

Annual Report 2023

Competence Centre for
Rehabilitation Engineering and Science



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Welcome

Global healthcare systems face significant challenges due to aging populations and technological advancements. Rehabilitation has emerged as a crucial solution to promote independence and social inclusion for individuals dealing with disabilities and/or health issues. The World Health Organization's Rehabilitation 2030 initiative emphasises the importance of integrating rehabilitation seamlessly into global healthcare systems to address future health challenges effectively.

ETH Zurich supports and strengthens the transformation of healthcare systems and policies, the advancement of precision rehabilitation and the implementation of innovative interventions. National and global challenges require multimodal approaches to guide and track patients and people living with disabilities over time through a comprehensive array of services. The transition towards a highly personalised and technology-driven continuum of care needs a comprehensive approach including competences in medical, economic, environmental, legal and societal domains. In this context, the ETH Competence Centre for Rehabilitation Engineering and Science (RESC) aims to advance and promote rehabilitation as a key pillar alongside global and national strategies in health and medicine.

This report looks back on the last year of the first accreditation period (2020-2023), which was marked by an emphasis on a variety of activities in research, education and outreach. Highlights include the fundraising of new core professorships and the further expansion of funding programmes. In autumn 2023, the new Major in Rehabilitation and Inclusion within the Master's degree programme in Health Sciences and Technology (HST) began, offering existing and new courses in rehabilitation technology, medicine and inclusion. RESC's second symposium delved into the nexus of health, technology and architecture, fostering public discourse on the topic in November 2023. Moreover, the project "ETH Index Inclusion" published a position paper aiming to close the current gap of data and knowledge in various clusters such as assistance systems, education and training or housing in a sustainable manner and to create a solid basis for decision-makers in politics, service providers and industries.

In the coming years, RESC will be dedicated to bolstering its network and establishing collaborations to propel professorships, research laboratories, educational programmes and outreach endeavours forward. A key goal is to augment both internal and external networks to fortify research and development in health science and technology, closely aligning with other health and medicine initiatives at ETH Zurich.

All activities are only possible thanks to the shared vision of many enthusiastic people, strong partnerships with the private sector and tremendous personal and financial support. We would like to thank our partners and all involved individuals, organisations and companies for their outstanding commitment.



Dr Oliver Stoller
Executive Director



Prof. Robert Riener
Chair



Prof. Roger Gassert
Vice Chair



Dr Serge Altmann
Chair of the Advisory Board

2023 at a glance

New partner

RESC partners with Gelbart | ORTHO-TEAM Group



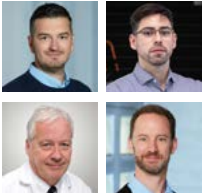
New professorship

Architecture and Care, Anna Puigjaner, Stavros Niarchos Foundation



Research grant

awarded to promote monitoring technologies for clinical decision-making in spinal cord injury (SCI)



National research activities
RESC begins to build up staff after the start of the project



RESC Steering Committee meeting



RESC online lecture series



Relocation of RESC office to new GLC building



January February March April May June

Onboarding

Thomas Reulein, Project Manager
Sonja Manser, Intern



Welcome to the RESC Advisory Board

Till Hornung, Serge Reichlin



RESC and Barrier-Free at ETH joint panel discussion



New members

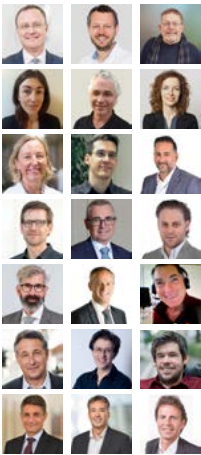
Chris Awai, Florian Freisleder, Christian Lanz



RESC team event



RESC Advisory Board meeting



New partner
RESC partners with F&P Robotics



New partner
RESC partners with Frei Swiss AG



Farewell
Miriam Daepf



RESC General Assembly meeting



RESC and CRGHS joint online lecture series



New members
Meret Branscheidt, Sarah Ebling



RESC and SMS-Lab joint workshop



RESC symposium



Research call
on outpatient and residential rehabilitation



RESC and FHT joint panel discussion at RehabWeek



RESC joins workshop at RehabWeek



Start of new Major in Rehabilitation and Inclusion at ETH Zurich



RESC at ETH Industry Day



July August September October November December

RESC Partnership Council



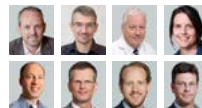
Farewell
Sonja Manser, Intern



RESC team retreat



RESC Steering Committee meeting



Farewell
Thomas Reulein



RESC position paper
ETH Index Inclusion



The Competence Centre

RESC has coordinated the ETH Rehab Initiative since its inception in 2020, drawing on expertise from academia, hospitals, industry, government, health insurance companies and disability organisations. The competence centre aims to advance and promote rehabilitation as a key pillar along the continuum of care.



Vision and Mission

Going to work, shopping, exercising, living where one wants, or simply climbing stairs – for people with physical impairments and patients with neuromuscular disorders, even these everyday tasks pose a great challenge. Meticulous research, intelligent technical assistance systems and societal awareness regarding questions of rehabilitation and inclusion can significantly improve the lives of many affected individuals and enable them to participate equally in society.

The ETH Competence Centre for Rehabilitation Engineering and Science (RESC) seeks to progress and advocate for the integration of rehabilitation as a fundamental component within both global and national health and medical strategies. The strong network facilitates the transformation of healthcare systems and policies, the advancement of precision rehabilitation and innovative interventions.

Governance

The centre consists of 67 research group leaders such as professors and senior scientists, and is managed by the Executive Office, in close collaboration with 9 Steering Committee members and 21 advisors from science, industry, administration and associations. The strategic development is led by the Executive Office in cooperation with the entire network and strong strategic partners (Hocoma, Stavros Niarchos Foundation, Schulthess Klinik, Swiss Paraplegic Foundation and Suva) through the annual Partnership Council. The network includes several relevant universities, hospitals, associations and many relevant start-ups in the field of rehabilitation and inclusion.



Network

RESC is a collaborative network involving leading Swiss partners from various sectors, including academia, hospitals, industry, government, insurance companies and disability organisations, aimed at facilitating communication, collaboration and strategic development.

New members



Dr med. Meret Branscheidt

Medical Deputy Director at cereneo



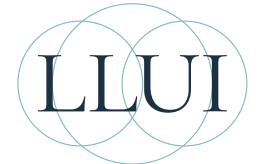
Prof. Sarah Ebling

Professor ad personam for Language, Technology and Accessibility at University of Zurich and Professor of Accessibility Studies at Zurich University of Applied Sciences (ZHAW)



Dr Chris Awai

Chief Scientific Officer, Director Data Analytics and Rehabilitation Technology (DART) at Lake Lucerne Institute



Dr med. Florian Freisleederer

Senior Physician Shoulder and Elbow-Surgery at Schulthess Klinik



Dr med. Christian Lanz

Chief Medical Officer Neurology at Schulthess Klinik



New advisors



Dr med. Till Hornung

CEO Kliniken Valens



Dr med. Serge Reichlin

CEO Barmelweid Gruppe AG



New partners



Gelbart | ORTHO-TEAM

The Gelbart | ORTHO-TEAM runs a digital manufacturing site in Switzerland, along with a network of orthopaedic workshops which offer customised technical orthopaedic treatments and rehabilitation solutions.



F&P Robotics

F&P Robotics is a pioneer in collaborative robotics and develops and markets highly-skilled robots, which are able to learn and to assist humans in an adaptive, personal style.



FREI SWISS

FREI SWISS AG is the experienced full-service provider for physiotherapists, doctors and rehabilitation centres.

The entire network is presented in the Annex.

Partner Event (Partnership Council)



The annual Partnership Council was held at the Villa Hatt. We extend our gratitude to all our strategic partners and interested participants for strengthening the ETH Zurich Rehab Initiative, RESC ETH Zurich and Cyathlon. Many new contacts and projects were initiated through this event.

Research

RESC's goal is to strengthen the transformation of healthcare systems and policies, the advancement of precision rehabilitation and the implementation of innovative interventions. The centre coordinates the establishment of professorships and labs, and hosts several research programmes in the field of rehabilitation.

