

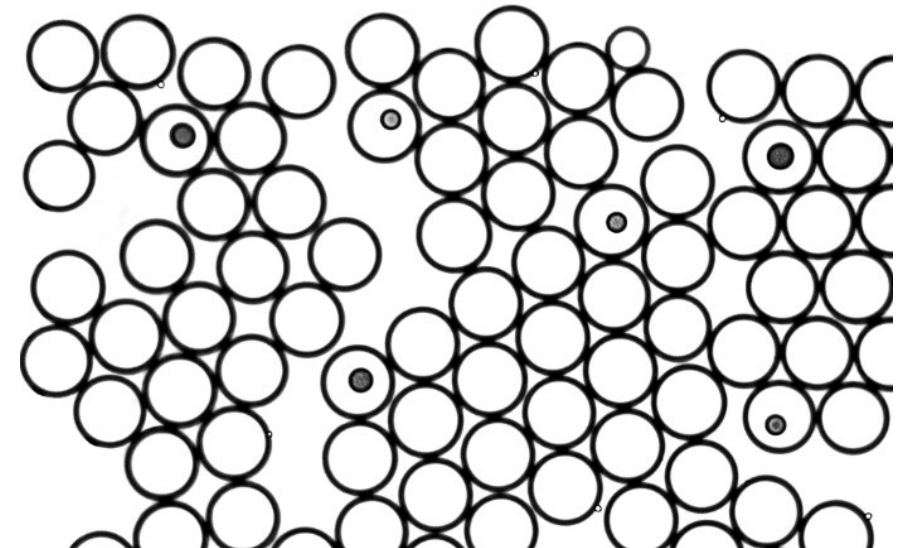
Artificial Intelligence for Precision Medicine and Personalized Therapies

Christoph Bock

23 July 2024

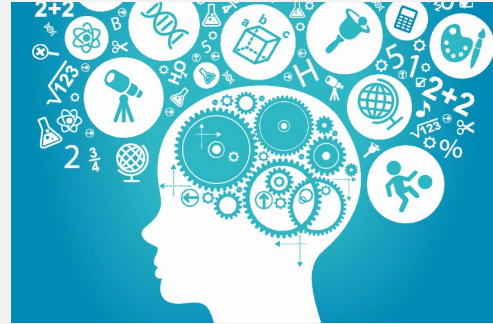


Research laboratory: <https://bocklab.org>
Social media: <https://twitter.com/BockLab>
MedUni AI Institute: <https://meduniwien.ac.at/AI>



Introducing myself

Trained as a computer scientist with a focus on machine learning



MSc: 1999-2004

PhD: 2004-2008

Germany, UK,
Taiwan, Japan



UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386



mpi max planck institut
informatik

Entered biomedical research to help develop molecular therapies

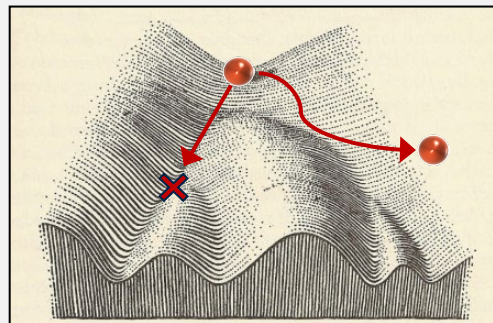


Postdoc: 2008-2011

USA



Our research combines genomics with bioinformatics & ML/AI



CeMM Principal Investigator
(since 2012)

Professor of Medical Informatics
& Head of MedUni AI Institute
(since 2021)



CENTER FOR MEDICAL DATA SCIENCE
MEDICAL UNIVERSITY OF VIENNA
Institute of Artificial Intelligence

