



Human Brain Project  
Education Programme

# HBP CURRICULUM INTERDISCIPLINARY BRAIN SCIENCE

INFORMATION BOOKLET

VALID FROM 1 APRIL 2018



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HBP Education



HBP Education Programme



<https://education.humanbrainproject.eu/>

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## LEGAL NOTICE

Media owner: HBP Education Programme Office at Medical University Innsbruck, Müllerstraße 59, 6020 Innsbruck, Austria

## ORGANISING INSTITUTIONS:



Human Brain Project

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# I. THE HBP EDUCATION PROGRAMME

The HBP Education Programme offers innovative learning packages for early career researchers working in and across the fields of neuroscience, information and communications technology (ICT) and medicine. The programme especially targets advanced master's-level and PhD students, as well as early post-doctoral researchers, from within and outside the HBP.

The **HBP Curriculum on Interdisciplinary Brain Science** combines web-based distance learning courses and complementary face-to-face workshops. It provides basic lessons in the HBP core fields neuroscience, medicine and ICT for early career researchers outside their area of specialisation, as well as courses on the subjects of ethics and intellectual property rights, translation and exploitation of research.

**HBP Schools** are five-day courses that provide more advanced lectures and tutorials. This format focuses on specific questions and challenges from a transdisciplinary point of view, to help break down barriers between different disciplines.

An annual **HBP Student Conference**, organised by early career researchers for early career researchers, aims to encourage collaboration and scientific exchange across the fields of neuroscience, brain medicine and computer science. At the conference, early career researchers get the chance to present their own research and engage in extensive discussions with peers and principle investigators from within and outside the HBP.

To offer training in the use of the various Platforms that make up the HBP Scientific Research Infrastructure and encourage user engagement, **Young Researchers Events** are organised to provide a setting in which the HBP Platform Subprojects can present their tools and results to early career scientists and future users.

Video material from all HBP Education Programme activities is collected and made available to the public via the HBP Education Programme **E-library**.

## II. HUMAN BRAIN PROJECT CURRICULUM: INTERDISCIPLINARY BRAIN SCIENCE

### ONLINE COURSES & COMPLETING WORKSHOPS

The HBP Course on Interdisciplinary Brain Science combines web-based distance learning courses and face-to-face workshops that provide basic lessons in the HBP core fields neuroscience, medicine and ICT as well as the complementary subjects of ethics and intellectual property rights.

Five courses are currently available online:

#### Specialist courses for non-experts:

- Brain medicine for non-specialists
- ICT for non-specialists
- Neurobiology for non-specialists

#### Complementary courses:

- Research, ethics and societal impact
- Intellectual property rights, translation and exploitation of research

Each online course is completed by an annual face-to-face workshop. The workshop programmes are based on the respective online lectures and provide deeper insights as well as practical exercises.

### PARTICIPATION & ACCREDITATION

The courses are open to the whole scientific community, regardless of affiliation with the HBP or not, but especially target the following groups:

- Master's students already carrying out research
- PhD students
- Researchers who have received their doctoral degree within the past three years at the time of their application for training

**Online lectures** are publicly available throughout the year. Each online lecture will be supplemented by a discussion forum and additional learning material.

<http://bit.ly/HBPOnlineCourses>

**Workshops** take place annually. Application is required.

Upcoming dates: <http://bit.ly/HBPEDuEvents>

Participants have the possibility of taking an exam related to the online content of the courses. Upon successful completion, **ECTS credits** can be awarded. The credits are awarded by the Medical University of Innsbruck / Austria (MUI) if the following conditions are fulfilled:

- Registration for HBP Online Course on Interdisciplinary Brain Science via e-mail to [curriculum.edu@humanbrainproject.eu](mailto:curriculum.edu@humanbrainproject.eu)
- Attendance of the online course(s)
- Full attendance of one workshop
- Successful completion of exam(s)

**For upcoming dates and deadlines please check our website.**

The credits for the 5 courses are distributed as follows:

- Brain medicine for non-specialists: **2,5 ECTS**
- Neurobiology for non-specialists - Basic: 1 ECTS; Advanced: 1 ECTS -> total: **2 ECTS\***
- ICT for non-specialists: **1,5 ECTS**
- Research, ethics and societal impact: **1,5 ECTS**
- Intellectual property rights, translation and exploitation of research: **2,5 ECTS**

In total, it is possible to achieve a maximum of **10 ECTS credits** for all 5 courses.

