



Botnar Research
Centre for
Child Health

Innovative and Translational Healthcare Interventions for Children and Adolescents Worldwide



University
of Basel

ETH zürich

Supported by Fondation Botnar

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According to the World Health Organization, more than 5 million children under the age of 5 die every year. The largest burden of disease and mortality is carried by low- and middle-income countries.¹ Many of these deaths could be averted with appropriate preventive measures and adequate therapies.

There is a critical need to develop and implement new, cost-effective and robust healthcare solutions and interventions for newborns, children and adolescents. Innovative bio-medical research and digital health technologies have the potential to address unmet medical needs around the world. To be impactful, solutions and interventions need to be context-specific and translatable.

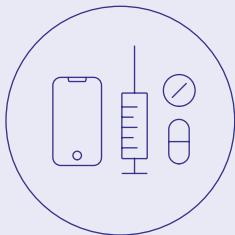
The Botnar Research Centre for Child Health enables research aimed at advancing our understanding of fundamental biological processes. Here, a researcher prepares samples in an oxygen-free tent for *in vitro* investigations of human gut bacteria, the gastrointestinal microbiome.





Who We Are

In order to develop innovative, efficient and effective healthcare interventions and treatments for paediatric patients worldwide, the University of Basel and ETH Zurich jointly founded the Botnar Research Centre for Child Health (BRCCH). This independent research centre is generously supported by Basel-based Fondation Botnar and it began its operations in 2019.



Our Mandate

is to drive outstanding and innovative scientific research that will lead to improved health outcomes and well-being in children and adolescents. The Centre addresses unmet medical needs, seeks to develop and improve diagnostic tools and designs novel interventions for young people, especially those in low- and middle-income countries (LMICs).



Our Mission

is to embrace the expertise of our partner institutions and thus foster a research community that is able to develop new healthcare solutions for the benefit of young people worldwide. To make this happen, physicians and scientists work together in multidisciplinary teams to recognize medical needs, implement innovative research and scale feasible solutions. The BRCCH pursues these goals collaboratively with partners across the globe.



Our Vision

for the BRCCH is to create a centre which fosters multidisciplinary and translational research in order to address unmet medical needs in paediatric health. The objectives are to create novel solutions for the prevention, diagnosis and treatment of disease and to develop tools that can accurately predict their course. The BRCCH aims to become a crystallisation point for national and international expertise in child health.



University
of Basel

Life sciences,
medicine, humanities &
social sciences

ETH zürich

Engineering,
computational sciences,
data sciences &
medical technologies

UKBB

Paediatrics,
clinical research &
clinical trials

The logo of Swiss TPH, featuring a stylized purple and white graphic element resembling a stylized letter 'S' or a flame.

Swiss TPH

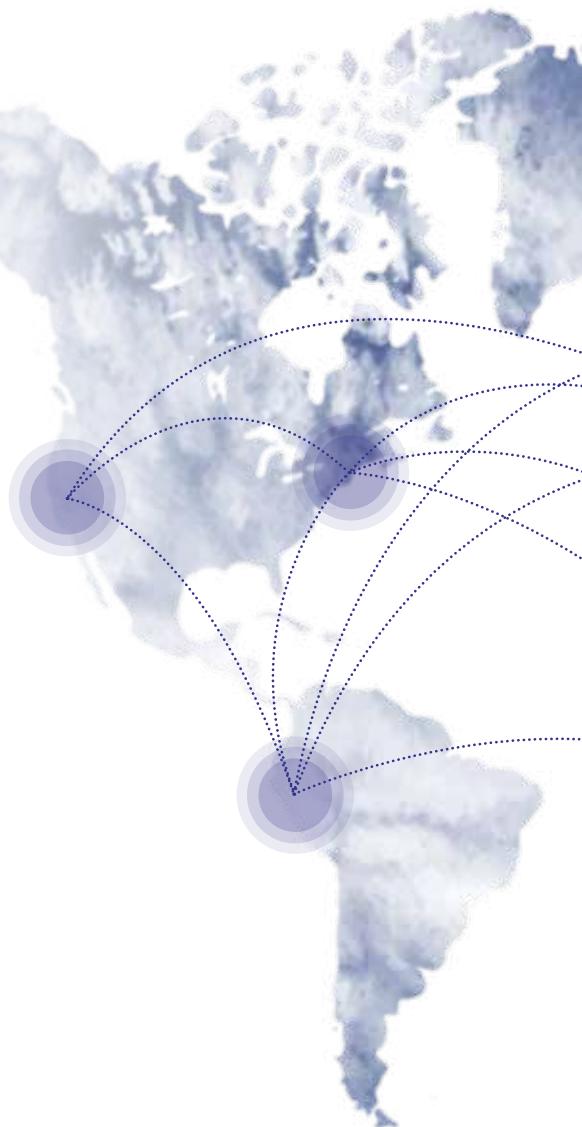
Infectious diseases,
public health &
epidemiology

