BIOGRAPHICAL SKETCH

NAME: Sandra Haider

POSITION TITLE: Ap. Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Applied Sciences, Vienna, Austria	Diploma	09/1997	Applied Sciences
Maternal and Fetal Health Research Group, Manchester, UK		04/2000	Human placental villous explant technology
University of Vienna, Vienna, Austria	Mag[a].rer.nat	06/2010	Molecular Biology
Medical University of Vienna, Vienna, Austria	PhD	07/2015	Molecular Signaling Transduction
Medical University of Vienna, Vienna, Austria	Postdoctoral	06/2024	Reproductive Biology Unit
Visiting Scientist at the CBRC, MGH, Boston USA		11/2023	Bioinformatics

A. Personal Statement

Multiple, still largely unknown molecular and cellular processes ensure human placental formation and development. While massive placenta-dependent local and systemic maternal remodeling and adaptations occur in the first weeks, extensive placental growth optimizes the transport between the mother and the rapidly growing fetus later in gestation. Major failures in placentation lead to early pregnancy loss, however, minor malformations and –functions bear the risk for developing preeclampsia, fetal growth restriction, and gestational diabetes that endanger maternal and fetal wellbeing during pregnancy, but also bear a risk for chronic health issues for the mother and her offspring later in life constituting a substantial strain on public healthcare budgets and a profound impact on health and economic wellbeing worldwide.

As an extraordinary Professor at the Medical University of Vienna, in the Placental Development Group of the Reproductive Biology Unit my research is dedicated to unravel signaling and communication pathways that orchestrate self-renewal, differentiation, and function of various placental cell types. As only limited structural and cellular placental features are shared among species, reliable human in-vitro models are strongly required. Accordingly and during my PhD and postdoc time, I have developed and studied 3-dimensional single- and multi-cellular in vitro cultures in animal-free models mimicking human in vivo organ development and function.

In my postdoc and as a PI, I have successfully managed, administered, and carried out projects, and established collaborations world-wide resulting in numerous peer-reviewed publications. Teaching, supervising and co-supervising undergraduate and graduate students, multiple fruitful collaborations, and consistent personnel development and diversity courses, have taught me the importance of communication among team and project members, detailed research plans, and realistic timelines to achieve a successful performance and completion of the projects.

Ongoing and completed research projects

2021 – 2025 "Crosstalk of villous cells in early placental development"
Austrian Science Fund, Principal Investigator Project P-34588

2023 – 2027 "Interaction of maternal-fetal cells during early placentation"
Austrian Science Fund, Principal Investigator Project P-36159,

2022 – 2023 Austria Science Fund (FWF; P-34588-B): "Crisis Support for a PhD student from the Ukraine"
This additional funding added to P-34588 supported an MD from the Ukraine to proceed her PhD in Vienna for one year. This funding enabled her to finish her PhD in December 2022.

Citations:

1. Ounadjela RJ, Zhang K, Koboyashi-Kirschvink KJ, Jin K, Russel A, Lackner AI, Callahan C, Viggiani F, Dey KK, Jagadeesh K, Maxian T, Prandstetter AM, Nadaf N, Gong Q, Raichur R, Zvezdov ML, Hui M, Simpson M, Liu X, Min W, Knöfler M, Chen F^{+}, **Haider S^{+}**, Shu J^{+}. Spatial multiomic landscape othe human placenta at molecular resolution. ***Nature Medicine***. 2024 (In press) **($^{+}$Co-corresponding authors**)
2. Dietrich B, Kunihs V, Lackner AI, Meinhardt G, Koo BK, Pollheimer J, **Haider S***, Knöfler M*. (2023) NOTCH3 signalling controls human trophoblast stem cell expansion and differentiation. ***Development***. 2023 Nov 15;150(22):dev202152. doi: 10.1242/dev.202152 **($^{+}$Co-corresponding authors**)
3. **Haider S**, Meinhardt G, Saleh L, Kunihs V, Gamperl M, Kaindl U, Ellinger A, Burkard TR, Fiala C, Pollheimer J, Mendjan S, Latos PA, Knöfler M. (2018) Self-Renewing Trophoblast Organoids Recapitulate the Developmental Program of the Early Human Placenta. ***Stem Cell Reports***. 2018 Jul 31. S2213-6711(18)30309-6.
4. **Haider S**, Lackner A, Dietrich B, Kunihs V, Haslinger P, Meinhardt G, Maxian T, Saleh L, Fiala C, Pollheimer J, Latos P, Knöfler M (2022) Transforming growth factor-β governs the differentiation program of extravillous trophoblasts in the developing human placenta. ***PNAS***; doi: 10.1073/pnas.212067199

