagocytic Lymphohistiocytosis.
- b. Management of familial HLH.

## **Malignant Hematological Disorders**

### Seminar 16

#### Acute Myeloid Leukemia.

- a. Laboratory investigations.
- b. Management of Pediatric AML.
- c. Management of Adolescent and Adult AML.

### Seminar 17

#### Acute Lymphoblastic Leukemia.

- a. Laboratory investigations.
- b. Management of Pediatric ALL.
- c. Management of Adolescent and Adult ALL.

### Seminar 18

#### Chronic Lymphocytic Leukemia.

- a. Molecular basis
- b. Diagnosis and management.

### Seminar 19

#### Plasma Cell Disorders

- a. Pathogenesis of plasma cell dyscrasias.
- b. Diagnosis and Prognostic Features of Multiple Myeloma.
- c. Management of Multiple Myeloma.

### Seminar 20

#### Plasma Cell Disorders.

- a. MGUS.
- b. POEM Syndroms.

### Seminar 21

Myeloproliferative Disorders.

- a. Overview, classification and differences in children and adults.
- b. Chronic Myeloid Leukemia.
- c. Polycythemia Vera.
- d. Myeloproliferative Disorders in Childhood.

### Seminar 22

Myelodysplastic Syndromes.

- a. Molecular basis.
- a. Myelodysplastic Syndromes in Adults: Diagnosis and Management.
- b. Myelodysplastic Syndromes in Childhood: Diagnosis and Management.

### Seminar 23

Hodgkins Lymphoma.

- a. Classification.
- b. Hodgkins Lymphoma in Adults.
- c. Hodgkins Disease in Children.

### Seminar 24

Non-Hodgkins Lymphoma.

- a. Classification and Differences between Adult and Pediatric Lymphoma.
- b. Non Hodgkins Lymphoma in Adults.
- c. Non Hodgkins Lymphoma in Children.

### Seminar 25

Non Hodgkins Lymphoma.

- a. Atypical lymphoproliferative disorders.
- c. Diagnosis and Management.

### Seminar 26

Lymphohistiocytic Diseases.

- a. Molecular biology and diagnosis of Langerhans cell histiocytosis.
- b. Management of LCH.

### Seminar 27

Pediatric Malignant Solid Tumors.

- a. Epidemiology of Cancer in Childhood.
- b. Molecular biology of cancer.

### Seminar 28

Pediatric Malignant Solid Tumors I.

- a. Molecular biology and diagnosis of Neuroblastoma.
- b. Management of Neuroblastoma.

### Seminar 29

#### Pediatric Malignant Solid Tumors II.

- a. Molecular biology and diagnosis of Wilms Tumour.
- b. Management of Wilm's tumour.

### Seminar 30

#### Storage Diseases of the reticuloendothelial system

- a. General concepts, classification and approach
- b. Gaucher's Disease
- c. Mucopolysaccharidosis

## **Hematopoietic Stem Cell Transplantation**

### Seminar 31

#### Hematopoietic Stem Cell Transplantation I

- a. General principles in HSCT.
- b. Outcome of HSCT for leukemia, lymphoma and benign hematological diseases.

### Seminar 32

#### Hematopoietic Stem Cell Transplantation II.

- a. Complications following HSCT.
- b. Infections in HSCT.

## **Supportive Care**

### Seminar 33

#### Infection

- a. Approach to management of infections in immunocompromised host.
- b. Antimicrobials in hematology.

### Seminar 34

#### Pain management and Palliative Care.

- a. Concepts and institutional protocols.
- b. Pharmacology of drugs used in pain management.

### Seminar 35

#### Psychological Aspects of Hematologic Malignancy.

- a. Counseling.
- b. End of life issues.

## **Hemostasis and Thrombosis**

### **Seminar 36**

Evaluation of Hemostatic Disorders.

- a. Clinical evaluation of hemostatic disorders.
- b. Laboratory evaluation of hemostatic disorders.

### **Seminar 37**

Hereditary Disorders of Coagulation.

- a. Hemophilia.
- b. Von Willebrand's Disease.

### **Seminar 38**

Thrombosis.

- a. Evaluation of thrombophilia.
- b. Venous Thromboembolism.
- c. Arterial thromboembolism.

## **Transfusion Medicine**

### **Seminar 39**

Blood group antigens and antibodies.

- a. Molecular basis.
- b. Blood group systems.
- c. Laboratory detection.

### **Seminar 40**

Principles of Blood transfusion.

- a. Red cell transfusion.
- b. Platelet transfusion.
- c. Granulocyte transfusion.

### **Seminar 41**

Complications of blood transfusion.

- a. Transfusion reactions.
- b. Transfusion transmitted diseases and prevention.

## **Consultative Hematology**

### **Seminar 42**

Consultative Hematology I

- a. Overview and role of hematology consultant in internal and pediatric medicine.

- b. The surgical patient.
- c. The pregnant patient.

