ETH zürich

Refresh Teaching

Learning “en bloc” - designing block courses and other block training opportunities“

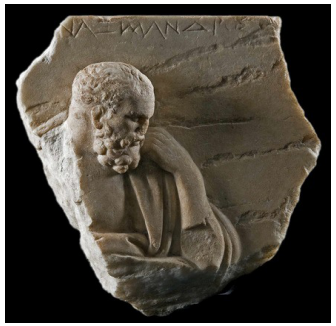
Scientific Concepts and Methods

(Master of Pharmaceutical Sciences)

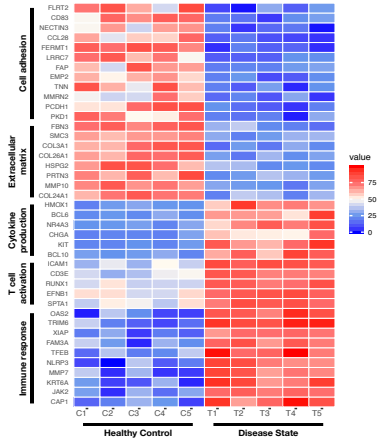
Elvan Kut and Vivianne Otto, IPW
Norman Sieroka, Philosophy, University of Bremen, Germany
Victor Collado Diaz, IPW

Aims of the course

Basic concepts of
philosophy of science



Advanced
scientific methods



Critical thinking

Interdisciplinary
discussions

Reflection on student's
own scientific project work

Foster critical thinking about scientific concepts and methods in the natural sciences with a particular focus on pharmaceutical and biomedical research

"Critical Thinking in Education and Research-Why and How?" Angewandte Chemie, 2018
"Teaching Students to Reflect Critically on Their Own Research in the Pharmaceutical Sciences" ChemMedChem, 2018

	Monday 28.2.2022	Tuesday 1.3.2022	Wednesday 2.3.2022	Thursday 3.3.2022	Friday 4.3.2022
08.30h – 09.45h **Input Philosophy of Science**	**Elvan Kut, Vivianne Otto** INTRODUCTION **Norman Sieroka** WHAT IS SCIENCE?	**Vivianne Otto (ETH)** ANIMAL MODELS IN PRECLINICAL DRUG DEVELOPMENT AND THE PURSUIT OF REPRODUCIBILITY **Sieroka** EXPERIMENTS	**Sieroka, Kut** MATHEMATISATION OF SCIENCE QUANTIFYING LIFE	**Sieroka, Kut, Otto** PARADIGM CHANGES	08.30 – 09.30h **Gerd Folkers (SSC)** DRIVERS FOR ACADEMIC RESEARCH
10.00h – 11.00h **Input Science**	BASIC VS. APPLIED RESEARCH	**Sieroka** USE OF IMAGES **Vivianne Otto (ETH)** IMMUNOHISTOCHEMISTRY – REPRESENTATIONS OF WHAT EXACTLY?	**Gunnar Rätsch (ETH)** PRECISION MEDICINE & BIG DATA	**Michael Scharl (USZ)** THE CONCEPTS OF IBD ARE SHAPED BY LAB METHODS AND SUCCESSFUL THERAPIES	09.45 – 10.45h **Mattias Ivarsson (Inositec)** FOUNDING A BIOTECH COMPANY
11.15h – 12.15h (20 + 40min)	SCIENTIFIC REASONING	Breakout Groups Discussion with philosophy speaker 1 & 2	Breakout Groups Discussion with philosophy speaker 1 & 2	Breakout Groups Discussion with philosophy speaker 1 & 2	11.00 – 12:00 Breakout Groups Two discussion rounds with speaker 1 & 2
Lunch					
13.15h – 14.15h (15 + 45min)	**Victor Collado Diaz, Otto, Sieroka** Discussions on Project work (reflecting and responding) *Reflection on project work*	*Reflection on project work*	*Reflection on project work*	*Reflection on project work*	13.00 – 15.00h **Collado Diaz, Kut, Otto, Sieroka** Presentations, discussions of the critical analyses
14.30h – 16.15h (2x45min)		**Collado Diaz, Sieroka** Workshop Close Reading Working groups (Paperanalysis)	Working groups (Paperanalysis)	Working groups (Paperanalysis)	15.15 – 16.30h Synopsis/ Reflections conclusions of the week

