I R P

International Foundation
for Research in Paraplegia
**Fondation internationale
pour la recherche en paraplégie**
Internationale Stiftung
für Forschung in Paraplegie

IRP Schellenberg research prize

**2003-2020:
19 worldwide known
scientists awarded.
Who will be next?**

WINNING AGAINST PARAPLEGIA STEP BY STEP

SUMMARY

PORTRAIT OF IRP

Since 1995, IRP - International Foundation for Research in Paraplegia - has undertaken fundraising activities for financing the best basic and clinical research projects worldwide in the field of paraplegia, selected by the IRP Scientific Committee of international experts.

IRP has helped to fund more than 220 research projects in Switzerland and abroad, contributing over CHF 32,000,000 in 25 years.

IRP has developed a partnership with FSP – Swiss Foundation for Paraplegics – to finance clinical projects.

IRP funds:

- IRP Research Grant (up to 150,000.– over 2 years)
- IRP Post-doctoral Fellowship (up to 80,000.– over 1 year)
- IRP Schellenberg Research Prize (up to 100,000.– every 3 years)
- IRP *Professor Alain Rossier* Chair at the University of Geneva, Switzerland
- STIMO Project (Stimulation of the spinal cord on paraplegic patients) at the Campus Biotech/EPFL and CHUV in Lausanne, Switzerland.

There is one single objective driving our activities:

WINNING AGAINST PARAPLEGIA STEP BY STEP

Progress in the field of neuroscience research also benefits patients suffering from other disorders of the central nervous system, such as Parkinson's disease, Alzheimer's disease, multiple sclerosis and stroke.

www.irp.ch

EDITORIAL THEODOR LANDIS

The booklet that you have in your hands reflects the outstanding nature of some of the research projects funded by IRP, driven by passionate researchers and which are gradually enabling a better understanding of the regeneration mechanisms of the spinal cord and improving living conditions for paraplegics.

A pursuit of excellence that leads me naturally to thank the members of the IRP Scientific Committee for their commitment. This Committee is made up of international experts in the field of neurosciences, who every year select the most promising projects for funding in a most rigorous process.

IRP, which is a private foundation, is proud to be able to share through this publication its firm belief that through the committed involvement of everyone, researchers and donors, paraplegia will one day no longer be an irreversible destiny.

This booklet reflects the painstaking research, editing and graphic design work that was put together by Béatrice Brunner of the IRP and Fritz Vischer, a former member of the IRP Foundation Board, who himself is paraplegic.

Professor Theodor Landis
President of the IRP Foundation

The *IRP Schellenberg Research Prize* is awarded to researchers who, by the significance of their scientific contributions and their publications in scientific journals of renown, have furthered understanding of the development, lesion and regeneration processes relating to the spinal cord.

Set up in 2003, the *IRP Schellenberg Research Prize* perpetuates the memory of Ulrich Schellenberg, the founder of the IFP Foundation in Zürich and co-founder of the IRP Foundation in Geneva, who died in 2001.

The Prize, up to CHF 100,000, is aimed at rewarding a scientist's outstanding work in the field of paraplegia. Priority is given to young but already established and successful scientists working experimentally in the above-mentioned fields. The funds awarded, by enabling the recruitment of new co-workers or personnel, and the purchase of equipment or supplies, should help investigate avenues that may, in due course, lead to progress in spinal cord regeneration and functional recovery.

IRP is proud to present in this brochure the

IRP SCHELLENBERG RESEARCH PRIZE WINNERS

Women and men who are IRP Ambassadors around the world and the symbol of our committment to research in paraplegia.

www.irp.ch

Nineteen scientists have received the *IRP Schellenberg Research Prize* since it was established in 2003. Each award marks a critical step towards IRP's vision of restoring neurological function to paraplegics. The 19 recipients so far have made important advances in clinical care and clinical trials, and in the science of how to protect and regenerate the spinal cord.

For researchers working in spinal injury, receiving the *IRP Schellenberg Research Prize* is a recognition from their peers that they have created a vision of present and future paraplegia treatments. Future laureates will join a group of the most outstanding researchers into spinal cord injury.

The *IRP Schellenberg Research Prize* offers a financial package for research of 100,000 Swiss francs, a fitting reward for unique achievements.

Who will be next?

Professor James W. Fawcett
President of the IRP Scientific Commitee

2003

PROFESSOR JAMES W. FAWCETT

BIO EXPRESS

Since 1995 Professor at the University of Cambridge; Director of Studies King's College;

2000-2018 Chairman Cambridge Centre for Brain Repair (BRC)

2003 First winner of the IRP Schellenberg Research Prize

1981 PhD in Medicine

1975 Medical Degree

LAB DESCRIPTION

The *Fawcett* lab has three programmes.

Reactivating plasticity

Plasticity is the ability of the nervous system to bypass injuries. After childhood plasticity decreases to a low level, and recovery from brain and spinal injury is poor. The lab has developed an enzyme treatment, *chondroitinase*, that releases the brakes on plasticity. Combined with rehabilitation this reactivated plasticity allows much improved recovery from spinal cord injury.

Stimulating nerve fibre regeneration

After they mature, spinal cord nerve fibres lose their ability to grow, and when damaged they regenerate weakly. The lab has shown that this loss of growth ability is caused by the neuron directing growth molecules away from the nerve fibres and losing growth signals. New treatments to transport growth molecules back into nerve fibres are being developed.

Bladder control

The lab is developing a new electronic method to control bladder emptying after spinal cord injury.

Professor
James W. Fawcett

Great Britain

IRP schellenberg research prize 2003

PUBLICATIONS – MILESTONES

2020, **EMBO Molecular Medicine**: Nieuwenhuis, B. et al. *PI 3-kinase delta enhances axonal PIP3 to support axon regeneration in the adult CNS.*

2019, **Nature Neuroscience**: Rosenzweig, E.S. et al. *Chondroitinase improves anatomical and functional outcomes after primate spinal cord injury.*

2013, **Science Translational Medecine**: Chew DJ, Zhu L, Delivopoulos E, Minev IR, Musick KM, Mosse CA, Craggs M, Donaldson N, Lacour SP, McMahon SB, Fawcett JW *A microchannel neuroprosthesis for bladder control after spinal cord injury in rat.*

2004

PROFESSOR

OLE KIEHN

BIO EXPRESS

2017 Novo Nordisk Foundation Laurate and Professor in Neuroscience University of Copenhagen, (UCPH)

2004 Professor in Neuroscience Karolinska Institutet (KI), Stockholm

2004 IRP Schellenberg Research Prize

2001 Group leader - KI

1997-2001 Associate Professor - UCPH

1995-2000 Hallas Møller Research Fellow -UCPH

1990-1995 Group leader UCPH

1989–1990 Post-Doctoral Fellow, Cornell, USA

LAB DESCRIPTION

Research in the *Kiehn* lab is directed to understand mechanisms by which neurons and neural networks operate to generate complex brain functions in particular movements in mammals. *Kiehn's* work has provided insights into the molecular and physiological organization of neuronal circuits in the spinal cord that generates locomotor movements.

He discovered the identity of neuronal circuits in the spinal cord that control the ability to produce the alternating movements within and between limps during locomotion and to set the rhythm of locomotion. *Kiehn* has also discovered specific populations of excitatory brainstem neurons that mediate the episodic control of locomotion: the start and stop of locomotion as well as turning.

Kiehn's lab has shown that L-type calcium channels are involved in development of spasticity after spinal cord injury and blocking these channels pharmacologically can prevent the development of these dysfunctional motor symptoms.

