The Scandinavian School
of Cardiovascular Technology
Aarhus, Denmark

Education Program in Cardiovascular Technology

Aarhus University

Aarhus University Hospital

Faculty of Health Sciences, Aarhus University, Denmark

Aarhus University Hospital, Denmark

Recommended and approved by the Scandinavian Society of ExtraCorporeal Technology and
The European Board of Cardiovascular Perfusion

INTRODUCTION

This education program includes a core curriculum of mandatory cardiovascular courses and a broad range of elective courses within the cardiovascular and biomedical engineering field, including perfusion techniques. A student who wishes to work within the health sector will obtain the necessary background to manage extracorporeal circulation with a heart-lung machine during cardiac surgery and take part in introducing new cardiovascular monitoring and treatment techniques that demand special qualifications. In addition, the program will give the student experience in research relating to the development and use of new cardiovascular technologies.

The education program is offered by the Faculty of Health Sciences, University of Aarhus in collaboration with Science & Technology, Aarhus University and Aarhus University Hospital, which all perform high quality teaching on an international level.

AIM

- To obtain the necessary qualifications to manage extracorporeal circulation and circulatory support units used during and after cardiac surgery as well as other related clinical disciplines
- To enhance the scientific skills necessary to participate in clinical research within the cardiovascular area

ENTRY REQUIREMENTS

A relevant Bachelor's degree in either nursing, engineering, medicine, chemistry, biology, physics, laboratory biotechnology or a similar background is required to enter this program. Additionally, at least 2 years of relevant clinical or technical experience after completion of such education is required.

DURATION

The duration of the program is two years, based on four modules – one module each semester. Each module requires six weeks of full time study starting around September 1st and February 1st. The last module comprises a scientific project and the submission of a thesis.

LANGUAGE

The official language is English.

STRUCTURE

The first three modules are divided into three courses. During the fourth module the student will perform the final science based thesis.
There is an examination/assessment shortly after each module.

	Module 1 **6 weeks**	**Module 2** **6 weeks**	**Module 3** **6 weeks**	**Module 4**
Physiology and treatment	Circulatory physiology	Biochemistry and microbiology	Cardiovascular treatment	Scientific thesis
Biomedical technology /research	Medical instrumentation	Research in medicine	Electrophysiology and medical imaging	
Perfusion techniques	Basic Perfusion Technology	Advanced techniques and Pathophysiology	Special techniques and ECMO/assist	
	Examination	Examination	Examination	Assessment
	15 ECTS	15 ECTS	15 ECTS	15 ECTS

Each course represents a total of five ECTS points (European Credit Transfer System) and consists of approximately 50 hours of tuition and laboratory exercises.

Lectures are given at the Faculty of Health Sciences, Aarhus University and Aarhus University Hospital. Animal experimental exercises takes place at the Department of Clinical Medicine, Aarhus University.
Fluid mechanics and medical instrumentation demonstrations and exercises takes place at the laboratories of Aarhus University Hospital.

COMPETENCE PROFILE

A degree in cardiovascular technology together with completed clinical practice approved by The National Health Board in Denmark and The European Board of Cardiovascular Perfusion (EBCP), will qualify the student to perform the following tasks:

- Set up and manage extracorporeal circulation using a heart-lung machine during open heart surgery
- Set up and manage mechanical circulatory support, including the use of intra-aortic balloon pump, extracorporeal cardiopulmonary resuscitation (ECPR), ventricular assist systems and artificial heart
- Set up and manage extracorporeal membrane oxygenation (ECMO)
- Set up and manage extracorporeal circulation in non-cardiovascular applications, such as selective organ perfusion
- Participate in interdisciplinary collaboration involving research and development of new methods for surveillance, diagnostics and treatment of cardiovascular patients
- Collaborate with the biomedical industry concerning exploitation of research results for development of new equipment within the cardiovascular field
- Assess new methods and equipment in the cardiovascular field
- Teach the theoretical background for and application of new cardiovascular technology

PRACTICAL TRAINING

The education can, combined with practical training in clinical perfusion, lead to certification as a Clinical Certified Perfusionist. This requires a full-time employment as perfusion trainee in a local heart center, for the two years education period – supervised by the school.

