



Medicine in Schleswig-Holstein

Excellent Research Exclusive Companies

More on research.
More on economics.



The largest snake farm in Europe is located in Schleswig-Holstein...

To discover more.

Excellent Research – Exclusive Companies

A healthy infrastructure for science is a precondition for discovering new inventions, which lead to new products and thus create new jobs. The Schleswig-Holstein University Medical Center, in the republic's northernmost state, is one of the largest clinical research facilities in Germany. Two universities in this region have pooled their resources for the purpose of better combating diseases, and also for finding ways of maintaining health.

Are you aware of the fact that there are two million people living in Germany today who suffer from chronic inflammatory diseases? These diseases can attack the skin, lungs, mouth or intestines. In many cases, lifestyle factors yet unspecified that accompany life in a modern industrial society are triggers for these chronic diseases. In Schleswig-Holstein, more than one hundred scientists from various universities and research institutions work together in an inflammation research network to tackle this problem, one of the biggest challenges of the 21st century.



A handwritten signature in blue ink that reads "Dietrich Austermann".

Dietrich Austermann
Minister of Science, Economic Affairs and Transport
of the State of Schleswig-Holstein

Did you know that there are plans for a Particle Therapy Center in Kiel where patients' tumors can be irradiated with particles traveling at half the speed of light, in treatments far more precise than has previously been possible? This means that cancer patients will endure less damage to healthy tissues and have a better prognosis for recovery. The Kiel Center represents an investment of 140 million Euros, and will serve the entire Northern Germany region as well as Scandinavia.

Did you know that Schleswig-Holstein is home to more than 200 medical technology companies, along with some 90 additional biotechnology businesses that operate globally from their local facilities? Moreover, there are numerous examples of highly productive collaborations between businesses, universities and research institutions. In this way, the discoveries made by researchers at one site can then be developed into marketable products at another.

Schleswig-Holstein has a great deal to offer to the medical field. Just read through this brochure; what you learn will amaze you!

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Cover picture: Stem cells are stored in liquid nitrogen. In this way they are virtually deep-frozen, and can be kept for decades. More information on this can be found on page 8.

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Drug development

Opening new doors with medicines from the sea

A vision of modern medicine is already beginning to take shape in Schleswig-Holstein: taking active substances from the far reaches of the ocean and, from them, developing new and innovative medications that can heal severe inflammatory and infectious diseases – or even cancer. Things that are only abstract discussions of potential research avenues in other parts of the world are already part of the daily routine for scientists in the land between the seas: researching active substances from marine sources.



With active ingredients from the far reaches of the ocean, innovative medications are to be developed which will be able to heal severe inflammatory and infectious diseases. To this as an insert: The research vessels of IFM-GEOMAR in Kiel.

© IFM-GEOMAR, Kiel

“In the water, chemical interactions play a special role, whether in defending against enemies or bagging prey,” explained Prof. Johannes Imhoff from IFM-GEOMAR in Kiel. The marine researchers want to take advantage of the plethora of natural substances which have had millions of years to develop under water. And the high expectations placed on the marine agents are absolutely warranted: Because marine organisms – especially stationary ones – must possess numerous substances which enable them to fight off attackers such as bacteria and viruses. If this were not the case, they could never survive. In order to take advantage of these substances for the benefit of humans, the Ministry of Science of Schleswig-Holstein has arranged a rather unusual alliance: within the framework of the new “Center for Marine Active Agent Research”, founded in 2005, physicians, oceanographers and micro and molecular biologists are examining the possibility of preparing marine substances for therapeutic uses.

An ideal prerequisite: exclusive materials banks

“We have been able to identify previously unknown active substances used by algae and sponges to optimally protect their surfaces,” said Johannes Imhoff. Because these sensitive – and extremely effective – systems remain largely understood, Schleswig-Holstein is intensifying its efforts in the research of marine substances for the advancement of medical science. Even today, the scientists in Schleswig-Holstein are taking advantage of various materials banks and expert sources to determine the chemical structures of individual active agents or to root out which biological activity of the substances is responsible for their protective effects. And this although the research field is still very young: The University of Kiel and the Leibniz Institute for Marine Sciences are forming internationally unique collections of marine bacteria and

fungi. These contain a remarkable number of biological and potentially therapeutically effective substances. "At the present, we still know very little about how these active substances interact," Imhoff said, in outlining the new scientific challenge. However, the oceanographer already sees concrete prospects in the near-term for the development of a marketable product stemming from the research of active marine substances – based on new active substances for specific diseases. To that end, his scientists are isolating marine bacteria, cultivating them and then characterizing their range of effectiveness.

Working together to fight infections, cancer and inflammation

Especially for the treatment of cancer, the diversity of the world's oceans promises new drugs with significantly milder side effect profiles than those – predominantly synthetic – medications in use today. It is for this reason that marine researchers are vigorously collaborating with the oncologists at the University Medical Center – and with industrial partners. "The corporation, Zentaris, for example, will play a key role in the development of cancer medications from marine active substances," said Imhof when speaking about the dynamic cooperation between private enterprise and the public sector.

The suppression of inflammatory processes with the help of marine agents promises to be particularly successful. Using a new active agent, a public-private partnership between the university and the biotech corporation Conaris, which originated as an offshoot of the University of Kiel, intends to disrupt the mechanism behind a constantly recurring inflammation. Conaris offers the university a technical platform for their research.

As such, the state of Schleswig-Holstein has chosen marine active substance research as a long-term focal point for research. Johannes Imhoff is satisfied: "For a long time, the therapeutic potential of the oceans' microorganisms was underestimated. Now we intend to make use of it for medical science as quickly as possible."

The Christian-Albrecht University at Kiel and its associated experts in the field of marine science are applying for a Cluster of Excellence, „The Future Ocean“, in the framework of the association's Excellence Initiative.

A close integration with industry

An integration of science and industry can be seen in the cooperations of Costal Research and Management (CRM) and BlueBioTech GmbH, which are actively involved in research and, as such, maintain close collaborations with public research institutions.



The newly founded center for marine active agents takes advantage of a one-of-a-kind collection of marine bacteria (pictured: Bacterial samples from the collection) and fungi at IFM-GEO-MAR in Kiel. © Prof. Johannes F. Imhoff, IFM-GEOMAR, Kiel

Stem cell research

The natural regeneration of organs

CRM, based in Kiel, takes active substances from the sea and uses them for the development of cosmetic and pharmaceutical products, as well as for dietary supplements.

BlueBioTech GmbH, based in Büsum, functions as a research center for the BlueBio® research group, headquartered in Elmshorn. It is an offshoot of the Research and Technology Centre Westcoast (FTZ) and is involved in the research and cultivation of microalgae strains. The corporation intends to further develop the potential for commercial products in the foodstuffs and animal feed industries, as well as in the pharmaceutical and cosmetics spheres.

Damage to a human being's individual organs can lead to considerable loss of function with a subsequent reduction in that individual's quality of life. In many cases, the afflicted tissues must be completely replaced, and it is at this point where the search for an appropriate donor begins. Still, there is an alternative: Increasingly, cells and entire organs will be able to regenerate themselves. This is the aim of „Regenerative Medicine“, a main focus of clinical stem cell research in Schleswig-Holstein, Germany. To reach this goal, 17 institutes from around the state have joined together, combining their extensive expertise.

The healthy human organism regenerates itself by constantly building fresh cells and new tissue from stem cells. Therefore, in order to restore damaged tissues, medical technology utilizes just such stem cells. The idea of removing stem cells from embryos is a socially controversial issue, and the argument that unborn life should be protected often arouses very strong feelings. In the meantime, methods have been developed which allow embryonic stem cells to be extracted from early embryos, without damaging them, or to convert non-embryonic stem cells into embryonic stem cells. Regeneration specialists in Schleswig-Holstein have also isolated cells from the bodies of adults which possess similar properties to those of embryonic stem cells. The prospects for the therapeutic use of stem cells isolated from the blood or organs of adults have improved dramatically, as the current research indicates they display a much higher degree of plasticity than previously suspected.



Stem cells being used at the University of Lübeck for research in the field of Regenerative Medicine.

© Thorsten Wulff, Kommunikationsdesign, Lübeck

More on regenerative medicine.

“Regenerative medicine” not only intends to reactivate defective tissues, but also to provide an alternative to risky organ transplantations. “Examining the interaction between cells and their surrounding molecules is the main focus of our research,” the stem cell researchers from the “Center for Regenerative Medicine” explained. This center optimally facilitates a cost-effective transfer of new regenerative products.

Intensive promotion of reconstructive medicine

Grants from various countries, as well as from European programs, underscore the outstanding research being carried out by the scientists in Schleswig-Holstein – even on an international scale. Taking center stage is the detailed research on the interactions between stem cells and their surroundings during cell division and differentiation being carried out by researchers in Lübeck, with the support of the Fraunhofer Institute for Biomedical Technology. The focus in Kiel is directed at alternative possibilities for the harvesting of stem cells, in close cooperation with international research groups. Collaborations with the Tissue Engineering Competence Centre offer nearly optimal scientific working conditions. This close-working relationship within the “Center for Regenerative Medicine” is striving for the quality-controlled clinical application of stem cell products as cellular and tissue replacements. This network of expertise is also responsible for the fact that commercial products have already resulted from individual projects.

