

SYSTEMS BIOLOGY BIOINFORMATICS ROSTOCK

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www.sbi.uni-rostock.de



Systems Biology & Bioinformatics **Our Departmental Goals & Teaching Philosophy**

Departmental Goals



■ Practice

- *Affection:* To appreciate the beauty and complexity of living systems, as well as the power of computational and mathematical approaches, and be able to articulate what systems and computational approaches are about, their purpose and value.
- *Inquiry:* To develop independence in your work and experience open-ended inquiry, to develop the competence and confidence to build your own knowledge and skills base.
- *Communication:* To develop effective thinking and communication skills for teaching, grant proposals, scientific publications and oral presentations.
- *Methodologies & Technologies:* To gain insights into technologies, methodologies and workflows that generate, analyse and interpret data.
- *Society:* To understand the relevance and impact of our work on society, to critically reflect, argue and discuss limitations and risks, as well as opportunities.
- *Teamwork:* To function as part of a multi/inter-disciplinary, international and multicultural team.

Departmental Goals



■ Content

- *Breath*: To be competent in a broad range of methodologies and technologies, ideas and concepts.
 - *Perspective*: To seek experience in key concepts and ideas from a variety of perspectives, including the view from other disciplines and alternative/opposing views.
 - *Administration*: To gain experience in administrative procedures, within the University, in project management and project acquisition.
 - *Science Communication*: To learn how to read, write, summarise and review scientific publications. To present this in oral and written form.
 - *Methodologies and Technologies*: To learn concepts, tools and methods from data analysis, computing and mathematical modelling. To appreciate technologies used to generate data in the life sciences.
 - *Projects*: To work independently or in small groups, in academic and industrial research projects.
 - *Careers*: To be aware of opportunities and expectations for careers in industry and academia.
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- Training PhD students: Preparing them for leadership position in industry and in leading academic institutions worldwide.
 - Training for postdocs: Preparing them for professorships and leadership positions in industry.

Teaching at the Department of Systems Biology and Bioinformatics



- Courses offered:
 - Modelling and Simulation with Application to the Life Sciences (Winter semester)
 - BioSystems Modelling and Simulation (Summer semester)
 - Both MSc courses are by now virtually identical. (We originally tried to target different audiences).

- Main Goal:
 - Providing an overview of methods, their application, challenges and opportunities
 - To the student with a background in the life sciences:
 - an appreciation for the role of mathematical modelling and computational analyses
 - To the student with a background in the physical and engineering sciences:
 - an appreciation for the complexity of living systems, and data generation

- Main Challenges:
 - Heterogeneity of the students.
 - Heterogeneity of the content.

Teaching at the Department of Systems Biology and Bioinformatics



- We are teaching at the Masters level. Where do our students go?
 - Some students will seek ‘regular’ jobs in companies.
 - Some will go into research in industry.
 - A few will continue with research in academia.
- Our teaching is geared towards a career in research & development (industry or academia)
 - This has consequences on content and expectations
- Due to the length of the course,
 - we can only survey methods and tools
 - we cannot provide in-depth skills to develop mathematical and computational solutions.
- Our course is not the core of a masters programme but an element of several masters programmes
 - Our focus is not on examining the students for their qualification in their master programmes; if we could, we would not have an exam.
 - Our focus is getting them interested in (interdisciplinary) systems biology and bioinformatics approaches.

Academic Learning



- Learning
 - In school you are told what to learn, and how.
 - At University you are told what to learn but not how.
 - In research you decide what to learn/research and you need to know how.

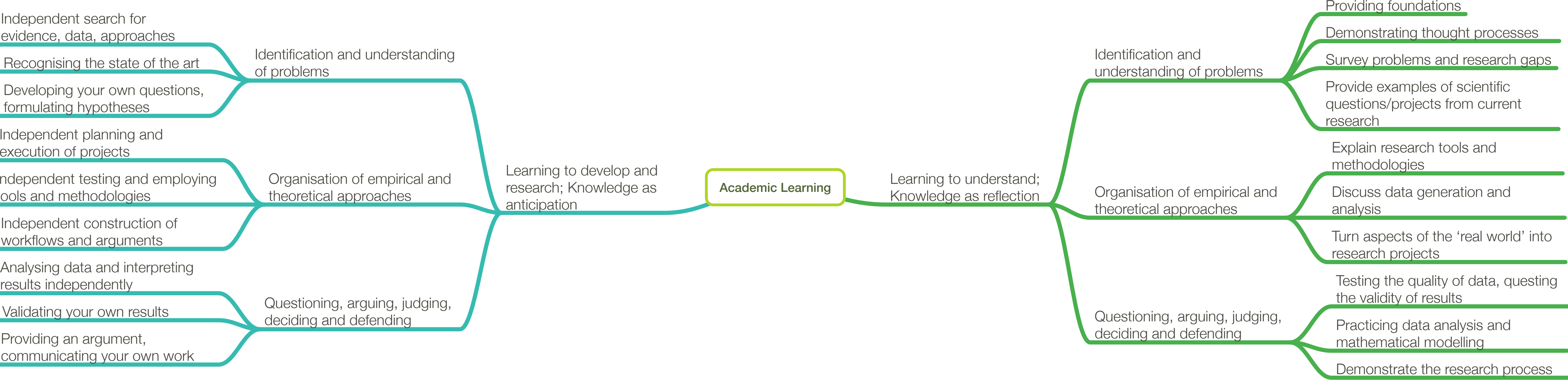
- At the masters level we are thus transitioning towards ‘academic learning’.

