



**MASTER OF MEDICINE
(OPHTHALMOLOGY)**

***Department of Ophthalmology and Visual Science
School Of Medical Sciences
Universiti Sains Malaysia
Health Campus
16150 Kubang Kerian
Kelantan***

**TRAINING CURRICULUM FOR TRAINEES AND SUPERVISORS
UNIVERSITI SAINS MALAYSIA**

-2022-

MASTER OF MEDICINE (OPHTHALMOLOGY)

1. Aim

A four-year post-graduate training program in Ophthalmology.

2. Background

The Ophthalmology Unit of Hospital Universiti Sains Malaysia (Hospital USM) was established in 1984, and was subsequently upgraded to the level of an Ophthalmology Department in the nineties, coincident with the establishment of the Master of Medicine (Ophthalmology) program. The program kicked off in 1997 with its first intake of 10 local trainees. Accepting international students since 2004, USM has graduated almost 210 ophthalmologists and fellows in different subspecialties to date, and currently has approximately 80 trainees in our Masters programme.

We work closely with other two universities providing postgraduate programs in Malaysia; Universiti Malaya and Universiti Kebangsaan Malaysia. The interuniversity collaboration was further strengthened with the formation of the flagship of the Malaysian Universities Conjoint Committee of Ophthalmology (MUCCO). With this Committee, the syllabus and examination format have been standardised to ensure that the quality of graduates produced are of the highest calibre. Currently, all ophthalmology postgraduate trainings are conducted based on the standards set by the national level.

MUCCO has established an electronic data base, National Ophthalmology Training and Education Database (NOTeD) to allow trainees to easily maintain a record of their training activities. By partnering with the local universities and Ministry of Health as a conjoint committee, we hope to unify the teaching, training and examination of ophthalmology graduates.

Our ophthalmology training program is a mixed-module mode, with a two year out-campus placement for distance learning to allow local trainees to familiarise themselves in ophthalmology before they enter the university campus, while it is a four year program for international trainees. All trainees will have access to teaching facilities available in the campus including a medical library, computer aided laboratory, clinical skill center and other research support. Teaching staff strength now stands at 12 lecturers.

Further collaboration with international ophthalmology centers abroad is integral to our program. We have a close partnership with Singapore, and have been privileged to have their visiting consultants grace us with their presence, both for our exam preparation courses and our Masters of Medicine examinations.

3. Structure of course

The training is divided into 3 phases.

- Phase I (year 1) : Basic sciences in ophthalmology
- Phase II (year 2 & 3) : Clinical training in ophthalmology
- Phase III (year 4) : Specialist in training

Please refer to Appendix I for further details

4. Mode of teaching and learning

Various modes used to achieve learning objectives include

- Notes, articles, references and audiovisual material
- Lectures and seminars
- Self-directing learning, including reading lists
- Clinical activities including clinics, ward management, preparation, planning and executing operative procedures, post-operative care and on-call duties
- Participation in academic and research activities
- Writing up of dissertation

5. **Supervision and progress reports**

The medical school will appoint a qualified ophthalmologist to be a supervisor for each candidate. The supervisor is responsible for the progress report of the candidate.

6. **Examination and assessment**

Assessment during the course is divided into 2 parts

- Continuous assessment
- Examination (annual and end-phase examinations)

Professional I examination consists of continuous assessment and an examination. Passing this component of phase I assessment is a prerequisite for admission to Phase II.

Phase II and III (year 2 & 3) likewise involves continuous assessment, with an examination at the end of year 3 (**Professional II examination**). Passing this component of phase II assessment is a prerequisite for admission to Phase III.

Phase III (year 4) involves continuous assessment and a dissertation viva at the end of year 4 (**Phase III assessment**).

7. **Entrance criteria**

- a) Candidate must hold a recognized medical degree.
- b) Candidate must have passed the national basic sciences examination.
- c) Candidates must be registered to practice medicine in Malaysia
- d) Candidates are required to appear for an entrance interview.

8. **Exemption**

Exemptions from the entrance criteria are based on the discretion of the Malaysian Universities Conjoint Committee in Ophthalmology.