Central concepts

Advanced methods

Linking concepts & methods

Reflect your own research

Scientific paper analysis

Daily structure

Central concepts	08:30-09:45h Input «Philosophy of Science»: e.g. on scientific reasoning
Advanced methods	10:00-11:00h Input «Science»: e.g. on explanatory power of preclinical studies in mice
Linking concepts & methods	11:15-12:15h Linking of both inputs and discussion between students and speakers (breakout groups)
Reflect your own research	13:15-14:15h Reflections on your own project work (online whiteboard KNOW)
Scientific paper analysis	14:30-16:15h Working groups: Close reading and analysis of a scientific article (Monday: discussions on project work (reflecting & responding))

Daily structure

Central concepts	08:30-09:45h Input «Philosophy of Science»: e.g. on scientific reasoning
Advanced methods	10:00-11:00h Input «Science»: e.g. on explanatory power of preclinical studies in mice
Linking concepts & methods	11:15-12:15h Linking of both inputs and discussion between students and speakers (breakout groups)

- **Lecturers from different disciplines**
- **Philosophy of science → new**
  → With a pharmaceutical approach
- **Interacting sequences → discussions**
  "Applied *versus* basic?"

Topics of the week

Questions to reflect on Science:

MONDAY

SCIENTIFIC REASONING & EXPERIMENTS

Ways of scientific reasoning: How (not) to reason in scence?

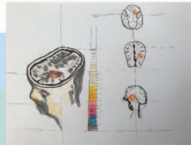
Which experimental model should I use to predict clinical efficacy of a new cancer drug?

TUESDAY

IMAGES

Are images representations of how things really are?

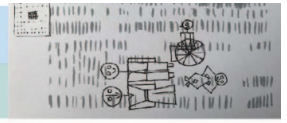
What does an fMRI image of a human brain represent?



WEDNESDAY

Will physicians be replaced by smart phone apps?

How can a patient be represented computationally?

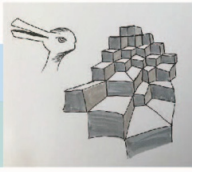


THURSDAY

PARADIGMS

How do models and concepts develop: continuously or in jumps?

Does the analytical method I use influence my paradigm of a particular disease (e.g. IBD)?

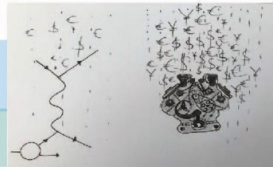


FRIDAY

RESEARCH AND INNOVATION

To be "innovative", do we need more applied and less basic research?

Must insight precede application?



Daily structure

Reflect your own research	13:15-14:15h Reflections on your own project work (online whiteboard KNOW)

Learning goals: **You**

- are able to critically evaluate and discuss the basic scientific assumptions, concepts and approaches underlying your own Project Work

Challenge

Performance assessment:

- ✓ Homework: in preparation for the course, **write a short summary of your Project Work**
- ✓ "Reflections on Project Work": every day, you will critically think about questions that reflect the main topics of the day with respect to your Project Work.
- ✓ Please upload your written reflections to the webpage **KNOW** (https://know.ethz.ch/)

Daily structure

Scientific paper analysis	14:30-16:15h Working groups: Close reading and analysis of a scientific article (Monday: discussions on project work (reflecting & responding))

Learning goals: **You**

- are able to "closely read" a scientific paper
- have the ability to analyse a scientific paper using a given set of aspects (e.g. scientific reasoning, methods of analysis)
- are able to present your paper analysis to an audience that is not expert in the research field

Performance (assessment):

- ✓ "Quickly read" three scientific articles and choose one for close reading and analysis.
- ✓ Actively participate in the group work aimed at closely analyzing the chosen paper in the course of the week