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2024 – Present	Ap. Professor, Obs/Gyn, Reproductive Biology Unit (RBU), Medical University of Vienna, AUT
2021 – Present	Teaching (medical students, PhD students) at the Medical University of Vienna
2021 – 2024	Qualification agreement, Department Obs/Gyn, RBU, Medical University of Vienna, AUT
2020 – Present	Council member, European Placental Group (EPG)
2021	Scientific Advisory Board Member, IFPA/EPG Meeting, Amsterdam, Netherlands
2022	Co-Organizer EPG Meeting, Versailles, France
2020 – 2024	Postdoc, Obs/Gyn, Reproductive Biology Unit (RBU), Medical University of Vienna, AUT
1997 – 2020	Biomed. Analyst, Obs/Gyn, RBU, Medical University of Vienna, AUT

Honors

2024	Gabor Than Award in Placentology for outstanding Contributions to Placentology, IFPA
2022	Dora Brücke-Teleky Award for excellent publication, Alumni Club Medical University of Vienna
2019	President's Presenter Award for an outstanding abstract, Society for Reproductive Investigation
2017	Research of the Month Award for an outstanding publication, Medical University of Vienna
2016	Giorgio Pardi Foundation Junior Scientist Award for outstanding research
2012	Award for Best Poster Presentation, Young Scientist Association, Medical University of Vienna

C. Contributions to Science

1. Early in my career, I was investigating various important factors influencing trophoblast differentiation and function including TNFα and human chorion gonadotropin. During gestation, a specialized trophoblast cell type, the extravillous trophoblast, invades maternal layers to remodel maternal spiral arteries and locally cease the maternal immune system ensuring the acceptance of the fetal semi allograft. In the studies based on TNFα, and by using

various in vitro models including whole-tissue villous explants, isolated cells, and immortalized cell lines I observed strong inhibitory effects on EVT motility provoked by the pro-inflammatory cytokine suggesting a harmful influence of local and systemic TNFα overdose on positive pregnancy outcomes. Interestingly, further studies unraveled that TNFα impairs the differentiation and function of the second specialized trophoblast subtype, the hormone-producing transport unit-representing syncytiotrophoblast indicating that this cytokine has fundamental effects on placental development and function.

a. **Bauer S**, Pollheimer J, Hartmann J, Husslein P, Aplin JD, Knöfler M (2004) Tumor necrosis factor-alpha inhibits trophoblast migration through elevation of plasminogen activator inhibitor-1 in first-trimester villous explant cultures. ***J Clin Endocrinol Metab*** 89(2): 812-22
b. Knöfler M, Saleh L, **Bauer S**, Galos B, Rotheneder H, Husslein P, Helmer H (2004) Transcriptional regulation of the human chorionic gonadotropin beta gene during villous trophoblast differentiation. ***Endocrinology*** 145(4): 1685-94
c. Leisser C, Saleh L, **Haider S**, Husslein H, Sonderegger S, Knöfler M (2006) Tumour necrosis factor-alpha impairs chorionic gonadotrophin beta-subunit expression and cell fusion of human villous cytotrophoblast. ***Mol Hum Reprod***. 12(10): 601-9
d. **Haider S**, Knöfler M (2009) Human tumour necrosis factor: physiological and pathological roles in placenta and endometrium. ***Placenta*** 30(2): 111-23

