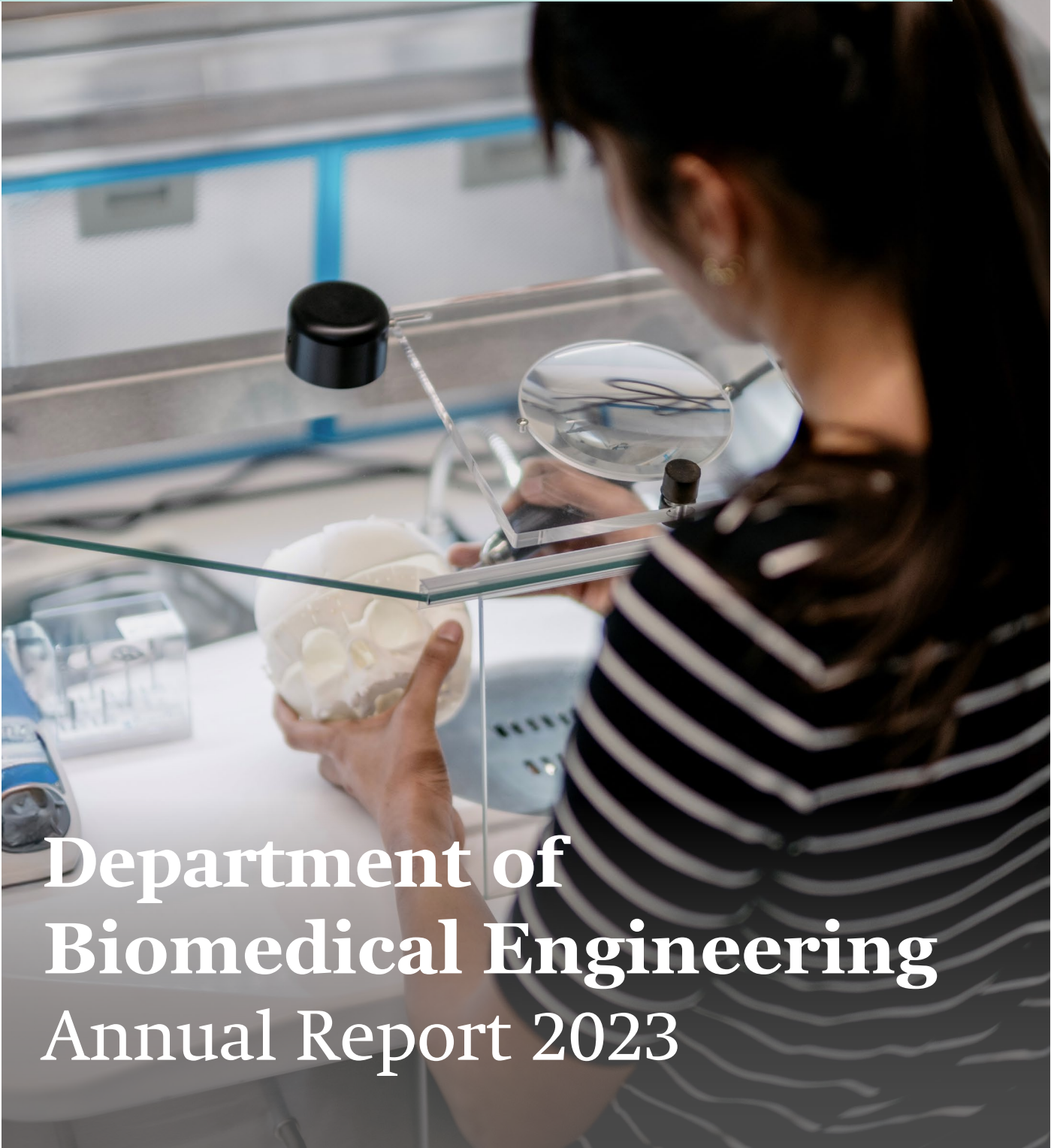




**University
of Basel**

Department of
Biomedical Engineering



**Department of
Biomedical Engineering
Annual Report 2023**

Guiding Principles

Our Vision

We contribute to a world where health care needs are met by innovative biomedical research and engineering solutions.

Our Mission

We translate basic science and engineering into medical knowledge and healthcare innovations.

We provide high-quality education and capacity building for academics, clinicians, and industrial partners.

Our Values

We adhere to the Code of Conduct of the University of Basel and promote an interdisciplinary culture of dialog, appreciation, respect, honesty, and tolerance.

We are committed to scientific integrity, reliability, transparency, and good scientific practice.

We value and foster enthusiasm and passion for science

Our Main Goals in Four Fields of Action

- 1. Research, Problem Solving, Innovation & Translation:** The DBE provides practical innovative biomedical engineering solutions for clinical challenges and covers the whole translation process from bench to bedside by developing and validating clinical applications and supporting approval processes.
- 2. Organization, Collaboration & Environment:** The DBE is a multidisciplinary network of research groups and clinicians and combines life sciences with complementary expertise. It is a research department that is embedded in the Medical Faculty, integrated in a clinical environment and part of an ecosystem of med-tech spin-offs, industry, and proximity to pharma and hospitals. In this constellation the DBE is a unique platform in Switzerland and the EU.
- 3. Talents & Education:** The DBE's motivated faculty provides excellent education, capacity building, and integrates our interdisciplinary students directly into ongoing research activities.
- 4. Finances & Structural Resources:** The DBE is secured by solid structural funding by the University, resp. the Medical Faculty covering the core facilities, research-IT, safety, and administration. To stabilize it in the future, at least one permanent University professorship in every research cluster will be needed. The DBE is an interesting partner for innovative research and able to secure substantial third-party funding exceeding the structural funding approximately three to four times.

The implementation of our mission relies on the support of our founding institutions:

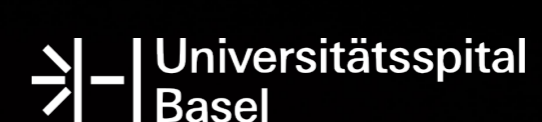


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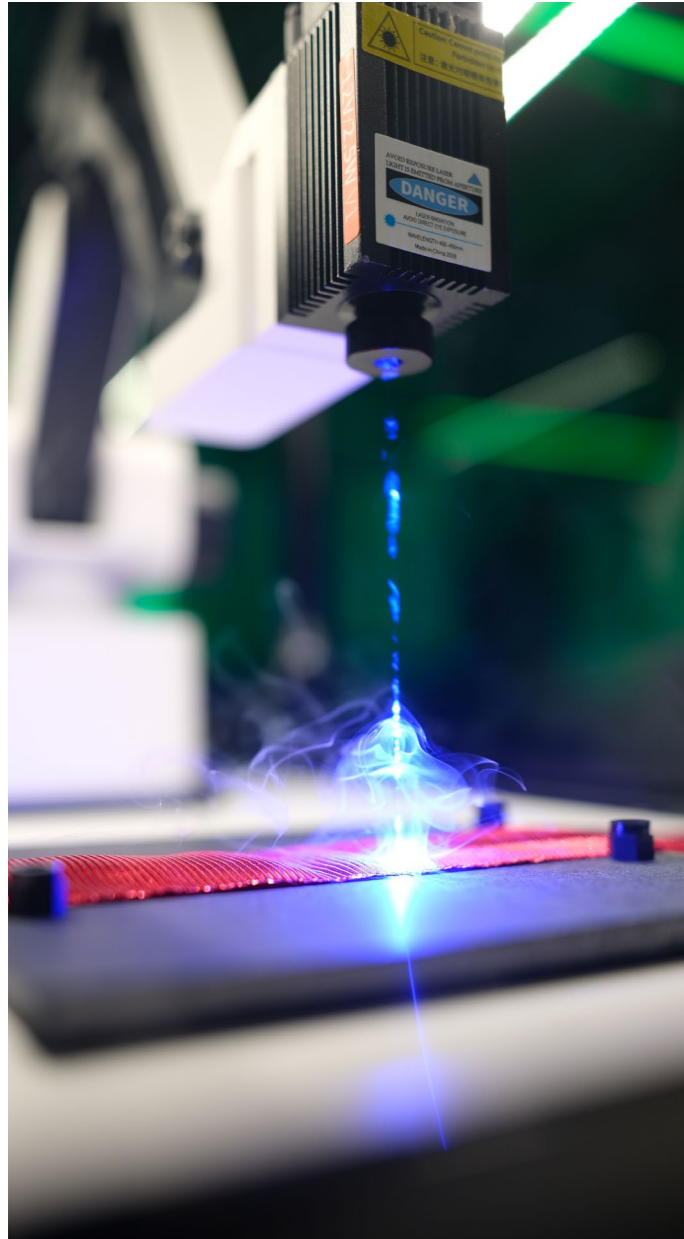
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Preface



All Engines Running



In January 2023, the DBE moved to its new premises with the aim of becoming a launch pad for truly translational engineering projects, a platform that allows researchers to take off and go where no one has gone before. These hopes have been fulfilled!

Completely new ideas crystallize when researchers of all groups and ranks casually meet in our Science Lounge (at the only coffee machine in the entire DBE). Within a very short period of time projects ideated here and elsewhere at the DBE have received many millions of Swiss francs in funding and made us the third-party funding champion of the University of Basel. As hoped, our laboratories – designed and equipped by the group leaders themselves – allow us to square the circle in creating truly new applications for clinical practice.

Not only has research seen a boost, but also the new Joint Master in Biomedical Engineering has been launched and now offers even more opportunities for the growing number of students.

Our expectations regarding the neighborhood have additionally been fulfilled: Exciting start-ups join us every month, and every week there is a lecture, a networking event, or a barbecue where people and ideas casually and playfully connect. The increasing density of life science companies and projects attracts more and more clinicians to work with us and our neighbors. This interest will intensify even further when our CADENCE gait and movement laboratory and our experimental OR will be up and running, and parts of the Skills Lab of the Faculty of Medicine will have moved into our building.

The sheer power of all these projects taking off reminds us of that decisive moment in the Apollo 11 mission when it was said: "All engines running."

Philippe Cattin & Daniela Vavrecka-Sidler

Take a quick tour of the new DBE:
<https://youtu.be/mV8siyliRXY>

DBE in Numbers in 2023

7.2 Mio CHF funding



3.4 Mio SNF
0.6 Mio EU-/SERI
0.6 Mio Innosuisse
2.6 Mio Foundations



13
Spin-Offs since 2015



25
Patents since 2014



120
Collaborations



21
Awards & Prizes



368
Peer Reviewed Publications
incl. **148** first/last author

28 Research Groups



243 Members

100 University employed
123 Hospitals employed
20 Others

13 PhD Graduates

45 PhDs since 2018

17 Master's Graduates

61 Masters since 2020



Highlights 2023



First In-house 3D-Printed Implant at the University Hospital Basel



The first customized in-house 3D-printed PEEK cranial implant has been successfully implanted at USB in 2023 (picture: Digital Content Team, Swiss MAM, USB).

Milestone in medical innovation

In August 2023, the University Hospital Basel (USB) achieved a historic breakthrough in medical technology by successfully implanting its first 3D-printed Polyether-etherketone (PEEK) skull implant using an in-house 3D printing technology. After years of research and development under the framework of Dr. Neha Sharma's Ph.D. project at the Department of Biomedical Engineering (DBE), the USB became capable of producing in-house 3D-printed implants that adhered to rigorous international medical device standards. This achievement represents a significant stride in modern medicine, showcasing Prof. Thieringer's Swiss Medical Additive Manufacturing (Swiss MAM) research group's commitment to cutting-edge innovation and its leading role in 3D-printed patient-specific medical implants.

Patient-centered success and future prospects

The landmark procedure was performed on a patient who suffered a stroke in 2019, leading to complications with his skullcap. The success of the surgery not only marked a significant improvement in the patient's condition but also highlighted the advantages of in-house production of customized implants. The USB capability to tailor medical implants precisely to a patient's anatomical structure, comply with legal requirements, and ensure compliance with the Medical Device Regulation (MDR) sets a new standard for personalized and efficient medicine. Looking ahead, the Swiss MAM research group aims to expand its 3D printing capabilities to produce more intricate implants, such as those for facial reconstruction or the spine, solidifying Basel's position as a pioneering innovation platform for in-house 3D-printed personalized implant solutions.

MIRACLE^{II} Postdoc Dr. Manuela Eugster Receives Tenure Track Assistant Professorship



Prof. Manuela Eugster and the humanoid robot "Valkyrie" (images: ihmc robotics).

Prof. Manuela Eugster, Prof. Georg Rauter's first PhD student and postdoc at the University of Basel, has been awarded a tenure track assistant professorship at the ARTORG Centre for Biomedical Engineering Research, University of Berne. The MIRACLE^{II} team is delighted about this success that also reflects the internal capacity building efforts.

Before joining the University of Berne and while she still worked as MIRACLE^{II} postdoc at the DBE, Dr. Eugster visited the IHMC robotics lab in Pensacola, Florida, for a research exchange. This was made possible thanks to the Zaeslin Teaching Grant.

The Florida Institute for Human and Machine cognition (IHMC) is a not-for-profit research institute of the University of Florida that is pioneering the development of technologies that harness and extend human capabilities. IHMC's robotics lab (1) focuses on research in the areas of robotics, exoskeletons and human robotic interdependence. IHMC aims at developing humanoid robots and avatars as platforms for locomotion and control research and wearable robotics in the form of lower-body exoskeleton devices for mobility assistance in paraplegic patients.

As part of the software group, Dr. Eugster enjoyed full insight into the processes of developing, testing, and maintaining robust software and simulation tools for highly complex robotic systems, learned how to use the open-source software of IHMC robotics, and actively contributed to its further development (2,3). In addition, she enjoyed being part of the IHMC robotics lab, experienced the lab routines and events, and got to know the around 40 members of the robotics team.

Funding:



WERNER SIEMENS-STIFTUNG

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References:

(1) Sharma N et al. Quantitative Assessment of Point-of-Care 3D-Printed Patient-Specific Polyether-etherketone (PEEK) Cranial Implants. Int. J. Mol. Sci. 2021, 22, 8521.

(2) 3D printing: The first patient received an implant made at USB ([link](#)).

Funding:

Zaeslin Teaching Grant



WERNER SIEMENS-STIFTUNG

Group Leader:

Prof. Georg Rauter
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References:

(1) <http://robots.ihmc.us/>

(2) <https://github.com/ihmcrobotics>

(3) [ihmc open robotics software tutorials](#)

PPHS “Invite-Your-Expert”- Event at DBE



Figure 1: Invitation slide to the Invite Your Expert Event (picture: M. Diepenbroek).