Professor
Ole Kiehn

Sweden

IRP schellenberg research prize 2004

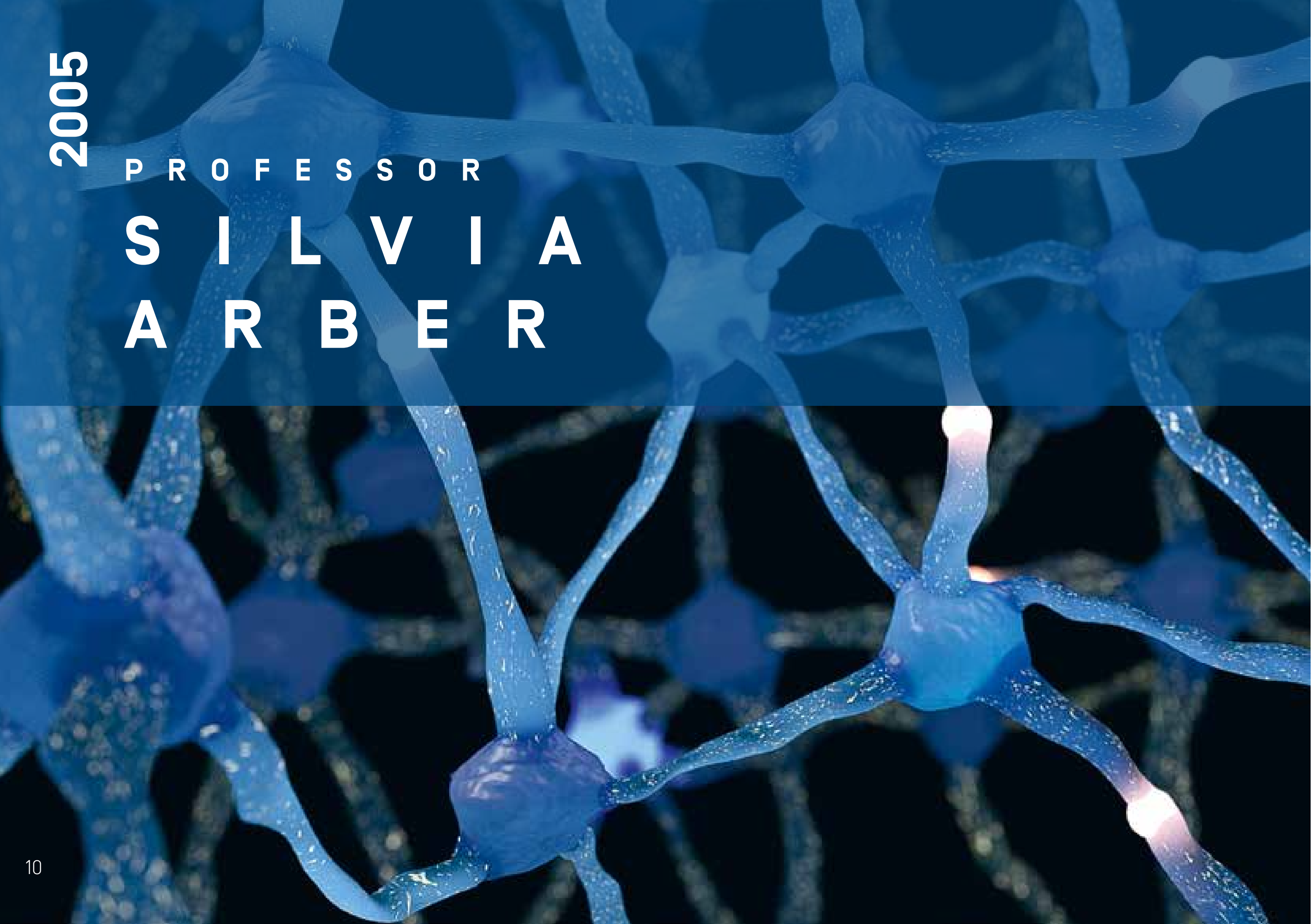
PUBLICATIONS – MILESTONES

2020, **Nature Neuroscience**: Cregg M J, Leiras R, Montalant A, Wanken P, Wickersham R I, Kiehn O
Brainstem neurons that command mammalian locomotor asymmetries.

2020, **Science Translational Medicine**: Marcantoni M, Fuchs A, Löw P, Bartsch D, Kiehn O, Bellardita C.
Early delivery and prolonged treatment with nimodipine prevents the development of spasticity after spinal cord injury in mice.

2018, **Nature**: Caggiano V, Leiras R, Goñi-Erro H, Masini D, Bellardita C, Bouvier J, Caldeira V, Fisone G, Kiehn O *Midbrain circuits that set locomotor speed and gait selection.*

2015, Cell: Bouvier J, Caggiano V, Leiras R, Caldeira V, Bellardita C, Balueva K, Fuchs A, Kiehn O
Descending command neurons in the brainstem that halt locomotion.



2005

PROFESSOR SILVIA ARBER

BIO EXPRESS

Professor of Neurobiology
Biozentrum, University of Basel
and Senior Group Leader
Friedrich Miescher Institute,
Basel

2015 AAAS Membership

City of Basel Award

2014 Otto Naegeli Prize for Medical Research

2005 IRP Schellenberg Research Prize

EMBO Membership

2003 National Latsis Prize

1996 Postdoctoral Fellow, Columbia University, New York

1995 PhD in Neuroscience

LAB DESCRIPTION

Research in the *Arber* lab focuses on understanding the organization and function of neuronal circuits involved in the control of motor behaviour, and on how injury impacts on and leads to reorganization of these neuronal circuits. **Using modern technologies, Arber's lab has recently unravelled the organization of the communication matrices between the brainstem and the spinal cord**. They found that highly specific modules exist for pathways from the brainstem to the spinal cord, as well as in the opposite direction.

Arber's work has for example identified a previously uncharacterized brainstem nucleus involved in the control of grasping through the control of spinal circuits. Furthermore, using a model of incomplete spinal cord injury, the *Arber* lab found that sensory feedback from muscle spindles is absolutely essential for functional recovery after injury and reorganization of descending neuronal circuits from the brainstem and within the spinal cord. Together, this work highlights the importance of identifying specific neuronal populations as entry point to understand motor function in health and upon injury.

Professor
Silvia Arber

Switzerland

IRP schellenberg research prize
2005

PUBLICATIONS – MILESTONES

2018, **Cell Reports**: Takeoka A and Arber S *Functional Local Proprioceptive Feedback Circuits Initiate and Maintain Locomotor Recovery After Spinal Cord Injury.*

2017, **Nature**: Capelli P, Pivetta C, Esposito MS, Arber S *Locomotor speed control circuits in the caudal brainstem.*

2015, **Cell**: Basaldella E, Takeoka A, Sigrist M, Arber S *Multisensory signaling shapes vestibulo-motor circuits specificity.*

2015, Neuron: Goetz C, Pivetta C, Arber S *Distinct limb and trunk premotor circuits establish laterality in the spinal cord.*

2014, Cell: Takeoka A, Vollenweider I, Courtine G, Arber S *Muscle spindle feedback directs locomotor recovery and circuit reorganization after spinal cord injury.*

2014, Nature: Esposito MS, Capelli P, Arber S *Brainstem nucleus MdV mediates skilled forelimb motor tasks.*

2005

PROFESSOR BRIGITTE SCHURCH

BIO EXPRESS

Since 2012
Head Physician Neuro-Urology, Lausanne University Hospital, Lausanne (CHUV)

Associate Professor, Lausanne University

Since 2004
Honorary Professor, Zürich University

2010-2012
"Kontinenz-Zentrum", Klinik Hirslanden, Zürich

2005 IRP Schellenberg Research Prize

1986-2010
Head of Neuro-Urology, Paraplegic Centre Balgrist, Zürich

1987 PhD in Medicine

LAB DESCRIPTION

Brigitte Schurch specialises in problems related to bladder control in conjunction with neurological illnesses. She has expert knowledge in the treatment of paraplegic patients. In the nineties, **she, as the very first clinician, discovered, that by treating patients locally with Botulinumtoxin (Botox), the hyperactive bladder, as a consequence of the neurogenic lesions could be overcame enabling the patients to achieve urinary continence**.

