

PLACENTA PLATFORM

Prof. PharmDr. Frantisek Staud, Ph.D.
Charles University, Czech Republic

EPTRI Stakeholders Roundtable - July 9th, 2020.



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Structure of the presentation

1. EPTRI Placenta Platform – current teams
2. Importance of the placenta for fetal development and programming
3. Methods to study placental (patho)physiology, pharmacology and toxicology

EPTRI Placenta Platform: teams

1. Prof. Dr. Christiane Albrecht, Ph.D. - University of Bern, Switzerland
2. Prof. Dr. Cathy Vaillancourt, Ph.D. - INRS University, Canada
3. Prof. Dr. med. Udo Markert, Ph.D. – Universitäts Klinikum Jena, Germany
4. Prof. PharmDr. Frantisek Staud, Ph.D. - Charles University, Czech Republic



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Why to study placental physiology/pharmacology/toxicology?

Prenatal period is the foundation for later life outcomes!

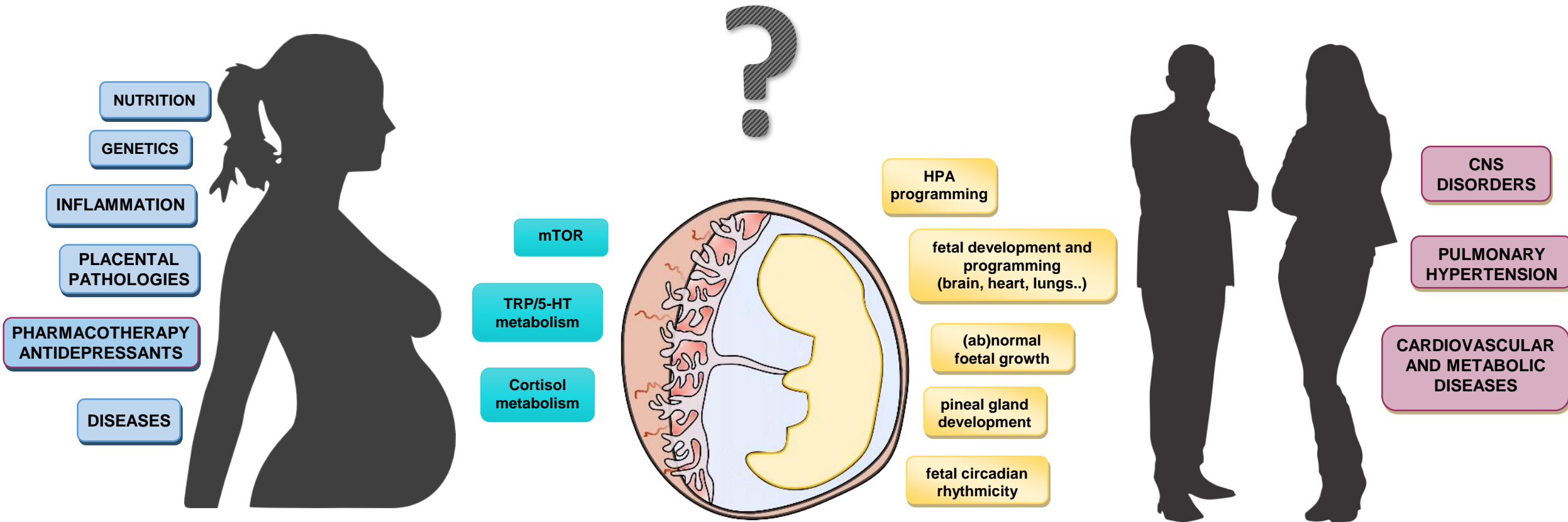
Placenta functions are crucial to maintain optimal *in utero* conditions for proper fetal development and programming.