The Institute of Artificial Intelligence at the Center for Medical Data Science

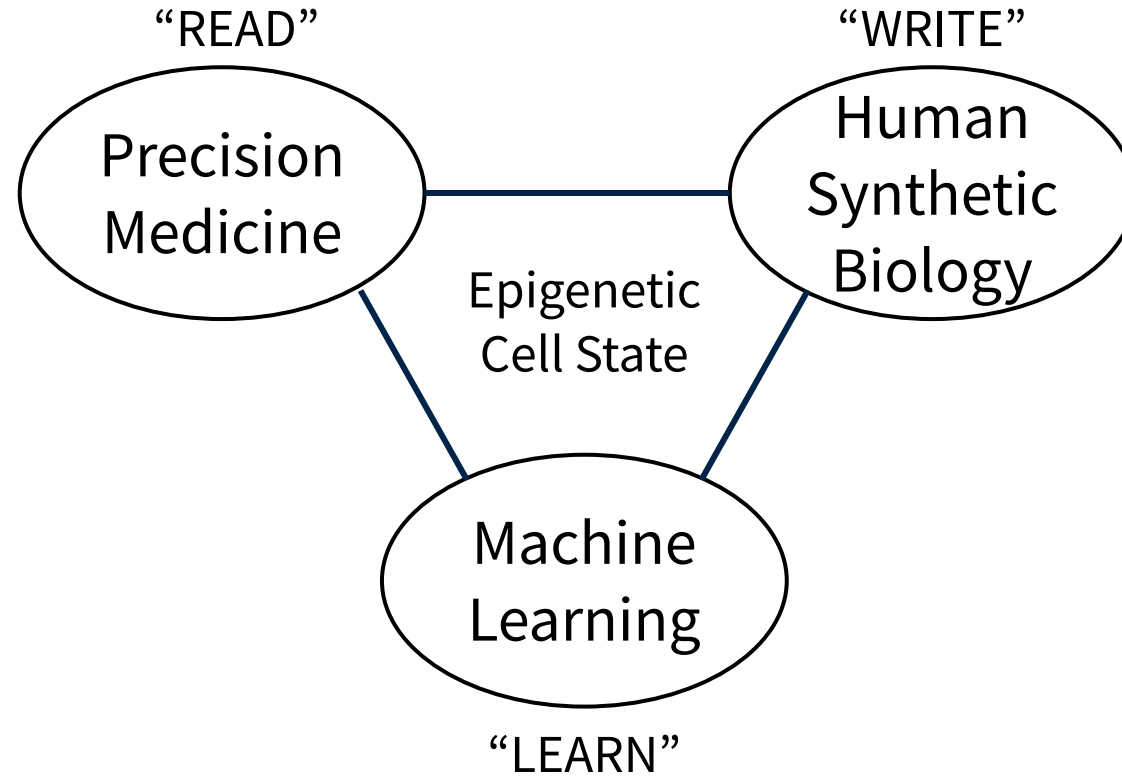
- Founded as “Institute for Medical Cybernetics” in 1977 (Prof. Dr. Robert Trappl)
- Goal: Contribute ML/AI research, expertise, collaboration to MedUni/AKH & beyond
- Three established research groups at the AI Institute:
 - Christoph Bock: “Machine learning in biomedicine”
 - Georg Dorffner: “Machine learning for signal processing”
 - Matthias Samwald: “Trustworthy Artificial Intelligence”
- Three additional research groups joining this year:
 - Adam Gosztolai: “Dynamics of Neural Systems” (started in April)
 - Hrvoje Bogunović: “Medical Image Computing” (started June)
 - David Fischer: “Deep Learning Methods & Applications” (starting in December)



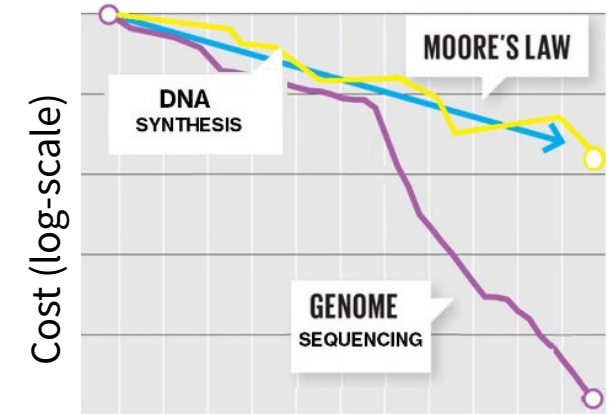
Our vision: Programming immune cells for biological discovery and therapeutic applications



Lead technology: Next Generation Sequencing



Lead technology: Interpretable machine learning



Lead technology: Massive-scale DNA synthesis

CellWhisperer: Interactive chat-like analysis of single-cell gene expression data