In her team at the Lausanne University Hospital (*CHUV*), Professor Schurch works alongside neurologists, physiologists, therapists and specialised care workers. Her range of treatment is comprehensive and encompasses neurological symptoms such as, cerebral haemorrhages, spinal cord injuries, and multiple sclerosis.

Her research work examines the supraspinal control of the bladder function, and the use of new substances in the treatment of functional disorders of the neurogenic bladder.

Professor Schurch is also actively involved in the *Neuroprostethic Project* of Professor Grégoire Courtine, who is also a winner of the IRP Schellenberg Research Prize.

Professor
Brigitte Schurch
Switzerland

IRP schellenberg research prize 2005

PUBLICATIONS – MILESTONES

2015, **Annals of Physical and Rehabilitation Medicine**: van den Brand R, Mignardot JB, von Zitzewitz J, Le Goff C, Fumeaux N, Wagner F, Capogrosso M, Martin Moraud E, Micera S, Schurch B, Curt A, Carda S, Bloch J, Courtine G
Neuroprosthetic technologies to augment the impact of neurorehabilitation after spinal cord injury.

2015, **Cerebral Cortex (Oxford Journals)**: Michels L, Blok BF, Gregorini F, Kurz M, Schurch B, Kessler TM, Kollias S, Mehnert U
Supraspinal Control of Urine Storage and Micturition in Men-An fMRI Study.

2010, **NeuroImage**: Zempleni MZ, Michels L, Mehnert U, Schurch B, Kollias S
Cortical substrate of bladder control in SCI and the effect of peripheral pudendal stimulation.

2006

PROFESSOR LARS OLSON

BIO EXPRESS

Since 2010
Senior Professor, Karolinska Institute (KI), Stockholm

2006 IRP Schellenberg Research Prize

2000-2004
Chair, Department of Neuroscience - KI

1986-2009
Professor of Neurobiology - KI

1987-1993
Chair, Department of Histology and Neurobiology - KI

1970 PhD, Neuroscience - KI

LAB DESCRIPTION

Lars Olson's Work has mainly concerned development, growth factors, regeneration, aging, transplantation in the central nervous system, models for *Parkinson's* disease and its treatment, models for spinal cord injury and treatment strategies, the roles of proteins that regulate gene activity in the brain, genetic risk factors for *Parkinson's* disease, and proteins that inhibit nerve growth in the nervous system.

Research has been taken all the way from animal studies to clinical trials.

Current focus is aging, neurodegenerative diseases, spinal cord injury and the role of the *Nogo system* in brain plasticity focusing on the formation of lasting memories and memory disorders.

Professor
Lars Olson

Sweden

IRP schellenberg research prize 2006

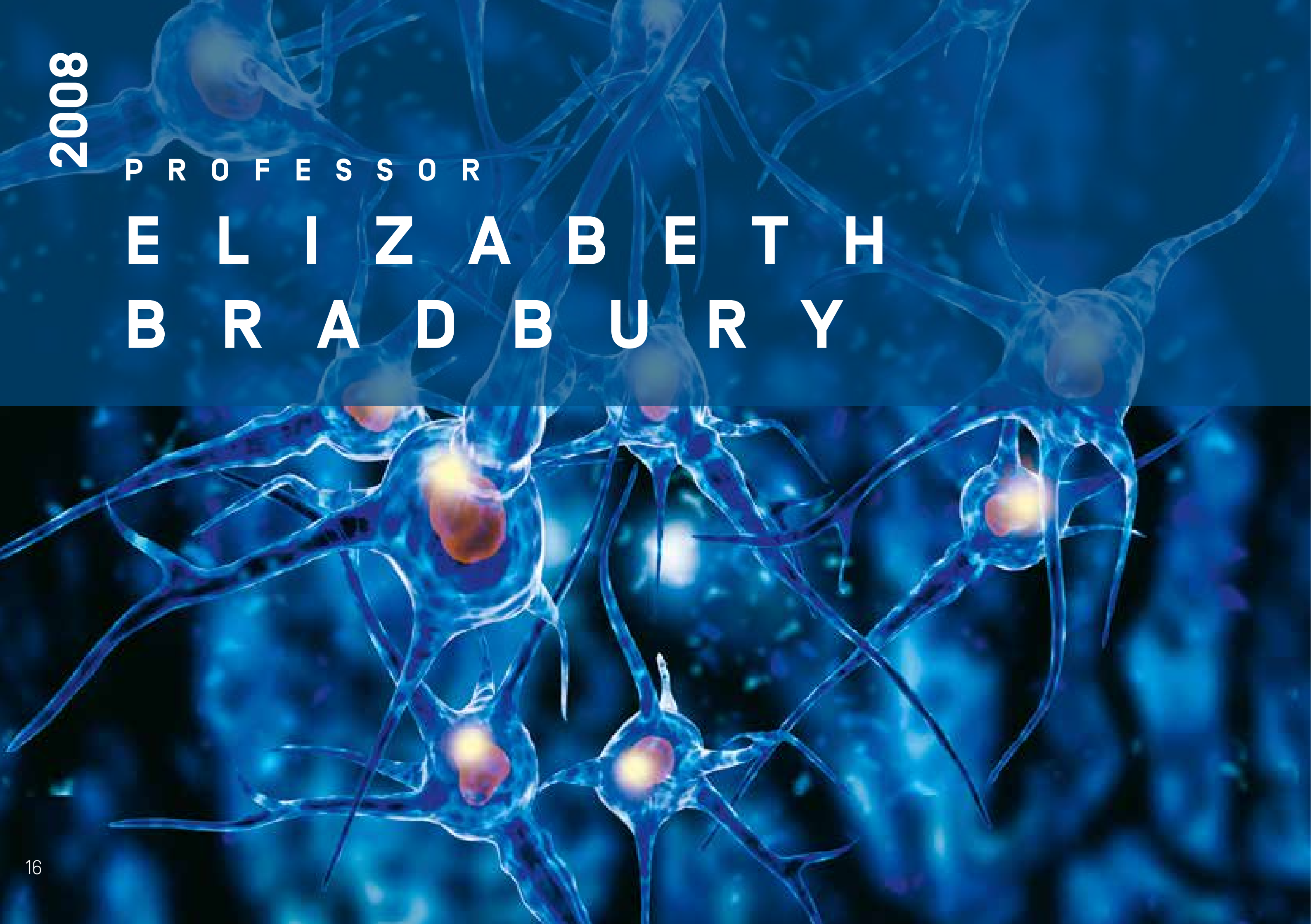
PUBLICATIONS – MILESTONES

2016, Cerebral Cortex: Karlsson et al.
A tunable sensor regulating formation, synaptic and dendritic plasticity. How levels of NgR1, a receptor for the nerve growth inhibitory protein Nogo, regulates density of contacts between nerve fibers.

2012, PloS One: Abrams et al.
Imatinib enhances functional outcome after spinal cord injury. Cancer drug counteracts spinal cord injury.

2007, Brain: Endo et al.
Cortical sensory map rearrangement after spinal cord injury: fMRI responses linked to Nogo signalling. Brain plasticity after spinal cord injury.

2005, Nature Neuroscience: Hofstetter et al.
Allodynia limits the usefulness of intraspinal neural stem cell grafts; directed differentiation improves outcome. Stem cell grafts in spinal cord injury.



2008

PROFESSOR ELIZABETH BRADBURY

BIO EXPRESS

2018 Suffrage Science Award

2015 Full Professor of Regenerative Medicine and Neuroplasticity

2011 Medical Research Council (MRC) Senior Fellowship

2008 IRP Schellenberg Research Prize

2003 MRC Career Development Award; Group Leader at King's College London

1999–2001 Wellcome Trust Research Fellow, King's College London

1996–1999 Post-Doctoral Fellow, St. Thomas Hospital, London

1996 PhD in Neuroscience

LAB DESCRIPTION

Research in the *Bradbury* Lab focuses on understanding why the injured spinal cord is unable to repair itself, with a particular interest in the injury scar which blocks nerve regeneration and prevents tissue repair.

