

# *Medical Technology in Bavaria*

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PORTRAITS  
PERSPECTIVES

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# THE SUCCESSFUL INNOVATION CENTRE MADE IN REGENSBURG

## Health Industry of Regensburg

- 1.8 billion Euro turnover
- 20.000 employees

## Cluster BioRegio Regensburg

- 55 companies (Life Sciences)
- 3.980 employees

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## Editorial

### High-tech solutions made to measure

Medical care for our society requires technological impulses and methods that improve therapeutic applications and sustainably increase safety and effectiveness.

The focus, among other things, is on the digitization of the healthcare system.

As noted by DigiMed Bayern, P4 medicine (predictive, preventive, personalised, participative) is what prediction in diagnosis and therapy aims for.

„Medical technology in Bavaria“ presents perspectives and offers answers to urgent questions:

- How can close cooperation be established with business and science?
- Who discovered something during the digital treasure hunt?
- Which institution organizes the worldwide export success of Bavarian companies?
- What effect does the integration and analysis of clinical, real, and research data have on the development in medicine?
- Where can „hot cells“ be used in the field of high-pressure system technology?
- Can an innovative tumour therapy „electrically switch off“ cancer?

- How do company founders in Europe make a lasting career through targeted advice, support and financing?

The course has been set for a positive and successful development in medical technology. Read on!

Walter Fürst, Managing Director

**This publication is also available online at**  
**[www.media-mind.info](http://www.media-mind.info)**

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### EIT Health Accelerator

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*Author: Angelika Balleis  
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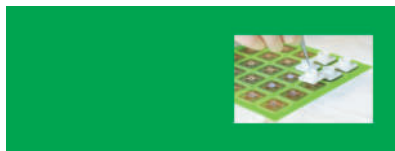


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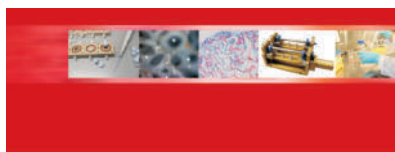


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*Author: Dipl.-Biol. Daniel Seitz  
Bio.Med Center Innovation gGmbH*



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# Your Key to Bavaria

## Easy access to economic partners in Bavaria

Exclusively available at Bayern International, the company database „Key to Bavaria“ comes free of charge and offers free information on more than 33.000 entries of companies from all sectors.

Visit [WWW.KEYTOBAVARIA.COM](http://WWW.KEYTOBAVARIA.COM)

Bavarian Ministry of Economic Affairs,  
Regional Development and Energy



## Welcome



Citizens would like to benefit from progress in medicine, but they are also concerned that access to highly efficient medical services could make it more difficult due to rising healthcare costs or sub-optimal framework conditions. Those affected feel time pressure during the treatment process and would like to have their needs taken more into account. They would like more time for counseling and possible treatment options. Also due to demographic change, society is increasingly interested in solutions that help elderly people to live independently at home for as long as possible, as well as to support relatives involved in care taking activities. Out of many, AAL (Ambient Assisted Living) and assisted robotics are just two keywords to name here. Digital applications such as Big Data/Artificial Intelligence support doctors in the treatment of their patients. Functions such as teleconsultations, telemonitoring and online coaching enable a new quality of interaction between service provider and patient, and a better exchange of information. Through productivity gains – resulting from the optimization of processes – service providers, such as doctors or nurses, have more time for dialogue and personal contact with the patient. In medical technology, applications and topics such as breast CT or 3D printing of tissues and organs are innovations that have a significant impact on our healthcare and will continuously be optimized. In general, digitization and innovations in medical technology will provide major benefits for more effective and efficient healthcare. There are estimates that health expenditure in Germany can be reduced by up to 40 billion euros per year as a result of this development, with the same or even better healthcare quality. Many of our healthcare innovations

are research-driven. Therefore, a strong alliance between research and industry is of utmost importance here. We need to further develop and train the ability to innovate. New training concepts – which in particular also promote working in trans-disciplinary teams – are important and supportive measurements. Hackathons, for example, are an example of new event and innovation formats that help to train and improve the ability to innovate. Network organizations, such as the Medical Valley Cluster of Excellence and ZOLLHOF as a digital incubator, have developed high-performance ecosystems for innovations and are organizing cross-industry Hackathons and other event formats with notable success. The activities of the Digital Health and Medicine theme platform of the Bavarian State Government aim to strengthen Bavaria's innovative drive in a wide variety of ways. In addition to the research and development of innovations, it is also necessary to have the courage to explore new things in healthcare and apply them area-wide. The complexity of the healthcare system is often used as an argument to explain why new approaches cannot simply be implemented. It is important that the key partners in healthcare strive to think about what's new and are interested in implementing what's new. This enables structural innovations to be successful which is necessary in order to make use of great innovation potentials for improving the quality of healthcare and also increasing its efficiency - all for the benefit of the citizens.

Prof. Dr.-Ing. Erich R. Reinhardt

Chairman of the Board  
Medical Valley EMN e.V.



# Forum MedTech Pharma – Innovations Through Health Care Networks

*Our healthcare system is constantly evolving. Due to technical progress, changing user requirements and regulatory requirements, the medical technology industry is increasingly facing challenges. Close cooperation with partners contributes to the continuing development of innovations and is decisive for success. It gives companies and research institutions advantage over their competitors. Forum MedTech Pharma provides support for the entire health care network.*

With about 550 members, the Forum MedTech Pharma is one of the leading cooperation networks in Europe. A fundamental task is to provide a platform for knowledge exchange and cooperations for the entire network. This mission is based on an effective communication between all stakeholders, as well as the determination of needs, challenges and stimulations.

## Cooperations, networking and knowledge-transfer

By offering a broad portfolio of network activities, Forum MedTech Pharma supports research institutes, companies, clinics and other actors within the health care market: innovation support, a knowledge database and conferences about technological developments are supporting members to attain knowledge and scout trends. Expertise in regulatory affairs, intellectual property rights and market access as well as several further education courses about medical technology are also offered. In the further development of innovations, coopera-



Forum MedTech Pharma is the German network for all actors in the health care sector. Individual consulting and special offers for members are part of the broad range of the organisation's profile. ■

tion agreements are an important factor for giving companies and research institutions a competitive edge over their rivals.

## Thematic focus and projects

Forum MedTech Pharma focuses on three topic fields. Medical & Health Care targets, among others, the medical need, hospital management and care & care technologies. High-end technologies, such as artificial intelligence or robotics, but also manufacturing processes or pharmaceuticals

are part of Technologies and Applications. The third subject area focusses on the complex Innovation Processes & Market Challenges in the health care sector, including regulation and reimbursement.

## Our network shaped by diversity

The network of Forum MedTech Pharma connects more than 10,000 customers and about 550 members. All the players involved with healthcare are integrated



Technology trends such as robotics, artificial intelligence, big-data-analytics or individualized manufacturing suggest new solutions. Current approaches are annually presented and discussed at the MedTech Summit – Congress and Partnering. ■

along the value chain: research and development, production, clinical application as well as cost bearers and self-administration. To adopt to the high ratio of small and medium sized enterprises in the medical technology sector, all events and services suit not only big companies but also start-ups and small companies. Besides Germany, the association has members in nine other European countries, as well as in the USA, Australia, Japan and India.

### More than 20 years Forum MedTech Pharma

In the twenty years since it was founded, the Forum Med-

Tech Pharma has welcomed about 25,000 delegates at 250 of its own expert conferences. The speakers of that conferences support the activities of the Forum MedTech Pharma with their expertise free of charge– just like the entire board of management, chaired by Prof. Dr. Thomas Armin Schildhauer.

Since the beginning, Bayern Innovativ GmbH operates the Forum MedTech Pharma via a business management contract, which is unique in Germany in terms of bringing together potential cooperation partners.

### Be part of our network

*You wish to expand your network? You are open minded for co-operations? Trends and innovations in medical technology and in the health care sector inspire you and are relevant for your daily business? Then we are your perfect fit.*

*Profit from a membership at the international network Forum MedTech Pharma and a broad range of services:*

- Support regarding your innovation process –from idea to marketability
- Conferences, symposia, expert talks, B2B-partnering and further events
- Identification and direct placement of partners
- Funding acquisition and consulting
- Consulting for market approval and reimbursement
- Presentation of your Company and news in our network
- Joint stand at Medica
- Internationalization

*Play a part and participate with your ideas. We are looking forward to your application!*

*Please find more information about the membership at Forum MedTech Pharma on our website:*

[www.medtech-pharma.de](http://www.medtech-pharma.de)

Author:  
Bianca Heinrich



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### Forum MedTech Pharma e.V.

- Independent network for innovations in medicine
- About 550 members from business, science and the health-care sector from 14 countries
- Various events: conferences, symposia, expert talks, workshops, company visits, trade fairs and B2B-partnering
- Technology and market-related topics customized to the need of the members
- Projects: Strategic Projects, Cluster Medical Technology Bavaria, Pflegepraxiszentrum Nürnberg (Center of Implementing Nursing Care Innovations Nuremberg) and others

# Bayern International expands white-blue horizons

*For 20 years, Bayern International has been organising projects worldwide for Bavarian companies' export success - on behalf of the Bavarian Ministry of Economic Affairs, together with a global network.*

## Trade fair promotion for trade fairs worldwide: the Bavarian Trade Fair Participation Program

Foreign trade fairs are an important sales channel in foreign markets. The Bavarian Trade Fair Participation Programme supports Bavarian companies in their trade fair participation: they receive financial support from the Bavarian Ministry of Economic Affairs as well as a turn-key trade fair stand with variable stand space. Bayern International takes over the entire organisation and on-site support. The Bavarian pavilion is organised at around 50 foreign trade fairs in 30 countries each year. ■

## Political support for your export business: delegation trips of the Bavarian Ministry of Economic Affairs

Politics is a door-opener when it comes to opening up new markets. On behalf of the Bavarian Ministry of Economic Affairs,



Bayern International organises the delegation trips under the leadership of the head of the Ministry of Economic Affairs. ■

## Entering the market with little effort: delegation visits

With the „Bavaria - Fit for Partnership“ and „Solutions - Made in Bavaria“ programmes, Bayern International brings delegations

from abroad to Bavaria. Here they receive practical and subject-specific training courses and meet Bavarian companies. Since 2004 there have been over 150 projects. ■

## The Bavarian company database

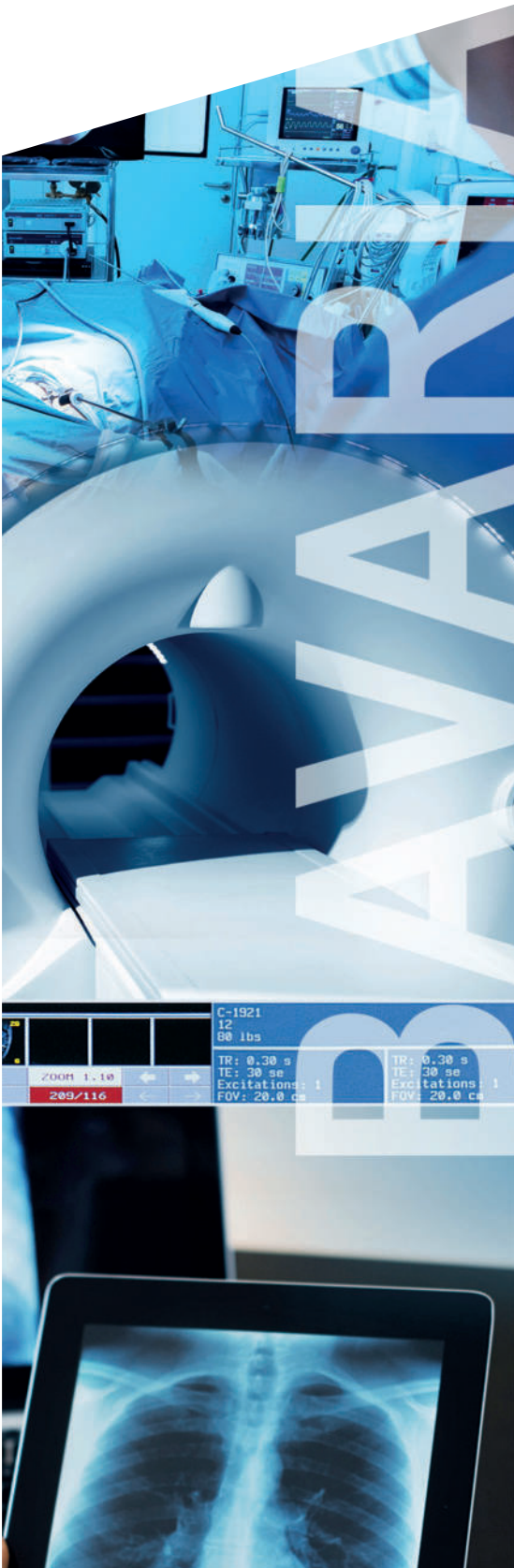
Foreign companies and institutions can search the Bavarian company database free of charge. The company database now contains more than 30,000 entries of Bavarian companies

[www.keytobavaria.de](http://www.keytobavaria.de)

Further information can be found at [www.bayern-international.com](http://www.bayern-international.com) ■







## Made in Bavaria

Meet Bavarian companies at the following international trade fairs and conferences

### Health Economics 2020

#### **CMEF INDONESIA**

11/03 - 13/03/2020, Jakarta (Indonesia)

#### **CMEF – CHINA MEDICAL EQUIPMENT FAIR**

09/04 - 12/04/2020, Shanghai (China)

#### **EXPOMED**

09/06 - 11/06/2020, Mexico City (Mexico)

#### **MEDICALL INDIA**

Juli 2020, Chennai (India)

#### **MEDIPHARM EXPO**

06/08 - 08/08/2020, Ho Chi Min City (Vietnam)

#### **HEALTH ASIA**

September 2020, Karachi (Pakistan)

#### **PUBLIC HEALTH**

October 2020, Kiev (Ukraine)

#### **MEDICAL JAPAN**

November 2020, Tokyo (Japan)

### Life Sciences 2020

#### **BIO EUROPE SPRING**

23/03 - 25/03/2020, Paris (France)

#### **CHINA BIO PARTNERING FORUM**

06/05 - 07/05/2020, Suzhou (Shanghai)

#### **BIO**

08/06 - 11/06/2020, San Diego (USA)

#### **AUSBIOTECH**

October 2020, Melbourne (Australia)

[WWW.BAYERN-INTERNATIONAL.COM](http://WWW.BAYERN-INTERNATIONAL.COM)

# The Medical Valley Digital Health Application Center – Paving the road to digital medicine – making technologies accessible to patients.

*With the new Digital Medical Application Center (dmac), we envision to shape tomorrow's health system – an ecosystem of digital health. Our main focus is to generate patient-centered digital health applications, by compiling innovative technologies into beneficial (tele)medical solutions for various clinical scenarios. Thereby, we help companies to integrate and accelerate their medical technology innovations to become applications for medical research or care. With an emphasis on personalized medical workflows, we enable patients to directly experience the tangible benefits of progress in digital health. In order to achieve these objectives, we add to the patients' needs the requirements of all participants of the addressed healthcare process: Not only patients and citizens, but also all involved healthcare provider, MedTech companies, insurance, academia and industry driven researchers, and societal requirements including regulatory, ethical, legal, and economic aspects. Thus, our concept aligns perfectly with the German government's new Digital Health Care Act that supports a fast-track clinical trial design and rapid access to the German healthcare system for digital health applications (DiGAs).*

## DIGITAL HEALTH ECOSYSTEM

Though it may sound abstract at first, the "DIGITAL HEALTH ECOSYSTEM" will be developed specifically to meet the needs of companies and their innovative solutions, driven by the patients' needs and individualized healthcare benefits. With this scope, we will adapt the application of new technologies to fit into the medical process for the respective disease. Technologies will then become part of new, digital supported and integrated care solution facilitating the largely data-driven "communication" between the patient, their doctors and other treatment providers. This has the effect that technologies themselves will "understand" how they can contribute to improved medical care. Regulatory and economic aspects will also be considered, while interaction with other technologies and platforms will be facilitated.

