

University Neurocenter Bern

Annual Report 2017



Imprint

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Printing: 2018, Vögeli AG, Langnau

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University Neurocenter Bern

Annual Report 2017

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Foreword

Various reasons prompted the decision of the Departments of Neurology, Neurosurgery, Pediatrics with the field of Neuropediatrics, the Department of Diagnostic and Interventional Neuroradiology and the University Bern Psychiatric Services (UPS) to establish the University Neurocenter Bern in 2012, and to expand and strengthen the cooperation that had already existed for decades. The decision to recognize “Neuro” as the focus of both the Inselspital, Bern University Hospital and the Faculty of Medicine of the University of Bern has translated a common vision and strategy into a nationally leading center with an international reputation.

Over the past five years, several excellent interdisciplinary programs have been carried out, such as the emergency care of stroke patients and the outpatient assessment and treatment of diseases of the nervous system in the “Outpatients Neurological Center (ONC)”. The combination of

patient-oriented, individualized care with targeted use of highly specialized, modern approaches in diagnosis, therapy, prevention, rehabilitation and the study of diseases of the nervous system distinguish the University Neurocenter Bern.

**In the past five years
several excellent interdisciplinary programs
have been conducted.**

This annual report is intended to provide an insight into the interdisciplinary services of our center and to highlight some of the landmarks of the year 2017, such as the opening of a state-of-the-art operating area, the 25th anniversary of thrombolytic treatment for stroke, the expansion of the neurorehabilitation unit and the 6 million francs grant awarded by the University of Bern for sleep research.

On behalf of the Board of Directors of the University Neurocenter Bern, I would like to thank all employees in the medical teams, in nursing, administration and in research for their excellent performance and invaluable cooperation. Special thanks go to the management of the Inselspital and to the management of the University of Bern for the benevolent support of our center.

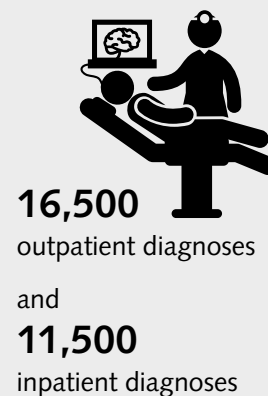
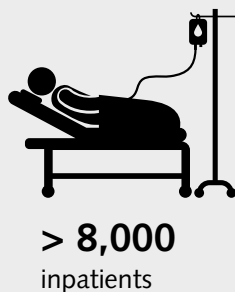


*Prof. Dr. med. Claudio L. A. Bassetti,
Chair of the University Neurocenter
Bern*

Five Disciplines – One Goal



Facts and Figures



Highlights



High-precision Operating Area

In February 2017, the Inselspital was the first hospital in Switzerland to commission a state-of-the-art surgical area. It can be used interdisciplinarily and is equipped with all three major imaging modalities, p. 10



25 Years of Stroke Therapy

Twenty-five years ago, doctors at the Inselspital laid the foundation for thrombolysis, which is now considered as the standard approach in the acute treatment of stroke, p. 12



Early Rehabilitation

Thanks to the expansion of the acute neurorehabilitation facilities at the Inselspital to include neurological-neurosurgical early rehabilitation in January 2017, the graduated care model can be implemented in neurorehabilitation, p. 14



Sleep Research: "IFK Grant"

In 2017, the University of Bern intensified its research and promoted the sleep project "Decoding Sleep: From Neurons to Health & Mind" with funding of 6 million francs through one of three new Interfaculty Research Cooperations (IRC), p. 33

Operations in the Operating Theater of the Future

Since mid-February 2017, three new operating theaters with integrated computed tomography (CT) and magnetic resonance imaging (MRI) have been available to all surgical departments in the Intensive Treatment, Emergency and Operation Center (IEO) at Inselspital. Together with the hybrid operating theater, which allows intraoperative angiography, they form a surgical facility that is unique in Switzerland.

The project "Operation with imaging" was carried out in two phases. The hybrid operating area (phase 1) in the IEO has been in operation since September 2013 and provides for intraoperative angiography. The high-precision operating area (phase 2) includes three new operating theaters with integrated CT and MRI. The main use of the high-precision operating area is for neurosurgery. It is also used by orthopedics, each in close cooperation with neuroradiology, radiology and anesthesia. The flexible and economical multi-room concept

of the high-precision operating area enables the participating disciplines to benefit from substantial synergies in the use of cost-intensive imaging. For example, the MRI system and its operating facilities are not located directly in the operating theater, but in two separate rooms with direct access to the operating theater. This allows the system to be used for the examination of patients outside the surgical area. The high-precision operating area is also equipped with three inlets and outlets, several support rooms and utility rooms.

For the benefit of the patients

The Inselspital is the first hospital in Switzerland to make the new methods available across disciplines. With intraoperative tomographic and three-dimensional imaging techniques and the associated navigation technology, surgeons can perform image controls directly during surgery and take corrective action if necessary. This can increase the quality of interventions, reduce the frequency of revision surgery and postoperative examinations and transport requirements.

3

new operating theaters with integrated computer tomography and magnetic resonance imaging

cost of around
19,5
million CHF

2

surgical specialities

all 3

major imaging modalities

1

hybrid operating theater with intraoperative angiography

increased
patient safety

Increased competitiveness

The high-precision operating area is a flagship project whose reach extends far beyond the borders of the canton – be it to patients, referring physicians or specialists. The high-precision operating area opens up new possibilities and approaches for cutting-edge clinical and technical research. And finally, with its state-of-the-art technology, it paves the way for molecular imaging and robotic surgery.

With the establishment of the high-precision operating area the Inselspital is playing a pioneering role. It is the first hospital in Switzerland with a state-of-the-art surgical area that can be used interdisciplinarily by different fields of expertise and that is equipped with all the latest imaging technology.



25 Years of Stroke Therapy

The Inselspital is a pioneer in stroke therapy. In 1992, it became the first Swiss center to offer thrombolytic treatments and to initiate the systematic development of a stroke management team. Today, the Inselspital has the largest stroke center in Switzerland.

In Switzerland, around 16,000 strokes occur each year. A stroke is the most common cause of acquired disability. After heart and tumor diseases, stroke is the third leading cause of death and an important risk factor for dementia. For a long time, medicine was ineffective in treating acute stroke. Only in the early 1990s was there a breakthrough, with the development of thrombolytic agents for dissolving the blood clot. This increased the chances of surviving the stroke (without disability) fourfold.

The thrombolytic agent can be administered in an intravenous infusion as well as through an arterial catheter via the inguinal artery directly to the clot in the cerebral vessel. This method, known as thrombolysis, was introduced at the Inselspital 25 years ago and further developed in close collaboration with other Swiss and international stroke centers. It is now the standard in the acute treatment of stroke (see page 22 of this report).

Catheter intervention saves even more lives

For occlusions in larger cerebral vessels, intravenous thrombolysis is often insufficient to completely clear the blood clot. The physicians at the Inselspital were also

actively involved in the development of mechanical thrombectomy. In stent retriever thrombectomy, a catheter is passed through the main artery in the groin to the occluded cerebral vessel and the blood clot is pulled out. Combined with intravenous thrombolysis, around 90 percent of the closed vessels can be reopened.

