

Leading the way in innovation and research



Winner of the Most Innovative CEO award, Germany, Karsten König has a life rich in challenges and extraordinary research with his business JenLab GmbH developing outstanding scientific methods for detecting skin cancer and testing cosmetic efficacy.

JenLab CEO Karsten König is a man who likes to cross challenging borders. In 1989, shortly before the Wall came down, he planned a route out from Jena in East Germany to Ulm in West Germany, taking an extraordinary journey via Siberia, China and Tibet. He became the first East German who climbed one of the giant 14 mountains in the Himalayas, the 8,033-metre high Shisha Pangma.

His extraordinary feats don't stop there though, and it's why Karsten was a natural choice for the Most Innovative

CEO award in Germany.

He started his new life as post-doc in the Laser Institute Ulm, performing research on the optical detection of cancer as well as that of dental caries. Three years later he moved to California and worked at the Beckman Laser Institute in Irvine. There he found for the first time two-photon effects in laser traps that were studied to realize laser-assisted *in-vitro* fertilization. The work was published in *Nature*.

These two-photon effects, and

multiphoton effects determined his further scientific life. Back in Jena, he realized the first nanoprocessing multiphoton microscope based on femtosecond laser technology and applied it as a novel low-power nano-surgery tool in biomedicine. He published another *Nature* article on femtosecond laser transfection where the optical beam drills a nanohole in the cellular membrane to introduce foreign DNA. The technique is now used to realize optical reprogramming of skin cells into other cell types. Dr. König gained another

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degree in cell biology and became a lecturer at the Friedrich Schiller University in Jena.

But his major driving idea was to become the pioneer of femtosecond laser technology as a novel diagnostic medical tool. Dr. König's idea was awarded with the *Kortum Motivation Prize* by *Reinhard Selten*, Winner of the Nobel Prize for Economics in 1994, and the prize money was used to set up the company JenLab GmbH.

The company developed a first prototype of the multiphoton tomograph to image human skin and to perform optical biopsies without any labeling or surgery. This means that high-resolution images of single cancer cells and even cell compartments deep in the tissue could be generated within seconds and seen immediately on the screen – an astonishing discovery. And not only was it the case that the mean power of the femtosecond laser was low enough to avoid any destructive effects, but the images had a resolution by a factor of about 1,000 better than medical ultrasound and even better than the microscope images of the pathologists who would normally be investigating sliced, labeled, and fixed physically taken biopsies.

JenLab was able to realize a first CE certified medical product. But besides skin cancer detection, sunscreen nanoparticles could also be detected using this procedure, and the efficiency of anti-ageing drugs tested over long time periods of three months by the introduction of a skin ageing index, based on collagen and elastin imaging. Naturally, this opportunity was of great interest to the cosmetic and pharmaceutical industries, and this first device was purchased by the cosmetic company *Beiersdorf*. *Shiseido*, *Kao*, *L'Oreal* and others followed. Further global players, such as *Procter&Gamble* and *Chanel* now perform studies with JenLab's multiphoton tomographs.

The opportunities for research are unquestionably valuable.

Large research hospitals started to use JenLab's novel tomographs to obtain optical biopsies of cancer patients, such as the *Princess Alexandra Hospital* in Brisbane, Australia, the *Hammersmith Hospital* in London, the *Charite* in Berlin, and hospitals in California, Russia, Italy, Austria, France, and Germany.

But not only skin biopsies can be generated. Recently, the multiphoton tomograph was successfully employed in an operation room to detect tumor borders during brain surgery.

In addition, to 3D optical biopsies on the tissue architecture, sophisticated multiphoton tomographs can also provide chemical fingerprints and the possibility of functional imaging. One of the largest British multinational healthcare companies just purchased such special tomograph to evaluate the efficiency and effect pharmaceuticals have on the skin.

The current most interesting application of JenLab's novel multiphoton tomography is the evaluation of skin effects in astronauts as a result of long-term flights. Within ESA's project "Skin B", Dr. König and his engineers take optical biopsies from five astronauts. Among them, Italians, German, French, and British. Interestingly they discovered that the upper part of the skin, the epidermis, shrinks during these long voyages, which is valuable information as this research shows that this could cause problems during very long flights to Mars.

Currently JenLab's multiphoton tomographs are based on tunable femtosecond lasers with a price on the order of 100,000 Euro. But the next generation of ultracompact, all-diode based systems will reduce the price and the size of JenLab's tomographs significantly.

Besides his successful activity as CEO of JenLab GmbH, Dr. König works also as a full Professor at the Saarland University

where he teaches engineering classes and does research on material processing. He has produced around 500 scientific publications and received many prizes. In 2014, he received the TNE Award in London and two IAIR awards in Milano as Best German Company for Innovation & Leadership in the Biomedicine sector and, together with Thomas Piketty, European Man of the Year. "I'm very proud and happy that the readers have named me as Most Innovative CEO, Germany," he said today, "because this award is excellent recognition of the continued work to transfer HighTech femtosecond laser technology into novel medical diagnostic tools and biotech nanoprocessing devices. My team and I are fascinated by the wide range of exciting applications for this, including optical biopsies to detect black skin cancer, to test anti-ageing cosmetics and to evaluate skin shrinking effects of astronauts during long-term space flights."

Karsten is the founder, CEO, and owner of the company JenLab GmbH. The company sponsors the annual *JenLab Young Investigator Award* as part of the *Photonics West Conference* in San Francisco and the *Skin Imaging Award*. Dr. König is a keen alpinist, and likes jogging, always starting his day with a 7 km run. As co-founder and treasurer of the *Special Olympics Saarland* he enjoys taking part in competitions side-by-side with athletes with intellectual disabilities.



KARSTEN KÖNIG, FOUNDER / CEO,
JENLAB GMBH

GLOBAL PLAYERS, SUCH AS PROCTER&GAMBLE AND CHANEL NOW PERFORM STUDIES WITH JENLAB'S MULTIPHOTON TOMOGRAPHS