Figure 2: Dr. Marta Diepenbroek's talk (picture: J. Schulte).

The PhD Candidate Janine Schulte, from Dr. Schulz's Forensic Genetics Group, received the PPHS (PhD Program Health Science) “Invite your Expert” grant for inviting an expert to give a talk and workshop at the DBE.

PhD students at the Faculty of Medicine and Swiss TPH have the opportunity to invite an expert in their field to give a talk in a variety of formats thanks to the “Invite your Expert” initiative. Funding of up to 2,000 CHF is available, and PPHS offers assistance with advertising and logistics.

Dr. Marta Diepenbroek was invited and hosted by the Institute of Forensic Medicine in May 2023. She gave a fascinating talk about “Molecular dissection of a crime scene? Everything you want to know about forensics”.

The students received some practical experience with capillary electrophoresis (CE) and massive parallel sequencing (MPS) data for forensic DNA mixture analysis and DNA phenotyping (FDP) predictions during a follow-up workshop. The guest speaker responded to every question, keeping the audience highly engaged and eager to absorb knowledge. With 14 participants, the event provided a valuable opportunity to delve into the fascinating world of forensic science. The subsequent lunch included highly beneficial conversations encompassing topics beyond career planning.

With the exceptional organization and support by the PPHS, we would strongly endorse this initiative to other research groups. PhD students can increase their organizational and communication proficiencies, establish connections with leading experts in their discipline, and foster relationships with fellow PhD candidates.

Funding:



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References:

<https://pphs.unibas.ch/program/funding-support/inviteyourexpert/>



Evaluated Groups



Evaluated Group 2023: Facial and Cranial Anomalies

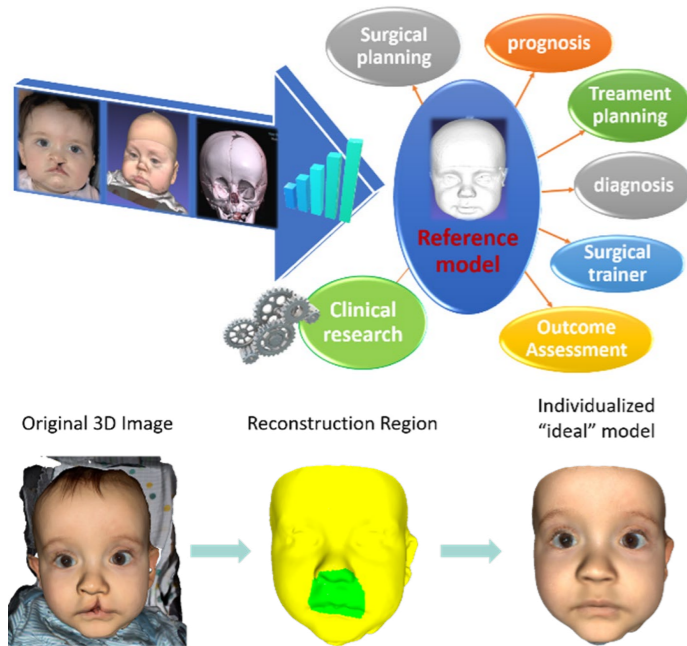


Figure 1: 3D data acquired in clinical routine is used to develop an algorithm to generate individualized "ideal" model (picture: FCA).

The primary objective of the Facial and Cranial Anomalies (FCA) research group is to advance our understanding of the morpho-functional aspects of congenital anomalies in infants and children across their developmental stages. In pursuit of this goal, we leverage the latest technologies to develop and identify engineering solutions for clinical questions. Our focus lies in unraveling the intricate relationship between natural growth and the impact of surgical or non-invasive interventions specifically within the context of facial cranial malformations.

Together with our partners in computer science and engineering at ETHZ, we digitalized and simplified our clinical workflow to make use of clinical digital data for our morpho-functional studies.

Our SNSF supported project in collaboration with ETH Zurich aims to develop accurate 3D infant face and head models based on clinical data using artificial intelligence (AI)-driven methods (Figure 1). The developed algorithm will be used for individualized prediction of reference or post-treatment morphology. It has potential applications in diagnosis, treatment planning, prognosis, outcome assessment, as well as for surgical training.

Within our multi-investigator project supported by Basel-Research Centre for Child Health (BRCCCH), our collaborators at ETH Zurich develop an algorithm for automated computation of palatal plate design, enabling individualized, more efficient, and decentralized 3D-printing of the presurgical therapy devices for newborns with cleft (Figure 2, Ref. 1 and 2). The developed automated pipeline will facilitate accessibility to the presurgical therapy at hospitals in regions with less resources. It received the "Bench to Bedside award" at the IPCAI 2023.

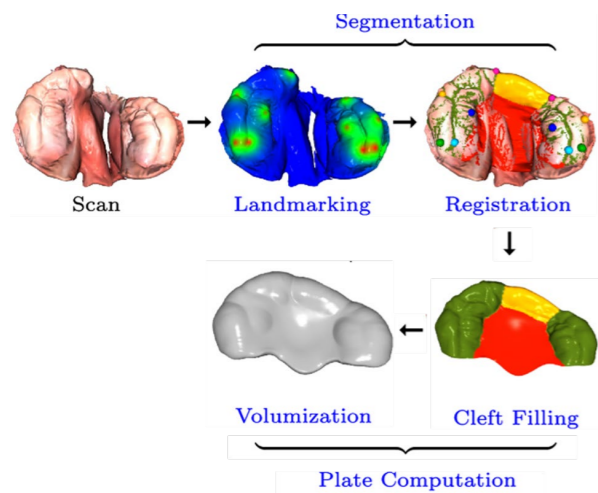


Figure 2: Automated plate computation, given an intraoral scan as input. The predicted landmarks guide the surface registration of a template that bridges over the scan's alveolar cleft (yellow). This registration yields a segmentation of the input scan, enabling automated plate computation (lower row) by filling the cleft palate area (red) and volumizing the surface for 3D-printing (picture: adapted from Schnabel et al., 2023).

Funding:
BRC CH Basel Research Centre for Child Health

Swiss National Science Foundation

propatient
 Forschungsförderung
 Universitätsspital Basel

Group Leaders:
 Prof. Andreas Müller
 aa.mueller@unibas.ch

References:
 (1) Schnabel TN, Gözcü B, Gotardo P, Lingens L, Dorda D, Vetterli F, Emhemmed A, Nalabothu P, Lill Y, Benitez BK, Mueller AA, Gross M, Solenthaler B. Automated and data-driven plate computation for presurgical cleft lip and palate treatment. *Int J Comput Assist Radiol Surg.* 2023 Apr 2.

(2) Meyer S, Benitez BK, Thieringer FM, Mueller AA. 3D-printable Open-source Cleft Lip and Palate Impression Trays – A Single-Impression-Workflow. *Plastic and Reconstructive Surgery.* May 15, 2023

Evaluated Group 2023: Magnetic Resonance Physics & Methodology

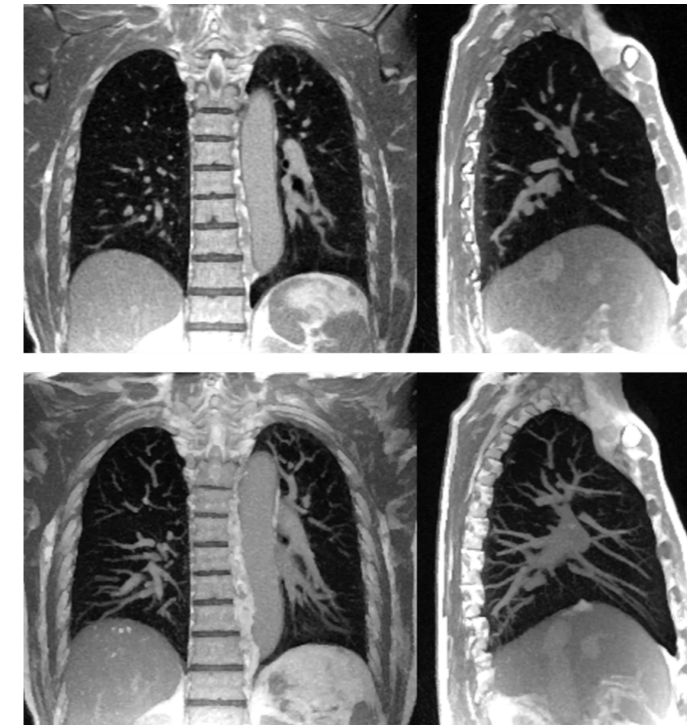


Figure 1: Exploring the "unseen" – morphological lung MRI: (top row) Coronal and sagittal view of the chest with 1.3 mm isotropic resolution. (bottom row) Corresponding 10 mm maximum intensity reconstructions (picture: Magnetic Resonance Physics and Methodology).

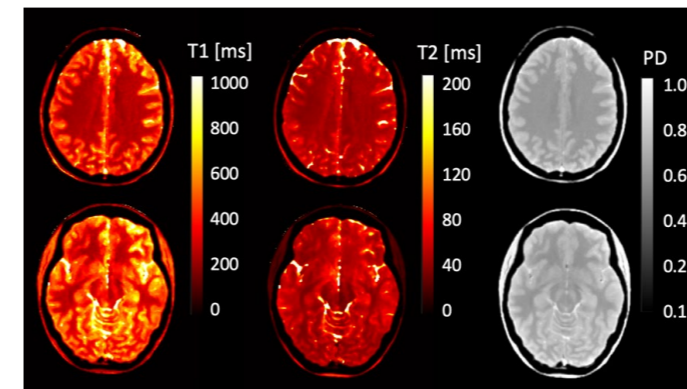


Figure 2: Beyond weighted MRI – brain tissue relaxometry with MRI: Longitudinal relaxation time (T1), transverse relaxation (T2) and proton density (PD) (picture: Magnetic Resonance Physics and Methodology).

Our research lies within the University of Basel's most important focal area „life sciences“. It is focused on basic research in the fundamentals of magnetic resonance physics, and on the development of dedicated magnetic resonance methods for applications in the field of biophysical, biochemical, and clinical sciences.

The division of Radiological Physics of the University Hospital Basel and the Magnetic Resonance Physics and Methodology Group of the Department of Biomedical Engineering (DBE) of the University of Basel are located within the Clinic of Radiology and Nuclear Medicine at the University Hospital Basel Campus. An overview of our current research activities at the Department of Theragnostics of the University Hospital Basel and at the Department of Biomedical Engineering of the University of Basel can be found [here](#).

We have numerous long-standing local, national, and international collaborations with renowned academic partners and a close collaboration in good standing with Siemens Healthineers International AG. We are active in the teaching and supervision of students and researchers at all different levels (from master students to post-doctoral researchers), and our research activities and overall competence in the field has continuously attracted highly motivated and highly skilled students and junior scientists from top universities worldwide to join our research group in Basel. The division of Radiological Physics is one of the world's top and highly renowned laboratories for cutting edge MR methods development, we are world leading experts in rapid imaging methods, and we have a strong commitment on the translation of our methods from the bed to the bedside.

Funding:
Swiss National Science Foundation

Group Leader:
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Evaluated Group 2024: CADENCE Clinical Biomechanics & Ergonomics Engineering

Evidence-based innovation in orthopaedics, neuroorthopaedics, spine surgery, and ergonomics

- BIROMED-Lab: Robot-assisted Theragnostics** (Prof. Rauter)
- Functional Biomechanics Adult Orthopaedics** (Prof. Mündermann)
- Clinical Biomechanics: Paediatric Orthopaedics and Musculoskeletal Modeling** (Prof. Viehweger, PD Dr. Sangeux)
- Spine Biomechanics** (PD Dr. Netzer)

Figure 1: The CADENCE research unit comprises several research groups (picture: CADENCE).

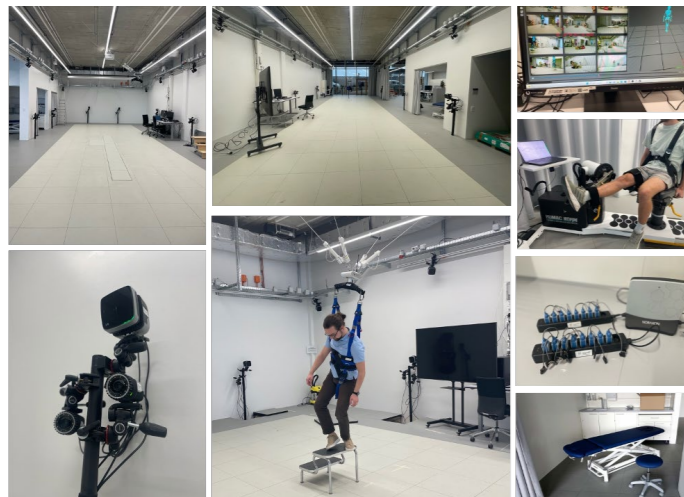


Figure 2: The CADENCE Core Facility offers a range of state-of-the-art technology (pictures: A. Mündermann).

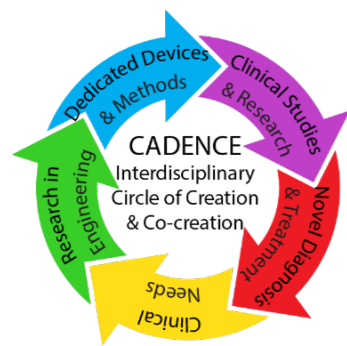


Figure 3: CADENCE and the interdisciplinary circle of creation and co-creation.

Funding:



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at UKBB: Dr. Friederike Prüfer (Radiology)

at ZHAW: Prof. Daniel Baumgartner
at ETH-Zürich: Prof. Stephen Ferguson, Prof. William Taylor, Dr. Dominika Ignasiak, Dr. Navrag Singh
at Universitätsklinikum Erlangen: Dr. Anna-Maria Liphardt

The CADENCE research unit combines the expertise and disciplines of robotics, functional biomechanics, musculoskeletal modelling, virtual reality, orthopaedics and neuroorthopaedics, paediatrics, spine surgery, biochemistry, and radiology.