Almost half of the survivors of a stroke still become disabled. Researchers at the Inselspital are therefore continuing to work to improve stroke management. Currently, the University Neurocenter Bern is conducting a major international study to further optimize therapy to speed up the treatment process, further improving the patients' chances of recovery.

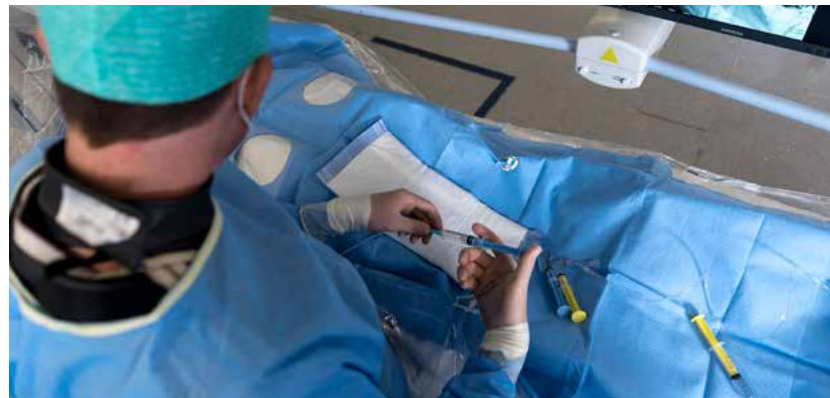
Timeline

- Until the 1990s: no effective stroke therapy
- 1992: Development of thrombolysis
- 2010: Development of stent-retriever thrombectomy





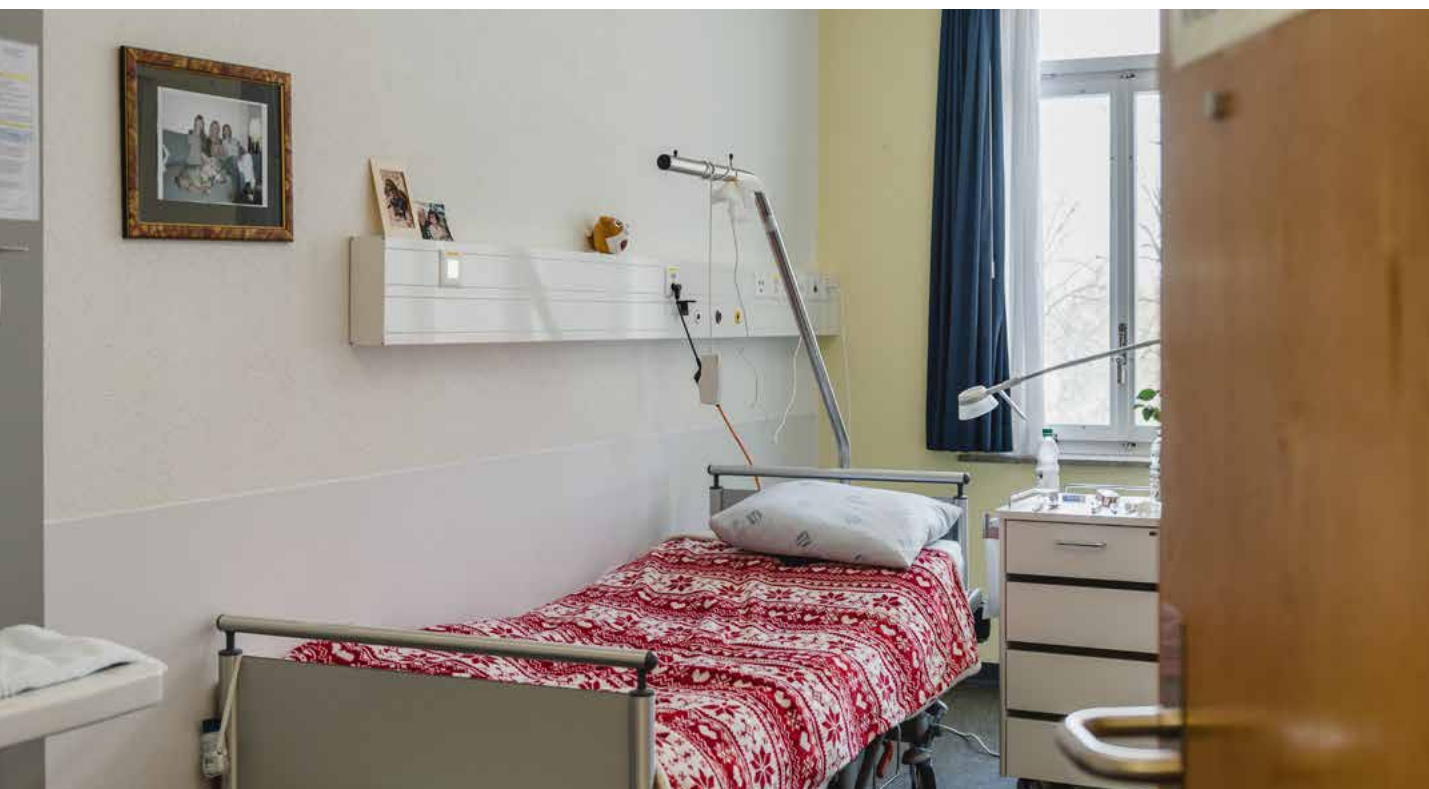
Using angiography, blood clots are removed from the brain with the catheter.



Early Rehabilitation Completes the Services Offered

Since January 2017, eight bright and modern single rooms have been expanding the range of acute neurorehabilitation services, so that the graduated care model of neurorehabilitation can be fully implemented.

One of eight newly renovated single bedrooms in the early rehabilitation unit.



> 70
beds in the
neurorehabilitation unit

> 500
inpatients treated at the
neurorehabilitation unit

300
outpatients treated at the
neurorehabilitation unit

In mid-January 2017, after thorough renovation of the Anna-Seiler-Haus, which is situated in the grounds of the Inselhospital, the early rehabilitation service commenced as planned. It includes eight video-monitored single rooms for patients with neurorehabilitation needs in the acute phase of their illness. The eight beds for early rehabilitation extend the existing range of acute neurorehabilitation services offered in the Anna-Seiler-Haus. Specialists are especially necessary for this new service: specific and increased requirements apply to the entire interdisciplinary treatment team. The criteria for this particular patient population are clearly defined in the tariff schedules and a specific scoring system is used for the classification of the patients eligible for this type of care.

