MASTER’S PROGRAM IN CARDIOVASCULAR TECHNOLOGY

Faculty of Health Sciences, Aarhus University, Denmark
Aarhus University Hospital, Denmark

Recommended by the Scandinavian Society of Extra Corporeal Technology and The European Board of Cardiovascular Perfusion
INTRODUCTION
This master’s 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 master’s 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 mind and manage extracorporeal circulation and circulatory support units used during and after cardiac surgery.
- To enhance the scientific skills that are necessary to participate in clinical research within the cardiovascular area

ENTRY REQUIREMENTS
A relevant Bachelor’s degree in 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 program is based on part-time tuition over 4 semesters, with a duration of 2 years. There are 4 modules, where one module each semester consists of full-time tuition covering the first 6 weeks, starting around September 1st and February 1st.

LANGUAGE
The official language is English.

STRUCTURE
The first 3 modules are divided up into 3 courses. During the 4th module the student will perform the final science based master thesis.
There is an examination/assessment shortly after each module.

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Each course represents a total of 5 ECTS points (European Credit Transfer System) and consists of approximately 50 hours of tuition and laboratory exercises.

Lectures will be given at the Faculty of Health Sciences, Aarhus University, Faculty of Science & Technology, Aarhus University and Aarhus University Hospital. Animal experimental exercises will take place at Department of Clinical Medicine, Aarhus University. Fluid mechanics and medical instrumentation demonstrations and exercises will take place at the laboratories of Aarhus University Hospital and the new Cardiovascular Fluid Dynamics Lab at the Faculty of Science & Technology, Aarhus University.

**TITLE AND COMPETENCE PROFILE**
Completion of the program leads to the title: Master of Cardiovascular Technology.

A master’s degree in cardiovascular technology together with completed clinical practice approved by The National Health Board 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 circulatory support, including use of an intra-aortic balloon pump, ventricle assist systems or an artificial heart
- set up and manage extracorporeal membrane oxygenation
- set up and manage extracorporeal circulation in non-cardiovascular applications, such as selective organ perfusion
- supervise surgical procedures concerning treatment of heart rhythm disorders, including pacemaker implantation
- participate in an 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

**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 master’s program is based on regulations concerning master programs from The Ministry of Science, Technology and Innovation (no. 682, August 16, 2002), and The National Board of Health’s regulations concerning perfusion education (no. 68, May 17, 1995). The school is approved by accreditation from the European Board of Cardiovascular Perfusion.

**TUITION FEE**
DKK 111,000 (approx. €14,800) 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

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

MEDICAL INSTRUMENTATION
Applied mathematics
Basic electronics
Fluid dynamics
Measuring 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

PERFUSION TECHNIQUES 1
The history of perfusion
The heart-lung machine
Oxygensators
Blood pumps
Open and closed circuits
Reservoirs and filters
Cannulation and drainage
Cardioplegia
Safety in perfusion
Pressure and flow
Problems and accidents
Evaluation and storage of data
Vent and suction
Use of the heater / cooler,
Temperature regulation
Priming solution and hemodilution
Cardiovascular products
Laboratory exercises

PERFUSION TECHNIQUES 2
Hypothermia
pH/alfa stat
VAVD – Vacuum Assisted Venous Drainage
Hemodynamics and ECC

PERFUSION TECHNIQUES 3
Pediatric ECC
Pediatric set-up
Animal experimental practice
Materials science
Biomaterials
Biocompatibility
Coating
Assist devices
IABP – Intra Aortic Balloon Pump
ECMO
The artificial heart (implant devices)
Pulsatile perfusion
Perfusion for thoracic aortic surgery
ECC outside of cardiovascular surgery
Special cases, unusual problems
Mini systems and minimal approach
Cardiovascular products
Intra-operative ultrasound
Data-acquisition
Signal processing techniques
New techniques and trends in perfusion
Laboratory exercises

FURTHER INFORMATION:
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