University of Basel
Department of Biomedical Engineering

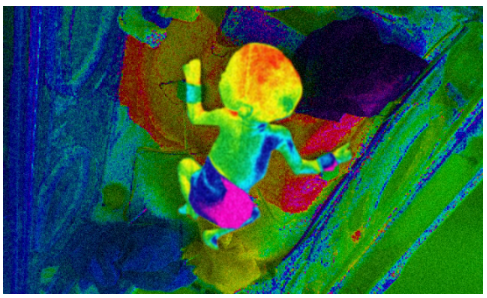
UKBB Universitäts-Kinderspital beider Basel

University of Basel, University Children's Hospital, Spitalstrasse 33, Postfach, CH-4031 Basel

Master of Science – Biomedical Engineering
Thesis Proposal

Temperature regulation in incubated infants

This project is about the relationship between physiological development and temperature regulation mechanisms in infants. Most preterm infants are kept in an incubator immediately after birth due to their underdeveloped ability to regulate their own body temperature. As the infant continues to develop outside the womb, their temperature regulation mechanisms mature as well, and the moment is reached at which the infant no longer needs to be in an incubator. However, determining this moment is difficult, and current medical practice is mainly based on trial and error.
In this project, for which most of the experimental data has already been collected, we will look at time series of body temperature in infants kept in an incubator. Moreover, at the same time, we will measure the incubator's activity in order to assess the incubator's work load required to keep the infant's temperature within the desired physiological range.
The goal of this master thesis project is to study the influence of the incubator on the infant's body temperature and the interaction between the infant's temperature regulation mechanisms and the incubator's servomechanism for temperature control. To this end, we would like to implement in Matlab a deterministic mathematical model of the incubator and the infant's body, including the temperature regulation mechanisms in both infant and incubator. The incubator's servomechanism is known to be a PID controller, which can readily be mathematically and computationally modelled. Some of the model's parameters will be obtained from the literature, others will be obtained experimentally using the incubators. For the infant's temperature control mechanism, we will implement different hypothetical models, with parameters reflecting the infant's maturation and developmental stage. Simulations of the model will then be compared to the actual data, which, as mentioned above, is already available.



Nature of the Thesis
Experimental: 15%
Programming: 80%
Documentation: 5%

Specific Requirements
Programming in Matlab; basic knowledge of control theory, for instance, as provided in the lecture "Optimal and Robust Control" by Georg Rauter.

Supervisor
Dr. Edgar Delgado-Eckert, University Children's Hospital (UKBB)
https://dbe.unibas.ch/en/research/imaging-modelling-diagnosis/computational-physiology-and-biostatistics/

Collaborators
Prof. Sven Schulzke, Neonatology Unit, University Children's Hospital (UKBB)

Contact
Dr. Edgar Delgado-Eckert: edgar.delgado-eckert@unibas.ch

University of Basel
University Children's Hospital (UKBB)
Spitalstrasse 33, Postfach
CH-4031 Basel

Dr. rer. nat. Edgar Delgado-Eckert
Research Group Leader
Computational Physiology and Biostatistics
Phone: +41 61 704 18 37
Email: edgar.delgado-eckert@unibas.ch
Web: https://dbe.unibas.ch/en/research/imaging-modelling-diagnosis/computational-physiology-and-biostatistics/