Partner Institutions

The BRCCH has four outstanding academic partners: University of Basel, ETH Zurich, University Children's Hospital Basel (UKBB) and the Swiss Tropical and Public Health Institute (Swiss TPH). They jointly support the Centre's objectives by combining their complementary expertise in the life sciences; medicine, especially paediatrics; engineering; information technology; epidemiology; public health; and social sciences. Collaborations among the BRCCH's partners facilitate the successful design and execution of multidisciplinary projects and thus create a unique research community.

Where We Are

The BRCCH is physically located in Basel, Switzerland, but engages with national and international networks of research communities in order to achieve its goals. Innovation and dialogue are bidirectional amongst its network partners. Hence, the BRCCH operates across institutional, regional and national borders in order to design, develop, translate and implement its research.

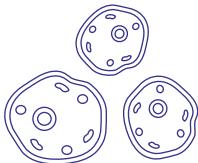




Research Portfolio

In order to deliver on its ambitious goals, the BRCCH seeks to support a comprehensive research portfolio with projects that span from early-stage endeavours with significant innovative and translational potential to late-stage projects focused on validation and implementation.

The Centre fosters projects on a continuous path from basic science towards translation and implementation. Its research portfolio is designed to have real-life impact by improving health outcomes for children and adolescents, especially in LMICs.



Cellular Systems



Population

Early-Stage Research

The Centre's projects have significant innovative potential and in the long term, a high likelihood of translation and eventual implementation in LMICs. These projects include endeavours that address relevant challenges associated with significant disease burden and/or societal implications in the Global South. The BRCCH therefore invests in scientifically outstanding early-stage projects that promise to deliver step-changing solutions.