For example, innovative matrix products stemming from marine sources have been developed – and, in some cases, marketed – in conjunction with Coastal Research & Management, based in Kiel. Furthermore, initial orders for quality analysis purposes have been placed by large conglomerates. Likewise, the development of a



Stem cells being stored in liquid nitrogen. They are stable for decades in this type of “deep freeze”.

© Thorsten Wulff, Kommunikationsdesign, Lübeck

stem cell bank will effectively strengthen the research focus. The insight gained from the basic research will ultimately convert the Department of Transplantation Medicine and Biotechnology at the University Medical Center into a lasting therapy concept, thereby strengthening the profile of Schleswig-Holstein as a nexus for the life-sciences.

The stem cell research groups from Schleswig-Holstein have close contact with the Fraunhofer's internationally-renowned Institute for Biomedical Technology. These cooperations are to be further developed in the future, particularly with the researchers at the Lübeck site.

Already making their mark on the free market

The stem cell researchers already have business models in place: Existing clean-room laboratories are available for the manufacture of regenerative products, and a regenerative medicine laboratory is being established, which offers infectiological, toxicological and immunological quality assurance of regenerative components, as well as tests of differentiation for the quality assurance of stem cell products. The company Blasticon was founded along these lines from the university development of a technology for the manufacture of tolerance cells. The preparation of the cell products for use in patient therapy is an imbedded element of the cooperation agreement with the university medical center – a prime example of a vivacious partnership between the public and private sectors. In addition to this, collaborations are in place with around two dozen additional industrial partners.



One area of use for stem cell research: The European research project, MyJoint, intends to find a way of enabling replacements for the body's joints to adhere better (pictured: Knee joint). Schleswig-Holstein researchers have already accomplished this with a lower jaw. MyJoint is being supported by the EU. In this project, a research network consisting of eight European universities is coordinated from Schleswig-Holstein.

© Assistent Professor Dr. Dr. Patrik Warnke

[More on MyJoint.](#)

Research into inflammation

On the trail of a phenomenon
of the civilized world

Worldwide, more and more people are developing chronic inflammations – of the skin, lungs, mouth or gastrointestinal tract. For the most part, the cause remains unclear. These conditions often result in severe complications, and sometimes even in death. These problems present one of the greatest challenges facing medical science in the 21st century. Schleswig-Holstein has responded to this phenomenon of modern society by bringing together renowned scientists from around the state of Schleswig-Holstein in an „Inflammation Research Network“. This has given birth to a research network, unlike any other in the world.

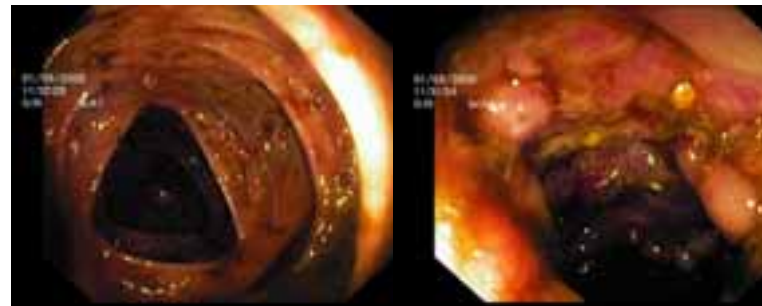
About two million people in Germany suffer from chronic inflammatory diseases. These chronic illnesses place a massive burden on the public health system. In Germany alone, Crohn's disease - an inflammation of the intestines - is responsible for over five million lost work days annually. While the number of people afflicted with this inflammatory disease of the gastrointestinal tract has remained mostly constant at about three hundred thousand, more and more people are developing other inflammatory diseases such as atopic dermatitis, sarcoidosis, or parodontitis. It is projected that, by the year 2020, chronic inflammatory bronchitis will have become the third most common cause of death in Germany, after coronary artery disease and cerebrovascular diseases. Human beings can develop inflammations of just about every organ.



Inflammation at Interfaces

Dramatic new insights into the process of inflammation

Researchers in Schleswig-Holstein have recognized the phenomenon and are confronting it – in an exclusive, worldwide forum: More than 100 scientists from the Universities of Kiel and Lübeck, as well as from research centers for medicine and biotechnology at the Leibniz Association in Borstel, are currently working in the „Inflammation Research Network“, which was founded in 2004. Building on the existing successful research of the “German National Genome Research Network” and the “Competence Network Bowel Diseases”, both of which are coordinated by the University Medical Center Schleswig-Holstein (UK S-H), they have constructed a concerted research agenda. The result has been to establish a one-of-a-kind collection of medical, structural-biological, immunological,

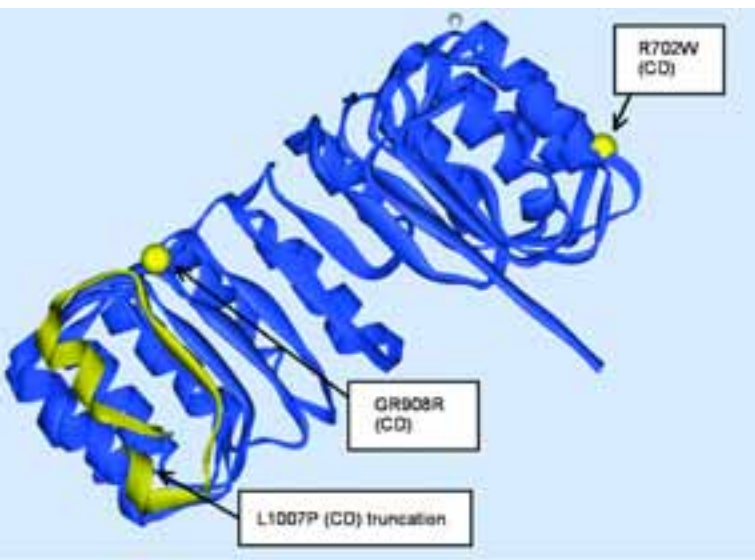


More on research.

When the inflammation destroys intestinal tissue – Crohn's disease. Left a healthy bowel, right an acutely inflamed bowel with pseudopolyps. © Dr. S. Nikolaus, CAU, UK S-H

infectiological and molecular-genetic expertise directed at explaining the phenomenon of the increasing incidence of chronic inflammatory disorders of the human body.

This is based upon exceptionally comprehensive and extremely well-characterized patient collectives as well as on established models. The over 2,000 publications released by north-German researchers in international scientific journals serve to document the remarkable scientific quality of the research association, and this is best described by the innovative use of the word „Network“. Up until now, medical science has viewed the various inflammatory diseases as mostly isolated, individual disease constellations that are primarily defined based on the organs affected; the Schleswig-Holstein Research network, on the other hand, is focusing on identifying the similarities



Crohn's disease – The genes are partly responsible: The first gene associated with chronic inflammatory bowel disease has been discovered in Schleswig-Holstein – NOD2.

© Competence Network Bowel Diseases (CED) / NGFN

between the various diseases to enable the development of new therapies and prevention strategies for a superordinate, constantly recurring, and dramatic disease process.

When inflammation leads to sickness

The scientists in the Inflammation Research Network (IRN) are interested in learning how microorganisms found on the surface of the body react with specific host receptors. This could explain why the cells release messenger substances that render the organism harmless. In this way, inflammation is actually a completely healthy mechanism which protects the body on a fundamental level.

Over the course of the evolution of *Homo sapiens*, this finely balanced biological system has always functioned reliably and largely undisturbed. Since the mid-twentieth century, however, the system has become increasingly unbalanced. Around that time, little-known allergies and autoimmune diseases began to develop and have been on the rise worldwide ever since, both quantitatively and qualitatively. Inflammation first becomes an illness when the inflammatory process damages the body's tissues, as is the case in chronic forms of inflammation. It is for just this reason that the Network researchers are trying to determine which cells dictate the pace and extent of the inflammatory reaction and which molecular and genetic causes may be responsible for the unrelenting, recurring inflammation. This knowledge could eventually result in the generation of innovative therapeutic strategies: Prof. Stefan Schreiber, who coordinates the "Inflammation Research Network", is convinced that "in the medium term, these insights stemming from concentrated research into inflammation will enable therapies which are more effective, because they can be individually tailored." The IRN is supported by the state government of Schleswig-Holstein. Even now, it can be quickly determined whether an over or under-regulation of genes is

The Comprehensive Center for Inflammation Medicine

In Kiel, a large, revolutionary outpatient clinic, unlike any other in the world, is establishing a new and deeper understanding of inflammation, one not confined by the barriers between the individual medical specialties. The attitude represents a departure from the organ-focused approach and a move toward understanding and treating the mechanism of the disease. It involves the integrated perception of the “Inflammation” phenomenon, regardless of where it manifests in the body, and its chronic nature. In order to facilitate the expeditious, comprehensive treatment of the patient in actual clinical practice, the “Inflammation Research Network” founded the one-of-a-kind “Comprehensive Center for Inflammation Medicine”, in which all the individual medical disciplines that deal with diseases of the human barrier organs are brought together under one roof. Particular advantages of this innovative structure: the close connection of the clinicians to the basic scientific research. Novel therapeutic approaches resulting from current research findings are quickly converted into clinical model systems in the “Network” center. Even in international comparison, this is a unique quality in the treatment of patients suffering from inflammatory diseases: Stefan Schreiber said, “The Comprehensive Center is the idyllic vision of comprehensive medicine, a new quality in the networking of research and practice.”



