

<u>Methodology of scientific research</u>	
Module code	<b>mlsScienceMethod-01a</b>
Abbreviated title	ScienceMethod
Module components	Lecture Medical statistic, tutorial Medical statistics, lecture Systems biology, tutorial Systems biology
When	Semester 1 (summer semester)
Module coordinator/ Organiser	IMIS, IEM
Lecturers	S. Freitag-Wolf (IMIS), C. Kaleta (IEM)
Contact hours	Lecture Med. Statistics 2 CH      Tutorial Med. Statistics 1 CH Lecture Systems biology 1 CH      Tutorial Systems biology 2 CH
Workload	<u>Lectures: 80 h</u> Attendance time 36 h, preparation 10 h, revision 34 h <u>Tutorials: 100 h</u> Attendance time 36 h, preparation 34 h, revision 30 h
Total: 180 h	
Credit points	6 (lecture Med. statistics 2 CP, tutorial Med. statistics 2 CP, lecture Systems biology 1 CP, tutorial Systems biology 1 CP)
Requirements	-
Expected outcome	<p><u>Knowledge:</u> Students</p> <ul style="list-style-type: none"> <li>- understand the theoretical and methodological foundations of evidence-based medicine</li> <li>- know the different designs of medico-scientific research approaches including their respective advantages and disadvantages</li> <li>- are familiar with common statistical methods</li> <li>- are familiar with the software R and know basic applications</li> <li>- are familiar with the ethical principles of Good Clinical Practice</li> <li>- have a thorough understanding of the concepts of systems biology</li> <li>- have a sound grasp of bioinformatical workflows used in systems biology</li> <li>- know the most important data processing techniques for interpretation of large data sets.</li> </ul> <p><u>Skills:</u> Students</p> <ul style="list-style-type: none"> <li>- can apply common statistical methods</li> <li>- can code simple commands in R and apply them for statistical analysis</li> <li>- can formulate potential hypotheses based on bioinformatical data analysis results</li> <li>- can discuss topics in systems biology adequately with informatics fellow students (terminology and argumentation in discussions subject related and relevant)</li> <li>- can use their knowledge to work with modeling approaches in future research projects.</li> </ul> <p><u>Competences:</u> Students</p> <ul style="list-style-type: none"> <li>- are able to assess the appropriateness of scientific statements and can evaluate them</li> </ul>

	<ul style="list-style-type: none"> <li>- have understood the concept of the computer language R and when and to what aim it is used</li> <li>- can select a suitable approach to execute a statistical analysis of a given data set, including the use of R.</li> </ul>
Content	<p><u>Lecture Medical statistics</u>: Basics of statistics with regard to their application in medicine: descriptive statistics, probability theory, estimation theory, epidemiology, diagnostic testing, statistical testing, regression and correlation, statistical models.</p> <p><u>Tutorial medical statistics</u>: Application and consolidation of knowledge and skills taught in the lecture via exercises using the Software R.</p> <p><u>Systems biology lecture and tutorial</u>: Basic concepts, aims and uses of modeling biological systems; modeling paradigms, modeling metabolic networks, modeling for integration and interpretation of large-scale experimental data sets.</p>
Module evaluation/ exam	<p><b>Ungraded</b></p> <p><u>Medical statistics</u>: Written exam (multiple choice)</p> <p><u>Systems biology</u>: Written assignments during semester [compound exam]</p>
Media used	Formula development in class, lecture notes
Literature	<p><b>Medical statistics</b></p> <p>Kirkwood BR, Essential Medical Statistics (Wiley-Blackwell, 2<sup>nd</sup> edition, 2003) [still valid]</p> <p>Bland M, An Introduction to Medical Statistics (OUP 4<sup>th</sup> revised edition, 2015)</p> <p>Pezzullo J, Biostatistics for Dummies (For Dummies, 2013)</p> <p><b>Systems biology</b></p> <p>Klipp E, Liebermeister W, Wierling C, Kowald A, Systems biology: A Textbook (Wiley 2<sup>nd</sup> edition, 2016)</p>