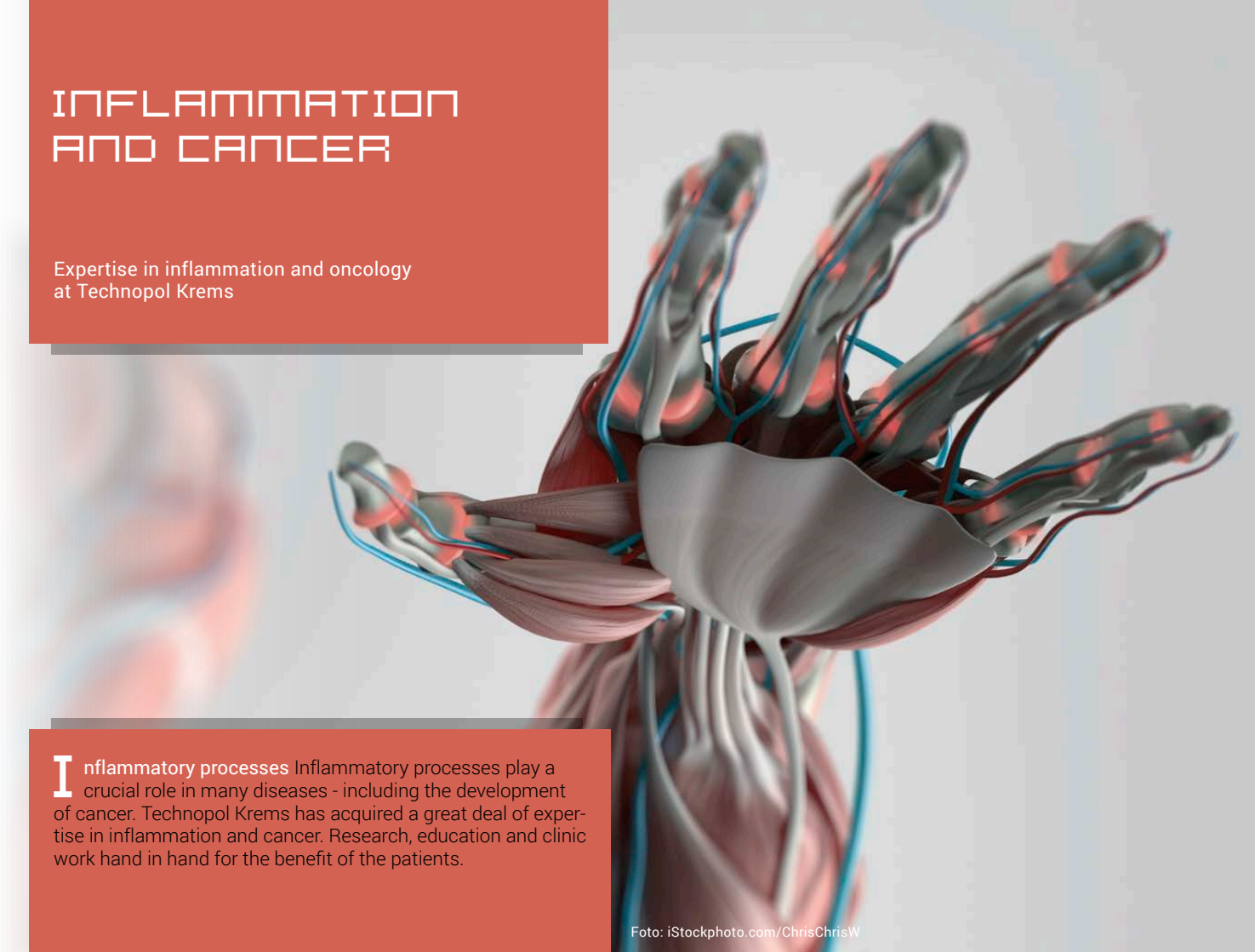
INFLAMMATION AND CANCER

Expertise in inflammation and oncology
at Technopol Krems



Inflammatory processes Inflammatory processes play a crucial role in many diseases - including the development of cancer. Technopol Krems has acquired a great deal of expertise in inflammation and cancer. Research, education and clinic work hand in hand for the benefit of the patients.

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TECHNOPOL KREMS

WHEN THE JOINT NO LONGER HAS THE WILL

Inflammatory processes for arthrosis

Apart from their natural protective function, inflammatory processes also play an important role in many local diseases. For example, in the case of arthrosis (the excessive wear of joints associated with damage to the cartilaginous tissue), inflammations occur as a secondary effect. Conversely, the development of arthrosis can be the result of an injury and the resulting inflammatory manifestation.

