



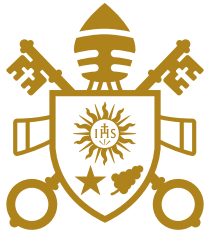
THE PONTIFICAL  
ACADEMY OF SCIENCES

WORKSHOP ON

# Neurotechnology and its Societal and Ethical Implications



13-14 December 2023  
Casina Pio IV, Vatican City



*Neurosciences offer ever increasing information about the functioning of the human brain. Through this information, fundamental realities of Christian anthropology such as the soul, self-awareness and freedom now appear in an unprecedented light and can even be seriously called into question by some.*

Post-Synodal Apostolic Exhortation  
*Christus vivit*  
Of the Holy father Francis  
To young people and to the entire people of God  
25 March 2019

# Concept note

Over the last decade unprecedented progress has been made in methodological developments permitting invasive and non-invasive registration and manipulation of the brain and its activity in animals and humans. These methodological advances expanded dramatically the options to interfere with the functions of the human nervous system, to substitute sensory and motor functions, to decode neuronal activity for the assessment of brain states and to generate brain organoids that mimic early embryonic development. In parallel, advances in the fields of Artificial Intelligence are about to expand human cognitive and executive functions and

to replace genuine human competences in multiple domains.

The purpose of the workshop is to

- i) provide a comprehensive overview of the state of the art in the field of neurotechnology,
- ii) investigate the potential of the new methods in basic research and clinical applications and
- iii) assess the societal and ethical implications of these new developments.

The workshop is co-organized by the PAS Academicians, Professors Wolf Singer, Stanislas Dehaene, and Jürgen Knoblich.

## Programme

### DAY 0 | Tuesday 12 November, 2023 – Reception – Extra Activity - Casina Pio IV

18.:00	Arrival – Registration Secretariat
18:00-19:30	Welcoming Session: Special presentation about the PAS, history and goals. Followed by reception Speakers: Chancellor, <b>Card. Peter K.A. Turkson</b> ; President <b>Joachim Von Braun</b> and Organizing Academicians

### DAY 1 | Wednesday 13 December 2023

09.00-09.30	Welcome and General Introduction to the Workshop <b>Joachim von Braun</b> <i>President</i> <b>Cardinal Peter K.A. Turkson</b> <i>Chancellor</i> <b>Wolf Singer</b> <i>PAS Academician</i>
09.30-2.30	SESSION 1: NEUROTECHNOLOGIES DEVELOPED AND APPLIED IN ANIMAL RESEARCH Chair: <b>Wolf J. Singer</b> <i>PAS Academician</i>
09.30-10.00	<b>Edward Boyden</b> <i>MIT - Y Eva Tan Professor</i> <i>Tools for Analyzing and Controlling Brain Computations</i>
10.00-10.30	<b>Viviana Gradinaru</b> <i>Center of the Chen Institute at Caltech</i> <i>The Blood-Brain Barrier: Friend and Foe</i>
10.30-11.00	<b>Coffee Break</b>