Principal Investigators are Prof. Annegret Mündermann (USB/DBE), Prof. Georg Rauter (DBE), Prof. Dr. Dr. Heide Elke Viehweger (UKBB/DBE), PD Dr. Cordula Netzer (USB/DBE) and Dr. Morgan Sangeux (UKBB). Together with their teams, they develop novel systems, and methods for diagnosis, outcome measurement, treatment, and rehabilitation of pathologies and conditions of the neuromusculoskeletal system.

The new CADENCE Core Facility at the GRID building allows the different groups within the CADENCE research unit to focus on collaborative research projects by utilizing and combining the multidisciplinary expertise within the same research space and to translate results directly to the clinic by partnering with the existing groups and facilities in the current clinically based settings. Other academic and industry users can use the CADENCE Core Facility and draw from the expertise of the research unit.

Facts and Figures

The equipment of the CADENCE Core Facility was funded by a SNF R'Equip matching grant and the University of Basel. The CADENCE research unit is currently funded by the Department of Orthopaedics and Traumatology, the Department of Spine Surgery at USB, Neuroorthopaedics/Clinical Motion Analysis of the Department of Orthopaedics at UKBB, several SNSF grants, Toggenburger Stiftung, NCCR Robotics, Werner Siemens Stiftung, Swiss Government Fund, Innosuisse, and other private foundations. The group comprises seven Postdocs, four PhD-students and several Master and Bachelor students.



Start-Ups



Tailwind for Deep Breath Intelligence



Figure 1: DBI-EP|breath Test support for better life quality with epilepsy (picture: DBI)

Winner of the *Zünder Accelerator Award 2023 and selected to take part in the Swissnex Startup Bootcamp powered by Innosuisse. The startup Deep Breath Intelligence (DBI) founded by Prof. Pablo Sinues and his team is on a roll in 2023!

DBI has developed a medical breath test where patients can exhale through a mouthpiece into a high-resolution mass spectrometer. The solution is already being used in practice to measure the clinical effect of an epilepsy medication. The company is also working on a "breath collector" for use at home.

Thanks to this innovative technology, DBI was able to take part in the *Zünder acceleration program together with 42 other startups. Initially shortlisted as one of the 6 finalists to take part in *Zünder Start Up Day, DBI finally won the *Zünder Accelerator Award 2023 including a Grant of 15,000 CHF.

Besides, the DBI has been selected to attend the Swissnex Startup Bootcamp powered by Innosuisse. Swissnex is a global network connecting Switzerland and the world in education, research and innovation. Their mission is to support the outreach and active engagement of their partners in the international exchange of knowledge, ideas and talents, thus contributing to strengthen Switzerland's profile as a world-leading innovation hotspot. They have offices in San Francisco, Boston, Rio de Janeiro, Bangalore, Shanghai and Osaka. This is a further milestone in DBI's worldwide expansion.



Figure 2: DBI wins the *Zünder Accelerator Award 2023 (picture: DBI)

Logo:



Start-up Founder & Board Directors

Prof. Pablo Sinues
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Prof. Dr. Malcolm Kohler

Sigi Föhn

References:

(1) <https://dbi.ch/en/about-us/team>

Introducing POC APP: Your key to regulatory compliance and Innovation



Figure 1: Cranial implant tailored to fit an individual's skull (picture: Digital Content Team, Swiss MAM, USB).

Did you know that implants, anatomical models, and surgical guides are medical devices according to the Medical Device Regulations (MDR), POC APP, a startup from Prof. Florian Thieringer and Dr. Neha Sharma in collaboration with external partners, is transforming the medical device industry with its emphasis on compliance and evidence-based documentation in planning and manufacturing at the Point-of-Care (POC).

Manufacturing anatomical models, surgical guides, and implants within the POC 3D print lab demands more than 3D printers, materials, and skilled personnel. POC APP's solution ensures compliance with the Quality Management System (QMS) and Quality Assurance (QA) by providing customized evidence-based documentation aligned with the EU Medical Devices Regulations (MDR) and, consequently, the requirements of Swissmedic.

Our mission is to empower healthcare facilities to create safe and efficient personalized medical devices for patient treatment. Collaborating with POC 3D printing labs, we leverage our expertise to ensure regulatory compliance, fostering improved care and cultivating a sustainable culture of innovation and ongoing enhancement in medical device production.

Since its foundation in February 2023, POC APP has achieved significant milestones: successfully implanting the first 3D printed PEEK cranial implant at the University Hospital Basel (August 2023) and at the University Hospital Salzburg (September 2023). The POC APP team's implementation of an MDR (2017/745) compliant design and production process and a QMS was instrumental in these achievements.

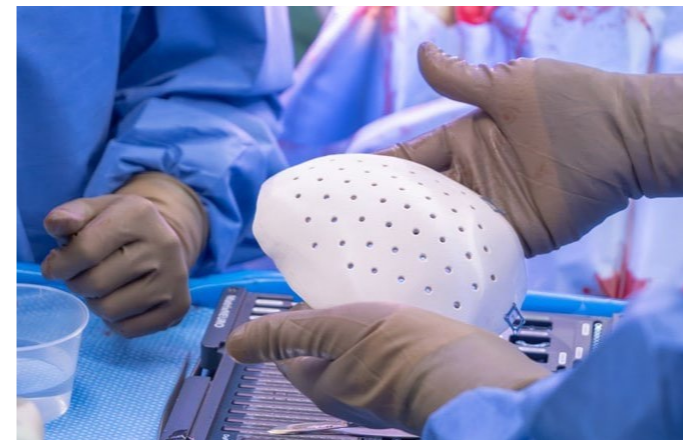


Figure 2: In-house 3D-printed customized Polyetheretherketone (PEEK) cranial implant (picture: Digital Content Team, Swiss MAM, USB).

Logo:



Start-up Founders:

Florian M. Thieringer (Clinical Advisor)

Bernhard Pultar (Chief Executive Officer)

Daniel Seiler (Chief Technical Officer)

Neha Sharma (Chief Medical Officer)

Özlem Weiss (Regulatory Advisor)

Ralf Schumacher (Strategic Advisor)

References:

(1) [3D-Druck: Der erste Patient hat ein am USB selbst hergestelltes Implantat erhalten.](#)

(2) [3D-Systems' Extrusion Technology to Produce Patient-specific PEEK Implants Supports Ground-breaking Cranial Surgeries at Leading European Hospitals.](#)

Specto Medical: Experience a New Dimension of Surgical Visualization

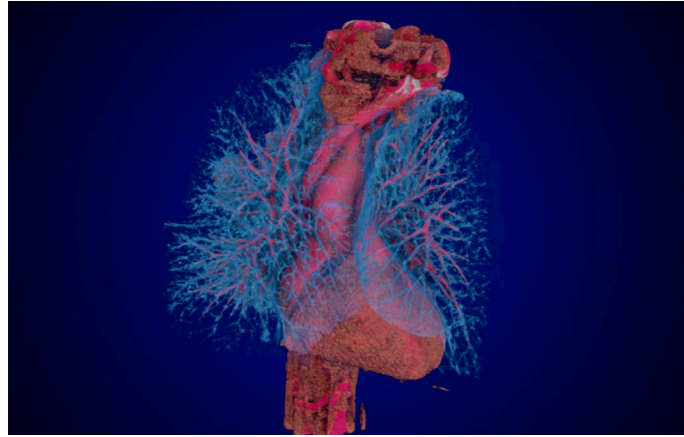


Figure 1: From scan to 3D visualization in seconds. Apply instant filters to visualize the tissue according to clinical needs (picture: Specto Medical).



Figure 2: Seamless exploration and manipulation of anatomical structures (picture: Specto Medical).

Specto Medical's unique VR software presents patients' data in a 3D virtual environment. It enables surgeons and patients to gain instant spatial understanding of complex surgical cases through immersive patient-specific visualizations of medical scans. This breakthrough in surgical foresight can be used for pre-operative planning, intra-operative visualization and patient education.

The VR software was developed within the MIRACLE project at the Department of Biomedical Engineering, University of Basel. Four members of the MIRACLE team including Prof. Philippe Cattin together with CEO and former Johnson & Johnson Manager Marc Mueller founded Specto Medical. Specto Medical is growing quickly and has currently 15 full-time employees.

The aim of the company is to medically certify the MIRACLE technology Specto for medical applications according to the Medical Device Regulation as well as FDA standard. Recently Specto Medical submitted the regulatory documents for FDA and CE certification to certify Specto as a class 2a medical product. In addition, Specto Medical is already successfully collaborating with the companies Stryker and B.Braun Aeskulap to create novel products to optimally prepare for surgeries.

Logo:



Start-up Founders:

Philippe Cattin
Marek Zelechowski
Balázs Faludi
Norbert Zentai
Marc Mueller

References:

(1) <https://spectomedical.com/>



Distinctions



Conference Awards



Figure 1: Several PhD students rewarded. From top to bottom: Linda Bühl, Esma Tankus and Jokin Zubizarreta (pictures: Functional Biomechanics Group and Swiss MAM)

With fourteen conference awards and prizes won this year by eight of our PhD students and three of our senior researchers the DBE has once again demonstrated its excellence.

Linda Bühl won the 2nd prize in the poster award competition sponsored by SPORLASTIC GmbH for her work "Vergleichbare Knie-Biomechanik aber unterschiedliche Muskelaktivierung nach VKB Naht mit Internal-BraceTM-Verstärkung und VKB Rekonstruktion."

Linda Bühl won the 1st prize for best poster at the GAMA (Gesellschaft für die Analyse menschlicher Motorik in ihrer klinischen Anwendung) Congress for her work "Knee kinematics during gait 2 years after ACL surgery: A comparison between internal brace-augmented ACL repair, ACL reconstruction and healthy controls."

Jokin Zubizarreta from Swiss MAM research group won the Gold Award at the 5th Symposium on 3D Printing for Life Sciences, held in Basel. The Pitching Award for 3D Printing in Life Sciences is a highly competitive event that brings together researchers, industry professionals, and experts in this field.

Esma Bahar Tankus from Swiss MAM research group received the best oral presentation award at the 5th Young Scientist Symposium of Swiss Society for Biomaterials and Regenerative Medicine (SSBRM) held at ETH Zurich.

Esma Bahar Tankus also won the Silver Award at the E.S.T.R.O.T. conference in Frankfurt, Germany for her abstract titled "Guiding nasal chondrocytes through 3D bio-printed design to generate an osteochondral tissue."

Alvaro Gonzalez Jimenez has received a remarkable dual honor: the prestigious MICCAI STAR (Student Author Registration) Award and the Best Paper Award for his outstanding contribution in the paper titled, "Robust T-Loss for Medical Image Segmentation."

Michaela Maintz and **Yukiko Tomooka** won the 2nd prize for the Stäubli Best Paper Award for their work on "In situ minimally invasive 3D printing for bone and cartilage regeneration – a scoping review" at the CURAC 2023 conference.

Michaela Maintz has been awarded the Gold Poster Award at the 9th DBE Research Day for her work "From Nature to the Operating Room – A Biomimetic Approach to Mandible Fracture Plate Design."

Murali Karnam has been awarded the Silver Poster Award at the 9th DBE Research Day for his work "Surgeon's Third Hand for Robot-Assisted Neuroendoscopy – A Proof of Concept Study."

Cédric Duverney has been awarded the Bronze Poster Award at the 7th DBE Research Day for his work "Manipulating and Assembling Miniature Objects and Parts."

Dr. Corina Nüesch won the 2nd prize for the best poster award at the GAMA Congress for her work: "Improvements in gait patterns of patients 1-year after total hip arthroplasty assessed using an inertial sensor system compared to a marker-based system."

Dr. Corina Nüesch won the 3rd prize for the best published scientific journal article with focus on clinical relevance of movement analysis at the GAMA Congress for her work: "Assessing Site Specificity of Osteoarthritic Gait Kinematics with Wearable Sensors and Their Association with Patient Reported Outcome Measures (PROMs): Knee versus Hip Osteoarthritis."

Dr. Alina Senst was awarded the poster prize of the 2023 conference of the Deutsche Gesellschaft für Abstammungsbegutachtung (DGAB).

Prof. Andreas Müller and co-workers' latest work published in the International Journal of Computer Assisted Radiology and Surgery was recognized with the "Intuitive Bench-to-Bedside Award" at the 14th International Conference on Information Processing in Computer-Assisted Interventions.

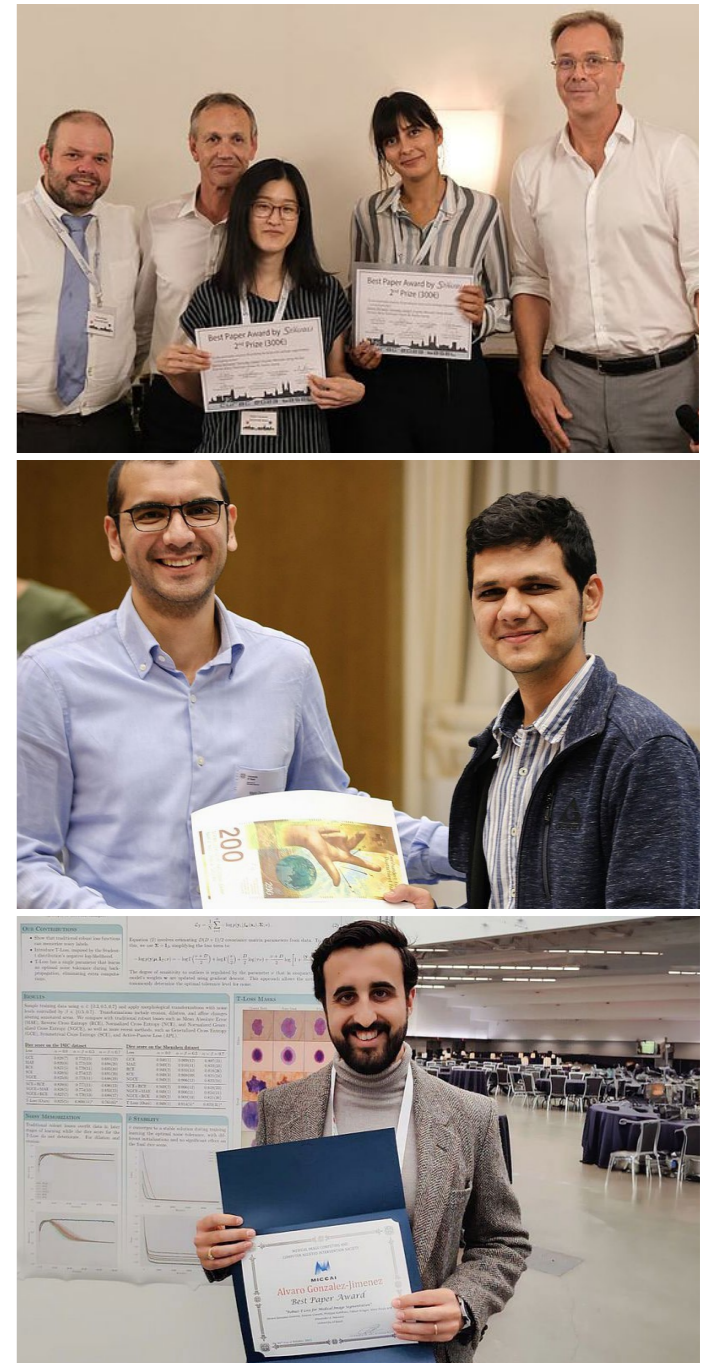


Figure 2: From top to bottom the awarded PhD students: Michaela Maintz and Yukiko Tomooka, Murali Karnam and Alvaro Gonzalez-Jimenez (pictures: BIROMED-Lab, R. Wender and Digital Dermatology Group).

