Microchimeric Cells: (Trans-placental) Routes to and Presence in the Host

Summary

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Supervisor:	PD Dr. Thomas Kroneis
Availability:	This position is available.
Offered by:	Medical University of Graz
Application deadline:	Applications are accepted between August 03, 2022 00:00 and September 20, 2022 23:59 (Europe/Zurich)

Description

Background:

During pregnancy, some cells manage to traffic from the fetus into the mother and vice versa giving rise to microchimerism (MC) – a phenomenon in which an individual hosts a small number of cells originating from another (genetically different) individual. In humans this microchimeric cells can persist beyond pregnancy thereby founding the basis for a lifelong MC. Microchimeric cells can differentiate into almost any cell type in the host, and implant in almost any tissue type. The consensus is that MC plays a paradoxical role in host health: some studies show benefits, others suggest it may play a role in the development of diseases. MC has been proposed to play a role in maternal wound healing, but may also be associated with pregnancy complications, such as pre-eclampsia and spontaneous abortion, as well as cancer and auto-immune diseases. MC may also play a role in providing immunological protection for the developing fetus, but also has been associated with offspring autoimmune disorders. Both, the routes of the microchimeric cells into the host and the biological meaning in the host are still unclear and lack a theory unifying its paradoxical effects.

We launched a John Templeton Foundation-funded project on microchimerism connecting experts in evolutionary medicine, reproductive immunology, biochermistry, and single-cell analysis to address basic scientific questions in microchimerism research including short-term and long-term fetal and maternal microchimerism with a special focus on immunology.

We recently developed methods unambiguously identifying haplo-identical cells (i.e., maternal and fetal) allowing to assess the frequency of microchimeric cells in host tissues and are currently developing approaches towards spatial histology using in situ techniques to characterize tissues at the single cell level. Combination of these techniques will be a focus in the ongoing projects to identify microchimeric cells, their biological function and their microenvironment.

Hypothesis and Objectives:

Trans-placental route into the host: Maternal cells with stem cell potential transmigrate via placental tissues to the fetus. The project tests if (1) maternal cells are present in fetally-derived placental tissues (e.g., placental villi) and – if present - (2) what cell type they represent. In addition, the project will (3) screen fetal organs, especially those involved in the developing immune system (e.g., lymph nodes, spleen, liver, fetal) for the presence of maternal cells.

Methodology:

In the project the candidate will use histological (e.g., tissue pre-analytics, sectioning, staining), molecular biology techniques (ddPCR, qPCR, FISH, in situ techniques) and conventional and cell culture (e.g., differentiation assays) to identify and characterize fetal and maternal cells.

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