Inflammation at Interfaces

responsible for the disease, “so that we can then administer an appropriate drug to suppress the inflammation. At the present time, however, this suppression is only temporary. And that has to change. We want to be able to heal this disease, not just alleviate the symptoms.”

Direct from the laboratory to the patient

In order to help its scientists bring chronic inflammations under control, Schleswig-Holstein affords them with extraordinary working conditions: Dozens of research groups as well as specialized institutes and laboratories form the foundation of the “Inflammation Research Network”. Three interdisciplinary centers are joint facilities of the research association and, as such, represent scientific and clinical pillars of the “Network” research:



Network researchers discuss findings on inflammatory diseases.

© Network

The center for molecular life sciences (ZMB)

The high-tech, robot driven molecular platforms are centralized here, and allow several hundred thousand molecular-biological experiments to be carried out every day. This has already led to discoveries which resulted in international marvel at the University Medical Center Schleswig-Holstein. One example involved the disposition of genes responsible for causing diseases. In the ZMB, an idyllically structured, highly specialized research center has been formed which focuses on the microbiological and genetic aspects of the inflammation phenomenon.

The center for medical structure and cellular biology (ZMSZ)

examines the structural and cellular causes of inflammatory diseases. The researchers are able to work with the most sensitive technology available, such as nuclear magnetic resonance spectroscopy, mass spectroscopy and x-ray structural analysis. And the results are tangible: The latest headlines lauded the development of effective therapeutic approaches for the so-called "avian flu", SARS and new antiviral medications which prevent the penetration of viruses into cells.

The secure laboratory, level S3

at the Borstel Research Center of Leibniz Center for Medicine and Life Sciences, is focusing on the mechanisms involved in the lung disease, tuberculosis: Special protective measures here enable scientists to also work with genetically altered tuberculosis bacteria, which the "Network" researchers test in cell culture and animal models.

Together with the Borstel Research Center, the Christian-Albrecht University at Kiel and the University of Lübeck are applying for a Cluster of Excellence, "Inflammation at Interfaces", in the framework of the association's Excellence Initiative.



Research into inflammation: Research under strict security –
working in the level 3 secure laboratory © Network

More on
interdisciplinary centers.

Vivacious partnership: academics and industry, hand in hand

Diverse cooperative efforts with industrial firms expand the unique infrastructure for research on inflammation in Schleswig-Holstein. In this vein, Astra Zeneca and the University Medical Center Schleswig-Holstein are experimenting with Crohn's disease, an inflammation of the gastrointestinal tract, and are also developing immunosuppressive drugs with revolutionary active pharmacological agents. The Wedel-based pharmaceutical giant and the university researchers have also been able to create a steroid preparation which is applied locally to the intestine as a standard medication for use in chronic inflammatory bowel disease.

Ferring, a Kiel-based company, is engaged in developing a drug for use in chronic inflammatory bowel diseases such as Crohn's disease and ulcerative colitis. Furthermore, one international conglomerate after another is associating itself with the University Medical Center: from Abbott to Otsuka and Schering to Serono and UCB. The German contribution to innovative concepts – such as the promising, so-called anti-TNF-therapy – is anchored in the northern part of the republic.

A particularly successful example of the dynamic public-private-partnership is that of the Biotech firm, Conaris, which was founded based on university research: it is developing, among other things, an innovatory anti-inflammatory agent from a protein which was originally formed in the University Medical Center Schleswig-Holstein. In turn, this exclusive preparation will undergo clinical trials on patients in the near future at the "Center for Inflammation Medicine" at the "Network's" own special outpatient clinic.

Other companies involved with the topics of inflammation and the inhibition of inflammation are: in the drug development sector, Planton in Kiel; in the diagnostic area, EUROIMMUN in Lübeck; and in the allergy research arena, Allergopharma in Reinbek.

Proteo Biotech AG in Kiel is setting a good example of turning basic university research into the development of a drug. This offshoot of the University of Kiel took the anti-inflammatory substance, Elafin, which was discovered at the University Skin Clinic, and developed it into an active pharmaceutical agent and is currently examining its safety for use in humans in a phase 1 clinical trial. Elafin is intended to be used for the treatment of inflammatory diseases involving almost every organ of the body, particularly those affecting the lung and heart.



More on partners.

A laboratory technician monitors the automated operation of a robot pipettor.

© Network

Therapeutic research

Putting research to work

Basic research often makes truly revolutionary discoveries available to the field of medicine. In the best case, this new knowledge will then find the earliest possible application in the treatment of patients. This transfer from the laboratory to the doctor's office is the goal sought by the intensive therapy and medical care researchers in Schleswig-Holstein – putting research to work.

“For this research in the future, it will be crucial to examine the current medical care situation in order to see whether the transformation of new clinical results into routine treatments has been achieved,” explains Prof. Heiner Raspe of the Schleswig-Holstein University Medical Clinic, which forms the heart of the medical care and therapeutic research effort in Schleswig-Holstein.



Therapeutic research is a broad area. Thus, for example, complications can be detected in heart disease. For this reason, patients are provided with mobile EKG monitors.

© Thorsten Wulff, Kommunikationsdesign, Lübeck

Various multi-center projects are focused on characterizing the current status of therapy, analyzing patient treatments in the region and developing concrete suggestions for the improvement of routine clinical operations.

Better diagnostics and more effective therapies

A case in point concerns the efforts of medical care researchers toward further optimization of diagnostic procedures in the area of breast cancer detection, for example through the double reading of mammograms. To this end, approximately 80,000 patients have been included in a model study. In addition, researchers are examining the quality of medical care in Schleswig-Holstein through an exacting analysis of treatment conditions; for example, they will determine the rehabilitation requirements of insurers, and document the complications that accompany heart disease. In this latter case, 1,500 patients were provided with mobile EKG monitors that record information on heart disorders and relay this directly to a telemedical center.

Moving toward an economical health care system

The central concern of this research project is to improve the quality of life for patients. Furthermore, extensive documentation will establish what the costs for individual treatments are, in order to develop alternative fee structures or more economical options. “Monitoring this transfer of research results into applications in medical care is essential to a modern health care system,” says Heiner Raspe.

More on networking.

This is also of interest to the medical technology industry: Therapeutic and medical care researchers from Schleswig-Holstein already have successful collaborations with a number of companies. Rising demands for cost-efficiency and treatment quality in the health care system present new challenges to physicians and hospital managers. Treatment processes and workflows increasingly take center stage among these changes.

As one of the world's leading manufacturers of medical technology system solutions, Dräger Medical offers products, services and integrated CareArea™ solutions along the entire patient process chain: from emergency medical aid, through the areas of perioperative, intensive care and perinatal medicine, all the way to home care. The goal of the company is to raise the quality of patient care while, at the same time, elevating the efficiency of the clinical process, in order to contribute to cost containment in the health care system.

The EUROIMMUN company is active in the field of medical laboratory diagnostics. Their focus is on test systems for detecting a wide range of antibodies in the serum of patients, in order to facilitate a rapid and cost-efficient diagnosis of autoimmune and infectious diseases, as well as allergies.

Among the other collaboration partners are ESKA Implants GmbH & Co. KG. and Söring Medizintechnik.

ESKA Implants is a leading manufacturer of artificial joint replacements for nearly every type of joint. This company has also decided to partner with the University of Lübeck in the creation of an endowed professorship in orthopedics. Many years of experience and close collaboration with scientific institutions and end users has

contributed to building the company's strong competency in the development and fabrication of specific designs for individual patients. These products provide one-of-a-kind solutions to problems in the complex field of revision and tumor surgery.

Söring pursues innovative new and further developments in various types of operative technology. Their central area of focus is in ultrasonic dissection, with such applications as in neurosurgery and liver surgery, as well as in coagulation techniques for safe and effective hemostasis.



Mobile EKG monitors record disturbances in cardiac function, and relay this information directly to a telemedical center.