**The journey to this big goal starts in small steps: Each use case that we support will also shape the generic requirements of this new ecosystem digital health.**

With the involvement of regional partners, we aim to create a hub for healthcare providers to develop, test, and conduct their care concepts in a target-oriented manner. With the idea "we make DiGAs" we advise the services to become or be integrated into digital health applications. We compile different technologies to address the patients' needs and generate a medical benefit, and we conduct the required clinical trial and implementation research to meet the patient-centered medical, regulatory and the economically relevant evaluation criteria.

This process allows us to not only help companies, but also learn more about the prerequisites and design of the optimal future healthcare system from each application- and patient-centered solution. In the course of this project, new standards of care are to be developed which include patient management platform concepts with decentralized data utilization and interoperability standards that reach far deeper into the medical workflow than existing data-transfer standards in healthcare. This will largely facilitate the cross-platform applicability and scale innovative, patient-centered diagnostic and therapeutic services.

Through interdisciplinary and intersectoral integration and consolidation of patient populations, regional and supra-regional health service providers and cost units, integrated care concepts with telemedical and



Fig. 1: Opening ceremony of the Medical Valley Centers Bamberg (©Lara Müller/city archive) ■

intersectoral services are created that can then be tested in our “Living Lab” in the Medical Valley region and scientifically evaluated by us and by our partners.

The product portfolio of **dmac** includes the following main services:

- **Studies:** Validation, development, conception and implementation research by clinical studies for the evaluation of medical benefit, efficiency in terms of health economics and healthcare science, implementation research aspects (usability, applicability, adherence, social, ethical and legal evaluation) of the technology in interdisciplinary and intersectoral healthcare concepts
- **Network:** Integration and networking of interdisciplinary development and cooperation partners
- **eHealth:** Conception and support for translation of innovative technologies to digital health applications and services
- **Living Lab:** Test environment consisting of our network of participating patients and service providers for testing and development of digital health applications
- **Know-how:** Support in all medical, economic, legal and regulatory aspects
- **Finance:** Support in financing innovation and access to refinancing digital health applications

- **Analyses:** Demand-oriented market and target-group analysis

Consequently, we see ourselves as providing guidance and support for companies on their journey to the digital medicine landscape of tomorrow, from development to marketing to reimbursement. We are in a position to define innovative products and services, for example in the form of digital health applications (“DiGA”), and to assist in the fast-tracked one-year evaluation of the new Digital Health Care Act (DVG).

The mixed background of our team members underlines the different viewpoints of joint vision of a new **DIGITAL HEALTH ECOSYSTEM**: Marco Wendel (Managing Director – Diploma in economics), Prof. Dr. med. Jochen Klucken (Medical Director) and Christian Weigand (Chief Technology Officer – computer scientist) describe it like this.

#### **To what extent does dmac encourage digitization and technology in Bavaria?**

Digitization offers numerous challenges, but also opportunities, for businesses large and small as well as for start-ups. dmac develops and establishes a modular concept for a “**DIGITAL HEALTH ECOSYSTEM**,” where interactions and part-

nerships between all actors are promoted and can be implemented more quickly. Being the coordinator of this concept provides us with a very good overview as well as detailed knowledge of the various stakeholders and processes covering patients’ view, healthcare workflows and provider-specific requirements, but also political, societal and financial needs. This knowledge helps us, together with our partners, to use emerging synergy effects and to position solutions faster on the market and make them competitive.

#### **How can dmac contribute to the optimization of healthcare?**

Medical and health technologies are combined to form target group-oriented, intersectoral care solution and services and thereby become innovative care options for patients and service providers that are (telemedically) applied and support the future of both medical and nursing care. The application of technologies requires individual guidance to reach the transfer from technical solutions to healthcare applications for patients in the context of prevention, prediction/diagnostics, therapy monitoring and nursing. The aim is to integrate the technology and the innovative solutions into the care concepts as well as into the newly developing **DIGITAL HEALTH ECOSYSTEM** and thus make them tangible for the patient. This improves patient care in terms of medical benefit and overall quality of care.

#### **What role do technical innovations and digital solutions play in this?**

The Digital Health Care Act seems to pave a fundamentally new way for technological innovation if it can actually improve patient care in the form of “digital health applications.” The technical innovations of digitization have the potential to improve various aspects of care more quickly and efficiently to the benefit of the patient. Disease-relevant data can be exchanged directly, diagnoses



can be found more quickly, therapy decisions can be better supported, and, above all, optimal and patient-centered observation can be achieved. A substantial gain in efficiency derived from abilities of digitalization is the individualization and tailoring of information to the individual problem, and by its facilitation of the connectivity between all healthcare team members – not only the information for and communication with the patient, but also the individual service providers (doctors, therapists, nursing staff, pharmacies and many more) can work together more effectively and access a standardized basis of information. New methods using artificial intelligence offer great potential for sorting this diversity of data and tailoring it precisely to the patient's situation and illness. In other words, we provide the medical and technical application expertise for technologies to be applied in all phases of health and disease – prevention, diagnostics, therapy and monitoring up to the integration of care and the various healing professions.

### **What does decentralize data processing mean and how does it work?**

The concept of decentralized data storage, which is implemented by the Fraunhofer Mobile Health Lab (MHL) as one of our partners, means that the data generated during a patient's examinations always remains with the patient. This data can include sensor data from wearables, examination results from the family doctor or the products of imaging procedures on the part of the clinic. The data is of course available to the respective treating physician, but the patient is always able to keep track of the use of their data. In addition, the Digital Patient Manager of the MHL enables us to automatically generate patient cohorts for scientific questions, e.g. Big Data or AI applications, as part of our Living Lab and dynamically ask patients for their consent

to process their data. Furthermore, the patient's data is evaluated locally by algorithms and only the results are transmitted to the respective study director. This ensures that the data is not simply copied and collected at a central location and thus beyond the patient's control.

### **How important is decentralized data processing and what are its advantages?**

Nowadays it is almost a given that digital applications of all kinds use the Internet. All data is stored centrally on the servers of cloud providers. The situation is similar in medicine. Here we often speak of central registers, which should make it possible to analyze the collected data of different patients, mostly for a certain indication, with modern methods, i.e. to carry out big data analyses or apply artificial intelligence methods. The aim is to find patterns that will be helpful in prevention, diagnosis or therapy in the future and help to treat diseases better or earlier. Within this framework, the new rules on data protection must be respected. Since the entry into force of the General Data Protection Regulation (GDPR), directives on data privacy have become significantly stricter. In order to protect the privacy of the patient, it is now essential to ensure that the patient has unrestricted access to their data at all times and the ability to decide independently who may use this data. We see that patients as part of our society want to take their part, get engaged and contribute to research and development with their own data – however, we should acknowledge this by accepting their access to their data but not to owning their data. Thus, we support technical solutions that allow both, usage of medical data for research and care, but at the same time protecting privacy and empowering patients to own and control their data.

We support this right of the patient with our approach to distributed data storage – storage takes place exclusively on the patient's premises. The patient remains in control of their data and can determine who may use it – as well as when, how and for what purpose. Of course, it is also possible to revoke consent for data processing (dynamic consent). A generic telemedical platform is being developed in cooperation with partners such as the Fraunhofer Mobile Health Lab (MHL). This platform for digital patient management allows us to conduct studies in our Living Lab and dynamically obtain the necessary consent of the patient concerned. The latter is thus always informed about what is happening with their data and can decide for themselves whether they want to make their data available for scientific research or pharmaceutical evaluations.

### **Are integrated care concepts always necessary and always the goal of every cooperation?**

Integrated care concepts are always necessary when the management of the patient's disease requires more than just one doctor dealing with the problem at once. Particularly in the case of chronic diseases, various health service providers including therapists, pharmacies, care institutions and paramedical services usually play an important role in optimally handling all aspects of disease-related quality-of-life limitations. Communication is a fundamental element of this, one for which our goal should always be consistent improvement. In addition, this communication and the distribution of information must be adapted to the specific aspects of the disease and the patient. This is the strength of digital healthcare applications and data-driven care processes.

It will be a great challenge for our society to make optimal use of the

limits and possibilities of this data use, addressing both sides of the coin: protection of the individual versus the promotion of knowledge and health. This demands an immediate and intense participation of all stakeholders in the discussion and consensus process of how we as a society of patients, citizens, healthcare provider and payer want to deal with this in our near future.

**Are there already ideas about this DIGITAL HEALTH ECOSYSTEM and how likely do you estimate that it will become established?**

We have a vision for this DIGITAL HEALTH ECOSYSTEM which we like to discuss and shape with other ideas and concepts towards our future in medicine; we believe it is to be shaped primarily by the needs of patient-centered digital health applications. Thus, our major goal is to support the

applications and products by incorporating primarily the patients' needs, but also with a strong eye on the requirement of the technologies themselves, healthcare service providers, payers and ultimately society as a whole. We want to combine and integrate industrial interests with the academic and societal aspects, because a good idea alone is not enough to make a patient healthier. In order to do so, we generate a modular requirements concept – a digital health checklist – to evaluate and implement digital health applications. This DIGITAL HEALTH ECOSYSTEM helps technologies to fit in faster and better, and to ensure quality and safety for patients.

**What opportunities and possibilities can you offer the region as a company?**

The Nuremberg metropolitan region "Medical Valley" is an absolute

hot spot for innovations in the fields of medical technology and health. Due to the constant rise of digitalization in this area, specific knowledge is needed to implement these digital applications in care processes. Our dmac in Bamberg synthesizes this knowledge and offers it to interested companies in the Medical Valley and beyond.



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	<p>An important prerequisite for a successful enterprise is an IT environment which supports your business processes without limiting you. By using state-of-the-art information systems, we can help you increase your company's efficiency considerably.</p>	<p>your partner: Christian Heldwein</p>
	<p>We are conscious about both the headaches of your development staff as well as the limited scope in which you, as a project manager, have to make decisions. Use our know-how to make your project a success within the designated time and regarding the cost factor.</p>	<p>your partner: Michael Hojnacki</p>

# www.protosoft.de



### Innovative housing solutions – Good ideas have to be well packaged

Therefore housing solutions have to be tailored perfectly to the requirements of material as well as quality and content. Also in competition the optical design plays an important role.

### acad systems – Time to Market

acad systems develops innovative housing solutions for the medical field. We produce small quantities up to 2,000 pieces, procure all purchased parts and manage the whole project – to your advantage: cost-effective solutions, high quality and a functional, innovative design.

### acad prototyping – Driven by Improvement

acad prototyping produces plastic prototypes with an express injection moulding process. Parts can be delivered within 5 to 15 working days. Applicable are all available thermoplastics, multi-component components or structured surfaces – all this is realizable.



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### Hygiene in Medical Data Input

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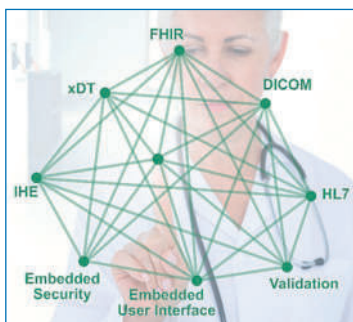
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### Professional software development for medical systems

Since its foundation in 1992, softgate has been active in the field of medical informatics with its teams Medical Solutions and Embedded Systems.



Our Medical Solutions team has many years of experience and professional competence in the field of medical imaging and connectivity with DICOM, HL7, GDT and IHE.

The Embedded Systems team specializes in the development of hardware-related, safety-critical software for medical devices and the entire software life cycle.

We are ISO 9001 and ISO 13485 certified. We develop our safety-critical software based on EN 62304 and ISO 14971.

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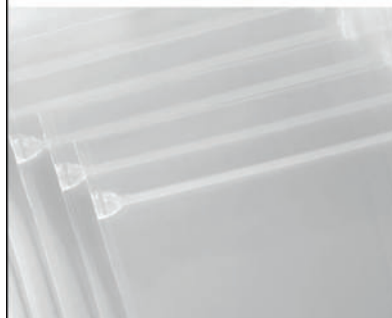
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3. **Digital therapy** with c-Digital Vision Trainer® for amblyopia.

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**VTplus** is a leading provider of highly integrated, easy to use **Virtual Reality Exposure Systems** with virtual environments that have been scientifically tested.

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## DIGITAL HEALTH CHALLENGE 2019

**Hackathons  
as a chance  
for tomorrow's  
health**

Boosting innovation independently, working together with experts at eye level, and helping people suffering from illness:

That is exactly what Healthcare Hackathons have to offer.

The Digital Health Challenge 2019 in Erlangen is the perfect proof that creativity, enjoyment of experiment and courage can make a difference. Under patronage of 130 participants from 22 nations came together and worked for 3 days and 2 nights to develop exciting digital health solutions.



Also in regard of the approaching „Digitale Versorgung-Gesetz“ (Digital Provision-Law), the journey of digital health solutions has just begun. The DHC-team is positive that in the next year people from all over the world will accept the challenge again and search for further possibilities to improve life quality.

Medical Valley EMN e.V.  
 Henkestraße 91  
 91052 Erlangen  
[www.medical-valley-emn.de](http://www.medical-valley-emn.de)



# Innovative robot-supported therapy from Austria

*Intelligent motion GmbH has a leading role in the field of robot-supported therapy in rehabilitation as well as in high-tech trainingsystems for top athletes.*

HIROB is a robotics-concept which helps patients who have physical impairments like strokes, neurological deficiencies, craniocerebral injuries etc. Using HIROB causes an increased activity in trunk and back-muscles and

- enhances selective pelvis movement
- improves the ability to maintain a straight pelvis and upper body posture
- improves trunk stability
- improves static and dynamic balance

Therapy involving HIROB is feasible during almost the full duration of rehabilitation, starting at the end of intensive care treatment. Non-stationary and post-rehabilitation patients can still improve with a continuous therapy using HIROB.

*„What I like best about the HIROB is the short time it takes to set up and to transfer patients to the therapy position. The HIROB may be adjusted quickly and precisely to the patient's needs. We are able to start using the HIROB at an early therapy stage. As the speed and intensity of the movement may be selected according to the individual needs of the patient treated“*  
**Dr. Andreas Mayr**

## Result of the study:

... Most patients showed a significant improvement of trunk stability,



ty, an increased activity of back-muscles, an improved ability to maintain a straight pelvis and upper body posture as well as an enhanced selective pelvis movement..“

**Ao. Univ. Prof. Dr. Leopold Saltuari**

## Therapy:

A therapy using HIROB makes sense with every issues which cause an unstable trunk. Patients with multiple sklerosis and children with cerebral paresis also showed very positive results when involving HIROB. Further range of application are patients who suffer from parkinsons disease, paraplegia or other orthopedic illnesses.

„I was diagnosed with Guillain-Barré syndrome. As a result, until just recently I was completely unable to walk. Since starting therapy with „HIROB“ one week ago, I have made great progress, and I am already cap-

able of walking a few steps. I can feel that particularly my back and abdominal muscles have greatly benefited from daily therapy sessions involving HIROB. I would definitely recommend this therapy; it has helped me a lot.!