#### Seminar 43

##### Consultative Hematology II

- a. Intensive care consultations.
- b. Renal and hepatic disease.

### **Laboratory Hematology**

#### Seminar 44

##### General Laboratory.

- a. Laboratory Information System.
- b. Quality assurance in hematological laboratory practice.
- c. Estimation of reference ranges.

#### Seminar 45

##### Automation in the hematology laboratory.

- a. Automated cell counters.
- b. Automated coagulation machines.

#### Seminar 46

##### Flowcytometry.

- a. Principles of Flowcytometry.
- b. Clinical application in hematological and non hematological practice.

#### Seminar 47

##### Cytogenetics.

- a. Principles and techniques of karyotyping and FISH.
- b. Clinical applications.

#### Seminar 48

##### Molecular Biology.

- a. Molecular techniques in diagnostic hematology.
- b. Gene expression profiling and its clinical application.

### **7.6 Contents of the program and detailed syllabus of the training program.**

#### **7.6.1 Laboratory Haematology**

##### **7.6.1.1 General Hematology & Morphology**

- a) Basic techniques for the measurement of hemoglobin concentration, packed cell volume, reticulocyte, white blood cell and platelet counts.

- b) Principles of operation of automated hematology counters; causes of “flagging”; causes of inaccurate blood counts; interpret blood counts in the light of clinical details (e.g., detection of erroneous blood counts by morphologic examination of a blood film).
- c) Aspiration and biopsy of bone marrow and lumbar puncture.
- d) Preparation, fixation, staining (e.g., Wright-Giemsa, May-Grünwald, Pappenheim), examination of blood smears, bone marrow aspirates touch preparations, CSF and body cavity effusions in hematological malignancies.
- e) Examination, interpretation and reporting of a blood film and bone marrow aspirate.
- f) Examination, interpretation and reporting of a bone marrow trephine biopsy.
- g) Preparation, staining, and interpretation of special stains such as neutrophil alkaline phosphatase, myeloperoxidase, esterase, tartrate-resistant acid phosphatase, Prussian blue iron stains of blood and bone marrow smears.
- h) Lymph node, spleen, and thymus histology. Review of pathological lymph node and other tissue biopsies for lymphoma diagnosis with a pathologist.
- i) Preparation, staining, examination of immunocytochemistry of in hematological malignancies.
- j) Miscellaneous tests like monospot test, ESR. From their experience during hematology training, trainees will understand the sensitivity, specificity, indications, limitations and costs of laboratory studies.

#### 7.6.1.2 **Red Blood Cell Laboratory Techniques**

- a) Hemoglobin variant analysis (electrophoresis, HPLC and IEF).
- b) Sickling process and sickledex test.
- c) Examination of blood and bone marrow smears for RBC parasites.
- d) Osmotic fragility and related tests for RBC membrane defects.
- e) G6PD and other red blood cell enzyme assays.
- f) Parameters of iron metabolism (e.g., iron, transferrin, transferrin saturation, soluble transferrin receptors, and ferritin).

- g) Laboratory approach to the diagnosis of nutritional deficiencies (e.g., vitamin B12, folic acid).
- h) Laboratory approach to the diagnosis of primary hemochromatosis (e.g., HFE mutations).

#### 7.6.1.3 **Immunohematology**

- a) Indications and processes of assays typically performed in a Blood Bank. These include cross matching, direct antiglobulin tests (direct Coomb's test), antibody screen (indirect Coomb's test), ABO and Rh typing of red blood cells, other antibody identification procedures, as well as HLA typing and anti-HLA antibodies.
- b) Laboratory approach to the detection of immunoglobulin abnormalities (i.e., serum and urine protein electrophoresis, serum and urine immunoelectrophoresis, immunofixation and cryoglobulin detection).

#### 7.6.1.4 **Flow Cytometry**

- a) General aspects of the methodologies for the following steps of flowcytometry testing:
  - 1. Pre-analytical phase (e.g., specimen processing, antibody choice, antibody staining, surface versus intracytoplasmic staining).  
Analytical phase (e.g., acquiring data, gating strategies).
  - 2. Post-analytical phase (e.g. data analysis and interpretation, taking into consideration morphology, cytochemistry, cytogenetics and molecular analyses) .
- b) Use of the essential cellular markers commonly applied to the benign hematological conditions and hematological malignancies which can be broadly categorized into the following groups:
  - 1. B-cell, T-cell, natural killer-cell.
  - 2. Myeloid lineage (i.e. granulocytic, monocytic, erythroid, megakaryocytic cells).
  - 3. Progenitor-cell- and non-lineage-associated markers.