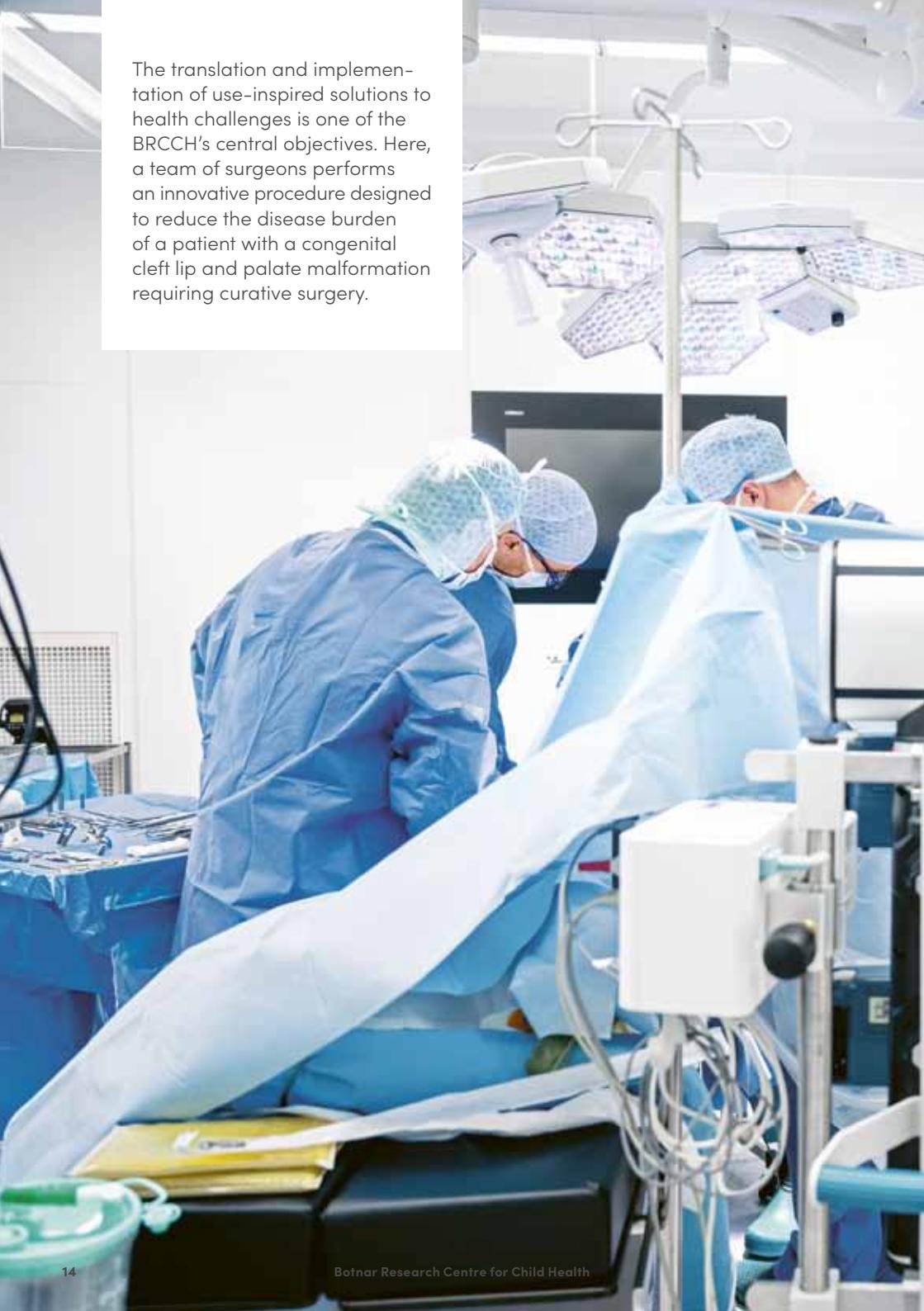
Mature-Stage Research

These projects test the feasibility, robustness and usefulness of methods and medical devices for the diagnosis, treatment, monitoring and predicted future course of diseases on a larger scale, in real-world settings and in consideration of specific contexts. BRCCH researchers work closely with international collaborators to test the effectiveness of methods and devices in their intended use and to investigate the feasibility of their uptake, especially under resource-constrained conditions.

Translational Research

These projects are positioned on the path to implementation at a stage where previously collected research findings can now be further validated at scale and translated into use-inspired solutions. Translational projects will advance early technology and engineering developments designed to improve diagnostics, disease monitoring or therapy. The realisation of these projects forms an essential element of the BRCCH's remit of implementing findings from basic science.

The translation and implementation of user-inspired solutions to health challenges is one of the BRCCH's central objectives. Here, a team of surgeons performs an innovative procedure designed to reduce the disease burden of a patient with a congenital cleft lip and palate malformation requiring curative surgery.



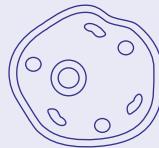


Research Focal Areas

The BRCCH and its partners conduct multidisciplinary research projects that address unmet medical needs in the context of a wide range of communicable and non-communicable medical conditions in young people. These efforts focus on diseases that cause a significant burden to individuals, their families and the wider community, irrespective of an individual's societal conditions. BRCCH scientists and physicians design and develop bespoke solutions to prevent, mitigate or even cure diseases. The BRCCH's output therefore focuses on improving the health of young people. Four broad research areas are at the centre of this effort.



Digital Health



Advanced
Bioengineering

BRCCCH Focal Areas



Essential
Medical Devices



Ethics, Policy &
Implementation



A medical student examines a plaster mould of a dental impression of a child's cleft palate, which is a necessary part of designing a treatment plan. Projected onto her is the algorithm that will be used to digitally transform 2D photos of the cleft palate into a 3D digital mould, thereby negating the need for traditional plaster dental impressions.