Prizes



Figure 1: Cédric Duverney and Prof. Georg Rauter won the Swiss DINNO Award (picture: BIROMED-Lab).

In addition to the fourteen conference awards won in 2023, ten DBE members and one of our spin-offs also were awarded prizes.

Alexandra Migga, a former student at BMC, was awarded the Basel Human Medicine Alumni Prize for her work "Human tooth cementum, paraffin-embedded nerve and zebrafish embryo: Comparative three-dimensional imaging study with micrometer resolution," supervised by Dr. Georg Schulz and Prof. Bert Müller.

Andrea Zirn won the prize for the Best DBE Master Thesis sponsored by the Zaeslin Teaching Grant for her work "Automated detection of cardiac and neurological causes of death in post mortem CT data" under the supervision of Dr. Claudia Lenz.

Dr. Alina Senst received the PhD thesis award from the German Society of Forensic Medicine (DGRM).

PD Dr. Christof Stieger, Prof. Tania Rinaldi-Barkat, PD Dr. Yves Brand, Dr. Hans Bernhard won the DBE Course Award for their lecture "Biomedical Acoustics".

Dr. Anas Taha has been awarded the 2023 prize of the Swiss Society of Thoracic Surgery for the best clinical publication.

Prof. Georg Rauter and **Cédric Duverney** won the Swiss DINO Award for their Seezer project together with Brütsch Elektronik AG. "Seezer – The seeing tweezers," is a "seeing" robot gripper with interaction force measurement for the handling of small, sensitive or unstructured objects with high precision.

Deep Breath Intelligence (DBI) won 1st price at the Zünder Accelerator competition for the best startup in the 'Innerschweiz'. The prize came with the cash sum of 15k CHF (see page 24).



Figure 2: DBI won the *Zünder Accelerator Award (picture: DBI).

Honors & Nominations



Figure 1: Prof Bert Müller, permanent member of the evaluation committee of the SNSF funding Scheme (picture: R. Wendler).

Committee Nominations

Prof. Bert Müller has been elected as the permanent member of the evaluation committee in the SNSF Agora funding scheme. This scheme aims to foster dialogue between scientists and society.

Dr. Francesco Santini has been elected as an executive board member of the European Society of Magnetic Resonance in Medicine and Biology (ESMRMB) for a 4-year cycle as membership, media, and marketing officer.

Prof. Andreas Müller has been appointed Honorary Professor at Sree Balaji Medical College & Hospital, BIHER University, Chennai.

Prof. Florian Thieringer has been elected into the scientific advisory committee of the Geistlich-Stucki Stiftung.



Figure 2: Dr. Francesco Santini, executive board member of the ESMRMB (picture: R. Wendler).

Changes in Personnel & Organization

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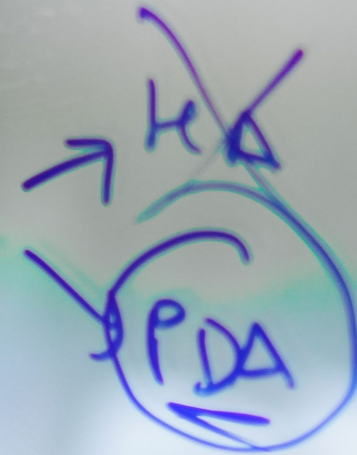
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Appointments & Promotions



In 2023, a new member was appointed clinical professor, two DBE members were promoted to full professor and one was promoted from junior to research group leader:

Appointment

Prof. Viktor Kölzer was appointed as clinical professor for “Experimental Pathology” at the Faculty of Medicine by the University Council.

Promotions

Prof. Andreas A. Müller, head of the Facial & Cranial Anomalies Research Group, was appointed Titular Professor for Oral and Maxillofacial Surgery by the University Council. His research at the DBE revolves around the simplification of orofacial cleft surgery through AI-powered 3D modeling and printing.

Dr. Claudia Lenz, former junior group leader, has been promoted to a full group Leader. She is heading the Forensic Medicine & Imaging Research Group.

Prof. Heide Elke Viehweger is the new clinical professor of Neuro-orthopedics at the Medical Faculty of the University Children’s Hospital Basel (UKBB). Her multidisciplinary and translational clinical research focuses on outcome research based on health data, biomechanical motion analysis, and patient-reported outcome measures, as well as research on digital clinical decision support.



Promoted DBE members in 2023. From top to bottom: Prof. Andreas Müller, Dr. Claudia Lenz and Prof. Heide Elke Viehweger (picture: R. Wendler).

Strategic Commissions at the DBE



The DBE’s Executive Board followed the SAB’s recommendation to distribute responsibilities for strategic tasks and installed specific commissions:

The **Integrity Commission** headed by Prof. Eva Scheurer will cover behavioral and research integrity. Eva shall be the DBE’s first point of contact and confidant in any case of (suspected) violation of integrity.

The **Outreach and Translation Commission** headed by Prof. Cristina Granziera, aims at maintaining links between clinics and research and to oversee actions to foster the exchange.

The **Core Facilities Coordination Commission** headed by Prof. Raphael Guzman intends to homogenize guidelines and procedures at all Core Facilities in order to comply with the respective SAB suggestion.

Before the installation of these new commissions, the DBE already had three commissions in place, taking care of teaching, mentoring and the fair distribution of research space at the DBE:

Teaching Commission headed by Prof. Pablo Sinues
Mentoring Commission headed by Prof. Bert Müller
Room Commission headed by Prof. Philippe Cattin.



New DBE commission heads. From top to bottom: Prof. Eva Scheurer, Prof. Cristina Granziera and Prof. Raphael Guzman (pictures: R. Wendler and T. Schürch).

Outreach



Events & Outreach Activities



Like every year, the DBE contributed to a large number of events. After the move to the GRID, we organized several events and outreach activities to introduce our new home to a public eager to learn about it.

DBE@GRID Housewarming Party

On January 10, the DBE celebrated its arrival at the GRID: A treasure hunt allowed to playfully get to know the new research site aka DBE@GRID. After a short welcome speech by the DBE's head Philippe Cattin, we enjoyed a meal of specialties from Spain, Greece, Turkey, Sudan, Bangladesh and other countries, catered by Restaurant du Coeur.

University's Master's Info Evening

On 16 March 2023 the virtual Master's Info Evening took place. Students interested in the new joint Unibas-FHNW Master's program attended a presentation of Prof. Pablo Sinues and joined virtual booths offering them the opportunity to discuss with a DBE student as well as to visit the DBE labs.

IFTToMM DACH held at the DBE

On March 16 and 17, the first major symposium took place in the new premises of the DBE. Under the leadership and patronage of Prof. Georg Rauter, 40 people met for the annual meeting of the German-speaking countries of the International Federation for the Promotion of Mechanism and Machine Science (IFTToMM DACH).

USB surgeons visit DBE

Prof. Philippe Cattin welcomed representatives from the University Hospital's Department of Surgery to the DBE. They immersed themselves in current research on VR technology. The [video](#) of the visit shows the focus on exchange as the foundation for translational innovation.

3rd DBE PhD Day

The 3rd PhD Day took place on May 5, 2023. The 30 participants could discover the 3D printing, robotics, optics, virtual reality and BSL2 labs at the GRID. They also attended a keynote speech by [Petra Wüst](#) about self branding. On the sidelines of the event they took part in a barbecue and participated in networking games. As a bonus, the winner had the chance to receive a 3D printed

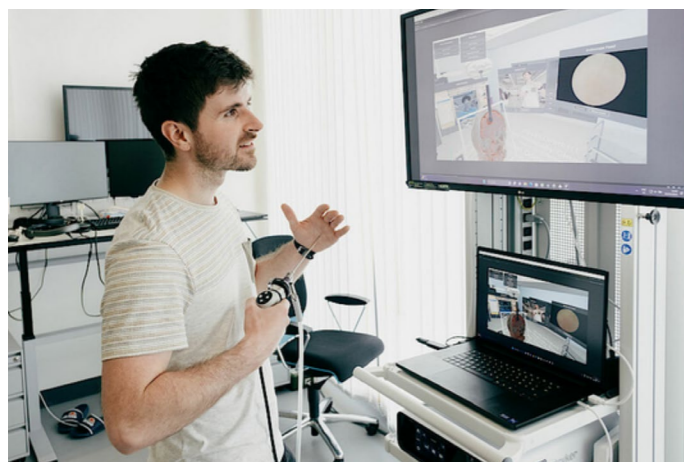


Figure 1: Impressions of the 3rd DBE PhD Day (pictures: M. Maintz).

model of him-/herself as a gift from the 3D Print Lab.

Kinder-Uni

On May 23, 24 & 25, Prof. Georg Rater gave a lecture "Roboter für die Medizin von heute und morgen" at the Kinder-Uni of the University of Basel. His lecture then was integrated in a short film for the Junior Campus "Wissenschaft für Kinder erklärt: [Roboter in der Medizin](#)".

DBE Summer School 2023

23 PhD students gathered from June 12 to 16 in the Southern Black Forest for a Summer School focusing on "Good Scientific Practice". During the week, 7 invited speakers from the fields of research, law and IT security addressed varied topics such as "Authorship & Patenting", "Data Protection", "Mentoring & Supervision", "Literature & Documentation", "Conflict Management" and "Cyber Safety".

5th Symposium on 3D Printing for Life Sciences

On June 28, Swiss MAM hosted the 5th 3D Printing for Life Sciences Symposium at the University Hospital Basel in collaboration with the University of Applied Sciences and Arts Northwestern Switzerland FHNW and Basel Area Business & Innovation. The event showcased groundbreaking applications in 3D printing within the Life Sciences field, featuring insightful sessions on bioprinting, the medical device industry, 3D printing in hospital environments, and a research session with a pitching contest.

CURAC 2023

The German Society for Computer- and Robot-Assisted Surgery held its annual CURAC conference in Basel at the Biozentrum from August 24 to 26. Organized by Prof. Georg Rauter, the conference featured presentations by leading researchers in the fields of AI, surgical robotics and digital surgery.

9th DBE Research Day

Once again this year, over 200 participants took part in the 9th Research Day. During this event, 60 doctoral students presented their work through posters, and 25 speakers shared the stage to give an overview of their research in the form of classic presentations or collaborative sketches in the spirit of a scientific slam.



Figure 2: Impressions of the 9th DBE Research Day (pictures: R. Wendler).

Events & Outreach Activities (2)



DBE hosted the SSBE Annual Meeting

In September the Biomaterials Science Center (BMC) of the DBE organized the 2023 Annual Meeting of the Swiss Society for Biomedical Engineering (SSBE) with almost 100 participants. The program included two keynote speeches, ten oral presentations and 43 posters about the latest developments and trends in biomedical engineering with a focus on imaging and image analysis.

Rector's Dinner

On October 26, the DBE along the rector of the University of Basel, Prof. Andrea Schenker-Wicki, welcomed sponsors and supporters of the University of Basel to the DBE for guided tours followed by a dinner. The guests were able to visit various laboratories and experience a wide range of research activities. The event was organized with the support of the University of Basel's fundraising team.

Visit of international journalists

A group of journalists from Switzerland and Germany visited the DBE in October as part of an excursion of the international science communication conference "Wissenswertes", which took place in Freiburg/Breisgau. During their half-day visit of the DBE, the journalists gained insights into projects focusing on AI, robotics, laser and 3D printing. The event was successfully organized together with the Communications and Marketing Department of the University of Basel.

Chamber of Commerce visits DBE

In fall 2023, the University of Basel invited the Chamber of Commerce from the cantons of Basel-City and Basel-Country to an exclusive research trip introducing the different players in the field of research and innovation and how they work together in the life science ecosystem in and around Basel. The third stop of this research trip was on November 1st at the DBE, where besides state-of-the-art research activities also collaborations with partners in the Bachgraben area in Allschwil were presented.

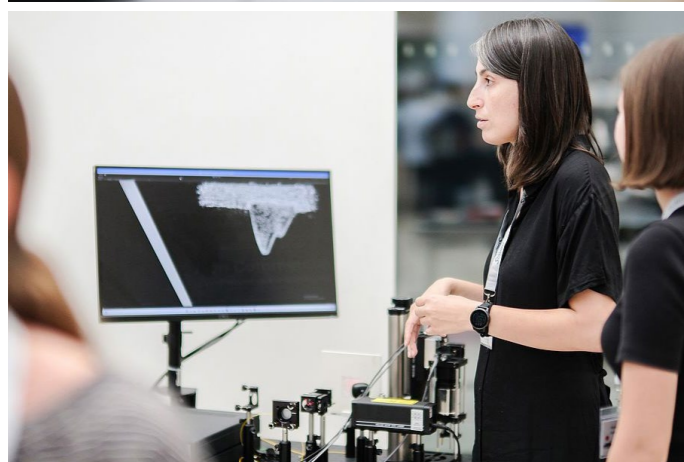


Figure 3: Impressions of the CURAC 2023 (pictures: R. Wendler).

Future Day

On November 9, 12 children aged 11 to 13 were able to immerse themselves in the world of biomedical engineering and learn more about DBE innovations. Among other things, they traveled inside the body with VR goggles, dived into a laser maze, x-rayed a surprise egg to discover what was hidden inside without opening it, and designed their own key ring in the 3D printing lab. It was a great pleasure to get to know the next generation of researchers!