Research chairs, labs and programmes

The first accreditation phase (2020–2023) of RESC achieved the establishment of several key research chairs in the field and beyond. Biomedical and Mobile Health Technology (Prof. Carlo Menon), Healthy Ageing (on appeal), Data Science for Personalised Health (Prof. Catherine Jutzeler), and Architecture and Care (Prof. Anna Puigjaner) are frontrunning research labs in the field. Together with the ETH Foundation and the ETH Office for Faculty Affairs, RESC additionally fundraised the research chairs in Economic Evaluation of Health Programmes and Technologies and Disability and Inclusion in Society (on appeal).

RESC fervently advocates for cross-disciplinary activities. The centre facilitates collaborative research endeavours through competitive grants provided by both our partners and external sources. The overarching objective is to address prevailing research gaps, align research themes with the established competencies at ETH Zurich, and engage with external stakeholders. Through these efforts, RESC aims to tackle current challenges in rehabilitation and inclusion effectively.

Within the current funding programmes of RESC, two further projects on "Monitoring Technologies for Clinical Decision Making in Spinal Cord Injury" have been supported and the fourth research call on "Outpatient and Residential Rehabilitation" was published. Currently, four research projects are active, of which one left RESC-funding at the end of 2023 but is ongoing (see the status updates of all projects on pages 11-14). It is also very pleasing that a highly rated proposal from the first RESC research call back in 2022 was funded by another source and has developed very well (see special communication on page 15).

National research activities

RESC is a member of the national flagship project SwissNeuroRehab 2022-2027, facilitated by Innosuisse. The project aims to establish and validate an innovative neurorehabilitation model utilising cutting-edge digital and technological approaches across the entire care spectrum, from hospital settings to home environments. SwissNeuroRehab brings together an unparalleled coalition of Switzerland's foremost companies and institutions. RESC is involved in three of five subprojects. Subproject 1 coordinates the understanding of the current model of care in neurorehabilitation and is currently developing a novel approach (RESC Project Manager: Thomas Reulein), subproject 3 develops a digital platform

for continuous monitoring (Data Scientist: Thomas Weikert, see portrait in box) and subproject 5 coordinates the development of a new education landscape in technological-assisted neurorehabilitation (RESC Project and Education Manager: Desiree Beck).

Furthermore, in collaboration with other Swiss universities, RESC is applying for an NCCR in Rehabilitation, Functioning and Society.

Meet the researchers: Towards data-driven rehabilitation with Thomas Weikert

Thomas joined ETH and University of Zurich (UZH) as a Research Assistant to extend his work in multiple research and clinical facilities as part of the Innosuisse flagship project SwissNeuroRehab. His work evolves around developing standardised protocols and data pipelines to streamline the entire process of data collection, storage, analysis and presentation of medical data.

Thomas holds a double degree in Autonomous Systems from KTH, Royal Institute of Technology in Stockholm, and Aalto University in Helsinki. During his studies, he focused on Machine Learning and Robotics. To further broaden his knowledge on developing and operationalising machine learning models, Thomas continued his journey as a Data Scientist within the industry. In 2022, he joined Silta, a Finnish accelerator in San Francisco, exploring digital health. Reviewing 50+ companies and research projects at Stanford, he noted that many healthcare analytics solutions lack viable business cases due to insufficient evidence supporting clinical decision-making.



Status of research project "Hackster - Patient-led innovation in online communities and physical spaces"

Funded by the Uplift Fundraising Campaign

**Principal Investigators: Georg von Krogh, D-MTEC;
Mirko Meboldt, D-MAVT; Christoph Stadtfeld, D-GESS**

This RESC-funded research project focuses on improving scholarly understanding of how innovation in rehabilitation and assistive technology unfolds in online communities and physical spaces, and investigates the roles of individuals with disabilities in driving this innovation process.

Innovation through online communities with Hackster

The "Hackster" research team has conducted an online experiment to investigate how users – individuals with disabilities – can shape the innovation process for rehabilitation and assistive technology. In this experiment, users interacted with problem-solvers who had engineering knowledge but lacked an understanding of

the disability space. These users adopted two different strategies to help problem-solvers understand their disabilities. In one group, the users relied on sharing facts and established knowledge about their disabilities. In the other group, the users focused on sharing their personal experiences and pain points. Problem-solvers were randomly assigned to one of the two groups and were tasked to create innovative solutions responding to the needs of the users.

The results indicated that the group focused on facts and established knowledge produced solutions that were evaluated to be more innovative by the users, when compared to the group focusing on sharing personal experiences and pain points. However, the latter group brought greater engagement from the problem-solvers, as they interacted more with the users, and submitted more solutions. Thus, a trade-off emerges between more innovation and more engagement, both of which are critical for the inclusion of individuals with disabilities.

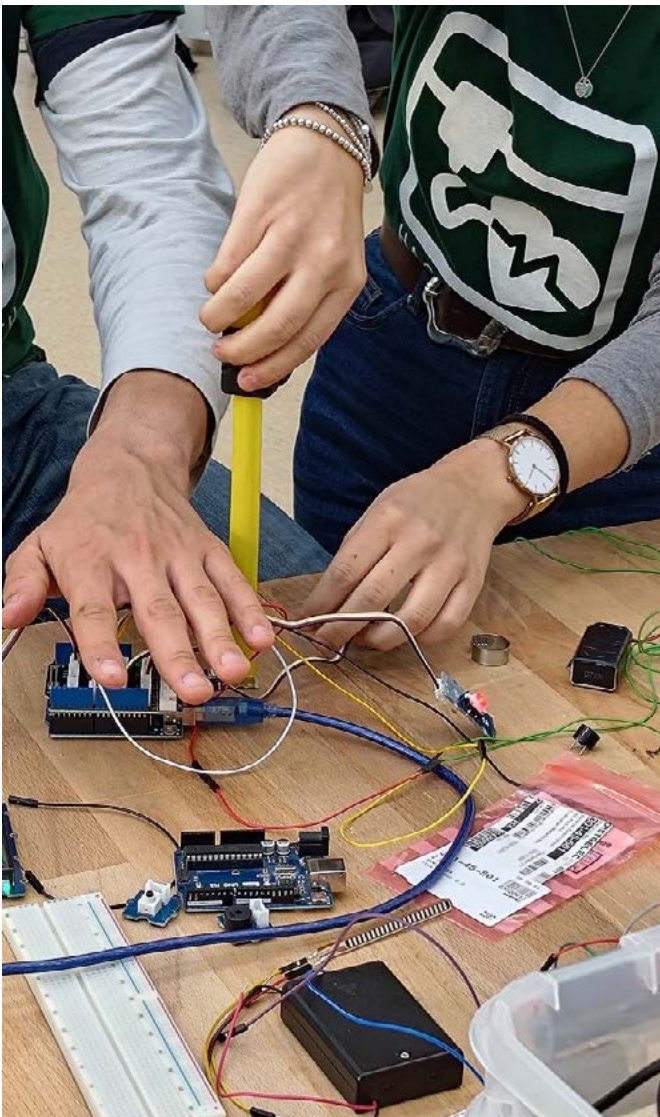
Hackathons with HackaHealth

The research team has gathered and initially analysed additional data, which encompasses around 300 hours of observation, Slack conversations, project reports, and roughly 50 interviews with hackers, challengers and mentors. This analysis underscores the significance of involving challengers – individuals with disabilities seeking tailored solutions – right from the innovation's outset, particularly in the problem formulation stage. During this stage, problem-solvers delve into understanding the specific issues the challenger aims to address. Our findings indicate that groups who integrated challengers into discussions more centrally, as opposed to relying predominantly on hackathon organisers' problem descriptions, not only fostered a stronger sense of inclusion but also achieved enhanced innovation outcomes.

When individuals with disabilities, as experts in the problems, are engaged in the problem-formulation process, they assume a central decision-making role. Conversely, if their involvement is marginal, they tend to feel excluded from the innovation process and detach themselves. This absence of expert input often leads to a lack of centralised and coherent plans among problem-solvers, ultimately resulting in less effective solutions.

