

Placental Perfusion

The dually perfused human term placenta

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Alternative method for studying fetal exposure and adverse effects on placental health

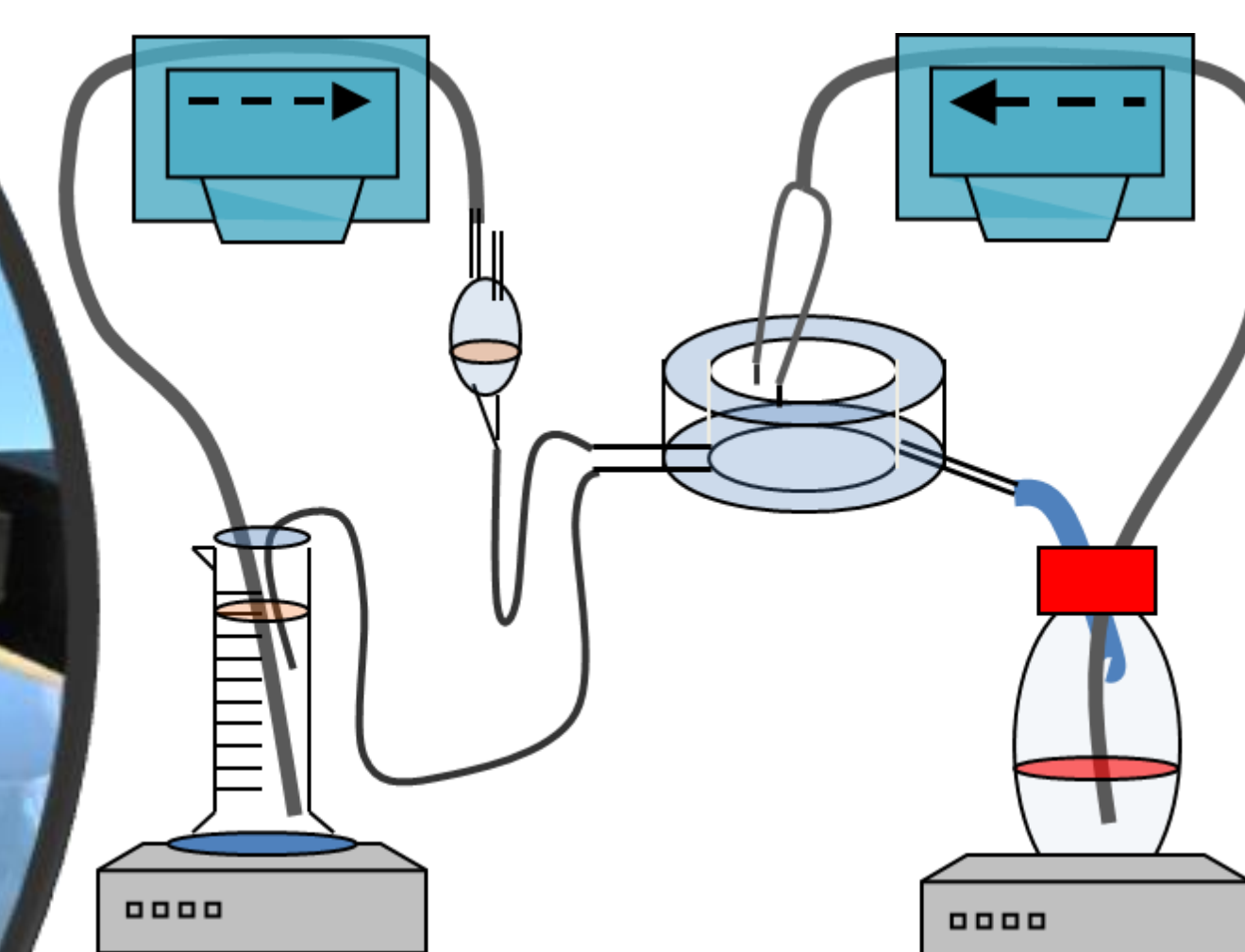
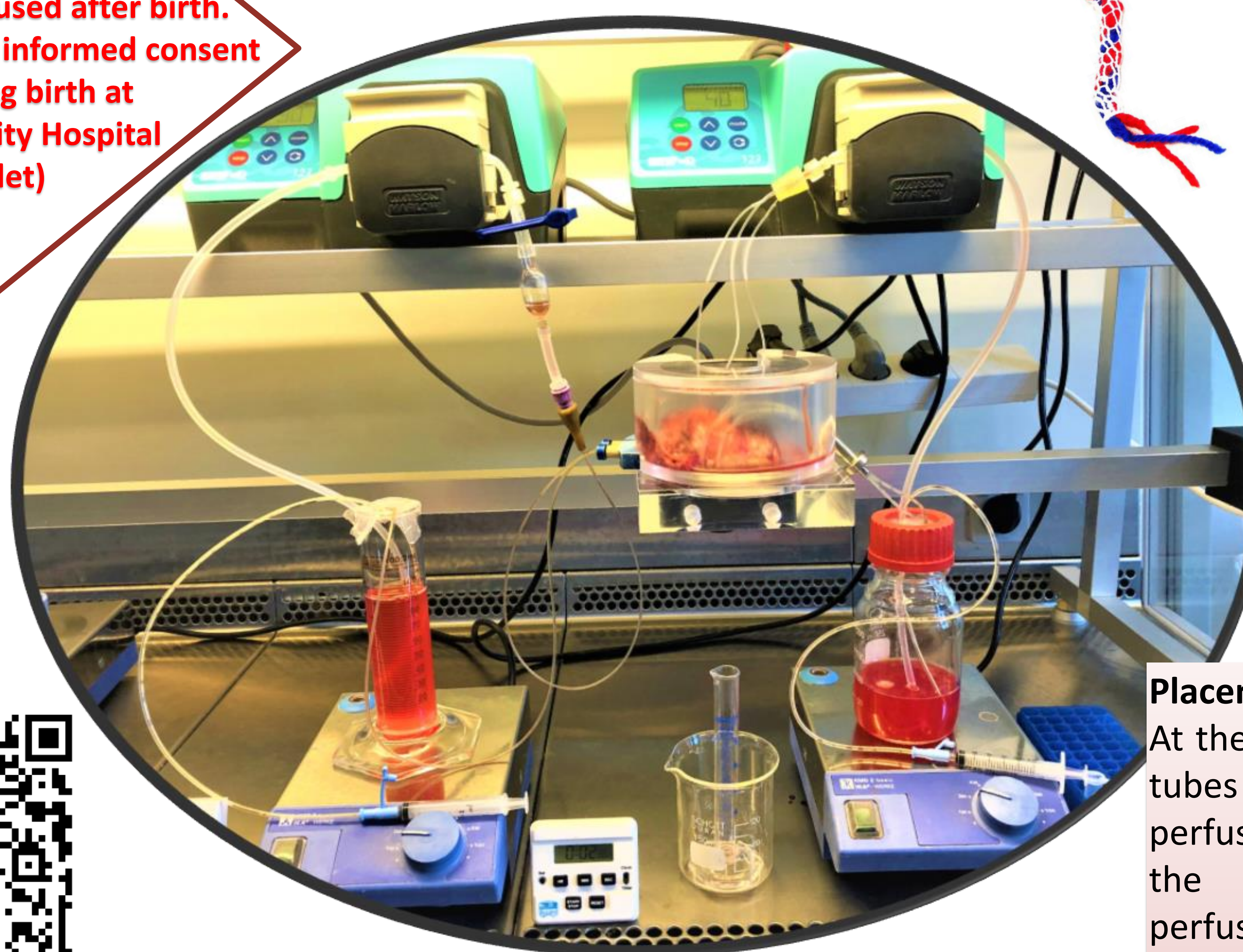
Fetal exposure to environmental chemicals occurs through the placenta, which forms the materno-fetal interface. To estimate developmental risks of adverse exposures, placental transfer has been increasingly studied in the last few decades, using the human placental perfusion model. The human placenta is unique, and therefore the use of the whole human placenta to study human fetal exposure is important.

