European Spatial Biology Center

(ESBC nv)

Creating the Leader in Genomics 3.0

Nachiket Kashikar, PhD, MBA

Co-founder and CEO

**Linking up the Heidelberg/Mannheim
and Leuven Health Ecosystems**

October 21, 2022

Biology has a challenge - of numbers and scale

What if we have a detailed spatial map of the human brain at cellular resolution - genes, proteins, …

Image credit: DJ (CC BY-SA 2.0)

- **171 billion** cells in human brain

- **100,000** cells - an average lab
- **1.71 million** labs(!)

- **Diverse foci**
- **Only incremental discoveries**
- **Severely limits our ability to understand diseases and find new medicines**

Enabling Solutions – Spatial Biology

Our understanding of biology has an **inherent problem**. We do not know **which genes, transcripts, proteins, metabolites** are expressed **when** and **where**; thereby limiting our ability to **unravel biology** and improve **crops and medicine**. **Spatial Biology solves this problem!**

Bulk RNAseq/Microarrays

many cells at once, but not possible to resolve the cells where the "ome" is expressed, therefore only indicative of what might be present in a tissue sample


Single-cell RNA seq

Transcript information per cell (for relatively abundant transcripts) followed by cell classification


Spatial Biology

Quantitative understanding of expression of genes, transcripts, and proteins at single-cell and subcellular level; how cells relate to each other spatially with comprehensive omics information

3

ESBC
European Spatial Biology Center

The Unmet Needs
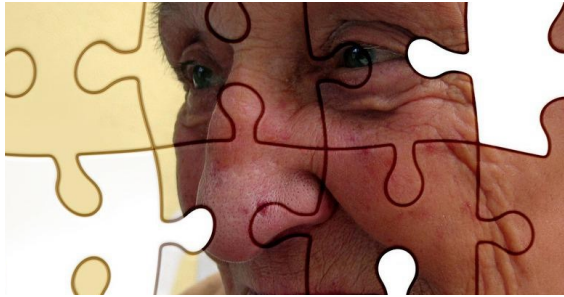
Neurological Disorders

- dysregulated cellular network in the vicinity of pathogenic hallmarks of AD
- molecular logic of disease spread?
- why selective cellular and regional vulnerability?
- genetic risk factors
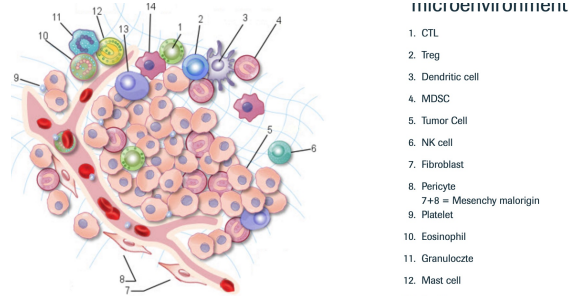
Cancer

- molecular heterogeneity in the spatial vicinity of a cancer
- spatial context of tumor/non-tumor cells
- how drug tolerant persister cells arise from the bulk tumour following successful treatment
- intact tissue for regulatory trials
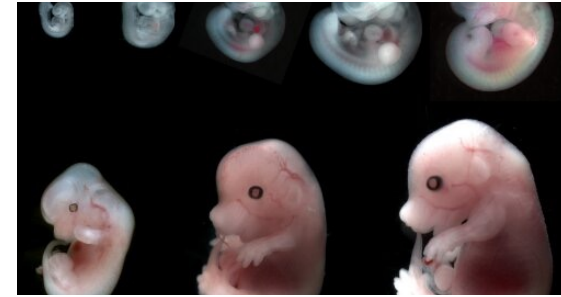
Developmental Biology