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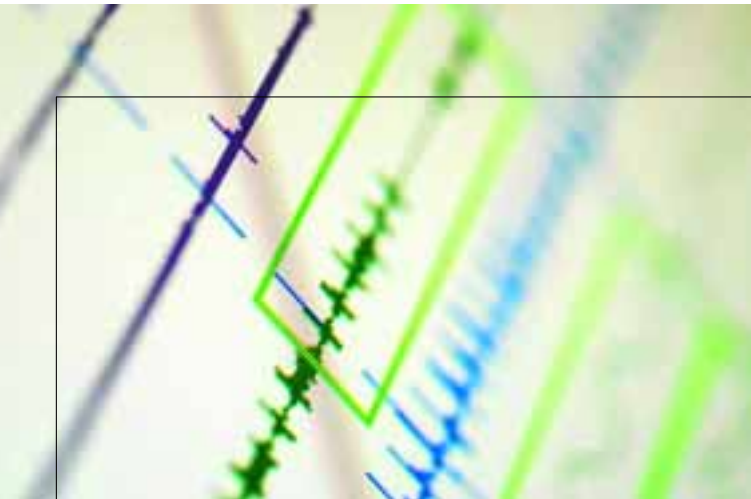
Sleep research

When the energy supply is improperly regulated

Oftentimes, disorders such as obesity and fat metabolism, hypertension and memory disturbances can be attributed to malfunctions of the brain. For this reason, these troublesome phenomena are often diagnosed as part of a psychologically-determined disease presentation, and can be successfully treated from this perspective alone. The Schleswig-Holstein University Medical Center possesses unique scientific expertise in this area.

“Our research efforts are focused on the energy demand of the brain, in order to explain disorders such as obesity or hypertension,” says Prof. Achim Peters of the

University Medical Center, who has assembled a scientific team in Schleswig-Holstein to study this innovative research approach. His team includes interns, psychiatrists, neurologists, neuroradiologists, pharmacologists and mathematicians. Underlying this ambitious project, funded by the Deutsche Forschungsgemeinschaft (German Research Foundation), is the knowledge that, as the most important regulatory organ for all the body’s vital functions, the brain must have priority access to the energy supply. Thus, when a critical deficiency arises, the other organs in the body are neglected. Improper regulation of the energy allocation under the brain’s control can ultimately lead to a variety of endemic diseases. Moreover, this improper regulation can also be related to psychiatric disorders such as depression, as well as to neurological and gynecological diseases.



Brain waves change with the depth of sleep. In the sleep laboratory, these changes are recorded. They provide scientists with valuable information about the energy requirements of the brain.

© Thorsten Wulff, Kommunikationsdesign, Lübeck

The healing power of sleep

Research into the dynamics of the brain’s reaction to external events has been expanded through investigations of the importance of sleep. The objective of the psychiatrists working with Prof. Jan Born of the Schleswig-Holstein University Medical Center is to develop medical strategies that involve sleep for the effective treatment of disturbances in memory formation. Thus, the recognition that sleep can become a highly useful component in the therapeutic treatment for a wide variety of illnesses forms the basis of a clinically-oriented research approach that is unique in the world, and that also holds much promise for patients. Born anticipates that, “When it becomes possible to exploit the plasticity reserve that is naturally present in everyone, or better yet, optimally, just to nudge it, we should be able to provide a significantly better quality of life in those many cases of patients with a disease presentation for which other valid therapies have been exhausted.

Laser High-Tech

Gentle and caring methodology
for diagnosis and operations

To be able to perform diagnoses and operations with care and precision, one needs a detailed view into the human body; this would be unthinkable without optical techniques, under the trained eye of a medical specialist. This technology for the future is being developed at the highly specialized Medical Laser Center at Lübeck. In many cases, minimally-invasive interventions can now be realized with the innovative systems that have resulted from this effort. The creative and flexible use of energy packets with a high power density or ultra-short light pulses has thus become an important area of expertise for the Schleswig-Holstein region.

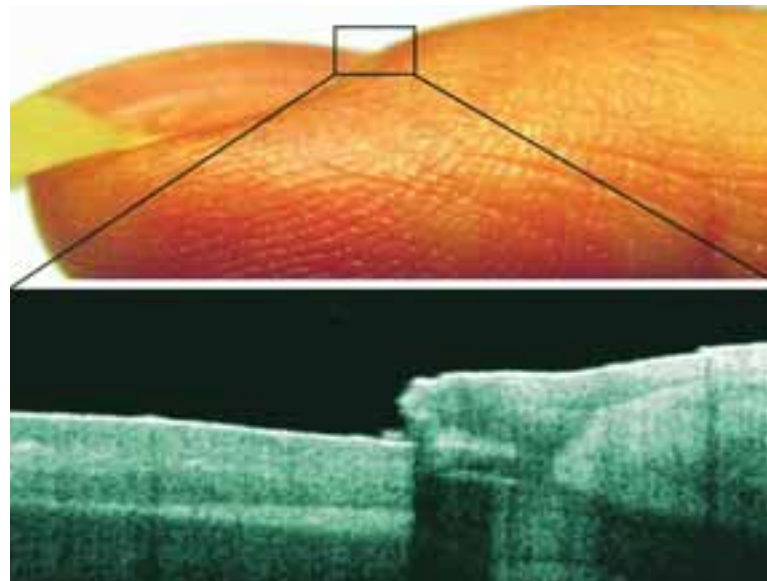
When performing surgical interventions and differential diagnoses that exceed the capabilities of the human eye, highly specialized medical technology is necessary. Whether for the preparation of biological specimens with focused femtosecond pulses, for intracellular nanosurgery, or for the study of protein function through optical labeling procedures with laser-irradiated gold particles, only the use of targeted energy beams permits such an in-depth, highly detailed view into the human organism, and offers gentle treatment options for the patient.

Prevention and therapy through precision modeling

Optical coherence tomography (OCT) is the primary tool with which a physician can peer deep into the body without applying a scalpel. OCT now makes it possible to see tissue structures near the surface in high resolution. The imaging procedures developed at the Laser Center can thus visualize tumors and even their precursors, which is useful both in diagnosis and for intra-operative monitoring of therapy. This tomography finds clinical applications in a number of areas, primarily in ophthalmology, dermatology, gynecology and neurosurgery.

Gentle treatments for the eye

When the eye suffers from damage or illness, lasers can be used to deliver highly efficient remedial therapies. Thus, a newly developed form of laser radiation can stimulate metabolism in the ocular fundus thermomechanically following damage due to diabetes. In cases of macular edema, there is now a technique referred to as selective retina laser therapy that can reduce the patholo-



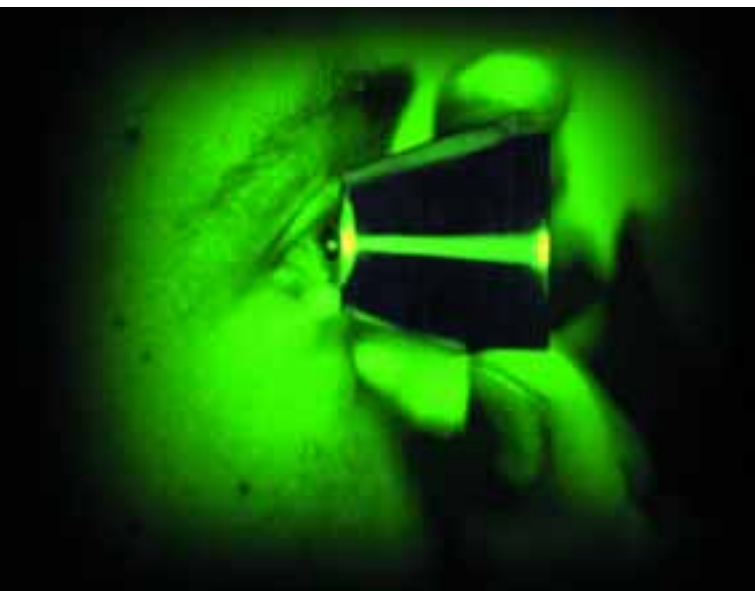
For example, light of lower coherence can be used to examine a patient's skin to a depth of up to 2 mm. In this way, changes in the skin can be monitored over long periods of time without the need for biopsy. The picture shows an example of the transition from the fingernail to the nailbed of a finger in cross-section.

© Laserzentrum Lübeck (Lübeck Laser Center)

gical accumulation of fluid in the eye. The healing effect has been proven, and the prophylaxis that can be produced in the earlier stages of the disease is very promising, while there is no deleterious effect on the visual capacity. This stands in contrast to the use of conventional procedures, in which there is always a danger of destroying the photoreceptors and, consequently, the vision cells. This new technology from Schleswig-Holstein is far gentler for the patient, and is not only being used at the University Medical Center, but also at clinics in London, and clinical trials will begin soon in Asia and the USA.

Rapid and precise incisions

The technological innovations coming out of Schleswig-Holstein have also become indispensable to surgeons;



A contact lens, as used for the laser treatment of the retina. This provides the doctor with an optimal view of the ocular fundus, while, at the same time, the laser beam (green in this case) passes through the lens as it is applied to the retina.