**Josefine Runegger, Patientin**

*„... a great device which complements the market in the field of active strengthening the muscles of the trunk. Further, patients have fun to work with HIROB and get motivated.“*

**Therapist**

**You can watch HIROB during the medica fair in Hall 4.**

## Contact:

*intelligent motion gmbh*

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# For a better understanding of dementia



## *The „Digital Dementia Register Bavaria“ supports those affected and their family caregivers with digital services*

*What is the course of dementia? What kind of support do those affected and their family caregivers need? The "Digital Dementia Register Bavaria" (digiDEM Bayern) examines these questions. The aim of the health outcome research project is to sustainably improve the situation of those affected and their families. The focus is on digital services.*

More than 240,000 people with dementia currently live in Bavaria, and the number is expected to rise to 300,000 by 2030. The future care of those affected is one of the greatest challenges for our society. digiDEM Bayern is meeting this challenge with digital services.

### Digital services and dementia register

On the one hand, digiDEM Bayern will develop digital services for people with cognitive impairments and dementia as well as for family caregivers and volunteers. On the other hand, a Bavaria-wide dementia register will be set up in order to better understand the long-term course of the disease. For this purpose, data will be collected on the care of people with dementia and on the burden on family caregivers. Currently, cooperation partners are being sought who can convince people with dementia to participate.

<https://www.digidem-bayern.de/koooperationspartner/>



The digiDEM Bayern-Team ■

### Interdisciplinary project network

digiDEM Bayern is a collaboration of the Friedrich-Alexander-University Erlangen-Nuremberg, represented by the Interdisciplinary Center for Health Technology Assessment and Public Health (Head: Prof. Dr. med. Peter Kolominsky-Rabas) and the Chair of Medical Informatics (Head: Prof. Dr. Hans-Ulrich Prokosch), the University Hospital Erlangen, represented by the Center for Health Service Research (Head: Prof. Dr. med. Elmar Gräßel) and the Innovation Cluster Medical

Valley European Metropolitan Region Nuremberg (members of the board: Prof. Dr.-Ing. Erich R. Reinhardt, Prof. Dr. h. c. Jürgen Schüttler).

digiDEM Bavaria is part of the Bavarian Dementia Strategy. It is timed for five years (2019–2023) and is funded by the Bavarian State Ministry of Health and Care.

Webseite: [www.digidem-bayern.de](http://www.digidem-bayern.de)

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digiDEM Bayern

Kathrin Seebahn

digiDEM Bayern Press & Communication

E-Mail: [kathrin.seebahn@fau.de](mailto:kathrin.seebahn@fau.de)



# Collin Medical Line

*Utmost precision, homogenous processing & high throughput.*

*Collin Medical Line lines are explicitly adjusted, designed and manufactured to the respective customer requirements. The entire Collin portfolio can be designed for medical lines, starting with the extruders, compounders, calenders, presses or roll mills up to complete strand and blown film lines.*

Highest precision, narrow tolerances, cleanness, process accuracy, excellent cleaning handling, clean-room conformity, quick and good service and custom-made trainings for customers are a matter of course.

## **Medical Line Extruders**

**Flexible & modular, for various fields of application**

Compact and modular – the Medical Line extruders from Collin. Driven by an innovative concept, the lines can be used in different ways. Therefore, different downstream equipment can be connected and numerous additional equipment and features can be realized.

## **Medical Line Compounders**

**Small & compact, ideal for pharmaceutical and medical technology**

Collin compounders are used for different applications in the pharmaceutical and medical technology. Due to the compact design, the lines can easily be cleaned and guarantee extremely short material changing times.

## **Medical Line Presses**

**Practical, quiet hydraulic system & ergonomic door**

Collin Medical Line presses integrate all advantages of Collin presses and are especially characterized by their quiet hydraulic system, the modern design and the vertically movable door.

## **Medical Line Calenders / Roll Mills**

**Modular & compact to the complete line**

Calenders and roll mills are essential elements for prototype production in the pharmaceutical product development or for the production of tablets in any size and form.

## **Blown Film Lines air-cooled / water-cooled**

**With high quality demand versatile in use**

Collin blown film lines are characterized by compact design with small floor space, easy operation and exact, reproducible movements as well as fast changes of products and parameters.

## **Strand Lines**

**Complete line from one source**

What is unique about Collin strand lines is that all production steps are from one source: compounding, coextruding, take-off and cutting.

Collin has already hundreds of references worldwide as well as an existing global service network.



Contact:



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# Medical Valley offers future oriented solutions for an optimized healthcare system

Metropolitan Region of Nuremberg

The city of Erlangen and the European Metropolitan Region of Nuremberg (EMN) have a strong association with medical technology. The EMN's strategic development statement under the direction of the Nuremberg Chamber of Commerce and Industry (CCI) identifies "medicine and health", a technological-ly significant area of expertise and growth, as particularly capable of development. Nevertheless, competition in the health

market implies a high pressure on companies. Increasingly, regions have to compete with each other for the qualified workforce. The regional economy and academia have the chance to position themselves in these spheres of activity. They are already taking advantage of this opportunity, using innovations to make healthcare provision more effective and efficient while at the same time offering dedicated people an interesting working en-

vironment. The extraordinary concentration of companies as well as research and development organisations within the Medical Valley EMN is also proven by the numbers of employees. About 127,000 persons could be assigned to this competence field. With a share of 10 Prozent of all employees of the Metropolitan Region, about every eleventh worker is connected to the competence field "Medicine and Healthcare". In the catchment



Medical Valley Start-up and Innovation Centre in Erlangen, in the heart of the EMN ■



area for tertiary institutions, and in particular the Friedrich Alexander University (FAU) Erlangen-Nuremberg, there are currently 60 departments with a focus on medical technology, 20 non-university research institutions, 40 clinics and over 180 businesses that are enjoying economic success in medical technology. This abundance of expertise is the secret for the region's success. The region's excellent, internationally competitive credentials in medical technology's key areas are the foundation for this: electronics and microsystem technology, information and communication technology, optical technology and new materials. Accents were set for the development of the business and scientific location of medical technology and health, and to use the potential of new technologies to increase the efficiency of the health system. The varied initiatives of regional players and the support of the Bavarian state government led to the completion in 2003 of a start-up centre, the "Innovation Centre for Medical Technology and Pharmaceuticals" – in the direct vicinity of university medical research facilities, what is now the Medical Valley Center in Erlangen. It is one of the most successful start-up centres in Germany. Moreover the start-up center in Forchheim and the Medical Valley Research and User Centre in Bamberg created an additional offer for companies with focus on Healthcare IT and Hygiene. The Nuremberg Chamber of Commerce and Industry is a founding member and has remained a shareholder of the operating company so far. The Chamber is also represented on the supervisory board of the Medical Valley Center and has been chairman for years. In this context the Medical Valley EMN e.V. was founded in 2007

to draw these activities together. The society has since then become an integral part of the EMN's overriding development strategy, and the Nuremberg CCI has been influential on the executive board from this point on. The CCI also supports technology transfer and networking with its own advice services and offerings, such as the "Medicine and Healthcare" CCI users club. The Nuremberg CCI is currently promoting the development initiative for a systematic operational health management (BGM), to which numerous regional companies are contributing. Moreover, the CCI Represents the interests of the regional health economy at a federal level on the "Health Economy" committee of the Association of German Chambers of Industry and Commerce. The Medical Valley EMN e.V. currently provides support at all levels of medicinal product development, including subsidy advice, networking, events, marketing activities, training and continuing

training. The Medical Valley EMN Association was named National Leading-Edge Cluster, with the claim of "Centre of Excellence for Medical Technology", in 2010. The "Medical Technology" Leading-Edge Cluster is the culmination of expertise that has grown over the years regarding healthcare provision, medicine and medical technology. The members of Medical Valley EMN e.V. are representative of how innovative medicine and healthcare are in our region, e.g. Patent applications. The current CCI report "Patents in Bavaria 2016/ 2017" credits the EMN with around 42 percent of all patents in Germany in the areas of "diagnostics". Together with the Forum Med-Tech Pharma e. V. the Medical Valley EMN e. V. manages the bavarian cluster „medical technology“ until 2024. An additional strong signal for the medicine site is the displacement of the Bavarian State Ministry for Health and Care from Munich to Nuremberg. ■



Siemens AG, x-ray tube unit for computer tomography and angiography. Each unit is tested in a Siemens computer tomograph before it leaves the technology centre ■

### Solutions for optimal and efficient healthcare from the Medical Valley EMN

Innovative medical technology is firmly rooted in our region. The interdisciplinary technologies of mechatronics, microsystem technology, optics, photonics, nanotechnology and biotechnology, concentrated in the EMN, contribute scientific know-how to medical technology. Biomedicine and bio-informatics in the Würzburg area provide the necessary supplements to interdisciplinary research and product development in the functional imaging, biomarkers and biomaterials sector. The functional textiles and nutrition sectors in Upper Franconia also provide developments. The result is a dense, extremely productive "Medical Technology Cluster" that spreads out far beyond the region and whose product portfolio and efficiency is unique within Germany. The partners of the Medical Valley EMN are furthermore international leaders in the following important medical technology product categories: computer tomography;

magnetic resonance tomography; interventional imaging (imaging diagnostics); refractive laser surgery; lithotripsy; endoscopy (therapy systems); sensor technology; medicinal information systems; home care; telerehabilitation; monitoring (telemedicine); pacemakers and revision implants (high-tech implants).

The network of players in research, production and service provision strengthens and accelerates the development and implementation of new products and procedures in healthcare sector. Yet start-up centres, such as the Innovation and Start-Up Centre (IGZ) and the Medical Valley Center, are also important points of contact for start-ups, small and medium-sized businesses and academia.

### Examples of companies and their highly innovative products

But small and medium-sized businesses also provide highly innovative products: **Peter Brehm GmbH**, founded in 1981, manufactures titanium implants – hip, knee and spinal implants, jaw joints – while the

instruments for inserting implants into the human body are also integral to the company's product portfolio. In the year 2014 the company was winner of the Innovation Award Bavaria. Other companies include **Corscience GmbH & Co. KG** (technologies to cardiovascular therapy and diagnosis), **Wavelight GmbH** (development and production of modern diagnostic and operations technology for correcting defective vision), **Sepp.med GmbH** (IT solutions with integrated quality assurance for complex safety applications), **ASTRUM IT GmbH** (software for the healthcare and medical technology sectors), **Bio-Gate AG** (anti-microbial products), **PAUSCH Medical GmbH** (x-ray accessories).

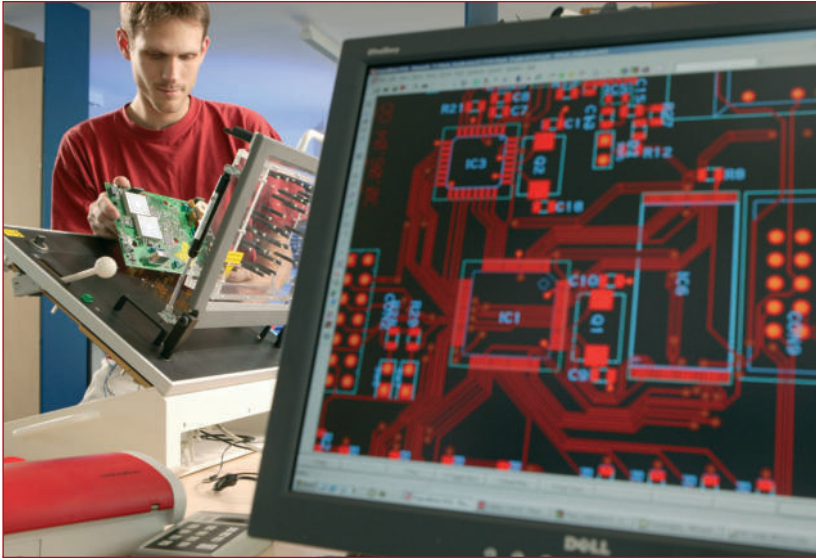
These, as well as numerous other companies, provide the health market with innovative products. Last but not least, as the world's biggest provider of electromedical devices, systems and equipment, **Siemens Healthineers GmbH** is a driving force in the region.

These companies further benefit from the research activities of R&D departments at universities – in particular, the FAU Erlangen-Nuremberg, the Fraunhofer Institute for Integrated Circuits (IIS) and the Fraunhofer Institute for Integrated Systems and Device Technology (IISB), as well as the Max Planck Institute for the Science of Light. These and other institutions, such as the Diakonie Neuendettelsau, rehabilitation clinics, Rummelsberger institutions and other private clinics, not only contribute to the highest level of medical provision, but also create and test the ideas for new developments. With the Medical Valley's innovative technologies and services, the image of healthcare provision can be changed. If the new products and services can be successfully integrated into the existing healthcare system, new standards can be set for efficient healthcare provision – on an international level. ■



*Peter Brehm GmbH, Weisendorf: In the year 2014 the company was winner of the Innovation Award Bavaria. The product innovation is called "revision hip support pan". (Photo: Peter Brehm GmbH, 2018) ■*





Firma Corsience GmbH & Co. KG, Erlangen: Defibrillator manufacturer in Erlangen ■

### ***Skilled workers for the healthcare economy***

Qualified young professionals are vital for the success of medical and healthcare players. The FAU and two universities for applied sciences offer degree courses in medical technology. The medical technology course at the FAU is coordinated by the Central Institute for Medical Technology (ZIMT).

The ZIMT acts as the interface between the Faculties of Engineering, Science and Medicine. Other highly specialised courses at the FAU include the Master of Health Business Administration and Integrated Life Science. The successful Medical Process Management course, created by the Faculty of Medicine, is the only one of its kind in Germany.

Other programmes leading to careers in the healthcare economy, from chemical laboratory assistant, surgery mechanic, optometrist

and hearing aid technician to nurse, are offered as professional training courses. Chambers in the EMN accompany and support businesses in training their employees; the publication "Health Career" is exemplary in this regard.

The region is positioned excellently to achieve its strategic goals for the future. These are: recognition worldwide as a point of reference for the medicine and healthcare sector; securing and expanding the international competitiveness of medical technology companies; accelerating knowledge and technology transfer to the greatest extent possible and increasing the attractiveness of the EMN to skilled workers. In the long term and with the support of the Nuremberg Chamber of Commerce and Industry, the EMN will become a model region for efficient and optimal healthcare provision. ■

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# For a natural smile



## Automated, digitally planable coloring of zirconium oxide for dental applications

*In Germany alone, around 1.3 million dental implants are used every year. The aim is on the one hand to restore functionality and on the other hand to achieve aesthetically pleasing results. According to the state of the art, zirconium oxide is often used as a material for fully anatomical restorations. Either industrial polychromatic pre-colored material is used or the implants are colored before sintering. The staining is carried out either monochrome in the dipping process or individually and polychromatic by hand. When staining by hand, the color result is hardly predictable or reproducible, especially since the color development only becomes apparent after the sintering process and can then only be corrected to a limited extent. The color perception and its reproduction is also strongly dependent on the experience of the dental technician. At the Institute of Microtechnology and Medical Device Technology at the Technical University of Munich, in a cooperative project with bredent GmbH & Co.KG and smart optics Sensortechnik GmbH, a process is developed that allows an automated staining process to achieve digitally predictable and reproducible shade results, as well as to influence these individually if desired.*

### Dental implants

Zirconium oxide (also known colloquially as zirconium), a high-strength technical ceramic (oxide ceramic), is often used as the material for dental prostheses. Due to its excellent mechanical properties and good biocompatibility and the favorable material price, it is particularly suitable for this field of application.