- progenitor subtype gene expression
- where are these makers spatially?
- how do the levels of these TF change over develop-mental stages?
- developmental diseases?
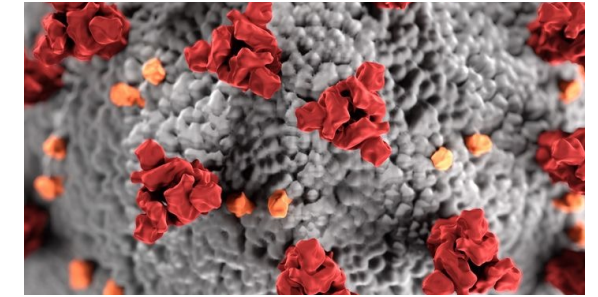
Infectious Diseases

- how does SARS-CoV-2 aggregate into the tissue and attack different cell types
- what are the molecular changes that occur in the tissue as virus spreads?
- how does it differ for different tissue types
- testing of old and new drugs

ESBC European Spatial Biology Center

It's Prime Time - I

Spatial Biology is *the* solution to previously unattainable scientific problems – whether basic or translational
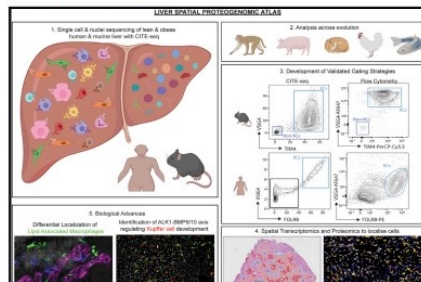
It's Prime Time - II

Big discoveries made possible by Spatial Biology

Cell

Resource

Spatial proteogenomics reveals distinct and evolutionarily conserved hepatic macrophage niches

Graphical abstract

Authors
Martin Guilliams, Johnny Bonnardel, Birthe Haest, ..., Hans Van Vlierberghe, Lindsey Devisscher, Charlotte L. Scott

Correspondence
martin.guilliams@ugent.be (M.G.), charlotte.scott@ugent.be (C.L.S.)

In brief
By combining single-cell and -nucleus sequencing with spatial mapping of RNA and proteins, this vast spatial proteogenomic atlas of healthy and obese human and mouse livers presents

COVID-19 tissue atlases reveal SARS-CoV-2 pathology and cellular targets

https://doi.org/10.1038/s41586-021-03570-8

Received: 16 November 2020

Accepted: 19 April 2021

Published online: 29 April 2021

Check for updates

COVID-19, which is caused by SARS-CoV-2, can result in acute respiratory distress syndrome and multiple organ failure[1-4], but little is known about its pathophysiology. Here we generated single-cell atlases of 24 lung, 16 kidney, 16 liver and 19 heart autopsy tissue samples and spatial atlases of 14 lung samples from donors who died of COVID-19. Integrated computational analysis uncovered substantial remodelling in the lung epithelial, immune and stromal compartments, with evidence of multiple paths of failed tissue regeneration, including defective alveolar type 2 differentiation and expansion of fibroblasts and putative TP63+ intrapulmonary basal-like progenitor cells. Viral RNAs were enriched in mononuclear phagocytic and endothelial lung cells, which induced specific host programs. Spatial analysis in lung distinguished inflammatory host responses in lung regions with and without viral RNA. Analysis of the other tissue atlases showed transcriptional alterations in multiple cell types in

New Results

🔔 Follow this preprint

Dynamic control of metabolic zonation and liver repair by endothelial cell Wnt2 and Wnt9b revealed by single cell spatial transcriptomics using Molecular Cartography