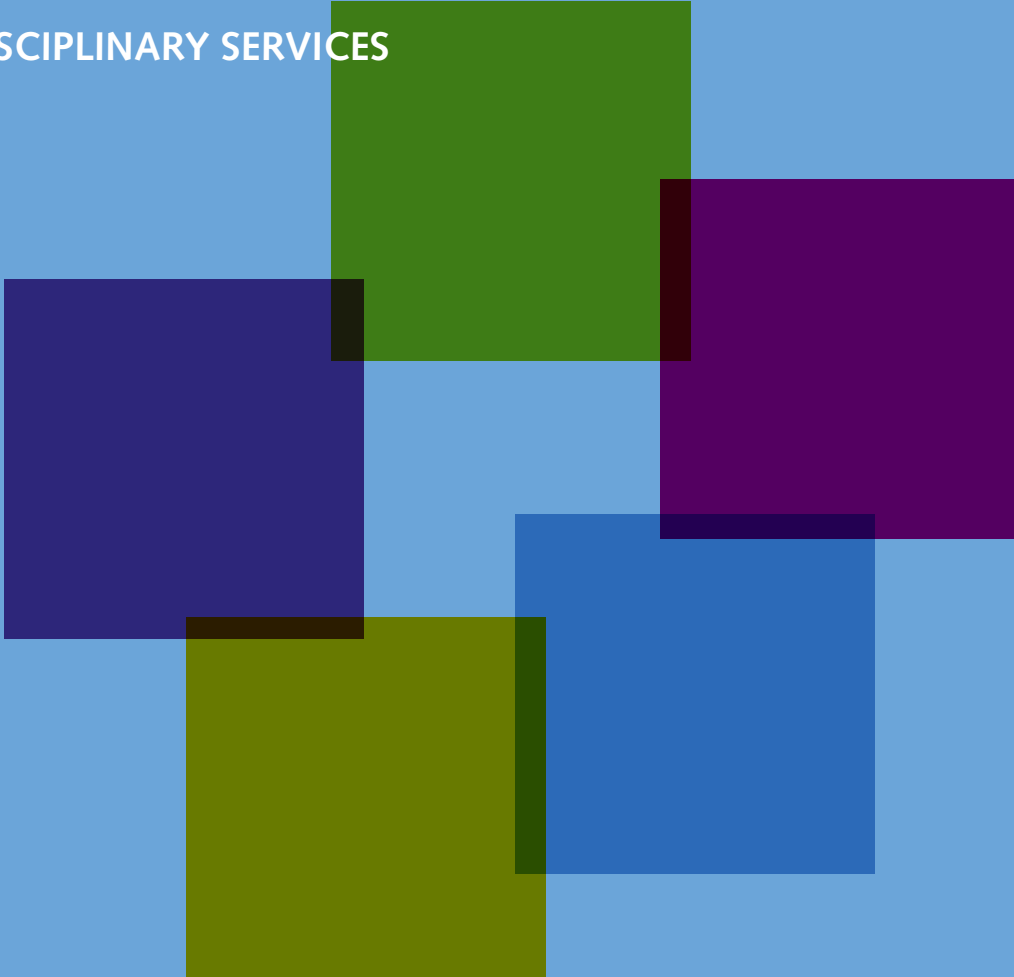
From acute treatment to reintegration into everyday life

The eight additional beds for early rehabilitation are part of the provision for acute neurorehabilitation in the Anna-Seiler-Haus of the Inselhospital. Their availability ensures the implementation of the graduated care model for neurorehabilitation. Patients with very severe disabilities begin their rehabilitation in the acute neurorehabilitation unit in the Anna-Seiler-Haus. At this early stage of their illness, they often require the highly specialized medical services of the University Hospital. After acute neurorehabilitation, patients are usually referred for further inpatient neurorehabilitation at Spital Riggisberg, which is also part of the Insel Gruppe, or at another institution. In total, the

Department of Neurology now has more than 70 beds for neurorehabilitation patients at the Inselhospital and Spital Riggisberg.

Patients who need further treatment after their inpatient stay have access to outpatient therapies (neuropsychology, physiotherapy, speech therapy or ergotherapy) again at the Anna-Seiler-Haus.

INTERDISCIPLINARY SERVICES



Dementia



At the Interdisciplinary Memory Clinic Bern, an interdisciplinary team of specialists sees around 300 dementia patients and their relatives each year. The team specializes in outpatient diagnosis and treatment of cognitive deficits.



300
outpatients

In Switzerland, there are around 25,000 new cases of dementia each year. Most of those affected do not receive a formal diagnosis of dementia. This makes it difficult for them to access specific support and therapy. The diagnosis of dementia reduces the psychological burden of those affected, because the observed symptoms, which could be hard to account for before the diagnosis, can be better explained. People who think they have symptoms of dementia often suffer from depression but there are good treatment options available.

Outpatient diagnosis and treatment of cognitive deficits

The interdisciplinary nature of dementia consultations at the University Neurocenter Bern allows the detailed characterization of dementia. For this purpose, specialists in cognitive testing, cerebrospinal fluid (CSF) diagnostics and imaging have access to several examinations that can comprehensively diagnose dementia. Thanks to the interdisciplinary collaboration, differential diagnoses from specialists in the disciplines represented – geriatric

psychiatry, neurology, neuroradiology and geriatrics – and the timely referral for further clarifications can be taken into account. In addition to classic anti-dementia drugs, neurology offers therapies for speech-dominant dementia, and geriatric psychiatry offers various forms of memory training and support, including for aggressive behaviors that can occur in people with dementia.

Research on dementia

To advance research on dementia, in addition to our clinical activities, we are also involved in a large number of research projects with patients who have cognitive impairments. We are exploring the mechanisms of learning and memory by observing the associated changes in neurotransmitters and activity using imaging techniques. Non-invasive brain stimulation is intended to positively enhance these processes and thus to improve the cognitive performance of dementia sufferers.

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Epilepsy



Epilepsy is one of the most common neurological diseases. Epileptic seizures are dangerous. In particular, the associated loss of control causes great suffering. The aim of the epilepsy team is to improve seizure control and the quality of life of those affected through comprehensive diagnosis, therapy, and care.



2,000

outpatient consultations

6,000

EEG examinations,
including **1,500** in children

50

pre-epilepsy surgery examinations,
including more than **10** with
intracranial electrodes

100

patients with inpatient, long-term
video EEG over several days

The epilepsy center is an integral part of the University Sleep-Wake-Epilepsy-Center Bern (SWEZ) of the Inselspital. It offers comprehensive care for adult epilepsy sufferers – and in collaboration with neuropediatrics, also for children. This care begins with the individual diagnosis, which involves first of all a detailed conversation with the patient and her or his relatives. This is followed by technical studies using state-of-the-art methods that include a non-invasive record of the brain's electrical activity (electroencephalogram, EEG) and imaging (magnetic resonance imaging, MRI). On the basis of the interview and the technical examinations, the doctors in the epilepsy team make the most accurate diagnosis possible and then develop an individually adapted treatment plan.