© Laserzentrum Lübeck (Lübeck Laser Center)

these specialists are now able to utilize a laser-based infrared scalpel, which, for the first time, can be applied via a flexible quartz waveguide. This technology produces tissue incisions with a precision and rapidity previously unknown. "Particularly in minimally-invasive surgery, it is important to make the most precise and rapid tissue incisions possible, without damaging the surrounding organs," explains Prof. Reginald Birngruber, who, in addition to his research activities at the university, heads the private institution Medizinisches Laserzentrum Lübeck (Lübeck Medical Laser Center, MLL). This regional non-profit organization has already taken a number of products that have grown out of basic university research and brought them to the marketplace.

Spin-offs as stimulants for research

Today, in addition to the universities of Schleswig-Holstein, there are five medical technology companies that are the primary partners with the MLL. This attractive business arrangement ensures an optimal network to bridge between the application-oriented basic research results that have been made public with the international medical technology market. "As a medium for carrying out industry-related development, the Laser Center forms an important link between medical technology and interdisciplinary optical technology," says Managing Director Birngruber. The MLL will implement ongoing complex industrial projects from which new types of treatment methodologies will emerge; these will eventually mature into internationally approved procedures. The scientists maintain a long-term collaboration with roughly a dozen technology companies.

The world's most prominent company in the area of lasers and optical components for industrial and scientific applications is Coherent Inc. This company maintains a manufacturing site in Lübeck with more than 100 employees. Coherent combines successful innovation with experience; for more than 30 years, it has regularly set new standards with highly innovative products, supported by its vigorous research and development activities and its close relationships with customers and scientific institutions.

Reproductive medicine

Hope for unintended childlessness

Much concern has been voiced over the declining birth rate in Germany. The most significant causes of decreased procreation are societal changes. However, many times health problems also play a role when women cannot become pregnant. The reproductive medicine specialists at Schleswig-Holstein have a variety of innovative approaches to use in overcoming Nature's stubbornness in such cases.

Nearly two percent of all births in Germany today begin with test-tube fertilization. Up to 30,000 couples per year owe their parental happiness ultimately to this artificial conception, or *in vitro* fertilization - truly a breakthrough in reproductive medicine. In recent years, a number of the physicians at the Schleswig-Holstein University Medical Center have joined the research group of Prof. Klaus Diedrich, to specialize in treatments for women who are unintentionally childless. From this intensive research effort have come a number of new methodologies for artificial fertilization.

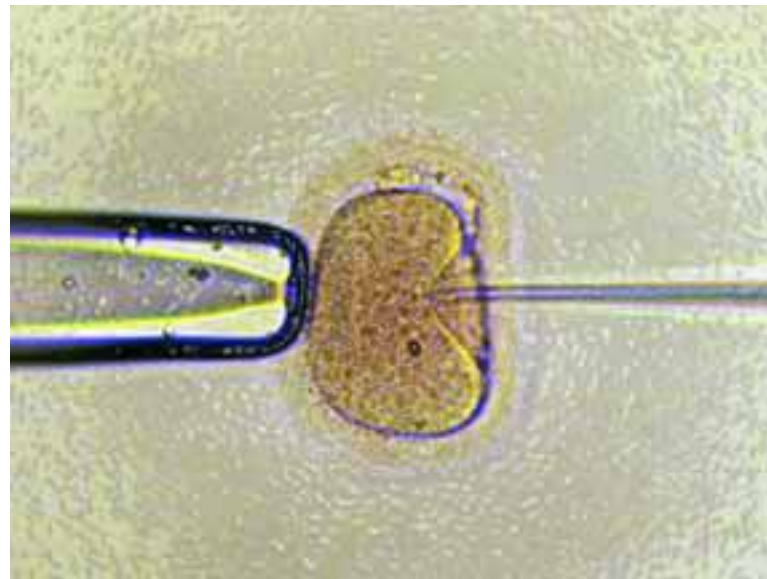
Consideration for the joys of motherhood

Newer drugs, such as the so-called GnRH antagonists, can shorten the duration of this burdensome therapy. In this way, the rather severe side effects on the woman that accompany this intervention can be significantly reduced. In addition, Schleswig-Holstein researchers are participating in an international clinical study for the pharmaceutical company Organon, which seeks to optimize *in vitro* fertilization through a new type of hormone therapy.

Another treatment approach involves the hormone stimulation of the egg cells in the test tube, and not in the woman's body. At the Schleswig-Holstein University Medical Center, the first child to come into the world as a result of this new technique arrived at the end of the year 2005.

A safer, healthier way

Meanwhile, miscarriages can be averted with new diagnostic procedures; Schleswig-Holstein researchers have developed a method for examining the egg cells for genetic defects even before fertilization. This new



More on hope.

Reproductive medicine brings hope for unintentionally childless couples. The picture shows the artificial fertilization of an egg cell.

© Prof. Safaa Al-Hasani, Frauenklinik Lübeck
(Lübeck Women's Hospital)

Particle Therapy Center

Innovative tumor treatments using accelerated elementary particles

technique, referred to as “polar body diagnosis”, helps a family to have a healthy child, even when there are serious genetic defects present. As Klaus Diedrich describes the research, “Our scientific efforts to date have led to increased levels of safety and efficacy for this procedure”.

The goal of fulfilling the wishes of childless couples to have children is also the focus of the Ferring company of Kiel. This company is the world’s largest manufacturer of peptide hormones, and is pursuing the use of its endocrinological/gynecological preparations for treating female infertility.



An embryo is produced from the fertilized egg. © Prof. Safaa Al-Hasani, Frauenklinik Lübeck (Lübeck Women’s Hospital)

Conventional methods of irradiating degenerated tissues can still produce undesirable side effects and damage healthy tissues. In the future, it should be possible to avoid these concomitant actions through the use of a new form of irradiation that is offered exclusively through the Schleswig-Holstein University Medical Center (UK S-H). Particles that travel at half the speed of light can be targeted far more precisely to the tumor. An innovative therapeutic center is being established in Kiel that will service all of Northern Europe.

“It is a mammoth undertaking from both the scientific and financial perspectives, one that will be able to offer cancer patients a new therapeutic approach, centered in Kiel, but serving all of northern Germany and Scandinavia,” says Assistant Professor Dr. Christian Schmidt, speaking of the 140 million Euro project taking shape at the Schleswig-Holstein University Medical Center. This novel approach involves conventional electromagnetic radiation, based on photons, being substituted with protons or heavy ions - particles such as the atomic nuclei of hydrogen or carbon. Based upon the wealth of knowledge acquired to date, this technique brings the hope of an improved treatment for cancer-related diseases, while reducing the side effects and risks of subsequent complications that are often linked with conventional radiotherapies.

Prevailing therapeutic standards support its validity

In this technique, the radiated particles can be delivered more precisely and in smaller doses. Through the use of three-dimensional reconstructions and high-resolution

imaging, it is possible to direct the radiation to the tumor with extremely high accuracy. In addition, the particles exhibit the same radiobiological properties as the photons used in the conventional treatment. For this reason, the validated dosing programs and fractionation schemes can be retained, and this new form of radiation can also be combined in a standardized format with chemotherapy. Another impressive feature is the way in which the healthy tissues that surround the tumor are spared. This leads to the expectation that far fewer complications will subsequently arise with particle therapy than have been observed in the past, primarily with regard to the development of secondary carcinomas in recovered patients and also in the treatment of tumor disorders in children. Initial international studies support the observation that the number of units of radiation can be reduced significantly.

Both public and private commitments have been made

Neither the university nor the government by themselves can realize a challenging project of this type from the economic perspective, so the Schleswig-Holstein University Medical Center (UK S-H) is working together with a number of partners, both from academia as well as private enterprise. Cooperative agreements are in place with the University Medical Centers of Oslo, Kaunas, Odense, Rostock and Hannover for the further optimization of the novel medical technologies as well as for the training of medical specialists to implement them. Negotiations are currently underway with facilities in Lund/Malmö and Greifswald. Moreover, agreements for scientific cooperation and training are being arranged with Harvard University in Boston. The planning, construction and technical operation have been opened up for a pan-European, competitive bidding process, with the ultimate goal of establishing an industrial consortium dedicated to supporting the

project. The Particle Therapy Center, which will also integrate a competency in conventional photon therapy, will be ceded at cost to the UK S-H by this consortium. The University Medical Center has already set up all of the infrastructure requirements in Kiel. The physicians and researchers at the site will manage the overall medical and scientific operations. The irradiation protocols and diagnoses will generally be coordinated from Kiel across borders to the Scandinavian, Baltic and German partners. In this way, the follow-up care for patients at the local sites will be defined in coordination with the therapies delivered in Schleswig-Holstein. This requires a system for the transfer of large quantities of accumulated data, the continuation of which will likewise be ensured through cooperation between the public and private sectors.

A synergy between resources and expertise

“The Particle Therapy Center project is a showcase for how high technology can be used in a partnership that bridges national borders,” says project coordinator Schmidt. The Schleswig-Holstein initiative provides a way for academic institutions in Northern Europe to grow together, and to benefit from a practically ideal type of synergy with the goal of advancing the medical arts. Schmidt: “It only needed the first step to be taken. Now, Schleswig-Holstein has taken this step.”