9. **Duration of training**

The minimum duration of training is four (4) years with a maximum of seven (7) years.

10. Curriculum and syllabus

The syllabus that will be used is attached (**Appendix II**). However, the syllabus will be updated from time to time in view of the progress in this field of specialty.

11. Academic and Teaching Staffs

All academic staff at the Department of Ophthalmology and Visual Sciences, School of Medical Sciences will be involved in teaching activities.

12. Administrative committee

The Department of Ophthalmology and Visual Sciences, School of Medical Sciences, will be responsible in organizing and monitoring the program, preparing teaching schedule and organizing seminars pertaining to the program.

13. Administration of Examination

The Medical School will coordinate and execute all examination. The result will be discussed at the Examination Board before approval by the Medical School Board and Malaysian Universities Conjoint Committee of Ophthalmology .

Appendix I: Program Structure

| PHASE | YEAR | CURRICULUM |
|------------------------------------|-------|--|
| I | 1 | Basic Medical Sciences Basic Ocular Sciences Optics and Refraction Introduction to Clinical Ophthalmology |
| Professional I Examination | | |
| II | 2 & 3 | Clinical Ophthalmology Scientific Presentations Case Reports / Publications Submission Dissertation Protocol & Ethical Approval Conduct Dissertation Project |
| Professional II Examination | | |
| III | 4 | Advanced Ophthalmology Specialist-in training Scientific Presentations Case Reports / Publications Submission Conduct and Complete Dissertation Project Dissertation Submission Elective Posting |
| Phase III Assessment | | |

Appendix II: Syllabus

PHASE I

1.1. Basic Sciences (General and Ocular)

1.1.1. Anatomy

1. The cranial cavity
 - Osteology of the skull including bony orbit
 - Meninges, blood supply, nerve supply
 - Venous sinuses
 - Foramina and their contents
 - Cranial fossae
 - Pituitary gland and its relations
 - Trigeminal ganglion

2. Central nervous system
 - Cerebral hemispheres and cerebellum
 - Surface appearance
 - Internal structure
 - Cortical areas
 - Ventricles
 - Formation and circulation of cerebrospinal fluid
 - Blood supply and venous drainage
 - Microscopic anatomy
 - Brain stem
 - Midbrain
 - Pons
 - Medulla and fourth ventricle
 - Nuclei of cranial nerves
 - Cranial nerves
 - Origin, course and distributions
 - Spinal canal
 - Spinal cord, venous plexus, meninges and subarachnoid space
 - Visual pathways – visual cortex, cortical connections and association areas
 - Structures involved in control of eye movements
 - Autonomic nervous system and the eye

3. Head and neck anatomy

Nose, mouth and paranasal sinuses

Lateral wall of nose, septum, vessels and nerves, osteology, anatomy, relations and development of air sinuses

The face and scalp - muscles, nerves and vessels, temporal fossa, zygomatic arch, salivary glands and temporomandibular joints

The inferotemporal fossa and pterygopalatine fossa – muscles, nerves

and vessels, carotid sheath, pterygopalatine ganglion

General topography of the neck – posterior triangle, anterior triangle,

suprahyoid region, pre vertebral region, root of neck

Respiratory system – the anatomy of mouth, pharynx, soft palate and

larynx with particular reference to bulbar palsies and tracheostomy

Lymphatic drainage of the head and neck

4. Histology

Knowledge of histological structure of tissues. Particular attention should be paid to the histological appearance of the structures of the head and neck especially in relation to their functions

5. Embryology

General embryology with particular emphasis to structures of the head and neck

1.1.2. Physiology

1. General physiology

Maintenance of homeostasis: osmolarity, osmotic and oncotic pressure

Transport processes in systems and tissues

Molecular events: the role of calcium in regulation of cell processes

Normal nutritional requirements

General metabolic response to trauma and sepsis

2. Nerve and muscle
 - Structure and function of nerve cell
 - Resting membrane potential, action potential and its propagation, synaptic potentials
 - The motor unit, neuromuscular junction and molecular events
 - Smooth muscle
 - Pain and its control