Epileptology and pre-epilepsy surgery investigations

Our primary goal is to achieve complete freedom from seizures while maintaining the highest possible quality of life. This ambitious goal can only be achieved through optimal and patient-specific combinations of drug and non-drug therapies. At SWEZ, all of these therapies are offered – in particular, the wide range of non-pharmacological measures is exceptional. On the one hand, the possibility of pre-surgical evaluation with extra- and intracranially recorded long-term video EEG is noteworthy. The aim is to precisely locate the epileptogenic brain areas and check that they can be surgically removed without negative neurological consequences. In addition, detailed sleep studies allow existing seizure-promoting conditions, such as sleep-related breathing disorders, to be recognized and successfully treated. Likewise, the uniquely close collaboration between epileptologists and sleep therapists makes it possible to relieve daytime fatigue and drowsi-

ness, which is very common even in seizure-free epilepsy patients, thus contributing to a better quality of life.

For our applied and patient-oriented research, we are working together with neurosurgeons, neuroradiologists and physicists to develop methods that enable improved analysis of the electrical activity of the human brain.

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Stroke



At the Stroke Center of the Inselspital, an interprofessional and interdisciplinary team of specialists cares for 3,000 people affected by stroke each year. As the largest stroke center in Switzerland's network, it has a long history and is one of the world's leading stroke centers.



The Stroke Center of the Inselspital is one of ten stroke centers in Switzerland. In 2013 it was the first university center to be certified according to the guidelines of the Swiss Federation of Clinical Neuro-Societies. It plays a leading role in this highly specialized field of medicine in Switzerland, not least because of the excellent education and training it provides, and its internationally recognized research program. Since 2014, the European Stroke Winter School has been held regularly at the Inselspital. This allows our stroke specialists to pass on their knowledge and experience to young neurologists and neuroradiologists from all over Europe to improve stroke therapy across the continent.

The Stroke Center of the Inselspital has been continuously expanding in recent years. It now has a specialized stroke unit with twelve beds. Together with the outpatient consultations, an experienced, efficient and motivated team looks after more than 3,000 people affected by stroke each year. Children, under the supervision of a neuropediatrician, are also treated.

Decades of experience

Back in 1992, the Inselspital was the first Swiss center to offer thrombolytic treatments and to systematically establish a stroke treatment team (see page 12 of this report). Today, the Stroke Center is staffed by an interprofessional and interdisciplinary team of neurologists,

> 1,500

acute stroke patients

> 400

thrombolysis and
catheter interventions

neuroradiologists, neuropsychiatrists, neurosurgeons, emergency physicians, anesthesiologists, intensive care physicians, cardiologists, vascular surgeons, interns, rehabilitation specialists, medical-technical assistants, specialist nurses, physiotherapists, speech- and occupational therapists and other professionals.

Hand in hand from emergency to rehabilitation

When treating an acute stroke, smoothly coordinated collaboration between the team members is crucial. Diagnostic and interventional neuroradiologists play a central role in the treatment of stroke patients. With their state-of-the-art equipment, neuroradiologists carry out imaging diagnostics and acute catheter-based interventions via the vascular system to remove blood clots in the brain – in patients ranging from toddlers to adults. Neurosurgeons are always available when needed. The care of patients affected by stroke is managed in close cooperation with the intensive care unit and the neurological-neurosurgical monitoring station (Neuro-Intermediate Care). During neurorehabilitation, stroke victims – both children and adults – receive optimized treatment (see page 14 of this report).

Center function and cooperations

The Stroke Center of the Inselspital cooperates with numerous regional and cantonal hospitals in the canton of Bern and with various institutions in other cantons, including through the use of teleradiology.

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Watch our film “Diagnosis Stroke – When Every Minute Counts”.

Brain Tumor Therapy



In 2017, the University Cancer Center Inselspital, to which the Neuro-oncological Center belongs, was successfully certified. Certification is an acknowledgment of the high quality of the interdisciplinary team and also of its innovative strength, as the example of the “HORA0” project in the field of brain tumors shows.

The Neuro-oncological Center is one of eleven organ cancer centers at the Inselspital. Together they form the University Cancer Center Inselspital (UCI), which was successfully certified in March 2017 in accordance with the guidelines of the German Cancer Society. In four years, the UCI is to become a Comprehensive Cancer Center, which is why the clinical research will be even more actively promoted.

The Neuro-oncological Center is staffed by an interdisciplinary team of neurosurgeons, neuroradiologists, neuro-pediatricians, medical oncologists, radio-oncologists and psychologists who work closely together to offer patients the best brain tumor therapy possible. The neuropathology department is equipped with the entire range of methods for modern and comprehensive diagnosis of brain tumors – including the increasingly important molecular genetic investigations and CSF cytology. Neuroradiologists use magnetic resonance imaging (MRI) to perform initial investigations of brain tumors and brain tumor progression. These investigations are increasingly complemented by MRI protocols such as MR perfusion imaging, MR spectroscopy (MRS), diffusion-tensor imaging (DTI) and functional MRI (fMRI). For the treatment of brain

tumors, our specialists ensure that the patient receives the best possible therapy – be it an operation, pharmaceutical therapy, radiotherapy or a combination. The therapeutic decision is made in a personal consultation with the patient.

Tumor boards for quality assurance

In the Neuro-oncological Tumor Board, specialists from various disciplines and professional groups discuss each case individually in order to define the best possible diagnostic or therapeutic procedure for each patient. Each patient is considered holistically.

Research support from crowdfunding

In August 2017 a crowdfunding campaign was launched for the first time ever at the Inselspital. With the project “HORA0”, the Department of Neurosurgery launched its campaign on the Swiss crowdfunding platform wemakeit. Its success was overwhelming: after only 29 days, the target of 50,000 francs had been reached. By the end of the campaign, more than 69,000 francs had been raised. The goal of “HORA0” is the development of a stronger microscope, using which neurosurgeons can better recognize brain tumors. Phase two of the project will be implemented in 2018: the HORA0 team is preparing a global

crowdsourcing competition between research and development teams. The money collected will be awarded to the winner of the competition.

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Specialties/Diseases →
Neurosurgical Diseases →
Brain Tumors



Successful certification of the Neuro-oncological Center at the Inselspital (from left to right: Prof. Dr. med. Jürgen Beck, Prof. Dr. med. Andreas Raabe, Chairman of the Department, and Prof. Dr. med. Philippe Schucht).

> 400

cerebral interventions to treat gliomas,
meningiomas, metastases, benign tumors, etc.

> 1,000

tumor board reviews

Cerebrospinal Fluid Dynamics



The University Neurocenter Bern is concerned with clinical and scientific work on disorders of cerebrospinal fluid (CSF) dynamics. This includes both the spontaneous loss of spinal fluid and idiopathic pressure build-up. Diagnostic and therapeutic concepts have been developed that are unique in this field, and which for the first time treat the underlying pathology – not just the symptoms.