- c) General principles of disease-oriented antibody panels designed to optimize detection and characterization of critical cells for determining:
  - i) Lineage of the cells of interest.
  - ii) Clonality, where appropriate, and
  - iii) Specific subtype of hematopoietic malignancy.
- d) Assessment of the utility, diagnostic applications, limitations and prognostic impact of immunophenotyping by flow cytometry in the following conditions:
  1. Distinction between neoplastic and benign hematological disorders.
  2. Diagnosis of paroxysmal nocturnal hemoglobinuria.
  3. Diagnosis and classification of lymphomas, leukemias and plasma cell dyscrasias.
  4. Detection and quantification of minimal residual disease in hematologic malignancies.
  5. CD34 count for stem cell quantification.
  6. Anti D detection.
  7. Utility of flowcytometry in the diagnosis of hereditary spherocytosis.
  8. Detection of platelet surface glycoprotein.

During hematology training, the fellow will become familiar with several interrelated stages of multi-parameter flow cytometry (FCM), from the initial medical decision regarding which benign and neoplastic hematological conditions are appropriate for FCM assay, to the final step of diagnosis whereby FCM data is correlated with relevant clinical and laboratory information.

#### 7.6.1.5 **Genetics and Molecular Biology**

- a) Chromosomes and gene structure.
- b) The role of deoxyribonucleic acid (DNA), ribonucleic acid (RNA) and proteins in normal cellular processes.
- c) Basic concepts of transcription and translation as well as the normal cellular processes, such as signal transduction, cell cycle regulation and apoptosis.
- d) Use and limits of conventional cytogenetics (i.e., banding techniques) and fluorescence in situ hybridization (FISH) as well as definition of chromosomal changes according to the International

Nomenclature of aberrations (e.g. reciprocal translocation, deletion, inversion, monosomy, trisomy, etc.)

- e) Standard techniques to evaluate cellular processes at the DNA, RNA and protein level by understanding, in general terms, the laboratory procedures of Northern blot, Southern blot, Western blot, polymerase chain reaction (PCR), reverse transcription-polymerase chain reaction (RT-PCR) and microarrays.
- f) Major genetic features occurring in hematological diseases (e.g., structural and numerical chromosomal changes, gene mutations) for understanding molecular events and clonality, diagnosis, definition of biologic and prognostic subgroups, and detection of minimal residual disease.

## 7.6.2 **THROMBOSIS AND HEMOSTASIS**

The practice of clinical hemostasis and thrombosis requires a combination of diagnostic laboratory and clinical expertise. As in other areas of clinical hematology there is a major overlap with general internal medicine. Many patients with bleeding and thrombosis do so for reasons other than disease of the blood and bone marrow; equally a wide range of systemic diseases may influence haemostatic mechanisms, blood coagulation and fibrinolysis. Therefore a holistic approach to disease management requires adequate training in general internal medicine as well as hemostasis and thrombosis.

### 7.6.2.1 **Laboratory Management**

- a) Techniques for assessing blood coagulation and its inhibition, fibrinolysis, primary hemostasis and platelet function, including automation.
- b) Instruments and methods and their pitfalls.
- c) Principles of laboratory management.
- d) Familiarity with reference ranges, quality assurance, laboratory computing.

### 7.6.2.2 **Acquired Bleeding Disorders**

- a) Mechanisms of bleeding in:
  - 1. Iatrogenic bleeding
  - 2. Surgical bleeding (including cardiopulmonary bypass)

3. Obstetric bleeding
  4. Disseminated intravascular coagulation
  5. Massive transfusion
  6. Renal disease
  7. Liver disease
  8. F VIII and vWF inhibitors
- b) Interpret laboratory tests accurately, in the clinical context, formulate an appropriate management plan, and liaise with other specialists.
  - c) Less common bleeding disorders (amyloidosis and very rare inhibitors).
  - d) Available treatments, including management of underlying disease, blood products, recombinant VIIa and immunosuppression, and their side-effects.
  - e) Advise on use of blood products and other therapies, including appropriate use of vitamin K and protamine.

#### 7.6.2.3 **Congenital Bleeding Disorders**

- a) Coagulation factors and current understanding of coagulation mechanisms.
- b) Natural history, presentation and complications of congenital coagulation disorders including hemophilia A & B, von Willebrand's disease + subtypes.
- c) Taking a relevant history, including previous challenges and family history, conducting a focused clinical examination to assess for abnormal bleeding and constructing a family tree.
- d) Ability to formulate a comprehensive differential diagnosis and management plan.
- e) Less prevalent factor deficiencies such as XI, X, VII, V and II and /dysfibrinogenaemia.
- f) Rare, easily overlooked deficiencies: factor XIII, antiplasmin.
- g) Diagnostic methods incl. screening tests, specific factor and inhibitor assays.
- h) Interpret laboratory results accurately, and in light of clinical background.
- i) Use of molecular biological techniques to identify genetic disorders.

- j) Advise on use of molecular biological techniques in diagnosis .
- k) Use of molecular biological techniques in prenatal and family testing.
- l) Appropriate use of therapeutic materials: recombinant products, blood products and adjuvant therapies, including desmopressin and antifibrinolytics, their indications and safety profiles.