The typical manufacturing process begins with the digital construction of the dental prosthesis using the CAD method. These data sets are produced from a zirconium oxide blank for milling the dental prosthesis, in the typical case of a fully anatomical crown or bridge. The milling process is

followed by coloring with metal salts dissolved in a liquid. The milled bridge or crown is then sintered and polished. Coloring is necessary because zirconium oxide in its raw state has a whitish, slightly transparent monochrome color. In order to achieve a natural, aesthetic, polychromatic result, it must therefore be stained in several colors before use. Metal salts are used for this, which are integrated in the crystal structure during the sintering process and thus achieve the desired color effect. Alternatively, pre-colored blanks can be used. These have a color gradient along their height that comes close to that of natural teeth.

However, this cannot be further individualized. A further disadvantage of these blanks are the material costs, which are about 3 times as high as those of colorable zirconium oxide. This is an important factor with regard to the prevailing cost pressure.

The metal salts for manual coloring are applied either in liquid solutions by brushing or by immersing the ceramic in the solution. In order to cover the entire natural color spectrum, a variety of different colors is required. For example, according to the VITA Classical (VITA Zahnfabrik) shade system, there are 16 different shades and inten-

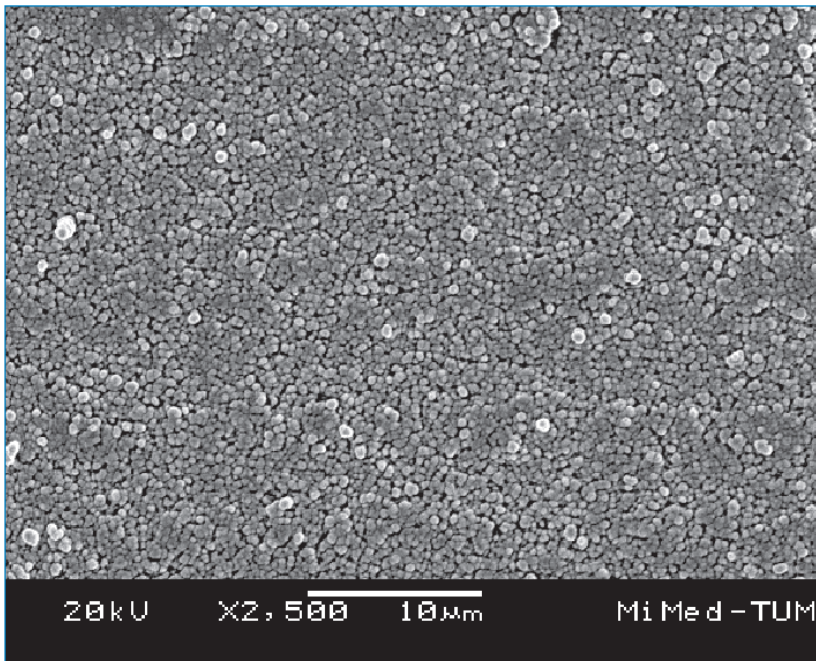


Fig. 1: SEM image of zirconium oxide before sintering. Pores are present between the particles. ■

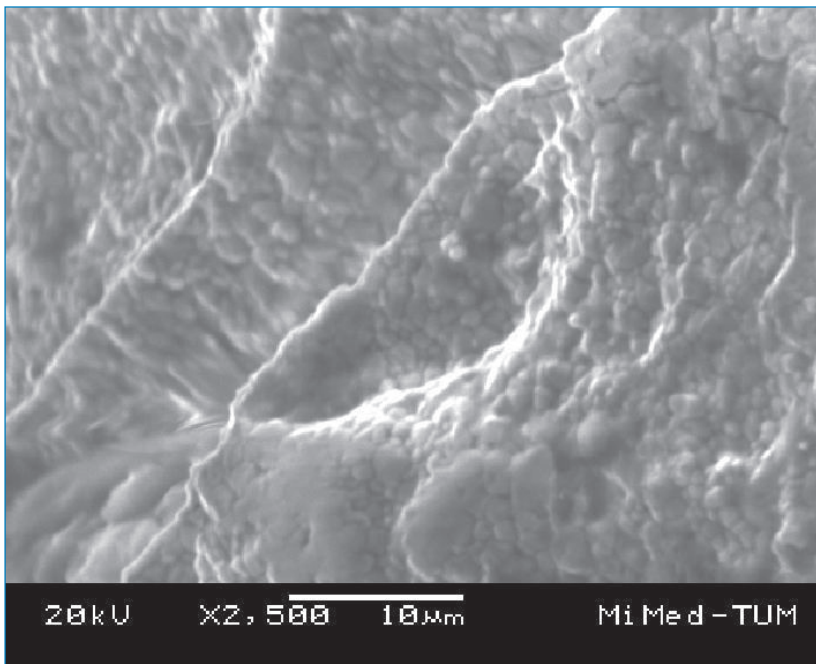


Fig. 2: SEM image of zirconium oxide after sintering. The pores are completely closed and the component shrinks. ■

sities. Before sintering, zirconium oxide has a pore content of around 40–50 % (Fig. 1). Due to this porosity, the liquid is absorbed by the material. After evaporation of the liquid, the metal salts remain in the ceramic and the milled prosthesis is sintered at 1400–1500 °C. During the sintering process, grain growth occurs and the pores close. This can be seen on images taken with

a scanning electron microscope (Fig. 2). The material shrinks in all directions by approx. 20 % and afterwards has a density of almost 100 %. This shrinkage is taken into account by appropriate scaling when milling the implants.

When manually staining the implants, the color result achieved is highly dependent on the

skill of the dental technician and is difficult to reproduce. The color application from the brush to the workpiece cannot be precisely quantified, since it depends on both the fluid saturation of the brush and that of the zirconium oxide. A great challenge is the achievement of realistic color gradients between the individual areas of the tooth (incisal, dentine, neck). This is aggravated by the fact that the shade effect only occurs after sintering and that no statement can be made about the final result during the shade application. The colorless solutions are therefore often artificially colored in order to make handling easier for the user. These indicator colors burn residue-free during sintering.

The Institute of Microtechnology and Medical Device Technology is developing a process for the automated coloring of zirconium oxide as part of a cooperation project with bredent GmbH & Co.KG and smart optics Sensortechnik GmbH. The contactless ink application by means of ink jet printing allows the precise dosing of exactly known ink quantities. The system has a droplet generator that can print droplets on any part of the implant using 5-axis kinematics (Fig. 3). The different color shades are produced by sequential application of the individual colors directly onto the implant, so that only one droplet generator is required. This means that the 16 standard shades can be produced from a smaller number of individual components.

This process allows reproducible, polychromatic color results to be achieved. In addition, the desired color result can be digitally planned on the PC before the beginning of the dyeing process and the later appearance can be visualized in advance.



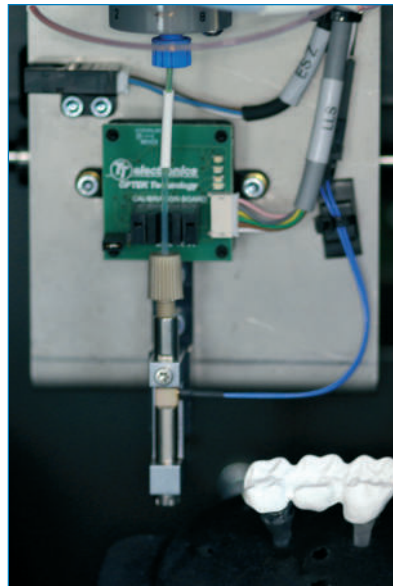


Fig. 3: Left: 5-axis printer for automated coloring of zirconium oxide. Right: Printer nozzle and placed zirconium oxide bridge. (www.softceram.com) ■

As before, the manufacturing process begins with the milling of the implant. The workpieces are then placed in the printer and the geometry and exact position inside the machine are determined using a 3D scanner. Specific software allows the user to digitally plan the coloring with simultaneous visualization (Fig. 4). The required ink quantities are then determined from the specified color settings and the paths of the 5-axis printer kinematics are calculated.

After the path calculation, the printing process is started and the



Fig. 5: Fully anatomical zirconium oxide crown, here colored with indicator colors for demonstration purposes. ■

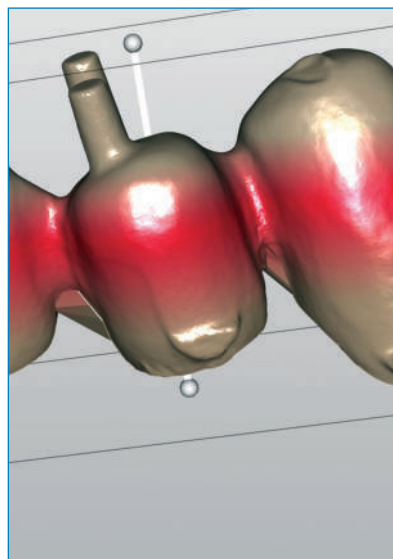
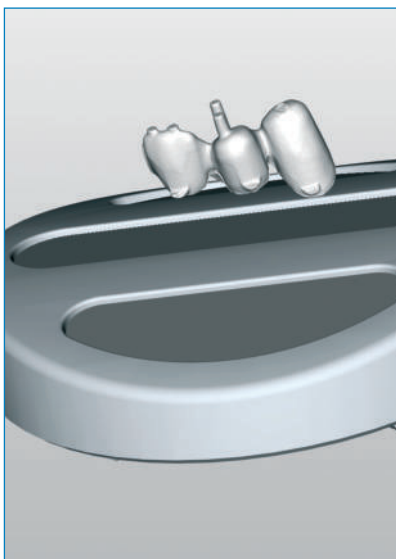


Fig. 4: Left: Representation of the prosthesis captured by the 3D scanner in the software. Right: Virtual colouring with colour transitions between the individual tooth areas. ■

ink is precisely applied to the implant by the drop generator. The implant is then sintered as usual and can then be inserted (Fig. 5).

This process offers several advantages over the state of the art. The contactless, precise ink application enables reproducible coloring of implants. Digital color planning allows polychromatic coloring and ensures that the color of the prosthesis matches the adjacent teeth perfectly. Low-cost white blanks can be used as the starting material. ■

*This project was supported by the Federal Ministry for Economic Affairs and Energy on the basis of a decision by the German Bundestag (ZF4433001).*

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# A ground-breaking digital 3D display technology

## Ergonomic. digital 3D viewing system with zoom

In times of increasingly demanding digital applications, image presentation is critical to improving the interpretation of 3D viewing or 3D models and enhancing the user experience.

DRV (Deep Reality Viewer) by Vision Engineering, the traditional microscope manufacturer, produces high-resolution 3D stereo images without using a monitor or wearing headset or special glasses: images „float“ in front of a viewing mirror.

### Patented stereo digital 3D viewing technology

In addition to the familiar ergonomic benefits of Vision Engineering products, DRV now offers users full interaction with other users or remote users in remote locations, as well as tools / PCs or complementary analysers.

Based on this worldwide new technology the digital 3D viewing system DRV-Z1 results as a microscope version with stereo zoom. It was developed specifically for inspection and manufacturing applications and combines the advantages of optical stereomicroscopy and digital technology in one system.

The zoom module is equipped with a zoom factor of 10: 1 and allows a magnification range of 6x - 93x, depending on the lens. The digital 3D stereo image is projected onto a 400 x 225 mm concave mirror in an aspect ratio of 16: 9. For users provides the digital stereo image of the DRV-Z1 a natu-



*With Vision Engineering's patent 3D viewing technology, operators enjoy a peripheral vision that enhances natural hand-to-eye co-ordination ■*

ral 3D view with Full HD resolution and excellent object sharpness, enabling improved inspection quality. For the first time is in a digital system a true depth perception presented which even better supports the use of tools such as soldering and deburring tools, micro tweezers or similar in the processing or manipulation of objects.

### Optimized hand-to-eye co-ordination

The ergonomic advantages of the DRV-Z1 including freedom of movement of the head, the view of the component, the comfortable working position, easy hand-to-eye coordination and the use of prescription eyewear help increase efficiency, accuracy and productivity.

For organizations with multiple locations and whose supply chain network is geographically spread out, DRV-Z1's patented technology drives productivity improve-

ment and new opportunities in collaboration. A unique combination of natural, high clarity 3D image presentation and 3D image capture makes it possible to share 3D images with distant colleagues through a real-time digital connectivity. This creates completely new opportunities for collaboration across distributed operations and for interdisciplinary cooperation's, for example, inside and outside a clean room environmental.

By merging the existing technologies of stereomicroscopy and digital microscopy, completely new viewing and inspection possibilities are opened up. Classic fields of application are electronics, precision engineering, aerospace, plastics technology, automotive and medical technology.

[www.visioneng.de/drv-z1](http://www.visioneng.de/drv-z1)

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# An Innovative University: Amberg-Weiden is Setting a Course for the Future.

The medical engineering campus at the Technical University of Applied Sciences (OTH), in the Max Reger city of Weiden, is growing into an important location for medical-technical and healthcare management networks in Northern Bavaria

- The competence centre for rural healthcare, as an inter-transdisciplinary think tank, is bundling rural healthcare activities in sciences, business and politics.
- Beginning in 2019, healthcare management is being coordinated by the Medical Valley Center, Weiden chapter, a new location site for the national cutting-edge cluster, Medical Valley.
- The "health region PLUS" of the Northern Upper Palatinate, is comprised of the districts of Neustadt, Tirschenreuth as well as the city of Weiden, where key players plan the future of rural healthcare.
- Machbar, the innovation laboratory, (<https://www.oth-aw.de/machbar/>) offers interested parties mobile and virtual infrastructures to develop and test ideas, products and processes.

The healthcare and medical engineering campus of the OTH Amberg-Weiden acts as the nucleus of all activities, where not just research is conducted but also where future scientists and engineers are trained. Beginning winter semester 2019/2020, the Industrial Engineering faculty redesigned and relaunched four established Bachelor programmes as well as created two brand-new programmes.



*Digital Healthcare Management combines competences in management, digitalisation and healthcare. ■*

## "Digital Healthcare Management"

The new bachelor, Digital Healthcare Management, combines competences in three areas of management, digitalisation and healthcare. „We teach our students to think and act cross-disciplinarily“, says Dr. Steffen Hamm, professor and bachelor programme head. „They learn how to understand the conceptual relationships and processes of healthcare management and assess healthcare economics. With this foundation, they later develop digital solutions and through that, work on concepts and implementation for innovative healthcare and business models.“ The technical, diagnostic and therapeutic advances in medicine offer challenges that mandate new digital products, processes and structural frameworks to meet the qualitative potential for effective and efficient healthcare. As a result of the network, the OTH

Amberg-Weiden can offer students the required practical training necessary. The first pillar in the field of study includes courses like business administration, marketing or logistics. Additionally, courses like epidemiology, anatomy and physiology, health economics or medical ethics make up the healthcare modules. Computer sciences, IT tools, e-health and information systems and data banks comprise the last third of the programme.

## "Physician Assistance"

The bachelor, Physician Assistance, prepares students for a newly developed health sciences profession, already recognised by the German Medical Association and the National Association of Statutory Health Insurance. Physician Assistants work hand in hand with doctors and support them in patient care. „The programme is truly a viable alterna-

tive for those interested in studying medicine but did not receive a placement due to entry requirements,” stated Dr. Stefan Sesselmann, professor and programme head. The OTH Amberg-Weiden is the first state school in Germany offering this programme without the prerequisite of a health-related apprenticeship.

The Physician Assistance programme at the OTH does not charge student tuition, in contrast to private universities. Those interested in studying in this programme should have a passion working with people and possess emotional intelligence. A large portion of the programme has to do with a standard medical school core curriculum like anatomy and physiology, orthopedics, trauma medicine and surgery. The second area involves health economics, hospital management, epidemiology and case management. Additionally, system and method competencies like medical ethics, medical law, medical technology, e-health and m-health, project management and presentation and communication skills are taught.