> 400
diagnostic workups

> 50
low CSF pressure
operations (largest
European series)

> 10
sinus stents for
intracranial hypertension



Spontaneous cerebrospinal fluid (CSF) hypotension syndrome

Spontaneous CSF loss is characterized by severe headache, which worsens when standing and improves when lying down, together with nausea, neck stiffness and many other symptoms. The actual cause of the spontaneous CSF loss syndrome was unknown until recently. Many possible causes underlying the syndrome had been discussed in the literature. In 2016, a team of neurosurgeons, neuroradiologists and neurologists from the University Neurocenter Bern achieved a coup: They published the reason and, at the same time the solution, for sudden CSF loss. More than 400 patients have since been diagnosed using a diagnostic protocol developed in Bern according to which they are examined and the presence of a CSF leak is confirmed or excluded. In addition, modifications to examination methods and imaging techniques have been specially adapted to this disease. Thus, the spinal level affected by the leak can now be detected – which is the real diagnostic challenge. The cause of the tear, which is only a few millimeters wide, can also be identified: in 77 per cent of cases it is a tiny microspur, originating from the interver-

tebral disc in the area of the cervical and thoracic spine, which pierces through the outer nerve lining.

The Inselspital has become the national and international reference center for low CSF pressure syndrome. Annually, between 50 and 100 patients referred from Switzerland and across Europe are diagnosed with CSF loss syndrome. More than 50 patients have been operated on and found to have a 93 percent chance of recovery. This is the largest surgical series worldwide in which this condition has been studied.

Hypertensive syndromes (idiopathic intracranial hypertension)

Idiopathic intracranial hypertension is an increased intracranial pressure ($> 20 \text{ cm H}_2\text{O}$), where the underlying cause is not a tumor mass, congestion of the nerves, or inflammation. The increased pressure damages the optic nerve – often in obese women of childbearing age – with effects ranging from blurred vision to blindness. In cases of inadequate response or side-effects of drug therapy, a new, minimally invasive endovascular procedure, so-called sinus stenting, can be used in selected patients. This requires a functional stenosis of the

cerebral sinus, which causes a disruption of venous drainage that is partly responsible for the emergence of the idiopathic intracranial hypertension. The novel transvenous stent insert can be used to remedy the drainage disorder and to relieve the increased intracranial pressure.

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Specialties/Diseases →

Neurosurgical disorders →

CSF circulation disorders

Neurovascular Diseases



The diagnosis, treatment and follow-up of diseases of the blood vessels of the central nervous system are carried out by an interdisciplinary team at the University Neurocenter Bern.

Cerebral aneurysms

Cerebral aneurysms are a focus of the work of the Department of Neurosurgery and the Department of Diagnostic and Interventional Neuroradiology of the University Neurocenter Bern. They offer specialized consultations for those affected by the disease, and can organize check-ups for relatives if needed. Treatment includes endovascular coiling and microsurgical clipping, two complementary options. Aneurysms are also frequently found by chance during other examinations of the head. These incidental findings are discussed in an interdisciplinary manner. Therapy is not always recommended. However, if treatment is necessary, the two options – microsurgery and endovascular treatment – need to be weighed up. This discussion is highly individual and is conducted by the aneurysm board prior to and following patient consultations with members of the neurosurgery or neuroradiology teams.

Arteriovenous malformations

The treatment of arteriovenous malformations is conducted in collaboration between the disciplines of neurosurgery, neuroradiology and radio-oncology. The decision to treat is largely individual and must take into account the location, size and angioarchitecture of the arteriovenous

malformation as well as the risk of endovascular or microsurgical treatment or radiotherapy. In addition, the symptoms, the age of the patient, his or her activity and, where appropriate, the patient's profession must be taken into account. Treatment options include microsurgical extirpation, endovascular embolization, radiotherapy or often a combination of different treatment modalities. The indications and treatment plan are therefore discussed and defined by the interdisciplinary neurovascular board.

Dural arteriovenous fistulas

The treatment indication for dural arteriovenous fistulas depends on the severity of the symptoms and the risk of bleeding due to the rupture of the fistula. The risk of bleeding is mainly related to blood back-flow in the cerebral veins or spinal veins. Therefore, it is important to know the exact vascular anatomy and drainage behavior of a dural arteriovenous fistula in order to determine the treatment and to define a treatment plan. The treatment of dural arteriovenous fistulas involves occlusion of the fistula at the junction with the draining vein, the so-called fistula point, either using microsurgical techniques or endovascularly via the vasculature using catheter techniques.

> 800

cases reviewed by the
aneurysm and arteriovenous
malformations board

> 350

interventions on cerebral and cervical vessels
(patients without strokes)

> 250

cases reviewed by the
carotis/vertebralis board

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Specialties/Diseases →

Neurosurgical diseases →

Cerebral vessels



Schizophrenia/Intensive Psychiatry



With the new Wernicke unit, the University Hospital of Psychiatry and Psychotherapy strengthened its presence at the Inselspital. Several high-level publications in 2017 revealed a specific pathophysiology behind individual symptom dimensions of schizophrenia.



One of the new rooms of the Wernicke unit.

> 3,000
inpatients
treated by the UPS

> 200
beds in the UPS

> 6,000
outpatients
treated by the UPS

On 1 December 2017, the Wernicke unit of the University Hospital of Psychiatry and Psychotherapy of the University Bern Psychiatric Services (UPS) was opened in the grounds of the Inselspital. The unit specializes in care for treatment-resistant depression and complex psychiatric movement disorders. In addition to psychotherapy and pharmacotherapy, the therapeutic spectrum includes the use of noninvasive brain stimulation methods such as transcranial direct current stimulation (tDCS), transcranial magnetic stimulation (TMS) and electroconvulsive therapy (ECT). In addition, patients may undergo deep brain stimulation for treatment-resistant psychiatric disorders (see page 34 of this report). There are now more psychiatric beds available at the Inselspital site, and clinical cooperation with the University Neurocenter Bern is being promoted and intensified.

Successful research

A number of articles on schizophrenia were published in 2017. One study showed that paranoid schizophrenia is specifically associated with increased circulatory blood flow in the amygdala. This increased blood flow visualized by magnetic resonance imaging (MRI) indicates greater activity. In patients without paranoia, the blood flow in the amygdala was unremarkable. The researchers recognized a pathological link between anxiety and paranoia (published in Schizophrenia Research 2017; authors: Dr. Katharina Stegmayer and Prof. Dr. med. Sebastian Walther, with the participation of Prof. Dr. med. Roland Wiest and Prof. Dr. Werner Strik).

Another study examined the interaction of motor areas in the brains of patients with schizophrenia. Individual motor abnormalities were found to be linked to highly specific changes in the brain regions in the motor system. This was the first time that motor

symptoms had been found to be associated with specific pathophysiological changes in schizophrenia patients. The results identified important targets for TMS therapy (published in Schizophrenia Bulletin 2017; authors: Prof. Dr. Sebastian Walther and Petra Viher, assisted by Dr. Katharina Stegmayer and Prof. Dr. Roland Wiest).

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Sleep



Sleep medicine is interdisciplinary according to the maxim of the University Sleep-Wake-Epilepsy-Center Bern (SWEZ). Thanks to this maxim, SWEZ can look back on a very successful year.

In the University Sleep-Wake-Epilepsy-Center Bern (SWEZ), disorders of sleep, wakefulness and consciousness, and epilepsy are diagnosed and treated as well as researched and taught in an interdisciplinary manner.