3. Autonomic nervous system
 - Organization and anatomy, cholinergic transmission, adrenergic transmission

4. Blood
 - Composition and function of blood
 - Iron metabolism, erythropoiesis and anaemia
 - Plasma components
 - Blood groups
 - Blood clotting and fibrinolysis

5. Respiratory system
 - Respiratory mechanisms including lung mechanics, volumes and control of ventilations
 - Pulmonary blood flow including ventilation-perfusion ratio
 - CO₂ and O₂ transport, carriage and distribution
 - Gas exchange in lung
 - Assessment of pulmonary function
 - Respiratory failure and other common derangements of respiratory function
 - Oxygen therapy and ventilatory support

6. Cardiovascular system
 - Blood pressure
 - The cardiac cycle
 - Control, excitation and conduction in heart
 - Control of circulation
 - Blood vessels and transcapillary exchange, measurement of blood flow
 - Pathophysiology and management of shock

7. Acid-base balance / metabolism
 - PH-buffers-acid-base balance
 - Bicarbonate/CO₂ buffer
 - Disturbances of acid-base balance
 - Nutrition

8. Renal system
 - Renal circulation
 - Glomerular filtration
 - Tubular function
 - Salt and water: hormonal control and water balance
 - Kidney in control of acid-base balance
 - Renin-angiotensin system
 - Disturbances of fluid and electrolyte balance

9. Endocrine system
 - Hormones, receptors and secondary messengers
 - Hypothalamic-hypophyseal system
 - Adrenal cortex, synthesis of glucocorticoids and steroid hormones
 - Thyroid hormones
 - Calcium and phosphate homeostasis
 - Carbohydrate metabolism: pancreatic hormones

10. Central nervous system and special senses
 - Cerebrospinal fluid
 - Superficial senses, proprioception, monosynaptic and polysynaptic reflexes, synaptic inhibition
 - Central processing of sensory input
 - Cerebellar function in motor control
 - Cerebral cortex in control of movement
 - Basal ganglia
 - Organization within cervical and thoracic spinal cord

1.1.3. **Molecular and cell biology**

Cellular biochemistry

Organization of cell organelle, plasma membrane, cytoskeleton, nucleus;
cell to cell communication; ion and solute transport

Protein and acid nucleic synthesis: molecular biology

Connective tissue and extracellular matrix

Collagen; synthesis/degradation

Basal lamina; collagen, laminin; Fibronectin; Proteoglykans; Glycoprotein

Receptor, signal transduction and second messenger

Adenylate cyclase, hormone receptor, protein-F, phosphoinositide system

Atrial natriuretics factor

Active oxygen species

Free radical and H₂O₂, scavenger; lipid peroxidase, phospholipase A

Eicosanoids

Prostaglandins, Leukotrienes

Enzymes that metabolize drugs (cytochrome P450 and multifunction
oxidase group)

1.1.4. **Pathology**

1. Inflammation

Acute inflammation: chemical and cellular mechanisms

Wound healing

Chronic inflammation: granulomata, granulation tissue, ulceration,
immune mechanisms, chemical mediators in response to infection
and tissue injury

Graft rejection

2. Disturbances of growth

Atrophy, hypertrophy, hyperplasia and metaplasia

3. Degenerations

Calcification, hyaline, amyloid

4. Aging

Mechanisms including apoptosis

5. Neoplasia
Morphological and cellular characteristics of benign versus malignant tumours
Carcinogenesis
Gene control
Oncogenes
Effects of irradiation and cytotoxic drugs
Environmental factors

6. Vascular disorders
Atheroma
Thrombosis
Embolism
Ischaemia and infarction
Hypertension
Aneurysms
Diabetes
Angiogenesis

7. Shock and trauma
Response to surgical, chemical and radiation trauma
Principles of the pathological effects of head injury

1.1.5. Microbiology

1. Principle of infection

2. Culture media

3. Bacteria
Gram staining and classification
Exotoxins and endotoxins
Mechanism of virulence and pathogenicity
Synergistic infections
Antibiotics: including mechanisms of action, bacterial resistance
Host defence mechanisms against bacterial infection