**Examination fee: 30€ (per exam).**

Further information on the online courses and the workshops can be found on the HBP Education Programme website and social media channels.

For questions and enquiries:

[curriculum.edu@humanbrainproject.eu](mailto:curriculum.edu@humanbrainproject.eu)

\* It is possible to only take the Basic exam, or both Basics and Advanced, but not only the Advanced exam.

<https://education.humanbrainproject.eu/>



### III. OVERVIEW OF ONLINE COURSES

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## IIIa) BRAIN MEDICINE FOR NON-SPECIALISTS

The human mind is a complex system that produces, processes and transmits information in an incomparable manner. Human thoughts and actions depend profoundly on the proper function of neurons. If this function is disrupted, degeneration and disease can be the consequence. This course provides insights into state-of-the-art views on neurodegenerative, neuropsychiatric and neuroimmunological disorders as well as clinical neuroanatomy and clinical aspects of brain imaging. Apart from the scientific understanding of specific disorders and their treatment, it also discusses the latest findings in research and therapeutics. The Medical Informatics Platform developed in the European Human Brain Project is introduced with an example of how a big data approach may have the potential to improve diagnosis and therapeutic concepts of neurological diseases. Contributions for this course come from renowned researchers and clinicians from Israel, Austria and Switzerland.

**ECTS credits: 2,5 ECTS** (after attendance of the online course, one full workshop and successfully passing the exam)

**Course Director:**

Uri Ashery (Tel Aviv University)

<https://education.humanbrainproject.eu/web/brain-medicine-for-non-specialists>

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## LECTURES

Lecture 1, part 1: The natural history of neurodegenerative diseases: Can we modify it?  
Nir Giladi (Tel Aviv University)

Lecture 1, part 2: The natural history of neurodegenerative diseases: Can we modify it?  
Nir Giladi (Tel Aviv University)

Lecture 2, part 1: Clinical neuroanatomy: From a lesion to a symptom  
Eitan Auriel (Tel Aviv Medical Center)

Lecture 2, part 2: Clinical neuroanatomy: From a lesion to a symptom  
Eitan Auriel (Tel Aviv Medical Center)



Lecture 3: Neuroimmunology: The brain as a cognitive antigen  
Anat Achiron (Tel Aviv University)

Lecture 4: Motivation and addiction: Neuronetworks and treatment targets  
Gerald Zernig (Medical University Innsbruck)

Lecture 5, part 1: Clinical aspects of brain imaging  
Dafna Ben Bashat (Tel Aviv University)

Lecture 5, part 2: Clinical aspects of brain imaging  
Dafna Ben Bashat (Tel Aviv University)

Lecture 6: Neurodegenerative diseases – En route to early detection and prevention  
Nir Giladi (Tel Aviv University)

Lecture 7: Introduction to schizophrenia  
W. Wolfgang Fleischhacker (Medical University Innsbruck)

Lecture 8: Affective disorders: Depression and somatic co-morbidity  
Barbara Sperner-Unterweger (Medical University Innsbruck)

Lecture 9: A manic depressive history: The genetic dissection of complex neuropsychiatric disorders  
Sven Cichon (University of Basel)

Lecture 10: HBP Medical Informatics Platform: Parkinson's disease & more...  
Bogdan Draganski (Centre hospitalier universitaire vaudois)

Lecture 11: Principles of neuropharmacology  
Sandra Santos-Sierra (Medical University Innsbruck)

## IIIb) ICT FOR NON-SPECIALISTS

“Computational Thinking” refers to a mindset or set of tools used by computational or ICT specialists to describe their work. This course is intended for people outside of the ICT field to allow students to understand the way that computer specialists analyse problems and to introduce students to the basic terminology of the field.

In particular, material is provided on: Complexity measures, computability, numerical analysis, software engineering, data management, electronics and chip design, and the ethical considerations involved in ICT.

