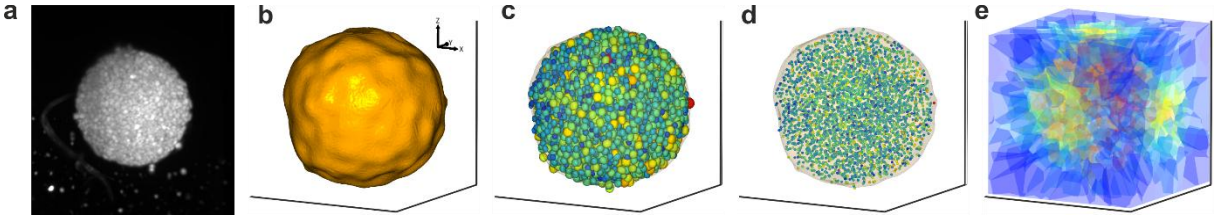
Dr. Florian LEVET
Researcher – HDR
Quantitative Imaging of the Cell
CNRS, University of Bordeaux
Tel: +33 (0)5 33 51 47 48
florian.levet@u-bordeaux.fr

3-years Post-Doctoral Researcher position available in Deep Learning, 3D Bioimage Analysis & Graph-Based Spatial Quantification at the Interdisciplinary Institute for Neuroscience (IINS, Bordeaux)



Spatial subdividing techniques to help quantify the spheroid organization.(a) Maximum projection of a breast cancer spheroid acquired with a light-sheet microscope. (b) Wavelet-based segmentation of the spheroid overall shape. (c) Stardist-based segmentation of the nuclei in the context of the segmented spheroid shape. While qualitatively looking good, we were not able to quantitively assess the segmentation quality because of a lack of a ground truth. (d) 3D Voronoi diagram reconstructed from the

Developing computational methods for quantitative analysis of multicellular 3D cell cultures

A fully funded three-year postdoctoral position is available at the **Interdisciplinary Institute of Neuroscience (IINS) in Bordeaux** in the framework of the **INSERM MIC (Contributions of mathematics and computer science to oncology) program** for an exciting interdisciplinary collaboration with the Bordeaux Institute of Oncology (BRIC).

Three-dimensional (3D) culture models, including organoids and multicellular spheroids, have become essential tools for studying tissue organization, cancer biology, and interactions between different cell populations. However, extracting reliable quantitative information from 3D fluorescence microscopy remains challenging. In particular, robust segmentation of individual nuclei and cells, as well as characterization of their spatial and temporal organization, are major limitations for the large-scale analysis of these complex biological systems.

The **3D-ORGAN-BENCH** project aims to overcome these limitations by combining deep learning, image processing, computational geometry, and graph-based analysis to develop a comprehensive framework for quantitative 3D organoid microscopy.

The recruited postdoctoral researcher, supervised by Dr. Florian LEVET, will contribute to two major research directions.

1. Deep learning and benchmarking for 3D cell segmentation

The postdoctoral researcher will participate in the development of a large, community-driven benchmark dataset for 3D nuclei segmentation and investigate the robustness and generalization of existing deep-learning methods, including StarDist, Cellpose, and emerging approaches.

A particular emphasis will be placed on evaluating self-supervised representation learning and synthetic data generation strategies, including generative models and domain adaptation, to determine how artificial training data can reduce the need for manual annotations and improve segmentation across different imaging conditions. This work will be done in collaboration with a PhD student already part of the team.

2. Graph-based spatial and temporal analysis of multicellular organoids

Building on the segmentation results, the postdoctoral researcher will lead the development of computational methods to characterize the spatial organization of cells within 3D spheroids.

Using computational geometry approaches such as 3D Voronoi tessellations and Delaunay triangulations, organoids will be represented as spatial graphs encoding cellular neighborhoods and local tissue architecture. Novel quantitative descriptors will be developed to characterize cell

Dr. Florian LEVET
Researcher – HDR
Quantitative Imaging of the Cell
CNRS, University of Bordeaux
Tel: +33 (0)5 33 51 47 48
florian.levet@u-bordeaux.fr

distributions, spatial heterogeneity, cell–cell relationships, and differences between spheroids across experimental conditions.

These methods will subsequently be extended to time-lapse 3D microscopy to investigate how multicellular organization evolves over time, including cellular rearrangements and responses to experimental perturbations.

