Moritz Schaefer

Postdoctoral Fellow, Stanford University

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Referees: *Prof. Jure Leskovec* (Stanford University), *Prof. Zinaida Good* (Stanford University), *Prof. Christoph Bock* (Medical University of Vienna / CeMM)

Research Profile

I develop human-interpretable AI systems that translate complex biomedical data into actionable biological insights.

I combine LLM-based data curation with multimodal AI training to enable single cell transcriptomics data analysis through interactive chat interface *("CellWhisperer", Schaefer et al., 2025, Nature Biotechnology)*, which I extended to histopathology analysis *("SpatialWhisperer", Schaefer et al., ICML 2026; "SpotWhisperer", Schaefer et al., 2025, bioRxiv)*. I leverage these multimodal AI to reason over large B cell lymphoma patients using AI agents, following my previous work on text-based biomedical simulations with LLMs *("SimulateGPT", Schaefer et al., 2024, Computers in Biology and Medicine)*. My research at the intersection of mechanistic biology and AI methods development draws from an interdisciplinary background, combining a Ph.D. in Systems Biology from ETH Zurich with a focus on gene regulation in embryonic development *(Schaefer et al., 2022, EMBO Reports)* as well as my Bachelor's and Master's studies in Computer Science and AI at TU Berlin *("PAVOOC", Schaefer et al., 2018, Bioinformatics)*.

Education & Research Appointments

Postdoctoral Fellow | 2025–Present

Stanford University, Stanford, CA (Advisors: Prof. Jure Leskovec & Prof. Zinaida Good)

Postdoctoral Researcher | 2022–2025

Medical University of Vienna & CeMM, Vienna, Austria (Advisor: Prof. Christoph Bock)

Dr. sc. (Ph.D.), Systems Biology | 2018–2022

ETH Zurich, Zurich, Switzerland (Advisors: Profs. Constance Ciaudo, Berend Snijder, Judith Zaugg)

M.Sc., Computer Science | 2016–2018

Technical University Berlin, Germany (Advisors: Prof. Manfred Opper, Dr. Andreas Steffen). Overall grade: 1.1 (Best: 1.0)

B.Sc., Computer Science | 2012–2016

Technical University Berlin, Germany (B.Sc. thesis at Jiao Tong University, Shanghai; Advisor: Prof. Baoliang Lu). Thesis grade: 1.3 (Best: 1.0)

Selected Publications (* *Denotes equal contribution*)

Schaefer, M., …, Bock, C., Leskovec, J., & Good, Z. (2026). Transitive Representation Learning Enhances Histopathology Annotation. *Proceedings of the 43rd International Conference on Machine Learning (ICML)*.

Schaefer, M.*, Nonchev, K.*, Awasthi, A.*, Burton, J.*, Koelzer, V.H., Rätsch, G., & Bock, C. (2025). Molecularly informed analysis of histopathology images using natural language. *bioRxiv*.

Schaefer, M.*, Peneder, P.*, …, Bock, C. (2025). Multimodal learning of transcriptomes and text enables interactive single-cell RNA-seq data exploration with natural-language chats. *Nature Biotechnology*.

Schaefer, M.*, Peneder, P.*, Malzl, D., …, Menche, J., Tomazou, E., & Bock, C. (2024). Joint Embedding of Transcriptomes and Text Enables Interactive Single-Cell RNA-seq Data Exploration via Natural Language. *ICLR 2024 Workshop on Machine Learning for Genomics Explorations*.

Datlinger, P.*, Pankevich, E. V.*, Arnold, C.D., …, **Schaefer, M.**, … & Bock, C. (2025). Systematic discovery of CRISPR-boosted CAR T cell immunotherapies. *Nature*.

Schaefer, M.*, Reichl, S.*, ter Horst, R.*, …, Bock, C., & Samwald, M. (2024). GPT-4 as a biomedical simulator. *Computers in Biology and Medicine.*

Schaefer, M.*, Nabih, A.*, …, Aebersold, R., Gatfield, D., & Ciaudo, C. (2022). Global and precise identification of functional miRNA targets in mESCs by integrative analysis. *EMBO reports.*

Müller, M.*, **Schaefer, M.***, …, Santoro, R., & Ciaudo, C. (2022). Argonaute proteins regulate a specific network of genes through KLF4 in mouse embryonic stem cells. *Stem Cell Reports.*

Müller, M., Fäh, T., **Schaefer, M.**, …, Ciaudo, C. (2022). AGO1 regulates pericentromeric regions in mouse embryonic stem cells. *Life Science Alliance*.

Grodzki, M., Bluhm, A.P., **Schaefer, M.**, Tagmount, A., Russo, M., Sobh, A., Rafiee, R., Vulpe, C.D., Karst, S.M., & Norris, M.H. (2022). Genome-scale CRISPR screens identify host factors that promote human coronavirus infection. *Genome Medicine*.

