

## FRIAS Lunch Lecture series

Summer term 2016

(schedule below)

*Every other Thursday between 12:15 and 1 p.m. FRIAS Fellows offer 25-30 minute lectures on a specific topic for students and the university public, followed by 10-15 minutes of discussion. The lecture takes place during the lunch hour in the university's centre in the middle of town. This academic year's topic of the lecture is "Paradigm Shifts in Science". From June on these lectures will be intermingled with lectures focussing on "Challenges of Ageing Societies".*

When: every other Thursday 12:15 to 1 p.m., beginning on 28 April

Where: Kollegiengebäude I (KG I – opposite the new university library),  
ground floor, lecture hall 1015 (HS 1015)

### ***Paradigm Shifts in Science***

Summer term 2016

A paradigm, according to the historian of science Thomas Kuhn, is a set of practices that defines a scientific discipline at any particular period of time. For him, a paradigm is not constituted primarily by theory, but defined by "universally recognized scientific achievements that, for a time, provide model problems and solutions for a community of practitioners" (*The Structure of Scientific Revolutions* 1962). This involves such key issues of scientific research as defining the object or problem of investigation, the questions to be asked, predictions to be tested, methods to be used, results to be interpreted, etc. Furthermore, according to Kuhn, all sciences have been, and continue to be, subject to fundamental changes and re-evaluations, resulting in paradigm shifts which may ultimately trigger scientific revolutions.

In the upcoming Lunch Lecture series, FRIAS Fellows from the humanities, the social sciences, and the natural and life sciences will address questions including the following: Which paradigm shift(s) has the relevant discipline experienced in the course of past 50 years? What was their nature, which basic assumptions did/do they challenge, which effects did/do they have? To what extent has technological progress, notably the digital revolution, contributed to that? Are paradigm shifts in the humanities and social sciences of a different nature than in the natural and life sciences? Can paradigm shifts involve scientific progress? To what extent can new paradigms incorporate elements of old paradigms? These and other questions will be addressed in 25-30 minute lectures followed by, on average, 10-15 minute discussions. Since the focus of the Paradigm Shifts lectures in the winter term was on the humanities and social sciences, the focus in the summer term 2016 will be on the natural and life sciences. Students from all disciplines and the general public are highly welcome.

## ***Challenges of Ageing Societies***

Due to better living conditions and health care systems in western countries we observe increased life expectancies of respective populations. With age, disease incidents also increase and individual fitness decreases, generating higher costs and bearing high socio-economic risks for western societies. Whereas, historically, aging has been regarded as a personal matter, ageing societies are nowadays regarded as a threat for our way of living. Thus, ageing societies and their implications are discussed in virtually all disciplines, ranging from medicine and natural sciences to economy, philosophy and ethics studies. Within the FRIAS Lunch Lecture Series an interdisciplinary approach will be taken bringing together experts from all of the above mentioned fields. The goal is to give a comprehensive overview of the Challenges of Ageing Societies.

In the upcoming Lunch Lecture series, FRIAS invites renowned scholars and scientists who will address questions including the following:

Which are the clinical challenges of an ageing society? What will our society look like in the year 2100? How is ageing discussed and regarded in different societies and eras? Which challenges may arise in communicating with old people? Is our health care system close to collapse due to increased health care costs of the ageing society? Which implications does the recruitment of nursing staff from our eastern European neighbors has on our relationship to these countries?

These and other questions will be addressed in 25-30 minute lectures followed by, on average, 10-15 minute discussions. Students from all disciplines are highly welcome.

All lectures in the Lunch Lecture series can be downloaded from the FRIAS media portal:  
<https://www.frias.uni-freiburg.de/de/mediathek/podcasts/lunch-lectures>