ETH zürich

2018

	Monday 19.2.18	Tuesday 20.2.18	Wednesday 21.2.18	Thursday 22.2.18	Friday 23.2.18
		08:00h – 09:30h **Sieroka** Concepts II - The roles and types of experiments - The role of images in science *Reflections on Project Work*			
8.45h – 10.30h (2x45min) **Input Philosophy of Science**	**Elvan Kut** Introduction **Norman Sieroka** Concepts I - What is science? - Scientific reasoning *Reflections on Project Work*		**Kut & Sieroka** Concepts III -The role of geometry and arithmetics in natural sciences - Quantising the human body *Reflections on Project Work*	**Sieroka** Concepts IV - Shifts, changes, crises in science - The values of basic vs. applied research *Reflections on Project Work*	08:45h – 10:00h **Gerd Folkers (ETH)** Concepts V - Shifting concepts and methods in pharmaceutical sciences - Economization of Science
		09:45h – 11.15h **Markus Rudin (ETH-UZH)** Methods II - How is a fMRI image produced? - How do I interpret an image? - Examples from research and clinic			10:15-11:30h **Mattias Ivarsson (Inositec)** Methods V - Bringing academic insights to market (Virtual biotech company)
10.45h – 12.30h (2x45min) **Input Science**	**Michael Detmar (ETH)** Methods I - Chances and limitations of animal studies in drug development - Reproducibility and explanatory power of preclinical studies in mice	11:30h – 12.15h Buzz Groups Discussion with philosophy Speaker 1 & 2	**Gunnar Rätsch (ETH)** Methods III - Explorative, hypothesis-driven and predictive approaches in medical genomics - Machine Learning	**Gerhard Rogler (USZ)** Methods IV - How do novel methods change concepts of diseases? - The role of microbiota in health and novel approaches in gastroenterology	11:45h – 12:30h Breakout Groups Discussion with philosophy Speaker 1 & 2
Lunch					
13.45h – 14.30h (45min)	Buzz Groups Discussion with philosophy Speaker 1 & 2	Working groups (Paperanalysis)	Buzz Groups Discussion with philosophy Speaker 1 & 2	Buzz Groups Discussion with philosophy Speaker 1 & 2	13.45h – 14:45h Working groups (Paperanalysis)
14.45h – 16.30h (2x45min)	**Otto, Sieroka** Workshop Close reading		Working groups (Paperanalysis)	Working groups (Paperanalysis)	15:00h – 17:00h **Kut, Otto, Sieroka** Presentations, ideas from the working groups, conclusions of the week

2022

	Monday 28.2.2022	Tuesday 1.3.2022	Wednesday 2.3.2022	Thursday 3.3.2022	Friday 4.3.2022
08.30h – 09.45h **Input Philosophy of Science**	**Elvan Kut, Vivianne Otto** INTRODUCTION **Norman Sieroka** WHAT IS SCIENCE?	**Vivianne Otto (ETH)** ANIMAL MODELS IN PRECLINICAL DRUG DEVELOPMENT AND THE PURSUIT OF REPRODUCIBILITY **Sieroka** EXPERIMENTS	**Sieroka, Kut** MATHEMATISATION OF SCIENCE QUANTIFYING LIFE	**Sieroka, Kut, Otto** PARADIGM CHANGES	08.30 – 09.30h **Gerd Folkers (SSC)** DRIVERS FOR ACADEMIC RESEARCH
10.00h – 11.00h **Input Science**	BASIC VS. APPLIED RESEARCH	**Sieroka** USE OF IMAGES **Vivianne Otto (ETH)** IMMUNOHISTOCHEMISTRY – REPRESENTATIONS OF WHAT EXACTLY?	**Gunnar Rätsch (ETH)** PRECISION MEDICINE & BIG DATA	**Michael Scharl (USZ)** THE CONCEPTS OF IBD ARE SHAPED BY LAB METHODS AND SUCCESSFUL THERAPIES	09.45 – 10.45h **Mattias Ivarsson (Inositec)** FOUNDING A BIOTECH COMPANY
11.15h – 12.15h (20 + 40min)	SCIENTIFIC REASONING	Breakout Groups Discussion with philosophy speaker 1 & 2	Breakout Groups Discussion with philosophy speaker 1 & 2	Breakout Groups Discussion with philosophy speaker 1 & 2	11.00 – 12:00 Breakout Groups Two discussion rounds with speaker 1 & 2
Lunch					
13.15h – 14.15h (15 + 45min)	**Victor Collado Diaz, Otto, Sieroka** Discussions on Project work (reflecting and responding) *Reflection on project work*	*Reflection on project work*	*Reflection on project work*	*Reflection on project work*	13.00 – 15.00h **Collado Diaz, Kut, Otto, Sieroka** Presentations, discussions of the critical analyses
14.30h – 16.15h (2x45min)		**Collado Diaz, Sieroka** Workshop Close Reading Working groups (Paperanalysis)	Working groups (Paperanalysis)	Working groups (Paperanalysis)	15.15 – 16.30h Synopsis/ Reflections conclusions of the week