11.00-11.30	<b>Muming Poo</b> Senior Investigator and Scientific Director   Institute of Neuroscience, Center for Excellence in Brain Science and Intelligence Technology, Chinese Academy of Sciences <i>Non-human primate models for neurotechnology development</i>
11.30-12.00	<b>Stanislas Dehaene</b> PAS Academician   Inserm-CEA, Cognitive Neuroimaging Unit, CEA/SAC/DSV/DRM/NeuroSpin <i>Seeing the mind: 35 years of progress in brain imaging</i>
12.00-12.30	<b>Florian Mormann, MD, PhD</b> Lichtenberg Professor of Cognitive and Clinical Neurophysiology University of Bonn, Department of Epileptology <i>Single-neuron correlates of perception and memory in the human temporal lobe</i>
12.30-14.00	Lunch
14.00-15.00	SESSION 2: ELECTROPHYSIOLOGICAL RECORDINGS IN HUMAN SUBJECTS Chair: <b>Stanislas Dehaene</b> PAS Academician; Inserm-CEA - Cognitive Neuroimaging Unit
14.00-14.30	<b>Josef Parvizi</b> Stanford University <i>Exploring the sense of self with direct recordings and stimulations of the human brain</i>
14.30-15.00	<b>Sid Kouider</b> CNRS <i>Non-invasive Brain-Computer interfaces</i>
15.00-15.30	Coffee Break
15.30-18.00	SESSION 3: BRAIN IMAGING OF HIGHER COGNITIVE FUNCTIONS AND CONSCIOUSNESS Chair: <b>Stanislas Dehaene</b> PAS Academician; Inserm-CEA - Cognitive Neuroimaging Unit
15.30-16.00	<b>Jean-Rémi King</b> Meta - team leader <i>The unreasonable effectiveness of artificial intelligence in the neurosciences</i>
16.00-16.30	<b>Steven Laureys</b> Chair holder, Research Director; CERVO Brain Research Centre U Laval CANADA and GIGA Consciousness U LIEGE Belgium <i>From consciousness science, AI and neurotechnology to better neurorehabilitation</i>
16.30-17.00	<b>Lionel Naccache</b> Sorbonne University <i>Neurotechnology for patients with disorders of consciousness: tools for diagnostic, prognostic and therapeutic goals</i>
17.00-18.00	General Discussion
18.00-20.00	Dinner

## DAY 2 | Thursday 14 December 2023

09.00-10.00	SESSION 4: MEASURING HUMAN BRAIN STATES AND ALTERING THEM Chair: <b>Jürgen Knoblich</b> Institute of Molecular Biotechnology of the Austrian Academy of Sciences (IMBA)
09.00-09.30	<b>Helen Mayberg</b> Ichan School of Medicine at Mount Sinai - Professor and Director <i>What is well? Decoding Recovery Signals to Optimize DBS Treatment for Depression</i>
09.30-10.00	<b>David Nutt</b> Imperial College London - Head of Psychedelic Research <i>Psychedelics: opening the mind, healing the brain</i>
10.00-10.30	Coffee Break

10.30-12.00	SESSION 5: VIRTUAL REALITY AND NEURONAL PROSTHETICS Chair: <b>Jürgen Knoblich</b> PAS Academician
10.30-11.00	<b>Blanke Olaf</b> EPFL - École Polytechnique Fédérale de Lausanne - Professor <i>Cognitive liberty and mental integrity in brain-computer interfaces</i>
11.00-11.30	<b>Pieter Roelfsema</b> Netherlands Institute for Neuroscience - Director <i>Interfacing with the visual brain to restore a rudimentary form of vision in blind people</i>
11.30-12.00	<b>Botond Roska</b> Institute of Molecular and Clinical Ophthalmology Basel - Director <i>Restoring vision</i>
12.00-14.00	Lunch
14.00-15.00	SESSION 6: USING ORGANOIDs TO SHED LIGHT ON HUMAN NEUROBIOLOGICAL MECHANISMS Chair: <b>Wolf J. Singer</b> PAS Academician
14.00-14.30	<b>Jürgen Knoblich</b> Institute of Molecular Biotechnology of the Austrian Academy of Sciences (IMBA) <i>Organoid models recapitulate neural network activity in the human brain</i>
14.30-15.00	<b>Sergiu P. Pasca, M.D.</b> Professor, Stanford University <i>From stem cells to constructing and deconstructing human neural circuits in living systems</i>
15.00-15.30	Coffee Break
15.30-17.30	SESSION 7: ETHICAL CONSIDERATIONS AND REGULATIONS Co-Chairs: <b>Joachim von Braun</b> and <b>Card. Peter K.A. Turkson</b>
15.30-16.00	<b>Rafael Yuste</b> Neurotechnology Center, Columbia University - Director <i>Neurorights: new human rights for the new digital era</i>
16.00-16.30	<b>Bettina Schöne-Seifert</b> University of Münster/Germany – Senior Professor <i>Benchmarks for a New Era of Neuroethics</i>
16.30-17.00	<b>Reinhard Merkel</b> Professor emeritus; University of Hamburg / Faculty of Law (Germany) <i>Neuroenhancement. Normative Foundations and Limits</i>
17.00-17.30	<b>James Beauregard</b> Rivier University <i>Person, Neurotechnology, Dignity</i>
18.00-18.30	GENERAL DISCUSSION Chair: <b>Wolf J. Singer</b> PAS Academician
18.30-19.00	Final Statement
19.00-20.30	Dinner