University's Bachelor Info Day

On November 17, we were present at the Bachelor Info Day held at the Biozentrum. As well as welcoming many potential future students to our stand, we could present our new joint master's degree in a 45-minute talk to a packed audience!

DBE and the Swiss Federal Council

The communication team of the Swiss Federal Council invited the MIRACLE^{II} project to take part in a series of publications on innovation in Switzerland. They visited the DBE on December 1st, in order to generate footage and conduct interviews. The video will be shown in 2024 on the Instagram account of the Federal Council.



Figure 4: Impressions of the SSBE Annual Meeting at DBE (pictures: T. Töpfer).

Media Coverage

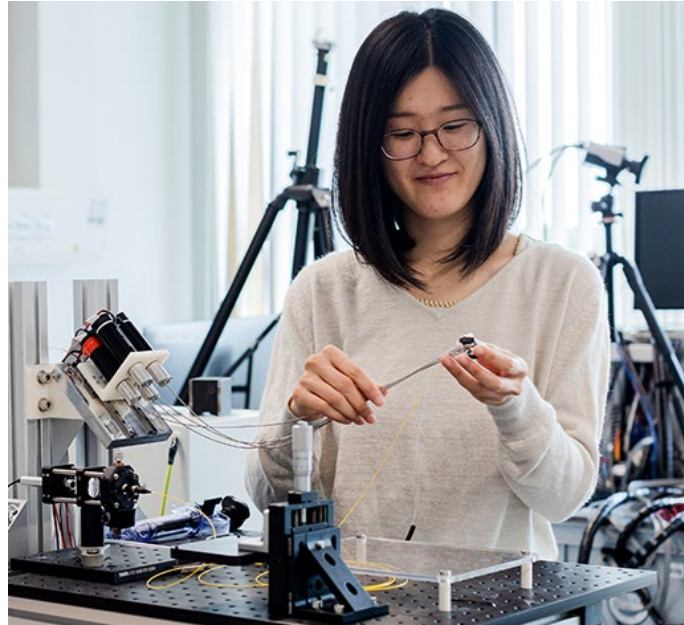


Figure 1: Yukiko Tomooka researches a miniature robot for minimally invasive laser surgery (picture: E. Kougionis, University of Basel)

Joint Master's on HKBB website

The new Joint Master's Program in Biomedical Engineering in collaboration with the FHNW is the subject of an article in the section "[Wissen schaft Wirtschaft](#)" of the Handelskammer beider Basel's (HKBB) website.

Yukiko Tomooka featured in the University of Basel's summer series "[In Focus](#)" where she gave an interview on her thesis project on a miniature robot for minimally invasive laser surgery which she can perform thanks to a Swiss Government Excellence Scholarship and a contribution of the NCCR Robotics.

Close-up of Prof. Georg Rauter's research

- [Uni News](#) published an interview with Prof. Rauter, where he outlines the constraints of an ideal surgical robot and the growing significance of Basel for translational medical robotics research.
- In an interview entitled "Basel leads the way in robotic surgery development" and broadcast on [Prime News "UniBâle" Podcast](#) channel, Prof. Rauter, presents his research.

Dr. Ferda Canbaz's work in the spotlight

- In a post entitled "The fascination of laser robotics: Ferda Canbaz and the MIRACLE project" on [Beast Blog](#), Dr. Canbaz explains how laser and robots will be an essential part of bone surgery in the future.
- In the Senior Member Insights installment of [Optica's Optics & Photonics News](#) section, Dr. Canbaz talks about the development of her career and her passion for research.
- [IEEE Spectrum](#) published an article by Dr. Canbaz and Dr. Hamid focusing on their smart laser feedback mechanism developed, which distinguishes between hard and soft tissue when cutting through bones.
- [Uni News](#) reported on Dr. Canbaz and Dr. Hamidi's research in an article entitled "Replacing bone saws with smart lasers".

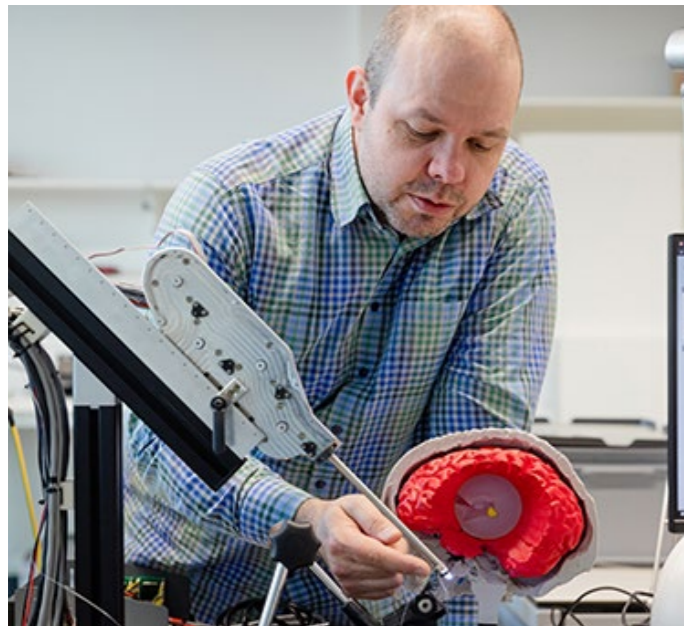


Figure 2: Georg Rauter explains the advantages of the flexible robotic neuro-endoscope of his PhD student Lorin Fasel (picture: E. Kougionis, University of Basel)

Prof. Florian Thieringer all over the news

Swiss MAM, under the lead of Prof. Thieringer, is playing a pioneering role in its field of research, as evidenced by the media coverage on the subject in 2023:

- On September 12, the news website [bzbasel.ch](#) is the first to report on the successful implantation of first ever in-house 3D-printed skullcap at USB.
- On September 13, [baseljetzt.ch](#) published an article on the same subject.
- On the same day, the regional newspaper Basler Zeitung devoted an article to this medical premiere.
- On September 14, [20 minuten](#) published an article entitled: "Premiere: 46-year-old man receives skullcap from 3D printer".
- Medinsinde features two articles devoted to this topic: "[Homemade: patient receives new skullcap](#)" and "[3D printing on the rise in medicine](#)".
- On September 18, [Radio CHF](#) broadcast an interview with Prof. Thieringer: "Premiere: University Hospital Basel implants skullcap from 3D printer".
- On September 27, [Schweizerische Ärztezeitung](#) published an article on medical 3D printing, focusing on the work of Prof. Thieringer at DBE and USB.
- On November 1, [Radio Seefunk](#) broadcast an interview of Prof. Thieringer entitled: "Medical advances in 3D printing".
- Another interview of Prof. Thieringer has been published in the "Interview" Magazine of the Ringier Group.
- The biannual publication "Mit allen Sinnen" of [Handelskammer beider Basel](#), also reports on the 3D-printed implant success.

*some article titles have been translated from German



Figure 3: Ferda Canbaz working on a smart laser feedback mechanism for osteotomy in the laser lab (picture: R. Wendler)



Figure 4: Successful implantation of the first in-house 3D printed skullcap at USB (picture: Digital Content Team, USB)

Collaborations



Collaborating Institutions & Partners



Collaborating Institutions & Partners (2)

Kantonsspital
Baselland

Kantonsspital Aarau

Kantonsspital
Graubünden

Kantonsspital
St.Gallen

KIT
Karlsruher Institut für Technologie

KIDNEY
CONTROL OF HOMEOSTASIS
SWISS NATIONAL CENTRE
OF COMPETENCE IN RESEARCH

KUMOVIS

LÖWENSTEIN
medical
technology

MIAAC
Medical Image Analysis Center

materialise
innovators you can count on

naturhistorisches
museum
archive
des lebens

PAUL SCHERRER INSTITUT
PSI



propatient
Forschungsstiftung
Universitätsspital Basel



robotics+
Swiss National
Centre of Competence
in Research



REHA STIM
MEDTEC

REHABILITATION
ENGINEERING
SCIENCE



SIEMENS
Healthineers

SWISS LIGHT SOURCE
SLS

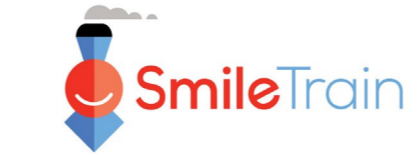


SPENTYS
REINVENTING ORTHOPEDICS



SYNOVA

stryker



STÄUBLI

Syracuse University
College of Arts & Sciences

SIMQ

Unil
UNIL | Université de Lausanne



UKBB
kompetent & menschlich



université
PARIS-SACLAY



UNIVERSITÄT
BERN

Universitätsklinikum
Erlangen

Université
de Strasbourg



Universität
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USZ
Universitäts
Spital Zürich

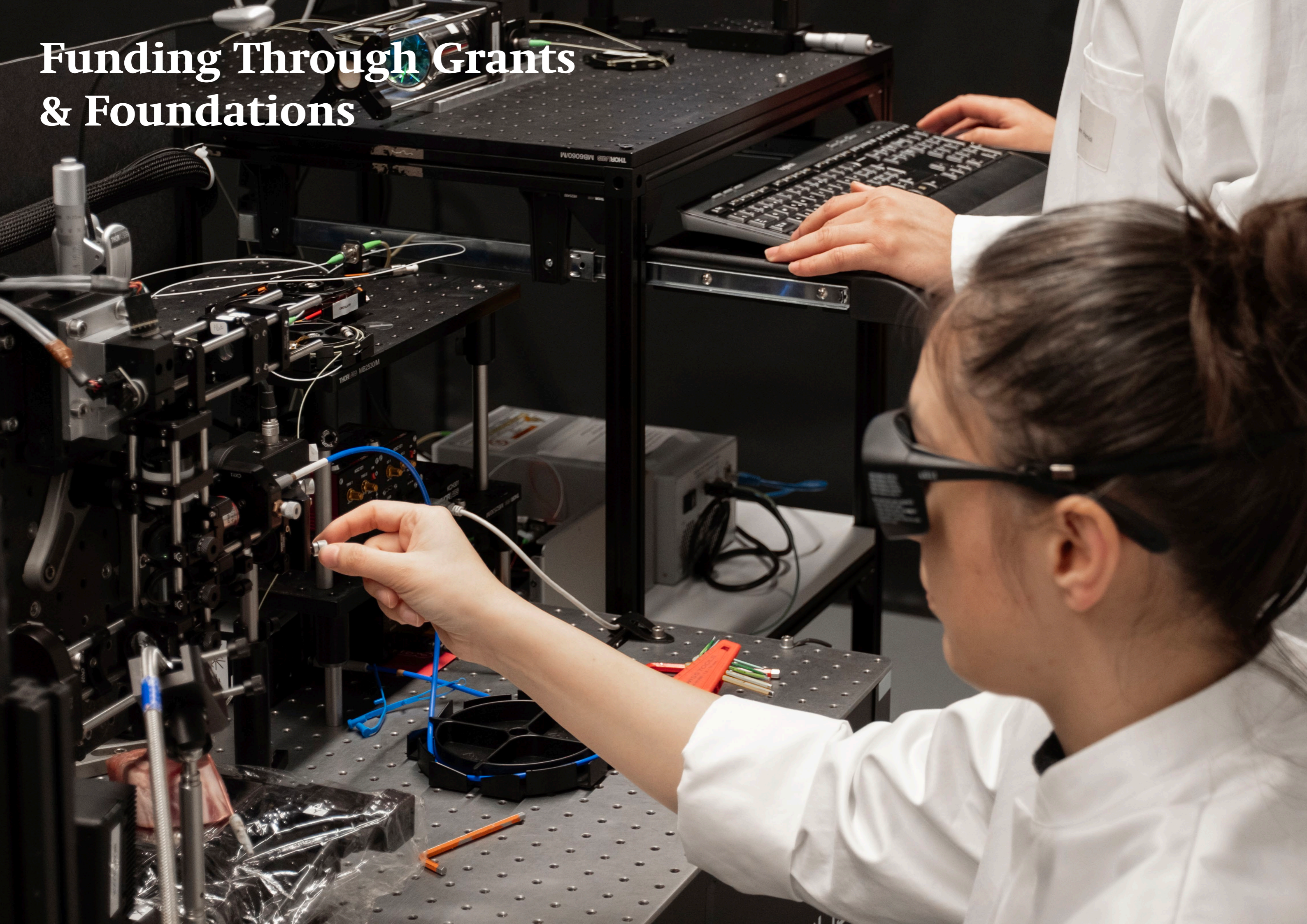
UZB
Universitäres
Zentrum für
Zahnmedizin
Basel

Zurich University
of Applied Sciences

zhaw
School of
Engineering



Funding Through Grants & Foundations



Research Funding secured in 2023



Innosuisse grant for Prof. Georg Rauter (pictures: G. Rauter).

In 2023, DBE researchers have secured a substantial amount of research funding, as listed in the table on the right.

Several of our collaborators with research groups located at the hospitals were granted substantial research funding as well:

Prof. Cristina Granziera head of the ThINk group received 1'474'254 CHF for her project "INsIDER-DIVE: ImagiNg the Interplay between Axonal DamagE and Repair in MS – DIvERSity and Evolution" from the "Stiftung zur Förderung der gastroenterologischen und allgemeinen klinischen Forschung sowie der medizinischen Bildauswertung".

Dr. Neha Sharma and **Prof. Florian Thieringer** of the Swiss Medical Additive Manufacturing research group, together with their collaborative partner Nadja Rohr from the University Center for Dental Medicine Basel (UZB) received the advanced researcher grant from the Osteology Foundation for their project entitled "Establishing Additive Manufacturing of Next-Generation Bio-Resorbable Composite Mesh for Guided Bone Regeneration." (90'000 CHF).

Dr. Prasad Nalabothu from the Facial and Cranial Anomalies group was awarded a grant by the "Research Fund for Excellent Junior Researchers" from the University of Basel for 80'000 CHF. His research focuses on clinical application of artificial intelligence and smartphone-based 3D reconstruction for newborns with cleft lip and palate in low resource settings.

Dr. Ferda Canbaz, ad interim leader of BLOG, with her implementation partner Atracsys Sàrl secured Innosuisse funding of 1.02 million CHF for their project "Line-beam shaped handheld laser resection tool". This project is not in the list on the left, because the contract was signed only in 2024.