This Particle Therapy Center fits well within the core theme of oncology at UK S-H; it is a substantial component of the interdisciplinary tumor treatment effort and provides a good environment for the establishment of a Comprehensive Cancer Center at this location. There are six such Cancer Therapy Centers in Germany supported by the Deutsche Krebshilfe (German Cancer Aid) organization.

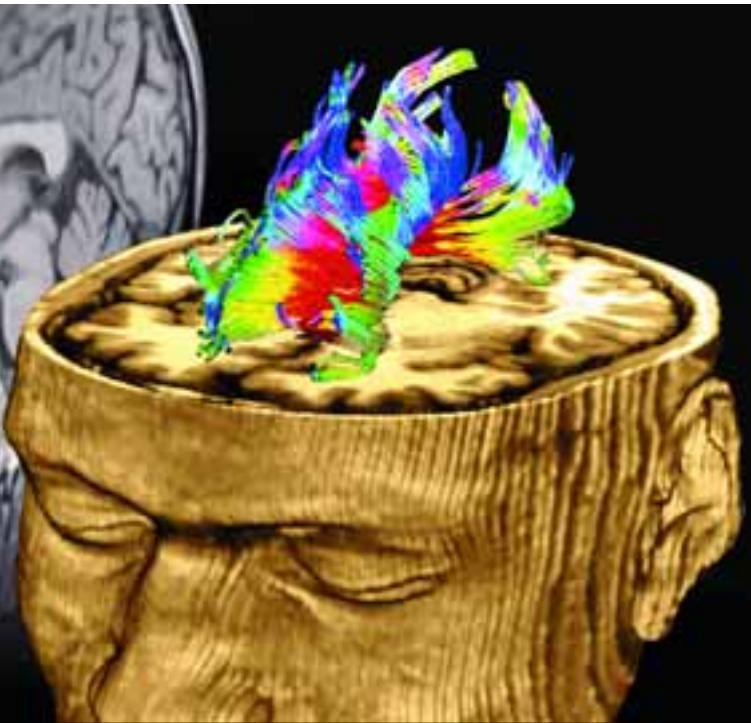
More on therapeutic approaches.

Diagnostic imaging

Taking a look into brain to understand how a person thinks and feels

Observing the brain at work and identifying the functions of its individual regions – ultra high resolution diagnostic imaging techniques afford just such an exciting insight into the complex headquarters of human thought and feeling. The resulting comprehension of the detailed mechanisms found in the

brain gives rise to therapeutic innovations for those suffering from severe brain disorders. For this reason, the collaboration of renowned neurologists from Schleswig-Holstein in the „NeuroImage Nord“ research network offers new hope for patients with strokes, Parkinson’s disease or dementia.



The rigorous networking of recognized experts is a triumph, summarized by Prof. Detlef Kömpf of the University Medical Center Schleswig-Holstein as follows: “The Kiel and Lübeck neurological research sites have stimulated the field of clinical, functional, neurological diagnostic imaging.” The exact depiction of the human brain is only now enabling us to begin to understand how individual regions of the brain function and, moreover, how they malfunction in cases of disease: “We were able to make out areas of the brain which were clearly involved in the perception of stimuli such as sight, touch and hearing, as well as those involved with targeted thought or the formation of memories” added the neurologist, Prof. Günter Deuschl, also from the University Medical Center Schleswig-Holstein.

The findings of this research are extremely important for understanding diseases of the brain. Such diseases substantially reduce the quality of life for those afflicted. In an international study involving patients with genetically inherited Parkinson Syndrome, “NeuroImage” scientists were able to detect disease-related hyperactivity and enlargement of certain areas of the brain. Apparently, the brain seems to compensate for such latent, possibly genetically transmitted, disorders. It was possible for the Schleswig-Holstein researchers to pick up the trail of this mechanism because they were able to measure brain structure and activity during various movements in both affected patients and control subjects, using functional and

This image depicts the Corpus callosum, a fibrous anatomical connection that links the two hemispheres of the brain, enabling communication between the brains, two halves.

© Siemens – press photo

structural magnetic resonance imaging – meticulous scientific labor, which finally resulted in new therapeutic approaches.

Treat patients more effectively

Researchers have also accomplished this for stroke patients. They are being treated at the University Medical Center Schleswig-Holstein with a revolutionary form of video therapy, in which the patients repeatedly view everyday movements such as using a duster or raising a glass – with the result that: their physical dexterity improves considerably. The basis of this innovative therapy stems from new insights into how the brain structures instructions and how it absorbs information from the environment. Newly discovered nerve cells, the so-called mirror neurons, play a central role in these processes. Researchers have proven that these neurons are always equally active, regardless of whether an action is carried out actively or merely observed: “For the first time, we have an explanation for extremely complicated brain functions. We now know that the learning, as well as the recognition of emotions, occurs to a significant extent through observation,” said Günter Deuschl. In Schleswig-Holstein, this exclusive knowledge was gained in the laboratory and directly converted into an effective treatment for stroke patients.

Working together for the good of the patient

Such innovative therapies can only be developed through the close collaboration of specialists, a point on which the Schleswig-Holstein neurology chiefs Kömpf and Deuschl both agree. With the support of the German Federal Ministry of Education and Research (BMBF), the state government and colleagues from the University Hospital Hamburg-Eppendorf, they brought together their expertise and resources in 2002, significantly expanding their research opportunities. “NeuroImage Nord” received a grant of three million Euros from the Federal Ministry of Education and Research; the funds required for the cost-intensive task of acquiring equipment are provided, in large part, by

the German Research Foundation. In light of the success achieved by their neuroscientists, the University Medical Center Schleswig-Holstein has formed state of the art neurocenters. Moreover, this unique, nationwide research network has been able to raise approximately ten million Euros in third-party funds for its scientific endeavors: numerous domestic and international partners are seeking cooperation with Schleswig-Holstein researchers. This is evident in the fact that several scientists from all over the world are working in “NeuroImage Nord” – from the USA, Japan, Brazil and various European countries.

Medical diagnostic imaging is also the primary focus of the company MIE – Medical Imaging Electronics – based in Seeth. For over 25 years, the firm has been



The modern nuclear magnetic resonance imaging technique is not only able to examine the exact structure of the brain in three dimensions, but also to depict the functions of the various regions and their specific anatomical connections in living humans.

© Siemens – press photo

Precision surgery

The precise surgery of internal organs

producing gamma camera devices for use across the entire spectrum of nuclear medicine, including private physician practices, clinics and hospitals. The modified gamma cameras, which incorporate optimal data and image-processing systems, are utilized in scintigraphic diagnostic procedures. As of recently, these diagnostic options have also found their way into the sphere of veterinary medicine. The efficient transfer of technology and the development of innovative products are made possible by intensive cooperation with scientific organizations, such as the Borstel Research Center and the University of Lübeck.



State of the art technology in the operating room

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What has long been considered a given in orthopedics or dental implantation does not yet exist for operative procedures on soft tissues such as the liver, pancreas or blood vessels: precise surgical techniques and technologies that enable the surgeon to operate with extreme accuracy in highly sensitive terrain. An expert team from Schleswig-Holstein – together with academic and industrial partners – is working on just such worldwide innovations.

FUSION is the name of the University Medical Center Schleswig-Holstein's exclusive research program. Their goal is to give new hope to people suffering from one of the most common malignant tumor diseases worldwide: liver cancer. Current forms of therapy are to be replaced by procedures and techniques that enable individualized and highly precise surgery to be performed. To achieve this, Prof. Hans-Peter Bruch and his scientists from the University Medical Center Schleswig-Holstein have brought together more than two dozen clinics, researchers and industrial partners to form a consortium characterized by outstanding expertise and experience in the quality-assurance-controlled development of innovative medical techniques.

Even the most aggressive tumors are combated

Nearly 6,000 people die in Germany each year from hepatocellular carcinoma. Surgical resection and removal of the tumor is the most highly recognized form of therapy. In so doing, the organ must be completely freed of tumor tissue, while simultaneously preserving as much of the critically important organ as possible – unthinkable without precision technology, including minimally invasive instruments for individualized planning, soft tissue navigation and operation. "And this is exactly where there is an opportunity for optimization into a potentially 'softer' form of liver surgery," said Hans-Peter Bruch.

In order to develop such innovative technologies and therapeutic procedures, the interdisciplinary research team has conceived the one-of-a-kind FUSION project: A central aspect of Bruch's and his team's plan is to enable the optimal projection of three-dimensional images onto the operative field. The new techniques are to allow significantly more efficient planning of the operation and will dramatically improve accuracy and safety during the operation itself. Even patients with advanced tumors could be offered such a potential treatment.