Comprehensive services with the most up-to-date technologies

The SWEZ offers specialized sleep consultations and a state-of-the-art sleep laboratory for children and adults with neurological sleep disorders (including narcolepsy, restless leg syndrome, sleepwalking, REM sleep disturbances), sleep-related respiratory disorders, insomnia, and circadian rhythm disorders (including in relation to shift work).

Patients with epilepsy and disorders of consciousness are also looked after by the SWEZ specialists. The center

has facilities for extracranial measurements of the electrical activity of the brain (electroencephalogram, EEG) as well as extra- and intracranial long-term EEG recordings in the context of highly specialized pre-epilepsy-surgery examinations, which are carried out in close cooperation with specialists in neuroradiology, neurosurgery and neuropsychiatry. The SWEZ not only has a telemetry station for multi-day continuous EEG recordings, but also offers EEG recordings for emergencies every day of the week and around the clock. Vigilance and driving fitness tests are available for the assessment of patients affected by daytime sleepiness and “microsleep”.

BENESCO: interdisciplinary and networked services

The SWEZ relies on interdisciplinarity: neurologists, pulmonologists, psychi-

atrists, neuropsychiatrists, psychologists, biologists, engineers and physicists all work closely together.

The SWEZ has established the Bern Network for Epilepsy, Sleep and Consciousness (BENESCO), which promotes cooperation with more than 20 Swiss and, more recently, foreign groups and organizes seminars, training courses and research projects.

NeuroTec Center: from the laboratory to the clinic

In December 2017, the Board of Directors of the Swiss Institute for Translational and Entrepreneurial Medicine (sitem-insel AG) approved the NeuroTec Center (NTeC) project. The NTeC is an interdisciplinary platform that tests new methods and devices for the diagnosis, monitoring and treatment of sleep disorders, epilepsy, reha-



bilitation, cognition and movement disorders, resulting from academic and industrial research (public private partnership), and developing them into clinical applications. sitem-insel AG is currently under construction on the grounds of the Inselspital and will open in the spring of 2019.

Research

In 2017, SWEZ groups conducted research on six projects supported by the Swiss National Science Foundation (SNSF). Here, too, the interdisciplinary approach paid off in full: In December, the University of Bern's management approved the project "Decoding Sleep: From Neurons to Health & Mind" as part of the Interfaculty Research Cooperations (IRC). The IRC are guided by the priorities of the University of Bern and the National Centres of Competence in

Research of the SNSF. The IRC sleep project is one of three research collaborations supported by the University of Bern with 6 million francs each. It comprises twelve research projects in the fields of neurology, psychiatry, psychology, pulmonology and basic research.

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Our offer →

University Sleep-Wake-Epilepsy-Center Bern (SWEZ)

> 5,000
consultations

> 1,500
technical "sleep-wake"
examinations

Deep Brain Stimulation



Deep brain stimulation is an example of the professional interdisciplinary activities of the University Neurocenter Bern. All five neuromedical disciplines are involved in the successful implementation of this treatment. In 2017, deep brain stimulation in a patient with depression was successfully performed for the first time.



> 40

deep brain stimulations

In the treatment of movement disorders, such as Parkinson's disease, by means of deep brain stimulation the University Neurocenter Bern can look back on a long tradition: in 1998, the first patient underwent deep brain stimulation here. Meanwhile, the interdisciplinary team, which is made up of all five specialties working at the Center, conducts more than 40 such surgeries each year.

First patient with severe depression

On 31 October 2017, a team of specialists performed the procedure for the first time in a depressed patient. Although the procedure for treating a depressed patient is comparable to that for patients with Parkinson's disease, which has become established over the past decade, deep brain stimulation for psychiatric disorders is still in its infancy.

Only around 150 cases had been published worldwide before the intervention, most of them from studies. Deep brain stimulation comes at the end of a long treatment chain and is the last hope for those affected. It is used in patients who suffer from severe refractory chronic depression after all other treatments, such as disorder-specific psychotherapy, pharmacotherapy and noninvasive brain stimulation procedures, have failed.

Interdisciplinary team with professional expertise

Interdisciplinary cooperation between practitioners of neuromedicine together with the extensive expertise of the University Neurocenter Bern made it possible to apply deep brain stimulation even for treating depression. Other indications include tremor, obsessive-compulsive disorder, epilepsy, dystonia and, as mentioned above, Parkinson's disease. For Parkinson's patients, the neurosurgeons

of the University Neurocenter Bern and engineers from the EPFL Lausanne are developing a mini-electrode that was tested intraoperatively in 2014 for the first time. It eliminates the annoying tremors without causing side-effects such as muscle spasms. The development of deep brain stimulation at the University Neurocenter Bern exemplifies the innovative strength and high professional competence of our specialists.

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Our Offers →

Center for Movement Disorders

Spinal Disorders



The University Neurocenter Bern is a center of competence for spinal disorders. It is characterized by interdisciplinary state-of-the-art medical care, optimized treatment and innovative strength.

The spine provides stability while simultaneously enabling agility. With age, however, wear and tear occur. Back problems are mostly caused by compression of the nerves. It is therefore one of the core competencies of the Department of Neurosurgery to perform spinal decompression for intervertebral disc disease and spinal stenosis. In addition, the entire spectrum of treatment for degenerative, tumorous, inflammatory, and traumatic diseases of the spine (cervical, thoracic and lumbar spine) is offered.

State-of-the-art surgical procedures and invasive pain treatment

At the University Neurocenter Bern, spinal disorders are comprehensively assessed. Neurosurgery works in close collaboration with neuroradiology, neurology, rheumatology, the pain center and orthopedics to diagnose and treat patients with spinal disease. Thus, the physician visits can be optimized for the affected patients. To ensure the best possible treatment for each patient, the specialists exchange information during interdisciplinary case conferences.

For neurosurgery, the operative focus is on minimally invasive and microsurgical procedures. Neurosurgeons work with the most advanced navigation technology in the newly opened high-precision operating area (see page 10 of this report). All operating theaters are equipped with spinal navigation, a 3D imaging intensifier and intraoperative computed tomography (CT). This increases the accuracy and safety of implant placement, reduces radiation exposure, and offers the possibility of precise position control during the operation.

The neurosurgical spectrum also includes invasive pain management techniques: neurostimulation and intrathecal drug infusion. The effect on the individual patient is tested before final implantation. Pain patients are individually and continuously supervised by qualified professionals – the so-called Pain Nurses of the Department of Neurosurgery. In cooperation with rheumatology and the pain center, conservative treatment plans are adapted and expanded.



500

spine operations

70

interventions in pain and spasticity

More security through innovation

There is a particular scientific interest in the development of improved safety measures for surgery. Researchers at the Department of Neurosurgery, the ARTORG Center for Biomedical Engineering of the University of Bern and the Swiss Center for Electronics and Microtechnology (CSEM) are therefore developing a new robotically supported surgical method for spine stabilization. The “Towards Intelligent Sensor-enhanced Robotic Neurosurgery” project was accepted in December 2017 in the first call for tenders for the “BRIDGE Discovery” sponsored by the Swiss National Science Foundation (SNSF) and Innosuisse (formerly the Commission for Technology and Innovation). It will be supported with funding of 2 million francs over a four-year period.