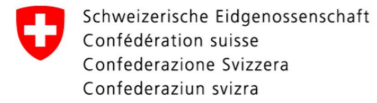
CHF	PI: Project title (funding source)
982'782	Rauter G. & Studer D.: "In SEA2 Spine-Bot" for Safe Intraoperative Intervertebral Stiffness Assessment (SNSF)
763'042	Santini F. & Schläger R.: Advancing Neuromuscular Disease Evaluation: Developing Novel Multiparametric MRI Methods for Myotonic Dystrophy Assessment and Management (SNSF)
709'150	Bieri O.: Lung MRI from Low to High Field: The Next GEneration of Balanced Steady State Free Precession Methods (SNSF)
590'838	Lenz C. in collaboration with Prof. Christoph Birkel at Medical University of Innsbruck: The role of tissue anisotropy in quantitative MRI of the human brain (SNSF)
545'594	Rauter G.: Miniature Intraoral Robot (MIR) performing Minimal-invasive, Personalized and Precision Dentistry (Innosuisse)
566'000	Cattin P. Guzman R.: Virtual and Augmented Reality Platform in Surgery (Verein Chirurgie des USB/UKBB)
555'484	Basoli V. Mainardi A. Martin I. Thieringer F.: Origami Paper-based technology for the innovative and sustainable Organ-on-chip devices (Horizon EU)
356'550	Basoli V. Thieringer F.: Innovative multiplex paper-based electrochemical biosensor and artificial intelligence for smart periprosthetic joint infection and AMR diagnostic – SENSIF (SNSF)

CHF	PI: Project title (funding source) continued
200'000	Suter B.: Bilateral Neuronal Coordination (Stiftung Wolf)
98'434	Weidensteiner C. Deligianni X Santini F.: Open and reproducible pipeline for the acquisition and analysis of muscle MRI data in Facioscapulothoracic Muscular Dystrophy (Stiftung)
79'206	Bertoli M. Sangeux M. Viehweger H.E.: Patient-specific musculoskeletal models to predict surgical outcome (Research Fund for Excellent Junior Researchers)
32'500	Gerig N.: Robotic surgery assistant: Intuitive one hand-guided endoscopic tool holder (Innosuisse)
25'000	Basoli V.: High precision 3D printing for temporomandibular regeneration using Origami self-assembling 4D approach – TMJ-ORIGAMI (NCCR)
30'000	Taha A.: Development of Machine Learning Models for the Prediction of BMI and Complications After Bariatric Surgery – CABS-Study (various)
10'678	Mündermann A.: 3Dimensions & 3Destinations of Human Movement Studies – 3D Human Movement Studies (Innosuisse)
5'545'258 CHF SNSF and 3rd-party funding awarded and paid to the University in 2023 (compared to 3'300'015 CHF in 2022)	
1'644'254 CHF from foundations to DBE researchers at the Hospitals.	

Funding Institutions



Innosuisse - Swiss Innovation Agency



Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

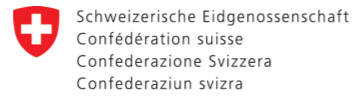


Claudine und Hans-Heiner Zaeslin-Bustany-Stiftung

Jacobson-Goldschmidt Stiftung



WERNER SIEMENS-STIFTUNG



Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Education,
Research and Innovation SERI

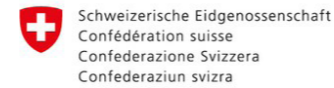


Freiwillige Akademische
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seit 1835

VELUX STIFTUNG



Alta Uro



Eidgenössisches Departement des Innern EDI
Bundesamt für Gesundheit BAG



eurostars™



Stiftung Wolf

MIAC Stiftung



Education



Launch of the Joint Master's Program in Biomedical Engineering



As of the fall semester of 2023, our Master's Degree has been replaced by a Joint Master's Program in Biomedical Engineering, offered in collaboration with the School of Life Sciences of the University of Applied Sciences and Arts Northwestern Switzerland (FHNW).

Two Institutions, One Program

The Joint Master's Program offers science and translation-focused education at the University campus Basel and Allschwil and the FHNW campus in Muttenz. Students benefit from the expertise and resources of the Medical Faculty of the University of Basel and the School of Life Sciences of the FHNW. This new cooperation enables students to profit from academic and industrial networks, broadening their career prospects.

Tailor-Made Education for Excellence

The program is designed for students who wish to combine medicine, engineering and natural sciences for the benefit of patients. It is, therefore, open to students with a wide range of backgrounds. During the first semester, depending on their previous training, students may be offered an in-depth introduction to engineering fundamentals and/or to the basics of human medicine. For instance, students with a bachelor's degree in biology, who are able to apply since 2023, will follow a curriculum that combines both aspects. The exams of selected courses of the basic modules in the first semester can only be retaken once. This ensures that only the best and most motivated students have access to the rest of the program, which will enable them to choose one of the four following specialties: Computer- & Robot-Assisted Medicine, Image Acquisition & Analysis, Diagnostic & Therapeutic Technologies, Implants & Regenerative Technologies.

An Attractive Program

Our offer is attracting more and more students and this trend has intensified since the launch of the Joint Master's program. Proof of this is the interest shown by the 75 students who registered to our Master Info Evening held on March 2023. This was the 3rd highest score achieved that year by a Master's program of the University of Basel, behind Psychology and Pharmacy. This momentum continued in September when 51 students joined our program.



Studying Biomedical Engineering (pictures: FHNW and R. Wendler).

Master of Science in Biomedical Engineering 2023



Figure 1: New study area with the student lounge (top) and lecture hall (bottom). (pictures: G. Oser).

Two significant developments shaped our Education activities in 2023: The Department of Biomedical Engineering inaugurated a state-of-the-art study area in our new building at Hegenheimermattweg 167B. This infrastructure includes a large lecture hall for 56 students, a teaching laboratory for 16 students, and a student learning space. Additionally, the new Joint Master's Degree in Biomedical Engineering, co-organized with the School of Life Sciences at the University of Applied Sciences and Arts Northwestern Switzerland (FHNW), was launched.

With the relocation of the DBE to a brand-new building, our steadily growing number of students enjoy state-of-the-art teaching infrastructure (Figure 1). The lecture room can host 56 students with desks or accommodate an audience of 99 with chairs. The modular teaching lab features flexible arms hanging from the ceiling that provide air and power supply. Additionally, it connects to the student learning space with a removable wall, allowing for the creation of either a large combined room or two separate rooms. The learning space faces the green inner courtyard of the building and is accessible to students on all working days.

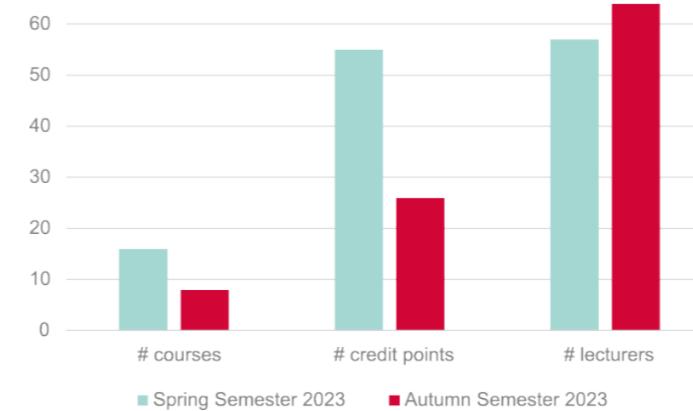


Figure 2: Number of courses, credit points and lecturers in the spring and autumn semester at the University of Basel (graph: G. Oser)

Regarding the previous Master's Program (2018-2023), 61 students have graduated, 27 students are still enrolled and are expected to graduate by the end of the autumn semester 2024. In autumn 2023, the new joint degree program was rolled out. 51 new students enrolled the program, more than doubling the mean annual matriculations of the previous Master's Program. During the spring semester, 16 courses (55 ECTS) were offered, while the autumn semester of 2023 featured 8 courses (26 ECTS). Notably, for the first time in autumn 2023, 6 courses (18 ECST) from the Master's Program were taught in collaboration with the FHNW. At the University of Basel, 57/64 lecturers supported the Master's Program in the spring/autumn semester (Figure 2).

In summary, our new teaching premises offer an unparalleled setting to foster the education of the next generation of Biomedical Engineers.

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Study Coordinator:
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Completed Master's Degrees



Working on a research project at DBE (picture: R. Wendler)

In 2023, numerous Master's students completed their education at the DBE. A summary of their Master's thesis can be found [here](#).

Zinar Arslan completed his Master's project about "Supersampling and Denoising of Volume-Rendered Medical Images using a Deep Learning Method" under the supervision of Balázs Faludi and Prof. Philippe Cattin at CIAN Group.

Annika Bill completed her Master's project about "Relationship Between Patient-Reported, Clinical, and Functional Outcomes in Patients 2 Years after ACL Surgery" under the supervision Dr. Corina Nüesch and Prof. Anne Münderman at Functional Biomechanics Group.

Cigdem Cetin completed her Master's project about "Optimization of Bone Ablation with Ho:YAG Laser for Endoscopic/Fiberscopic Laser" under the supervision Dr. Ferda Canbaz at BLOG.

Hélène Corbaz completed her Master's project about "Automatic Curvature Measurements of the Left Atrium from Cardiac Magnetic Resonance Imaging" under the supervision of Madina Kojanazarova and Prof. Philippe Cattin at CIAN Group.

Aleksandra Ivanova completed her Master's project about "Registration of a Surgical Tool Based on CT Data and Optical Tracking" under the supervision of Cédric Duverney and Prof. Georg Rauter at BIROMED-Lab.

Adam Jakimiuk completed his Master's project about "Bioresorbable Implants for Corrective Osteotomies of The Distal Radius" under the supervision of Prof. Florian Thieringer at Swiss MAM.

Tejeswini Jayakumar completed her Master's project about "Predicting Remyelination in Multiple Sclerosis Patients using Deep Learning" under the supervision of Dr. Po-Jui Lu and Prof. Cristina Granziera at ThInK Basel Group.

Claes Jolérus completed his Master's project about "Preconditioning of Adipose-Derived Stromal Cells for Chon-

drogenesis" under the supervision of Dr. Adrien Moya and Prof. Arnaud Scherberich at the Vascularized Bone Biofabrication Group.

Bassma Lhumeur completed her Master's project about "Fabrication of Functional Muscular Thin Films for Biohybrid Soft Robotics" under the supervision of Prof. Arnaud Scherberich and Prof. Robert Katzschmann at Soft Robotics Laboratory (ETH, Zürich).

Adriana Manea completed her Master's project about "Effects of Sterilization on the Accuracy and the Mechanical Performance of 3D-Printed Surgical Guides Materials" under the supervision of Dr. Neha Sharma and Prof. Florian Thieringer at Swiss MAM.

Annette Mettler completed her Master's project about: "Emergency Department 2.0: Improving Medical Care with Machine Learning" under the supervision of Dr. Julia Wolleb and Prof. Philippe Cattin at CIAN Group.

Davide Milone completed his Master's project about "Letting Bio-bots Roam Free: Wireless Actuation of Skeletal Muscle Constructs" under the supervision of Prof. Arnaud Scherberich and Prof. Robert Katzschmann at Soft Robotics Laboratory (ETH, Zürich).

Fabian Neumüller completed his Master's project about "Quantitative Evaluation of Shared Surgeon-Robot Workspace for Robot-Assisted Knee Surgery and Training" under the supervision of Murali Karnam, Dr. Nicolas Gerig and Prof. Georg Rauter at BIROMED-Lab.

Colino Neves completed his Master's project about "Total Human DNA Sampling for Forensics" under the supervision of Dr. Martin Zieger and Prof. Eva Scheurer at the Department for Forensic Molecular Biology, Institute for Forensic Medicine Bern.

Isabella Ortiz completed her Master's project about "Additive Manufacturing of Patient-Specific Bone Grafts at the Point of Care" under the supervision Prof. Florian Thieringer at Swiss MAM.

Niccolò Prociari completed his Master's project about "Robot-Assisted Laser-Ablation of Engineered Human Cartilage" under the supervision of Cédric Duverney and Prof. Georg Rauter at BIROMED-Lab.

Marc Puschmann completed his Master's project about "Optimization of Fibrin-based Hydrogels for Cardiac Tissue Engineering" under the supervision of Dr. Anna Marsano and MD Gregory Reid at Cardiac Surgery and Engineering (CSE) Group.

Nicole Rittiner completed her Master's project about "Establishing Forensic Body Fluid Identification by RNA Profiling into the Routine DNA Extraction Workflow" under the supervision Dr. Iris Schultz at the Forensic Genetics Group.

Dominic Spothelfer completed his Master's project about "Minimally Invasive 3D Bioprinting (MI3DB) for Articular Cartilage Restoration in the Knee" under the supervision of Yukiko Tommoka and Prof. Georg Rauter at BIROMED-Lab.

Lisa Stefani completed her Master's project about "Integration of Sensing Elements in Engineered Muscle for Proprioception in Bio-hybrid Robots" under the supervision of Prof. Arnaud Scherberich and Prof. Robert Katzschmann at Soft Robotics Laboratory (ETH, Zürich).

Veronica Towianski completed her Master's project about "Simulating Fatal Fall from Height Cases: Evaluating Biomechanical Analysis Possibilities" under the supervision Dr. Claudia Lenz at the Forensic Medicine and Imaging Group.

Woosik Yang completed his Master's project about "Organoids Microscopic Image Analysis Using Convolutional Neural Networks" under the supervision of Cédric Schicklin and Prof. Georg Rauter at BIROMED-Lab.

Moirá Zuber completed her Master's project about: "Automated Detection of Tiger Mosquito Traps with Deep Learning" under the supervision of Dr. Julia Wolleb and Prof. Philippe Cattin at CIAN Group.



PhD Program in Biomedical Engineering 2023

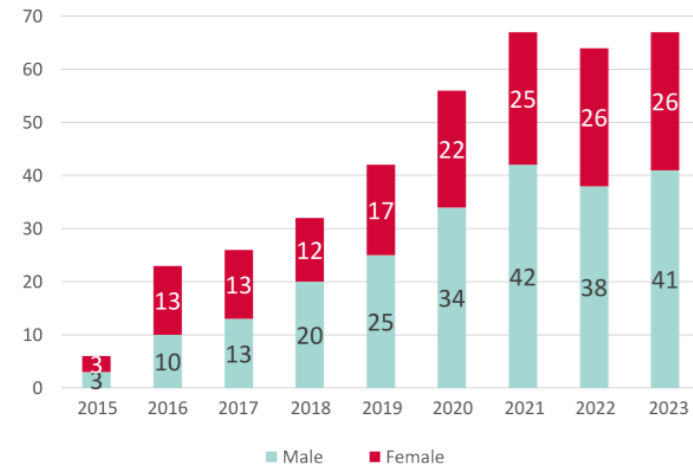


Figure 1: Evolution of the number of PhD students enrolled in the DBE PhD Program since its launch in 2015 (graph: S. Freund).