### Medical Engineering with Specialisations

In the bachelor programme, Medical Engineering, the focuses of people, technology, health and engineering intersect. Students learn how to develop, produce and use medical components, devices and systems. “We have modified the programme and added new specialisations to our portfolio optimised to prepare graduates for the modern working world and digitalization,” explained Professor Burkhard Stolz, head of the bachelor programme. Digitalisation opens completely new perspectives. Mechanical and electronic components in combination with software make medical engineering products smarter, more func-



Brand-new program in Weiden: Physician Assistance. ■

tional and comfortable – and these under extremely difficult and dynamic requirements in healthcare. Digital medical engineering concerns itself with pattern recognition in medical imaging, medical information systems or system signal theory. Medical physics involves the intersection of natural sciences and healing since many applications and larger devices require interdisciplinary know-how. The Service and Applications course puts a focus on service management. The Medical Product Development and Regulatory Affairs course examines the development, trialing and licensing of medical engineering products and devices. Given changing regulation and legislation, this is a dynamic and challenging area.

### machbar Innovation Laboratory

Shortly after its founding, operations began in the machbar Innovation Laboratory. In medical engineering for example, best practice processes and tools for an efficient science and technology transfer are developed and tested. Under the leadership of Dr. Clemens Bulitta, Head of the Medical Engineering Campus of the OTH Amberg-Weiden and Faculty Dean, a team of six supports firms, associations and regional authorities in the creative process. Here an entire product life cycle can be supported starting with idea generation, followed by development and testing stages through to the application and commercialization of each project. For interested parties, the

fully-equipped mobile innovation laboratory and its team can be booked or one can visit the virtual laboratory online. Professor Clemens Bulitta is convinced that the continued further development of the campus and expansion of the network will benefit the entire region. “We are not inert objects or those that simply react to change, we can proactively design and influence the future of our region and its inhabitants!”

The laboratory is part of the project Transfer and Innovation in Eastern Bavaria (TRIO) funded by the German Federal Ministry of Education and Research (BMBF) in the funding initiative Innovative University.

### Infos & Contact

#### Institute for

#### Medical Engineering:

[www.ifmz-weiden.de](http://www.ifmz-weiden.de)

#### Study Programmes:

##### Bachelor:

<https://www.oth-aw.de/digital-healthcare-management/>

<https://www.oth-aw.de/physician-assistance/>

##### Master:

<https://oth-aw.de/master-medizin-technik/>

#### machbar Innovation Laboratory

<https://www.oth-aw.de/machbar/>

<https://www.instagram.com/machbar.innovationslabor/>

[machbar.innovationslabor/](https://www.oth-aw.de/machbar.innovationslabor/)

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# EIT Health Accelerator



## Business start-ups at European Level

### EIT Health

EIT Health is one of the largest health initiatives worldwide. It aims to promote sustainable innovations for health care and thus healthier lives and well-being for people throughout Europe. EIT Health uses the know-how of more than 140 of the most relevant organisations in the central areas of industry and research in the health care sector. The consortium was already supported by leading European research institutions, universities and industrial partners in the application phase. It was then selected by the European Institute for Innovation and Technology (EIT) under the name „EIT Health“ as one of the „Knowledge and Innovation Communities (KICs)“ in a highly competitive process at the end of 2014. With a project volume of over EUR 2 billion, one quarter of which will be funded by Horizon2020, EIT Health will invest specifically in Europe's best entrepreneurial talent. Creative minds with ideas for the development and marketing of intelligent product and service solutions are promoted, particularly those tackling challenges linked to demographic change and the associated aging society.

The local structure of EIT Health covers the whole of Europe and connects highly innovative areas.



Fig. 1: EIT Health headquarter in Munich (© Design Offices GmbH 2016) ■

In addition to its international headquarter in Munich, EIT Health consists of six independent regional centres, so-called „Co-Location Centres (CLCs)“ based in the following cities: Heidelberg and Mannheim (for Germany), and, since the end of 2015, London (for the UK and Ireland), Stockholm (for Scandinavia), Barcelona (for Spain), Paris (for France), and Rotterdam (for Belgium and the Netherlands). A seventh company, InnoStars, integrates the innovative regions of Hungary, Poland, Portugal, Croatia, Italy and Wales (Figure 2).

EIT Health aims to achieve a real health improvements for European citizens through innovation. In this context, it has identified the following three particularly

important future challenges: „Promote healthy living“, „Support active ageing“, and „Improve healthcare“. EIT Health connects leading organisations in the fields of education, research and technology and thus bundles innovative energies in a unique way.

### The EIT Health ACCELERATOR

EIT Health is based on 3 pillars: Campus, Innovation and Accelerator. The Accelerator was created to provide the best possible support to the most innovative entrepreneurs and start-ups in the healthcare sector at every stage. In order to successfully meet the above described future challenges, an ecosystem needs to be created in which interdisciplinary innovations for the health care

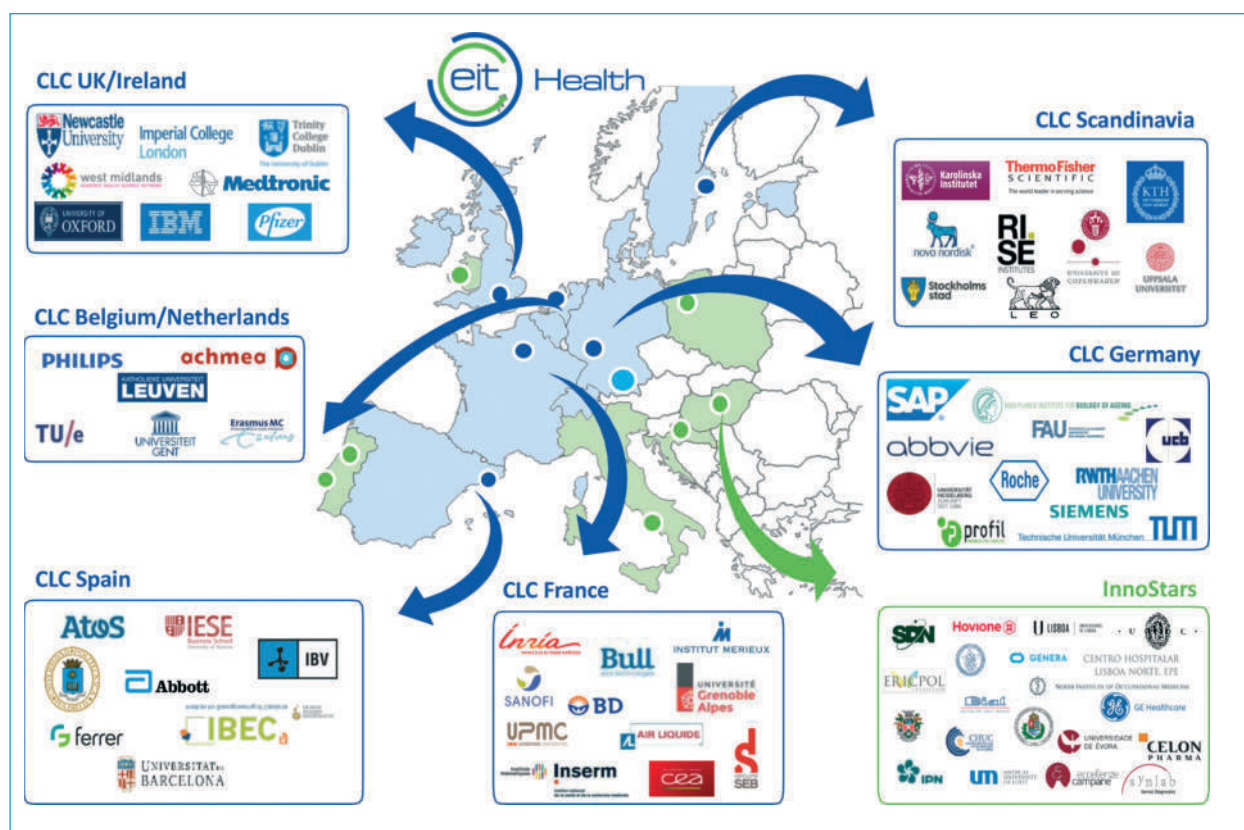


Fig. 2: EIT Health Core Partners and Co-Location Centres (CLC) ■

system can be developed. The Accelerator brings together the best entrepreneurs in healthcare and supports them in realizing their ideas in this very special market.

The EIT Health Accelerator is not an ordinary incubator, but a network that links health and medical technology clusters throughout Europe. The projects are designed to provide start-ups with the necessary know-

how and tools throughout their entire development phase, adapted to their individual needs. To cover the complete supply chain for entrepreneurs, the accelerator offers a variety of programmes that consist of three activity lines: „INCUBATE!“, „VALIDATE!“ and „SCALE!“ (Figure 3).

EIT Health does not compete with existing incubators by connecting private and semi-

governmental incubators. The EIT Health Accelerator links the currently fragmented European ecosystems by offering a whole portfolio of interdisciplinary projects. Based on the positive experiences of recent years, the geographical scope of the projects in Europe will be expanded to allow that more innovative entrepreneurs benefit from the activities by EIT Health.

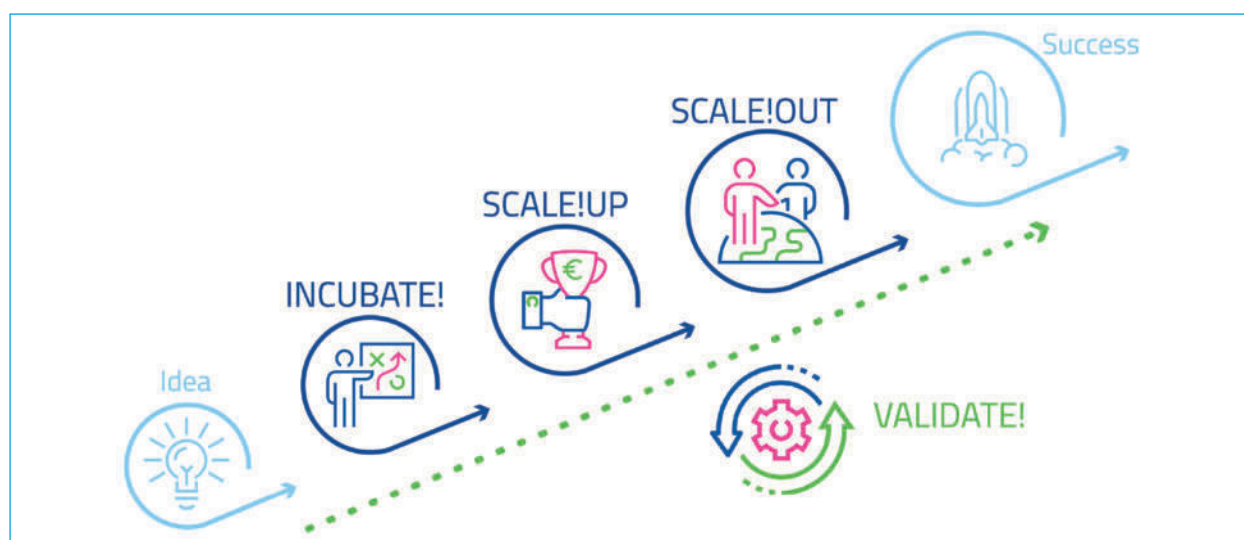


Fig. 3: The activity lines INCUBATE!, VALIDATE! and Scale-Up! Or Scale-Out! correspond to the maturity of the supported start-ups and their respective needs. ■

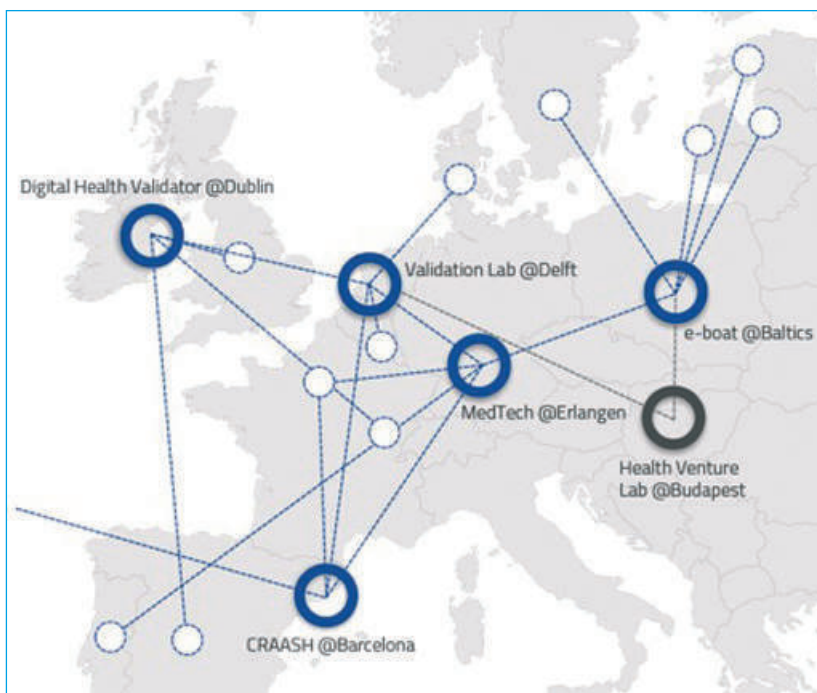


Fig. 4: 6 bootcamps offered in 2020: Barcelona, Oxford, Delft, Copenhagen, Munich, Erlangen ■

### Incubate!

The INCUBATE! Activity Line brings together entrepreneurs, intrapreneurs, start-ups and SMEs in the early stages of setting up a business. The INCUBATE! Activity Line includes various projects targeting early stage companies such as Bootcamps (CRAASH Bootcamp@Barcelona, Medtech Bootcamp@Erlangen, E-Boat Bootcamp@Lodz, Digital Health Validator@Dublin, Health Venture Lab@Budapest, Validation Lab@Delft), the CaixaImpulse Programme and the Start-up Meets Pharma Programme. These are closely linked to the EIT Health Campus, the organization's education division. For example, students can participate in the Campus Summer Schools or e-Labs and then further develop their business ideas within the Accelerator. The connections made by entrepreneurs in this setting are extremely important, as these can learn a lot from other entrepreneurs from other countries as well as from mentors with special experience in their particular field.

The Bootcamps have been established throughout Europe due to strong demand in recent years and

currently consist of 6 programmes taking place in 6 different countries (Figure 4). The two to three month programmes strengthen ambitious entrepreneurs in the HealthTech sector in the implementation of their ideas at European level. This is done, for example, by support in developing the market potential or in determining the target groups in corresponding regions.

### Validate!

The VALIDATE! Activity Line supports start-ups, entrepreneurs and SMEs in evaluating and validating their products or services in the health industry. The VALIDATE! Programs run through the entire Accelerator pillar, as aspects of validation are required in each individual phase, e.g. validation of an idea, proof-of-concept, prototype or already developed product for different markets or target groups. VALIDATE! comprises Programmes Living Lab and Test Beds, Mentoring and Coaching Network, and EIT Health Headstart (with a total of €4.5 million funding, distributed as €50,000 grants to start-ups to validate their products). The Programmes of the VALIDATE!

Activity Line offer direct access to common databases to all participants (Accelerator, Campus and Innovation). There they can choose their own mentors from a pool of experts or find the right Living Lab to test their product.