Shikai Hu, Silvia Liu, Yu Bian, Minakshi Poddar, Sucha Singh, Catherine Cao, Jackson McGaughey, Aaron Bell, Levi L Blazer, Jarret J Adams, Sachdev S Sidhu, Stephane Angers, Satdarshan P. Monga

doi: https://doi.org/10.1101/2022.03.18.484868

Spatial omics and multiplexed imaging to explore cancer biology

Sabrina M. Lewis, Marie-Liesse Asselin-Labat, Quan Nguyen, Jean Berthelet, Xiao Tan, Verena C. Wimmer, Delphine Merino, Kelly L. Rogers ✉ & Shalin H. Naik ✉
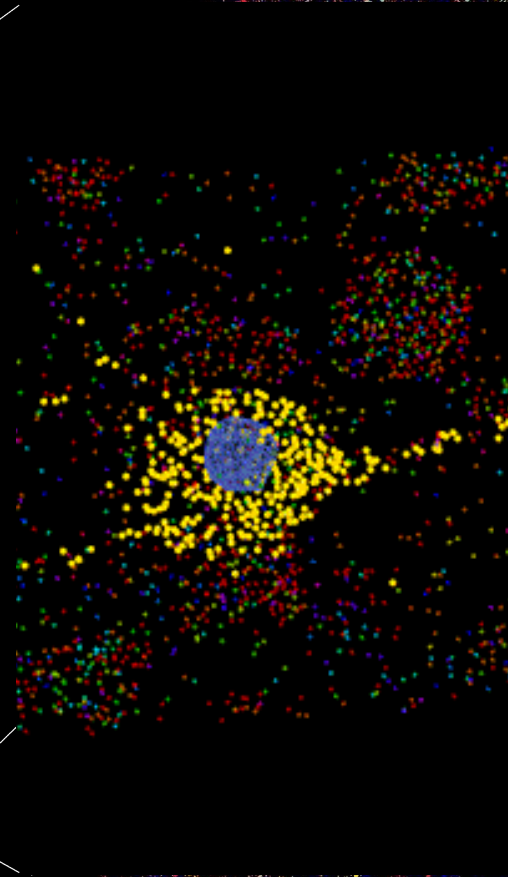
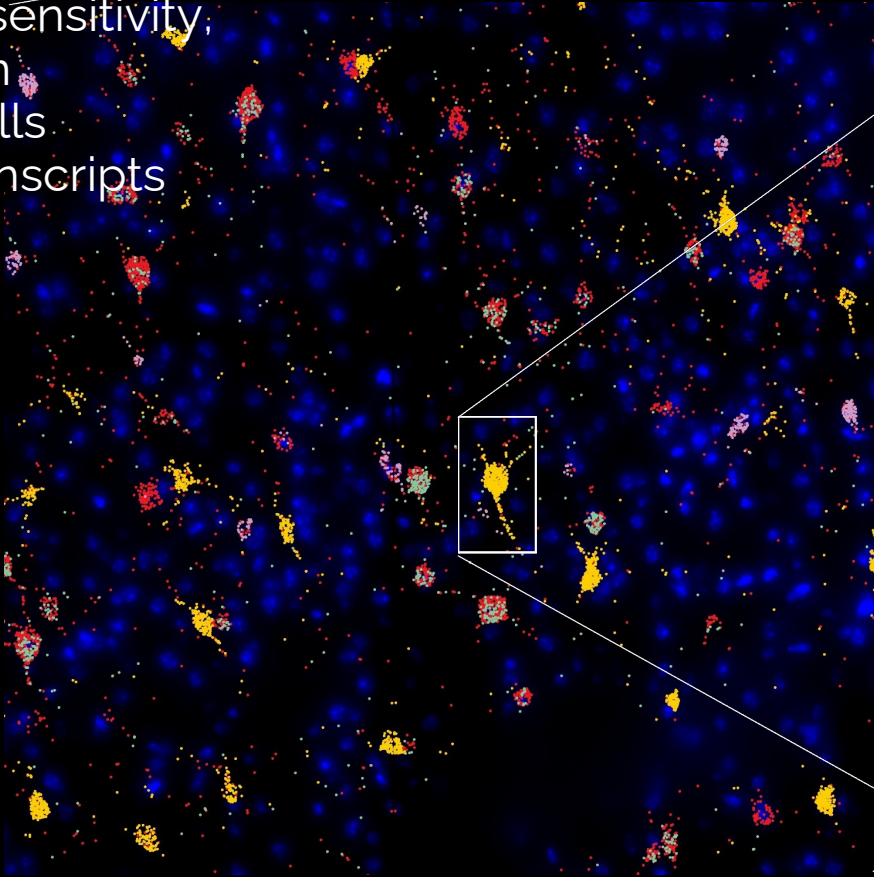*Nature Methods* **18**, 997–1012 (2021) | Cite this article