Figure 2: The DBE Summer School welcomed 23 PhD students (picture: R. Pawlak).

For several years, the number of students enrolled in our doctoral program has stabilized at around 65 members. In 2023, 14 of them defended their theses and 15 new students started at our department.

Fact and figures

In 2023, 26 women and 41 men from 18 countries were enrolled in our program (see Figure 1). Of these, 13% hold a Master's degree from the University of Basel, 21% from other Swiss universities and 66% hold a foreign degree.

Teaching Activities

Our doctoral program has intensified its collaboration with the PhD Program Health Science (PPHS) at the University of Basel. By combining our efforts and pooling our budgets, we have been able to expand the range of courses on offer to our students. They now have free access to more than 30 dedicated courses and networking events, enabling them to validate up to 20 ECTS per year.

Among other activities, our students were able to take part in a Summer School dedicated for the first time to a transferable skills topic: "Good Scientific Practice". They got an overview of the rules of good scientific practice and how to deal with cases of scientific misconduct. The overall aim was to raise awareness of the breadth and depth of the topic in order to counteract questionable practices and scientific misconduct at an early stage. 70% of the participants rated the benefit gained during Summer School as good or excellent and 73% of them would recommend the event to their peers.

Other highlights of the year include the organization of our two seminars series on selected research topics in Biomedical Engineering:

- Quantifying Placebo Effects: Problems and Limitations organized by Prof. Pablo Sinues
- Robot- & Assisted Surgery organized by Prof. Georg Rauter and Prof. Philippe Cattin

During these two series of seminars, the doctoral program financed the visit of 15 national and international experts.

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Completed Doctoral Degrees



Dr. Eva Schnider celebrating after her PhD Defence (picture:CIAN)

In 2023, fourteen students of the DBE's doctoral program defended their thesis and took the next career step. A summary of their PhD research work can be found [here](#).

Dr. Roya Afshari PhD student at the Magnetic Resonance Physics & Methodology Group of Prof. Oliver Bieri, defended her thesis about "Rapid Magnetization Transfer Magnetic Resonance Imaging".

Dr. Kim Arnold PhD student at the Translational Medicine Breath Research Group of Prof. Pablo Sinues, defended her thesis about "In vitro and in vivo Metabolomics: Tapping the Potential of Secondary Electrospray Ionization – High Resolution Mass Spectrometry".

Dr. Mohamad Awchi PhD student at the Translational Medicine Breath Research Group of Prof. Pablo Sinues, defended his thesis about "Breath Pharma-cometabolites on Type-1 Diabetes and Epilepsy".

Dr. Yakub Bayhaqi PhD student at the BLOG Group of Prof. Azhar Zam and Dr. Ferda Canbaz, defended his thesis about "Automatic Tissue Characterization from Optical Coherence Tomography Images for Smart Laser Osteotomy".

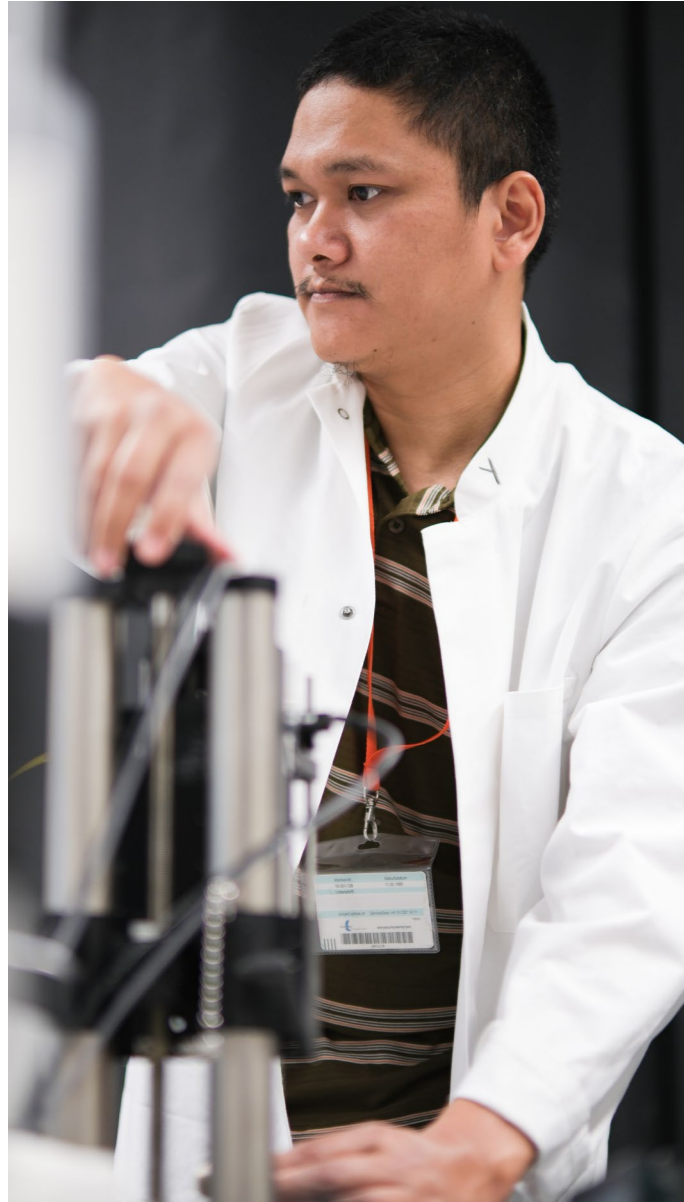
Dr. Céline Berger PhD student at the Forensic Medicine and Imaging Group of Dr. Claudia Lenz, defended her thesis about "Post Mortem Temperature and its Effects on Quantitative Magnetic Resonance Imaging".

Dr. Linda Bühl PhD student at the Functional Biomechanics Group of Prof. Anne Mündermann, defended her thesis about: "Clinical and Functional Outcomes 2 Years after Internal Brace-Augmented ACL Repair vs. ACL Reconstruction and Healthy Controls".

Dr. Eleonora Croci PhD student at the Functional Biomechanics Group of Prof. Anne Mündermann, defended her thesis about: "Influence of Additional Weight Carrying on Load-Induced Changes in Shoulder Kinematics after Rotator Cuff Tears – An in vivo Study".



Completed Doctoral Degrees (2)



Dr. Yakub Bayhaqi working on his PhD project (picture:R. Wendler)

Dr. Jeremy Genter PhD student at the Functional Biomechanics Group of Prof. Anne Mündermann, defended his thesis about: "Load-Induced Biomechanical Changes in Shoulder Kinematics with Rotator Cuff Tears – An Experimental Simulator Study".

Dr. Roushanak Haji Hassani PhD student at the BI-ROMED-Lab Group of Prof. Georg Rauter, successfully defended her thesis.

Dr. Arsham Hamidi PhD student at the BLOG Group of Prof. Azhar Zam and Dr. Ferda Canbaz, successfully defended his thesis about "Development of Miniaturized Long-Range Optical Coherence Tomography for Smart Laser Surgery System".

Dr. Simon Herger PhD student at the Functional Biomechanics Group of Prof. Anne Mündermann, defended his thesis about: "Dose-Response Relationship of in vivo Ambulatory Load and Mechanosensitive Cartilage Biomarkers: The Role of Age and Tissue Health".

Dr. Santosh Iyyakkunel PhD student at the Magnetic Resonance Physics & Methodology Group of Prof. Oliver Bieri, defended his thesis about "Methodological Advances in Electrical Properties Tomography".

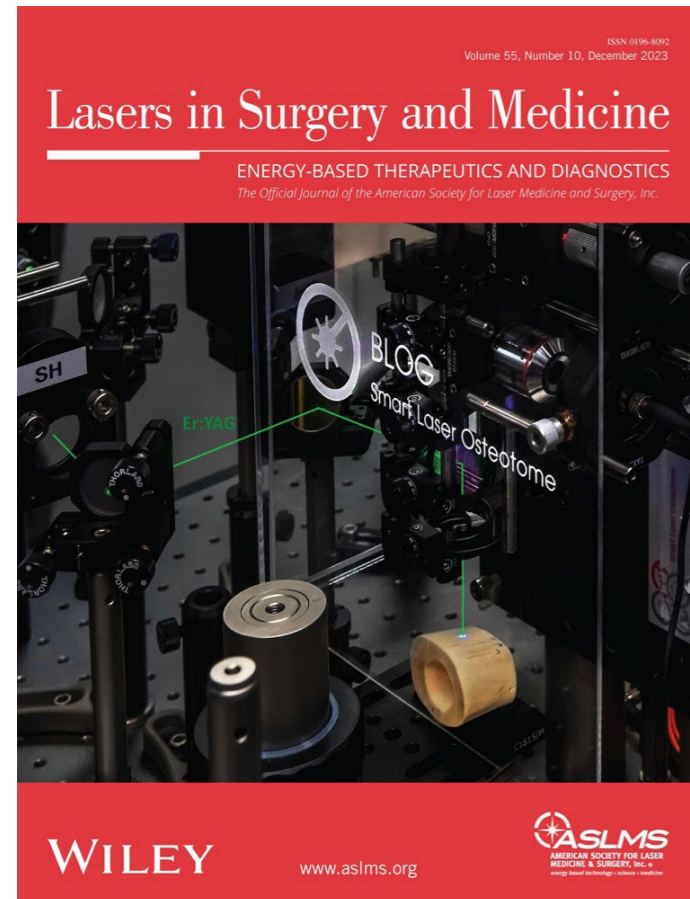
Dr. Eva Schneider PhD student at the Planning and Navigation Group of Prof. Philippe Cattin, defended her thesis about "Distinct Bone Segmentation for CT Images using Deep Learning".

Dr. Carlo Seppi PhD student at the Planning and Navigation Group of Prof. Philippe Cattin, defended his thesis about "Solving Inverse Problems for Medical Applications".



Publications





Dr. Hamidi and Dr. Canbaz's research is the featured cover of the journal *Lasers in Surgery and Medicine* (picture: journal *Lasers in Surgery and Medicine*).

A wide research spectrum, heterogeneous but equally important studies: in this section we report some of our milestone publications of the year 2023 in order to give an insight into the DBE's research.

Dr. Arsham Hamidi, Dr. Ferda Canbaz and their team have published a basic science article, where they aim to enhance the safety and precision of laser osteotomy by incorporating optical feedback systems with an Er:YAG laser. The article is the Editor's choice and the featured cover of the journal *Lasers in Surgery and Medicine* in December 2023. [read](#)

Prof. Bert Müller's team, together with pharmaceutical technologists and French beamline scientists, have evaluated whether zebrafish larvae could serve as a vertebrate screening model to detect changes of renal organs induced by the antibiotic gentamicin. The approach can, therefore, be used to identify potential nephrotoxins in drug discovery or environmental sciences. [read](#)

Dr. Anas Taha is in the driving seat of a retrospective cohort study conducted in the Republic of Belarus over a 31-year period. This study reports on the increased incidence of solid secondary tumors in men and women after the Chernobyl disaster. For this work, Dr. Taha was awarded the prize for Best Clinical Publication by the Swiss Society of Thoracic Surgery. [read](#)

***Peer-reviewed publications (148), where first author or last author is at DBE.**

Afshari R; Santini F; Heule R; Meyer CH; Pfeuffer Josef; Bieri O (2023): 'Rapid whole-brain quantitative MT imaging'; *Zeitschrift für Medizinische Physik*.

A D'Antonoli T; Cavallo AU; Vernuccio F; Stanzione A; Klontzas ME; Cannella R; Ugga L; Baran A; Fanni SC; Petrash E; Ambrosini I; Cappellini LA; van Ooijen P; Kotter E; Pinto Dos Santos D; Cuocolo R; EuSoMII Radiomics Auditing Group (2023): 'Reproducibility of radiomics quality score: an intra- and inter-rater reliability study'; *European Radiology*.

A D'Antonoli T; Cuocolo R; Baessler B; Pinto dos Santos D (2023): 'Towards reproducible radiomics research: introduction of a database for radiomics studies'; *European Radiology*.

A D'Antonoli T; Stanzione A; Bluethgen C; Vernuccio F; Ugga L; Klontzas ME; Cuocolo R; Cannella R; Koçak B (2023): 'Large language models in radiology: fundamentals, applications, ethical considerations, risks, and future directions'; *Diagnostic and interventional radiology (Ankara, Turkey)*.

Arnold K; Dehio P; Lötscher J; Singh KD; García-Gómez D; Hess C; Sinues P; Balmer M L (2023): 'Real-Time Volatile Metabolomics Analysis of Dendritic Cells'; *Analytical Chemistry*.

Astasov-Frauenhoffer M; Göldi L; Rohr N; Worreth S; Dard E; Hünerfauth S; Töpfer T; Zurflüh J; Braissant O (2023): 'Antimicrobial and mechanical assessment of cellulose-based thermoformable material for invisible dental braces with natural essential oils protecting from biofilm formation'; *Scientific Reports*.

Awchi M; Sinues P; Datta AN; García-Gómez D; Singh KD (2023): 'UHPLC-MS/MS-Based Identity Confirmation of Amino Acids Involved in Response to and Side Effects from Antiepileptic Medications'; *Journal of proteome research*.

Awchi M; Singh KD; Dill P E; Frey U; Datta A N; Sinues P (2023): 'Prediction of systemic free and total valproic acid by off-line analysis of exhaled breath in epileptic children and adolescents'; *Journal of Breath Research*.

Barakovic M; Pizzolato M; Tax Chantal M W; Rudrapatna U; Magon S; Dyrby TB; Granziera C; Thiran J-P; Jones DK; Canales-Rodríguez EJ (2023): 'Estimating axon radius using diffusion-relaxation MRI: calibrating a surface-based relaxation model with histology'; *Frontiers in Neuroscience*.