Research output

The first paper was accepted for publication in Nature Reviews Bioengineering, summarising initial findings from the hackathons. Since then, the group presented the experiment on Hackster at the European Group of Organization Studies in 2023.



Status of research project "RehabCoach - A digital platform to support remote rehabilitation"

Funded by the ETH RESC – Suva Funding Programme

**Principal Investigators: Olivier Lambercy, D-HEST;
Tobias Kowatsch, D-MTEC**

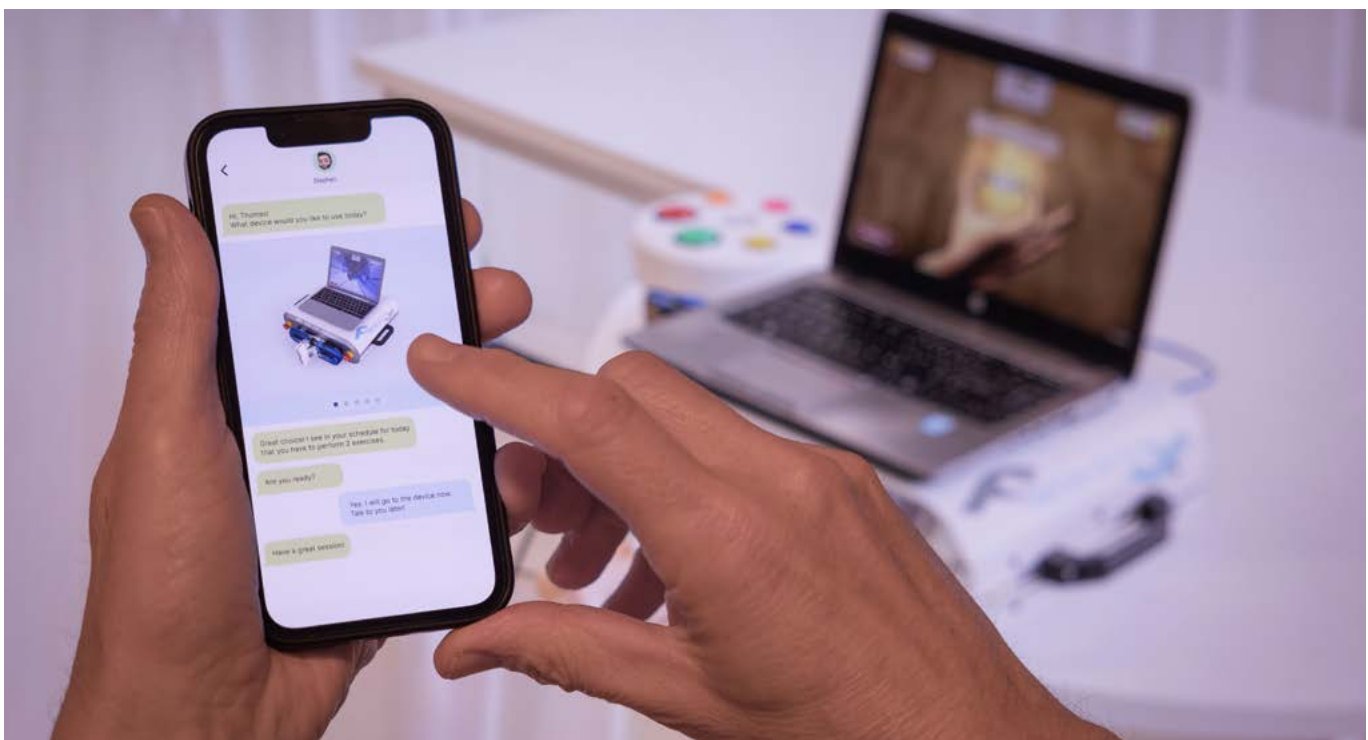
The RehabCoach project is working on a novel smartphone application combined with a portable rehabilitation robot to assist neurological patients undertaking rehabilitation at home, without the need for direct therapist supervision. The overarching goal of RehabCoach is to motivate patients to follow their personalised unsupervised rehabilitation plan after being discharged from clinic and encourage adherence to therapy, thus increasing the likelihood of maintaining, or even improving, rehabilitation outcomes in the long run. The RehabCoach app is chatbot based, meaning that the patient can interact with a virtual coach via a chat interface. The virtual coach, for example, reminds patients to perform their assigned (robot-assisted or conventional) exercises and provide informational materials about stroke and health. The first prototype of the RehabCoach app has already been successfully tested in a pilot usability study with therapists and stroke patients, who were able to successfully interact with the different features of the app and rated its usability as very high (Devittori et al. 2024, submitted).

The RehabCoach app is now being further tested within a more extensive feasibility study at the Clinica Hildebrand Centro di riabilitazione Brissago, in which stroke patients are encouraged to use the app for one week to support unsupervised conventional exercises, suggested by therapists. The main goal of this

ongoing study is to investigate whether it is feasible for stroke patients to interact with the virtual coach over a longer period of time and how they perceive its role and functionality. By gathering these insights, the aim is to refine the conceptual model of the app, augmenting the available features to make the next prototype more user-friendly, beneficial and interactive.

In parallel, the group has been working on connecting the RehabCoach app to ReHandyBot, a robotic device for upper limb rehabilitation, such that in the future, patients could train with the device without the supervision of a therapist, but with the support of the virtual coach. In addition, to enable patients to access a more comprehensive and personalised rehabilitation plan, they explore the possibility to link RehabCoach to other technologies. To facilitate this process, RehabCoach is being restructured to be as modular as possible. Furthermore, to optimise the interaction between patients and the rehabilitation technologies supported by RehabCoach, different methods that could make the chat feature more engaging are being investigated, such as the use of large language models to develop an expert virtual coach that could answer device-related questions and motivate users to accomplish daily tasks.

By enhancing patient adherence and motivation to engage in unsupervised rehabilitation, this project seeks to complement unsupervised robot assisted rehabilitation programs and ultimately increase the quality and quantity of therapy neurological patients can receive along the continuum of care.



Status of research project "pAIIn-sense – An artificial intelligence-based telemonitoring tool to measure pain in spinal cord injury patients in at home settings"

Funded by the ETH RESC – SPS Funding Programme

Principal Investigators: Stanisa Raspopovic D-HEST; Armin Curt, UZH/Balgrist

Chronic pain has long been known as a major health concern after spinal cord injury (SCI), impacting psychological health, functioning and quality of life. However, its treatment is complex and is challenged by a complex interplay between biological, psychological and social factors. The pAIIn-sense project aims at providing a telemonitoring and decision-aid system to quantify and qualify the multidimensional subjective pain experience of SCI patients. By collecting biometric data with wearable devices and psychological and life-quality information using an interactive and user-friendly phone application, pAIIn-sense continuously monitors the real nature of the pain. Leveraging the use of advanced Artificial Intelligence techniques with these multidimensional data, pAIIn-sense aims at disentangling pain components (emotional vs physical) to improve the diagnosis and the efficacy of pain management by promoting individualised therapies.

The project team has completed a study disentangling the subjective and physical pain components in controlled experiments inducing acute pain in chronic pain participants. Following these results, the project team developed the interactive multiplatform phone application for at-home monitoring and released it for

android and iOS. The interactive application sends timely notifications to ask the patients for different information (e.g., sleep quality, pain status, psychological assessment) depending on the time of the day. The data are automatically saved and anonymised on the cloud, and can be accessed in real time. Furthermore, the team has designed a fully automated pipeline for data recording, collection and analysis both from the wearable physiological device and from the application.

Following ethical and clinical trial approval, the clinical trial has begun with the first 14 patients from multiple centres in Switzerland and Italy, showing promising compliance and interest by the participants in continuously monitoring their pain and physiological signals. The first preliminary results showed that pain increases in the evening and decreases when activity increases, and it is influenced by psychological factors. Furthermore, it is possible to reliably extract relevant biomarkers from the physiological signals representing the physical reaction to pain.