The research funds have been bolstered by a grant of 15 million Euros from the German Federal Ministry of Research, and no doubt because the work could be groundbreaking: if the men from Schleswig-Holstein are able to revolutionize the surgery of soft tissues with their innovations, their techniques will also be extended to procedures on the lungs, kidneys or pancreas. This serves to highlight the economic drive for the project. "The market for such specific systems is large and mostly undeveloped," said Bruch. "This offers Schleswig-Holstein the chance to ensure itself a long-lasting advantage in international competition."

Using intelligent instruments to feel the organs

The chances of this happening are good. Hans-Peter Bruch has optimally activated existing resources: Leading mathematicians from the fields of chaos and fractal research, outstanding navigation technicians and other renowned research groups from all over Germany are paving new ground in the development of surgical instrumentation. The innovative new technologies will improve the dexterity and mobility of the sur-

geon, not least „because he will be able to feel the texture of the organs accurately through the new instruments," Bruch raved, when speaking about the new generation of equipment. An intelligent laser has also found a place in the FUSION scientists' research agenda. These will automatically detect blood vessels and then even have the ability to seal them or automatically shut down to avoid unintentionally injuring larger vascular structures.

The embodiment of networking

The researchers develop their specific individual technological components at their own locations and then integrate them in their own designated operation room in the University Medical Center Schleswig-Holstein. In addition to the academic élite, Hans-Peter Bruch has



Microscope being used during an operation – An expert team from Schleswig-Holstein hopes to develop more precise surgical techniques and technologies for procedures on soft tissues.

© press department and public relations, UK S-H

been able to bring together leading manufacturers of medical technology like Dräger, Siemens and KARL STORZ, as well as smaller, highly specialized corporations like Söring, Bauer & Hässelbarth, WaveLight, Poly Dimension and LOCALITE to help develop the novel OR systems: "In the end, our research association intends to provide certified prototypes of the various operative and navigation modules for use in clinical applications."

A focus on precision surgery by medical technology corporations

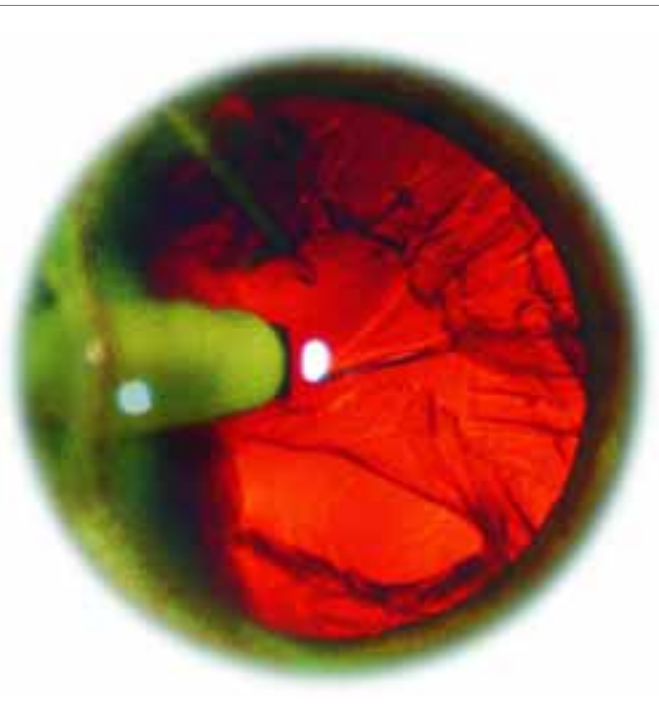
Precision surgery, optical OR instrumentation and implant development are important focal points for the medical technology corporations in Schleswig-Holstein.

Ethicon GmbH is one of the largest subsidiaries of Johnson & Johnson, which has offices in 57 countries; in the health care field, Ethicon is their largest subsidiary. In Norderstedt, Ethicon has the world's largest and most modern production facility for surgical suture material, needles and resorbable implants. They are the market leader in the development and production of products for wound closure, of implants and of many other operative therapy procedures. Over 1,000 staff members are involved in production. Furthermore, Ethicon operates the only research center in the world for products and procedures for use in hernia surgery.

Möller-Wedel develops and manufactures surgical microscopes of the highest quality and with targeted construction for use in the fields of eye-surgery, neurosurgery, dentistry, otolaryngology and reconstructive surgery.

ESKA Implants GmbH & Co. KG and TiJet are active in the area of implant development.

ESKA Implants, based in Lübeck, develops and manufactures artificial joint replacements for basically every joint in the upper and lower extremities, as well as for the vertebral column. Most notably, they provide individually crafted, custom constructions on short notice.



Cataract operation in which the opaque lens is being penetrated. The procedure is performed under a surgical microscope, as this is the only way in which the delicate structures can be recognized and the incisions made with adequate precision.

© Möller-Wedel

Molecular imaging

MOIN has the expertise,

MIC brings it to commercialization

TiJet Medical Technology develops and manufactures titanium implants using a specially-developed, metal injection molding procedure (MIM). This know-how is based on long-standing collaborations carried out with research facilities, in which the established processes of MIM-technology was further developed for use with titanium products. For the first time, this allowed complex components to be manufactured from titanium alloys that retained the exceptional mechanical properties of the starting material.

The Stryker Corporation is a worldwide leader in the orthopedic and medical technology markets. Stryker Trauma, based in Schönkirchen / Kiel, is responsible for the research, development and production of intramedullary implants. The concern's product range is supplemented by endoprosthetics, devices for surgery of the vertebral column, instruments, craniofacial surgery equipment, as well as endoscopy systems. An additional focus is being made in the areas of biotechnology, navigation and emergency medical treatment.

H.C. Hartwig Feinwerktechnik, based in Lentförden, develops and produces articulated arm systems that are chiefly employed in minimally invasive surgery and in the therapy of prostate cancer. Because of the modular construction nature of these systems, they can be offered for many other applications, as needed by the individual customer.

Together, Schleswig-Holstein and Hamburg are collaborating on an interregional project to promote new developments in molecular imaging procedures. In March 2005, the University Medical Centers of Schleswig-Holstein (UK S-H) and Hamburg-Eppendorf (UKE) initiated a project together with their technology partner, Philips, for the diagnosis of serious illnesses such as cancer and Alzheimer's Syndrome. Known by the abbreviation MOIN (Molecular Imaging North), this collaboration combines the medical fields of tumor and vascular diseases, transplants and senile dementia with the corresponding imaging facilities at



More on precision.

Radiolabeled glucose is frequently used in Positron Emission Tomography. An abnormal concentration of the energy-rich sugar appears white in the image. This can indicate a tumor or neurological disorder. (The white representation of the brain and urinary bladder are normal.)

© Philips AG

both University Medical Centers. Within the framework of this project, diagnostic procedures are being further developed and combined - from magnetic resonance tomography through positron emission tomography to the use of special contrast agents.

The goal of this project is the development of a technology platform for molecular imaging by means of nuclear spin tomography and nuclear medical procedures.

The technology platform will include three essential components:

New quantitative measurement and evaluation procedures for molecular imaging;

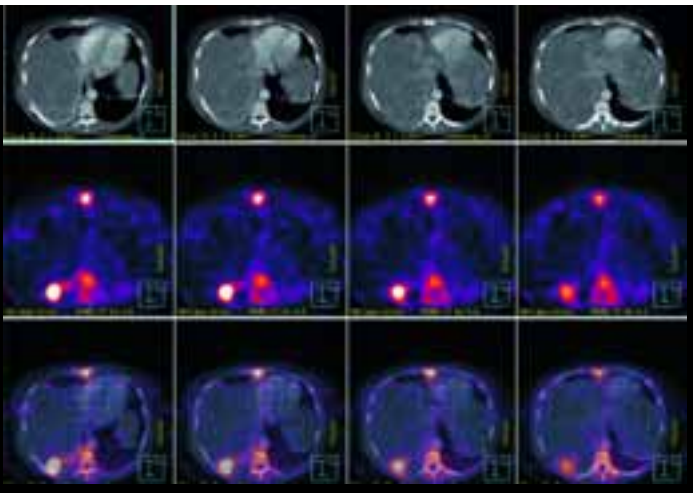


Image of the upper abdomen (on the left is the liver, and the spleen is to the right). Of interest here is the white region in the lower left portion of the liver.

Upper row: Computer tomography image

Middle row: SPECT image

Lower row: SPECT and CT images superimposed

By combining the two procedures, one can obtain an exact spatial image (from the CT) together with metabolic information (from the SPECT).

© Philips AG

New dedicated contrast agents for molecular imaging with MRT, PET and SPECT;

Pre-clinical and clinical trials for the evaluation of newly developed quantitative measurement procedures and dedicated contrast agents for molecular imaging with MRT, PET and SPECT.

The focused linkages between the existing activities of the individual partners will make personnel resources, know-how and technological options mutually available to both medical centers, creating a collaborative structure in the area of molecular imaging that has never before been realized in Germany. Prof. Gerhard Adam (UKE) and Prof. Claus-C. Glüer (UK S-H) have undertaken the leadership of this major project together. This collaboration is supported from a 3.4 million Euro fund, with half contributed by each region.