4. Viruses
 - Classification
 - Structure and replication
 - Host defence against viral infection
 - Antiviral agents: mechanism of action
 - Laboratory methods for viral detection
5. HIV and AIDS
 - Classification, diagnosis, laboratory diagnosis and monitoring of HIV infection
 - Opportunistic infections
 - Anti-HIV agents
6. Fungi
 - Classification
 - Host factors which predispose to fungal infection
 - Antifungal agents
7. Others
 - Toxoplasmosis
 - Chlamydia
 - Acanthamoeba
 - Helminthic infections
 - Antimicrobials

1.1.6. Immunology

- Innate and acquired immunity
- Effector mechanisms of immune response
- Humoral immunity and antibody class and function
- Cellular immunity
- Immunity against microbes
- T and B cells: cluster differentiation, phenotype, T and B cell activation
- MHC antigens, antigen presenting cells and antigen processing
- Immune mechanism of tissue damage
- Interleukins, complements
- Immunodeficiency and immunosuppression
- Organ transplantation and pathophysiology of allograft rejection

1.1.7. Pharmacology

Pharmacokinetics and pharmacodynamics

Drug receptor and secondary messengers: cellular mechanisms of drug action

Cholinergic and adrenergic systems

Serotonin

Histamine

Anti-inflammatory agents

Anti-infective agents

Immunosuppressants

Local anaesthetics

Analgesics

Mechanisms of drug toxicity

1.1.8. Genetics

Chromosomes and cell division

Methods of genetic analysis

Mendelian inheritance

X-linked inheritance

Mitochondrial inheritance

Linkage analysis, disequilibrium and population genetics

Chromosome mapping

Gene mutations

Oncogenes and genetics of malignancy

Principles of gene therapy

1.2. Ocular Sciences

1.2.1. Anatomy of visual and ocular system

Orbit and paranasal sinuses

Ocular appendages

Eyeball

Surface anatomy as seen under slit lamp

Extraocular muscles

Orbital nerves

Visual pathway

Orbital autonomic system

Embryology of the eye

1.2.2. Physiology of visual and ocular system

Function of eyelid
Lacrimal apparatus
Physiology of cornea
Somatic sensation
Control of ocular movement and extraocular muscles
Ocular circulation
Aqueous humour
Intraocular pressure
Vitreous
Lens
Pupil and accommodation
Retina and optic nerve
Photochemistry
Electrical phenomenon in the retina
Physiology of visual pathway
Colour vision
Entoptic phenomenon
Binocular vision
Visual adaptation
Time related visual function

1.2.3. Introduction to ocular pathology

1. To describe ocular anatomy and to identify the histology of major structures of the eye e.g. conjunctiva, sclera, cornea, anterior chamber angle, iris, ciliary body, lens, vitreous, retina, retinal pigment epithelium, choroid and optic nerve
2. To describe basic pathophysiology of the common disease processes of the eye and to identify the major histological findings of each e.g. wound healing, infection, inflammation, neoplasm
3. To identify the histology of important intraocular and adnexal diseases
e.g. endophthalmitis, retinoblastoma, choroidal melanoma, microbial keratitis
4. To describe common basic ophthalmic-related immunology

1.2.4. **Basic optics and principles of ophthalmic instruments**

1. Physical Optics
 - Features of light
 - Defraction
 - Interfens
 - Resolution
 - Polarization
 - Refraction
 - Transmission and resorption
 - Photometry
 - Laser

2. Geometry Optics
 - Reflection
 - Refraction
 - Prisms
 - Spherical lenses
 - Astigmatic lenses
 - Optical prescription
 - Identification of lenses
 - Aberration of optical systems

3. Introduction to Clinical Optics
 - Ocular optic
 - Refraction by the eye
 - Reduced schematic eye
 - Pupillary response (Styles Crowford effect)
 - Visual acuity
 - Contrast sensitivity
 - Catoptric images
 - Emmetropia
 - Accomodation
 - Perkinje image
 - Principle of pinhole

