1-week Introductory Course

BONN INTERNATIONAL GRADUATE SCHOOL
CLINICAL AND POPULATION SCIENCE

A Structured PhD | Interdisciplinary | International | Excellence in Research

25 – 29 September 2023

General Information

Welcome to the Introductory Course of the Bonn International Graduate School Clinical and Population Science!

This course will give you a broad overview over the different topics in the field of Clinical and Population Science as well as in depth insight into specific topics and research methods.

The course will be held in person at the **Lehrgebäude** building in the seminar rooms A010.2.07 & A010.2.08 (Building A10 on the UKB map).

Schedule:
In the course we will introduce you to 5 different areas - 1 area per day.
The days start between 8:30 and 10:30 and end between 16:00 and 16:30 (except Wednesday).

Social Evening on Wednesday:

The social event gives new PhD students the fantastic opportunity to connect with their fellow graduate students from diverse backgrounds and to get to know their peers better.

The social event starts directly after the course day on Wednesday.

25.09.2023	26.09.2023	27.09.2023	28.09.2023	29.09.2023
Clinical Studies and Translation **Starts at 10:30**	Imaging	Statistics **From 17:00 Social Evening**	Epidemiology **Starts at 9:00 Ends at 16:00**	Genetics

Attendance:
We need to document your attendance in the course, since it is a mandatory module of your curriculum. If you are not able to join the course on a specific day please inform us in advance. We will count the course as passed when you have been present 85% of the time.

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Clinical Studies and Translation – September 25, 2023

Day 1

Time	Topic	Lecturer
Lehrgebäude Seminarräume 7 & 8 (A010.2.07 und A010.2.08)		
10:30 am – 11:15 am	**Major clinical challenges in surgery**	Sven Wehner
11:15 am – 12:00 am	**Major clinical challenges in cardiology**	Sebastian Zimmer
12:00 am – 01:00 pm	**Break**	
01:00 pm – 01:45 pm	**Identification of biomarkers in oncology**	Tobias Bald
01:45 pm – 02:30 pm	**Principles of clinical trial regulation**	Martin Coenen
02:30 pm – 03:00 pm	**Break**	
BMZ 2 im Seminarraum EG (B012.EG.405)		
03:00 pm – 03:45 pm	**Clinical trials and drug development – an overview**	Martin Coenen
03:45 pm – 04:30 pm	**Translational pharmacology: pharmacogenetics for innovative treatment strategies and drug safety**	Britta Haenisch

26th of September 2023 – Day 2
BIGS Clinical and Population Science – Introductory Course: Imaging

Organized by Univ.-Prof. Henning Boecker
Department of Diagnostic and Interventional Radiology
(Director: Univ.-Prof. Ulrike Attenberger)

Lehrgebäude A10 – Seminar rooms A010.2.07 / A010.2.08

08:30 am – 09:15 am
X-Ray & CT
Daniel Kütting

09:15 am – 10:00 am
Single Photon Emission Tomography (SPECT) & Positron Emission Tomography (PET)
Henning Boecker

10:00 am – 10:30 am Break

10:30 am – 11:15 am
Magnetic Resonance Imaging (MRI) Basics
Dariusch Hadizadeh

11:15 am – 12:00 am
Functional Magnetic Resonance Imaging (fMRI)
Marcel Daamen

12:00 am – 01:00 pm Break

01:00 pm – 01:45 pm
High Field Magnetic Resonance Imaging
Sascha Brunheim

01:45 pm – 02:30 pm
Structural MRI: Brain Morphometry & Diffusion Tensor Imaging
Neeraj Upadhyay

02:30 pm – 03:00 pm Break

03:00 pm – 03:45 pm
Ultrasound
Daniel Ginzburg

03:45 pm – 04:30 pm
Deep learning in radiology
Sebastian Nowak

X-Ray & CT
Basics from electromagnetic radiation to density differences. Technical developments in CT, clinical and scientific applications.