**ECTS credits: 1,5 ECTS** (after attendance of the online course, one full workshop and successfully passing the exam)

**Course Director:**

David Lester (The University of Manchester)

<https://education.humanbrainproject.eu/web/ict-for-non-specialists>

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# LECTURES

Lecture 1: Computational complexity  
David Lester (The University of Manchester)

Lecture 2: Numbers, errors, chaos  
David Lester (The University of Manchester)

Lecture 3: Turing, computability, halting problem  
David Lester (The University of Manchester)

Lecture 4: Introduction to software engineering  
Jeff Muller (École Polytechnique Fédérale de Lausanne)

Lecture 5: Cheap as chips!  
Steve Furber (The University of Manchester)

Lecture 6: Advanced data management  
Thomas Heinis (Imperial College London)

Lecture 7: Querying and analysing big scientific data  
Thomas Heinis (Imperial College London)

Lecture 8: Electronics and VLSI  
Andreas Grübl (Heidelberg University)

## IIIc) NEUROBIOLOGY FOR NON-SPECIALISTS

The field of neuroscience is one of the most interdisciplinary scientific fields. It is constantly expanded and developed further and unites researchers from a vast variety of backgrounds such as chemistry, biology, physics, medicine or psychology. By examining the principles that influence the development and function of the human nervous system, it advances the understanding of the fundamental mechanisms of human behaviour, emotions, and thoughts, and what happens if they fail. This course addresses the basic principles relevant for the performance and evolution of the nervous system and provides an overview for PhD students from a different area of specialisation. It further includes advanced lectures on more specific questions and challenges of the field.

**ECTS credits: 2 ECTS** (after attendance of the online course, one full workshop and successfully passing the exam)

### Course Directors:

Alois Saria (Medical University Innsbruck)

Christoph Schwarzer (Medical University Innsbruck)

<https://education.humanbrainproject.eu/web/neurobiology-for-non-specialists>

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## LECTURES

### Part 1: Basics

Lecture 1: Intercellular signal transduction

Christoph Schwarzer (Medical University Innsbruck)

Lecture 2: Intracellular signal transduction

Christoph Schwarzer (Medical University Innsbruck)

Lecture 3: Glial cells

Christine Bandtlow (Medical University Innsbruck)

Lecture 4: Myelination in the CNS and PNS

Christine Bandtlow (Medical University Innsbruck)

Lecture 5: Neuronal networks  
Christoph Schwarzer (Medical University Innsbruck)

Lecture 6: Basic neuroanatomy  
Lars Klimaschewski (Medical University Innsbruck)

Lecture 7: Nociceptors and perception of pain  
Serena Quarta (Medical University Innsbruck)

## **Part 2: Advanced**

Lecture 1: Neuroinflammation and demyelination  
Markus Reindl (Medical University Innsbruck)

Lecture 2: Neurodegenerative diseases – En route to early detection and prevention  
Nir Giladi (Tel Aviv University)

Lecture 3: Learning and memory: Basic concepts and medical implications  
Nicolas Singewald (University of Innsbruck)

Lecture 4: Learning and memory: Underlying mechanisms and networks  
Francesco Ferraguti (Medical University Innsbruck)

Lecture 5: Motivation and addiction: Neuronetworks and treatment targets  
Gerald Zernig (Medical University Innsbruck)

Lecture 6: Computational neuroscience: Bridging brain scales with mathematics  
Gaute Einevoll (Norwegian University of Life Sciences)

Lecture 7: The human brain atlas as a part of the HBP Neuroinformatics Platform  
Timo Dickscheid (FZ Juelich)

Lecture 8: Principles of neuropharmacology  
Sandra Santos-Sierra (Medical University Innsbruck)

## IIIId) RESEARCH, ETHICS AND SOCIETAL IMPACT

This course explores ethical and social issues that have arisen, and continue to arise, from the rapid research development in neuroscience, medicine and ICT. Lectures focus on key ethical issues contained in the HBP – such as ethics of robotics, dual use, ICT ethical issues, big data and individual privacy, and the use of animals in research.