4. Instruments
 - Direct ophthalmoscope
 - Indirect ophthalmoscope
 - Retinoscope
 - Simple magnification glass (Loupe)
 - Focimeter
 - Lensometer
 - Automated refractometer
 - Slit lamp microscope – including technique of examination
 - Keratometer
 - Applanation tonometer
 - Corneal pachymeter
 - Specular microscope
 - Principle of zoom lens
 - Operating microscope
 - Gonioscope
 - Hruby lens, 90D etc.
 - Fundus lenses (Panfunduscope lens and Goldmann)
 - Fundus camera
 - Synoptophore
 - Stereoscopic test
 - Lees screen / Hess chart

5. Principles of LASER in Ophthalmology
 - Basic concept
 - Argon Laser
 - Nd:YAG laser
 - Excimer laser, diode, krypton and CO₂ laser
 - Historical aspect
 - Lenses use in LASER therapy

6. Ultrasound in Ophthalmology
 - Principle of sound wave
 - A-scan and B-scan
 - Diagnostic ultrasound

1.2.5. **Clinical refraction**

Ametropia

Accommodation disorders

Refractive error

Ametropia correction

Glasses problem in aphakic patient

The effect of glasses and contact lens to accommodation and convergence

Effective power of lenses

Back vertex distance

Spectacle magnification

Intraocular lens power calculation

Presbyopia

Low visual aids

Retinoscopy

Subjective refraction

Back vertex distance calculation

Accommodative power

Interpupillary distance

Lens decentration and prismatic effect

Advantages of lens

Glass prescription to children

Cycloplegic refraction

2.1. Clinical ophthalmic pathology

Inflammation and immune related eye disease
Ocular inflammation – specific and idiopathic
Sympathetic ophthalmia
Pathology of external eye
Eyelid growth and lesion
Uveal tract growth
Lens disorders
Retinal degenerative diseases
Retinal vascular diseases
Neuroepithelial growth
Glaucoma
Optic nerve lesion
Phacomatosis
Lymphoid tissue growth
Congenital defect
Injury and surgical trauma

2.2. External eye disease

Eyelids inflammatory disease and pseudotumour
Bacterial conjunctivitis
Ophthalmia neonatorum
Follicular conjunctivitis
Phlyctenulosis conjunctivitis
Vernal conjunctivitis
Conjunctival growth
Therapeutic hydrogel lens
Skin and mucous membrane bullous disorder
Lacrimal drainage system
Diagnosis and treatment of dry eye

2.3. Uveal disease

Fluorescein angiography
Uveitis work-up
Uveal biopsy
Ocular albinism

General facts in uveitis
Pathogenesis of uveitis
Aetiology of uveitis
Treatment of uveitis
Bacterial uveitis (including tuberculosis and syphilis)
Viral uveitis
Uveitis – presumed viral aetiology
Presumed ocular histoplasmosis
Mycotic uveitis
Toxoplasmosis
Uveitis and parasites
Uveitis and general diseases
Hypersensitivity uveitis
Postoperative uveitis
Paediatric uveitis
Other types of uveitis
Trauma: laceration and hemorrhage
Trauma: inflammation
Ciliochoroidal effusion
Iris atrophy and degeneration
Choroidal atrophy and degeneration
Uveal tumours

2.4. Retinal disease

Fluorescein angiography
Clinical visual electrophysiology
Colour vision
Congenital fundus disorder
Hereditary macular dystrophy
Retinal inflammatory disease
Fungal endogenous endophthalmitis
Hypertension and arteriosclerosis
Retinal periphlebitis
Sickle cell retinopathy
Blood dyscrasia retinopathy
Retinopathy of prematurity
Age related macular degeneration
Systemic lupus erythematosus retinopathy

Vascular fundal disorder
Acquired maculopathies
Primary retinal degeneration
Choroideremia and gyrate atrophy
Retinal degenerative disease
Rhegmatogenous retinal detachment
Retinopathy related to metabolic disorder
Diabetic retinopathy
Blunt trauma to the posterior segment
Intraocular tumours
Toxic retinopathy
Radiation retinopathy
Changes and diseases of vitreous

2.5. Lens disease

Examination and measurement of lenses
Types of cataracts and complication of cataract
Congenital lens disorders

