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

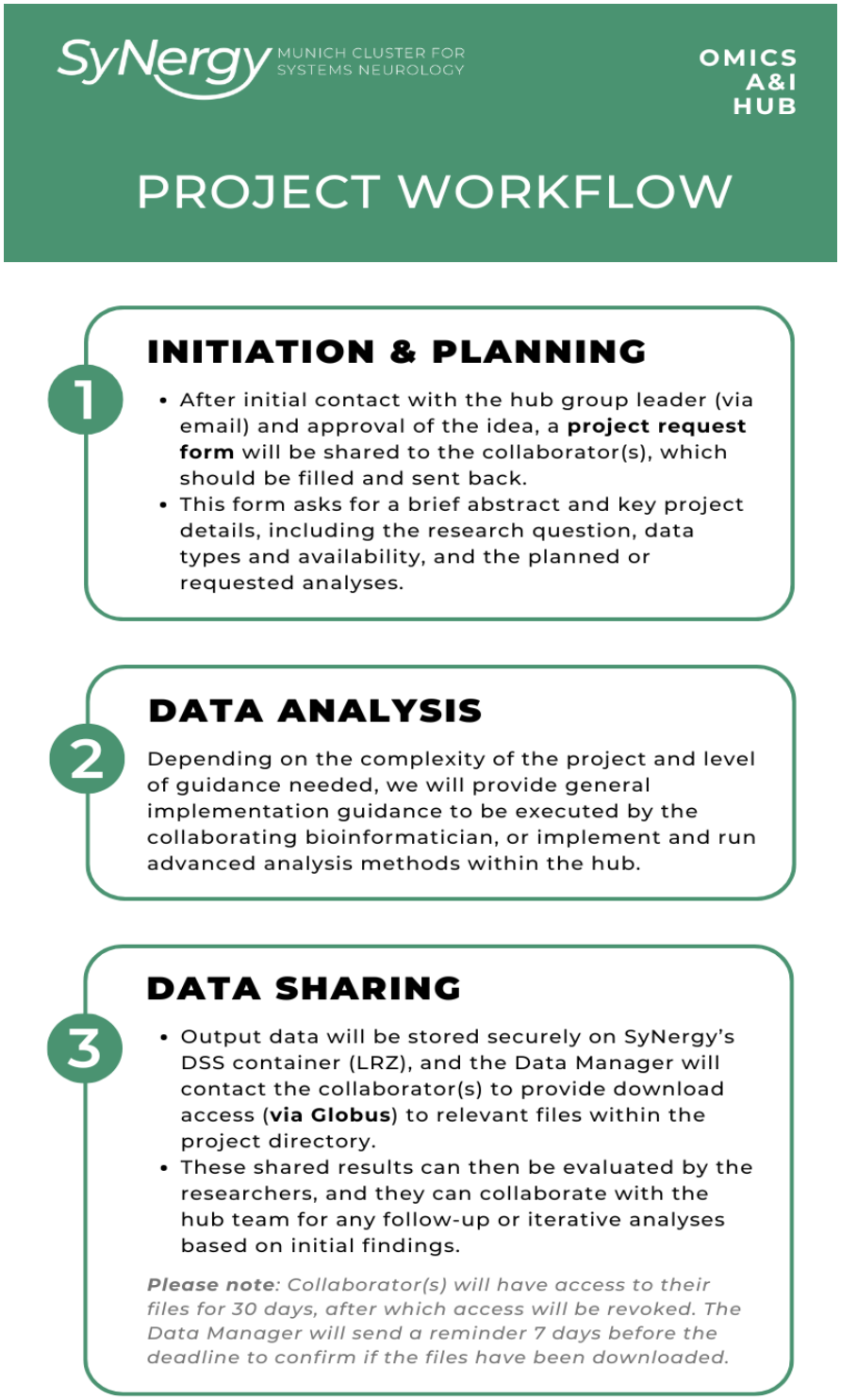
- Advanced single-cell analyses (trajectory inference, composition analysis, spatial analysis)
- Multi-omics data integration and analysis (spatial multi-omics integration, spatial and single cell omics data integration, bulk proteomics deconvolution)
- Disease-spanning and cross-species analyses (atlas 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).

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.



Authorship and Acknowledgments Guidelines

We follow the DFG Guidelines (https://www.wissenschaftliche-integritaet.de/en/gl-14-395122) for safeguarding good research practice.

Authorship: We request co-authorship when our work appears in the publication (a figure, plot, table, or supplementary result), supports a key conclusion, produces an important negative or null result, or contributes to study design, method development, or interpretation. In these cases, the analyst who did the work and the PI supervising the analysis would request authorship. The author order would of course be agreed upon based on the scale and nature of the contribution. Intellectual input, such as regular discussions or advice on design and interpretation, can also qualify if the input shaped the study design, analysis, or conclusions.

Acknowledgement: Routine data processing without input into interpretation, troubleshooting that did not shape the study, and access to infrastructure or software may only request an acknowledgement. Brief informal questions need no credit.

We are open to discussing contributions and authorship when a project starts and revisit them if the scope changes.

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