#### 7.6.2.4 **Platelet Disorders**

- a) Platelet structure and function.
- b) Platelet-vessel wall interactions.
- c) Measurement of platelet numbers by automated counters.
- d) Interpretation of laboratory data and awareness of pitfalls.
- e) Diagnosis and management of thrombocytopenias, including Immune Thrombocytopenic Purpura.
- f) The performance of screening tests of primary hemostasis, and tests of platelet aggregation and release.
- g) The interpretation of screening tests of primary hemostasis, and tests of platelet aggregation and release.
- h) Diagnosis of inherited congenital platelet disorders, including Glanzmann's thrombasthenia, Bernard-Soulier disease, storage pool disorders and enzymopathies.
- i) Management of rare congenital platelet disorders.
- j) Diagnosis and management of acquired platelet disorders, including myeloproliferative diseases.
- k) The mechanisms, classification and diagnosis of Thrombotic Thrombocytopenic Purpura and other microangiopathic disorders.
- l) Management, including supportive treatment and plasma therapy in Thrombotic, Thrombocytopenic Purpura and related disorders.
- m) Diagnosis and management of thrombocytopenia in pregnancy.
- n) Novel investigations, such as Platelet Function Analyzer 100.

#### 7.6.2.5 **Thrombophilia / Thrombosis**

- a) Physiological coagulation inhibitors including epidemiology and molecular basis of heritable thrombophilia, including V Leiden, II G20210A and anticoagulant deficiencies.
- b) Appropriate use of clinical and laboratory methods to reach a diagnosis, including family history, bioassays, immunoassays and molecular methods.
- c) Skill in genetic counseling.
- d) Mechanisms of acquired thrombotic disease, incl. antiphospholipid syndrome, Paroxysmal Nocturnal Hemoglobinuria, myeloproliferative diseases.
- e) Use of appropriate clinical and laboratory methods, including tests for antiphospholipid antibodies.
- f) Appreciation of gene-environment interaction in thrombosis, incl. the role of acquired risk factors such as pregnancy, hormone use and immobility.
- g) Accurate assessment of risk factors and risk of recurrence from clinical assessment.
- h) The natural history, presentations and complications of heritable and acquired thrombophilia.
- i) Advising on prophylaxis and treatment of thrombophilia.
- j) Management protocols for pregnancy complications in antiphospholipid syndrome.
- k) The role of heritable thrombophilias in pregnancy failure.
- l) Post-thrombotic syndrome.
- m) Diagnostic methods for thrombosis
- n) Use of appropriate diagnostic methods incl. D-dimer assay and imaging.

#### 7.6.2.6 **Anti-Thrombotic Agents**

- a) Pharmacology, including mechanism of action, pharmacokinetics and indications for heparins, other anti-thrombins, oral anticoagulants and thrombolytic agents.
- b) Indications for prophylaxis, including in malignancy.

- c) Initiation and laboratory monitoring and dosing of anticoagulants and thrombolytics.
- d) Use of anticoagulants and thrombolytics in pregnancy.
- e) Management of anticoagulant-related bleeding.
- f) New anti-thrombotic agents.
- g) Appropriate tests for anticoagulant control and familiarity with different models of anticoagulant management, including computerized systems and implementation of multi-professional delivery of anticoagulant control.
- h) Advise on the follow-up of patients receiving anticoagulants, incl. advice on duration and intensity of therapy.
- i) Additional interventions and their indications, incl. IVC filters and surgery.
- j) Side-effects of anticoagulants.
- k) Management of over-anticoagulation and bleeding.
- l) Diagnosis and management of HIT, including interpretation of bio- and immunoassays and use of alternative anticoagulants.
- m) Mechanisms of antiplatelet agents.
- n) Advise on selection and use of antiplatelet agents.

### 7.6.3 **TRANSFUSION MEDICINE**

#### 7.6.3.1 **Blood Donation.**

- a) International norms of donor eligibility.
- b) Epidemiology of infectious diseases in the area..
- c) Donor preparation and venesection.
- d) Donation screening.
- e) Donation-associated side effects.
- f) Preparation and preservation of standard and special blood components: Whole Blood; Red cells; Plasma; Platelets. Cryoprecipitate; irradiated; leukocyte depleted; washed; filtered; Pediatric Units.
- g) Viral inactivation and quarantine.

### 7.6.3.2 **Compatibility Testing**

- a) Blood Antigens and Antibodies.
- b) Blood Grouping:  
ABO and D grouping, Complete Phenotype, Rhesus and Kell testing, Antibody screening, Cross-match.
- c) Serologic Principles and investigations in transfusion medicine.
- d) Detection and identification of red cell antibodies (allo and auto).
- e) Drug induced immune hemolytic anemia.
- f) Auto and allo adsorption techniques for antibody identification.
- g) Platelet and granulocyte antibodies: laboratory investigation & clinical significance.