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Specialties/Diseases → Spine

Our research

In 2017, 29 Swiss National Science Foundation (SNSF) projects were carried out at the University Neurocenter Bern and more than 250 original papers were published. Furthermore, two researchers were awarded a Consolidator Grant by the European Research Council (ERC). In addition, a new international journal, "Clinical and Translational Neuroscience (CTN)" was launched.

RESEARCH PROFILE

Research areas with strong trans- and interdisciplinary approaches:

- Stroke,* including complex neurovascular disorders
- Sleep-Wake-Epilepsy,* including epilepsy surgery
- Movement disorders, including functional neurosurgery for Parkinson's disease, neurological and psychiatric disorders
- Neurorehabilitation, including computer-aided systems and robotics
- Neuroimmunology*
- Neurodegeneration*/dementia
- Intraoperative imaging, neuromonitoring, augmented reality, navigation-related developments, targeted procedures and 3D printing and simulation techniques
- Systems neuroscience and psychopathology

* Clinical/human and experimental/animal approaches are used in these areas.

RESEARCH PLATFORMS

- Neuro Clinical Trial Unit (NCTU), in close collaboration with the Clinical Trials Unit Bern (CTU Bern)
- Neurophysiological laboratories

- Imaging procedures, including the neuro-interventional laboratory
- Center for Experimental Neurology (ZEN Lab)
- ARTORG Center for Biomedical Engineering Research
- Support Center for Advanced Neuroimaging (SCAN)

SELECTED RESEARCH PARTNERS

- Alzheimer Research Center, Karolinska Institute, Stockholm, Sweden
- Department of Neurology, University of California Los Angeles (UCLA), USA
- Department of Pediatric Neurology, Royal Children's Hospital, Murdoch Research Institute, Melbourne Australia
- Department of Pulmonology, Inselspital, University Hospital, Bern
- Institute of Psychology, University of Bern
- Institute for Artificial Organs (ARTORG Center for Biomedical Engineering Research), University of Bern
- Institute for Research in Biomedicine (IRB), Università della Svizzera italiana, Bellinzona
- Institute for Surgical Technology and Biomechanics (ISTB), University of Bern
- Swiss Center for Electronics and Microtechnology (CSEM), Neuchâtel

ERC CONSOLIDATOR GRANTS



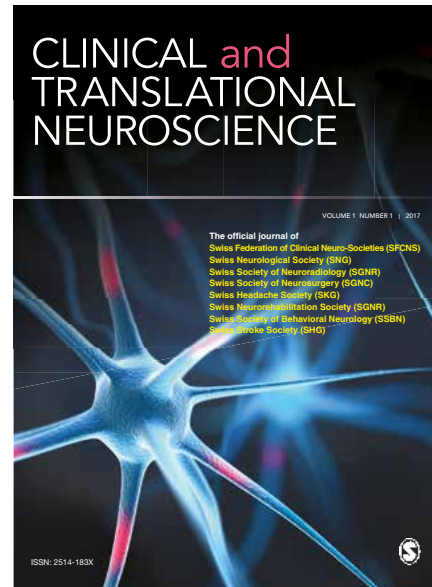
Dr. phil. nat. Smita Saxena

Connectivity Correlates of Molecular Pathology in Neurodegeneration: Investigating the role of dysfunctional neuronal circuits in governing selective neuronal vulnerability and promoting pathological degeneration of vulnerable neurons in neurodegenerative diseases.



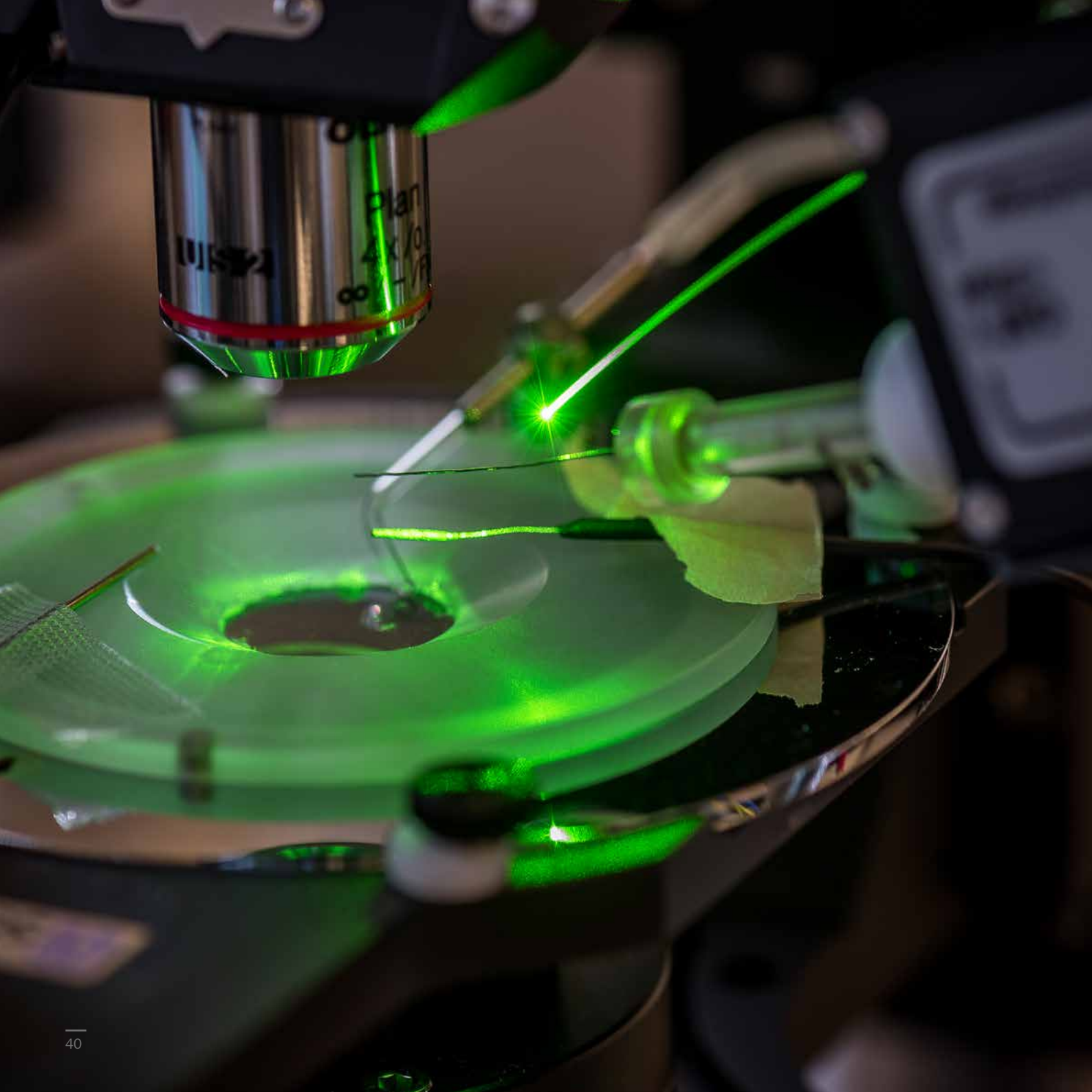
Prof. Dr. Antoine Adamantidis

All-optical deconstruction of thalamic control of sleep-wake states: Investigation of the role of the thalamus as a hub that integrates sleep-wake inputs of both subcortical and cortical origin into stable sleep-wake states in mice. The project will provide a mechanistic perspective on subcortical, thalamo-cortical and cortical control of brain oscillations during sleep-wake states, and their functions in cognition and consciousness in the rodent brain.



