

# THE COLLEGE OF CLINICAL PERFUSION SCIENTISTS OF GB AND IRELAND

## EXAMINATION GUIDE

This guide covers general information relating to requirements for the Written Examination of the College, (and for the Practical and Viva Perfusion Examination conducted by the Society).

### 1. WRITTEN EXAMINATION GUIDANCE

#### 1.1. General

A written examination is required by the College for (i) Limited Registrants who have secured a job in the UK or Ireland, and who have a primary perfusion qualification from overseas, and a minimum experience of 12 months' post-qualifying experience (before sitting the exam, candidates must have met English-language requirements) and (ii) British accredited perfusionists who have not practised for 4 years or more.

There are normally at least two opportunities each year to sit these exams, usually during April and November. Additional exams can be set if demand requires.

NB. It is the policy of the College that we do not provide example exam papers. However, described below is a detailed format of the current exam papers.

#### 1.2. Exam Format

Each exam consists of two papers: a Medical Science paper and a Perfusion paper.

##### **Exam A: Medical Science Paper**

This paper is divided into 3 sections:

- Anatomy and Physiology
- Pathology and Congenital
- Pharmacology

Each of these sections consists of 4 questions: candidates are expected to answer 3 out of 4 of these questions from each section. The answers should be in the format of a short essay; diagrams to illustrate and clarify the answer are encouraged and expected.

Each question has a maximum of 10 marks.

##### **Exam B: Perfusion Paper**

This paper is divided into 2 sections:

- Essay
- Short-Answer Questions

The Essay section has a choice of 3 questions, and candidates are expected to answer one of these. It should be answered in full as a long essay. The essay has a maximum of 40 marks.

The Short Answer section has a choice of 8 questions, and candidates are expected to answer 6 of these questions. Typically, the questions can be divided into subsections, and relatively short, concise, and accurate answers are expected. Each question has a maximum of 10 marks.

The marks for both exams are combined, and the overall pass mark is 50%. Thus, candidates can theoretically fall below 50% (but not below 40%) in one exam but bring the mean mark above 50% by doing well in the other exam (which will result in an overall pass). However, candidates with lower than 40% in either exam cannot pass overall.

The below should provide some indication of the range of potential subject areas covered by the exam (see later).

#### Anatomy and physiology of organs affected by CPB

The physiological functions of the major systems in the body relevant to perfusion science and the associated abnormalities in diseases associated with them.

This covers the anatomy, physiology and pathology of the heart, blood, lungs, liver, kidney, and nervous system.

#### Adult CPB principles and practice; Paediatric perfusion and circulatory support

Components of the adult and paediatric cardiopulmonary bypass circuit and the effects of CPB and the materials used in circuits on the anatomy and physiology of the patient and organs including the heart, lungs, kidney, brain, blood and the immune system.

The design, function and limitations of circuit designs, components and perfusion practices for adults and paediatrics including: oxygenators; pumps and filters; safety devices; blood conservation methods; perfusion parameters; IABPs; aortic dissections; ECMO; heart transplantation; cardioplegia; pharmacology; anaesthesia.

#### Coronary artery disease; Heart and valve disease; Congenital cardiovascular disorders

The nature of perfusion-relevant human disease; risk factors; aetiologies; the associated pathological changes at the molecular and cellular level; clinical therapeutic interventions; diagnostic techniques. This includes: coronary artery disease; atherosclerosis; extracranial cerebrovascular disease; thrombosis; cardiac ischaemia/reperfusion; heart failure; arrhythmias; valve disease.

Congenital cardiovascular disorders including embryology, fetal cardiology, clinical intervention, including paediatric surgery.

### 1.3. Potential Subject Areas of Exam

The following list gives an indication of subject areas that may be covered in any examination; however, this is not exhaustive.

- Structure and function of contents of thorax and mediastinum
- Great vessels, valves, cardiac chambers, coronary arteries
- Embryological development of cardiovascular system
- Cardiovascular physiology
- Renal physiology, structure and glomerular filtration
- Blood flow and distribution
- Temperature regulation
- Starling's Law, La Place's Law, Boyle's Law, Charles' Law
- Gas exchange and calculation of O<sub>2</sub> content of blood
- Normal values for blood gases and electrolytes
- Autonomic nervous system
- Cardiac cycle
- Pressure changes in cardiac chambers during cardiac cycle
- Cerebral autoregulation
- Agonist and antagonist differences
- Modes of action
- Vasodilators and vasoconstrictors
- Anticoagulants (heparin, warfarin etc), alternatives to heparin
- Antifibrinolytics
- Pharmacological agents for blood loss
- Antiplatelet drugs
- Cardiac drugs (Ca-channel blockers,  $\beta$ -blockers, K-channel blockers, antiarrhythmics)
- Antibiotics
- Anaesthetic drugs (muscle relaxants, analgesics, inhalation anaesthetics)
- Atherosclerosis (surgical options, conduits)
- Valve pathology (surgical options, valve types)
- Marfanoid conditions
- Pathology of the aorta (surgical options)
- Cardiomyopathies
- Cardiogenic shock
- Left ventricular failure (surgical options)
- Grown-up congenital conditions
- Surgery for heart/heart-lung transplantation
- Circuits
- Oxygenators
- Pumps
- Primes
- Cannulation techniques
- Filtration
- Coatings
- Hypothermia
- Acid-base management