Status of research project "FMW – A lightweight force measurement wheel system for assessing wheelchair activity in daily life"

Funded by the ETH RESC – SPS Funding Programme

Principal Investigators: Bill Taylor, D-HEST;
Diego Paez, D-HEST/SPZ

Manual wheelchair users heavily rely on their upper extremities for most activities of daily living. Pain or injury, particularly in the shoulder joint, can therefore significantly impair mobility, independence and societal participation. Unfortunately, overuse injuries are prevalent among full-time manual wheelchair users, with nearly all experiencing some form of shoulder problems during their lives. Consequently, extensive research has focused on various propulsion techniques and resulting loading conditions in the respective joints in recent decades. Accurate information regarding the forces exerted on push-rims during functional wheelchair propulsion, typically assessed in laboratory settings on treadmills, forms the basis of biomechanical research and informs clinical practice. However, the instruments used to collect such data are bulky, aging and no longer commercially available, necessitating the development of new measurement solutions. Critically, however, novel concepts should focus on suitability for use outside confined laboratory environments to allow new, longitudinal study designs and open doors to other applications beyond the research domain, for instance as a feedback-device for users to improve propulsion techniques or for performance diagnostics in para-sports.

Funded through the RESC–SPS project call, a team at the Laboratory for Movement Biomechanics (LMB) and the Spinal Cord Injury Artificial Intelligence Lab (SCAI) is currently developing a measurement instrument designed for unsupervised usage and

long-term data capture in daily life. Central to this concept is a novel sensor layout where three connectors between the wheel rim and the push-rim serve as the primary 3D force measurement units. This design allows the entire measurement technology to be integrated in an ergonomic push-rim and facilitates the development of a compact system weighing less than half of the current gold standard, the remaining SMARTwheels.

The project has made significant progress, starting with focus group interviews with researchers and prototype evaluations with wheelchair users. The team developed the entire measurement wheel from scratch, including a custom hub with an integrated optical rotary encoder, a unique load cell design and a CNC-milled push-rim profile housing electronic components for data processing and communication with mobile devices. Currently, the team is finalising a prototype batch of two sets of measurement wheels.

In the upcoming months, the system will undergo dynamic validation in collaboration with colleagues at Università degli studi, Brescia, followed by use in a first study lead by SCAI Lab. To the best of their knowledge, the team will be the first to track wheelchair propulsion forces three-dimensionally over several days and it will be interesting to compare propulsion forces during activities of daily living against the better understood laboratory conditions.

The prototypes have gained substantial traction within the wheelchair propulsion research community. Beyond this project, the team is therefore exploring options for commercialisation through partnerships or spin-offs.



Special: "Inclusion in the neighbourhood"

This project applied for funding in RESC's initial 2020 research call "Changing Behaviours", but was not able to be directly financially supported. Fortunately, the promotion was successful through another funding source.

Funded by Georg und Bertha Schwyzer-Winiker-Stiftung through ETH Foundation

Good social relationships within a neighbourhood contribute a lot to quality of life and well-being. Encounters in the immediate environment and the opportunity to actively participate in local community life gain additional importance when physical mobility is limited and the radius of action decreases.

The "Inclusion in the neighbourhood" project is based on the idea that "hybrid neighbourhoods" with physical and digital contact opportunities can help overcome challenges in everyday life by enhancing local social relationships. For the emergence and

promotion of "hybrid neighbourhoods", it is central that online tools are coupled with on-site activities (cf. SNF project "Emerging Digital Neighborhoods", 2020/2021 ETH CASE). This research and development project builds on this insight and centres on a pilot study in a Zurich neighbourhood, which includes the implementation of an online tool in combination with offline activities on site. The digital neighbourhood platform was set up by the Swiss startup beUnity. The project works together with existing neighbourhood actors and municipal organisations throughout the entire process, so that the results can be transferred to other urban neighbourhoods once the project is over.

Initial results showed that:

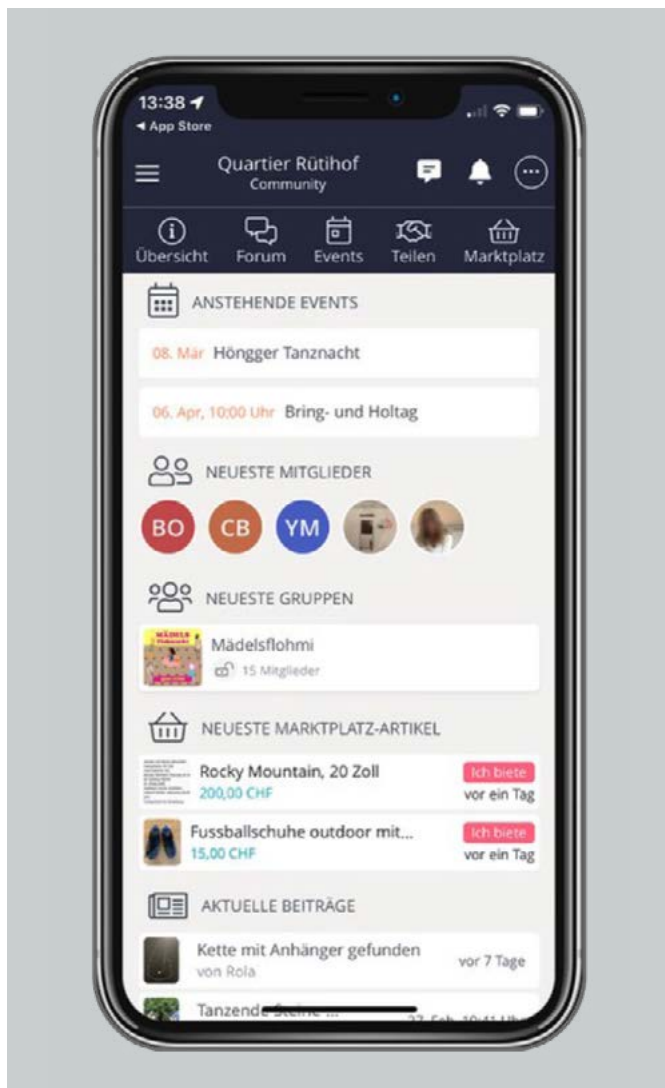
- The neighbourhood app is appreciated and used as an additional "local infrastructure" by many people and across a wide range of demographic backgrounds, such as ages, gender, time of residence (long-term or newcomers) and household type.
- Users consider the event calendar and marketplace functions to be particularly important.
- Active participation or concrete personal benefits from the app are not of central importance - even the feeling of being informed about what is happening in the neighbourhood is seen as additional value.
- Only a few people have more contact with their neighbours as a result of the app or have met new people through the app. The fact that the app is nevertheless considered by most users to have a positive effect underlines the importance of weak ties (which are the predominant form of relationships in the neighbourhood), and shows that these can also be articulated digitally in a neighbourhood app.
- The implementation of a neighbourhood app is not a sure-fire success: it requires analogue measures and a significant and repeated presence on site.

Challenges encountered that should be addressed in the next phase are:

- Strengthening local networking with organisations/ stakeholders and searching for potential platform holders, funding models and moderators.
- Improving multilingualism and accessibility of the app through technical developments.
- Accessibility of people who are difficult to reach.

Team:

Angela Birrer, Lucas Caluori, Anina Oegerli



Education

RESC aims to establish a broad, cross-departmental and cross-institutional educational landscape to train the next generation of rehabilitation professionals. Essential achievements in 2023 were the start of a new Major in Rehabilitation and Inclusion at ETH Zurich as well as a joint online lecture series in collaboration with the University of Lucerne.

Bachelor's degree level

The core elective Rehabilitation and Inclusion within the existing Bachelor's programme in Health Sciences and Technology (HST) at ETH Zurich continued to arouse great interest. 180 students enrolled in this course in 2023 and gained insight into relevant topics along the rehabilitation continuum of care. With this growing interest, RESC is confident that a reasonable number of the students will choose the new Major in Rehabilitation and Inclusion within the consecutive Master's programme in HST.

Master's degree level

In the Autumn Semester 2023, the new Major in Rehabilitation and Inclusion within the existing Master's programme in HST finally started. Students can choose from already existing as well as newly created courses in the focus areas rehabilitation technology, rehabilitation medicine and inclusion. The new courses attracted up to 30 students, confirming the perceived curiosity from the Bachelor's core elective in Rehabilitation and Inclusion. The start of this major marks an important milestone in the development of education programmes and will significantly contribute to train the next generation of rehabilitation professionals.