The Holy Grail of Biology - Spatial Molecular Profiling

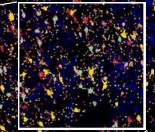*   Single-cell (subcellular) resolution,
*   Unmatched sensitivity,
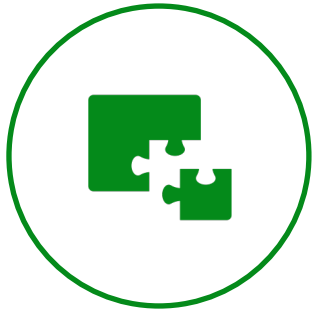* Quantification
* Millions of cells
* Billions of transcripts

Data Courtesy of Resolve Biosciences' Molecular Cartography™

Why is Scale Important for Spatial Biology?

Accelerate Innovation 100X

- Biologically relevant datasets to **reveal subtle insights**
- Multiparametric and multiplex experimentation to **transform validation and throughput of biology**
- Intelligent automation for **reproducible and optimized biology**
- **Break silos**
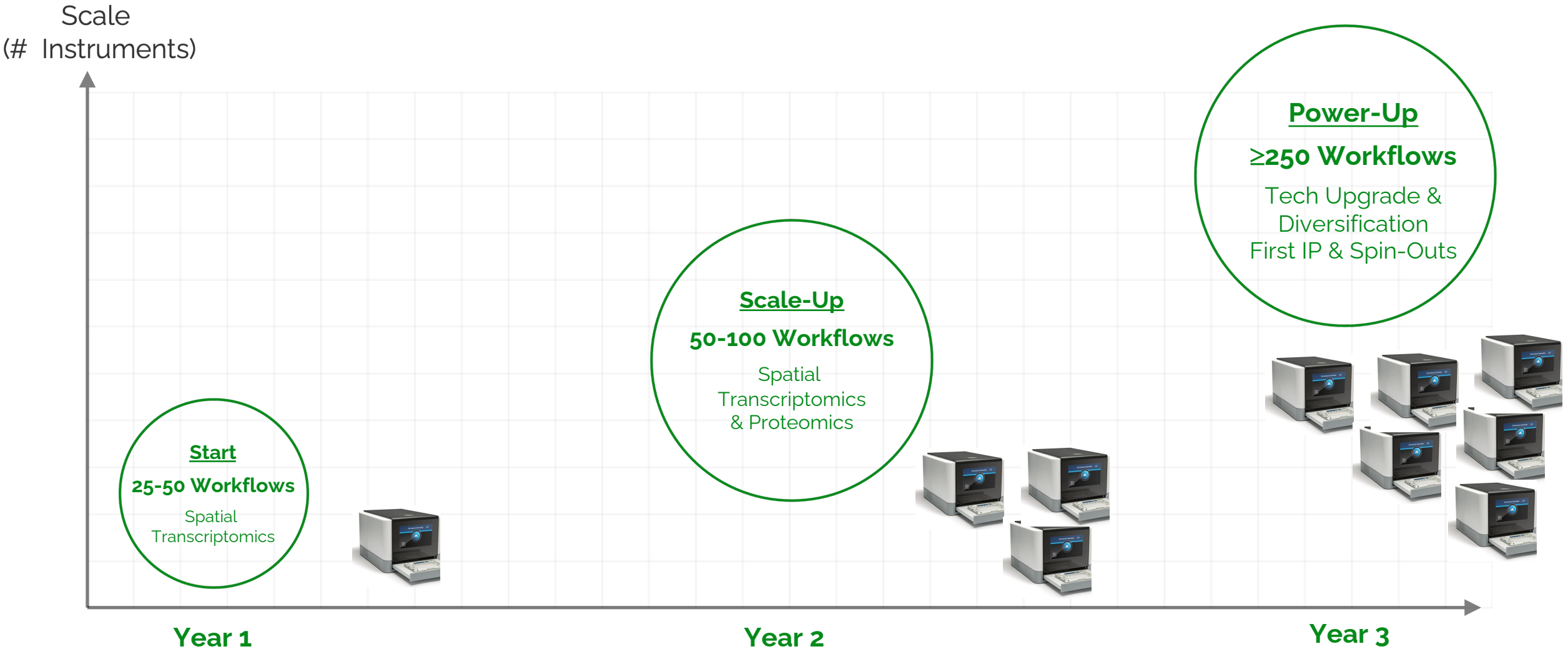
The Power of Big data

