

סמינר - SEMINAR

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 05.04.2021
(כ"ג בניסן תשפ"א), בשעה 14:30 באמצעות הזום: <https://technion.zoom.us/j/91082960087>

מרצה:

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על הנושא:

Mechanics of the Microcirculation: The Role of Mechanical Forces in Reproduction

The seminar will be given in English

להלן תקציר ההרצאה:

The microcirculation refers to the blood flow through the smallest vessels ($> 100 \mu\text{m}$), where the delivery of oxygen and nutrients to the tissues takes place. It exists in all tissues and organs except for the cornea. In this seminar, we will review the mechanics of the microcirculation: we will take a closer look at the role of the red blood cells in fluid dynamics and how they dictate blood flow viscosity, the role of the mechanical forces in biological processes such as angiogenesis (development of new blood vessels), apoptosis (tissue damage and programmed cell death) and thrombosis (blood clots), and the different transport mechanisms that take place at this scale. We will also review the current techniques and approaches to visualize, quantify and model the microcirculation. Following, I will discuss placental blood flows and the importance of mechanical forces in the normal development of pregnancy. The placenta is the organ that interfaces between a mother and her developing baby. The importance of placental blood circulation was already noted by Aristotle on the Generation of Animals, ca. 340 B.C., due to its role in the transport of respiratory gases from the mother to her fetus. The placenta is the only organ that has two separate circulations, the maternal and fetal circulations, that do not mix but do come into close proximity. Maternal blood enters the placenta when it reaches the intervillous space via the uterine arteries, percolates between branches of the villous tree and returns deoxygenated to the maternal circulatory system through the uterine veins. **Details of the materno-placental circulation hemodynamics remains unknown.** On the other side, fetal blood flows from the umbilical arteries towards the branching trees of the chorionic vasculature, and oxygenated blood returns via the umbilical vein. The feto-placental capillaries are tortuous, have variable diameters and sharp bends, making their architecture quite unique. Oxygen transport is believed to be the most important function of the placenta. At the smallest branches of placental villous trees, diffusive transport takes place due to concentration gradients that arise between the outer surface of the trophoblast layer and the inner surface of the fetal capillary endothelium. Because of the *in-vivo* ethical limitations and the complicated acquisition and manipulation of the *ex-vivo* organ, placental research has been very challenging. Therefore, there is a gap in our understanding on the interaction between placental blood flows, their role in fetal oxygenation and development, and the hemodynamics of normal and pathological pregnancies. We will take a look at the recent advances in the field, and the future opportunities that animal models, imaging techniques and computational modeling are providing. Lastly, I will briefly review my lab's future plans and grand vision to implement computational modelling, experimental approaches and imaging techniques to uncover placental hemodynamics in health and diseases. Deeper understanding of placental blood flows and transport capacity is needed to improve our diagnosis and treatment capabilities in pregnancy complications.

מארח: פרופ' אולג גנדמן

בברכה,

פרופ' נ"ח אחי סאס
מרכז הסמינרים