At the Centre for Regenerative Medicine and Orthopaedics at the Danube University Krems, headed by Stefan Nehrer, researchers have long been studying therapies for the regeneration of damaged cartilage tissue. These include the restoration of the lost lubricating effect by the injection of hyaluronic acid or its derivatives into the joint (viscosupplementation) and the renewal of worn cartilage material by transplantation of patient's own cells.

In a project funded by the Austrian Research Promotion Agency (FFG), Dr Nehrer and his team investigated how the retention time of hyaluronic acid, in particular in the inflammatory joint, can be increased in order to make better use of its healing effects and to be able to further improve it by targeted modification. For this purpose, an inflammation model was developed in which macrophages (phagocytic immune cells) were cultured together with arthrotic cartilage cells. It showed that high-molecular hyaluronic acid not only contributes to the regeneration of cartilage cells, but also helps to reduce the release of inflammatory mediators. ■

"Hyaluronic acid has an anti-inflammatory effect."

Univ.-Prof. Dr. Stefan Nehrer
Centre for Regenerative Medicine and Orthopaedics at Danube University Krems

Foto: Donau-Universität Krems

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DISEASES AND MECHANISMS

Inflammatory processes play a role in many diseases

Inflammation is a reaction of the immune system to microorganisms, toxins or other stimuli. Since ancient times, the four typical local symptoms to look out for are redness, overheating, swelling and pain. Today, these symptoms are explained by the entry of immune system cells into the affected tissue and the release of a large number of endogenous substances (called inflammatory mediators). In this way, pathogens and non-viable tissues are removed and the healing process is initiated.

Inflammations are problematic if they exist beyond the acute threat, as is the case with chronic inflammatory diseases. In addition, inflammatory processes also play an important role in many other pathological mechanisms, such as metabolic diseases and arthrosis. Inflammatory processes are also associated with the development of malignant tumours. Accordingly, a tumour uses inflammatory processes and the messenger substances released therefrom to grow, migrate and metastasize.

There are many different forms of cancer. In principle, all types of tissue and even blood cells can be affected by malignant changes. In addition, tumours of the same organ can show very different molecular patterns in different patients.

The Danube University Krems has acquired extensive know-how on arthrosis and sepsis (a life-threatening systemic inflammatory reaction). Researchers at the IMC University of Applied Sciences Krems and the Karl Landsteiner Private University for Health Sciences are engaged to researching diagnoses and treatments for various forms of cancer. ■

INFLAMMATION THROUGHOUT THE BODY

New approaches to diagnosis and treatment of sepsis

Sepsis is a clinical complication that is one of the leading causes of death in intensive care patients. It manifests itself as an out-of-control inflammatory response that causes a chain reaction that affects the entire organism.

The key to patient survival is the early detection of sepsis. As part of the H2020 project Smartdiagnos, the Centre for Biomedical Technology (CBMT) at the Danube University Krems, in collaboration with CubeDx, is engaged in the development of diagnostic procedures that enable quick and easy detection of pathogens in the blood as point-of-care systems in order to start targeted treatment at an early stage. Another project at CBMT is the characterisation and use of antimicrobial peptides for extracorporeal procedures. The Christian Doppler Laboratory for Innovative Therapy Approaches in Sepsis, headed by Viktoria Weber with Fresenius Medical Care as a corporate partner, is engaged in the development of supportive therapies for the treatment of sepsis, especially in the field of extracorporeal blood purification. Under this project, cell culture models were developed to study the activation of the endothelium under septic conditions. A new field of research in this context are the extracellular vesicles released by activated cells during inflammatory processes, which are of great importance both as a biomarker and as a potential therapeutic target.

As part of the Sepsis Unit, the CBMT works in collaboration with the Department of Anaesthesiology and Intensive Care Medicine at the St. Pölten University Hospital, headed by Christoph Hörmann. The aim is to convert research results into clinical application. Clinical studies in the field of extracorporeal procedures are conducted at the University Hospital where samples are obtained from sepsis patients for basic research. ■