Paediatric Digital Health



Currently, advances in computational and digital medicine focus largely on adult datasets. In comparison, efforts to collect and analyse high-quality health-specific data from young people are less common, not least because ethical and legal considerations often exclude or minimize the participation of minors in clinical trials. Consequently, solutions in precision and personalised medicine are particularly rare for this age group.

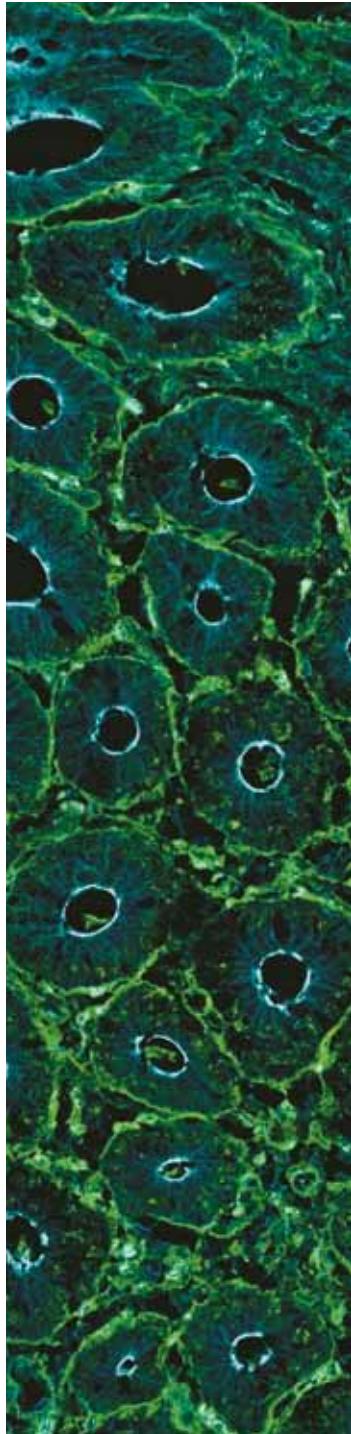
Using digital tools specifically tailored to the needs of children and adolescents, the BRCCH and its partners seek to collect high-quality multi-modal data related to health and states of disease. This will constitute an essential step towards effective disease modelling, diagnosis, treatment and monitoring.

The BRCCH's focus on paediatric digital health aligns with the strategies of both the University of Basel and ETH Zurich and accords with the mission of Fondation Botnar. A multi-pronged effort in digital health will fill current gaps in knowledge and thus create new opportunities for unique, valuable and impactful research.

Advanced Bioengineering for Paediatric Medicine

Ground-breaking advances in bioengineering (biotechnology and computational biology) and biomedical research are fuelling our ability to assess disease treatment and prevention, taking into account an individual's variability in genes, environment and lifestyle. This bioengineering approach is resulting in an era of more precise medicine, though it has so far been primarily applied to diseases affecting adults. The BRCCH therefore seeks to support bioengineering-based advances in precision medicine and to foster its application to health challenges in young people, especially those in LMICs.

Bioengineering-enabled precision medicine will provide a more accurate prediction of which treatment and prevention strategy for a particular disease will work in which groups of young people. To harness the power of precision medicine, the BRCCH will specifically invest in innovative bioengineering technologies to achieve this goal. Areas that are of interest to the BRCCH include the creation of novel platforms that support cost-effective, multi-modal approaches in order to collect large-scale diagnostic and therapeutic data sets; the new development of *in vitro*-based technologies that provide minimally invasive yet efficient diagnostic opportunities for present and emerging diseases; and the design and manufacture of advanced bio-therapeutics as an effective means of preventing and treating diseases.





A microscopic view of the crypt structure of the digestive tract showing the extracellular matrix protein fibronectin in green and F-Actin, a major component of the cellular cytoskeleton, in blue. These biomedical imaging approaches are used in research aimed at understanding and ultimately improving child health at a cellular level.



A researcher prepares a sample to load into a desktop PCR (polymerase chain reaction) device, pictured on the right. Innovations in the design and workflow of these devices mean that they can potentially be used at sites without extensive infrastructure.