- **Platform-driven** large-scale science + AI/ML
- **Standardisation** in sample preparation, data generation, data analysis
- **Move away from static, incremental** science to generate novel hypotheses that you would not have come up with otherwise
- Unbiased data and computational advances to create **predictive models of biology**

From Bench to Bedside

- **Discovery** research in pharma
- **Preclinical** studies/Tox/target engagement, MoA
- **Clinical** Trials
- Target **identification** and target **validation**, new disease **biomarkers**

ESBC
European Spatial Biology Center

ESBC Growth Trajectory

Scale
(# Instruments)

Start
25-50 Workflows
Spatial Transcriptomics

Scale-Up
50-100 Workflows
Spatial Transcriptomics & Proteomics

Power-Up
≥250 Workflows
Tech Upgrade & Diversification
First IP & Spin-Outs

Year 1

Year 2

Year 3
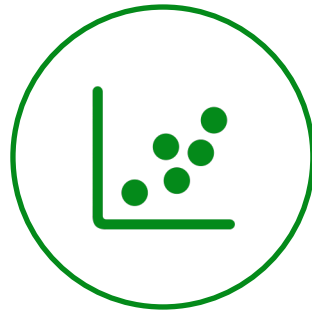
ESBC
European Spatial Biology Center
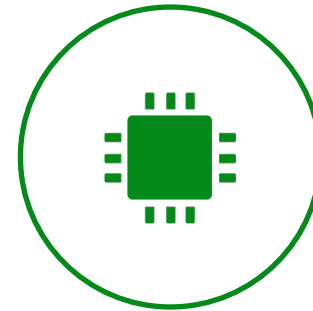
Value Proposition of the ESBC

Data at Scale

- Large flagship projects
- Academia and Pharma
- Tech agnostic
- Democratization

Insights - data solutions

- Big data custom analytics
- Partnering + ESBC hires
- Sell data insights and interpretation

Tech Commercialization

- Close partnership with Flemish ecosystem
- Chemistry + workflow + instrumentation
- Commercialize and scale new Spatial Biology technologies

Spin-outs

- Public-Private Partnerships
- Joint-IP/licensing with Pharma partners
- Spin-outs - Pharma. Biotech, Data sciences

Partnering across four pillars | 3-4 across each pillar | Shared costs & expertise