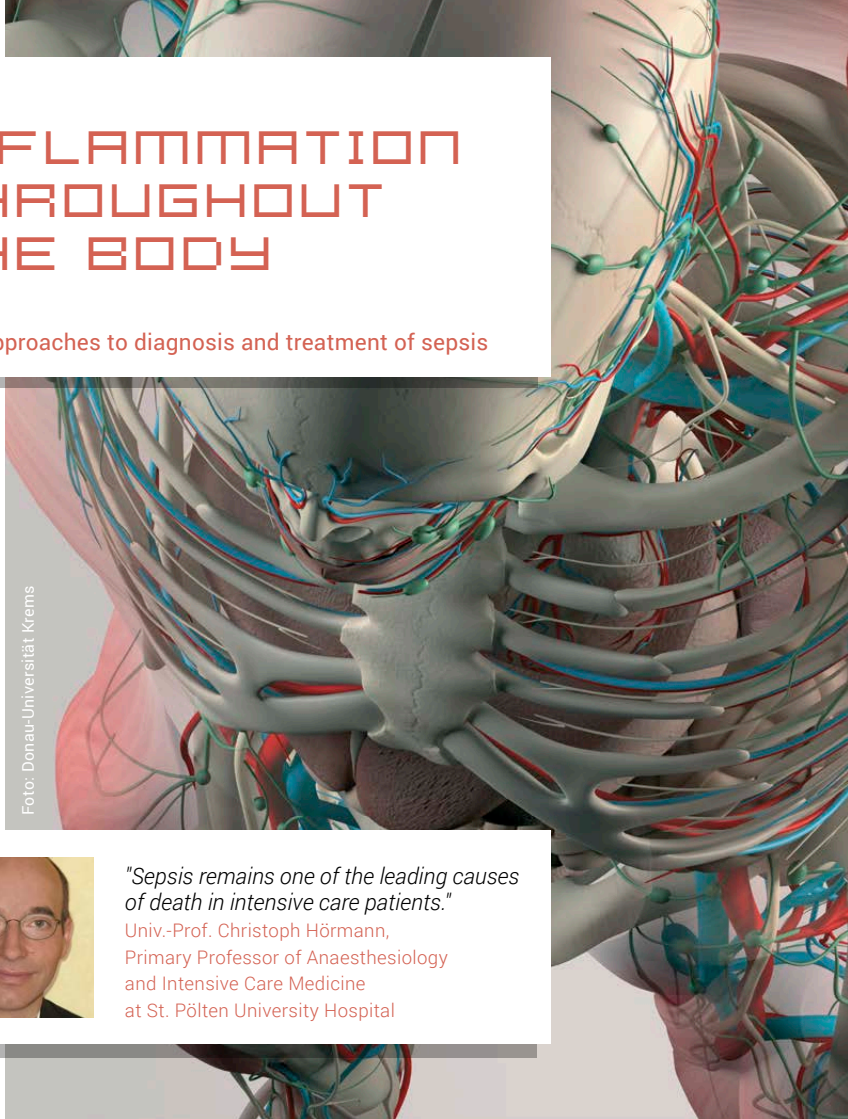
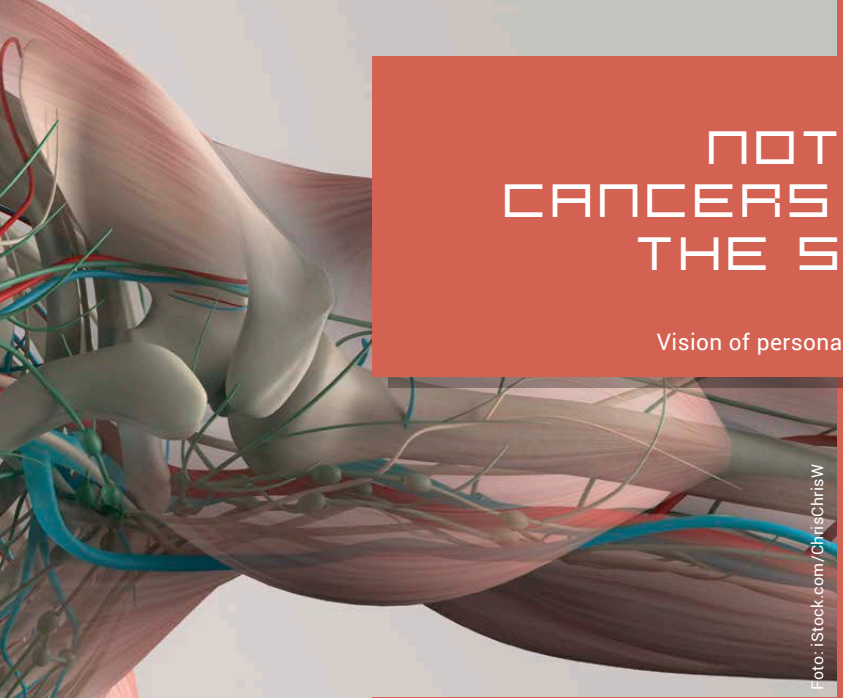