Results from the Placental Perfusion Model show placental toxicokinetics of testsubstances, as well as changes in placental metabolism and steroidogenesis due to environmental chemicals, pharmaceuticals and even maternal stress levels.

Placenta

- develops in the womb alongside the fetus during pregnancy
- transfers all nutrients, gasses and waste between mother and fetus through the umbilical cord
- produces hormones that maintain pregnancy

The placental perfusion involves no invasive procedures as the placentas are perfused after birth. Placentas are donated with informed consent from mothers giving birth at Copenhagen University Hospital (Rigshospitalet)



Placental Perfusion:

At the left is the fetal reservoir and tubes with bubble-trap recirculating perfusion medium. In the middle is the placental lobule in the perfusion chamber. At the right is the maternal reservoir and tubes, recirculating medium.



Link Placenta Perfusion movie

The Set Up: The placenta is transported directly after birth to the perfusion laboratory, where a suitable artery-vein pair is cannulated to perfuse a single cotyledon. The cotyledon is removed from the surrounding tissue and placed in the perfusion chamber maternal side up and moved to a heated flowbench (37° C), where the maternal side is bluntly cannulated with three metal cannula, perfusing the maternal side of the cotyledon. The fetal and maternal systems are closed to recirculate perfusion medium (100 ml RPMI 1640 cell culture medium with physiological levels of human serum albumin (HSA)), the maternal outflow is drained by gravity.

The Perfusion: Following the pre-perfusion is the three to six hours perfusion. The test substances and the control substance antipyrine are added to the maternal reservoir at start perfusion (time 0). Samples are taken out from maternal and fetal reservoir at time 0, and at selected intervals until the end of perfusion. Oxygen level, glucose levels and pH in maternal and fetal circulation and fetal outflow are regulated to stay at physiological levels. Success criteria are fetal system volume loss of less than 3 ml/h and antipyrine feto-maternal ratio (FM-ratio) above 0.75 after 150 minutes.

Placental Perfusion website in Danish:

<http://www.ifsv.ku.dk/afdelinger/ms/forskning/placenta/>.

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