Bradbury's **work led to the discovery that treating the spinal cord with an enzyme called *chondroitinase* could enable nerve fibres to regenerate through scar tissue**, form new connections with target cells and restore some function to paralysed limbs in experimental models. This work has had a major impact and *chondroitinase* is now a leading candidate for translating to the clinic.

Bradbury is a member of the international CHASE-IT *Consortium* (*chondroitinase* for injury therapy) who are developing and testing a *chondroitinase* gene therapy which is safe for human use. Current research is focused on combining *chondroitinase* gene therapy (to encourage nerve fibre growth or "neuroplasticity") with a neurorehabilitation programme to improve hand function.

Professor Elizabeth Bradbury

Great Britain

IRP schellenberg research prize 2008

PUBLICATIONS – MILESTONES

2019, **Nature Communications**: Bradbury EJ, Burnside ER *Beyond the glial scar for spinal cord repair.*

2018, **Brain**: Burnside ER, De Winter F, Didangelos A, James ND, Andreica EC, Layard-Horsfall H, Muir EM, Verhaagen J, Bradbury *EJ Immune-evasive gene switch enables regulated delivery of chondroitinase after spinal cord injury*. The first use of a regulatable chondroitinase gene therapy that can recover skilled hand function (reach and grasp) after cervical contusion injury.

2002, **Nature**: Bradbury EJ, Moon LD, Popat RJ, King VR, Bennett GS, Patel PN, Fawcett JW, McMahon SB *Chondroitinase ABC promotes functional recovery after spinal cord injury*. The first demonstration that chondroitinase treatment could restore function after spinal cord injury.

2010

PROFESSOR

GRÉGOIRE COURTINE

BIO EXPRESS

2019 Rolex Award for Enterprise

2018 Man of the Year, Canton of Vaud, Switzerland

Georg and Susanne Klein-Vogelbach Stiftung Award

2016 European Research Council (ERC) Consolida-tor grant awarded

2014 Founder, GTX medical, Lausanne / Eindhoven

2013 Debiopharm Prize

2012 Associate Professor at IRP Chair in Spinal Cord Repair EPFL

2010 IRP Schellenberg Research Prize

2008 University of Zurich

2005-2007 Christopher Reeve Foundation

LAB DESCRIPTION

Over the past 15 years, *Prof Courtine* and his team have developed an unconventional therapeutic strategy that **re-established voluntary control of leg movements after a spinal cord injury leading to complete and permanent paralysis**.

This strategy is shortly described as follows: when an injury occurs, the brain signals to the spinal cord are severely compromised. The neurons that control the muscles become dormant. To reawaken these neurons, bursts of electrical stimulation are delivered to the spinal cord with a spatial sequence and timing that mimic the natural activation of the spinal cord during walking. With training, this thera-py promotes the growth of new neuronal con-nections that re-established voluntary control of movement in people with chronic paralysis. *Prof Courtine* is now director of the Defitech Center for Interventional Neurotherapies (NeuroRestore) together with the neurosurgeon Prof Bloch.

Their goal is to translate this treatment into a commonly available therapy. For this purpose, they co-founded GTX medical, a start-up that develops next-generation technologies opti-mized for these applications.

Professor
Grégoire Courtine

France

IRP schellenberg research prize 2010

PUBLICATIONS – MILESTONES

2018, **Nature** Wagner et al.
2018, **Nature Neuroscience** Formento et al.
2017, **Science Translational Medicine:** Mignardot N. et al.
2016, **Nature** Capogrosso et al.
2016, **Neuron**: Martin Moraud E. et al.
2016, **Nature Medicine**: Wenger N. et al.
2015, **Science Translational Medicine**: Friedli L. et al.
2015, **Science**: Minev. I et al.
2014, **Cell**: Takeoka A. et al.
2014, **Neuron**: Borton DA. et al.
2014, **Science Translational Medicine**: Wenger N. et al.
2014, **Neuron**: Borton DA. et al.
2013, **Science Translational Medicine**: Borton DA. et al.
2012, **Nature Medicine**: Dominici N. et al.
2012, **Science**: Van den Brand R. et al.
2010, Nature Neuroscience: Courtine G. et al.
2009, Nature Neuroscience: Courtine G. et al.

2010

PROFESSOR OLIVIER RAINETEAU

BIO EXPRESS

2014 Research Director at INSERM, Paris

2013-2016 Recipient of an IDEX package – official French "Initiative of Excellence"

2010-2015 Recipient of a Swiss National Research Program grant

2010 IRP Schellenberg Research Prize

2009-2014 Group Leader, Swiss Federal Institute of Technology Zurich (ETHZ)

2004-2008 Group leader, University of Cambridge, UK

2001 PhD in Neurosciences

LAB DESCRIPTION

Research in the *Raineteau* Lab aims at understanding the capacities of the injured CNS (central nervous system) tissue to undergo plasticity and regeneration after a lesion.
He has participated to research demonstrating that significant spontaneous recovery occurs after spinal cord injury. **His work showed that this spontaneous but incomplete reorganization could be potentiated by neutralization of the neurite growth inhibitor *Nogo-A*.** He also explored the mechanisms by which digestion of the extracellular matrix by *chondroitinase* promotes functional reorganisation of CNS circuits.

His most recent research aims at better understanding the capacities of neural stem cells (NSCs) to participate to CNS repair.

His group currently studies the plastic potential of postnatal CNS stem cells, that is to say their capacity to change fate upon manipulation of intrinsic or extrinsic factors. By unravelling how environmental signals and transcriptional networks determine NSCs behaviours, his research brings key knowledge to design innovative approaches for their recruitment after lesion or in pathologies.

Professor
Olivier Raineteau

France

IRP schellenberg research prize 2010

PUBLICATIONS – MILESTONES

2018, Cell Reports: Donega V, Marcy G, Lo Giudice Q, Zweifel S, Angonin D, Fiorelli R, Abrous DN, Rival-Gervier S, Koehl M, Jabaudon D, Raineteau O (2018) *Transcriptional Dysregulation in Postnatal Glutamatergic Progenitors Contributes to Closure of the Cortical Neurogenic Period.*