### 7.6.3.3 **Preparation Indication & Use Of Blood & Blood Components.**

- a) Whole Blood.
- b) Red Cells.
- c) Alternatives to allogeneic blood transfusion.
- d) Autologous blood; use of r-huEPO, iron etc.
- e) Volume; Number of required platelet.
- f) Quality testing; management of refractoriness.
- g) Fresh Frozen Plasma.
- h) Cryoprecipitate.
- i) Factors VII, VIII and IX; Fibrinogen.
- j) Immunoglobulins.
- k) Granulocytes.
- l) Blood irradiation.
- m) Use of CMV negative blood products.
- n) Leukodepletion and use of appropriate leukodepletion procedures.

#### 7.6.3.4 **Administration Of The Transfusion**

- a) Information for the patient.
- b) Routine vs. emergency transfusions.
- c) Proper identification of the recipient.
- d) Rate and conditions of administration and monitoring

#### 7.6.3.5 **Adverse Reactions**

- a) Identification of transfusion reactions.
- b) Investigation and reporting.
- c) Management.

#### 7.6.3.6 **Special Conditions And Procedures**

- a) Hemolytic disease of the newborn.
- b) Neonatal thrombocytopenia.
- c) Laboratory work-up of the autoimmune hemolytic anemias.
- d) Apheresis.
- e) Therapeutic apheresis.
- f) Plasmapheresis.
- g) Red cell exchange.
- h) Plateletpheresis.
- i) Leucopheresis (therapeutic).
- j) Donation by apheresis.
- k) Donor lymphocyte infusion.
- l) Therapeutic phlebotomy.

### 7.6.4 **CLINICAL HAEMATOLOGY**

The trainee will be competent in the following:

#### 7.6.4.1 **Red Cell Disorders**

- a) Anemias due to deficiency (iron, B12, folate) or chronic disease.
- b) Pure red cell aplasia, Parvovirus B19 infection and sideroblastic anemia

- c) Thalassemias and sickle cell disease
- d) Spherocytosis and G6PD deficiency
- e) Other congenital hemolytic anemias .
- f) Acquired hemolytic anemias.
- g) Erythrocytosis.

#### 7.6.4.2 **Bone Marrow Failure**

- a) Constitutional anemias like Fanconi's anemia.
- b) Acquired aplastic anemia.
- c) Paroxysmal Nocturnal Hemoglobinuria .

#### 7.6.4.3 **Non Malignant White Blood Cell Disorders**

- a) Hereditary and acquired disorders of granulocytes and macrophages.
- b) Hereditary and acquired disorders of lymphocytes

#### 7.6.4.4 **Hematological Neoplastic Disorders**

- a) Chronic myeloid leukemia
- b) Polycythemia Vera
- c) Chronic idiopathic Myelofibrosis.
- d) Hypereosinophilic syndrome.
- e) Mastocytosis.
- f) Essential thrombocythemia .
- g) Acute leukemias/ lymphoblastic lymphomas.
- h) MDS.
- i) B-cell lymphomas (Follicular, large-cell, marginal zone, mantle-cell, lymphoplasmacytic, Burkitt).
- j) B-cell lymphomas (other subtypes, including post-transplant EBV-related lymphomas).
- k) Hodgkin's disease.
- l) Peripheral T-cell lymphomas.
- m) Other T-cell and natural killer lymphoproliferative disorders.

- n) Histiocytic neoplasm.
- o) Dendritic cell neoplasm.
- p) B-CLL, hairy-cell leukemia, and prolymphocytic leukemia.
- q) Multiple myeloma, plasmacytoma and monoclonal gammopathy of unknown significance.
- r) Amyloidosis.
- s) Castleman's disease.

#### 7.6.4.5 **Stem Cell Transplantation**

- a) Indications, risks and benefits of autologous and allogeneic transplants
- b) Conditioning regimens
- c) Cell source and donor selection
- d) Mobilization of Peripheral Blood Progenitor Cells (PBPC) and harvesting of BM progenitors
- e) Collection and manipulation of progenitor cells

#### 7.6.4.6 **Platelet Disorders**

- a) Acquired platelet function disorders
- b) Immune thrombocytopenia
- c) Other peripheral thrombocytopenia
- d) Inherited Platelet Disorders

#### 7.6.4.7 **Supportive And Emergency Care**

- a) Tumor lysis syndrome
- b) Disseminated Intravascular Coagulation
- c) Thrombotic thrombocytopenic purpura and microangiopathic disorders
- d) Hyperleukocytosis
- e) Hyperviscosity
- f) Transfusion (indications, potential benefits and complications)

#### 7.6.4.8 **Miscellaneous**

- a) Iron overload.
- b) Hematological manifestations of congenital metabolism disorders.
- c) Hematological changes in pregnancy.
- d) Hematological changes associated with HIV /other infectious diseases .
- e) Interpretation of results of genetic and molecular biology tests for diagnosis, prognosis and assessment of minimal residual disease.

