ABSTRACT SUBMISSION FORM

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Exploring the role of sex and gender on health research

CHRD
CHILD HEALTH RESEARCH DAYS

CHRD 2020: Abstract Submission Form

Submitter Name
Shahla Shojaei

Email
shahla.shojaei@umanitoba.ca

Title
Dynamic placenta-on-a-chip model for screening the interaction of nanoparticles and flow effects

Background
Placenta regulates the trafficking between maternal and fetal circulation to provide a healthy environment for the fetus. Medications/diagnostic agents crossing the placenta pose fetal risks. Quantum dots (QDs) have higher brightness and photostablility than conventional trackers however their effect on susceptible populations like embryos is not defined yet.

Objective
Development a microphysiological model of placenta to assess QDs fetotoxicity

Methods
We cultured BeWo b30 and HUVEC cells in a two-channel microfluidic chip separated by a porous membrane and connected to a pressure flow-controller. We synthesized a novel class of QDs with indium phosphide core and Zinc sulfide shell. They were capped with mercaptopropionic acid (MPA) to render them dispersible in aqueous media. QDs were characterized for colloidal, optical and fluorescence properties. The potential toxic effect of QDs on cell proliferation and viability were evaluated using ViaLight BioAssay kit.

Results
Markers of tight junction and cytoskeleton showed the formation of tight junctions and microvilli respectively. Flow sensors confirmed the adjustment of the flow rate and shear stress in the range of 20-300 µl/h and 0.001-10 dyne/cm2 respectively. Fluorescent and monodispersed QDs were successfully synthesized with a size range of 14-18 nm (polydispersity index=0.290) and a zeta potential (approximates surface charge) -29 mV. Prepared QDs have peak absorbance at 575 nm and peak fluorescence emission at 625 nm after capping with MPA and were stable under conditions mimicking the physiological conditions. Viability assay confirmed that QDs had no toxic effects on the placental cells under different

flow rates and shear stress conditions.

Conclusion
The dynamic model of the placenta simulates the in vivo situation and is suitable to screen the effect of a wide spectrum of nanoparticles like QDs under different flow rate/shear stress conditions on the placental structure and function. Indium-based quantum dots are promising safe diagnostic tools during pregnancy.

Theme:
Basic Science

Do you have a table/figure to upload?
Yes

Untitled
Graphical abstract.pdf

Are you willing to participate in Goodbear's Den?
Yes

Presenter Status:
Post-Doctoral Fellows

What was your role in the project?
Designing and performing the experiments and analyzing the data of Microfluidics part and writing the abstract

Authors

Name	Email	Role	Profession
Shahla Shojaei	shahla.shojaei@umanitoba.ca	Presenting Author	PostDoctoral fellow
Tushar Upreti	upretit@myumanitoba.ca	Co Author	Summer student
Madhumita Suresh	sureshm@myumanitoba.ca	Co Author	MSc student
Hagar Labouta	hagar.labouta@umanitoba.ca	Co Author	Assitant Professor

Dynamic placenta-on-a-chip model