Major in Rehabilitation and Inclusion

Course List

Rehabilitation Technology	Rehabilitation Medicine	Inclusion
Artificial Intelligence in Rehabilitation NEW	Biomechanics of Sport Injuries and Rehabilitation	Disability (Studies), Inclusion and Human Rights NEW
Assistive Technology Challenge NEW	Clinical Challenges in Musculoskeletal Disorders	Economic and Regulatory Principles of Rehabilitation NEW
Biomechatronics	Clinical Exercise Physiology	Ethics of Life Sciences and Biotechnology
Digital Health in Practice	Clinical Neuroscience	Inclusion Praxis NEW
Human Computer Interaction	Motor Neurorehabilitation NEW	Paraplegia and Sports
Mobile Health and Activity Monitoring	Physical Activities and Health	Public Economics
Rehabilitation Engineering I: Motor Systems	Physical Medicine and Rehabilitation NEW	Public Health Concepts
Rehabilitation Engineering II: Sensory & Vegetative Functions		Rehabilitation and Inclusion NEW
Technology Entrepreneurship		Web and Mobile Accessibility NEW
Transfer of Technologies into Neurorehabilitation		
Translation of Clinical Concepts into Telerehabilitation NEW		
Wearable and Mobile Technologies of the Future		

Online lecture series

The RESC online lecture series, initiated in November 2022 to raise awareness within society, was continued in 2023. Starting with Prof. Roger Gassert sharing his personal rehabilitation journey in 2022, the focus expanded towards a global perspective in 2023. Justine Gosling, a technical advisor on rehabilitation for the WHO Regional Office for Europe, delved into the implementation of the WHO Rehabilitation 2030 initiative in her insightful talk.

Additionally, a collaborative series between RESC and the Center of Rehabilitation in Global Health Systems (CRGHS) of the University of Lucerne was implemented. Top-level speakers from both networks discussed relevant research topics and aspects of implementation to strengthen rehabilitation in Switzerland.



Addressing the Shortage of Rehabilitation Professionals in Switzerland – Status Quo and Solutions

- Prof. Sabine Hahn, Department Manager Nursing, School of Health Professions, Bern University of Applied Sciences (BFH)
- Diana Sigrist-Nix, EMBA MSc, Head of Medical Services, Responsible for Clinical Systems, Member of the Management Board, Swiss Paraplegic Centre, Nottwil

WHO's Package of Interventions for Rehabilitation – Implications for Switzerland

- Dr Alexandra Rauch, Sensory functions, Disability and Rehabilitation Unit, Department for Noncommunicable Diseases, Geneva, World Health Organization
- Prof. Dr med. Peter Sandor, Vice President of Medical Affairs at SWISS REHA (a.i.), Medical Director of ZURZACH Care

Innovative Technologies for Strengthening Rehabilitation Services

- Prof. Carlo Menon, Head of the Biomedical and Mobile Health Technology Lab, Department of Health Sciences and Technology, ETH Zurich
- Dr Florian Haufe, Founder and CEO, Akina

Rehabilitation within Swiss Health Information Systems

- Prof. Carla Sabariego, Assistant Professor of Rehabilitation and Healthy Ageing, Faculty of Health Sciences and Medicine, University of Lucerne
- Dr Sarah Brüningk, Postdoctoral Fellow and Group Leader, Biomedical Data Science Lab, Department of Health Sciences and Technology, ETH Zurich
- Dr Stephan Tobler, Head of Rehabilitation, ANQ Swiss National Association for Quality Development in Hospitals and Clinics

Financing Rehabilitation in Switzerland – Investment Case and Mechanisms

- Prof. Diana Pacheco Barzallo, Assistant Professor of Rehabilitation and Healthy Ageing, Faculty of Health Sciences and Medicine, University of Lucerne
- Prof. David Weisstanner, Assistant Professor for Health and Social Policy, Faculty of Health Sciences and Medicine, University of Lucerne
- Samuel Noll, Head of TARPSY and ST Reha, Swiss DRG AG

[Watch the recordings](#)

Outreach

RESC's outreach activities aim to raise awareness about its work among the general public, opinion leaders in government and industry, and other relevant stakeholders. RESC seeks to participate actively in public discussions about the opportunities and challenges of rehabilitation. It contributes to finding solutions for a more inclusive society by constantly expanding its network and creating collaborative platforms. RESC is dedicated to increasing the visibility and impact of its network's research and expertise.

RESC Public Symposium

RESC launched its second symposium to explore the interaction of health, technology and architecture. RESC was thrilled to be joined by leading experts from politics, sports, research and industry. Top athlete Marcel Hug presented the development of the world's fastest racing wheelchair, Prof. Anna Puigjaner and Dr Anna Myjak-Pycia gave insights into the history and current state of barrier-free architecture, Michel Fornasier (aka Bionicman) presented his commitment to promoting diversity and inclusion among children, and Christian Lohr discussed the political view on accessibility and the rights of persons with disabilities. Comedian Tan Caglar showed how he turns his own daily experiences as a wheelchair user into an entertaining, humorous comedy show. Overall, this event encouraged the public discussion at the interface of health, environmental design and technology.



ETH Index Inclusion

What influence do modern technical assistance systems such as motorised prostheses have on the social participation and life satisfaction of people with disabilities? How inclusive and accessible are Swiss universities? What about e-accessibility in Swiss retirement and nursing homes? How many rehabilitation clinics are already successfully using digital forms of therapy? There are many questions - and few answers - and this is exactly where the ETH Index Inclusion comes in.

The project aims to close the significant data gap in the field in the long-term, thus providing a solid information basis for decision-makers in politics, administration, organisations and the private sector to increase the level of societal inclusion in Switzerland. The ETH Index Inclusion focuses on the clusters of rehabilitation, assistance systems, housing and barrier-free education, in which ETH has long-standing core competencies and which align with its strategic orientation. Additionally, the ETH Index Inclusion also aims for international cooperation on European and global levels, such as with the European Disability Forum (EDF) or the World Health Organization (WHO).