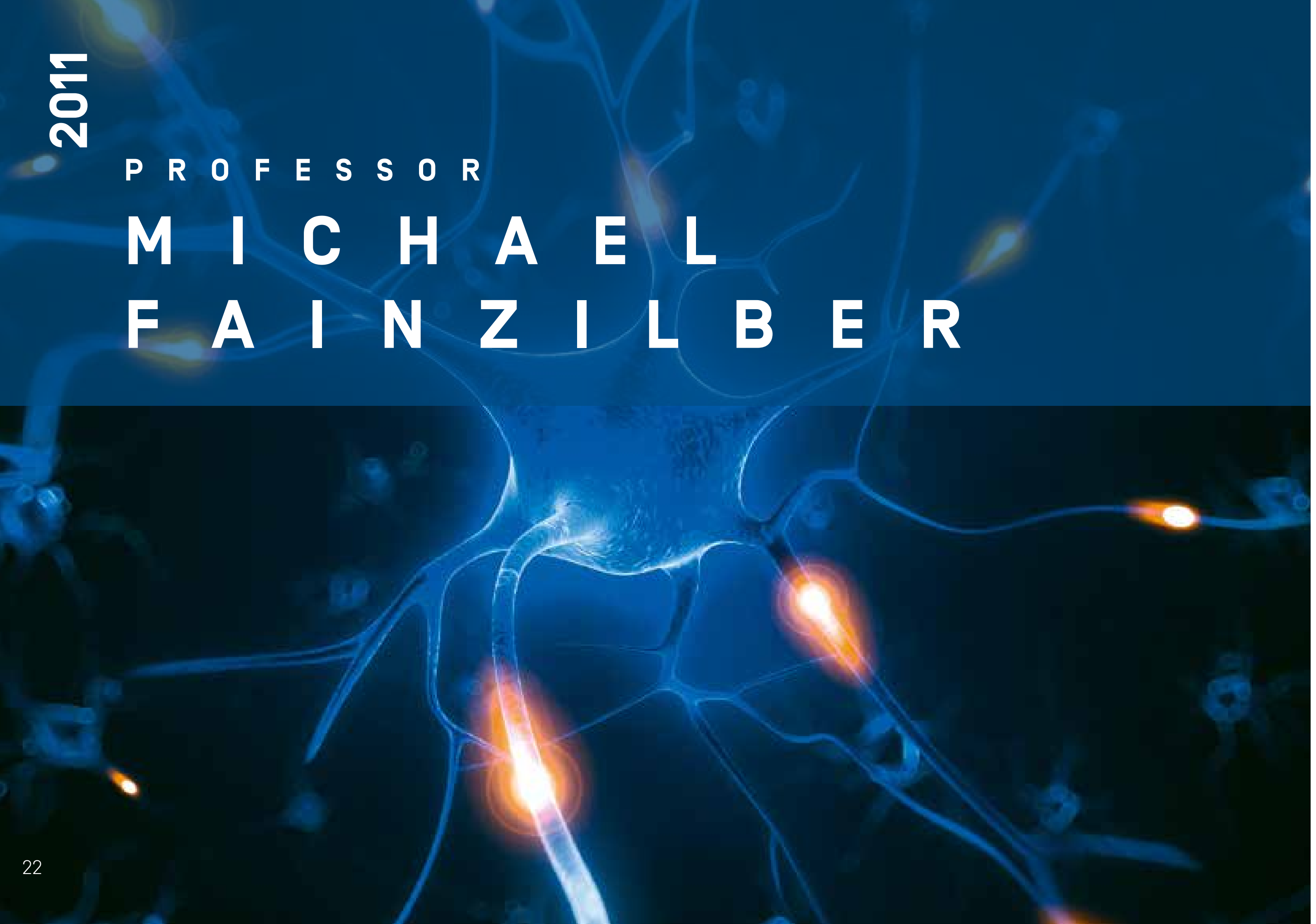
2017, PLOS Biology: Azim K, Angonin D, Marcy G, Pieropan F, Rivera A, Donega V, Cantu C, Williams G, Berninger B, Butt AM, Raineteau O (2017) *Pharmacogenomic identification of small molecules for lineage specific manipulation of subventricular zone germinal activity.*

2009, Nature Neuroscience: Brill MS, Ninkovic J, Winpenny E, Hodge RD, Ozen I, Yang R, Lepier A, Gascón S, Erdelyi F, Szabo G, Parras C, Guillemot F, Frotscher M, Berninger B, Hevner RF, Raineteau O, Götz M *Adult generation of glutamatergic olfactory bulb interneurons.*

2004, Nature Neuroscience: Bareyre FM, Kerschensteiner M, Raineteau O, Mettenleiter TC, Weinmann O, Schwab ME *The injured spinal cord spontaneously forms a new intraspinal circuit in adult rats.*

2011

PROFESSOR MICHAEL FAINZILBER



BIO EXPRESS

2013-2018 European Research Council (ERC) *Advanced Research Grant*

2011 IRP Schellenberg Research Prize

Since 2006 *Chaya* Professorial Chair in Molecular Neuroscience, Weizmann Institute

1998-2005 *Koshland* Career Development Chair, Weizmann Institute

1995-1997 Postdoctoral Fellow, Karolinska Institute

1993-1995 Postdoctoral Fellow, Vrije Universiteit Amsterdam

1993 PhD in Life Sciences

LAB DESCRIPTION

Research in the *Fainzilber* Lab is focused on understanding basic mechanisms of intra-cellular communication along nerve axons, in particular how the axons communicate information about an injury to the neuronal soma.

Fainzilber and colleagues **identified a central role for nuclear import factors called *importins* in injury signalling from axon to soma**, and showed that localized translation of an *importin* mRNA in axons is required to trigger this process.

In more recent work, the group has shown how RNA localization and local translation regulate neuronal growth rates. Current efforts are focused on identifying regulators and drug leads targeting these mechanisms for the acceleration of nerve regeneration.

Professor
Michael (Mike) Fainzilber
Israël

IRP schellenberg research prize 2011

PUBLICATIONS – MILESTONES

2018, Science: Terenzio M, Koley S, Samra N , Rishal I, Zhao Q, Sahoo PK, Urisman A, Marvaldi L, Oses-Prieto JA, Forester C, Gomes C, Kalinski AL, Di Pizio A, Perry RB, Doron-Mandel E, Koppel I, Twiss JL, Burlingame AL, Fainzilber M *Locally translated mTOR controls axonal local translation in nerve injury. Elucidation of key regulatory control of local translation in injured axons.*

2016, Cell Reports: Perry RB, Rishal I, Doron-Mandel E, Kalinski A, Medzihradszky KF, Terenzio M, Alber S, Koley S, Lin A, Rozenbaum M, Yudin D, Sahoo PK, Gomes C, Shinder V, Geraisy W, Huebner EA, Woolf CJ, Yaron A, Burlingame AL, Twiss JL, Fainzilber M *Nucleolin-mediated RNA localization regulates neuron growth and fibroblast cell size. Identification of a critical RNA localization mechanism that controls neuron growth rates.*

2012, Neuron: Perry RB, Doron-Mandel, E, Iavnilovitch E, Rishal I, Dagan SY, Tsoory M, Coppola G, McDonald MK, Gomes C, Geschwind DH, Twiss JL, Yaron A, Fainzilber M *Subcellular knockout of importin beta1 perturbs axonal retrograde signaling.*

2011

PROFESSOR FRANK BRADKE

BIO EXPRESS

2018 Roger de Spoelberch Prize

2016 Gottfried Wilhelm Leibniz-Prize

2014 Member Leopoldina

2013 Member EMBO

2011 IRP Schellenberg Research Prize

Professor at the University of Bonn and Senior Research Group Leader for Axonal Growth and Regeneration at DZNE

2003-2011 Max Planck Institute of Neurobiology

2000-2002 Postdoc in the U.S.

1999 PhD

1995 Diploma in Biochemistry

1994 B.Sc., University College London

LAB DESCRIPTION

Research in the *Bradke* lab focuses on how nerve cells grow during development and how these processes can be reactivated to induce nerve regeneration in the injured spinal cord.

His laboratory has a special interest in the skeleton of the cell, called the *cytoskeleton*.

Bradke and his coworkers **showed that manipulation of the cytoskeleton with low doses of anticancer drugs leads to regrowth of nerves and reduction of scarring**.

His lab also developed a novel imaging technique that enables visualization of nerves at microscopic resolution within whole tissue.

Professor
Frank Bradke

Germany

IRP schellenberg research prize 2011

PUBLICATIONS – MILESTONES

2019, **Neuron**: Tedeschi A, Dupraz S, Curcio M, Laskowski CJ, Schaffran B, Flynn KC, Santos TE, Stern S, Hilton BJ, Larson MJE, Gurniak CB, Witke W, Bradke F *ADF/Cofilin-Mediated Actin Turnover Promotes Axon Regeneration in the Adult CNS.*

2016, **Neuron**: Tedeschi A, Dupraz S, Laskowski C, Xue J, Ulas T, Beyer M, Schultze J, Bradke F *The Calcium Channel Subunit Alpha2delta2 Suppresses Axon Regeneration in the Adult CNS.*

2015, **Science**: Ruschel J, Hellal F, Flynn KC, Dupraz S, Elliott DA, Tedeschi A, Bates M, Sliwinski C, Brook G, Dobrindt K, Peitz M, Brüstle O, Norenberg MD, Blesch A, Weidner N, Bunge MB, Bixby JL, Bradke F *Axonal regeneration. Systemic administration of epothilone B promotes axon regeneration after spinal cord injury*.

