Toxoplasma gondii interactions with the placental barrier.

My Laboratory research program focuses on understanding the cellular and molecular mechanisms that enable the food-borne parasite Toxoplasma gondii (T. gondii) to infect the fetus during pregnancy. Worldwide, 200,000 infants are affected by congenital toxoplasmosis each year, along with an unknown number of miscarriages and fetal deaths. The placenta is an extraordinary organ that supports fetal growth while protecting the fetus from pathogens. Two types of placental cells interact directly with maternal tissues and blood and could serve as entry points for T. gondii into the fetus. The syncytiotrophoblasts (STBs), which are bathed in maternal blood, form a physical barrier surrounding the fetus. In contrast, migratory extravillous trophoblasts anchor the placenta to the maternal decidua and help generate maternal immune tolerance. The interactions between T. gondii and these cells determine the infection outcomes in the fetus. However, the cellular and molecular dynamics of these interactions remain largely unknown and underexplored. Addressing this gap is crucial for developing effective therapeutics to protect the fetus from infection. Currently, only a few research teams worldwide, including ours, are investigating this issue. This limited exploration is partly due to the lack of a practical in vitro placental model and a suitable in vivo model, as well as the prevailing belief that congenital infection is a random phenomenon. Our laboratory's central hypothesis is that congenital infection is actually driven by specific molecular mechanisms. We propose that T. gondii possesses particular molecular factors that facilitate infection, survival, and the crossing of the placental barrier. During this seminar, we will present our in vitro human placental barrier models and share recent discoveries on TgMIF. This excreted parasitic effector mediates the extracellular transmigration of the parasite across STB cellular tight junctions. We believe that TgMIF represents an excellent target for vaccine therapy to prevent congenital infection