Placenta malfunction may result in:

- acute effects – malformations, FGR
- chronic effects – diseases developed later in life metabolic (DM, cardiovascular), psychological (autism, depression) > Developmental Origins of Health and Disease (**DOHaD**)

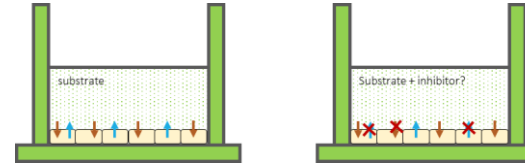


Developmental Origins of Health and Disease

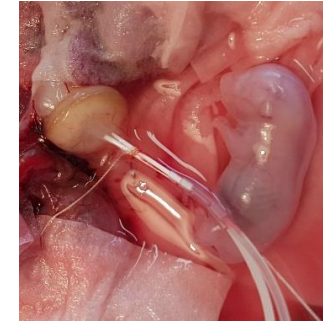


Staud and Karahoda *Int J Biochem Cell Biol* 2018

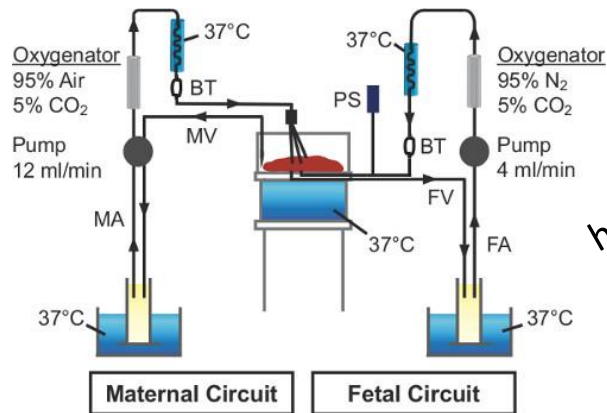
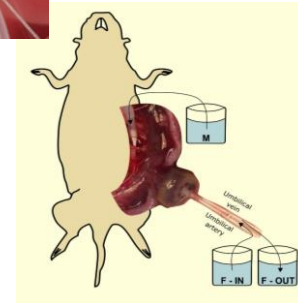
Methods to study placenta



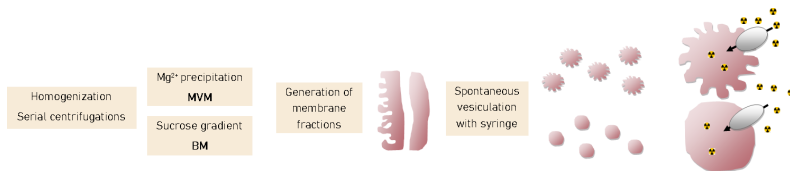
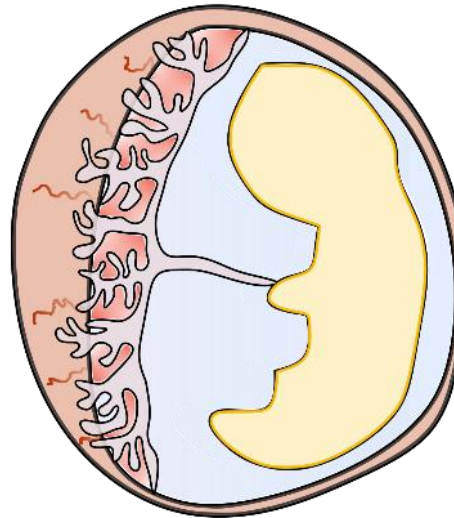
In vitro
cell-based