CLINICAL AND TRANSLATIONAL NEUROSCIENCE (CTN)

The official journal "Clinical and Translational Neuroscience (CTN)" of the eight Swiss neurosocieties: Swiss Federation of Clinical Neuro-Societies (SFCNS), Swiss Neurological Society (SNG), Swiss Society of Neuroradiology (SSNR), Swiss Society of Neurosurgery (SSNS), Swiss Headache Society (SKG), Swiss Neurorehabilitation Society (SGNR), Swiss Society for Behavioral Neurology (SSBN) and Swiss Stroke Society (SSS) appeared in 2017 for the first time. The editors of CTN are based in Bern. They include four members of the University Neurocenter Bern: Prof. Dr. med. Claudio Bassetti (Editor-in-Chief), Prof. Dr. Antoine Adamantidis, Prof. Dr. med. Andrew Chan and Prof. Dr. med. Andreas Raabe.



GRANTS (FINANCIAL SUPPORT)

The following list shows the projects funded by Swiss National Science Foundation (SNSF) grants in 2017 at the University Neurocenter Bern.

DEPARTMENT OF NEUROLOGY

Principal investigators

Swiss study of initial decompressive craniectomy versus best medical treatment of spontaneous supratentorial intracerebral hemorrhage (switch): a randomized controlled trial (#150009)

Sleep loss and sleep disorders and their impact on the short- and long-term outcome of stroke (#149752)

Sleep as a model to understand and manipulate cortical activity in order to promote neuroplasticity and functional recovery after stroke (#160803)

Optogenetic dissection of hypothalamic sleep-wake states (#156156)

A bayesian inference approach to intracranial EEG seizure dynamics (#155950)

Ätiologie des Hirninfarkts – Senken der Last kryptogener Hirninfarkte (#167789)

Early sleep apnea treatment in stroke: a randomized, rater-blinded, clinical trial of adaptive servo-ventilation (#166827)

Safety of early versus late initiation of direct oral anticoagulants in post-ischemic stroke patients with non-valvular atrial fibrillation (ELAN safety) (#169975)

Creativity after focal brain lesions – a matter of paradoxical facilitation? (na)

Mechanisms to improve glucocorticosteroid efficacy in neuroimmunological disease (#172952)

The Bern heart and brain interaction study (BEHABIS) – Interaction between brain and heart in acute ischemic stroke (#172793)

Co-Investigators

Role of executive functions on language: an experimental and clinical approach with application to mother language and second language (#156937)

Interference with gesture control and transcallosal white matter integrity: A theta-burst stimulation and diffusion tensor imaging study in apraxia after stroke (#155954)

Magnetic resonance techniques to determine metabolite levels: extending scope and clinical robustness (#156952)

Effects of serotonergic neuromodulation on behavioural recovery and motor network plasticity after cortical ischemic stroke: a longitudinal, placebo-controlled study (#160107)

The interplay of visual attention and response inhibition (#169789)

Impact on clinical outcome of continuous EEG monitoring in patients with disorders of consciousness: a randomized controlled trial (#169379)

DETECT – Dizziness evaluation tool for emergent clinical triage (#173081)

DEPARTMENT OF NEUROSURGERY

Principal Investigators

RESURGE – Randomized controlled comparative phase II trial on surgery for glioblastoma recurrence (#159648)

BRIDGE Discovery: Towards intelligent sensor-enhanced robotic neurosurgery (Project 20B2-1-176498/1)

Implantable bioelectronics for wireless and high resolution monitoring of epilepsy in vivo. Part II (#149742)

Co-Investigators

Swiss study of initial decompressive craniectomy versus best medical treatment of spontaneous supratentorial intracerebral hemorrhage (switch): a randomized controlled trial (#150009)

DEPARTMENT OF DIAGNOSTIC AND INTERVENTIONAL NEURORADIOLOGY

Principal Investigators

Stroke treatment goes personalized: Gaining added diagnostic yield by computer-assisted treatment selection (the STRAY-CATS project) (#170060)

Effects of serotonergic neuromodulation on behavioural recovery and motor network plasticity after cortical ischemic stroke: a longitudinal, placebo-controlled study (#160107)

In situ photoactivated hydrogel-based platform to treat cerebral aneurysms (#170992)

Co-Investigators

Early sleep apnea treatment in stroke: a randomized, rater-blinded, clinical trial of adaptive servo-ventilation (#166827)

DEPARTMENT OF PEDIATRICS – NEUROPEDIATRICS

Principal Investigators

Cortical reorganisation of cerebral networks after childhood stroke: impact on outcome (#146894)

UNIVERSITY HOSPITAL OF PSYCHIATRY AND PSYCHOTHERAPY

Principal Investigators

Therapeutic response and neurobiological prediction markers in auditory verbal hallucinations (#146789)

Gesture deficits in schizophrenia: A combined functional MRI and diffusion tensor imaging study of disconnectivity to investigate the neural basis of limb praxis (#152619)

Learning to resist the urge: Inhibition training in abstinent alcohol dependent patients (#159286)

Co-Investigators

Interference with gesture control and transcallosal white matter integrity: A theta-burst stimulation and diffusion tensor imaging study in apraxia after stroke (#155954)

UNIVERSITY HOSPITAL OF OLD AGE PSYCHIATRY AND PSYCHOTHERAPY

Principal Investigators

MRI-based pattern recognition techniques in dementia diagnostics (#173880)

INTERDISCIPLINARY TRAINING*

30 January–2 February 2018

5th ESO ESMINT ESNR Stroke Winter School

15 February 2018

Neurology for Practising Doctors

1 March 2018

11th Bernese Symposium on Movement Disorders

22 March 2018

Brain and Skin

7 June 2018

Neuro-emergencies

23 August 2018

Stroke

13 September 2018

Vascular Diseases – Brain and Heart

17–19 October 2018

Bernese Sleep-Wake Days

(BENESCO – Trifaculty Annual Meeting)

6 December 2018

Advent Symposium

* This is only a selection of events.



Your Contacts



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Department of Neurosurgery

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Barbara Weiss-Zurschmiede, Head of Nursing



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Beat Burri, Head of Nursing and Pedagogy



Department of Diagnostic and Interventional Neuroradiology

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