2012

PROFESSOR ARMIN CURT

BIO EXPRESS

2012 IRP Schellenberg Research Prize

Since 2009 Full Professor for Paraplegiology and Medical Director, Balgrist University Hospital, Zurich

2005-2008 Associate Professor in Neurology and SCI Research, University of British Columbia, CA

2005 Fellow Royal College of Physicians and Surgeons of Canada

Associate Professor for Neurorehabilitation, University of Zurich

1998 Licensed Specialist in Neurology and Clinical Neurophysiology

LAB DESCRIPTION

The research laboratory of the Spinal Cord Injury Center at the *Balgrist University Hospital*, University of Zurch, is devoted to research in humans suffering from paraplegia.

The clinical center is focused on translational research from bench (basic science) to bed (i.e. true clinical applications) and is spearheading novel approaches for clinical trial design and treatments in acute and chronic human spinal cord injury (SCI). It is chairing the *European Multicenter Study in SCI* (www.EMSCI.org) that is prospectively collecting the most comprehensive and standardized data sets about the recovery from SCI based on generous and visionary funding by IRP since 2001.

The *SCI Center Balgrist* has been centrally involved in designing and performing interventional clinical trials in acute SCI (phase I study with first in man intrathecal application of antibodies against *Nogo-A*; phase II study of *Nogo-A antibodies* in incomplete SCI (NISCI); first international study for the transplantation of human neural stemcells into the cord of patients with SCI).

Professor
Armin Curt

Switzerland

IRP schellenberg research prize 2012

PUBLICATIONS – MILESTONES

2020, **Nat Rev Neurol**: Badhiwala JH, Curt A *Degenerative cervical myelopathy -update and future direction*

2019, **Lancet Neurol**: Freund P, Curt A *MRI in traumatic SCI: from clinical assessment to neuroimaging biomarkers*

2018, **Ann Clin Trans Neurol**: Jutzeler K, Curt A *Sensorimotor plasticity after SCI: a longitudinal and translational study*

2017, **NNR**: Kucher K, Curt A *First-in-Man Intrathecal Application of Neurite Growth Promoting Anti-Nogo-A Antibodies in acute SCI*

2016, **Neurology**: Killeen T, Curt A *Spontaneous resolution of an extensive posttraumatic syrinx*

2015, **Annals of Neurology**: Grabher P, Curt A *Tracking sensory system atrophy and outcome prediction in spinal cord injury*

2014, **The Lancet Neurology**: Klamroth-Marganska V, Curt A *Three-dimensional, task-specific robot therapy of the arm: a multicenter randomized clinical trial in stroke patients*

2012

PROFESSOR VOLKER DIETZ

BIO EXPRESS

2019 L-Guttmann prize

2018 Fellow of the European Academy of Neurology

Since 2009 Senior Research Professor University Hospital Balgrist

2012 IRP Schellenberg Research Prize

1992-2009 Head of the Paraplegic Centre and Chair of Paraplegiology, University of Zurich

2007 Hans Berger prize

2006 Sobek prize

2002-2003 Visiting Professor, University of Miami

2001 Fellow of the Royal College of Physicians

LAB DESCRIPTION

Translational research - "from bench to bed"

- Establishment of the "*European Multicenter Spinal Cord Injury" (EM-SCI)*, a network of paraplegic centres acting as a data base for research projects.
- Together with Novartis and M Schwab: completion of phase I trial using Nogo-A-antibodies to regenerate human spinal marrow.

2. Technology and neurorehabilitation

- In cooperation with the Swiss Federal Institute of Technology (ETH), development of the first walking robot *Lokomat*, for gait training and the ability to walk.
- Publication of the Textbooks *Neurorehabilitation Technology* (Springer, 2012; 2nd edition 2016) and Neurorehabilitation, Textbook series Neurology (Oxford University Press, 2015; 2nd edition 2020).

3. Main research projects

- *Neuroplasticity* in paraplegic and stroke subjects: What makes a functional training effective?
- Evidence of the development of a *neuronal dysfunction* in the event of severe paralysis.
- Alteration of *reflex function* following paraplegia or stroke.
- Initial description of a *neuronal coupling* during cooperative hand movements and their dysfunction following stroke.

Professor
Volker Dietz

Switzerland

IRP schellenberg research prize 2012

PUBLICATIONS – MILESTONES

2020, **European Journal of Neuroscience**: Dietz V
Neural coordination of bilateral power and precision finger movements.

2015, **Oxford Journals**, **Cerebral Cortex**: Dietz V, Macauda G, Schrafl-Altermatt M, Wirz M, Kloter E, Michels L *Neural coupling of cooperative hand movements: A reflex and fMRI study.*

2014, **Oxford Journals**, **Brain**: Dietz V, Fouad K
Restoration of sensori-motor functions after spinal cord injury (Review).

2011, **Oxford Journals**, **Brain**: Kloter E, Wirz M, Dietz V
Locomotion in stroke subjects: Interactions between unaffected and affected sides.

2010, **Nature Reviews Neurology**: Dietz V
Behavior of spinal neurons deprived of supraspinal input.

2013

PROFESSOR TOMMASO PIZZORUSSO

BIO EXPRESS

Currently
Full Professor, University of Florence; associate scientist, Institute of Neuroscience CNR, Pisa

2013 IRP Schellenberg Research Prize

1998 Lecturer, Scuola Normale Superiore (SNS), Pisa University System

1995-1998
Postdoc, Institute of Neurophysiology CNR, Pisa

1994 Postdoc, Georgetown University, USA

1993 PhD in Neurobiology

LAB DESCRIPTION

Pizzorusso's long-term interest is to understand the functional basis of formation and response to pathology of cortical circuits in normal conditions. To answer this question, models of environmental (visual deprivation), genetic (models of neurodevelopmental disorders), and vascular lesions are used. The approach is to combine electrophysiological and imaging techniques with molecular studies. **The lab has a longstanding expertise in such experiments on visual system function and plasticity in mice**.

Current main research topics are

- Role of epigenetic mechanisms in experience-dependent development of the visual cortex.
- Role of perineuronal nets in controlling critical periods of brain development.
- Plasticity mechanisms after stroke in juvenile and adult animals.
- Circuit development defects in Rett *syndrome*, an incurable developmental condition that mostly affects young girls.

Professor
Tommaso Pizzorusso
Italy

IRP schellenberg research prize 2013

PUBLICATIONS – MILESTONES

2019, **Nature Reviews Neuroscienc**e: Fawcett JW, Oohashi T, Pizzorusso T. *The roles of perineuronal nets and the perinodal extracellular matrix in neuronal function.*

2017, **Nature Communications**: Gherardini L, Gennaro M, Pizzorusso T Mazziotti R, Baroncelli L, Ceglia N, Chelini G, Della Sala G, Magnan C, Napoli D, Putignano E, Silingardi D, Tola J, Tognini P, Arthur JSC, Baldi P, Pizzorusso T *Mir-132/212 is required for maturation of binocular matching of orientation preference and depth perception.*

2015, Biological Psychiatry: Della Sala G, Putignano E, Chelini G, Melani R, Calcagno E, Michele Ratto G, Amendola E, Gross CT, Giustetto M, Pizzorusso T *Dendritic Spine Instability in a Mouse Model of CDKL5 Disorder Is Rescued by Insulin-like Growth Factor 1.*

2015, Cerebral cortex: Gherardini L, Gennaro M, Pizzorusso T *Perilesional Treatment with Chondroitinase ABC and Motor Training Promote Functional Recovery After Stroke in Rats.*

2013

PROFESSOR

JOOST VERHAAGEN

BIO EXPRESS

Since 1998 Professor, Vrije Universiteit, Amsterdam

2013 IRP Schellenberg Research Prize

2004 Raine Foundation Visiting Professor, UWA, Perth

1994-1999 Pioneer Fellow, NL Institute for Neuroscience, Amsterdam

1992 Visiting Scientist, Rockefeller University, USA

1990–1994 Research Fellow, Royal Academy of Science, RMI, Utrecht

1987-1989 Post-doctoral Fellow, Roche Institute for Molecular Biology, NJ, USA

LAB DESCRIPTION

The *Verhaagen* lab focusses on understanding the molecular and cellular processes that drive regeneration in the peripheral nervous system and that underline the failure of regeneration in the central nervous system, with a focus on the role of regeneration-associated transcription factors and chemorepulsive proteins.