Thursdays

28 April	Ad Aertsen	<i>Paradigm Shifts in the Neurosciences?</i>
12 May	Iliia Polian (U Passau)	<i>Paradigm Shifts in Electronics</i>
2 June	Henriette Herwig (U Düsseldorf)	<i>Repräsentationen von Alter und Demenz in der Literatur der Gegenwart</i>
9 June	Stefan Kebekus (U Freiburg)	<i>Paradigm Shifts in Mathematics</i>
16 June	Melanie Börries (DKFZ Heidelberg)	<i>System-Medizin des Alterns</i>
23 June	Robert Murphy (Carnegie Mellon)	<i>Paradigm Shifts in Biology: From description to automation</i>
30 June	Pierre-Louis Tharaux (FRIAS & Paris Cardio-vascular Research Center, Inserm)	<i>Internal Defense Strategies against Age</i>
7 July	Stefan Schiller (U Freiburg)	<i>Paradigm Shifts in Molecular Sciences: “Molecular Philosophy” across the disciplines and beyond</i>
14 July	Klaus Aktories (U Freiburg)	<i>Arzneitherapie im Alter</i>
Tuesday 19 July	All Fellows (FRIAS Seminar room)	<i>Paradigm Shifts and lessons learned</i>
21 July	Veronika Lipphardt (U Freiburg)	<i>Paradigm Shifts: The View from Science Studies</i>

Additional information (including abstracts and podcasts of the first series of “Paradigm Shifts” lectures between October 2015 and February 2016) you can find on: <https://www.frias.uni-freiburg.de/de/veranstaltungen/lunch-lectures>

## **Abstracts**

28 April

### *Paradigm Shifts in the Neurosciences?*

**Ad Aertsen**

The occurrence of a paradigm shift in a scientific area, in the Kuhnian sense, presupposes the existence of a paradigm and an associated “normal science” program. In the neurosciences, neither of these is anywhere in sight. Hence, serious paradigm shifts in the neurosciences are not to be expected anytime soon.

Having said that, it may be nevertheless worthwhile to inspect some examples of shifts of emphasis in neuroscience research in recent decades. For instance, to look at the role of new experimental methodologies in such shifts, to study the effect of researchers with a different scientific background entering the field, or to see the impact of funding-driven shifts of emphasis towards translational research. In my presentation, I will present and discuss examples of each of these.

#### **Acknowledgements**

This presentation includes results and insights from collaborations within and beyond the Bernstein Center Freiburg, mostly from discussions with my colleagues Arvind Kumar, Stefan Rotter, Ulrich Egert, Carsten Mehring and my friends from abroad. Work supported by the German Federal Ministry of Education and Research (BMBF Grants 01GQ0420 to BCCN and 01GQ0830 to BFNT Freiburg-Tübingen). Further information and publications at [www.bcf.uni-freiburg.de](http://www.bcf.uni-freiburg.de)

12 May

### *Paradigm Shifts in Electronics*

**Ilia Polian**

The word “Electronics” refers to both: a scientific discipline between Physics, Engineering and Computer Science, and its products, ranging from tiny silicon chips able to perform unbelievably complex calculations to huge power stations and energy-distribution networks. This presentation will focus on micro and nanoelectronics, a field where scientific progress is pushed forward not only by research labs but also by the semiconductor industry with a global turnover of \$377 billion in 2015 and with the highest share of research and development expenditures among all sectors. This implies that scientific curiosity must coexist with both short-term and long-term market success, and competition must coexist with cooperation. We will review paradigm shifts that happened in the past both in microelectronics technology and in circuit design and identify technological, economic and societal driving forces behind them. Finally, we will attempt to make – necessarily speculative – predictions about the further development of this discipline in the world where, on the one hand, any modern society totally relies on microelectronics-based devices and, on the other hand, market forces are increasingly dominated by strategic thinking and political raison.

2 June

*Repräsentationen von Alter und Demenz in der Literatur der Gegenwart*

**Henriette Herwig**

Das Alter ist zum Thema der Literatur geworden, auch das hohe Alter, und mit ihm die Endlichkeit des menschlichen Lebens. Nicht nur Liebe, Krankheit, Sterben und Tod, auch Fragen der Menschenwürde, der Erinnerung, der Lebensbilanz, des Perspektiv- und Beziehungsverlusts, der Verarmung im Alter, Sinnkrisen und Glaubensfragen sowie der Wunsch nach einem selbstbestimmten Tod prägen den literarischen Altersdiskurs der Gegenwart. Das zeigt beispielsweise die neue Gattung „Pfleheimroman“. Eine besondere Herausforderung geht dabei von der Alzheimer-Krankheit und allen Formen demenzieller Erkrankung aus, denn sie stellen das cartesianische Menschenbild in Frage und fordern von Angehörigen und Pflegenden ein Höchstmaß an Empathie, Phantasie und Geduld. Anhand exemplarischer (Auto-)Biographien, Romane, Erzählungen und Essays und ihrer Darstellungsweisen des Alters zeigt der Vortrag die Leistung der Literatur auf, für Probleme der Hochalterungsphase zu sensibilisieren und Generationenverhältnisse zu entwerfen, die es erlauben, in Würde zu altern und zu sterben.