#### 7.6.4.9 **Pediatric Hematology**

The trainee will receive specialized training in:

- a) Basic principles of inheritance of hematological disorders.
- b) Genetic counseling.
- d) Embryonic and fetal hematopoiesis. Post natal changes.
- e) Neonatal alloimmune thrombocytopenia.
- f) Acquired and inherited bleeding disorders.
- g) Hemolytic disease of the newborn .
- h) Normal hematological values.
- i) Juvenile myelomonocytic leukemia.
- j) Hemophagocytic lymphohistiocytosis.
- k) Fetal Transfusion.
- l) Neonatal Transfusion.
- m) Transfusion in Children.

#### 7.6.4.10 **Evidence Based Medicine / Critical Appraisal**

A doctor in training should have access to a computer with internet access. It is recommended that during training a doctor actively participates in a journal club, either locally or via the internet. The parts recommended below also include understanding of appropriate statistics. It is essential that a junior specialist can read and understand research data, and draw appropriate conclusions.

The trainee will be able to:

- a) Use of computer and relevant applications.
- b) Use search engines to find information on the internet (medical libraries).
- c) Understand the use of medical databases in clinical decision making from a single case point of view.
- d) Read scientific literature and critically evaluate information.
- e) Understand the principles of evidence based medicine.
- f) Comprehend the basic function of simple electronic databases.

#### 7.6.4.11 **Communication Skills**

A trainee should demonstrate skills appropriate and necessary to provide professional communication. If necessary, we recommend participation in a training course.

The trainee will be able to:

- a) Identify the principles of personnel management .
- b) Effectively communicate within a multi-disciplinary team.
- c) Communicate hematological diagnosis and treatment.
- d) Manage strong emotions with skill and compassion .

#### 7.6.5 **RESEARCH**

The trainee should acquire the basic skills of research and be able to design, conduct and analyze a suitable research project related to hematology. Trainees should attend specialized courses in basic research methodology provide at SQU.

1. Research methodology and basic statistical methods.
2. Submit a project.
3. Conduct research.
4. Analysis of data.
5. Prepare for submission to a journal.

7.7 **LOG BOOK**

1. Each Trainee will be provided with a log book.
2. Log book will be assessed by the programme director prior to each examination.

8 **COURSES, CONFERENCES, WORKSHOPS REQUIRED**

1. Trainee should attend & participate actively in departmental meetings.
2. Trainees are encouraged to attend at least one international meeting per year.
3. Trainees should participate actively in weekly educational seminars.
4. Trainees are encouraged to present papers in national seminars and workshops.

9. **EXTERNAL ELECTIVES ABROAD**

The final year of the program should be spent in a center abroad in a laboratory area approved by the committee.

10. **RESEARCH REQUIREMENTS**

Refer to item 7.6.5

11 **PARTICIPATING TRAINING CENTERS**

- 1 Sultan Qaboos University Hospital.
- 2 The Royal Hospital.
- 3 Central Blood Bank, Ministry of Health.

12. **MEMBERS OF TEACHING FACULTY**

**SULTAN QABOOS UNIVERSITY**

Adult Hematology

Dr. Salam Al Kindi  
Dr. David Dennison  
Dr. Shahina Daar  
Dr. Anil Pathare  
Dr. Fehmida Zia  
Dr. Naglaa Abdulaziz Saleh Sawaz  
Dr. Chao Ho Hung

Pediatric Hematology

Dr. Yasser Wali  
Dr. Zakia Al Lamki  
Dr. Mathew Zachariah  
Dr. Wafa Bashir

Senior Laboratory Staff

Mr. Stuart Donaldson  
Mr. Shoaib Al Zadjali  
Mr. David Gravel

**ROYAL HOSPITAL**

Adult Hematology

Dr. Muhanna Al Muslahi  
Dr. Arudathi Kurukulasuriya  
Dr. J.P. Prakash  
Dr. Sunil Dabadgo  
Dr. Sulaima Al Lamki

Pediatric Hematology

Dr. Eileen Tomas  
Dr. Nagwa El Banna  
Dr. Dipali Bhuyan

Senior Laboratory Staff

Mr. Alexander George Rowan  
Mr. Hussain Ali Al Salhi  
Mr. Abeer Ahmed Al Belushi

**CENTRAL BLOOD BANK**

Dr. Shahnaz Al Belushi  
Dr. Thamina Ashraf

### 13. EXAMINATIONS OUTLINE

#### BOARD EXAMINATIONS

There will be two major board examinations for the entire program:

1. OMSB Part I will be held after the third year (R3)
2. OMSB Part II will be held after the fifth year (R5)
3. Both examinations will be held in the month of April
4. There will be no limits to the number of attempts for each exam

#### DETAILS

##### OMSB Part 1

Paper 1: 3 hours

Content: Essays and Short answers

Pass Mark: 60%

Paper 2: 3 hours

Content: MCQs and Matching

Pass Mark: 60%

Wet Practical: 3 hours

Content: Transfusion Medicine: Grouping, Cross matching and antibody screening.