Schaefer, M. & Ciaudo, C. (2020). Prediction of the miRNA Interactome - Established Methods and Upcoming Perspectives. *Computational and Structural Biotechnology Journal*.

Schaefer, M., Clevert, D.A., Weiss, B., & Steffen, A. (2018). PAVOOC: Designing CRISPR sgRNAs Using 3D Protein Structures and Functional Domain Annotations. *Bioinformatics*.

Research Outputs

Open, publicly deployed tools: web applications for non-computational users. **CellWhisperer** (natural-language single-cell analysis; integrated into the open-source CELLxGENE Explorer web app, deployed at cellwhisperer.bocklab.org; 200+ GitHub stars); **SARS-CoV-2 CRISPR-screen compendium** (portal unifying re-analysed genome-scale screens); **PAVOOC** (structure-guided CRISPR sgRNA design on 3D protein structures).

Open models & code: released weights and training/analysis pipelines. **CellWhisperer** (multimodal transcriptome–language model); **SpatialWhisperer / SpotWhisperer** (language-based histopathology annotation); **SimulateGPT** (step-wise LLM biomedical simulation framework).

Datasets & benchmarks: **CellWhisperer transcriptome–text corpus** (~1M LLM-curated paired profiles); **SpotWhisperer benchmark** for cell-type prediction from histopathology.

Educational products: Machine-Learning curriculum (lectures and seminars), MSc "Molecular Precision Medicine", Medical University of Vienna (2022–2024). Weekly GenAI Journal Club Coordination (2025).

Public engagement & open science: public-science talk at the Chaos Communication Congress (38C3, 2024); Long Night of Research Vienna (2022, 2024); organized and moderated "OILS" open-science and science-communication panels, Zurich (2020–2021); ongoing open-source contributions.

Talks (selection)

- Single Cell Genomics Day (invited) | 2026
- Stanford Computational Medicine Colloquium | 2026
- Mila Genomics Reading Group (invited) | 2026
- Google Genomics Deep Dive (invited) | 2025
- RNA-AI Conference, Monte Verita, Switzerland | 2025
- CSHL Biological Data Science Meeting | 2024
- EU-LIFE Utopia Conference (invited) | 2024

Grants, Fellowships & Awards

Fellowships & Awards

- Researcher of the Month, Medical University of Vienna, 2026 (for CellWhisperer)
- CRI Immuno-Informatics Postdoctoral Fellowship (CRI17992), 2026 ($243,000)
- Student Fellowship "Deutschlandstipendium" (supported by GE & Carmeq), 2015–2018
- Ferry Porsche Prize (for exceptional performance in Math & Physics), 2011

Grant writing

- MSCA Global Postdoctoral Fellowship, 2025 (top 15%)
- Second round "WWTF LS23 (Understanding Biology with AI/ML)", 2024
    - *Role: Lead-PI. Budget: €800,000. (top 25%)*

Teaching & Mentoring

Mentoring (informal)

- **Undergraduate Supervision**, Stanford University, 2025
    - *Wei Liu*, "Overexpression-based CAR T cell design with AI"
    - *Warren Xu*, "Single-Cell Level Histopathology Analysis"
    - *Kristin Tsui,* "CAR T Cell Optimization Guided By Multiple Instance Learning"
    - *Ramin Hamedi,* "Inverse Perturbation Modeling for CAR T Cell Optimization"
- **PhD Student Co-Supervision**, MedUni Vienna, 2023–2025
    - *Animesh Awasthi*, "AI-driven enhancer design"
- **Master's Thesis Supervision**, MedUni Vienna, 2022–2023
    - *Fabian Traxler*, "Deep Learning antibody binding affinity prediction"

Teaching

- **Lecturer & Seminar Leader**, MedUni Vienna (2022–2024). Machine Learning module at MSc-level program "Molecular Precision Medicine"
- **Guest Lecturer**, TU Vienna (2023). Seminar: "Generative AI as a driver for biotechnology."
- **Teaching Assistant**, ETH Zurich (2021). MSc. workshop "Functional Genomics."

Academic Service & Leadership

Peer Review

- *Journals*: Bioinformatics, Nature Methods (2026)
- *Conferences/Workshops*: NeurIPS (FM4LS Workshop), ICML (FM4LS Workshop), ICML (2026)

Institutional Service

- Postdoc Representative: CeMM (2023–2025), EU-LIFE (2024–2025)
- MedUni AI Institute Seminar Coordinator, 2022–2025
- PhD Application Screening Committee (ELLIS, MedUni Vienna), 2022–2024
- Academic Staff Representative (Treasurer, Dept. Conference Rep), ETH Zurich, 2019–2021