9 June

*Paradigm Shifts in Mathematics*

**Stefan Kebekus**

Mathematics is the art of proof. Proof that you can measure the height of a pyramid without leaving the ground (Thales), proof that you can know the earth is a sphere rather than a donut by measuring its curvature (Gauss-Bonnet), or proof that you can colour any map using only four colours (Appel-Haken).

Despite its central place in the subject, the concept of “mathematical proof” has seen dramatic evolution in time, and is subject to some national traditions even today. The lecture aims to highlight some of these developments: the “Hilbert program”, a proposed research program from the 1920s aiming to clarify the foundations of mathematics, completely revolutionized the meaning of “proof”. Starting from the 1990s, input from theoretical physics has turned some areas of mathematics upside down. In long term, the increasing computational power of machines may again change the ways that working mathematicians think about proofs and handle them in practise.

23 June

*Paradigm Shifts in Biology: From description to automation*

**Robert Murphy**

The origins of biology were in ancient studies that provided descriptions of plants and animals accompanied by theories based in religion and essentialism. The rise of empiricism in the 17<sup>th</sup> century led to the widespread acceptance of the scientific method, and by the early 20<sup>th</sup> century description (especially at the organism or population level) gave way to mechanistic explanation, exemplified by genetics and the discovery of DNA replication and the genetic code. A shift to reductionist analysis at the molecular level led to dramatic progress in identifying roles of specific molecules in biological processes, and was associated with the rise of model organism studies and targeted drug development. But this also gradually led to the demise of generalizable theories, as more and more

exceptions to these theories were found. The development of systems biology therefore emphasized automated, high throughput data collection and the creation of predictive computational models. In the process, the role of the scientific method has become unclear.

7 July

*Paradigms in molecular sciences: "molecular philosophy" across the disciplines & beyond*

**Stefan M. Schiller**

Thinking of matter and molecules is thinking about the world. As such it is influenced by our environment, language, and the philosophical models/ideas of our time. In the context of our experience with the perception of the molecular world, classical molecular models/paradigms involving linear cause-and-effect correlations, especially in complex molecular system descriptions such as complex chemical reaction networks and cellular systems, scratch just the surface, offering a quasi-stationary mirror image of a highly non-linear world. From what we know about molecular systems now, linearity can simply be regarded as a mental trick of our brain to deal with our anticipation of (dynamic) developmental processes.

Talking about dynamic, non-linear complexity directly raises the question how we are able think along these lines. I will thus present some findings illuminated by Dietrich Dörner in his book *The Logic of Failure* (1989/1996), which addresses common mistakes in our thinking when we deal with complex dynamic systems including non-linear behavior. Hence, in this lecture I do not want to follow a historical trace of models and paradigms leading and influencing our view and understanding of molecules, but rather want to connect models and their respective contexts (including, for example, Aristotle's idea of analysis, Heidegger's *Being and Time*, and Poincaré's discovery of "strange" non-linear effects in "three body systems").

21 July

*Paradigm Shifts: The View from Science Studies*

**Veronika Lipphardt**

Is the concept of paradigm shifts a useful tool for understanding historical changes in various disciplines? In this concluding lecture, we will look at the outcome of the series through the lens of History of Science and Science Studies. After briefly discussing Kuhn's concept, how it has been taken up in these two fields, and how Kuhn responded, we will examine various other theoretical approaches for conceiving changes in the sciences and humanities. I assume that in most of the lectures of this series, speakers will find the recent history and the current situation of their discipline too complex for being able to state a clear-cut paradigm shift. If this is the case, we can discuss whether that's the case because one needs to have a larger temporal distance to diagnose a paradigm shift, or whether the condition of science/"Wissenschaft" has changed so dramatically that paradigm shifts do not occur (in the way Kuhn has proposed).