Verhaagen's work led to the discovery that the expression of the chemorepulsive guidance protein *Semaphorin3A* is induced in the neural scar. **He recently showed that *Semaphorin3A* is present in perineuroral nets, specialized extracellular matrix structures around mature neurons with a key role in regulating neuroplasticity**. His laboratory was among the first to use viral vector-mediated gene transfer as a strategy to express pro-regenerative proteins in the injured nervous system and he is currently involved in generating novel regulatable gene therapy vectors based on "Stealth" technology.

Verhaagen is a member of the *CHASE-IT* consortium, which is developing gene therapy for *chondroitinase*, an enzyme which enables axon regeneration through scar tissue, most likely by releasing inhibitory molecules, like *Semaphorin3A*, from the matrix.

Professor
Joost Verhaagen
Netherlands

IRP schellenberg research prize
2013

PUBLICATIONS – MILESTONES

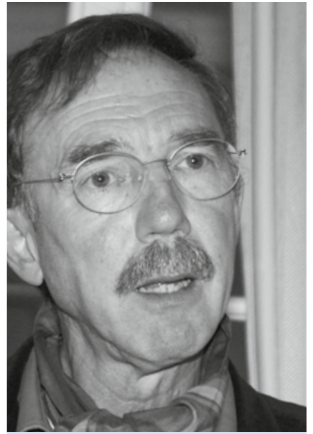
2020, **PNAS**: Carulli D, Broersen R, de Winter F, Muir EM, Meskovic M, de Waal M, de Vries S, Boele HJ, Cantho CB, de Zeeuw CI, Verhaagen J. *Cerebellar plasticity and associative memories are controlled by perineuronal nets.*

2019, **Brain**: Eggers R, de Winter F, Hoyng SA, Hoeben RC, Malessy MJA, Tannemaat MR, Verhaagen J. *Timed GDNF gene therapy using an immune-evasive gene switch promotes long distance axon regeneration.*

2018, **Brain**: Burnside ER, De Winter F, Didangelos A, James ND, Andreica EC, Layard-Horsfall H, Muir EM, Verhaagen J, Bradbury EJ. *Immune-evasive gene switch enables regulated delivery of chondroitinase after spinal cord injury.*

2016

PROFESSOR MARTIN E. SCHWAB



BIO EXPRESS

2016 IRP Schellenberg Research Prize

Since 1997 Professor of Neuroscience, ETH Zurich

Since 1985 Professor of Brain Research, University of Zurich

1979-1985 Group leader, Max-Planck Institute for Psychiatry, Munich

1978-1979 Research Fellow, Dept. Neurobiology, Harvard Medical School

1978 Lecturer, University of Basel

1974-1978 Postdoc, Biocenter Basel

1973 PhD in Zoology

LAB DESCRIPTION

With his group in Zurich *Martin Schwab* discovered the existence of potent nerve fiber growth inhibitory factors which are present in the adult brain and spinal cord. This new concept was rapidly adopted by the neuroscience community and became the basis of many studies on regeneration and repair after spinal cord and brain injuries in many laboratories worldwide.

An important further breakthrough was the demonstration that antibody-mediated neutralization of one of the most potent neurite growth inhibitory factors, *Nogo-A*, lead to long distance regeneration of injured nerve fibers in the rat spinal cord and to greatly improved functional recovery. **These results overthrew the dogma that the adult mammalian spinal cord and brain would be unable to regenerate**. Intense rehabilitation training was shown to further enhance the structural and functional repair processes.

Today, *anti-Nogo-A* immunotherapy is in clinical trials and is widely seen as one of the most advanced and promising new therapeutic approaches to improve patients' lives for spinal cord injury, brain injury, stroke and also multiple sclerosis.

Professor
Martin E. Schwab

Switzerland

IRP schellenberg research prize 2016

PUBLICATIONS – MILESTONES

2014, Science: Wahl AS, Omlor W, Rubio JC, Chen JL, Zheng H, Schröter A, Gullo M, Weinmann O, Kobayashi K, Helmchen F, Ommer B, Schwab ME
Neuronal repair. Asynchronous therapy restores motor control by rewiring of the rat corticospinal tract after stroke.

2006, Nature Medicine: Freund P, Schmidlin E, Wannier T, Bloch J, Mir A, Schwab ME and Rouiller E
Nogo-A-specific antibody treatment enhances sprouting and functional recovery after cervical lesion in adult primates.

2000, Nature: Chen MS, Huber AB, van der Haar ME, Frank M, Schnell L, Spillmann AA, Christ F and Schwab ME
Nogo-A is a myelin-associated neurite outgrowth inhibitor and an antigen form monoclonal antibody IN-1.

1990, Nature: Schnell L and Schwab ME
Axonal regeneration in the rat spinal cord produced by an antibody against myelin-associated neurite growth inhibitors.

2018

PROFESSOR MAGDALENA GÖTZ

BIO EXPRESS

- **2020** European Research Council (ERC) advanced grant
- **2020** Jakob-Herz-Prize, Friedrich-Alexander Universität, Erlangen-Nürnberg
- **2019** Mendel Medaille Leopoldina Academy
- **2018** IRP Schellenberg Research Prize
- **2017** Roger de Spoelberch Prize
- **2017** Member of the Bavarian Academy of Sciences
- **2016** Member of the Royal Academy of Pharmacy of Spain
- **2013** European Research Council (ERC) advanced grant
- **2007** Gottfried-Wilhelm Leibniz Award

LAB DESCRIPTION

Our lab investigates the basic molecular and cellular mechanisms for stem cell maintenance and stem cell differentiation. On this basis, it develops approaches for the replacement of degenerated cell types, either by activation of endogenous stem cells or by re-programming other endogenous cells for repair.

Our aim is also to improve understanding of how specific functions of the nervous systems come into being, to elucidate the electrophysiological and molecular mechanisms of aberrant function within the nervous system that lead to disease and to establish strategies targeted at repairing these aberrant functions by means of pharmacological, molecular or cell replacement interventions.

Professor
Magdalena Götz

Germany

IRP schellenberg research prize 2018

PUBLICATIONS – MILESTONES

2020, **Cell Stem Cell**: Kjell et al
2020, **The EMBO Journal**: Esgleas et al
2019, **Neuron**: Mattugini et al
2019, **Nature**: Camargo et al
2018, **Cell Stem Cell**: Petrik et al
2018, **Embo Reports**: Frik et al
2018, **Glia**: Mattugini et al
2017, **Neuron**: Falk et al
2016, **Genes & Development**, Ramesh et al
2016, **Nature**: Falkner et al
2016, **Cell Stem Cell**: Gáscon et al
2015, **Glia**: Sirko et al
2015, **Cell Stem Cell**: Masserdotti et al
2013, **Cell**: Stahl et al
2013, **Cell Stem Cell**: Sirko et al
2013, **Nature Neuroscience**: Bardehle et al
2013, **Nature Genetics**: Cappello et al

2018

PROFESSOR CLAIRE JACOB

BIO EXPRESS

2019 Founder AdRegeneer, Basel, Switzerland

2018 IRP Schellenberg Research Prize

Associate Professor of Cellular Neurobiology at Johannes Gutenberg University Mainz, Germany

2012 Marie-Heim Vögtlin Prize

Swiss National Science Foundation Professor, University of Fribourg, Switzerland

2004 Spinal cord injury

2003-2012 Postdocs, UCSF and ETHZ

LAB DESCRIPTION

Professor Jacob and her team work at reprogramming the response of myelinating cells to traumatic injuries of the nervous system to allow damaged axons to regrow and to recover their myelin sheath. The myelin sheath is critical for the function of many neurons and for their protection against degeneration, however it creates an unfavourable environment for axonal regrowth in case of injury. For this reason, it is essential to get rid of the myelin sheath around damaged axons to allow them to regrow.

