NOTE: Although the lectures are geared for the European time zone. All lectures will be recorded and you will be able to attend offline too.

Day 1 (Monday 03/03) (15:30 - 17:00 CET, 1-1:30 hrs):

1. **Introduction to Spatial Omics**

2. **Technology-specific omic datasets**

    - Visium
    - Xenium
    - VisiumHD

3. **Introduction to VoltRon**

    - Managing VoltRon objects
    - Image manipulation
    - Visualization
    - Multilayer data visualisation

4. **Spatially aware analysis**

    - Relationship to single cell analysis
    - Niche clustering
    - Hot spot analysis
    - Image Alignment

Day 2 (Tuesday 04/03) (15:30 - 17:00 CET, 1:30 hrs):

1. **Visium Analysis**

    - **Data:** Visium (Anterior and Sagittal Brain Sections)
    - **Tutorial**: https://bioinformatics.mdc-berlin.de/VoltRon/nicheclustering.html

    - Clustering
    - Niche clustering
        - Deconvoluting with RCTD
        - Clustering spots based on cell mixtures

2. **Xenium Analysis**

    - **Data**: Xenium In Situ Replicate 1 (Breast Cancer)
    - **Tutorial**: https://bioinformatics.mdc-berlin.de/VoltRon/spotanalysis.html#Xenium_Data_Analysis

    - OnDisk Support
        - Introduction to delayed/lazy operations
        - Saving VoltRon objects to disk
        - Operations from disk
            - Processing
            - Visualization
    - Clustering
    - Niche clustering
    - Hot spot analysis

Day 3 (Tuesday 05/03) (15:30 - 17:00 CET, 1:30 hrs):

- **Q&A session**

Day 4 (Thursday 06/03) (15:30 - 17:00 CET, 1:30 hrs):

1. **Spatial Data Alignment**

    - **Data:**
        - Visium Cytassist (Breast Cancer)
        - Xenium In Situ Replicate 1 (Breast Cancer)
    - **Tutorial**: https://bioinformatics.mdc-berlin.de/VoltRon/registration.html

    - Introduction to image registration
    - Same section alignment (Xenium vs H&E)

2. **Spatial Data Transfer**

    - **Data:** Xenium Lung COVID19
    - **Tutorial**: https://bioinformatics.mdc-berlin.de/VoltRon/multiomic.html

    - Xenium virus data example
    - Hot spot analysis of viral molecules
    - Overlaying viral molecules and cells with H&E annotations
    - Label transfer
    - Interactive visualization
    - Interactive annotation

Day 5 (Tuesday 07/03) (15:30 - 17:00 CET, 1:30 hrs):

- **Q&A session**