

A Dynamic Microphysiological Model of Placenta to Study the Effect Of Gold Nanoparticles

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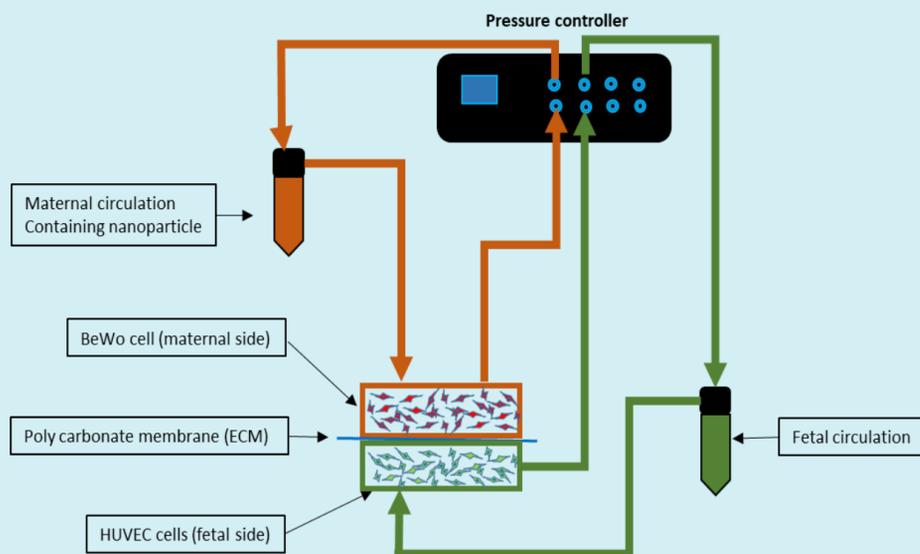
Purpose

Development of a dynamic placenta-on-chip model help to study the impact of nanoparticle on the fetus as flow-related factors impact the interaction of the nanoparticles with the placental barrier

Methods

- A two-channel microfluidic chip was co-cultured with human trophoblasts and human fetal endothelial cells separated by a layer of membrane to mimic the placenta.
- Formation of tight junctions and microvilli was assessed by immunostaining of markers of tight junction and actin cytoskeleton.
- Gold nanoparticles (AuNPs) were synthesized by the Turkevich method.
- Gold cores were imaged using scanning electron microscope (SEM). Hydrodynamic diameter and zeta potential were determined using dynamic light scattering