### Scale!

The SCALE! Activity Line helps start-ups and SMEs to take their existing business to a new level. Ultimately, the SCALE! activities will make a strong contribution to participating start-ups and SMEs to increase their turnover and increase the number of jobs they create. In this context start-ups and SMEs often face the challenges of finding the right investors, financial support for product development and the development of internationalisation strategies. The programmes of the SCALE! Activity lines such as GoGlobal Programmes, European Health Catapult, Product/Market Fit and Investor Network, Gold Track Programme and Bridgehead Programme are particularly valuable for start-ups and SMEs that have already participated in other INCUBATE! or VALIDATE! Activity Lines. Through business plan competitions, investor rounds, crowdfunding or GoGlobal programmes, they can gain additional capital, important contacts and further input to successfully form their company. Consequently, they can gain greater visibility and reach in their home market or on international level.

The GoGlobal Programmes give 35 teams the opportunity to explore their opportunities in global markets. Intensive one-week programmes enable the company to enter into lucrative medical technology markets worldwide such as Canada, Mainland China (Shenzhen), Hong Kong, South Korea and Japan.

The European Health Catapult is organised in cooperation with



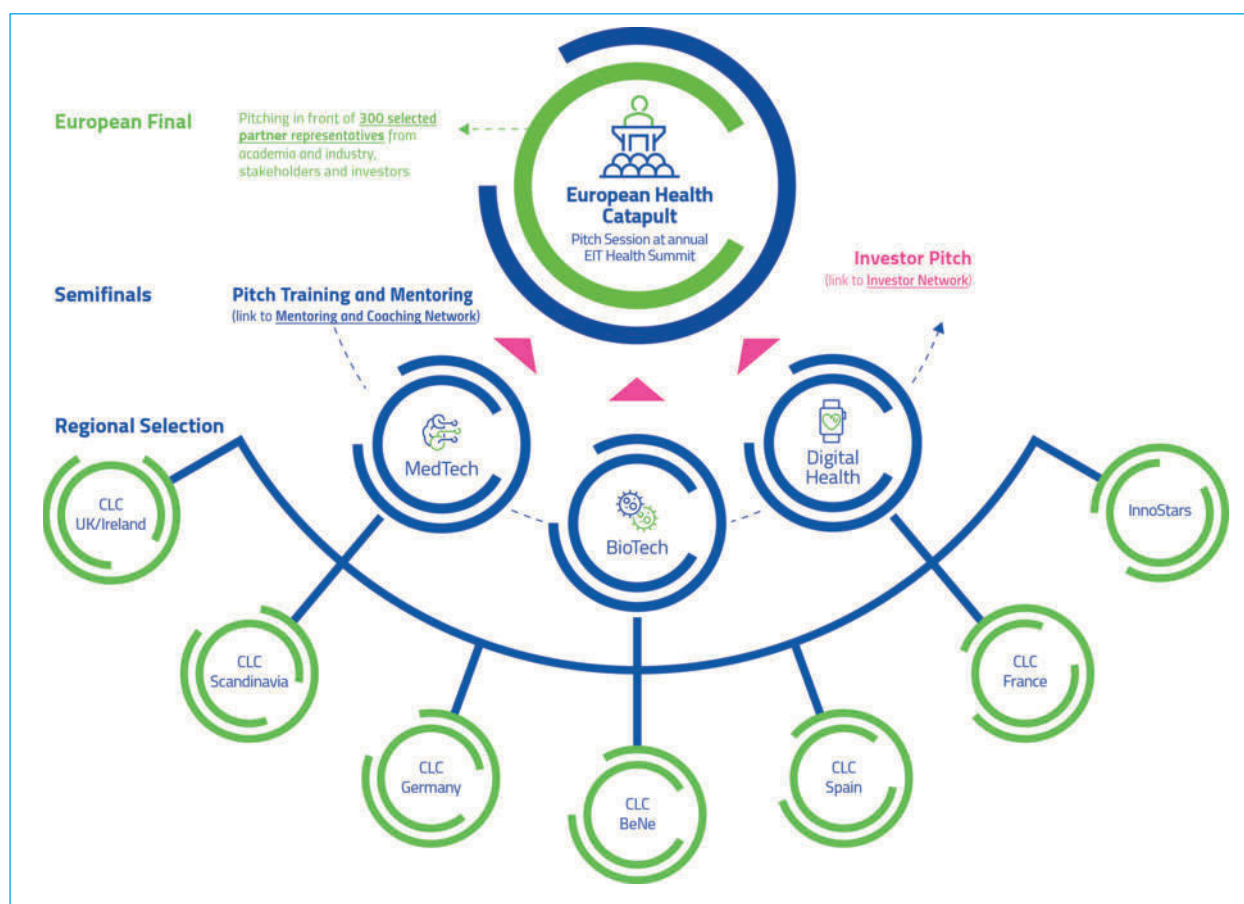


Fig. 5: After regional pre-selections in each CLC, selected start-ups have the opportunity to present themselves to investors in the semifinals. ■

Health Axis Europe. Following the regional pre-competitions in 2019 with 150 applicants in the medtech, biotech and digital health areas, the 42 regional winners present themselves in the newly introduced, category-specific semi-finals in London, Delft and San Sebastián (Figure 5). Of the 21 semi-final winners, 9 winners were selected in the finals in Lodz. In front of a renowned auditorium consisting of all EIT Health partner institutions prizes were handed over to the winners by the categories „Biotech“, „Medtech“ and „Digital Health“. The prize money amounted to €135,000 in total.

The Bridgehead Programme aims to connect European incubators and to target reimbursement and regulatory challenges in EU's fragmented healthcare market. The project has the objective of becoming an „Erasmus“ programme for healthcare entrepreneurs. Start-ups will be hosted by

exactly those incubators that provide the best European-wide support in terms of extensive knowledge transfer and soft landing support. The programme does not only support innovative technologies in healthcare but also link the infrastructure of various stakeholders such as incubators and clusters as well as start-ups localised all over Europe. Through the activity, „hot-zones“ and regions in need of innovation will be mapped which will contribute to a better understanding of innovation barriers in Europe.

Gold Track supports „high potential“ start-ups and SMEs in a highly intensive and individualised programme. Based on the the successful model of the Boston-based „German Accelerator LifeSciences (GALS)“ around Christoph Lengauer selected companies with potential for massive growth will be mentored and supervised from world

leading Investors and Life Science CEOs throughout one-year program. Additionally, the participants will be integrated into the EIT Health network and receive direct access to other EIT Health Accelerator programmes.

### ACCELERATOR Success Stories

The winners of the European Health Catapult in 2017 reflect the success of the Accelerator (for more information on the following examples, see

[https://www.europeanhealthcatapult.eu/wp-content/uploads/2018/02/Catapult\\_2017\\_Brochure.pdf](https://www.europeanhealthcatapult.eu/wp-content/uploads/2018/02/Catapult_2017_Brochure.pdf)):

#### Sleepiz AG

Sleepiz AG is a Swiss start-up by graduates from ETH Zurich and St. Gallen (HSG), backed by leading hospitals. 1 Billion people suffer from sleep apnea and more than 80% are undiagnosed! If untreated, it leads to heart failure,

diabetes, accidents and productivity loss. The state-of-the-art demands hospitalization, full-night supervision with 30+ cables. As a result, doctors are requesting more efficient screening solutions without compromising reliability. Using wireless signals, our device measures vital signs without touching the patient - enabling non-contact home diagnosis of sleep apnea. Coupled with machine learning and secure cloud sharing, we empower doctors to diagnose efficiently.



<https://www.f6s.com/sleepiz>

#### NeuroPSAI

NeuroPsyAI uses artificial intelligence to identify disease 'signatures' of neurodegenerative illnesses in conventional brain scans. As currently 1/3 of cases of Alzheimer's and Parkinson's disease are mis-diagnosed, this software-as-a-service allows for the timely detection of the two most common neurodegenerative illnesses, for an earlier and more accurate diagnosis (>90%), by clinicians and pharma companies. As the right treatment can thus start earlier, disease progression is slowed, and Healthcare is more cost-effective. With a served market of 1.3 Million new patients every year (US and EU), and a highly scalable technology, NeuroPsyAI promises to revolutionize mental Healthcare.



<https://www.neuropsychcad.com/>

#### FeetMe

Dunmet medical need; 100 million people are suffering from mobility disorders worldwide. FeetMe has a mission to simplify and accelerate therapeutic and

rehabilitation evaluations through continuous real-life mobility assessment. FeetMe Monitor is a connected insole and an associated mobile software that collects and analyse gait spatio-temporal parameters and variability in real life thanks to embedded smart algorithms and wireless connection. Our solution is sold to pharma companies for clinical trials, or to hospital and rehabilitation centres for mobility assessment and gait training and to patients for home rehabilitation.



<https://feetme.fr/fr>

#### SyNoesis Therapeutics Ltd.

SyNoesis Therapeutics is a start-up biotech with the vision to cure Parkinson's disease (PD) and other major brain diseases. We aim to capitalise on the potential of a new therapeutic we have patented for PD to be further developed towards being successful in clinical trials and become the first drug to cure it. The therapeutic covers remarkably the major unmet needs of PD in several mouse models and has drug-like properties. We filed a PCT application and we are expressed funding interest by big pharmas. Importantly, we have shown that the therapeutic efficacy of our compound also applies to other major brain diseases. We are currently filing 2 new PCT applications.



#### LifT BioSciences Ltd.

LifT Biosciences Ltd is a Immuno-Oncology Cell Therapy Biotech start-up bringing a 1st in class ATMP to market. Our vision is to develop the world's first cell bank of 'cancer killing neutrophils' to deliver a portfolio of

immuno-oncology cell therapies for all solid tumours. LifT has already shown 40-80% solid tumour necrosis in an FDA approved small study. LifT Bio Sciences stunned the world as they produced N-LifT: 'The World's First Ever Neutrophils Ex-vivo from stem cells to Demonstrate Super Cancer Killing Ability', and was given first-in-class status by the EMA as an ATMP. N-LifT is a potentially patented, scalable product that destroys tumours that other therapies cannot.



<https://www.liftbiosciences.com/>

#### Gedea Biotech AB

Gedea Biotech develops a safe and antibiotic-free treatment of vaginal infections, affecting most women. It is dually efficient against both pathogenic bacteria and fungi. In addition, it restores normal vaginal pH and removes biofilm, which is important for achieving a long-lasting effect and prevent recurrence. Gedea's innovative research is paving the way for new therapeutic possibilities in the treatment of vaginal infections, while reducing the problem of antimicrobial resistance. The product is to be launched as an OTC medical device in collaboration with a pharmaceutical company in 2019/2020. Gedea Biotech has so far raised 0.45M€ in grants and 2M€ in seed funding.



<http://gedeabiotech.com/>

#### Aenitis Technologies

Cost effective and efficient Bio-processing solutions are main issues in cell therapy processing. Aenitis develop innovative patented medical devices for continuous, contactless and pressurless sorting of cells in suspensions,

using Acoustic Radiation Forces. With large added values, Aenitis answer in cell therapy units and blood banks' challenges on cell sorting, on cell washing and on cell isolation for blood, tissues and stem cells processing. Its 1st CE marked devices should be on the market by early 2021. Supported by major companies and largely awarded in Europe, Aenitis received over €5,8M grants and €2M VC funding. € VC-Finanzierung erhalten.



<http://www.aenitis.fr/>

### VitaDX International

VitaDX combines fluorescence imaging and image processing using machine learning algorithms to detect cancerous cells in a urine sample. The company was created in 2015 and our 12 people are based in Rennes and Paris. We are strongly supported since the beginning of the company by the regions Ile-de-France and Bretagne, BPI, the SATT Paris-Saclay. Our clinical trial on 1400 patients will end in early 2019 and the first solution, VisioCyt, will be commercialised in early 2020. We have fundraised 2.6 M€ in two turns of financing with business angels and Venture Capitalists.



<http://vitadx.com/en/>

### HydrUStent, LDA

Every year around 10 million people worldwide need a urological STENT. But did you know that almost 100% of these people develop a bacterial infection wit-



Fig. 6: Three EIT Health supported winners of pitch event and representatives of EIT Health at the MedtecLIVE in Nuremberg in May 2019 ■

hin 30 days of implantation? And also, require a second surgery for stent removal? Imagine that we have a product that avoids this. HYDRUSTENT does that! HydrUStent is a biodegradable, anti-bacterial and tailor-made stent which underlying technology has been protecting by a patent. HydrUStent not only reduces the risk of bacterial infection but it also cuts down half the number of surgical procedures reducing the treatment cost by 60%. HydrUStent is a Portuguese spin-off company from 3Bs Research Group, University of Minho a leading group in Biomaterials research. The biodegradable ureteral stent is our first product from a patented biodegradable drug-eluting medical devices pipeline. HydrUStent has raised € 2.3M until the end of 2019.



<https://www.hydrustent.com/>

### EIT Health in the Bavarian region

Apart from its headquarters in Munich, EIT Health has a strong presence beyond the state capital. This year, EIT Health was able to enrich the MedtecLIVE fair in Nuremberg. During these events over 150 exhibitors from 13 countries presented their innova-

tive ideas in the medical technology industry to over 1500 visitors. In addition to the active participation of leading managers from EIT Health, 19 start-ups supported by EIT Health presented their innovations and were able to further expand their network. Out of the 19 start-ups invited by EIT Health, ten short-listed start-ups pitched their ideas in front of an audience of conference members and five jury members. The first, second and third place start-ups (pictured at the awards ceremony) received a share of a total of €21 000 in prize money, as well as two-to-six months of workspace and facilities at Neighborhood Voisin Consulting Paris and Medical Valley Erlangen. They were also guaranteed a sponsored booth at MedtecLIVE 2020, which is scheduled for 31 March-2 April of next year. (Figure 6, for more information see <https://www.eithealth.eu/-/eit-health-start-ups-earn-attention-at-medteclive-in-nuremberg>).

If you are an entrepreneur and are also interested in support from EIT Health, please contact the Director of Business Creation directly

([kurt.hoeller@eithealth.eu](mailto:kurt.hoeller@eithealth.eu))

or visit our website

[www.eithealth.eu/accelerator](http://www.eithealth.eu/accelerator)

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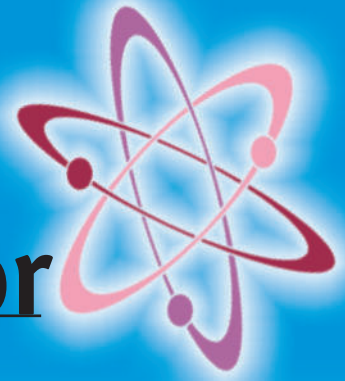
Web: [www.eithealth.eu/accelerator](http://www.eithealth.eu/accelerator)



EIT Health is supported by the EIT,  
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# “Hot Cells” Gas-Tight Compressor Systems in Nuclear Medicine

*BAUER KOMPRESSOREN GmbH is the technology leader in the field of high-pressure systems technology for air, nitrogen and rare gases. BAUER can draw on over 75 years of industry-sector experience as global market and quality leader in the manufacture of high-pressure compressor systems – an invaluable basis for developing tailored applications of all kinds for its customers. The company’s product portfolio spans both individual compressors and complete systems from compression to air and gas purification, storage, distribution, monitoring and dosage.*

BAUER KOMPRESSOREN GmbH

Customers receive advance in-depth consulting for their system design and installation needs. BAUER takes over project management, installation and, on request, system handover by certification organizations such as TÜV and German Lloyd.

