

## **Microscopy and Quantitative Histology for Biomedical Research Schedule for Bonn September 2017**

The goal of this workshop is to combine formalized lectures on the principles of microscopy and quantitative histology (stereology) with practical sessions on the use of microscopes and post-acquisition analysis. Upon completing this short course, the participants should be able to efficiently operate their research instruments, obtain optimal image resolution and quality, and understand the design of a quantitative stereological study.

### **Lectures on Theoretical Principles**

Monday 25 September, 2017 DZNE, seminar room B.1.119/120

- Lecture 1 Principles of Experimental Design and Reproducibility of Data
- Introduction
  - Participants' introduction and project objectives
  - Experimental Design and Specimen Preparation
  - Rigor and Reproducibility in Science

*Lunch*

- Lecture 2 Principles of Microscopy
- Microscope optics
  - Magnification and Resolution
  - Widefield Microscopy for Biological Sciences

*Break*

- Lecture 3 Principles of Fluorescence Detection
- Fluorophores
  - Spectral separation
  - Fluorescence microscopy
  - Confocal microscopy

Tuesday 26 September, 2017 DZNE, seminar room B.1.119/120

- Lecture 4 Principles of Image Acquisition
- Digital image detection
  - Dynamic range of signal
  - Imaging standards and ethics
  - Post-acquisition image processing

*Lunch*

- Lecture 5 Introduction to Systematic Sampling and Design-Based Stereology
- Complete Enumeration and Statistical Sampling
  - Independent Random and Systematic Random Sampling (SRS)
  - Quantitative Histology (Stereology) of 2-D and 3-D Imaging

*Break*

- Lecture 6 Estimation of Cell Number, Volume and Length in Tissue
- Model-Based and Design-Based Probes
  - Development of the Optical Disector Probe
  - Probes for Volume and Length Estimation
  - Assessment of Sample Variance and Efficiency

### **Small Group “Hands-on” Tutorials on Microscopes**

Directed group tutorials at the **Nikon A1R confocal microscope**

- Orientation to equipment and light path for scanning confocal microscopy
- Principles of image acquisition
- Strategies for saving and managing images
- Collecting image stacks and determining colocalization

Directed group tutorials at the **Zeiss Apotome microscope**

- Orientation to equipment and light path for structured illumination
- Principles of image acquisition
- Strategies for saving and managing images
- Collecting image stacks and determining colocalization

Directed group tutorials at the **MBF Bioscience Stereology Workstation**

- Principles of Systematic Random Sampling (SRS) for stereology
- Overview of Design-Based sampling probes
- Practicum in the Optical Fractionator and Data Analysis

Wednesday 27 September, 2017      *DZNE, seminar room B.2.119/120*

09:00-12:30

Group A      Nikon A1R- Confocal Microscopy  
Group B      Zeiss Apotome- Structured Illumination  
Group C      MBF Bioscience- Stereology

*Lunch*

13:30-17:00

Group B      Nikon A1R- Confocal Microscopy  
Group C      Zeiss Apotome- Structured Illumination  
Group A      MBF Bioscience- Stereology

Thursday 28 September, 2017      *DZNE, seminar room B.2.119/120*

09:00-12:30

Group C      Nikon A1R- Confocal Microscopy  
Group A      Zeiss Apotome- Structured Illumination  
Group B      MBF Bioscience- Stereology

*Lunch*

13:30-17:00

All Groups      Extra time with Nikon, Zeiss, or MBF Bioscience

### **Tutorial on Post-Processing of Images for Scientific Analysis and Publication**

Friday 29 September, 2017      *Uniklinikum Nord, Bldg. 11, 1<sup>st</sup> Floor, Rm 601*

09:00-12:30

Creating Publication Images in Photoshop      Group A and Group B (half)

*Lunch*

13:30-27:00

Creating Publication Images in Photoshop      Group B (half) and Group C