cell×gene dataset ⓘ

CellWhisperer

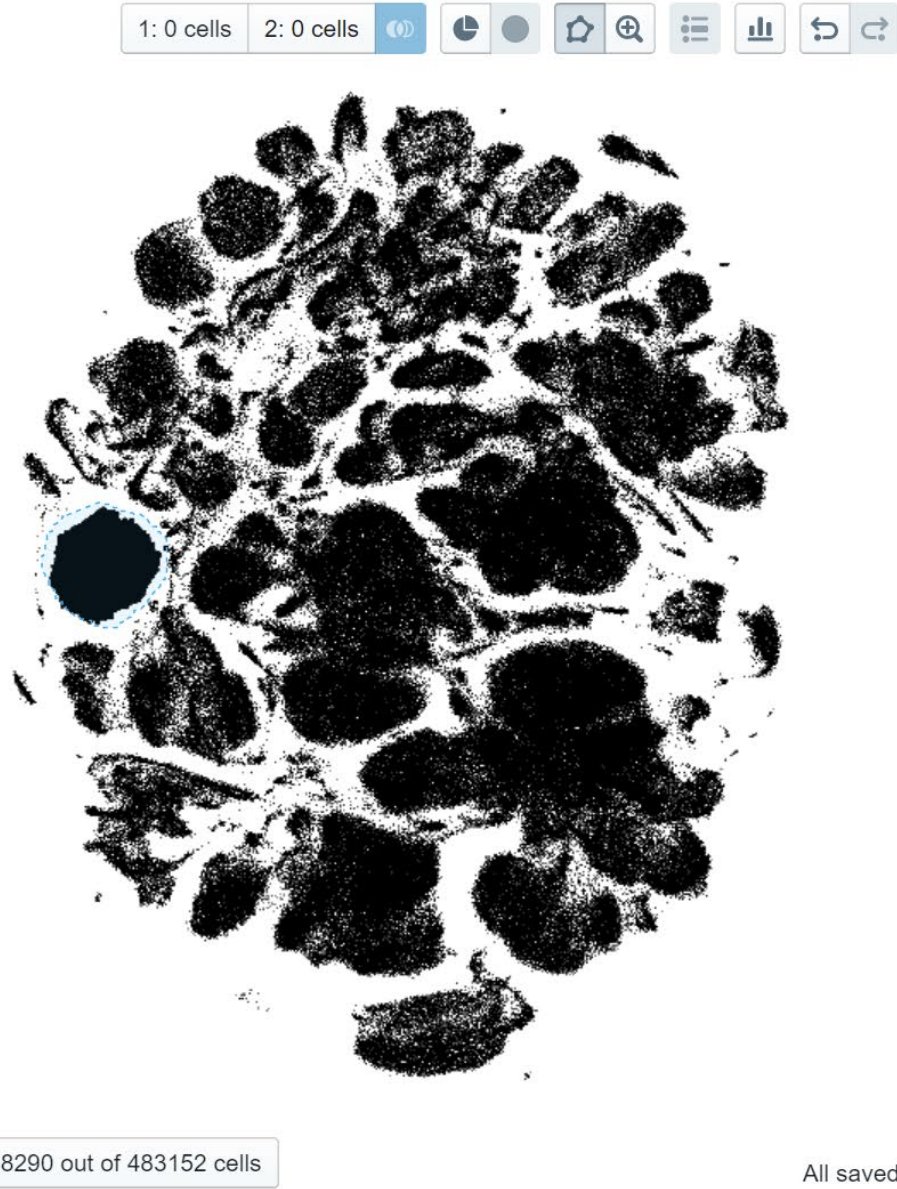
Create new category

- anatomical_information >
- cell_ontology_class >
- cluster_label >
- compartment >
- donor >
- free_annotation >
- gender >
- leiden >

manually_annotated: true

- method >
- organ_tissue >

min 2500 5e+6 1e+7 2e+7 2e+7
n_counts_UMIs max 2.228e+7



Genes ▾

Quick Gene Search

Gene Sets ▾ Create new

Describe the selected cells.

The selected cells are epithelial cells from the proximal tubule of the kidney, specifically from the cortex region. 👍

I thought that the cortex region is in the brain?

No, the cortex region in the kidney is the outer layer of the kidney, where the glomeruli are located. 👍

Okay, understood. Can you tell me more about these cells?

These cells are epithelial cells from the proximal tubule, which is the first part of the tubule in the kidney's filtration system. They play a crucial role in reabsorbing water, electrolytes, glucose, and amino acids from the filtrate. 👍

Which genes are particularly active in the selected cells?