- Myocardial preservation
- IABP
- Cerebral perfusion
- Blood flow
- Blood conservation techniques
- ECMO
- Problem solving scenarios

## 1.4. References

The potential references/books to cover all aspects of Clinical Perfusion is extensive, and it is not the remit of this guide to provide an exhaustive list. However, some potentially useful suggestions are provided below:

### 1.4.1. Books:

Gravlee GP, Davis RF, Stammers AH, Ungerleider RM. *Cardiopulmonary Bypass: Principles and Practice*. Lippincott Williams and Wilkins, 3<sup>rd</sup> Ed (2007).

Opie LH. *Heart Physiology: from Cell to Circulation*. Lippincott Williams and Wilkins, 4<sup>th</sup> Ed (2003).

Katz AM. *Physiology of the Heart*. Lippincott Williams and Wilkins, 5<sup>th</sup> Ed (2011).

Kouchoukos NT, Blackstone EH, Doty DB, Hanley FL, Karp RB. *Kirklin/Barratt-Boyce Cardiac Surgery*. Churchill Livingstone 3<sup>rd</sup> Ed (2003).

Aaranson PI, Ward JPT. *The Cardiovascular System at a Glance*. Wiley-Blackwell 3<sup>rd</sup> Ed (2007).

Katzung BG, Masters SB, Trevor AJ. *Basic and Clinical Pharmacology*. McGraw-Hill Medical, 12<sup>th</sup> Ed (2012).

Allman KG, Wilson IH. *Oxford Handbook of Anaesthesia*. Oxford University Press 3<sup>rd</sup> Ed (2011).

Barnard M, Martin B. *Cardiac Anaesthesia*. Oxford University Press (2010).

### 1.4.2. Journals:

*Perfusion*. Sage Journals. 1986 – present.

*Journal of ExtraCorporeal Technology*. AmSECT. 1967 – present.

*European Journal of Cardio-thoracic Surgery*. Oxford University Press. 1987 – present.

*Annals of Thoracic Surgery*. Elsevier. 1965 – present.

*Journal of Thoracic and Cardiovascular Surgery*. Elsevier. 1965 – present.

*Journal of Cardiothoracic and Vascular Anaesthesia*. Elsevier. 1997 – present.

## **2. PRACTICAL EXAMINATION GUIDANCE**

As part of the registration process, prospective perfusion scientists must sit a Practical Examination and a Perfusion viva.

### **2.1. Practical Examination**

Perfusion students are examined whilst running a case and will be expected to be proficient in the areas listed below (at least).

- Pre-bypass preparation
- Aseptic technique
- Circuit assembly
- Priming of circuit
- Initiation of bypass
- Levels
- Flow and pressure
- Temperature
- Other physiological parameters
- Communication
- Records
- Termination
- Post-bypass awareness

Candidates are required to achieve a mark of at least 50% to pass this practical examination. If they fail any of the above areas (ie. obtain zero marks), the practical examination will be terminated and they will be deemed to have failed.

If the practical examination is passed, the candidates will then be given a viva in various aspects of perfusion.

### **2.2. Perfusion Viva Revision Topics**

Revision topics for this viva are detailed below:

#### **(a) Emergency procedures**

- pump boot/centrifugal pump changeout
- oxygenator changeout
- reservoir changeout
- gross air embolism
- power failure

#### **(b) Filters**

- pre-bypass
- in reservoir
- arterial line
- haemofiltration
- leukocyte depleting

#### **(c) Myocardial protection**

- cardioplegia, route of administration, antegrade/retrograde, content
- hypothermia vs normothermia

- blood vs crystalloid
- cross-clamp fibrillation

(d) Priming solutions

- crystalloids
- colloids
- diuretics
- bicarbonate
- albumin
- blood
- mannitol

(e) Pumps

- roller pumps
- centrifugal pumps
- pulsatile vs continuous

(f) Parameters

- acid-base management
- temperature management
- pressure management

(g) Vents

- root
- LV
- PA

(h) Drugs

- phentolamine
- metaraminol
- noradrenaline
- magnesium
- potassium
- milrinone
- fentanyl
- sodium nitroprusside
- trasylol
- heparin
- protamine

(i) Safety features

- level alarm
- bubble alarm
- temperature alarm
- pressure alarm

(j) Blood conservation

- cell salvage
- haemoconcentration
- pre-op autologous donation
- trasylol

(k) Inflammatory response

- platelets
- clotting cascade
- leukocytes
- cytokines
- thrombocytopaenia

This list is not exhaustive.

The pass mark for the viva is 50%.