The Jacob group uses chromatin-remodelling enzymes and other factors to increase the plasticity of myelinating cells after injury and induce a pro-regenerative behaviour of these cells towards damaged axons.

From this work, several strategies have been identified to promote axonal regrowth and remyelination of regenerated axons. *Professor Jacob* and her partner Thomas Meier have recently founded AdRegeneer, a start-up that will further develop these strategies to make regenerating medicine available for patients with traumatic injuries.

Professor
Claire Jacob
Switzerland

IRP schellenberg research prize 2018

PUBLICATIONS – MILESTONES

2020, **Nature Communications**: Duman et al.

2019, **Cell Reports**: Vaquié et al.

2017, **Nature Communications**: Brügger et al.

2015, **PLOS Biology**: Brügger et al.

2014, **The Journal of Neuroscience**: Jacob et al.

2011, **Nature Neuroscience**: Jacob et al.

2010, **Science**: Cotter et al.

2008, **The Journal of Cell Biology**: Jacob et al.

2020

PROFESSOR PATRICK FREUND

BIO EXPRESS

- **2020** IRP Schellenberg Research Prize
- **2019** Eccellenza Professorship
- **2018** PD, University of Zürich
- **2015** MD, University of Zürich
- **2014** MSc Medicine, University of Zürich
- **2013** Group Leader of Neuroimaging at Balgrist Hospital
- **2008-2010** Post-Doc at Wellcome Trust Centre for neuroimaging, London
- **2008** PhD in Neuroscience
- **2005** MSc Biology

LAB DESCRIPTION

The focus of previous and current research projects is to better understand how the anatomy and the function of the spinal cord and the brain change in neurological disorders involving the spinal cord.

The main goal is to develop neuroimaging biomarkers that are sensitive and accurate in predicting functional outcome in order to register more quickly the impact of therapeutic treatments and rehabilitative interventions.

The development and application of high-resolution MR sequences and post-processing imaging pipelines are therefore a major area of our research. Other areas of interest are to explore the mechanisms underlying cortical and spinal plasticity during learning.

Furthermore, we aim to facilitate the translation from animal models to humans by conjointly applying the same neuroimaging protocols in animals and post-mortem human spinal and brain tissue and correlating the latter findings with histological markers of repair and degeneration.

Professor
Patrick Freund

Switzerland

IRP schellenberg research prize 2020

PUBLICATIONS – MILESTONES

2020, **The Lancet Neurology**: P. Freund, M. Seif, N. Weiskopf, K. Friston, M. G. Fehlings, A. Thompson, and A. Curt *MRI in traumatic spinal cord injury: progress from a clinical assessment tool to a neuroimaging biomarker.*

2019, **Nature Reviews Neurology**: G. David, S. Mohammadi, A. Martin, J. Cohen-Adad, N. Weiskopf, A. Thompson, P. Freund *Spinal cord pathology in traumatic and non-traumatic spinal cord injury.*

2018, **Neurology**: G. Ziegler, P. Grabher, D. Altmann, M. Hupp, J. Ashburner, K. Friston, N. Weiskopf, A. Thompson, A. Curt, and P. Freund; *Progressive neurodegeneration following spinal cord injury: Implications for clinical trials.*

2017, **Annals of Neurology**: E. Huber, R. Suter, P. Lachappelle, A. Curt, and P. Freund; *Are midsagittal tissue bridges predictive of outcome after cervical spinal cord injury?*

2015, **Annals of Neurology**: P. Grabher, M. Callaghan, J. Ashburner, N Weiskopf, A. Thompson, A. Curt, and P. Freund; *Tracking sensory system atrophy and outcome prediction after spinal cord injury.*

2020

PROFESSOR JONAS FRISÉN

BIO EXPRESS

2020 IRP Schellenberg Research Prize

2017 Eric K Fernström Nordic Prize

2011 Member of the Royal Swedish Academy of Sciences

2008 Member of the Nobel Assembly

2005 Member of the Royal Swedish Academy of Engineering science

2001 Tobias Foundation Professor of Stem Cell Research, Karolinska Institute

1995-1997 Postdoctoral fellow, Princeton, USA

1993 PhD in Neuroscience

1991 MD

LAB DESCRIPTION

Research in the Frisén lab focuses on nervous system plasticity in health and in response to pathology, with a longstanding interest in spinal cord injury and the role of scar tissue formation.

We have identified two small cell populations, ependymal cells and pericytes, as key players in scar tissue formation. Ependymal cells are the neural stem cells of the adult spinal cord and they mainly generate astrocytes, which reinforce the structure of the tissue after spinal cord injury and limits the damage and neuronal loss. Pericytes gives rise to the fibrotic component of the scar that seals the lesion, but inhibits axonal regeneration.

In our current work we aim to find ways to modulate the endogenous response to spinal cord injury, both by directing the differentiation of cells generated by ependymal stem cells and by reducing the axonal regrowth inhibiting effect of pericyte-derived fibroblasts, to promote regeneration and functional recovery.

Professor
Jonas Frisén

Switzerland

IRP schellenberg research prize 2020

PUBLICATIONS – MILESTONES

2014, **Science**: Dias, D.O., Kim, H., Holl, D., Werne Solnestam, B., Lundeberg, J., Carlén, M., Göritz, C. and Frisén, J. *Reducing pericyte-derived scarring promotes recovery after spinal cord injury.*

2013, **Science**: Sabelström, H., Stenudd, M., Reu, P., Dias, D., Elfineh, M., Damberg, P., Göritz, C. and Frisén, J. *Resident neural stem cells restrict tissue damage and neuronal loss after spinal cord injury in mice.*

2011, **Science**: Göritz, C., Dias, D., Tomilin, N., Barbacid, M. and Frisén, J. *A pericyte origin of spinal cord scar tissue.*

2008, **PLoS Biology**: Meletis, K., Barnabé-Heider, F., Carlén, M., Evergren, E., Tomilin, N., Shupliakov O. and Frisén, J. *Spinal cord injury reveals multilineage differentiation of ependymal cells.*

WHO WILL BE NEXT?

The IRP Schellenberg Research Prize is regarded as Nobel prize among the paraplegia research community. If you also would like to be part of these outstanding and successful scientists please apply or nominate someone you know until October 31.

See also our website: www.irp.ch/irp-schellenberg-research-prize

IMPRESSUM

Editor: IRP Foundation, Switzerland 2020
Design: L'ADMP – Damien Gallay, Nyon
Text and Content: Fritz Vischer, freelance writer, Therwil and IRP Secretariat
Illustrations: Dreamstime, 123RF, Depositsphotos, Adobe Stock
Printing: ABP-Project

IRP GENEVA
Rue François-Perréard 14
CH-1225 Chêne-Bourg - Geneva
Tel. +41 (0)22 349 03 03
info@irp.ch

IRP ZÜRICH
Seestrasse 19
CH-8002 Zürich
Tel. +41 (0)43 268 00 90
research@irp.ch

BANKING DETAILS
Banque Pictet & Cie SA
Account number T-566191.001
CCP 12-109-4
IBAN : CH48 0875 5056 6191 0010 0

I R P

www.irp.ch