Bauman G; Lee NG; Tian Y; Bieri O; Nayak KS (2023): 'Submillimeter lung MRI at 0.55 T using balanced steady-state free precession with half-radial dual-echo readout (bSTAR)'; *Magnetic Resonance in Medicine*.

Bayhaqi YA; Hamidi A; Navarini AA; Cattin PC; Canbaz F; Zam A (2023): 'Real-time closed-loop tissue-specific laser osteotomy using deep-learning-assisted optical coherence tomography'; *Biomedical Optics Express*.

Berger C; Bauer M; Scheurer E; Lenz C (2023): 'Temperature correction of post mortem quantitative magnetic resonance imaging

using real-time forehead temperature acquisitions'; *Forensic science international*.

Berger C; Bauer M; Wittig H; Gerlach K; Scheurer E; Lenz C (2023): 'Investigation of post mortem brain, rectal and forehead temperature relations'; *Journal of thermal biology*.

Born G; Plantier E; Nannini G; Caimi A; Mazzoleni A; Asnaghi M A; Muraro M G; Scherberich A; Martin I; Garcia-García A (2023): 'Mini- and macro-scale direct perfusion bioreactors with optimized flow for engineering 3D tissues'; *Biotechnology Journal*.

Bosticardo S; Schiavi S; Schaedelin S; Battocchio M; Barakovic M; Lu P-J; Weigel M; Melie-Garcia L; Granziera C; Daducci A (2023): 'Evaluation of tractography-based myelin-weighted connectivity across the lifespan'; *Frontiers in Neuroscience*.

Brunner R; De Pieri E; Wyss C; Weidensteiner C; Bracht-Schweizer K; Romkes J; Garcia M; Ma N; Rutz E (2023): 'The Non-Affected Muscle Volume Compensates for the Partial Loss of Strength after Injection of Botulinum Toxin A'; *Toxins*.

Bühl L; Müller S; Nüesch C; Mündermann A; Egloff C (2023): 'Vergleichbare Knie-Biomechanik aber unterschiedliche Muskelaktivierung nach VKB-Naht mit InternalBrace™-Verstärkung und VKB-Rekonstruktion'.

Bühl L; Müller S; Nüesch C; Boyer K A; Casto E; Mündermann A; Egloff C (2023): 'Ambulatory knee biomechanics and muscle activity 2 years after ACL surgery: InternalBrace™-augmented ACL repair versus ACL reconstruction versus healthy controls'; *BMC Musculoskeletal Disorders*.

Bühl L; Müller S; Nüesch C; Pagenstert G; Mündermann A; Egloff C (2023): 'Functional leg performance 2 years after ACL surgery: a comparison between InternalBrace™-augmented repair versus reconstruction versus healthy controls'; *Journal of Orthopaedics and Traumatology*.

Cagol A; Fuertes NC; Stoessel M; Barakovic M; Schaedelin S; D'Souza M; Würfel J; Brandt AU; Kappos L; Sprenger T; Naegelin Y; Kuhle J; Granziera C; Papadopoulou A (2023): 'Optical coherence tomography reflects clinically relevant gray matter damage in patients with multiple sclerosis'; *Journal of neurology*.

Canbaz F; Butkus Arminas (2023): 'Spectroscopic investigation of Tm³⁺-Dy³⁺ co-doped KY3F10 crystals for 3 µm laser applications'.

Cerdá-Fuertes N; Stoessel M; Mickeliunas G; Pless S; Cagol A; Barakovic M; Maceski A Maleska; Álvarez González C; D' Souza M; Schaedelin S; Benkert P; Calabrese P; Gugleta K; Derfuss T; Sprenger T; Granziera C; Naegelin Y; Kappos L; Kuhle J; Papadopoulou A (2023): 'Optical coherence tomography versus other biomarkers: Associations with physical and cognitive disability in multiple sclerosis'; *Multiple Sclerosis Journal*.

Cetin C; Drusová S; Hamidi A; Bayhaqi Y; Rauter G; Cattin P; Zam A; Canbaz F (2023): 'Bone ablation performance of a Tm-Cr:Ho:YAG Laser'.

Selected Publications 2023 (2)

- Chen X; Schädelin S; Lu P-J; Ocampo-Pineda M; Weigel M; Barakovic M; Ruberte E; Cagol A; Marechal B; Kober T; Kuhle J; Kappos L; Melie-Garcia L; Granziera C (2023): 'Personalized maps of T1 relaxometry abnormalities provide correlates of disability in multiple sclerosis patients'; *NeuroImage: Clinical*.
- Croci E; Born P; Eckers F; Nuesch C; Baumgartner D; Müller AM; Mundermann A (2023): 'Test-retest reliability of isometric shoulder muscle strength during abduction and rotation tasks measured using the Biodex dynamometer'; *Journal of Shoulder and Elbow Surgery*.
- Croci E; Hess H; Warmuth F; Künzler M; Börlin S; Baumgartner D; Müller AM; Gerber K; Mundermann A (2023): 'Fully automatic algorithm for detecting and tracking anatomical shoulder landmarks on fluoroscopy images with artificial intelligence'; *European radiology*.
- Croci E; Warmuth F; Baum C; Kovacs BK; Nuesch C; Baumgartner D; Müller AM; Mundermann A (2023): 'Load-induced increase in muscle activity during 30° abduction in patients with rotator cuff tears and control subjects'; *Journal of Orthopaedics and Traumatology*.
- Croci E; Baum C; Mundermann A (2023): 'New methods for the in vivo diagnostics of shoulder kinematics'; *Arthroskopie*.
- D'Antonoli Tugba A; Todea R-A; Leu N; Datta A N; Stieltjes B; Pruefer F; Wasserthal J (2023): 'Development and Evaluation of Deep Learning Models for Automated Estimation of Myelin Maturation Using Pediatric Brain MRI Scans'; *Radiology: Artificial Intelligence*.
- De Pieri E; Cip J; Brunner R; Weidensteiner C; A N (2023): 'The functional role of hip muscles during gait in patients with increased femoral anteversion'; *Gait & posture*.
- De Pieri E; Nuesch C; Pagenstert G; Viehweger E; Egloff C; Mundermann A (2023): 'High tibial osteotomy effectively redistributes compressive knee loads during walking'; *Journal of orthopaedic research : official publication of the Orthopaedic Research Society*.
- Duering M et al. (2023): 'Neuroimaging standards for research into small vessel disease—advances since 2013'; *The Lancet Neurology*.
- Duteil T; Bourillot R; Braissant O; Henry A; Franceschi M; Oliver M-J; Le Roy N; Brigaud B; Portier E; Visscher PT (2023): 'Down in the dungeons: microbial redox reactions and geochemical transformations define the biogeochemistry of an estuarine sediment column'.
- Duthaler U; Bachmann F; Ozbey AC; Umehara K; Parrott N; Fowler S; Krähenbühl S (2023): 'The Activity of Members of the UDP-Glucuronosyltransferase Subfamilies UGT1A and UGT2B is Impaired in Patients with Liver Cirrhosis'; *Clinical pharmacokinetics*.
- Ebel F; Tschudin-Sutter S; Weisser M; Roethlisberger M (2023): 'Reconsidering risk factors for ventriculostomy-related infections'; *Journal of Neurosurgery*.
- Egloff L; Frei P; Gerlach K; Mercer-Chalmers-Bender K; Scheurer E (2023): 'Effect of vaporizing cannabis rich in cannabidiol on cannabinoid levels in blood and on driving ability – a randomized clinical trial'; *International journal of legal medicine*.
- Etter MM; Nguyen A; Brehm A; Aberle C; Tsoqkas I; Guzman R; Dmytriw AA; Parra-Farinas C; Mascitelli J R; Pereira Vitor Mendes; Starke RM; Fragata I; Reis J; Wolfe S Q; Porto G B; Spiotta AM; Psychogios M-N (2023): 'Endovascular Treatment and Peri-interventional Management of Ruptured Cerebrovascular Lesions During Pregnancy: Case Series and Case-based Systematic Review'; *Clinical Neuroradiology*.
- Fiorito M; Yushchenko M; Cicolari D; Sarracanie M; Salameh N (2023): 'Fast, interleaved, Look-Locker-based T<inf>1</inf> mapping with a variable averaging approach: Towards temperature mapping at low magnetic field'; *NMR in Biomedicine*.
- Friedrich P; Wolleb J; Bieder F; Thieringer F M; Cattin PC (2023): 'Point Cloud Diffusion Models for Automatic Implant Generation'.
- Fuhrer Y; Eggmann F; Reichardt E; Filippi A (2023): 'Head and dental injuries among farriers and hoof care practitioners: A nationwide survey in Switzerland'; *Dental traumatology : official publication of International Association for Dental Traumatology*.
- Galbusera R; Bahn E; Weigel M; Schaedelin S; Franz J; Lu P-J; Barakovic M; Melie-Garcia L; Dechent P; Lutti A; Sati P; Reich D S; Nair G; Brück W; Kappos L; Stadelmann C; Granziera C (2023): 'Postmortem quantitative MRI disentangles histological lesion types in multiple sclerosis'; *Brain Pathology*.
- García-García A; Pigeot S; Martin I (2023): 'Engineering of immunoinstructive extracellular matrices for enhanced osteoinductivity'; *Bioactive Materials*.
- Genter J; Croci E; Ewald H; Müller AM; Mundermann A; Baumgartner D (2023): 'Ex vivo experimental strategies for assessing unconstrained shoulder biomechanics: A scoping review'; *Medical Engineering and Physics*.
- Genter Jeremy; Rauter G; Müller As M; Mundermann A; Baumgartner D (2023): 'Musculoskeletal model-based control strategy of an over-actuated glenohumeral simulator to assess joint biomechanics'; *At-Automatisierungstechnik*.
- Ghosh N; Bregere C; Bustos P; Guzman R (2023): 'L-Ala-L-Gln Suppresses Hypoxic Phenotype and Fibrogenic Activity of Rat Perineurial Fibroblasts'; *CNS & neurological disorders drug targets*.
- Gonzalez-Jimenez A; Lionetti S; Gottfrois P; Gröger F; Pouly M; Navarini AA (2023): 'Robust T-Loss for Medical Image Segmentation'.
- Greutmann M; et al.; Winkel DJ (2023): 'Effect of phosphodiesterase-5 inhibition on SystEmic Right VEtricular size and function. A multicentre, double-blind, randomized, placebo-controlled trial: SERVE'; *European Journal of Heart Failure*.
- Guebeli A; Thieringer F; Honigmann P; Keller M (2023): 'In-house 3D-printed custom splints for non-operative treatment of distal radial fractures: a randomized controlled trial'; *The Journal of hand surgery, European volume*.
- Hamidi A; Bayhaqi YA; Canbaz F; Navarini AA; Cattin PC; Zam A (2023): 'Towards phase-sensitive optical coherence tomography in smart laser osteotomy: temperature feedback'; *Lasers in Medical Science*.
- Hamidi A; Bayhaqi YA; Drusová S; Navarini AA; Cattin PC; Canbaz F; Zam A (2023): 'Multimodal feedback systems for smart laser osteotomy: Depth control and tissue differentiation'; *Lasers in Surgery and Medicine*.
- Hamidi A; Bayhaqi YA; Navarini AA; Cattin PC; Zam A; Canbaz F (2023): 'Towards miniaturized OCT-guided laser osteotomy: integration of fiber-coupled Er:YAG laser with OCT'; *OSA Continuum*.
- Herger S; Liphardt A-M; Wisser A; Eckstein F; Harder D; Nuesch C; Egloff C; Mundermann A (2023): 'The Increase Of Load-Induced Serum Cartilage Oligomeric Matrix Protein Concentration Correlates With T2 Relaxation Time In Participants With Anterior Cruciate Ligament Injury'.
- Herger S; Nuesch C; Eckstein F; Wirth W; Egloff C; Mundermann A (2023): 'BETWEEN-KNEE DIFFERENCES IN DEEP ZONE T2 ARE GREATER AFTER UNILATERAL ACL INJURY THAN IN HEALTHY CONTROLS'.
- Honigmann P; Keller M; Devaux-Voumard N; Coppo E; Sutter D (2023): 'Extension osteotomy of the metacarpal I and ligamentoplasty of the trapeziometacarpal joint for the treatment of early-stage osteoarthritis and instability of the trapeziometacarpal joint'; *Archives of Orthopaedic and Trauma Surgery*.
- Honigmann P; Keller M; Devaux-Voumard N; Thieringer FM; Sutter D (2023): 'Distance mapping in three-dimensional virtual surgical planning in hand, wrist and forearm surgery: a tool to avoid mistakes'; *International Journal of Computer Assisted Radiology and Surgery*.
- Howard JJ; Willoughby K; Thomason P; Shore BJ; Graham K; Rutz E (2023): 'Hip Surveillance and Management of Hip Displacement in Children with Cerebral Palsy: Clinical and Ethical Dilemmas'; *Journal of clinical medicine*.
- Huang D; Guo Y; Guan X; Pan L; Zhu Z; Chen Z; Dijkhuizen RM; Duering M; Yu F; Boltze J; Li P (2023): 'Recent advances in arterial spin labeling perfusion MRI in patients with vascular cognitive impairment'; *Journal of cerebral blood flow and metabolism : official journal of the International Society of Cerebral Blood Flow and Metabolism*.
- Ilesan RR; Beyer M; Kunz C; Thieringer FM (2023): 'Comparison of Artificial Intelligence-Based Applications for Mandible Segmentation: From Established Platforms to In-House-Developed Software'; *Bioengineering*.
- Ismailidis P; Mundermann A; Stoffel K (2023): 'A Monocortical Screw for Preventing Trochanteric Escape in Extended Trochanteric Osteotomy: A Simple Solution to a Complicated Problem?'; *Journal of clinical medicine*.
- Jung J-O; Crnovrsanin N; Wirsik N M; Nienhüser H; Ps L; Popp F; Schulze A; Wagner M; Müller-Stich BP; Büchler M W; Schmidt T (2023): 'Machine learning for optimized individual survival prediction in resectable upper gastrointestinal cancer'; *Journal of Cancer Research and Clinical Oncology*.
- Karnam M; Cattin PC; Rauter G; Gerig N (2023): 'Qualitative and quantitative assessment of admittance controllers for hand-guiding surgical robots'; *At-Automatisierungstechnik*.
- Karnam M; Zelechowski M; Cattin PC; Rauter G; Gerig N (2023): 'Workspace-aware Planning of a Surgical Robot Mounting in Virtual Reality'.
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