The postdoctoral researcher will also contribute to the segmentation and spatial integration of non-nuclear cell types, including macrophages and fibroblasts, whose complex morphologies require dedicated analysis strategies.

All computational developments will be integrated into PoCA (Point Cloud Analyst), our open-source platform for interactive visualization and quantitative analysis of multidimensional microscopy data.

The developed methods will be applied in close collaboration with cancer biologists to investigate the organization of tumor and immune cells in 3D models of cutaneous lymphomas.

Qualifications

The candidates must:

- Have a PhD in computer science, computational biology, bioinformatics, applied mathematics, or a related field.
- And/or proven experience in developing bioimage analysis methods and/or tools.
- Have demonstrated experience in deep learning, particularly using frameworks such as PyTorch or TensorFlow.
- Be able to independently develop, evaluate, and implement computational methods.
- Have good communication skills and an interest in interdisciplinary research involving experimental biologists.

Experience in one or more of the following areas would be particularly appreciated:

- Bioimage analysis, especially 3D microscopy and cell segmentation.
- Generative models, self-supervised learning, or domain adaptation.
- Computational geometry, graph-based analysis, or spatial statistics.
- C++ programming and scientific software development.
- Analysis of time-lapse microscopy data and cell tracking.

Previous experience in cancer biology is not required.

Scientific Environment

The postdoctoral researcher will join the **Quantitative Imaging of the Cell** (QIC) team at the **Interdisciplinary Institute for Neuroscience** (IINS), a joint research institute of CNRS and the University of Bordeaux.

Dr. **Florian LEVET** leads the analysis developments of the QIC team and has extensive expertise in computer graphics, image processing, computational geometry, and quantitative microscopy. His research has led to the development of several open-source software tools, including SR-Tesseler, Coloc-Tesseler, and more recently PoCA, published in Nature Methods (2023).

The successful candidate will work in a highly interdisciplinary environment bringing together computer scientists, imaging specialists, and biologists, with access to advanced microscopy setups/facilities.

The project will involve close collaboration with the team of Dr. **Laurence BRESSON-BEPOLDIN** at the **Bordeaux Institute of Oncology** (BRIC), which develops innovative 3D lymphoma models to investigate interactions between cancer cells and their microenvironment.

Dr. Florian LEVET
Researcher – HDR
Quantitative Imaging of the Cell
CNRS, University of Bordeaux
Tel: +33 (0)5 33 51 47 48
florian.levet@u-bordeaux.fr

The position offers the opportunity to develop original computational methods while addressing biologically relevant questions, with a strong emphasis on open-source software, scientific publications, and interdisciplinary collaborations.

Contact

Starting date is as soon as the 1st January 2027.

Send your CV and motivation letter to florian.levet@u-bordeaux.fr

References

1. Galindo*, X., Barry*, T., Guyot, P., Rivière, C., Galland, R., **Levet, F**. (2024) 3D Nuclei Segmentation by Combining GAN Based Image Synthesis and Existing 3D Manual Annotations. In proceedings of Bioimaging 2024, **best paper award**.
2. **Levet, F**. & Sibarita, J.-B. PoCA: a software platform for point cloud data visualization and quantification. Nature Methods 2023 1–2 (2023).
3. Beghin, A., Grenci, G., Sahni, G., Guo, S., Rajendiran, H., Delaire, T., Mohamad Raffi, S.B., Blanc, D., de Mets, R., Ong, H.T., Galindo, X., Monet, A., Acharya, V., Racine, V., **Levet, F.**, Galland, R., Sibarita, J.B. & Viasnoff, V. Automated high-speed 3D imaging of organoid cultures with multi-scale phenotypic quantification. Nat Methods 19, 881–892 (2022).
4. **Levet, F.**, Tonnesen, J., Närgel, V., Sibarita, J.B. (2020) SpineJ: A software tool for quantitative analysis of nanoscale spine morphology. Methods.
5. **Levet, F.**, Julien, G., Galland, R., Butler, C., Beghin, A., Chazeau, A., Hoess, P., Ries, J., Giannone, G., Sibarita, JB. A tessellation-based colocalization analysis approach for single-molecule localization microscopy. Nature Communications, Article number: 2379 (2019).
6. **Levet, F.**, Hosy, E., Kechkar, A. et al. SR-Tesseler: a method to segment and quantify localization-based super-resolution microscopy data. Nat Methods 12, 1065–1071 (2015).