**ECTS credits: 1,5 ECTS** (after attendance of the online course, one full workshop and successfully passing the exam)

### Course Director:

Abdul K. Mohammed (Karolinska Institute/Linnaeus University)

<https://education.humanbrainproject.eu/web/research-ethics-and-societal-impact>

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## LECTURES

Lecture 1: Introduction to ethical theory  
Christine Mitchell (Harvard Medical School)

Lecture 2: Computer ethics and the HBP  
Bernd Stahl (De Montfort University)

Lecture 3: The Ethical Robotist  
Alan Winfield (University of the West of England)

Lecture 4: Responsible Research and the Human Brain Project  
Nikolas Rose (King's College London)

Lecture 5: Scaling up neuroscience - Responsible Research and the big brain projects  
Nikolas Rose (King's College London)

Lecture 6: Neuroscience and the problem of dual use  
Malcolm Dando (University of Bradford)

Lecture 7: Ethics in biomedical research and the 3Rs  
Viveka Hillegaard (Karolinska Institutet)

Lecture 8: Societal attitudes to animal research  
Rafael Frias (Karolinska Institutet)

Lecture 9: Research integrity and ethics management: HBP case study  
Emma Harris (De Montfort University)

Lecture 10: Cognitive enhancement: Ethics and efficacy  
Sebastian Porsdam Mann (Harvard Medical School)

Lecture 11: The Thinking Robot  
Alan Winfield (University of the West of England)

## IIIe) INTELLECTUAL PROPERTY RIGHTS, TRANSLATION AND EXPLOITATION OF RESEARCH

Knowing how to incorporate innovation and entrepreneurial mindset and concepts into day-to-day research work can be very beneficial and rewarding; however, it is very challenging specifically for students coming from disciplines such as computer science, engineering, life science or medicine (a non-MBA background). The current course will help building personal leadership skills for early-stage researchers and group leaders from the neuroscience field by inspiring them to look for better and smarter solutions, to think outside the box and consider end-products when it comes to their present and future research. Especially at early stages of the academic career, students can benefit from learning from the experience of innovators and entrepreneurs, through their failures and successes, and gain some practical tools and advice. Additionally, the course presents the basic concepts of intellectual property and how research can be exploited and translated into products.

**ECTS credits: 2,5 ECTS** (after attendance of the online course, one full workshop and successfully passing the exam)

### **Course Director:**

Dana Bar-On (Tel Aviv University)

<https://education.humanbrainproject.eu/web/ipr-translation-and-exploitation-of-research>

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## LECTURES

Introduction video to the IPR course

Lecture 1: Is your „Million Dollar Idea“ a viable business concept?

Michael Ehrlich (New Jersey Institute of Technology)

Lecture 2: Bottom-up research: The most critical skill in entrepreneurship

Danny Warshay (Brown University)



Lecture 3, part 1: Basic elements in the patenting world  
Eyal Bressler (Founder of Dr. Eyal Bressler & Co.)

Lecture 3, part 2: Basic elements in the patenting world  
Eyal Bressler (Founder of Dr. Eyal Bressler & Co.)

Lecture 4, part 1: Patents in the realm of neuroscience  
Eyal Bressler (Founder of Dr. Eyal Bressler & Co.)

Lecture 4, part 2: Patents in the realm of neuroscience  
Eyal Bressler (Founder of Dr. Eyal Bressler & Co.)

Lecture 5, part 1: New innovation models at the interface between academia and industry  
Christian Tidona (BioRN Network/BioMed X Innovation Center)

Lecture 5, part 2: New innovation models at the interface between academia and industry  
Christian Tidona (BioRN Network/BioMed X Innovation Center)

Lecture 6, part 1: Transferring innovation from academy to industry  
Shlomo Nimrodi (Tel Aviv University)  
Daniel Offen (Tel Aviv University)  
Ehud Gazit (Tel Aviv University)

Lecture 6, part 2: Transferring innovation from academy to industry  
Shlomo Nimrodi (Tel Aviv University)  
Daniel Offen (Tel Aviv University)  
Ehud Gazit (Tel Aviv University)

Lecture 7, part 1: Looking into the future using emerging trends: What are they and how do we identify them?  
Iris Ginzburg (Tel Aviv University)

Lecture 7, part 2: Looking into the future using emerging trends: What are they and how do we identify them?  
Iris Ginzburg (Tel Aviv University)