- Academic learning prepares for a position in research and development.

- Academic learning is a process that should put the learner in a position
 - to question the state-of-the-art,
 - to challenge established paradigms,
 - to go beyond the currently possible.

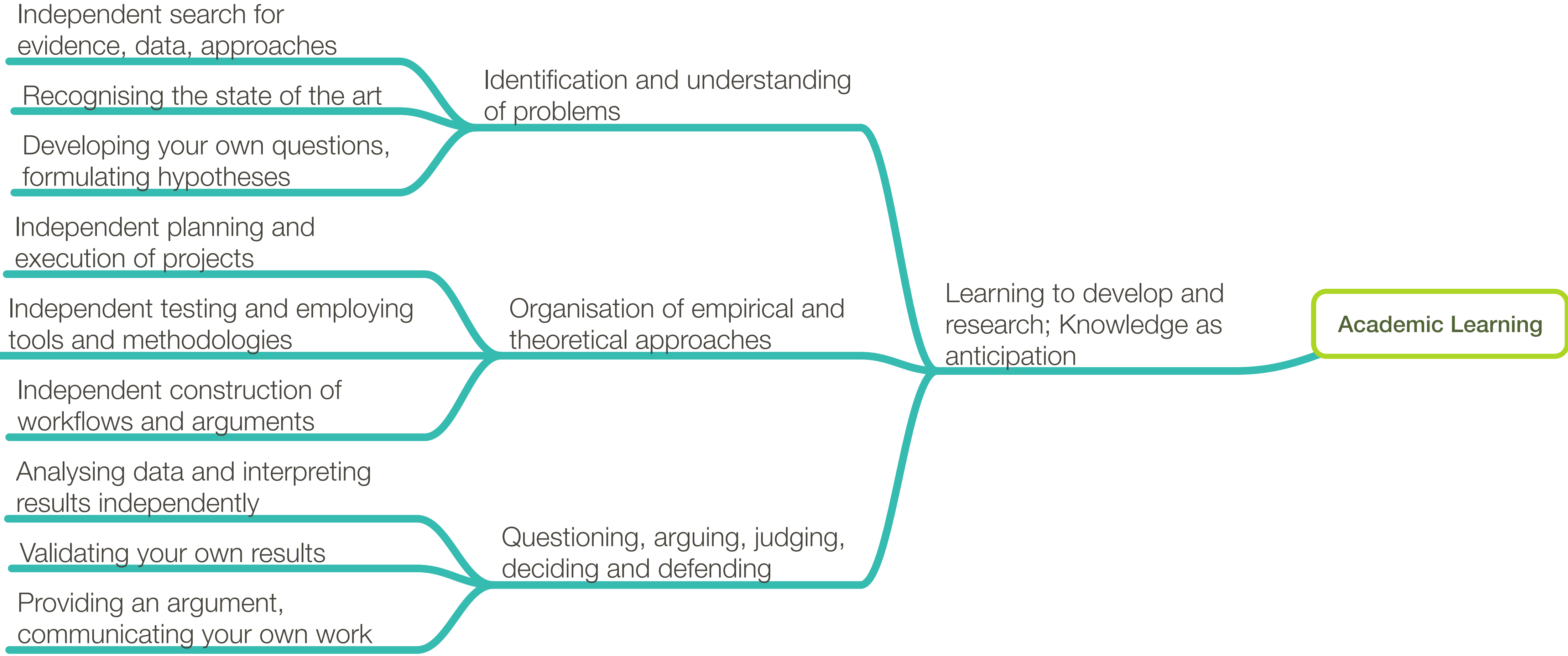
- You become a member of a tribe that establishes what is the case, true and valid (or not).

Academic Learning



**We cannot cover all of those aspects, not properly
but we should try to keep those elements here in mind as our teaching philosophy and the goal we have with our classes.**

Academic Learning



Academic Learning



Academic Learning

Learning to understand;
Knowledge as reflection

Identification and understanding of problems

Providing foundations

Demonstrating thought processes

Survey problems and research gaps

Provide examples of scientific questions/projects from current research

Organisation of empirical and theoretical approaches

Explain research tools and methodologies

Discuss data generation and analysis

Turn aspects of the 'real world' into research projects

Questioning, arguing, judging, deciding and defending

Testing the quality of data, questioning the validity of results

Practicing data analysis and mathematical modelling

Demonstrate the research process

Academic learning and training



- We are a research-driven group. This influences the learning and teaching.
- Our teaching is aligned with research processes
 - Complex systems > Uncertainty > Abstraction > Mathematical modelling
- This implies that our teaching is touching the unknown, unexpected, controversial, uncertain.
- The learning of the individual must then be related to what the collective (society, science, politics ...) accepts, considers relevant/true etc.
 - There is a social and philosophical dimension / responsibility
- Training PhD students: Preparing them for leadership position in industry and in leading academic institutions worldwide.
- Training for postdocs: Preparing them for professorships.

Teaching objectives



- Motivating students, raising their interest in systems biology and bioinformatics approaches
- Developing their skills to understand ... problems and their solutions (knowledge as reflection)
- Developing their skills to develop and research ... beyond the state-of-the-art (knowledge as anticipation)
- Supporting the development of their personality and independence
- Train them to appreciate the complexity of living systems; to appreciate the necessity of multidisciplinary approaches
- Demonstrating the challenges and opportunities in inter/multidisciplinary research
- Demonstrating the communication skills required in (interdisciplinary) research