2. In mid-career and after my maternity leave, I specifically focused on signaling pathways including the NOTCH and WNT signaling and studied their roles in early placental development and function. Various publications investigated the expression and role of signaling pathway molecules such as NOTCH receptors, WNT ligands and TGFβ SMAD transcription factors. In 2016 my first mile stone publication unraveled a crucial role for NOTCH receptor 1 in EVT lineage determination and maintenance and represented the first factor that directs trophoblast differentiation towards this invasive phenotype.

a. **Haider S**, Meinhardt G, Velicky P, Otti GR, Whitley G, Fiala C, Pollheimer J, Knöfler M (2014) Notch signaling plays a critical role in motility and differentiation of human first-trimester cytotrophoblasts. ***Endocrinology*** 155(1): 263-74
b. Velicky P, **Haider S**, Otti GR, Fiala C, Pollheimer J, Knöfler M (2014) Notch-dependent RBPJκ inhibits proliferation of human cytotrophoblasts and their differentiation into extravillous trophoblasts. ***Mol Hum Reprod* 20(8):** 756-66
c. **Haider S,** Meinhardt G, Saleh L, Fiala C, Pollheimer J, Knöfler M (2016) Notch1 controls development of the extravillous trophoblast lineage in the human placenta. ***PNAS***; 113(48):E7710-E7719
d. **Haider S**, Kunihs V, Fiala C, Pollheimer J, Knöfler M. (2017) Expression pattern and phosphorylation status of Smad2/3 in different subtypes of human first trimester trophoblast. ***Placenta***; 2017 Sep;57:17-25

3. My postdoc and PI time started with the establishment of 3-dimensional (3D) cell culture models closely mimicking human trophoblast self-renewal, lineage determination, differentiation and function. Based on our recent findings, I could now link, in novel state-of-the-art models important pathways with crucial developmental steps in early human placentation. Funding allowed me to build my own research group with a focus on multiomics of in vivo tissues and various suit- and adaptable 3D in vitro models aiming to investigate cellular interactions and interdependency supporting placental functions such as transport and defense mechanisms against pathogens. It is assumed that worldwide more than 60 % of all human pregnancies fail, and the majority in the first trimester of gestation. Spatial multiomics-based data has recently set a ground for specifically designing multi-cellular 3D models of placental and maternal cells to stepwise elucidate intra- and intercellular interactions essentially involved in early placental development and function and ensure a successful pregnancy outcome.

a. **Haider S**, Meinhardt G, Saleh L, Kunihs V, Gamperl M, Kaindl U, Ellinger A, Burkard TR, Fiala C, Pollheimer J, Mendjan S, Latos PA, Knöfler M. (2018) Self-Renewing Trophoblast Organoids Recapitulate the Developmental Program of the Early Human Placenta. ***Stem Cell Reports***. 2018 Jul 31. S2213-6711(18)30309-6.

b. **Haider S**, Lackner A, Dietrich B, Kunihs V, Haslinger P, Meinhardt G, Maxian T, Saleh L, Fiala C, Pollheimer J, Latos P, Knöfler M (2022) Transforming growth factor-β governs the differentiation program of extravillous trophoblasts in the developing human placenta. ***PNAS.*** doi: 10.1073/pnas.212067199
c. Dietrich B, Kunihs V, Lackner AI, Meinhardt G, Koo BK, Pollheimer J, **Haider S⁺**, Knöfler M⁺. (2023) NOTCH3 signalling controls human trophoblast stem cell expansion and differentiation. ***Development***. 2023 Nov 15;150(22):dev202152. doi: 10.1242/dev.202152 **(⁺Co-corresponding authors**)
d. Ounadjela RJ, Zhang K, Koboyashi-Kirschvink KJ, Jin K, Russel A, Lackner AI, Callahan C, Viggiani F, Dey KK, Jagadeesh K, Maxian T, Prandstetter AM, Nadaf N, Gong Q, Raichur R, Zvezdov ML, Hui M, Simpson M, Liu X, Min W, Knöfler M, Chen F⁺, **Haider S⁺**, Shu J⁺. Spatial multiomic landscape of the human placenta at molecular resolution. ***Nature Medicine***. 2024 (In press) **(⁺Co-corresponding authors**)

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