WINNING AGAINST PARAPLEGIA STEP BY STEP

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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 Alan 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

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 commitment 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 Committee
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.
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 limbs 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.
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.

PUBLICATIONS – MILESTONES


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 overcome 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 Neuroprosthetic Project of Professor Grégoire Courtine, who is also a winner of the IRP Schellenberg Research Prize.

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 Walzand, Zürich
2005 IRP Schellenberg Research Prize
2005-2010 Head of Neuro-Urology, Paraplegic Centre Balgrist, Zürich
1987 PhD in Medicine

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Since 2012 Head Physician Neuro-Urology, Lausanne University Hospital, Lausanne (CHUV), Associate Professor, Lausanne University
Since 2004 Honorary Professor, Zürich University
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2005 IRP Schellenberg Research Prize
2005-2010 Head of Neuro-Urology, Paraplegic Centre Balgrist, Zürich
1987 PhD in Medicine

2005

Professor Brigitte Schurch Switzerland


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.

**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.


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

2006 IRP Schellenberg Research Prize

1998-2009 Professor of Neurobiology – KI

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

1970 PhD, Neuroscience – KI

**BIO EXPRESS**

Professor Lars Olson

Sweden

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

2006 IRP Schellenberg Research Prize

2000-2004 Chair, Department 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.
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.
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 therapy promotes the growth of new neuronal connections 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 optimized for these applications.

PUBLICATIONS – MILESTONES

2018, Nature Wagner et al.
2018, Nature Neuroscience Formento et al.
2016, Nature Casagrosso et al.
2015, Science: Minov I. et al.
2014, Cell: Takasaki A. et al.
2014, Neuron: Borton DA. et al.
2010, IRPschellenberg Research Prize
2008, University of Zurich
2005-2007 Christopher Reeve Foundation

2010, Rolex Award for Enterprise
2010, Man of the Year, Canton of Vaud, Switzerland
2008-2009 Swiss National Science Foundation Award
2008, European Research Council (ERC) Consolidator grant awarded
2008, Founder, GTX medical, Lausanne / Eindhoven
2007, Debiopharm Prize
2001, Associate Professor at IRP Chair in Spinal Cord Repair EPFL
2001, IRP Schellenberg Research Prize
2000, University of Zurich
2008, Christopher Reeve Foundation

2019, relax Award for Enterprise
2019, Man of the Year, Canton of Vaud, Switzerland
2019, Geirg and Susanne Klein-Vogelbach Schellenberg Award

2018, Nature Wagner et al.
2018, Nature Neuroscience Formento et al.
2016, Nature Casagrosso et al.
2015, Science: Minov I. et al.
2014, Cell: Takasaki A. et al.
2014, Neuron: Borton DA. et al.
2014, Neuron: Borton DA. et al.
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 unraveling 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.

PUBLICATIONS – MILESTONES


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.

PUBLICATIONS – MILESTONES


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.
The research laboratory of the Spinal Cord Injury Center at the Balgrist University Hospital, University of Zurich, 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 stem cells into the cord of patients with SCI).

PUBLICATIONS – MILESTONES


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


IRP Schellenberg Research Prize

- Since 2009: Full Professor for Paraplegiology and Medical Director, Balgrist University Hospital, Zurich
- 2010-2019: 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

2012 IRP Schellenberg Research Prize
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.

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.

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.

PUBLICATIONS – MILESTONES

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

Neural coupling of cooperative hand movements: A reflex and fMRI study.

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

Locomotion in stroke subjects: Interactions between unaffected and affected sides.

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

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- Plasticity mechanisms after stroke in juvenile and adult animals.
- Circuit development defects in Rett syndrome, an incurable developmental condition that mostly affects young girls.

**PUBLICATIONS – MILESTONES**


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

The Verhaagen lab focuses 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 perineuronal 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.

PUBLICATIONS – MILESTONES


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 overturned 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.


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 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.

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: Cotar et al.

LAB DESCRIPTION

2018, Founder AdRegeneer, Basel, Switzerland
2018, IRP Schellenberg Research Prize
2012, Marie-Helm Vogtlin Prize
Swiss National Science Foundation Professors University of Fribourg, Switzerland
2004, Spinal cord injury
2003-2012, Postdocs, UCSF and ETHZ

Professor Claire Jacob
Switzerland
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.

PUBLICATIONS – MILESTONES


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

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 limit the damage and neuronal loss. Pericytes give 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.

PUBLICATIONS – MILESTONES


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