# List of Participants

**Prof. Dr. Joachim von Braun**

President  
The Pontifical Academy of Sciences

**Cardinal Peter K.A. Turkson**

Chancellor  
The Pontifical Academy of Sciences

**Dr James Beauregard**

Rivier University, Nashua, NH  
USA

**Prof. Edward Boyden**

Y Eva Tan Professor  
MIT  
USA

**Prof. Stanislas Dehaene**

PAS Academician  
Inserm-CEA  
Cognitive Neuroimaging Unit  
CEA/SAC/DSV/DRM/NeuroSpin  
France

**Viviana Gradinaru, Ph.D.**

Lois and Victor Troendle Professor of Neuroscience  
and Biological Engineering, Caltech;  
Director of the Molecular and Cellular Neuroscience  
Center of the Chen Institute at Caltech

**Dr. Jean-Rémi King**

Team leader  
Meta  
France

**Dr. Jürgen A. Knoblich**

PAS Academician  
Institute of Molecular Biotechnology of the Austrian  
Academy of Sciences (IMBA)  
Austria

**Prof. David Nutt**

Head of Psychedelic Research  
Imperial College London  
United Kingdom  
Prof Sid Kouider  
CNRS  
France

**Prof. Steven Laureys**

Chairholder, Research Director  
CERVO Brain Research Centre U Laval CANADA and GIGA  
Consciousness U Liege  
Belgium

**Prof. Helen Mayberg**

Professor and Director  
Ichan School of Medicine at Mount Sinai  
USA

**Prof. Reinhard Merkel**

Professor emeritus  
University of Hamburg / Faculty of Law  
Germany

**Dr. Florian Mormann, MD, PhD**

Lichtenberg Professor of Cognitive and Clinical Neurophysiology  
University of Bonn  
Department of Epileptology  
Germany

**Prof. Lionel Naccache**

Sorbonne University  
France

**Prof. Blanke Olaf**

Professor  
EPFL - École Polytechnique Fédérale de Lausanne  
Switzerland

**Prof. Mu-ming Poo**

Senior Investigator and Scientific Director  
Institute of Neuroscience, Center for Excellence in Brain Science  
and Intelligence Technology, Chinese Academy of Sciences  
China

**Prof. Josef Parvizi**

Stanford University  
USA

**Prof. Dr. Pieter Roelfsema**

Director  
Netherlands Institute for Neuroscience  
The Netherlands

**Prof. Botond Roska**

Director  
Institute of Molecular and Clinical Ophthalmology Basel  
Prof. Pasca P. Sergiu  
Stanford University  
USA