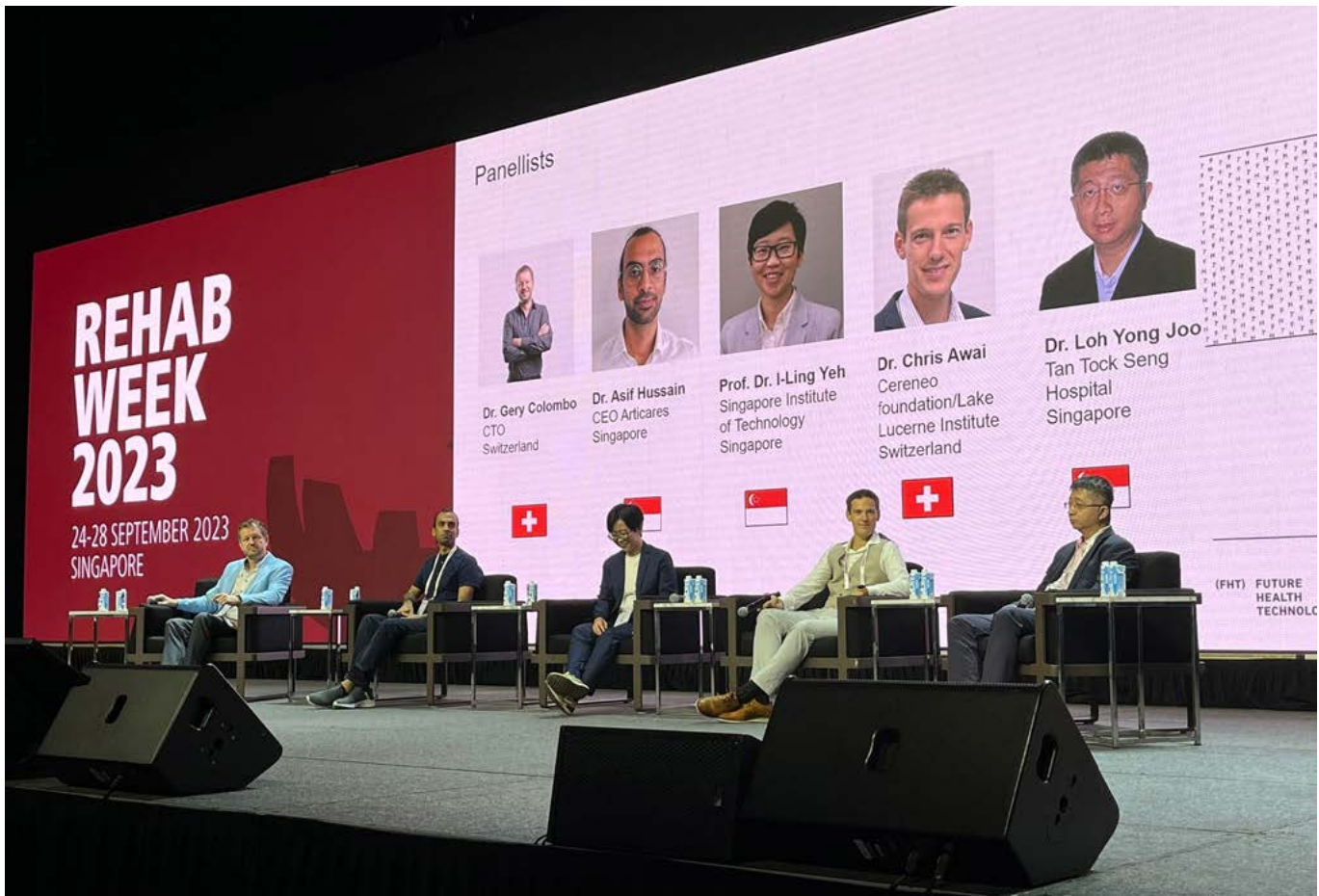
The tangible benefits of an ETH Index Inclusion include not only the pure status assessment, i.e., identifying problematic areas of life for people with impairments, but also quantifying the potential for improvement in these areas (potential assessment) and trend measurement by documenting long-term development trends.

[Download Position Paper as PDF \(German\)](#)



RehabWeek Singapore

RESC hosted a panel discussion at RehabWeek on "Rehab anywhere – how next-generation technologies can bring healthcare to community" together with the Singapore-ETH Centre (SEC) and participated in a collaborative workshop on "Novel educational pathways in rehabilitation" which was organised by the Lake Lucerne Institute (LLUI). In both formats, experts in the field shared their clinical, industrial and educational perspectives on how to transform and further advance the field of rehabilitation – ensuring access to rehabilitation services anywhere, anytime and for anybody.



Panel Discussion "Accessibility and inclusion in higher education – merely a trend?"

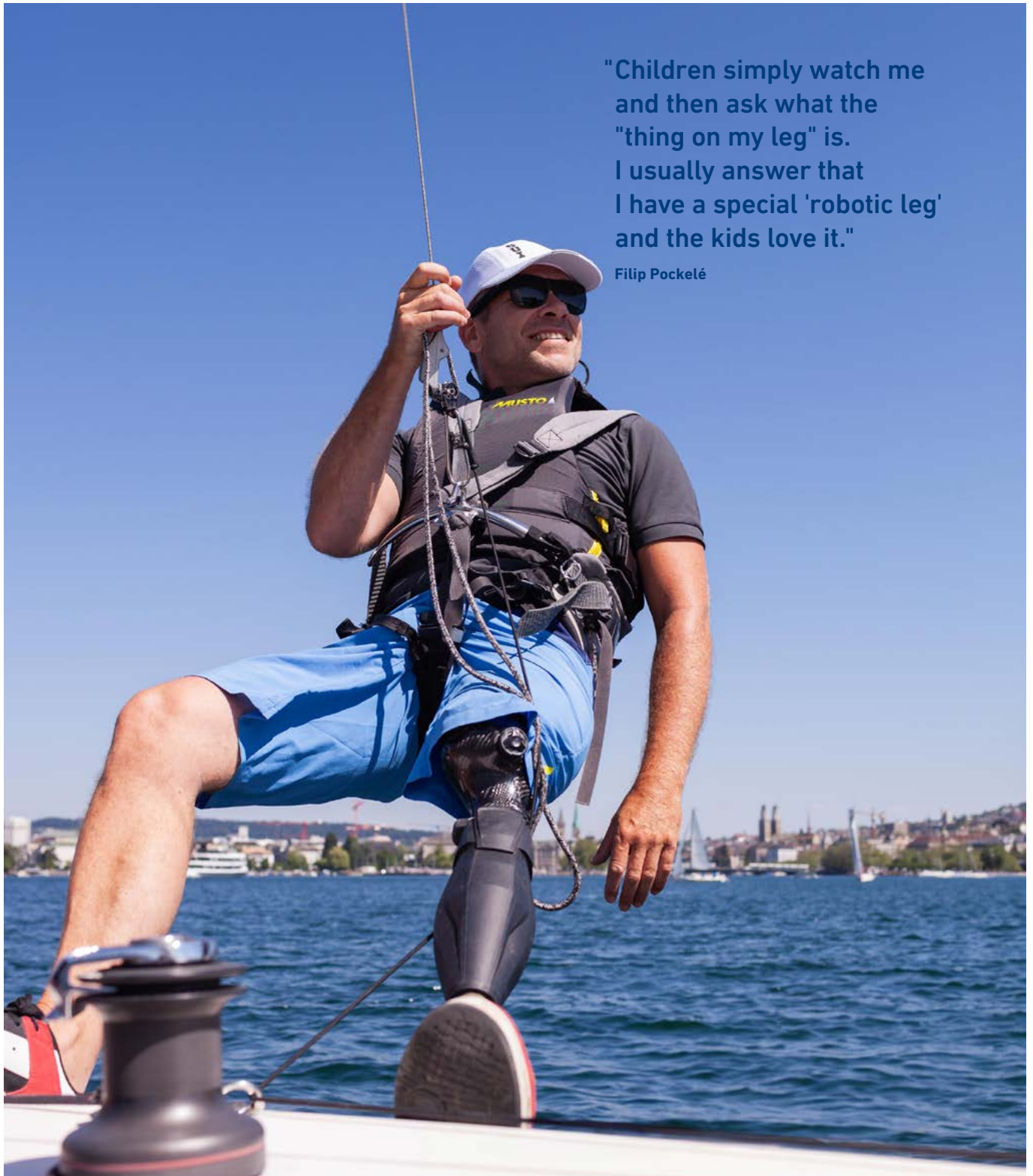
The UN Convention on the Rights of Persons with Disabilities (CRPD) calls for an inclusive education system – including at university level. Together with Barrier-Free at ETH Zurich, RESC organised a panel discussion in April 2023 where affected students, lecturers, and people with expertise in the area of teaching discussed the possibilities and limits of accessibility in education and reported on their experiences of exclusion and inclusion.

ETH Industry Day

At ETH Industry Day, RESC showcased three projects and labs from our network: Reto Togni with "Steering-by-Leaning" wheelchair design of the Laboratory for Movement Biomechanics of Prof. Bill Taylor, Spinal Cord Injury and Artificial Intelligence (SCAI) Lab of Dr Diego Paez-Granados, and the Biomedical Data Science (BMDS) Lab of Prof. Catherine Jutzeler.

Campaign - Faces of Inclusion

At the core of everything RESC does are the individuals living with disabilities. With the campaign Faces of Inclusion, a portrait series, we opened a dialogue with people who are affected and learn about the challenges they face due to their disabilities, and their vision of an inclusive society. We are now bringing the campaign to a close, and will transform to a different format in the future.



"Children simply watch me and then ask what the "thing on my leg" is. I usually answer that I have a special 'robotic leg' and the kids love it."

Filip Pockelé

Outlook

RESC is committed to strengthening its network and forging partnerships while advancing professorships, research labs, education programmes and outreach initiatives. A primary objective is to enhance both internal and external networks to reinforce research and development in health sciences and technology, aligning closely with other health and medicine initiatives at ETH Zurich.

