

# Umbilical cord haemodynamics

The umbilical cord allows vital gas and nutrients exchanges between the placenta and the fetus. The transport between the mother and the infant is carried out by the blood, which flows towards the placenta through two umbilical arteries and comes back to the baby through the unique umbilical vein. A significant anatomical feature of the cord is its coiled, or helical nature. The two arteries are indeed twisted in spirals about the vein, as illustrated in the figures below. The three vessels are also surrounded by the so-called Wharton jelly, which fills the volume of the umbilical cord. The umbilical coiling index (UCI) is defined as the number of coils per unit length along the cord. The normal values for this parameter range from 0.18 to 0.22 coils per cm and abnormal UCI have been associated with perinatal difficulties and obstetrical issues.

The purpose of the work is the study of the umbilical cord haemodynamics. In particular, the influence of abnormal UCI on blood flow will be analyzed and related to medical issues. The approach will be mainly numerical and the COMSOL Multiphysics® software will be used to describe not only the blood flow, but also the deformations of the vessels and the fluid-structure interactions. Collaboration and discussions with medical doctors are also foreseen because of the interdisciplinary nature of the topic.

## Profile of the student:

- Interest in interdisciplinary work
- Skills in fluid mechanics, solid mechanics and numerical calculations

## Supervision of the work:

- Prof. Pierre Dauby and Dr. Hatim Machrafi, GIGA – In silico Medecine
- Dr. Xavier Capelle, Liège University Hospital (CHU)

## Contact:

- Pierre DAUBY, email: [pc.dauby@ulg.ac.be](mailto:pc.dauby@ulg.ac.be)