Typical applications for BAUER systems include:

- Breathing air supply for divers and firefighters
- Pressure chambers in diving and hyperbaric medicine
- Production of medical air
- Construction and establishment of complete CNG refuelling systems
- Compressed air for test rigs  
Gas decanting and recovery
- Gas injection technology (GIT) for the plastics industry

and many more



*The gas-tight new-generation BAUER VERTICUS system offers innovative design, outstanding ergonomic features and high cost-effectiveness ■*

Nuclear medicine is a particularly interesting area, using BAUER helium compressors in gas-tight housing in conjunction with cyclotrons. Projects like this have been successfully completed at hospitals inclu-

ding the Klinikum rechts der Isar of TU Munich, Charité in Berlin, University of Münster, Vienna General Hospital (AKH) and the Preclinical Imaging and Radiopharmacy department at the Uni-



A redundant system of two VERTICUS compressors safeguards production continuity ■

versity Clinic in Tübingen (UKT). Areas of radiopharmacy covered at UKT include production of established radiopharmaceuticals for PET/CT (positron emission tomography / computer tomography) patient procedures and in nuclear medicine.

In addition to patient treatment, the UKT also sells the approved radio-

pharmaceutical to customers in the vicinity, and establishes and supplies newer radiopharmaceuticals for clinical trials and preclinical studies. Basic research is a further important pillar of operations at UKT. Extending beyond purely radiochemical and radiopharmaceutical areas, it identifies and evaluates new target structures for multimodal imaging

(PET, optical imaging, MRI) and develops suitable biomarkers.

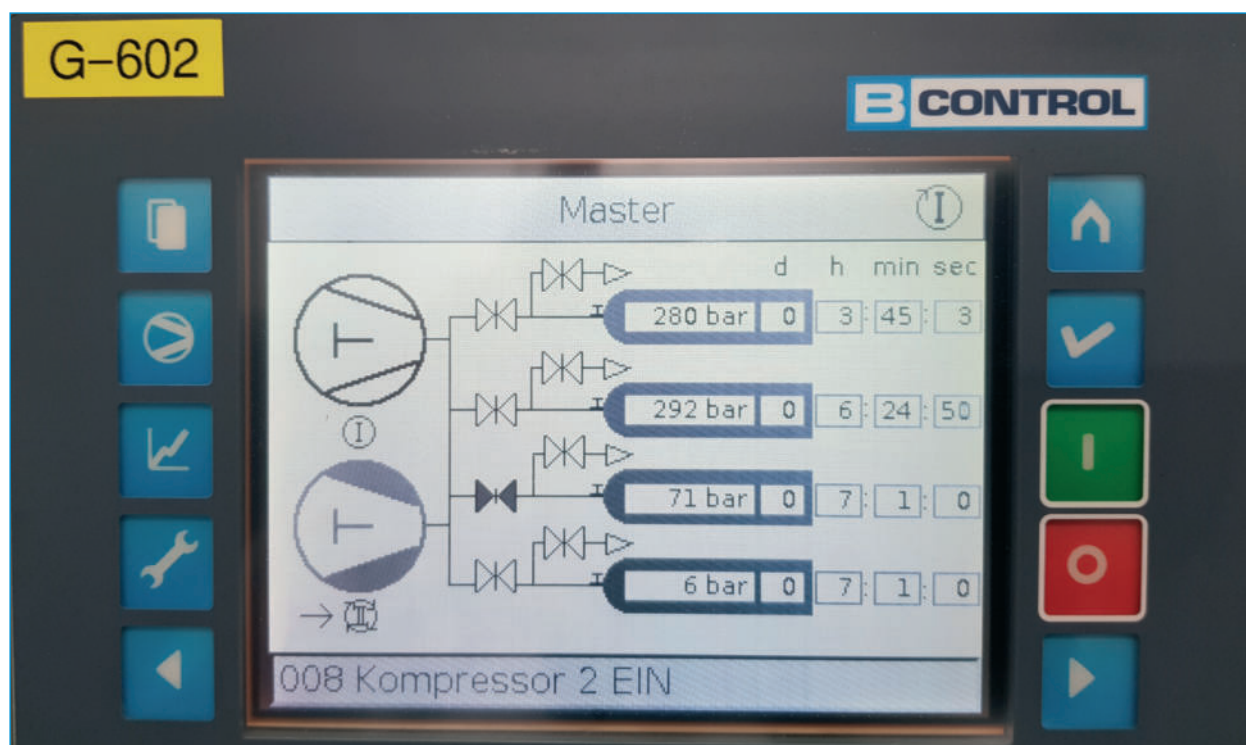
PET/CT is a cutting-edge imaging procedure primarily used in tumour diagnosis. Its main advantage is the combination of a functional method (PET) with a morphological imaging process (CT) in a single examination. Thus, the procedure simultaneously supplies information on metabolic functions and healthy or diseased tissue structures in the body.

Numerous centres of nuclear medicine use cyclotrons to produce radionuclides for positron emission tomography (PET).

These radionuclides – e.g. fluorine-18, oxygen-15, nitrogen-13 and carbon-11 – all have extremely short half-lives of between 2 and 110 minutes and are thus produced with high levels of radioactivity.

They are processed by chemists in “hot cells” to form substances such as fluorodeoxyglucose (an analogue of glucose labelled with fluorine-18), which is injected as a radiotracer in patient scans.

The spatial and temporal distribution of the substance is then measured by a PET scanner. Results en-



The display of the B-CONTROL unit provides reliable real-time information on all parameters in the filling and emptying Process ■





*The solenoid valves of the storage rack tanks are controlled by the B-CONTROL unit in fully automated operation. ■*

able conclusions to be drawn about sugar metabolism, which may show abnormal changes in cases of cardiac or cerebral disease or malignoma.

Volatile substances may be produced during radionuclide processing in the "hot cells", causing radioactive contamination of the air in these cells. As the cells are not completely gas-tight, their exhaust air may contain radioactivity.

The German Radiation Protection Ordinance defines annual radioactivity exposure levels for the cyclotron-produced radionuclides. For these radionuclides, exposure limits are set at some parts per thousand of the annual level of radioactivity produced.

Given this, effective retention devices to manage the exhaust air from

the "hot cells" are essential to guarantee compliance with exposure limits. Because the radionuclides have such short half-lives, consideration was given to the idea of installing long delay lines for the exhaust air to ensure radioactivity had largely decayed before the air was released to the outside.

However, this would require large and extremely complex exhaust air systems. A far simpler method is to compress the exhaust air from the "hot cells" – which have a geometrical volume of approximately 1 m<sup>3</sup> per cell – in a storage container to pressures of up to 350 bar. After a few hours, the radioactivity in the exhaust air has decayed and the air can be released. This method has been used successfully for several

years in a string of university clinics. High-pressure technology clearly offers superior advantages; it enables huge volumes of air contaminated with radioactivity to be compressed to 1/350th of its original volume, resulting in an extremely low geometric storage volume.

However, as a core prerequisite for the success of high-pressure technology, the entire compressor system must be gas-tight.

High-pressure systems designed to fulfill these technology requirements, such as BAUER's G 180-18.5, G 15.1-7,5-5 and G 120-4-5 models, have been in operation with complete reliability at nuclear medicine centres such as those named above for many years.

The compressor used in these systems must be supplied as a completely gas-tight model reaching leak rates between 1.2 and 1.6 mbar x l/s.

These leak rates are outstanding for piston compressors of this type and are accepted not only for helium recovery in low-temperature technology settings, but also increasingly in nuclear medicine.

The high-pressure storage systems used comprise multiple racks of storage cylinders. The filling and emptying process is managed by the BAUER B-CONTROL SPS control unit. BAUER is thus able to supply a fully automated system for waste air management of "hot cells".

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# Paving the way for the digital hospital

## *MEDePORT – a clever software solution which benefits patients and makes clinical workflow more efficient*

*In times of increasing cost pressure and tight schedules, every minute counts in hospitals, doctors' surgeries and health-care centres. e.Bavarian Health GmbH, based in Erlangen, Germany, is constantly developing its software system further to meet these demands.*

In many hospitals, doctors' surgeries and healthcare centres, the workflow still resembles a time-consuming relic from the past: patient data is entered multiple times, medical histories are repeatedly recorded. As a result, precious time needed for treating patients is lost through administrative requirements such as obligatory record keeping – tasks which could be made much less time-consuming and more economical through well-designed software solutions. Informing patients prior to a procedure as required by law could also be facilitated by using "automated communication" in everyday clinical processes.

### **Patient communication without data integration gaps**

In order to meet precisely these requirements, the Erlangen-based Bavarian software company e.Bavarian Health GmbH has developed the brand MEDePORT. It is an intelligent software system designed to provide an overview of each individual patient's communication without any data integration gaps – from a patient's initial admission, to their anamnesis and information provided to them, to treatment agreements

and electronic signatures and archiving. "We want to help hospitals improve their digital information flow and thus lower their costs significantly," managing partner Angelika Balleis says.

### **Easily understandable 3D patient films**

The multimedia platform does not only provide digital patient information sheets in up to ten different languages. e.Bavarian Health also offers medical history sheets as well as computer-animated, easily understandable 3D patient films, such as films explaining a particular examination method. "The information sheets and films are developed for each medical field by our own editorial department and a team of around 60 scientific experts made up of medical professors and head physicians." Moreover, everything is checked in detail by specialised lawyers in order to ensure that legal requirements are met.

Angelika Balleis and her team of highly-qualified staff invested more than four years to make the content fit for the digital age. MEDePORT is already being applied successfully by university clinics as well as small and medium-sized hospitals, among them the Klinikum Forchheim, whose IT infrastructure is considered a digital showpiece. e.Bavarian Health has wasted no time in developing additional functionalities – heading towards telemedicine, Artificial Intelligence and health apps.

### **Process managers support new users**

According to Angelika Balleis, "using MEDePORT can help hospitals in Europe become significantly more efficient." Those who are only beginning to digitalise their workflow will be supported individually by experienced process managers of e.Bavarian Health. Naturally, all patient information sheets are also available on paper as a standard. ■

### **Mobile communications anytime anywhere**

Patients can access relevant pre-operative information on their mobile devices via the MEDeCONNECT extension. This allows the preparation for a pre-procedure interview to be locally and temporally separated from its in-depth discussion in hospital later on, resulting in more flexible working structures and a significant saving of time and money for our customers. ■

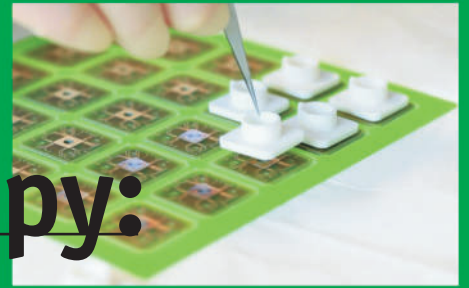
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# Novel tumour therapy: “Switching off” cancer electrically

*With the continuous development of ever smaller electronic components, millions of transistor functions can now be packed into one square millimetre – making it possible to design tiny implants that could be introduced into the human body in the vicinity of a tumour. Once in place, these electronic implants could alter the transmembrane potential electrically and thus help suppress cancer growth – which could very soon enable both an effective and gentle tumour therapy.*

Electrical signals are used not only by neural cells to communicate with their neighbouring cells, but also by epithelial cells (in epithelial and glandular tissue) to exchange information – a fact that has been known for more than 30 years [1]. While their pulse form and their propagation speed differ from that of neural cells, the electrical communication between epithelial cells (as with neural cells) is function-specific, and these signals can also be calibrated [2]. Considering evolution, this is not surprising at all: The initial cell clusters did not yet have complex structures for signal transmission and mainly communicated via the transmembrane potential [3]. In the 1960s, scientists demonstrated that the transmembrane potentials of epithelial cells are related to their functional status and that cellular processes can be influenced by exposing them to electrical fields. The scientists made another fundamental discovery: The ability of cells to divide can be correlated with their transmembrane potential (Fig. 1) [1].

Based on these findings, novel therapeutic options for oncology can be developed [5]. It was in

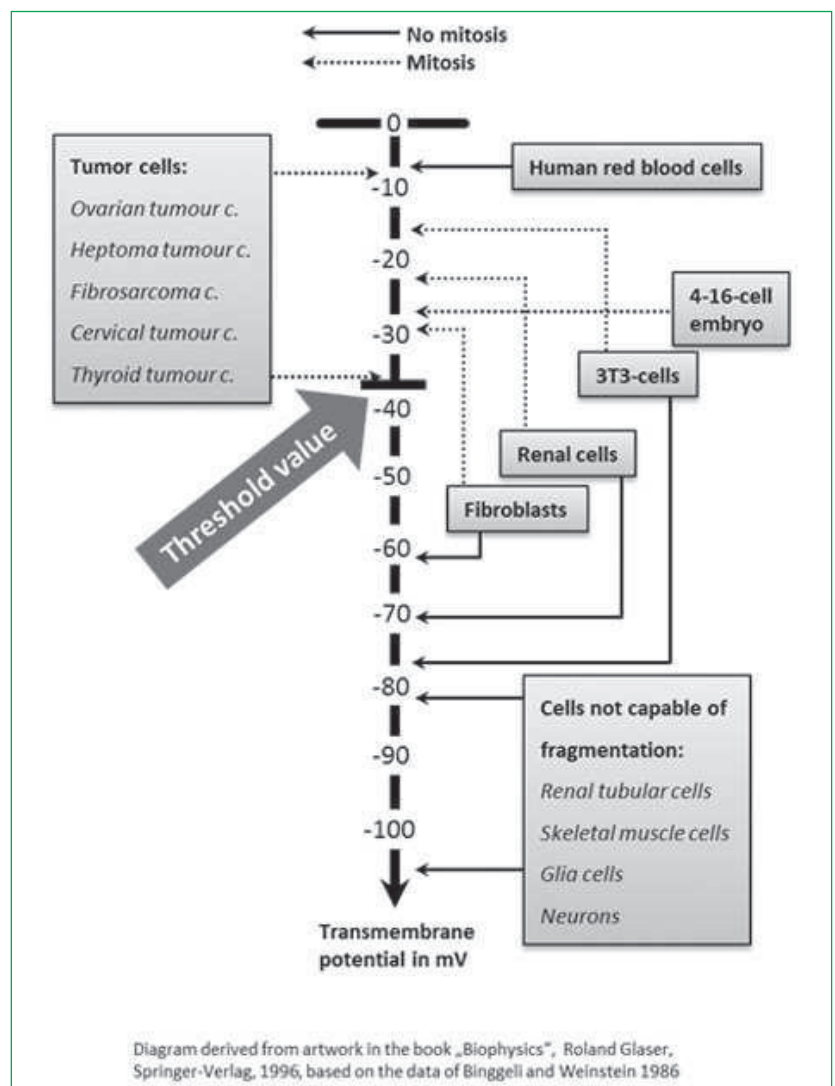


Fig. 1: Transmembrane potentials of healthy cells (right) and of tumour cells (left). Cells undergoing division have a transmembrane potential of less than -37 mV. Below this value, there is no mitosis for cell division (with data from Binggeli u. Weinstein 1986 [1]) [4]. ■

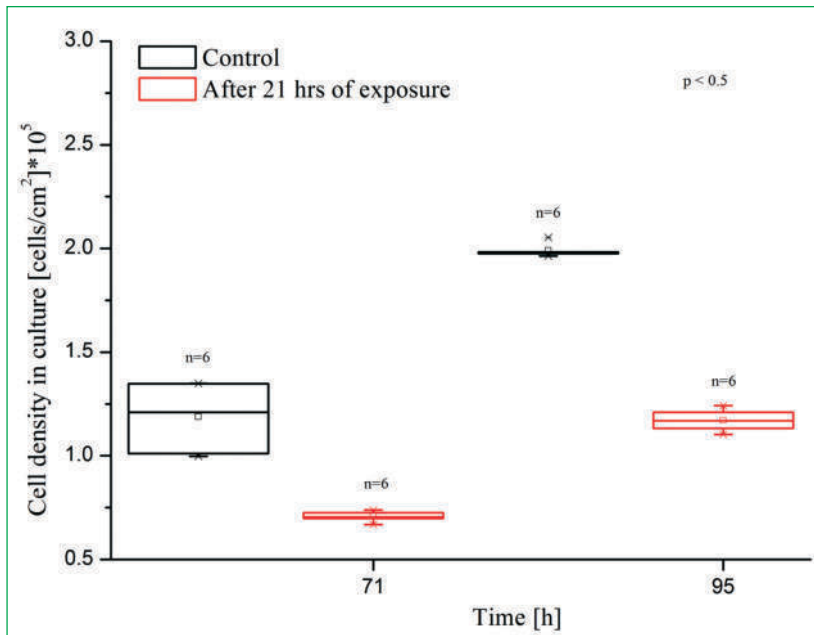


Fig. 2: Breast cancer cells were exposed to a pulsed electrical field for 21 hours. Afterwards, the cell density in the culture (red bar) was significantly lower than in the control wells – indicating slower growth of the tumour cells. Also, the cell morphology had changed and the number of cell junctions had decreased [7] [8]. ■

1983 that Swedish radiologist Björn Nordenström first ever successfully utilised the transmembrane potential of tumour cells for therapeutic applications [6]. However, the technical capabilities at that time were not sufficiently advanced to allow for the development of therapies. More than 20 years later, our scientific team at Heinz Nixdorf-Lehrstuhl für Medizinische Elektronik of TUM demonstrated that the growth patterns of epithelial tumour cells (e.g. gastric, breast, or prostate cancer) can be influenced by exposing them to electrical fields (Fig. 2) – many questions concerning the technical application of these findings still remained unanswered, however [7] [8].