The end of 2023 marked a milestone as it closed the first accreditation period as a competence centre at ETH Zurich. Within the years 2020-2023, RESC built up a strong expert network, raised a large amount of research funds, launched a variety of research programmes, and established key educational programmes and outreach activities. The lean structure of the Executive Office has leveraged its potential to establish a strong basis towards further growth and potential expansion together with other health and medicine initiatives at ETH Zurich. In a future structure, RESC aims to guide and continuously support national and international initiatives in rehabilitation.

Research

With a strong further development plan in the field of rehabilitation, RESC will orchestrate the existing and upcoming research chairs towards a comprehensive approach by building on the established network and activities. A core focus will be the further definition of the core research questions and the associated launch of research calls with already and newly established funding sources. RESC will expand its research portfolio to strengthen interdisciplinary research collaboration along the continuum of care.

Building upon its solid foundation, RESC will concentrate its efforts and resources on a few flagship projects, aimed at influencing national and international societal development projects in the healthcare and technology sector. Together with external partners, RESC is preparing a proposal on rehabilitation together with other Swiss universities for an upcoming NCCR call.

Education

The Major in Rehabilitation and Inclusion within the Master's degree programme in HST at D-HEST will be further developed by RESC's well-trained personnel within the next years to secure an optimal alignment at ETH Zurich. In parallel, establishing continuing education formats will attract professionals from various professional fields and strengthen ETH Zurich's position in health and medicine. RESC foresees to establish collaborations with national universities to facilitate interprofessional continuing education formats. While the topic of rehabilitation and inclusion generates larger interest and the number of students continues to grow, RESC will establish educational and networking formats for doctoral students.

Outreach

The annual RESC Symposium will be organised in collaboration with the Swiss Society for Physical Medicine and Rehabilitation (SGPMR) in October 2024. To showcase recent developments and achievements in the field of rehabilitation and inclusion, RESC will promote the exhibition "Mobility and Inclusion" on several occasions (see pictures on next page). The already launched exhibition will serve as a basis for future events and various excursions. RESC will continue to facilitate knowledge transfer by (co-)organising conferences, networking events and media presence.

RESC is looking forward to strengthening both internal and external networks in order to bolster research and knowledge transfer within the realms of health science and technology, in close coordination with other health and medicine endeavours pursued at ETH Zurich.



Annex

Official bodies Members of the General Assembly

Ordinary members (ETH internal)

Luca Benini	D-ITET	Biomedical Applications; Brain-Computer Interfaces; Machine Learning Accelerators
Katrien De Bock	D-HEST	Muscle Regeneration; Exercise; Metabolism
Eling de Bruin	D-HEST	Motor Control and Learning; Functional Anatomy; Virtual Reality-Driven Rehabilitation
Benjamin Dillenburger	D-ARCH	Housing Typologies; Computational Design; Digital Fabrication
Stephen Ferguson	D-HEST	Musculoskeletal Biomechanics; Regenerative Medicine; Medical Technology
Roger Gassert	D-HEST	Rehabilitation Robotics; Assistive Technology; Neural Control of Movement
Isabel Günther	D-GESS	Social Impact Assessments of Technologies; Poverty and Inequality Analysis
Michael Hampe	D-GESS	Philosophy of the "Good Life"; Critical Theory of Anthropological Essentialisms; Criticism of the "Nature-Culture-Devide"
Otmar Hilliges	D-INFK	Human-Computer-Interaction; Computer Vision; Robotics
Christian Holz	D-INFK	Sensing Technologies Interface with End-Users; Continuous Physiological Monitoring for Predictive Healthcare; Physical Computing and Computational Interaction
Marco Hutter	D-MAVT	Robotics; Control; Machine Learning
Marcello Ienca	D-HEST	Bioethics/Neuroethics and Health Policy; Disability Studies; Health Technology in Society
Taekwang Jang	D-ITET	Brain-Machine interface; Implantable Sensors; Ultra-Low-Power Systems
Catherine Jutzeler	D-HEST	Biomedical Data Science; Data Mining; Translational Medicine
Marko Köthenbürger	D-MTEC	Public Economics of Digitisation and AI; Health Expenditure Forecast; Innovation and Public Policy
Tobias Kowatsch	D-MTEC	Blended Digital Coaching with Conversational Agents (Chatbots); Just-In-Time Adaptive Interventions; Digital Biomarker Research
Olivier Lamercy	D-HEST	Rehabilitation Robotics; Technology-Based Assessments in Neurorehabilitation; Digital Biomarkers
Michael Leunig	D-HEST	LIS Orthopaedics; Surgery; Outcome Research
Jörg Löffler	D-MATL	Materials Science; Biodegradable Implants; Metallic Biomaterials
Zina-Mary Manjaly	D-HEST	Neurophysiology and Neurology; Functional Neuroimaging; Mindfulness based Cognitive Interventions

Isabelle Mansuy	D-HEST	Neuroepigenetics; Psychiatry; Animal Models
Mirko Meboldt	D-MAVT	Usability; Human Machine Interaction; Engineering Design
Carlo Menon	D-HEST	Innovation in Wearable Technologies; Sensorimotor Recovery; Neurorehabilitation
Ralph Müller	D-HEST	Bioimaging; Biomechanics; Mechanobiology
Diego Paez	D-HEST	User-in-the-Loop Computational Modelling and Design; Continuous Sensing and System Integration; Applied ML in Assistive Robotics
Anna Puigjaner	D-ARCH	Care; Gender and Non-Normative Studies; Housing
Stanisa Raspopovic	D-HEST	Engineering; Technology Transfer; Medical Devices
Robert Riener	D-HEST	Rehabilitation Robotics; Human-Machine Interaction; Biomechanics
René Rossi	D-HEST	Smart Textiles; Wearables; Materials-Skin Interactions
Roland Sigrist	CYBATHLON	Project Development and Managing; Events and Communication; Human Movement Science
Jess Snedeker	D-HEST	Biomechanics; Engineering; Regenerative Medicine
Christina Spengler	D-HEST	Human Physiology in Sleep, Rest and Exercise; Medical and Health Technology
Christoph Stadtfeld	D-GESS	Social Networks; Statistical Modelling; Social Integration and Mental Health
Bill Taylor	D-HEST	Musculoskeletal Biomechanics; Medical Technology; Neuromotor Control
Philip Ursprung	D-ARCH	Contemporary Architecture; Contemporary Art; Relation of Visual Culture and Science, Economy and Politics
Effy Vayena	D-HEST	Bioethics; Data Ethics and Governance; Health Policy
Julia Vogt	D-INFK	Medical Data Science; Machine Learning; Data Mining
Georg von Krogh	D-MTEC	Strategic Management of Digital Technology and Artificial Intelligence; Innovation in Pharma and Health Care; Organisation of User Innovation
Nicole Wenderoth	D-HEST	Neurofeedback; Brain Stimulation; Motor Neuroscience
Peter Wolf	D-HEST	Human-Robot Interaction; Biomechanics; Motor Learning
Mehmet Fatih Yanik	D-ITET	Brain Machine Interfaces; Systems Neuroscience; Ultrasound Drug Delivery
Marcy Zenobi-Wong	D-HEST	Biomaterials; Bioprinting; Cell-Material Interactions

Associate members (ETH external)