Pass or Fail

##### OMSB Part 2 (End of R5)

2 hrs: Case Scenarios with morphology and data interpretation

2 hrs: Slide interpretation (blood films, marrow aspirates & trephines)

Pass Mark 60%

Dry Practicals: 3 hours

Data interpretation on transfusion medicine, hemostasis and thrombosis, hemoglobinopathies, flowcytometry, cytogenetics and other laboratory results

Pass Mark: 60%

Two Vivas (30min each)

1. Transfusion, Hemostasis and thrombosis

2. General and Clinical hematology

Pass or Fail

**NB:** Once accredited, the trainee should attempt the FRCPA exam as per RCPA regulations

#### END OF YEAR EXAMINATION

End of year examinations will be conducted to assess the achievement of the candidate in the rotations they have done at the end of each year. These examinations will be held in June.

14. **EVALUATION**

Evaluation by both the supervisors and trainee as per OMSB regulation.

Six month Evaluation: February

End of Year Evaluation: September

15. **EXIT QUALIFICATIONS**

Upon successful completion of the program trainee will receive the following:

1. Oman Fellowship in Hematology
2. Certificate of completion of training by OMSB

The candidate should attempt one of the following international examinations once this program has been accredited by the concerned college:

1. Fellowship of the Royal College of Pathologists (Australia)
2. Membership of the Royal College of Pathologists of the United Kingdom.

## 16. **SPECIFIC REQUIREMENTS FOR OMSB ACCREDITATION FOR TRAINING**

### **LABORATORY HEMATOLOGY:**

In order to gain OMSB accreditation all hematology and transfusion medicine laboratories must conform to certain minimum requirements as follows:

#### **Professional Staff**

It is expected that there will be at least three full time specialist hematologists and senior biomedical scientists with appropriate qualifications and/or experience in teaching

#### **Supervisor**

One professional staff should be nominated as the supervisor of each trainee. The supervisor is required to submit a proposed training program to the hematology scientific committee at the commencement of each year and to complete the supervisors report as per OMSB guidelines.

#### **Education Program**

The trainee should be exposed to all aspects of clinical and laboratory work, including clinical liaison and bench work, so that a thorough practical understanding of the hematology discipline is achieved. Participation in conferences and seminars in the clinical environment of the institution should be available to the trainee.

#### **Library/Internet Facilities**

A reasonable number and variety of journals and up to date textbooks should be made available in the laboratory as well as access to a medical library with borrowing facilities. Access to literature search and internet facilities should be available.

#### **Equipment and Floor Space**

There should be adequate space and optimal facilities for each section included in the trainees' rotation. Teaching facilities such as seminar rooms, multi-headed microscope and projection facilities should be made available.

#### **Accreditation**

Each laboratory should participate in recognized internal and external quality assurance program and preferably accredited by an external body such as RCPA, RCPATH or equivalent.

### **RESIDENT EVALUATION FORMS**

- **RESIDENTS MONTHLY EVALUATION**
- **ROTATION EVALUATION  
-RATING**
- **CONSULTANT/STAFF EVALUATION**
- **ROTATION EVALUATION  
(6 Months Progress Report)**

**RESIDENT MONTHLY EVALUATION FORM**

Name: ..... OMSB #: .....

Program: .....

Resident Level:  R I  R II  R III  R IV  R V

Date of Rotation:

From ..... To .....

No	Criteria	Unsatisfactory 1	Borderline 2	Satisfactory 3	Above Average 4	Outstanding 5	N/A
<b>I. Patient Care</b>							
1-	History and physical examination.						
2-	Interpretation and differential diagnosis.						
3-	Decision making and management plan.						
4-	Organization of work and time management.						
5-	Maintains patient confidentiality						
6-	Verbal and written communication.						
7-	Provides comprehensive care.						
8-	Ability to manage emergency conditions.						
9-	Consultation skills.						
<b>II. Medical Knowledge &amp; Attitudes</b>							
10-	Punctuality.						
11-	Basic and clinical knowledge.						
12-	Works effectively in a team environment						
13-	Technical skills and procedures.						
14-	Reports facts accurately, including own errors						
15-	Attitude to patient and staff.						
16-	Ability to supervise.						
17-	Recognizes own limitations						
18-	Maintains code of ethics & honesty.						
<b>III. Scholarly Contributions</b>							
19-	Attends and contributes to rounds, seminars And other learning events						
20-	Accepts and acts on constructive feedback						
21-	Teaching skills (Peers)						
22-	Ability for self directed learning						
	<b>Overall Assessment</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

General Comments (including strengths, weakness and needs for special attention)

Name and Signature of Supervising

Consultant ..... Date ..... Name of

Resident: ..... Signature: ..... Date: .....

Official Use:-

Total Score:

No of items evaluated X 20 = ..... %



**ROTATION EVALUATION FORM**

Name : ..... Resident Level: .....

Program : .....

Rotation : ..... Hospital : ..... OMSB : .....  
#

Date of Rotation: From: ..... To: .....