Foto: Donau-Universität Krems

"Sepsis remains one of the leading causes of death in intensive care patients."
Univ.-Prof. Christoph Hörmann,
Primary Professor of Anaesthesiology
and Intensive Care Medicine
at St. Pölten University Hospital

NOT ALL CANCERS ARE THE SAME

Vision of personalised medicine



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There are many types of cancer. Every organ and every type of tissue can in principle be affected by a malignant neoplasm. But even with regard to a specific organ, there are often very different mechanisms of development and molecular patterns. The goal of personalised medicine is to take these differences into account and provide each patient with the appropriate therapy. The key to this is sophisticated diagnostics, which detect these molecular patterns using suitable biomarkers. Methods for this are being developed at the Life Sciences Department of the IMC University of Applied Sciences Krems. These not only identify specific gene mutations in the affected cells, but also which of the existing genes are currently active and have been converted into protein structures ("expressed"). A project led by research director Andreas Eger has developed standardised diagnostic procedures that use genetic biomarkers to predict the therapeutic success of cancer drugs. In a research project funded by the Femtech funding scheme, Rita Seeböck used epigenetic biomarkers (modifications of the DNA that do not alter the actual genetic information) to investigate the differences in lung cancer between women and men. Department head Harald Hundsberger is the coordinator of a project which, in collaboration with the Medical University of Vienna and the Tulln-based biotech firm Sciotec Diagnostic Technologies, will develop tailor-made antibodies that can be used to distinguish whether primary skin melanomas form metastases or not. ■

INFO

Gender differences in sepsis

As part of a Femtech-funded project, Elisabeth Hofmann developed a cell culture-based sepsis model system at IMC University of Applied Sciences Krems, with which gender-specific differences can be investigated and taken into account in the development of potential therapies. For example, immunomodulating peptides which are investigated, generated and tested in collaboration with Procomcure Biotech are suitable candidates.

THE DISEASE AND ITS MODEL

Cancer models demonstrate if therapy is effective

The better cancer can be characterised, the more precise the therapies that can be developed. Each new therapeutic approach must undergo preclinical trials prior to implementation with patients. To this end, disease models for various cancers were developed at IMC University of Applied Sciences Krems.

A special emphasis is placed on three-dimensional, organotypic tumour models, which can also be cultured together with the tumour environment (the stroma). The condition and development of a tumour can be assessed, and drug candidates can be tested for efficacy using a range of biophysical and biomolecular testing methods.

These methods have already been used to support the development of various novel approaches to cancer therapy: for example, a project funded by the COIN programme investigated the treatment of cancer patients with dendritic cells, which stimulates the formation of tumour-specific immune cells. In collaboration with Kamil Önder at Paracelsus Medical University of Salzburg, researchers are working on the development of therapeutic peptides that modulate the activity of the EGF receptor, which plays an important role in many cancers. This involves combining rational design (molecular modelling) and high-throughput screening.

In collaboration with Mario Mikula from Medical University of Vienna and Franz Trautinger from St. Pölten University Hospital, researchers are investigating the molecular basis of the increased metabolic activity in metastatic melanoma cells. The long-term goal is to block tumour-specific protection systems and to selectively kill metastasising melanoma cells. ■