ADVISORY COMMITTEE

An advisory committee and school board representing employers of the graduated masters from hospitals and industries in Scandinavia, as well as member from EBCP and SCANSECT is a supervising body for the academic level and performance of the school.

REGULATIONS

The school is approved by accreditation from the European Board of Cardiovascular Perfusion.

TUITION FEE

DKK 115,000 (approx. €15,400) includes application fee for EBCP, books and teaching material for all four semesters but not travel and accommodation.

CIRCULATORY PHYSIOLOGY

Anatomy and physiology
Cardiac physiology
Circulation physiology
Pathophysiology
Blood-gas and acid-base physiology
Hematology
Circulatory biophysics
Prenatal physiology
Myocardial protection
Hemodynamics
Pressure and flow regulation
Laboratory exercises

MEDICAL INSTRUMENTATION

Applied mathematics
Basic electronics
Fluid dynamics
Measurement techniques
Static and dynamic characteristics
Transducers and chemical biosensors
Amplifiers and signal processing
Hemodynamics
Blood pressure measurement
Heart sounds and murmurs
Blood flow measurement
Catheterization
Patient safety
Laboratory exercises

BIOCHEMISTRY AND MICROBIOLOGY

Clinical chemistry and biochemistry
Microbiology and bacteriology
Hygiene
Sterilisation techniques
The immune system
The complement system
Inflammatory response
The endocrine system
The coagulation system
Anticoagulant therapy

ELECTROPHYSIOLOGY AND MEDICAL IMAGING TECHNIQUES

The origin of biopotentials
The electrical functions of the heart
Electrodes
Electrocardiography
Pacemaker treatment
Arrhythmia
Arrhythmia treatment
X-ray imaging techniques
Radionuclide imaging
MR-imaging
Ultrasound imaging
Doppler ultrasound
Echocardiography
Laboratory exercises

CARDIOVASCULAR SURGERY

Heart valve disease
Coronary artery disease
Valve surgery
Coronary surgery
Vascular surgery
Lung surgery
Anaesthesia
Pharmacology and the circulation
Cardioplegia
Intensive care
Organ transplantation
Extracorporeal circulation
Circulatory support
Interventional cardiology
Post-operative care

RESEARCH IN MEDICAL SCIENCE

Theory of science
Research methodology
Ethics
Planning of experiments
Biostatistics
Literature search
Abstracts and posters
Publication techniques
Oral presentation
Law and medicine
Exercises

BASIC PERFUSION TECHNOLOGY

The history of perfusion
The heart-lung machine
Oxygenators
Blood pumps
Open and closed circuits
Reservoirs and filters
Cannulation and drainage
Cardioplegia
Safety in perfusion
Pressure and flow
Problems and accidents
Sampling and storage of data
Vent and suction
Use of the heater / cooler
Cell-savers, hemofiltration and other blood saving techniques
Temperature regulation
Priming solution and hemodilution
Cardiovascular products
Laboratory exercises

ADVANCED TECHNIQUES AND PATHOPHYSIOLOGY

Pathophysiology in ECC
Hypothermia - pH/alfa stat
VAVD – Vacuum Assisted Venous Drainage
Hemodynamics and ECC
Embolism – solid and air
CPB impact on blood.
Blood products.
Blood- air and surface interface
Bubble detection and bubble removal
Cavitation / HITS / MES
In-line monitoring
Neurological effects
ECC and the lungs
Impact on other organs
Fluid and electrolyte balance
Metabolic balance.
Inflammatory and endocrine response
Cardiovascular products
Anticoagulation management
Data-sampling and handling
Laboratory exercises

SPECIAL TECHNIQUES AND ECMO/ASSIST

Pediatric ECC and set-up
Animal experimental practice
Materials science
Biomaterials and Biocompatibility
Coating of cardiovascular utensils
Assist devices
IABP – Intra Aortic Balloon Pump
ECMO
VAD (Ventricular Assist Devices)
Pulsatile perfusion
Perfusion for thoracic aortic surgery
ECC outside of cardiovascular surgery
Special cases, unusual problems
Mini systems and minimal approach
Cardiovascular products
New techniques and trends in perfusion
Laboratory exercises
RAP (Retrograde Autologous Prime)
VAP (Venous Antegrade Prime)

FURTHER INFORMATION:

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