2.6. Orbital disease

Introduction to orbital diseases and technique of examination
Radiology of orbit
CT-scan of orbit
Introduction to ophthalmic ultrasound
Ocular and orbital ultrasonography
Neuro-ophthalmic view of orbital diseases
Congenital orbital disorders and growth abnormalities
Cystic tumour
Introduction to ultrastructure, inflammation and neoplasia
Eye and orbital changes in Graves disease
Vascular tumour, malformation and degeneration
Lymphoma, plasma, histocytic and haemopoietic
Lacrimal gland tumour
Neurogenic tumour
Optic nerve glioma
Rhabdomyosarcoma
Mesenchyme and fibro-osseous tumour
Orbital metastasis tumour

Orbital bone fracture

2.7. Visual pathway disease

Diagnosis: prechiasma

Diagnosis: optic chiasma

Diagnosis: retrochiasma and cortical function

Extraocular movement and technique of data recording

Supranuclear and ocular motility disorder

Nystagmus and ocular movement

Infranuclear and ocular motility disorder

Congenital optic disc disease

Pupil and accommodation

Aneurysm, A-V malformation and other related vascular disease

Migraine

2.8. Ocular motility disease

Extraocular muscle and extraocular movement

Nerves that innervate the extraocular muscles

Supranuclear area and extraocular movement

Binocular single vision

Alignment

Vergence

Sensorial adaptation in strabismus

Sensorial tests

Amblyopia

Treatment of sensorial adaptation and amblyopia

Concomitant esodeviation and concomitant exodeviation

Monofixation syndrome

Concomitant vertical deviation

A and V pattern

Oblique muscle dysfunction

Dissociated vertical deviation

Cranial nerve palsies

Trauma and ophthalmoplegia syndrome

2.9. Glaucoma

Use of gonioscopy

Aqueous humor dynamics

Tonography and tonometry

- Visual field changes
- Congenital glaucoma
- Primary open angle glaucoma
- Primary angle closure glaucoma
- Secondary glaucoma
- Glaucoma and cataract
- Changes in glaucoma treatment
- Glaucoma surgery
- Problems in glaucoma treatment
- Postoperative hypotony

2.10. Medical ophthalmology and neuro-ophthalmology / neurosurgery

- Ocular manifestation of endocrine and metabolic diseases
- Cardiovascular disease
- Haematology disease
- Respiratory disease
- Connective tissue disease
- Allergy and immunology of external eye disease
- Muscle and bone disease
- Dietary and gastrointestinal disease
- Renal disease
- Infection and inflammatory disease
- Metastasis to the eye and ocular adnexa
- Chromosomal disease
- Phacomatosis
- Perinatal ophthalmology
- Glaucoma and systemic disease
- Cataract and systemic disease
- Retinal disorder and systemic disease
- Corneal disorder and systemic disease
- Systemic and ocular manifestation in child abuse

2.11. Preventive ophthalmology

- Introduction to preventive ophthalmology
- Causes of blindness
- Epidemiology of blindness
- Ophthalmology screening program

Ocular surgery in developing countries
Preventive methodology
Food-blindness: xerophthalmia and keratomalacia
Pathogenesis and prevention of trachoma
Onchocerciasis
Ocular leprosy
Epidemiology and clinical research
Statistics in clinical research

2.12. Therapeutics

Drugs used in treating ocular diseases
Ocular side effects of systemic drugs

2.13. Paediatric ophthalmology and strabismus

Ocular congenital defects
Hereditary diseases
Paediatric eye diseases, orbit and visual pathway diseases
Ocular manifestation of paediatric diseases
Refractive error and amblyopia
Anisometropia
Allergic conjunctivitis
Congenital ptosis
Type of strabismus
Management of strabismus
Principle of strabismus surgery
Retinopathy of prematurity

2.14. Ophthalmic surgeries

Principles of ophthalmic surgeries
Preoperative assessment
Techniques in operation theatre
Instruments, suture and technique of suturing
Cryotherapy, laser surgery, diathermy and cautery
Lids surgery
Extraocular muscle surgery
Lacrimal system surgery
Orbital surgery
Reconstructive surgery

Complications of surgery

Postoperative treatment

2.15. Others

Tests for ophthalmic disease including CT-scan and MRI

Ocular trauma

Genetic counseling

Rehabilitation for blinds

Current views and issues