Fig 1. Schematic of dynamic placenta-on-a-chip model



Results

Characterization of the placental barrier on the chip

Fig 2. Tight junction formation

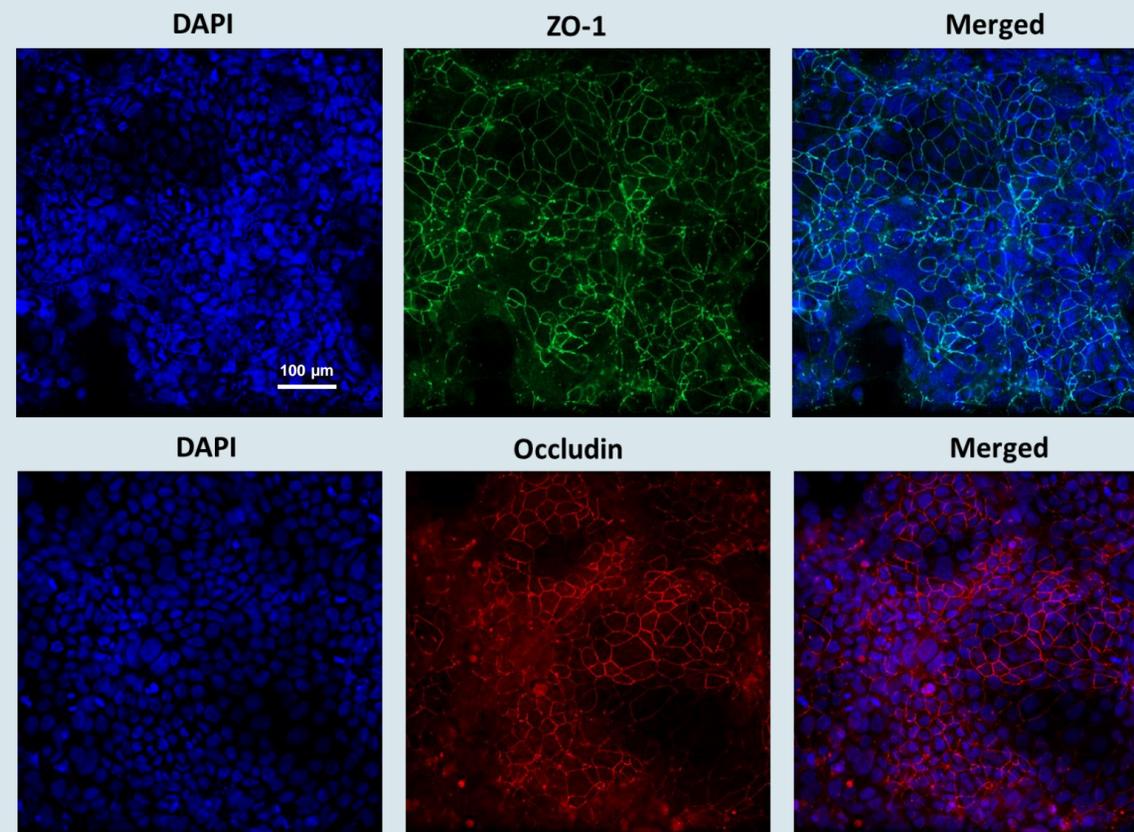
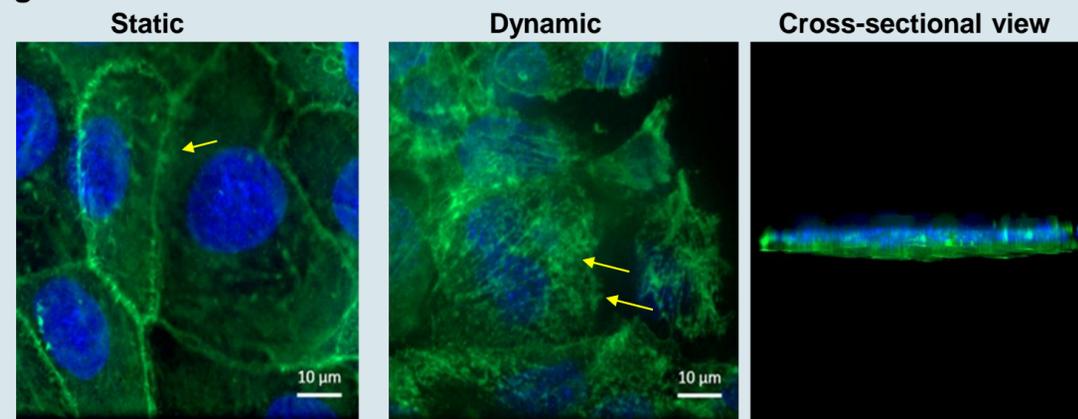


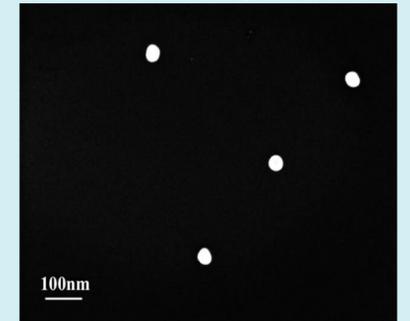
Fig 3. Effect of flow rate and shear stress on microvilli formation



Results

Characterization of Gold nanoparticles

Fig 4. SEM of AuNPs with 19.1 ± 1.3 nm diameter and -30.9 ± 2.6 mV zeta potential



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 AuNPs under different flow rate conditions on the placental structure and function.

Future Direction

We will use the developed model to evaluate the effect of AuNPs on placental structure and function, and its possible fetal toxicity under biologically relevant conditions.

Acknowledgments



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