“Predicting treatment outcomes of infants with cyanotic heart disease using computational modeling”

PI: Sandra Rugonyi

The objective of this project is to develop computational models of babies with cyanotic congenital heart disease, with the ultimate goal of using model simulations as a tool in surgical intervention planning. Cyanotic heart defects, which cause “blue-baby syndrome”, occur when the blue (deoxygenated) blood returning from the body bypasses the lungs and is then pumped back into the body. In such cases, a Blalock-Taussig-Thomas (BTT) shunt, essentially a tube, is placed in the baby to redirect blood flow from the systemic (body) circulation to the pulmonary circulation to increase blood oxygenation. The procedure has dramatically increased survival rates of infants with cyanotic heart disease, but still carries about 10% mortality. In addition, there is a lack of consensus on how to proceed in cases of small premature babies or babies with rare defects. Computational models, which could be used to perform virtual surgeries and determine babies’ outcomes under different scenarios prior to surgery, have great potential to become a tool to guide physicians in intervention planning. The proposed computational models will be infant-specific. Because the models will be infant-specific, they will account for the individual cardiac defect and characteristics of the specific baby under consideration, and therefore will provide a personalized surgery approach for intervention planning.