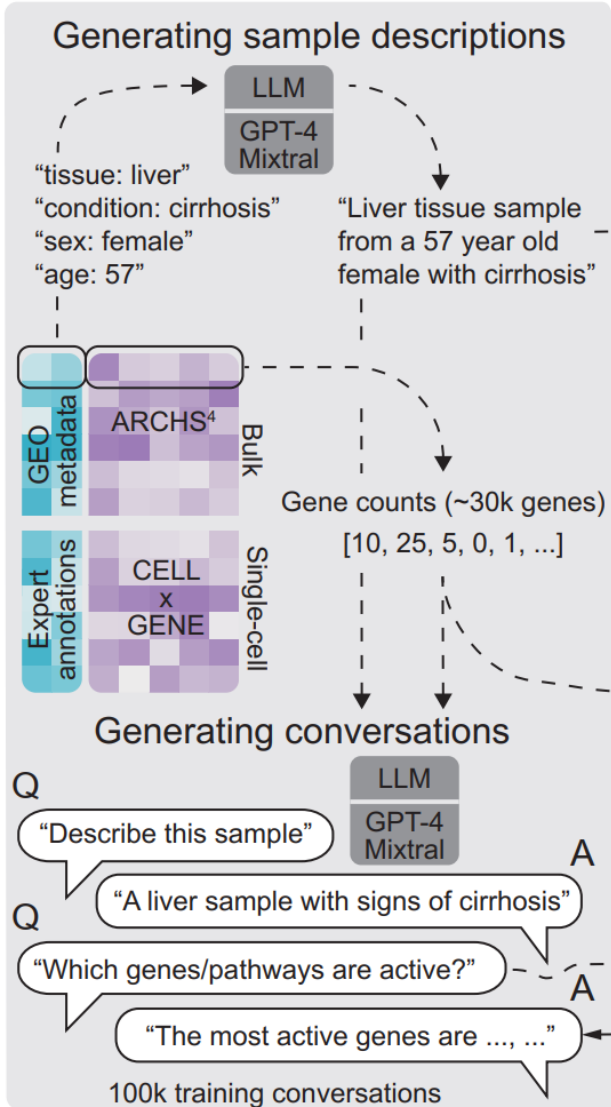
The most strongly expressed genes in the selected cells include CRYAB, C11orf54, PDZK1IP1, FXYD2, MTND1P23, PEBP1, GPX3, LDHB, ATP5MC3, ALDOB, COX7B, DAB2, MT-CO3, CHCHD10, AK4, CXCL14, TXN, ATP5MD, CRYL1, PRDX1, PCK1, IL32, CMBL, BBOX1, MT1G, GLYAT, ASS1, C12orf75, SLC25A5. 👍

Type your request here and press <Enter>. For example: '/search T cells'

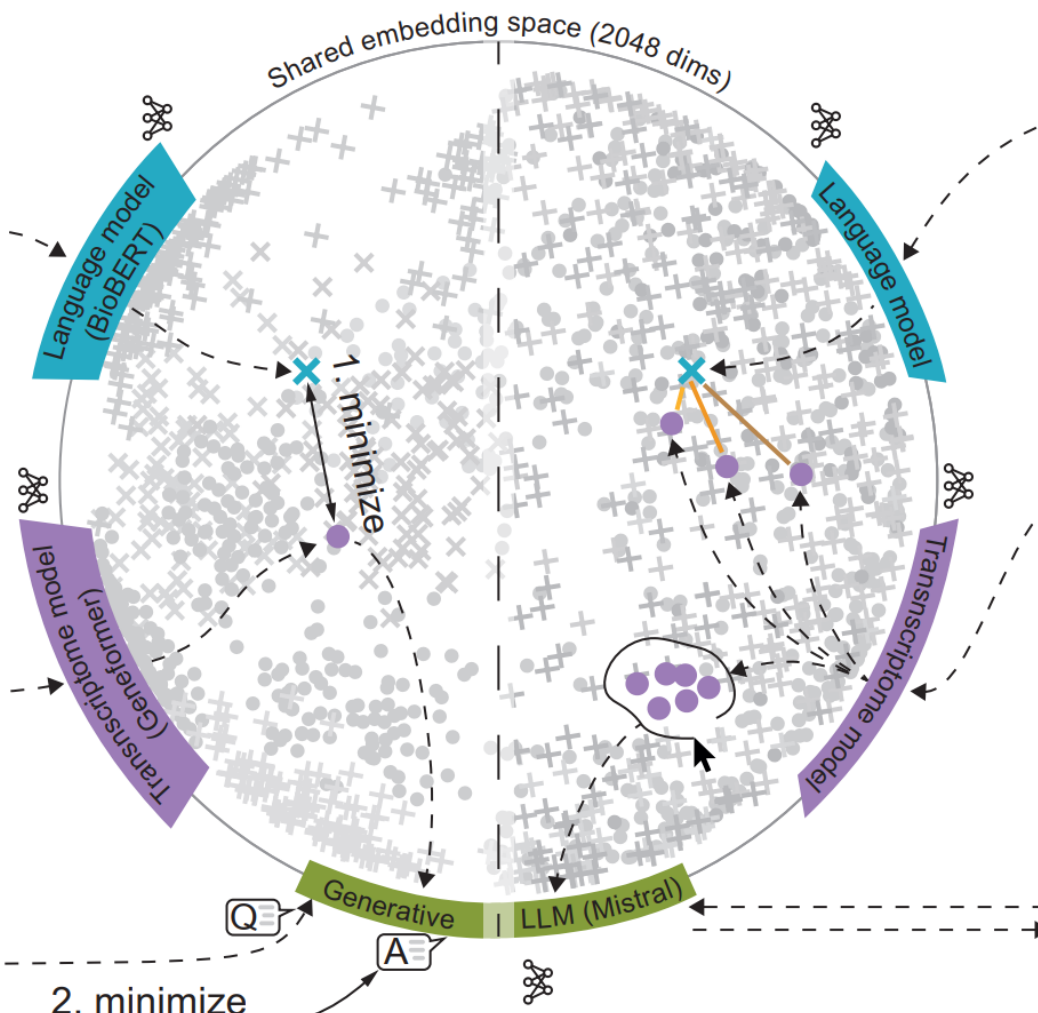
Describe the selected pseudocell (mean of n=8290)