In situ
organ perfusion



Ex vivo
human placenta-based

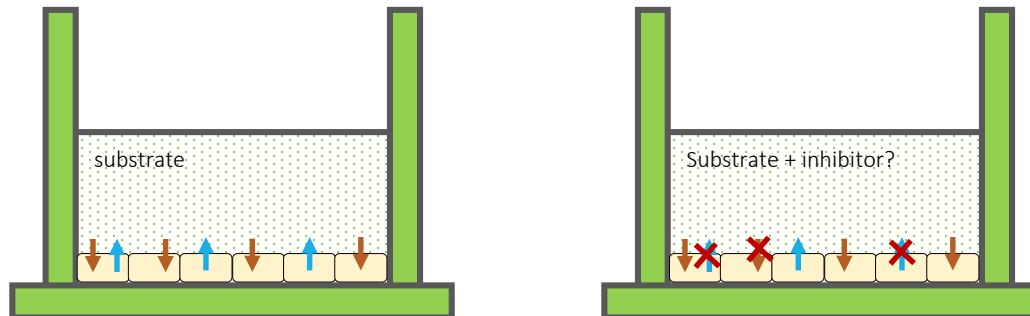


In vivo
imaging techniques

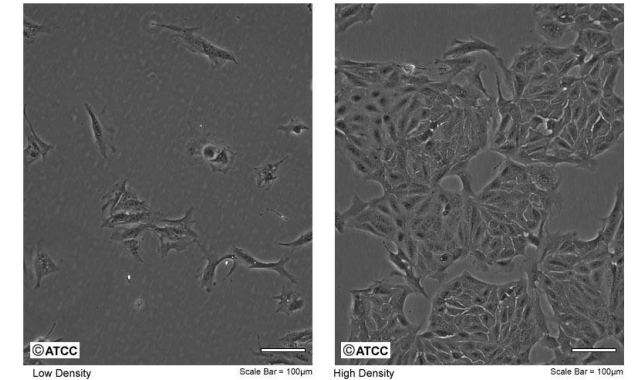
Methods to study placenta: *in vitro*

- Transfected/transduced **MDCK cells**
- **Placenta-derived cell lines** (BeWo, JEG-3, Jar)

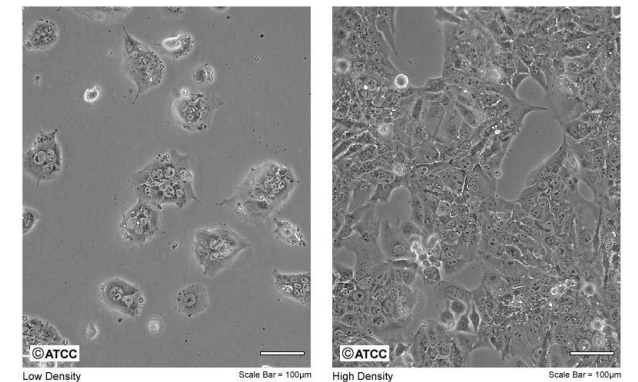
➤ to study drug/nutrient transport across the placenta



ATCC Number: **CRL-2936™**
Designation: **MDCK.2**

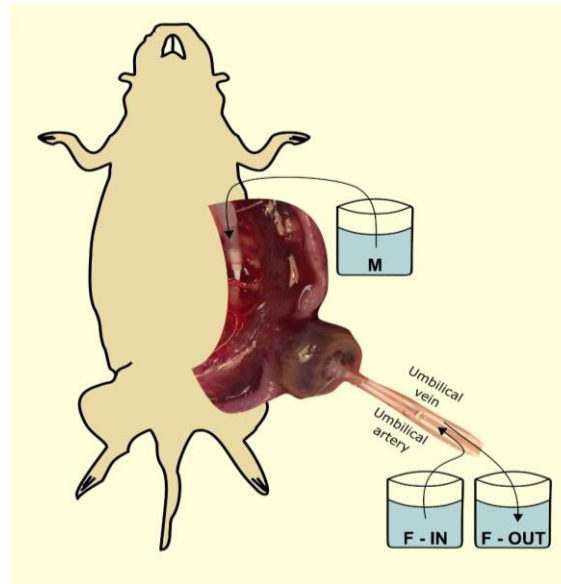


ATCC Number: **CCL-98**
Designation: **BeWo**



Methods to study placenta: *in situ*

- **Perfusion of animal placenta**
 - to study drug/nutrient transport across the placenta or placental homeostasis of endogenous hormones (glucocorticoids, monoamines...)

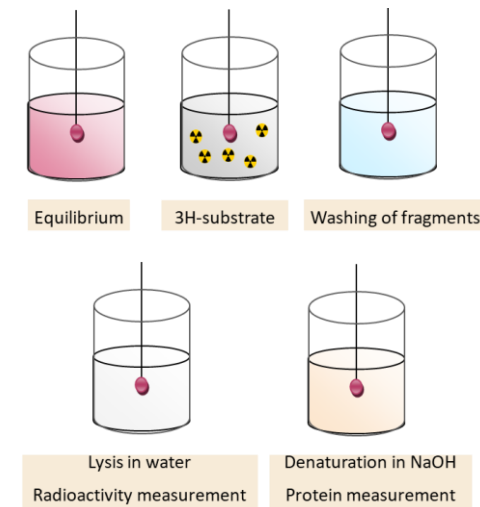
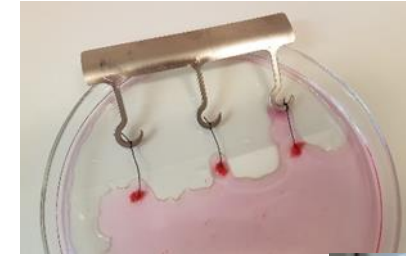