	Unsatisfactory	Deficient	Good	V.Good	Outstanding	N / A
Rotation:	1	2	3	4	5	
1 The number of in-patients cases seen was appropriate and demonstrated a broad range of clinical problems.						
2. The number of out-patients cases seen was appropriate and demonstrated a broad range of clinical problems.						
3.The opportunity to see acute emergency cases.						
4The opportunity to see consultation/ referrals.						
5. Ward rounds.						
6. Clinical Meetings / Lectures.						
7. Journal Club						
8. Audit ( e.g. Morbidity / Mortality )						
9. Clear learning objectives.						
10. The number of procedures adequate.						
11. Demonstration & Supervision of techniques.						
12. Level of responsibility in patient care.						
13. Opportunity to attend lectures						
14. Patient management.						
15. Quality / quantity of teaching on rotation.						
16. My total workload was appropriate for the time available.						
17 Interaction with faculty.						
18. Adequate feedback from consultant / staff on performance.						
19 Support and supervision was available and adequate.						
20. Opportunity to do research.						

21. Overall quality of rotation

Signature of Resident: ..... Date: .....

**Official Use:-**

\_\_\_\_\_ Total Score \_\_\_\_\_ X 20 = ..... %

No. of items evaluated

## RATING

### UNSATISFACTORY ROTATION EVALUATION FORM

### OUTSTANDING

Out patients	Do not see new patients. No time for/interest in discussion with consultant. Large number of patients. Poor organization.	←→	See new and old patients. Time for discussion with consultant. Reasonable time with patients. Well organized.
Acute Emergency	Advice/help not easy to obtain. Consultant difficult to find/contact. Also not keen to come and assist.	←→	Advice/help readily available. Consultant always happy to be phoned/consulted/give assistance.
Ward rounds	Rarely consultant led. Rapid decisions, little discussion. Junior views not listened to.	←→	Usually consultant led. In depth presentation/discussion of patients. Adequate time
Clinical meetings / lectures	Poor consultant support. Badly attended. Rigid non innovative programme. Not multi-disciplinary. Held outside normal working hours. Little input from consultants.	←→	Consultant led. Well attended by all grades. Varied programme. Often multi-disciplinary. Regularly held in normal seasonal time. Juniors encouraged present/take part.
Journal club	Juniors expected to do all reviewing. Poor consultant attendance. Didactic discussion?	←→	Equal consultant/junior participation. Articles précised and discussed.
Audit	Morbidity/mortality only. No in-depth review of clinical practice/problems. Does notad to change clinical practice. Retrospective data. Juniors expected to collect all data. Non constructive or threatening atmosphere.	←→	Proper audit cycle utilized. Lead to change in clinical practice. Prospective data collection. Juniors assisted with data collection. Friendly, non confrontational atmosphere.
Demonstration of techniques	Works on own. Poor senior support. Not shown/taught new or more advanced techniques.	←→	Taken through procedures. Graduated discussion about patients with consultants.
Patient management	No guidelines. No trust Consultant questions all decisions. Consultant does not back trainee.	←→	Consultant readily offers help/advice. Trainee given guidelines. Trusted to use own initiative/judgment. Consultant back trainee.
Adequate feedback from Consultants	Poor or absent appraisal. No specific protected time for discussion of performance. Consultant not frank about performance. Mainly critical, rarely praises.	←→	Regular appraisals in protected time. Consultant opens about strengths, weaknesses and areas for improvement.
Research Opportunity	No fixed time allowed. Any identified time often not taken due to other pressures.. Clinical work precludes time for research	←→	Fixed session/protected time allocated. Arrangements made to free trainee of some clinical work to allow research activity.

**CONSULTANT/ STAFF EVALUATION**

Name of Consultant / Staff: .....

Program: ..... Resident Level: .....

Rotation: ..... Hospital: .....

Date of Rotation: From:..... To: .....

1. How many weeks did you work with this consultant / staff?  
 Up to 2     3 or 4     5 or 6     7 or 8     8+

2. The frequency of your contacts with the teaching consultant / staff was: (per week)  
 1 or less     2     3     4     5 or more

Consultant	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5	N/A
1. Made rounds regularly.						
2. Provided quality teaching.						
3. Was well organized.						
4. Stimulated enthusiasm for knowledge.						
5. Demonstrated breadth of knowledge.						
6. Established good rapport with resident.						
7. Provided direction and feed back.						
8. Was approachable for help and feedback.						
9. Encouraged resident to take appropriate responsibility.						
10. Promoted a comprehensive approach to patient care.						
11. Provided a good role model as a Physician.						
12. Was available with enough time for Resident support and supervision						
13. Allowed resident protected teaching time.						
14. Provided opportunity for performing procedure and techniques.						

**An Average Score:** < 30% Unsatisfactory, 30-60% Satisfactory, 60-80% V. Good, > 80% Excellent

**Name of resident (optional)** ..... **Date:** .....

**Office Use:-**

$$\frac{\text{Total Score}}{\text{Number of evaluation items}} \times 20 = \dots\dots\dots \%$$