Under the hood: Joint embedding of transcriptomes and text for single-cell data analysis

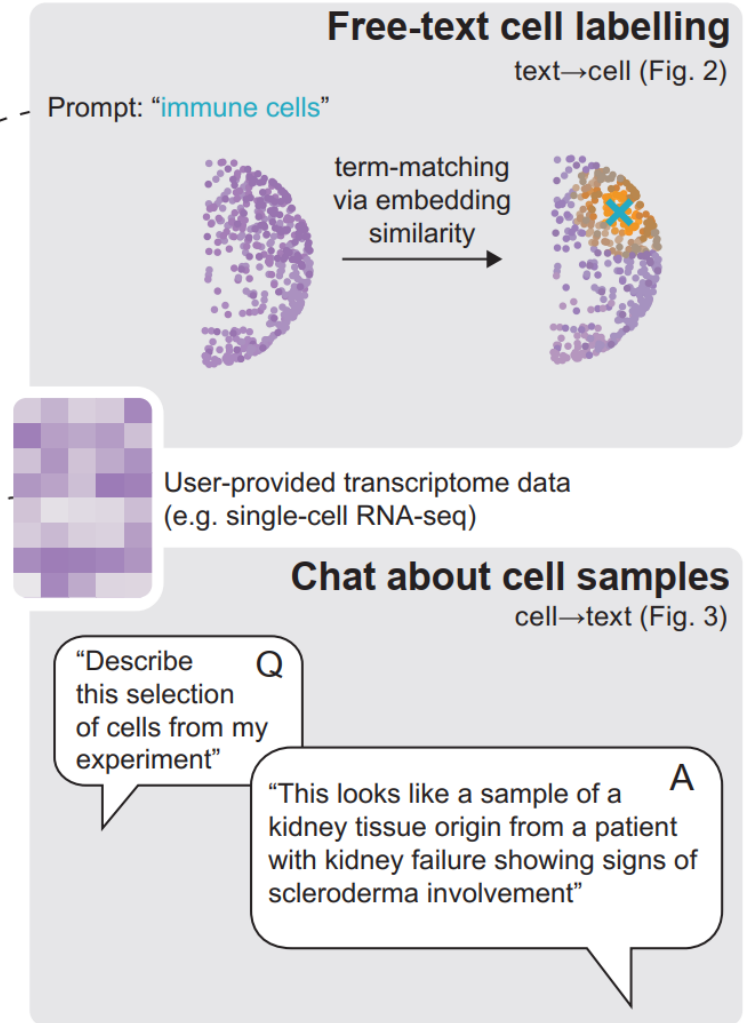
Dataset 1M human transcriptome-text pairs



Training | Inference



Application



Acknowledgements

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Lab Alumni: Nathan Sheffield (now: University of Virginia), Christian Schmidl (now: RCI / Uni Regensburg), Florian Halbritter (now: CCRI Vienna), Matthias Farlik (now: MedUni Vienna), Johanna Klughammer (now: LMU Munich Gene Center), André Rendeiro (now: PI at CeMM), Nikolaus Fortelny (now: University of Salzburg), Peter Traxler (now: MedUni Vienna), Lukas Folkman (now: Griffith University), Paul Datlinger (now: Xaira Therapeutics, San Francisco)

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<https://bocklab.org>

<https://twitter.com/BockLab>

<https://www.meduniwien.ac.at/en>

<https://cemm.at>



BSF | Biomedical Sequencing Facility

Alberto Alises, Lina Dobnikar, Diana Drobná,
Veronika Mancikova, Michael Schuster, Hannah
Riegler, Carina Suete, Benjamin White



We are looking for ambitious students & postdocs!