Methods to study placenta: ex vivo



- Fresh **villous fragments**
- **Placenta explants**
- Assessment of xenobiotic metabolism by **placenta homogenates**

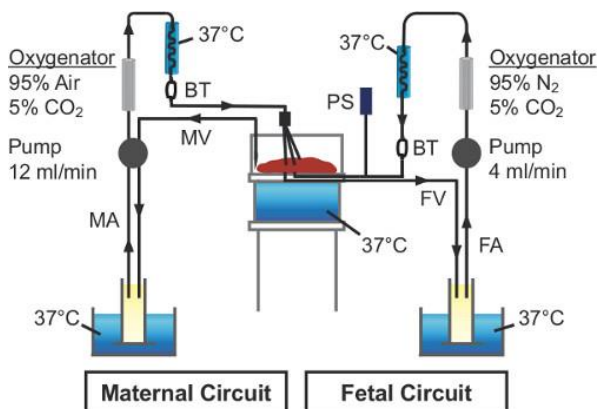
➤ to study placenta physiology and toxicity



Methods to study placenta: ex vivo



- Apical and basal **membrane vesicles** isolated from human term placenta
- Dually **perfused human term placental lobule** system



➤ to study drug/nutrient transport across the placenta or placental homeostasis of endogenous hormones (glucocorticoids, monoamines...)

Homogenization
Serial centrifugations

Mg²⁺ precipitation

MVM

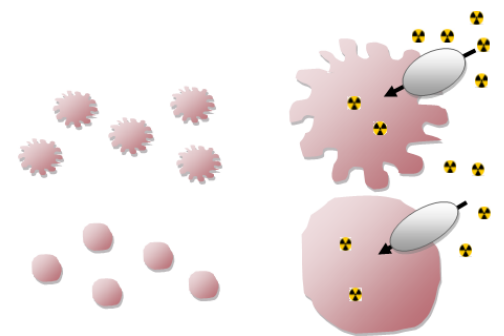
Sucrose gradient

BM

Generation of
membrane
fractions



Spontaneous
vesiculation
with syringe



Methods to study placenta: *in vivo*



Chronic exposure of animals to pharmacotherapy or pathological conditions (stress, inflammation)

ADME/PKPD studies in pregnant animal models

Use of innovative **imaging system** to study fetal/placental development

- to study long-term effects of drugs/pathological condition on placenta and fetus development



Home // Funding & Awards // Research funding // 2019

Engineering a novel cell-based model for assessing materno-fetal drug transfer during pregnancy

Results of 2019 Open Call: 4 projects selected

The Strategic Board has selected four projects that will be financed through its 2019 Open Call:

OC-2019-009: *BEHAVE: A toolkit for deep-behavior profiling of laboratory rodents*, Johannes Bohacek, Department of Health Sciences and Technology, ETH Zurich

OC-2019-025: *IPF-on-Chip: Replacing the bleomycin induced lung injury and fibrosis model with lung-on-chip technology*, Olivier Guenat, ARTORG Center for Biomedical Engineering Research, University of Bern; Thomas Geiser, Pneumology Department, Inselspital, Bern University Hospital

OC-2019-003: *Development of a platform for GU cancer patient-derived organoids*, Marianna Kruithof-de Julio, Mark Rubin, Department for BioMedical Research (DBMR), University of Bern

OC-2019-019: *Engineering a novel cell-based model for assessing materno-fetal drug transfer during pregnancy*, Christiane Albrecht, Institute of Biochemistry and Molecular Medicine, University of Bern; František Štaud, Pharmaceutical Faculty, Charles University, Hradec Kralove, Czech Republic; Chennakesava Cuddapah, Curio Biotech SA, Visp, Switzerland

You find more information about the projects on the [project website](#) and in a press release in [English](#), [German](#), [French](#) and [Italian](#).



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Thank you for your attention!

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