Essential Paediatric Medical Devices

The use of age-appropriate and age-effective medical devices is especially critical for reducing disease burden in young people. However, there is a generally acknowledged deficiency of medical devices that are specifically designed to be used in the paediatric age group due to the physiological differences between young people and adults. Moreover, this deficiency is further compounded for devices to be implemented in LMICs since they have been primarily, if not exclusively, developed for use in high-income countries. Consequently, these devices may be incompatible with the conditions and infrastructure present in resource-limited settings.

The BRCCH supports the innovative design of essential medical devices that will improve paediatric care throughout the world. Its research portfolio will also support novel technologies that offer new or improved solutions for the diagnosis, monitoring and treatment of acute and chronic childhood diseases, as well as the rehabilitation of young people with disabilities, injuries and other life-threatening conditions. Bespoke point-of-care diagnostic and therapeutic devices will therefore be developed that meet the criteria to be used both in young people and under conditions relevant to LMICs.

Ethics, Policy and Implementation Research in Paediatric Health

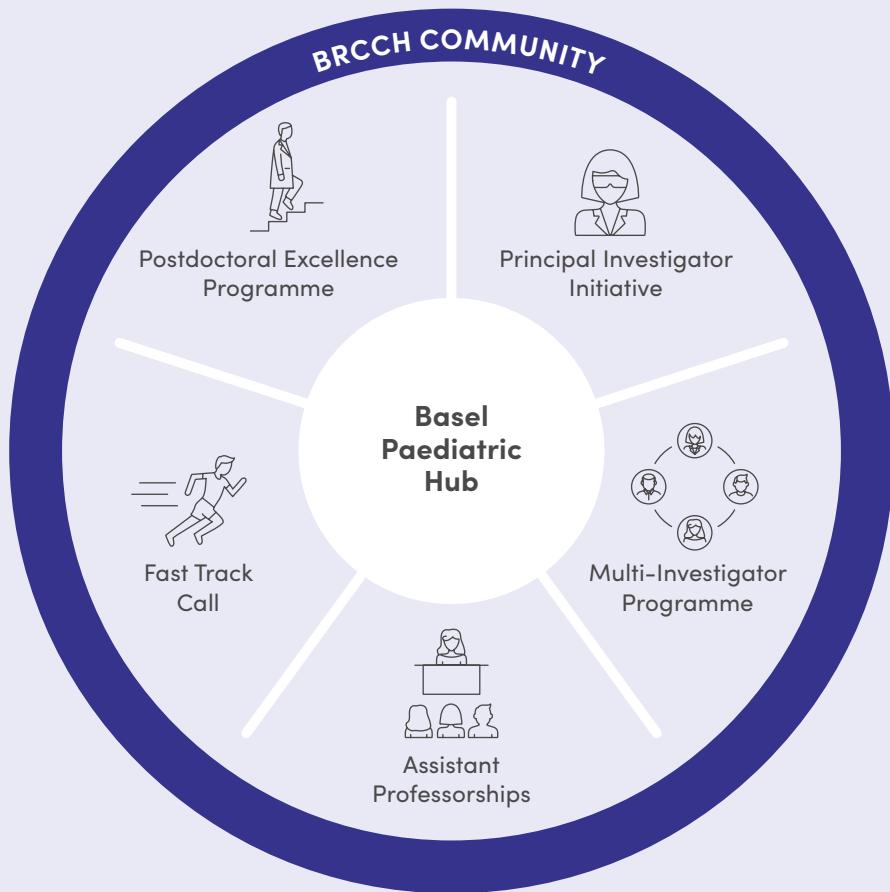
The BRCCH wants young people across different societies to have broad access to innovative technology and digital health solutions, thus benefitting society at large. However, many technologies have been deployed without due ethical considerations or circumspect policies in place. Regulatory frameworks within this domain are only just beginning to be developed by governmental and non-governmental organisations and regulatory bodies.

The BRCCH will therefore actively pursue and enable research dedicated to ethics, policy and implementation related to paediatric digital health interventions. In these research projects, specific attention will be given to how digital tools influence behavioural changes and decision-making in health issues that concern young people and their caregivers. Moreover, research related to the economic and socio-cultural implications of paediatric digital health data and their use in interventions and in the design of clinical trials will be undertaken in both the Global North and the Global South.





