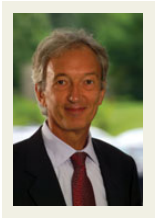
Physician, engineer, inventor and entrepreneur: Dr Johannes Müller has contributed to Berlin's reputation as a hot-spot for Med-Tech companies



Dr Johannes Müller, a highly accomplished physician and engineer, has developed cutting-edge medical devices that have reshaped diagnostics and treatments in cardiac surgery and cardiology. His name is also linked to Berlin's surge as a Mecca for medical technology in Germany over the past years.

Awards, such as the City of Berlin Research Award, the Medical Oscar for transferring a cardiac-assist device for newborns from a university lab-based system to a medically approved commercially available worldwide device, the European Society of Artificial Organs Award and many others, refer to Johannes Müller's fundamental contributions in a unique innovative field during the past several years.

However, looking back at this impressive list of achievements in medical device development, it is striking how simply and modest Müller explains his inventions.

Johannes Müller describes the decisive steps, which allowed him to design several pioneering medical devices. His first contribution, during his clinical training, was the development of a method, allowing the non-invasive detection of rejection episodes after heart transplantation by an implantable device (*IMEG System*) instead of performing endomyocardial biopsies.

Another of his important contributions was the development of a mobile driving unit for the pulsatile cardiac-assist device for children with heart failure. Based on his idea, *Berlin Heart* extended the famous *EXCOR* device, which has in the meantime emerged as a new treatment standard in the USA for bridge to transplantation in paediatric heart failure patients.

Based on his patent, another major contribution in cardiac device technology was an implantable, magnetically levitated axial flow pump. The pump has no touching parts and magnetic levitation causes free flotation of a spinning impeller, resulting in almost frictionless rotor movement. This axial blood pump, which entered the market as the *INCOR* device, again distributed by *Berlin Heart*, provides continuous forward flow as well as unloading of the impaired left ventricle. Compared with external-assist devices, it has the advantage of greater simplicity, less vulnerability, and smaller size. Roland Hetzer, former chair and head of the German Heart Center implanted the first *INCOR* devices in 2002 in Berlin.

Müller's name is not only linked to the successful cardiac-assist devices. As an engineer and physician he had learned to understand physiology and was driven by ambition to use his knowledge for contributions in the development of heart failure therapies.

When he was still a medical student, he designed a small neurostimulating electric device, similar to a pacemaker, based on physiological principles, which activates baroreceptors in the wall of the carotid artery. Nowadays, this device distributed as a vagus nerve stimulator takes advantage of the body's natural baroreflex system to relax blood vessels, to slow the heart rate and reduce fluid retention in the body.

Another example of Müller's entrepreneurship is a recently launched start-up company, Berlin Cures, which takes up the cause of developing a drug against diseases induced and/or maintained by autoantibodies directed against G-protein-coupled receptors.

Johannes Müller's career and impressive contributions as inventor and entrepreneur in health care technology is closely linked to Berlin, the capital of Germany and currently one of the most attractive cities for High Tech companies in the European Union. Berlin provides a particularly exciting environment for innovative start-ups in the medical-technology sector.

This is due to the fact, that one of Europe's largest University Hospital, the *Charité* is among over 100 regional hospitals in the greater city area and several renowned research institutes, such as *Max Delbrück Center for Molecular Medicine*, the *German Arthritis Research Center* and the *Technical University Berlin* are located in Berlin.

If innovation is to turn into economic strength, a critical mass of academic environment is always required. Excellently trained professionals, strong research performance, and high reputation of academic institutes are all critical. In addition Germany's capital developed a reputation as a creative, multicultural, and vibrant city with high, but still affordable quality of life. The city's authority's support for start-up business boosted the local medical-technology scene.

Johannes Müller has again chosen Berlin as the location for his recently founded *Berlin Heals*. *Berlin Heals,* a medical engineering company, aims to distribute a novel cardiac device for heart failure treatment. Müller explains: 'heart failure has become one of the most important causes of hospitalization and mortality in the Western world. Current evidence-based therapies are mainly on pharmacologic concepts aimed at the vicious cycle between progressive loss of cardiac function and the resulting counter-regulatory but further harmful mechanisms such as salt and water retention or sympathetic activation. Specific groups of patients take advantage of cardiac resynchronization, but real causal treatment approaches are lacking'.

Johannes Müller gets excited. You can feel his commitment, when he outlines his novel therapeutic concept. 'We realized that a weak electrical current prevents and even reverts pathological remodelling, including the functional impairment of cardiomyocytes, tissue fibrosis and dilation of heart chambers. These reparative effects are reproducible *in vivo*, in rats with heart failure using an external cardiac device delivering a microcurrent over a specially designed silicone based platinum electrode'.

At the moment, a preproduction model of a microcurrent device for use in humans is under development. Müller is convinced, that initial preliminary studies in patients will be coming within the next

2 years. 'The concept is simple, but the effects are impressive' Müller says. 'Very low electric current improving microtexture and cardiomyocyte contractility sounds weird, but our data look great'.

Despite his enthusiasm, Johannes Müller is well aware that the biological mechanisms of his appealing microcurrent concept are still poorly understood. This might be disappointing from an academic point of view. But from the perspective of an inventor and entrepreneur the focus is on his commitment to provide a novel strategy against a deadly disease – and on business as well.

Berlin is a hot spot – for health care, for research and for medical-technology companies. Johannes Müller represents one of the masterminds, who analyses clinical problems, offers innovative technical treatment concepts, and translates them into novel devices and business ideas. This is a way to go and Berlin is a place where medicine, academics, and industry meet.

Conflict of interest: U.R. is a member of the Berlin Heals scientific advisory board, collaborates with several Research groups in Berlin and has received speaker invitations from Charité University.