### Tiny electronic systems

The electronic equipment we have nowadays is completely different (also see [13]) and thus offers new possibilities for influencing tumour growth with electrical signal patterns. Meanwhile, the dimensions in the semiconductor industry have become so small that even small cancerous

areas, such as metastases, can be targeted by to electrical fields. It is also conceivable to specifically switch off electrically active ion channels in the walls of the tumour cells. Ion channels play an important role in cellular signaling and cell division – most important are potassium channels [9]. Tests using the example of colon cancer have shown that with chemical potassium channel blockers, the division rate of tumour cells can be decreased. If

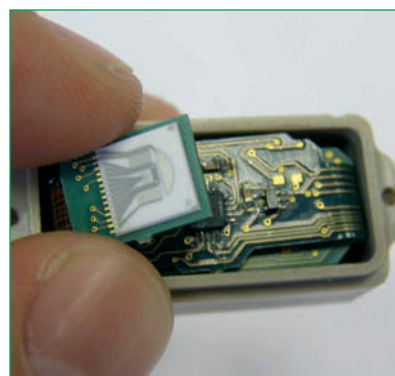


Fig. 3: First prototype of an electronic implant for measuring the oxygen potential and for therapeutic oxygen generation. The folded electronic structure can be seen inside the implant; the oxygen sensor is clearly visible on the left. This model was also designed to accommodate a gas cell for drug delivery (also see [10]). ■

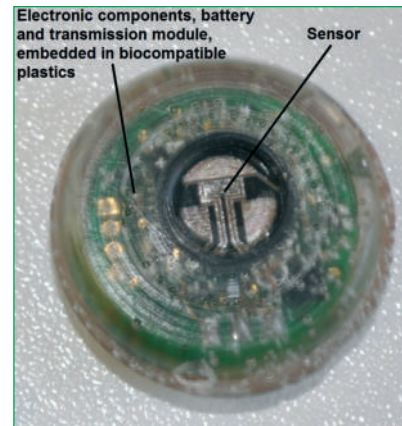


Fig. 4: New, enhanced version of the electronic implant – now merely the size of a 2 euro cent coin. Further miniaturisation is already planned. ■

researchers succeed in specifically switching off the potassium channels by means of electrical stimulation, this would represent a breakthrough with a novel tumour therapy, presumably without the risk of inducing therapy resistance.

### Fighting cancer with implants

Electronic components could thus be implanted in the human body using minimally invasive surgery and could be placed directly at the tumour site. On the one hand, integrated sensors could be used to measure the tumour activity within the body and the integrated communications system could be used to send this information to the physician for analysis. On the other hand, they could be used to fight the tumour by targeting the tissue with electrical pulses and to change the transmembrane potential so that it approximates the potential of healthy cells. Similar implants have already been developed by our research teams (Fig. 3, 4) [11]: On their surface, they have a sensor for measuring the oxygen saturation in the cancerous tissue. A decrease in oxygen saturation indicates that the tumour is growing. If the sensor detects a drop in oxygen saturation, the electronic unit within the implant will send this information



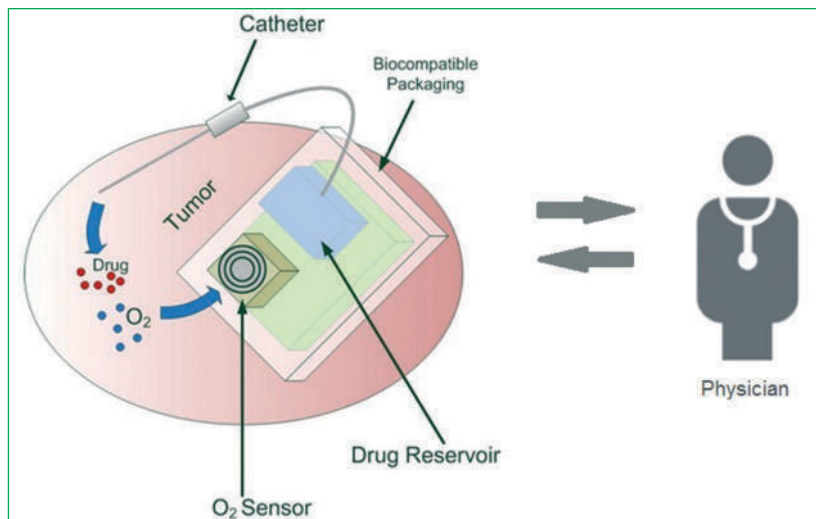


Fig. 5: Electronic implant in a closed-loop system: Once it detects tumour growth, it automatically delivers the drug to the tumour – with the physician monitoring the processes via radiocommunication [11]. Instead of drug delivery, it is also conceivable to expose the tumour to an electrical field in order to change the transmembrane potential of the tumour cells. ■

to a receiver unit outside the body. Equipped with this information, the physician can initiate the appropriate therapy.

This therapy can also be initiated directly via the implant – with various possible forms of treatment: The first option is the aforementioned exposure to an electrical field that changes the transmembrane potential of the

tumour cells and prevents tumour growth. The second option would be to release a highly concentrated chemotherapy drug directly into the area around the tumour from a tiny drug reservoir within the implant. The third option would be to generate oxygen within the implant and release it into the cancerous tissue – which appears to be a very promi-

sing approach if combined with radiation therapy. Various studies have shown that the concomitant release of oxygen into the tissue during radiation therapy increases the effectivity of the radiation while decreasing the adverse effects [12]. The higher the oxygenation, the lower the ability of the tumours to develop and the more effectively they can be treated.

### Only minor side effects

Such novel forms of therapy using electronic implants would offer both patient and physician significant benefits: The side effects for the patient would be much milder than, for example, with conventional chemotherapy drugs, as the new therapy would focus on the tumour and its microenvironment – there would be little impact on the rest of the body. In addition, the therapeutic effect can be monitored directly via the sensor unit integrated in the implant and can also be controlled externally (also see [14]). The components can be integrated into these intelligent thera-

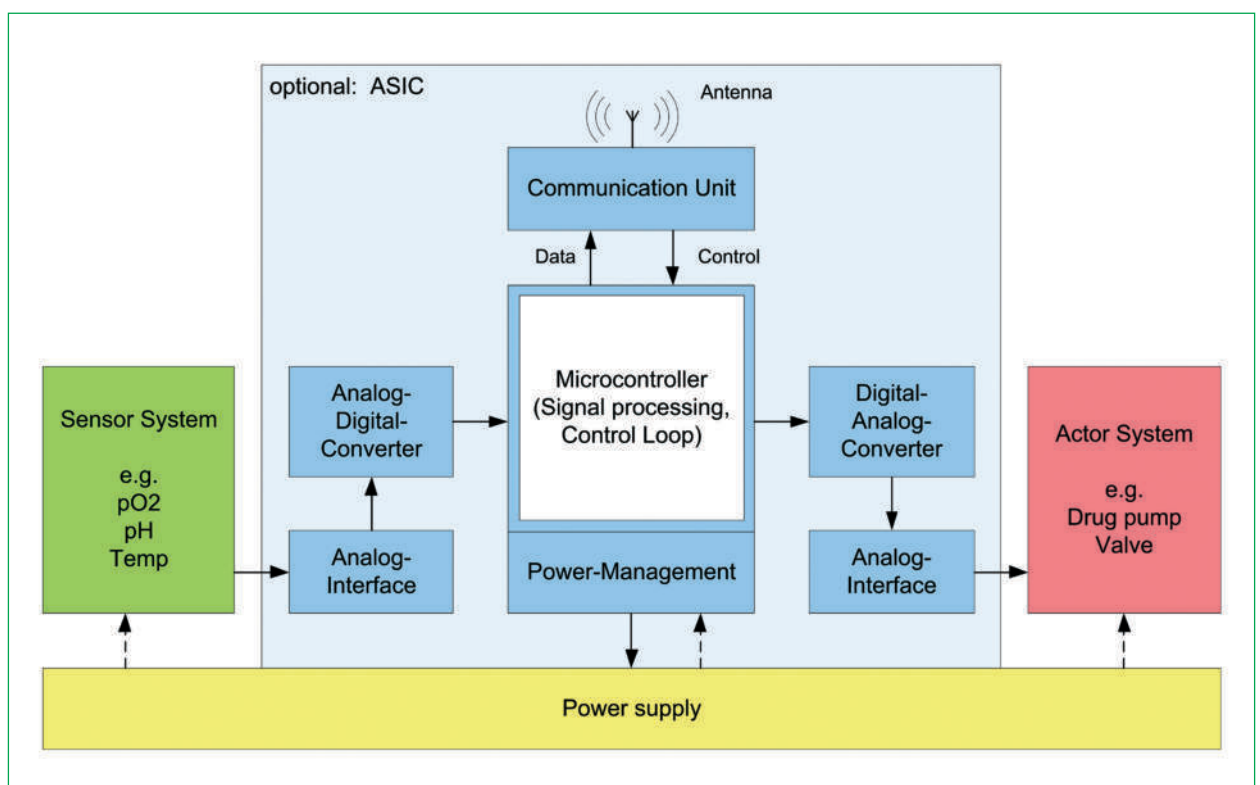


Fig. 6: Schematic illustration of a platform technology for intelligent implants, enabling a wide variety of implant applications. ■

peutic implants (Figs. 3, 4) developed by our research teams with manageable effort and reasonable cost, since the concept for these implants is based on a platform technology (Fig. 6). This enables a large variety of sensor and actuator functionalities to be integrated into the system – and thus the implementation of implant solutions for diverse medical indications. The option of exposing tumours to electrical fields, above all, could allow for completely new approaches to cancer medicine and would offer patients new chances for a cure, less burdensome treatment and a much better quality of life.

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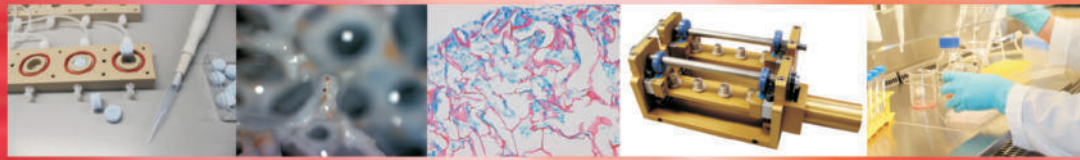


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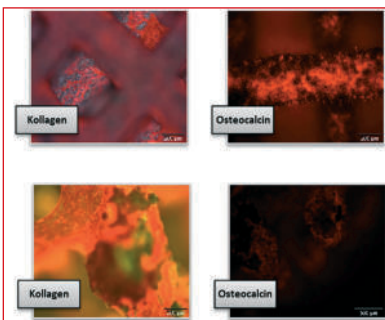
# invitroTest Center introduces multicellular tissue cultures into medical product development

*BioMed Center Innovation in Bayreuth has started a new platform for modern in vitro test procedures on bio- and tissue compatibility*

Fulfilling the basic requirements of the ISO 10993 in terms of cell testing is usually easy, and of course this standard assay is also part of the scope of the invitroTest Center in Bayreuth. But relying only on this basic biocompatibility and cytotoxicity evaluation, maybe complemented by some tests on young, healthy animals, can lead to a bad awakening when clinical application starts. The BioMed Center Innovation has researched on methods to more reliably predict the suitability of biomaterials, implant materials in general and active ingredients in reference to their desired effect, using modern tissue cultures to describe the interaction with the biological target in detail. This enables a more precise analysis of effects and potential improvements. For all those who apply such assays themselves, the invitroTest Center is a competent partner supplying knowledge, technology and support to establish the novel 3D-culture procedures in their lab.

## **Innovative 3D-culture technology at an economic price**

The invitroTest Center supplies bioreactors and 3D matrix carriers at an unbeatable price for value, using high-quality PEEK for added durability. Only 600 Euros get customers starting into 3D culture with 4 perfusion chambers. And novices to the topic can receive an "all-in" package inclu-



*Same titanium material, different structure: good tissue formation with bone protein on top, below only fibrous tissue ■*

ding supplements to get going right away.

Of course, all users are trained for the handling procedures. Cell culture courses and training are also being offered separately in English language by experienced instructors and laboratory supervisors. With the support of the Förderverein BioMed-Center Innovation e.V., the program ranges from basic courses for complete beginners to advanced 3D-tissue culture and bioprinting on [www.biomed-kurse.de](http://www.biomed-kurse.de). Individually tailored courses are available on request.

## **Efficient in vitro models are the future of biocharacterization**

Tissue cultures enable the direct investigation of the effect that treatments have on living system, much more detailed and reproducible than in animal models. The range of options is large and continuously growing. Well established, the invitro-Bone system comprises an osteoclast-osteoblast coculture in a concerted assay on everything concerning bone, bone substitute and implants. This includes in vitro vascularization using the HET-CAM method. Recently, bone cultivation with im-

planted microtumors has been developed. A sensitive bacterial adhesion investigation with stromal cell competition enables the detection of antibacterial effects based on surface interactions even for mildly or passively acting materials. Cartilage cultures are realized using compression-perfusion systems – the versatile compression systems made of anodized aluminum are a real show and one of the most popular products. Microtumors form in soft-tissue carriers. Both highly reproducible cell lines and primary cells are used. This include neurons and myocardiocytes – a muscle cell culture is "under construction".

Those inspired to start their own project will find the research institute BioMed Center Innovation gGmbH to be a competent partner to apply for grants and realize innovative, independent research. The non-profit organization also cooperates with universities to employ researchers in conflict with short-term contract regulations and can take over packages in funded projects by direct transfer of resources.

**BioMed Center**  
Innovation gGmbH

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Auszeichnung des Films

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**"Mindblowing cinematography."**

Jakub Duszynski, Co-President of Europa Distribution

**"(...) the film operates in terms of striking images."**

"The Hollywood Reporter", review by Neil Young

**"Delicately shot by cinematographer Siri Klug (...)"**

"Indiewire", review by Eric Kohn

**"The cinematography of Siri Klug is striking and gently (...)"**

"Screen Daily", by Marc Adams, Chief film critic

Diese Auszeichnung erhielt unsere Kamerafrau Siri Klug.

<http://songfromtheforest.com/>



# Magazines

## Future Technologies in Bavaria