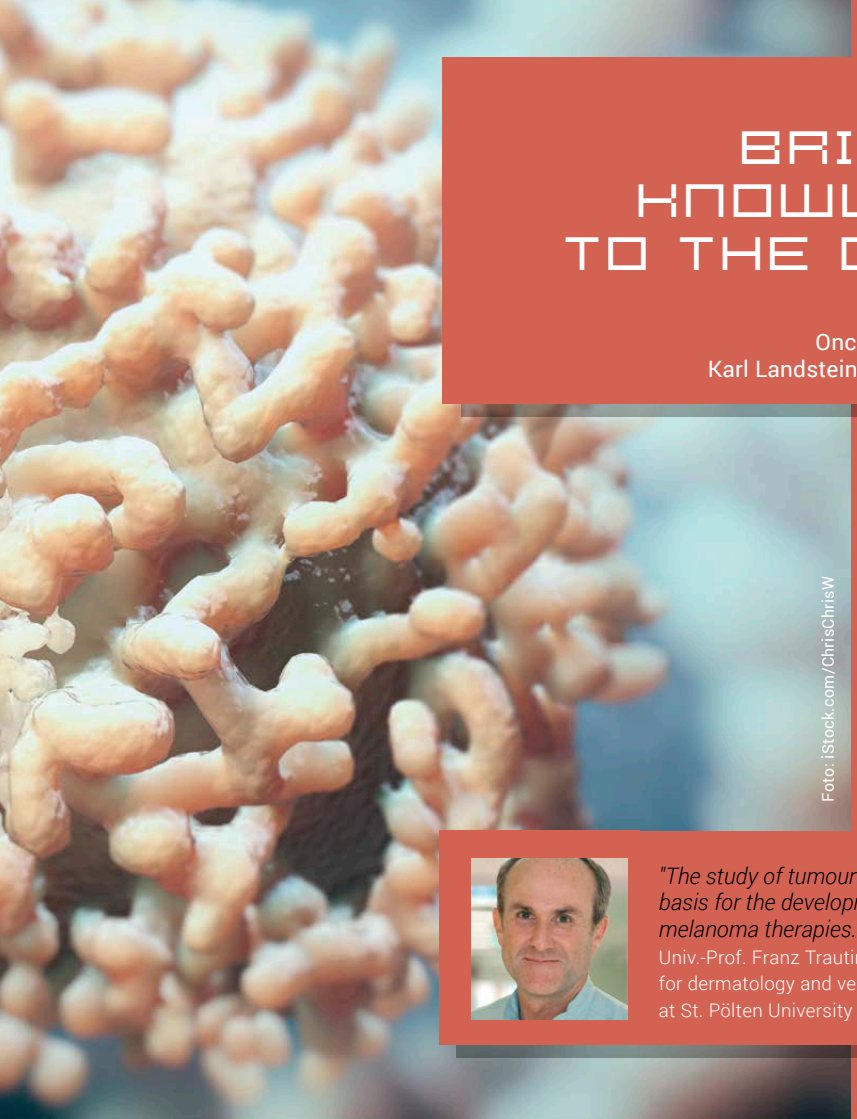
Foto: IMC Fachhochschule Krems

"With organotypic 3D cancer models, we can test the effectiveness of new therapies."

Dr. Andreas Eger, Department of Life Sciences at IMC University of Applied Sciences Krems

BRINGING KNOWLEDGE TO THE CLINIC

Oncological expertise at Karl Landsteiner Private University



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Medical studies at the Karl Landsteiner Private University for Health Sciences are strongly oriented towards clinical practice. To ensure that such training can be offered in a quality-oriented, research-led manner, the private university cooperates closely with the university hospitals in St. Pölten, Krems and Tulln. Some of the clinical departments have special expertise in oncological diseases and inflammatory processes. For example, under the direction of Martin Pecherstorfer, the Department of Internal Medicine 2 at the University Hospital Krems has established a focus on haemato-oncological issues. Pecherstorfer has also been working for many years on new ways of treating bone metastases. As part of a research project by the Karl Landsteiner Private University, issues concerning metabolic diseases and cancer were found to be linked. Both the metabolic syndrome (characterised by obesity, hypertension, insulin resistance and high blood lipid levels) and tumour cachexia (a metabolic disorder that occurs as a result of cancer) showed higher levels of inflammatory markers in the blood. Funded by the Lower Austrian Research and Education Society, the project will now study the underlying pathophysiological processes to find out if there are common diagnostic markers at the molecular level. The Department of Dermatology and Venereal Diseases at St. Pölten University Hospital, headed by Franz Trautinger, has acquired a great deal of knowledge on the early detection of skin tumours. ■

"The study of tumour metabolism is the basis for the development of innovative melanoma therapies."
Univ.-Prof. Franz Trautinger, Primary Professor for dermatology and venereal diseases at St. Pölten University Hospital

TECHNOPOL KREMS

Europäische Union Investitionen in Wachstum & Beschäftigung. Österreich.

Technopol Krems brings together education, research and companies in the field of health sciences. The cornerstones are the colleges located at Campus Krems (Danube University Krems, IMC University of Applied Sciences Krems, Karl Landsteiner Private University for Health Sciences) and the TFZ Technology and Research Centre Krems (with BTZ Biotechnology Centre Krems and RIZ Nord). The technopole is breaking new ground in biomedicine, pharmacy and healthcare, specialising in the areas of apheresis, regenerative medicine, inflammation and water & health.

The special-purpose premises at TFZ with clean-room laboratories offer the best conditions for research companies working in the field of medical biotechnology. The site has comprehensive facility management and provides comprehensive consulting services for the production, certification and implementation of R&D results in the biotechnology sector.

The technopole currently provides jobs for more than 400 employees working in technology, of which approximately 160 are engaged in research and development and about 80 in production. Krems has a student population of around 12,000.

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This booklet is also available as an e-paper.
Simply scan or download the QR code at:

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In this publication, all statements relating to persons refer equally to women as to men, the male form was chosen in the text only for the sake of simplicity.

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