Chris Awai	Lake Lucerne Institute	Technology-Based Assessments of Movement Quality; Digital Biomarkers; Rehabilitation Trajectory Modelling in Decentralised Rehabilitation
Meret Branscheidt	UZH/cereneo	Clinical Neurorehabilitation; Motor Learning & Control; Neurophysiology of Recovery
Florian Brunner	UZH/Balgrist	Complex Regional Pain Syndrome; Spine Conditions; Manual Medicine
Armin Curt	UZH/Balgrist	Spinal Cord Injury; Neurophysiology; Neurology
Sarah Ebling	UZH	Artificial Intelligence for Language Accessibility; Language-Based Assistive Technologies; Digital Accessibility
Mazda Farshad	UZH/Balgrist	Orthopaedic Surgery; Spine; Surgical Innovation
Florian Freisleder	Schulthess Klinik	Reverse Shoulder Arthroplasty; Biological Augmentation in Rotator Cuff Repair; Scapulothoracic Disorders
Claudia Galli	ZHAW	Occupational Therapy; Management and Accreditation; Interprofessional Leadership
Roman Gonzenbach	Kliniken Valens	Neurorehabilitation; Neurology; Neuroplasticity
Lukas Imbach	UZH/Klinik Lengg	Brain Stimulation; Epilepsy and Disability; Sensor Technology for Diagnosis and Monitoring
Thomas Kessler	UZH/Balgrist	Neuro-Urology; Neurosciences; Clinical and Translational Medicine
Christian Lanz	Schulthess Klinik	Interventional Pain Management; Peripheral Nerve Disorders; Electroneuromyography
Bertrand Léger	Suva/ Suva-Kliniken	Molecular Biology; Epigenetic; Clinical Research
Andreas Luft	UZH/USZ	Stroke Rehabilitation; Neural Plasticity & Learning and Reward; Telerehabilitation
Andreas Meyer-Heim	UZH/KISPI	Paediatric Rehabilitation; Spastic-Dystonia-Management and Neurocognitive Function after ABI; Translational Research
Carsten Möller	VAMED	Parkinson's Disease and other Movement Disorders Data Science; Neurorehabilitation; Clinical Neurology
Rahel Naef	UZH/USZ	Family Health; Nursing Interventions; Implementation Science
Jürgen Pannek	UNIBE/SPZ	Neuro-Urology; Incontinence; Spinal Cord Injury
Peter Sandor	UZH/ZURZACH Care AG	Neurorehabilitation; Headache & Pain; Therapeutic Interventions
Johannes Scherr	UZH/Balgrist	Exercise on Musculoskeletal and Cardiopulmonary System; Prehabilitation; Performance Assessment
Dominik Straumann	UZH/USZ	Neuro-Otology; Movement Perception; Concussion
Markus Wirz	ZHAW	Rehabilitation of Functions; Assessment of Functions; Pragmatic Research
Björn Zörner	UZH/SPZ	Neuroscience; Gait Disturbances and Analysis

Honorary members (ETH internal/external)

Volker Dietz	UZH/Balgrist	Human Motor Control; Movement Disorders; Neurorehabilitation
Martin Schwab	ETH/D-HEST	Neuroscience; Drug Development; Clinical Trial Planning

Members of the Steering Committee



Robert Riener
Chair
D-HEST



Roger Gassert
Vice-Chair
D-HEST



Armin Curt
UZH/Balgrist



Isabel Günther
D-GESS



Christian Holz
D-INFK



Philip Ursprung
D-ARCH



Marko Köthenbürger
D-MTEC



Mirko Meboldt
D-MAVT



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Grand Resort Bad Ragaz



Gery Colombo
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Centre for Accessible
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Georg Schrattenecker
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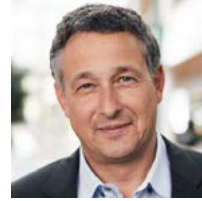
Andreas Gerber-Grote
ZHAW School of Health
Sciences



Till Hornung
Kliniken Valens



Nils Jent
University of St. Gallen
(HSG)



Stefan Launer
Sonova



Jacqueline Martin
Careum



Brian McGowan
Sensability



Fabrizio Petrillo
AXA Switzerland



Serge Reichlin
Barmelweid Group

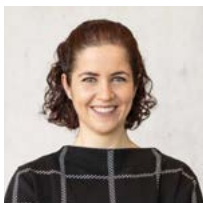


Andreas Roos
VAMED Switzerland

Executive Office



Oliver Stoller
Executive Director



Desiree Beck
Project and Education
Manager



Stefan Schneller
Content & Multimedia

Supporting staff



Frederic Schlicht
Administration



Diana Siedler
Administration



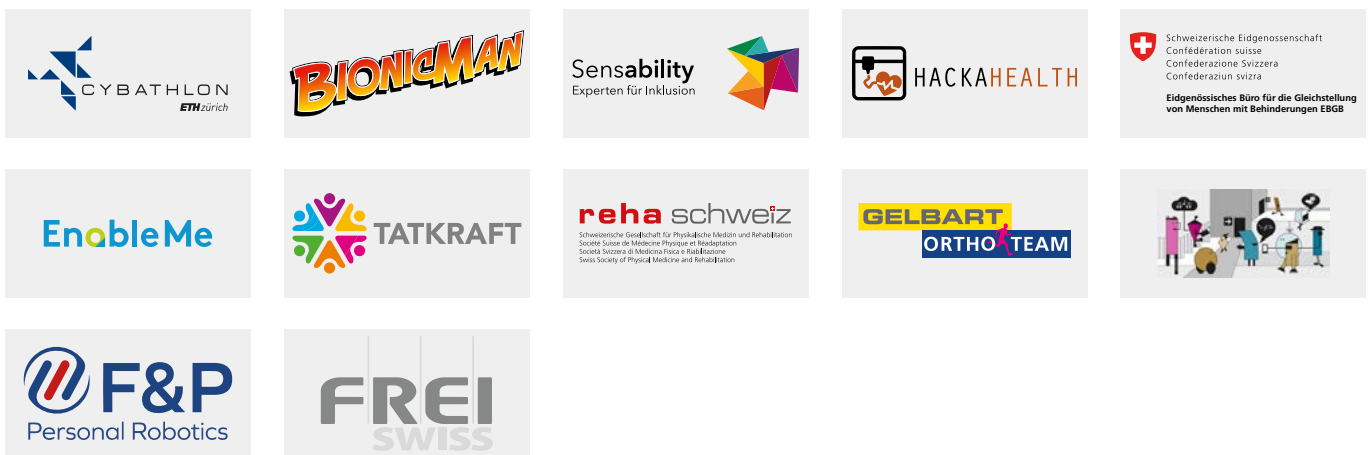
Sabina Eipe
Administration

Partners

Strategic partners



Knowledge partners



Start-up partners



Associated universities and clinics



Financial report 2023

Funding budget for RESC research and development programmes (multi-year)

Revenues	Donor/Third party	Start	Duration (y)	CHF
	Uplift Fundraising (various)	2020	open	133,033
	Swiss Paraplegic Foundation ¹	2021	5	1,000,000
	Uplift Fundraising (various)	2022	one-time	130,000
	Suva	2022	5	1,000,000
	Innosuisse Flagship	2022	5	268,265
	Stiftung Cerebral	2022	open	5,000
	Total			2,536,298
Awarded / Transfer	Project / Recipient			
	Hackster (RESC Research Call 1)	2021	1.5	93,033
	FutureINg (RESC Research Call 1)	2022	one-time	130,000
	RESC Outreach Project "Exhibition"	2022	1	40,000
	RehabCoach (RESC Research Call 2)	2022	3	300,600
	pAln-sense (RESC Research Call 3)	2023	1.5	192,900
	FMW (RESC Research Call 3)	2023	2	276,100
	RESC Executive Office Management	2022/2023	2	80,000
	RESC Personnel costs "SwissNeuro-Rehab"	2023	1	36,783
	Total			1,149,416
Financial result				1,386,882

¹ Total donation is CHF 2.5 Mio (expected to be a total of CHF 5 Mio over 10 years). ≤40% of volume can be used for research programmes, ≥60% for the ETH research lab at the Swiss Paraplegic Centre.

Operational budget of the RESC Executive Office

Revenues		CHF
	ETH Zurich Executive Board	200,000
	ETH D-HEST Contribution	100,000
	RESC Member fees	38,000
	Sponsors (operational)	91,900
	Third-party funding (projects)	36,783
	Carry over from 2022	62,583
	Total	529,266
Expenses		
	Personnel costs (incl. social benefits)	387,149
	Basic costs (IT, repro, office)	5,530
	Communications and PR	10,541
	Events, seminars, development	84,061
	Travel, representation, education	4,674
	Total	491,955
Financial result	Carry over into 2024	37,311

ETH Zurich
Competence Centre for Rehabilitation
Engineering and Science RESC
GLC, Gloriastrasse 37/39
8092 Zurich
resc.ethz.ch
info@resc.ethz.ch
linkedin.com/company/ethzresc

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