**Prof. Bettina Schöne-Seifert**

Seniorprofessor  
University of Münster/Germany

**Prof. Wolf J. Singer**

PAS Academician  
Max-Planck-Institute for Brain Research  
Germany

**Msgr Dario E. Viganò**

Vice Chancellor  
The Pontifical Academy of Sciences

**Prof. Rafael Yuste**

Director  
Neurotechnology Center, Columbia University  
USA

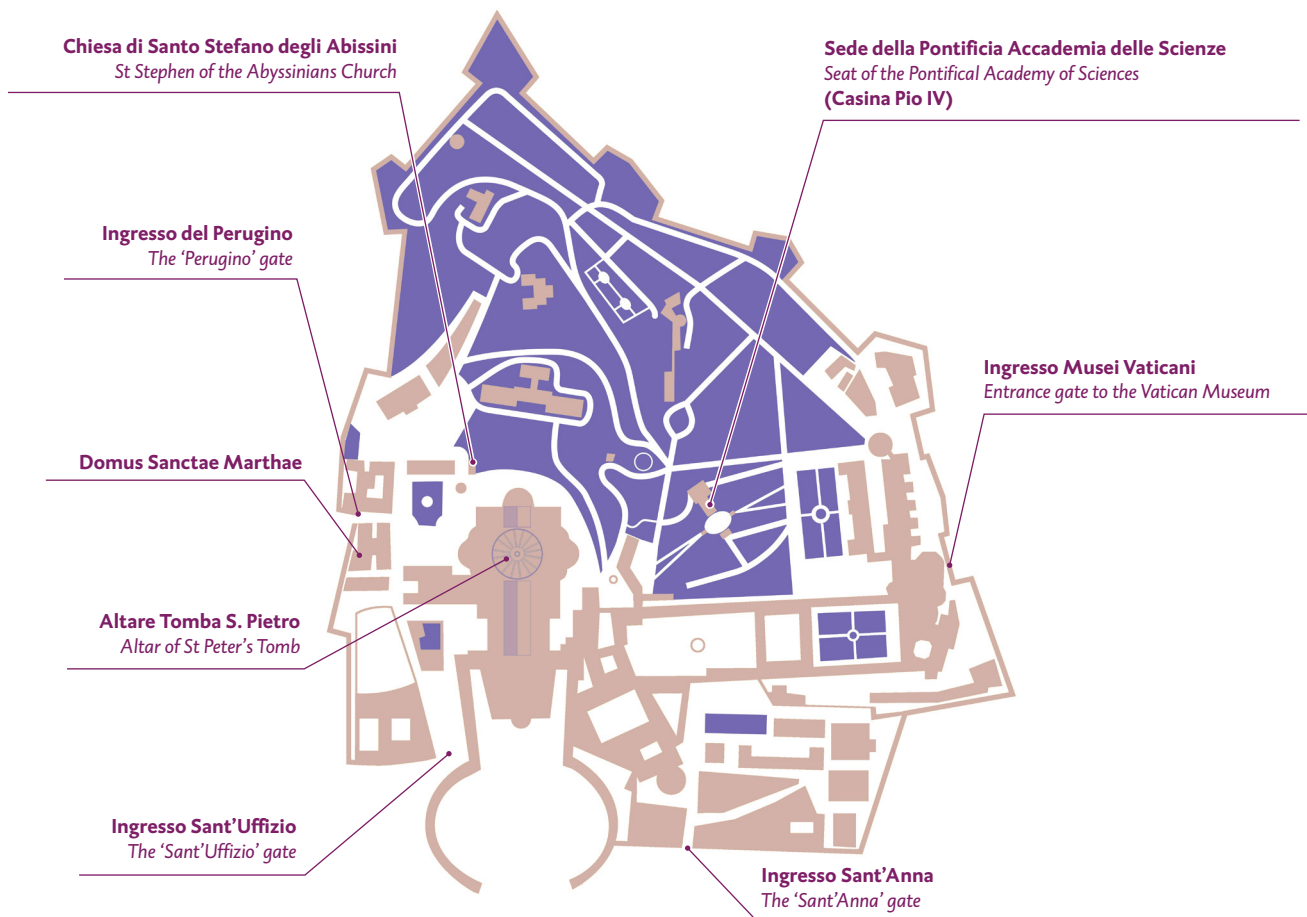
## Pickup schedule from and to the Hotels

### General information

- ▶ **Dress code** is business attire.
- ▶ **Invites** are strictly personal. But accompanying persons are invited to the conference and to share the meals.
- ▶ **The Audience with the Holy Father is not confirmed.**
- ▶ Please remember to **bring a valid ID.**
- ▶ In case of any problems, please call the Academy on +39 0669883195 or +39 0669881441. On travel days, the mobile phone number +393420026216 will be available.
- ▶ Please refer to **www.pas.va** for further information on the Academy, the Academicians, and current and past events.

#### WI-FI

- ▶ WI-FI network: academy-guest
- ▶ Password: G@rdens1936



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