

# Omics Analysis & Integration (A&I) Hub:

## Information for SyNergy Members

The Hub brings together experts in single-cell and cross-modal omics integration and analysis to help SyNergy researchers gain deeper insights from complex datasets. We offer support for advanced single-cell and spatial analyses and develop best-practice workflows for spatial data in collaboration with the Spatial Transcriptome Hub.

In addition, we develop representation learning methods to integrate multiple layers of bulk and single-cell omics, spatial omics, and imaging data, and support SyNergy researchers in applying these novel frameworks to their data. For cross-modal and cross-scale models, the Hub is collaborating closely with other Hubs, such as the Nanoscale Hub. We also facilitate disease-spanning and cross-species analysis through the use of trained atlas models, enabling harmonized annotation and joint, batch-invariant data representations.

### PLEASE NOTE:

- Projects with the Omics A&I Hub are organized on a collaborative, case-by-case basis and **require a designated contact person with bioinformatics expertise in the requesting lab**, who is responsible for data preprocessing.
- Project requests will be reviewed by the hub coordinators and selected based on feasibility, scientific impact, and available hub resources.
- While the Hub provides **only limited support for basic preprocessing tasks** (such as quality control, single-modality integration and cell type annotation), we continuously collect and update training materials and best-practice workflows for single-cell and multi-omics analysis to enable independent work.

## Technical portfolio

- Advanced single-cell analyses (trajectory inference, composition analysis, spatial analysis)
- Multi-omics data integration and analysis (spatial multi-omics integration, spatial and single cell omics data integration, bulk proteomics deconvolution)
- Disease-spanning and cross-species analyses (atlas reference mapping)
- Integration of omics and imaging data (cross-modal representation learning from (spatial) omics and histology (H&E/DAPI))

We offer training on key aspects of single-cell and multi-omics data analysis, and collect and update best-practice workflows and training materials.

## Project request procedure

**For more information and to discuss a potential project, please get in touch with the Omics A&I Hub group leader via email ([hannah.spitzer@med.uni-muenchen.de](mailto:hannah.spitzer@med.uni-muenchen.de)).**

We encourage you to reach out before beginning data acquisition, so that we can jointly plan the appropriate amount of data and number of replicates needed for statistically sound analyses and integration.

## PROJECT WORKFLOW

1

### INITIATION & PLANNING

- After initial contact with the hub group leader (via email) and approval of the idea, a **project request form** will be shared to the collaborator(s), which should be filled and sent back.
- This form asks for a brief abstract and key project details, including the research question, data types and availability, and the planned or requested analyses.

2

### DATA ANALYSIS

Depending on the complexity of the project and level of guidance needed, we will provide general implementation guidance to be executed by the collaborating bioinformatician, or implement and run advanced analysis methods within the hub.

3

### DATA SHARING

- Output data will be stored securely on SyNergy's DSS container (LRZ), and the Data Manager will contact the collaborator(s) to provide download access (**via Globus**) to relevant files within the project directory.
- These shared results can then be evaluated by the researchers, and they can collaborate with the hub team for any follow-up or iterative analyses based on initial findings.

*Please note: Collaborator(s) will have access to their files for 30 days, after which access will be revoked. The Data Manager will send a reminder 7 days before the deadline to confirm if the files have been downloaded.*

## Organization

The Omics A&I Hub is located at the Center for Stroke and Dementia Research (CSD) building hosting the ISD and DZNE.

### Team Members (in alphabetical order):

Name	Function	Location
Aditi Methi	Data Manager	ISD
Fabian Theis	Hub Coordinator	HMGU / TUM
Hannah Spitzer	Hub Group Leader / Cross-modal integration	ISD
Martin Dichgans	Hub Coordinator	ISD
Tbd	Data Analysis	ISD

## Publications

Yang, K., Spitzer, H., Sterr, M., Hrovatin, K., de la O, S., Zhang, X., Setyono, E. S. A., Ud-Dean, M., Walzthoeni, T., Flisikowski, K., Flisikowska, T., Schnieke, A., Scheibner, K., Wells, J. M., Sneddon, J. B., Kessler, B., Wolf, E., Kemter, E., Theis, F. J., & Lickert, H. (2025). A multimodal cross-species comparison of pancreas development. *Nature Communications*, *16*(1), 9355.

<https://doi.org/10.1038/s41467-025-64774-4>

Simats, A., Zhang, S., Messerer, D., Chong, F., Beşkardeş, S., Chivukula, A. S., Cao, J., Besson-Girard, S., Montellano, F. A., Morbach, C., Carofiglio, O., Ricci, A., Roth, S., Llovera, G., Singh, R., Chen, Y., Filser, S., Plesnila, N., Braun, C., ... Liesz, A. (2024). Innate immune memory after brain injury drives inflammatory cardiac dysfunction. *Cell*, *187*(17), 4637-4655.e26.

<https://doi.org/10.1016/j.cell.2024.06.028>

Spitzer, H., Berry, S., Donoghoe, M., Pelkmans, L., & Theis, F. J. (2023). Learning consistent subcellular landmarks to quantify changes in multiplexed protein maps. *Nature Methods*, *20*(7), 1058–1069. <https://doi.org/10.1038/s41592-023-01894-z>

Palla, G., Spitzer, H., Klein, M., Fischer, D., Schaar, A. C., Kuemmerle, L. B., Rybakov, S., Ibarra, I. L., Holmberg, O., Virshup, I., Lotfollahi, M., Richter, S., & Theis, F. J. (2022). Squidpy: a scalable framework for spatial omics analysis. *Nature Methods*. <https://doi.org/10.1038/s41592-021-01358-2>