Single Photon Emission Tomography (SPECT) & Positron Emission Tomography (PET)
Gamma radiation, Anger Camera, positron emission, cerebral glucose metabolism, FDG, cerebral perfusion, dopaminergic neurotransmission, neuro tracers, molecular imaging, analysis tools, clinical applications

Magnetic Resonance Imaging (MRI) Basics
Excitation, Resonance, Relaxation, FID, Larmor equation, T1, T2, TE, TR

Functional Magnetic Resonance Imaging (fMRI)
temporal and spatial resolution; BOLD (blood oxygen level dependent) contrast, HRF (hemodynamic response function); resting-state functional connectivity; task fMRI; experimental designs: blocked versus event-related; preprocessing; General Linear Model (GLM), statistical significance

High Field Magnetic Resonance Imaging
Potential and challenges, increased spatial, temporal, and spectral resolution; transmit field inhomogeneity; parallel transmission; phase contrast; quantitative susceptibility mapping

Structural MRI: Brain Morphometry & Diffusion Tensor Imaging
Basic introduction to structural MRI (T1, T2), voxel-based morphometry and surface based morphometry. Basics of diffusion tensor imaging (DTI, voxel-based analysis, tract based spatial statistics and tractography).

Ultrasound
Technical considerations incl. Principles, Imaging Modes, Artefacts, Applications

Deep learning in radiology
Supervised Learning Methods, Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN), Classification based on images, Semantic segmentation of structures in images, Examples from applied radiological research

Statistics – September 27, 2023

Time	Topic	Lecturer
08:30 am – 09:15 am	**Data structures and descriptive analysis**	Leonie Weinhold
09:15 am – 10:00 am	**Probability theory and statistical distributions**	Leonie Weinhold
10:00 am – 10:30 am	**Break**	
10:30 am – 11:15 am	**Confidence intervals and hypothesis tests (1)**	Michael Steffens
11:15 am – 12:00 am	**Confidence intervals and hypothesis tests (2)**	Michael Steffens
12:00 am – 01:00 pm	**Break**	
01:00 pm – 01:45 pm	**Correlation and simple linear regression**	Andreas Mayr
01:45 pm – 02:30 pm	**Multiple linear regression**	Andreas Mayr
02:30 pm – 03:00 pm	**Break**	
03:00 pm – 03:45 pm	**Diagnostic tests**	Sach Mukherjee
03:45 pm – 04:30 pm	**Time-to-event analysis**	Matthias Schmid

Epidemiology - Thursday, 28th September 2023

Day 4

TIME	TOPIC	LECTURER
09:00-9:30	Introduction to epidemiology: definition and history of epidemiology.	Ahmad Aziz
09:30-10:00	Causal inference	
10:00-10:30	Validity: accuracy, precision, bias, confounding	
10:30-10:45	BREAK	
10:45-11:30	Measures of occurrence (prevalence, incidence and risk) and measures of association (ratios and differences)	Ahmad Aziz
11:30-12:15	Quiz	
12:15-13:15	BREAK	
13:15-13:45	The Rhineland Study: Overview + Covid-19 related research	Ahmad Aziz
13:45-14:15	Rhineland Study Research Showcase 1	Lucas Secchim Ribeiro/Dan Liu
14:15-14:45	Rhineland Study Research Showcase 2	Valentina Talevi
14:45-15:15	BREAK	
15:15-15:45	Rhineland Study Research Showcase 3	Weiyi Zeng
15:45-16:00	Feedback and concluding remarks	Ahmad Aziz

Genetics – September 29, 2023

Time	Topic	Lecturer
08:30 am – 09:15 am	**Introduction into human genetics**	Elisabeth Mangold
09:15 am – 10:00 am		
10:00 am – 10:30 am	**Break**	
10:30 am – 11:15 am	**Variability of the human genome**	Maximillian Billmann
11:15 am – 12:00 am	**Screening gene function**	Maximillian Billmann
12:00 am – 01:00 pm	**Break**	
01:00 pm – 01:45 pm	**Genome Wide Association Studies**	Kerstin Ludwig
01:45 pm – 02:30 pm	**Gene identification in monogenic disorders**	Nicole Cesarato
02:30 pm – 03:00 pm	**Break**	
03:00 pm – 03:45 pm	**Next-generation sequencing**	Per Hoffmann
03:45 pm – 04:30 pm	**Genetics of colorectal cancer**	Stefan Aretz