Two children living in the region of San Marcos, Peru, a remote location whose inhabitants may have difficulty accessing health services and infrastructure. The BRCCH supports research that seeks to evaluate, improve and validate a digital health support platform for early childhood development.



The BRCCH supports five distinct research programmes that have been specifically designed to implement its objectives both in the short and the long term.

1. The **Multi-Investigator Programme** (MIP) enables cornerstone projects led by larger consortia including at least two BRCCH partners that address big challenges in child and adolescent health and well-being. MIPs provide support for up to 5 years.
2. The **Principal Investigator Initiative** (PII) enables projects with a concise focus undertaken by consortia from single or multiple BRCCH partners. PIIs expand on existing and emerging expertise and receive support for up to 4 years.
3. The BRCCH creates **Assistant Professorships** at the University of Basel and ETH Zurich in order to address gaps in knowledge and competences related to its remit.
4. The **Postdoctoral Excellence Programme** sponsors the next generation of scientific leaders in global paediatric health and medicine and prepares them for the next stage of their careers.
5. The **Fast Track Call** provides a unique tool for responding to extraordinary and emerging health challenges to which the Centre's partners can rapidly provide innovative and far-reaching solutions.

Team



Prof Georg Holländer
Director BRCCH



Prof Sai Reddy
Vice Director BRCCH

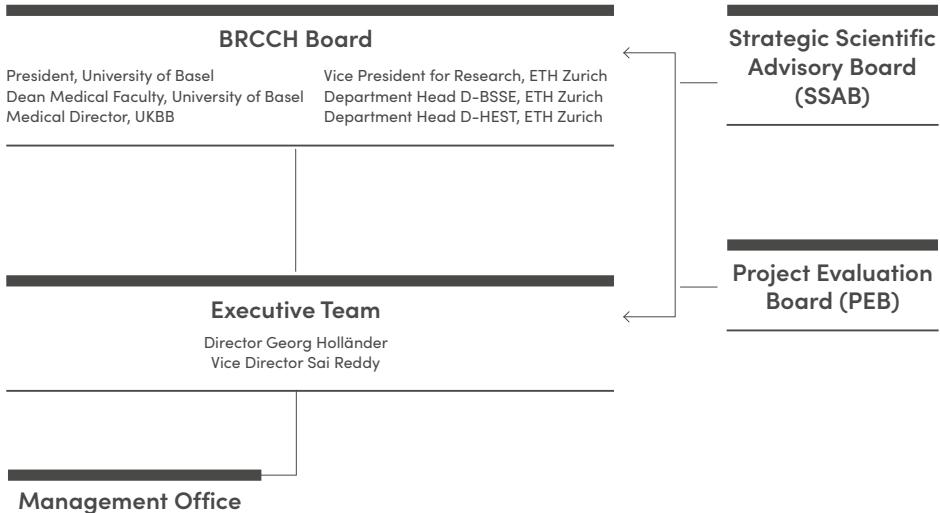
Academic Directors

Directors Holländer and Reddy are the Centre's academic leads and are responsible for its strategic orientation, initiatives and operations. Prof Holländer, an expert in molecular developmental immunology, holds professorships at the University of Basel, ETH Zurich and the University of Oxford. Prof Reddy, an expert in systems and synthetic immunology, holds a professorship at ETH Zurich and is the co-founder of the biotechnology spin-off company deepCDR Biologics.

Management Office

The directors are supported by a core management team. Led by the General Manager, the team is in charge of the administration of research calls and evaluations, grants management, budgeting and financial control, community-building and public engagement, communications and more.

Governance



The BRCCH's work is supported by the BRCCH Board, formed of representatives from the University of Basel and ETH Zurich, and the Strategic Scientific Advisory Board (SSAB), comprising national and international experts. An ad hoc Project Evaluation Board (PEB) is responsible for the independent scientific evaluation of research applications.





Reference

1. Institute for Health Metrics and Evaluation (IHME). GBD Compare Data Visualization. Seattle, WA: IHME, University of Washington, 2018. Available from <http://vizhub.healthdata.org/gbd-compare>. (Accessed 20.10.2020.)

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Cover: Digital 3D mesh rendering of a child's cleft palate.