ESBC
European Spatial Biology Center

Who we are

The Operating Team

Dr. Nachiket Kashikar

Co-founder & CEO

Formerly J&J, Resolve, QIAGEN

Entrepreneur

Dr. Benedikt Nilges

Data & Tech

Formerly Resolve, QIAGEN

Dr. Roopika Menon

Business Development

Formerly Siemens Healthineers

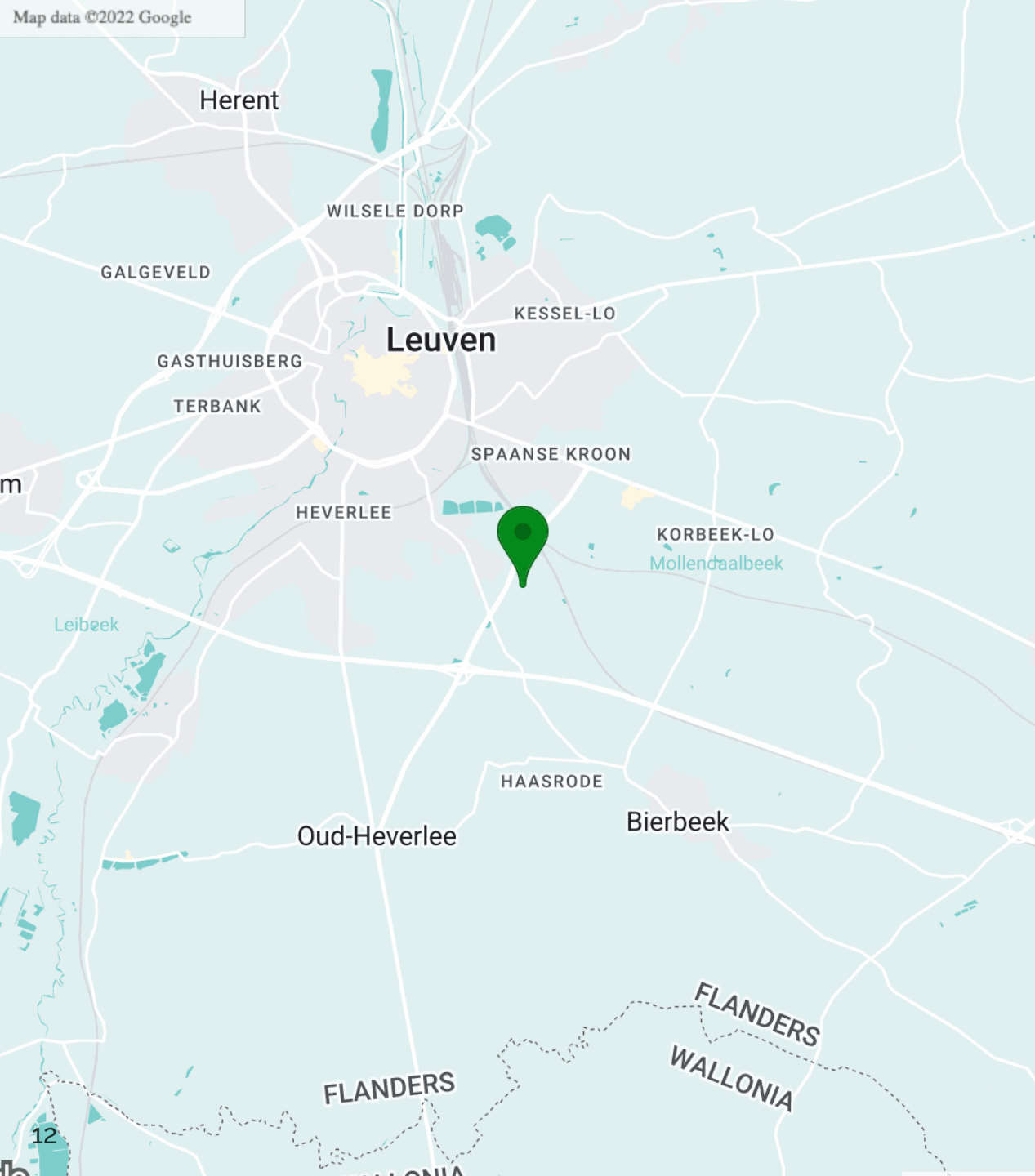**Dr. Jasper Kläver**

Operations

Formerly QIAGEN, Resolve

More to come

Finance

Formerly at a VC firm

7

Operational Team in Leuven

ESBC
European Spatial Biology Center

Contact Us

Technologielaan 3, 3001 Leuven, Belgium

+49 173 7045651

www.esbc.science

@BiologySpatial

linkedin.com/company/european-spatial-biology-center