The MOIN partners

The main focus of the project participants from the Schleswig-Holstein University Medical Center, in addition to the further development of the tomographic methods in collaboration with the UKE, lies in making new advances in optical and fluorescent procedures and in their combination with other imaging techniques, primarily for use in the pre-clinical development of new diagnostics and therapeutics. In addition, both UK S-H and the Christian-Albrechts-Universität in Kiel maintain a high level of competence in the identification and development of new functionalization entities (antibodies, ligands, etc.) for the design of the corresponding specific, target-linked, contrast-enhancing agents for modern molecular imaging.

At UKE, interdisciplinary research in the area of molecular imaging takes place in close proximity to the clinical users. In addition to the clinic and polyclinic for diagnostic and interventional radiology, as users and co-developers of the imaging procedures, UKE has at its disposal the research group of Prof. Mester, with acknowledged expertise in the areas of nuclear medicine and contrast

Hepatitis C and SARS

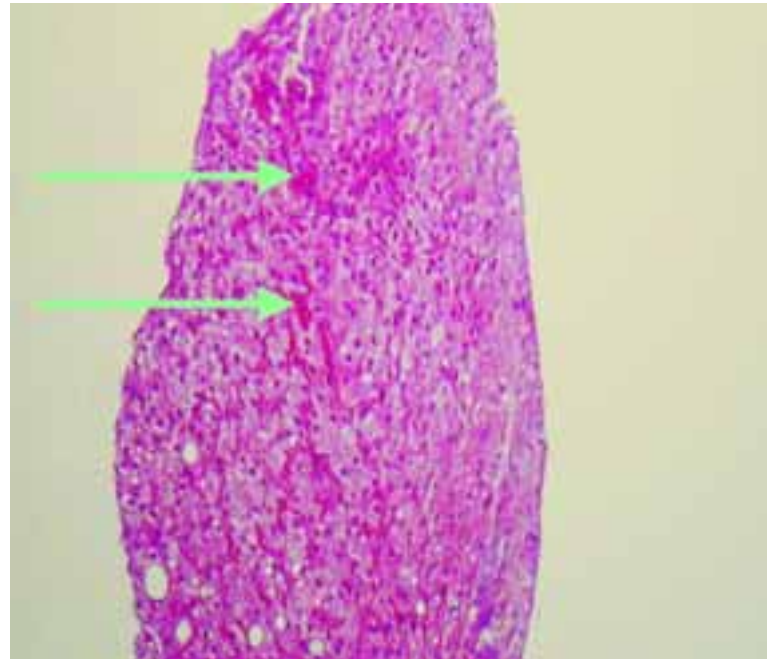
Understanding the plagues of the modern-day

agents for ionizing radiation imaging. Here, the close coordination with the cell biologists at the UKE Transplant Center comes into play, primarily in the formulation of approaches to cell tracking through the use of the corresponding therapy-relevant stem cells. The corresponding results at the animal experiment stage will have a significant impact on the applications, for example, for cell transplants in approaches to cardiologic diagnoses. These cell transplants and applications are already at an advanced stage of development as therapeutic alternatives, and are being tested in clinical trials in a variety of locations such as the UKE Heart Center and Cardiology Clinic.

MIC brings competencies to commercialization

The pathway for utilizing the findings accumulated in the MOIN effort has already been laid out. For example, the Molecular Imaging Center (MIC) is in the process of commercializing the applicable procedures and molecular contrast agents that have grown out of the MOIN Project. A positive synergy has emerged here for the application of such procedures in the pre-clinical and animal experiment stages in the development of new therapeutic systems. Pharmaceutical developers have already indicated interest in using these modern imaging procedures to obtain sufficient data from in vivo studies at much earlier stages in their own research programs. They are pursuing the goal of, the option to use these procedures later on, from the perspective of diagnostic and therapeutic aids in combination with a newly developed medicine. Even for development approaches such as these, the MIC is ready to offer services and products from the developments and findings coming from the MOIN Project.

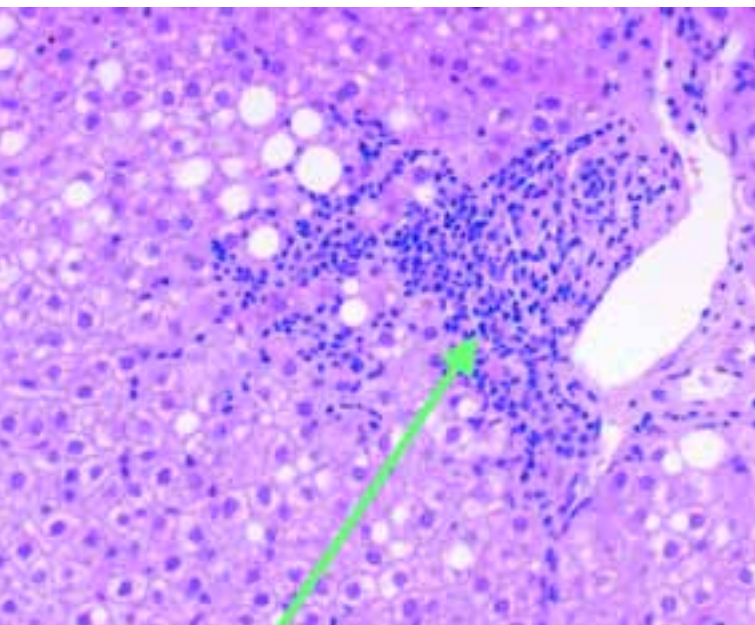
Until 1997, scientists were unable to identify the aggressive virus responsible for most cases of liver cirrhosis or cancer. Up to that point in time, the disease had often been fatal. Since then, however, it has become possible to save most patients with the help of so-called protease inhibitors. This medication was also developed for use against the SARS virus, which first arose in the year 2003: modern anti-viral agents, resulting, in large part, from the work of Schleswig-Holstein's researchers are – a milestone in the history of medicine.



Scar formation (fibrosis) in chronic hepatitis C

© Dr. Holger Hinrichsen, Kiel

Worldwide, infection with the hepatitis C virus is the leading cause of rapidly progressive, chronic diseases of the liver. One percent of the German population is affected. Historically, patients had suffered for long periods before a medication was found which displayed any effect whatsoever. Since 2004, the story has changed. Schleswig-Holstein researchers and the pharmaceutical conglomerate Boehringer-Ingelheim collaborated to develop a method that pharmacologically inhibits the replication of the virus in the body. With the help of a so-called serine-protease inhibitor, the viral load falls significantly within two days. The earlier prevailing standard therapy was only able to achieve comparable effects after twelve hours, if at all. Further derivatives of this innovative new agent have now also been created. These are undergoing suitability testing at the State's University Medical Center. "This is ground-breaking work," explained Prof. Ulrich Fölsch from the University Medical Center Schleswig-Holstein.



Inflammatory infiltrate in the region of the portal field in chronic hepatitis C.
© Dr. Holger Hinrichsen, Kiel

Combating the SARS virus as well

In 2003, a new disease-causing agent arose together with the SARS-corona virus in Southern China and began to spread rapidly: the so-called bird flu, or avian influenza. The highly contagious virus caused the severe acute respiratory syndrome (SARS), resulting in the death of 15 percent of those developing symptoms. Nobody knows if and when SARS will occur again. "It would certainly be unwise to not be prepared for a renewed outbreak," explained the structural biologist Prof. Rolf Hilgenfeld from the University Medical Center Schleswig-Holstein. He and his team exclusively determined the structure of the SARS protease during the last outbreak, which occurred three years ago, and suggested the first inhibitors. Since then, the design of new protease inhibitors with antiviral effects has been the subject of vigorous research in Schleswig-Holstein. These new protease inhibitors also show good levels of effectiveness against other viruses such as the coxsackie virus, which can lead to inflammation of the heart, particularly in children.

Experience has shown – the focus on hepatitis pays off

While the anti-SARS project is still in the stages of initial research, the hepatitis C protease inhibitor has already completed clinical trials. In Kiel's specialized hepatitis outpatient clinic alone, 2,000 patients are currently being treated each year, and numerous clinical studies are carried out. And now, together with the Robert-Koch Institute, the virus specialists in northern Germany intend to decipher the structural mechanisms by which human beings develop liver diseases. With the help of a grant from the German Federal Ministry of Research, a project in Schleswig-Holstein is analyzing the genetic characteristics of hepatitis patients. "We are trying to

identify the genetic factors responsible for inducing the disease,” said Fölsch’s colleague, Assistant Professor Holger Hinrichsen.

Regeneration instead of transplantation

The goal of all research efforts is also to treat patients as gently as possible, and, in particular, to develop alternatives to replacing damaged organs. This is why the specialists working with Ulrich Fölsch and Holger Hinrichsen are operating in close contact with the transplant surgeons. They are working together to determine whether stem cells from patients are capable of returning severely damaged livers back to working order. The goal is to reduce the number of risky transplantations being performed.

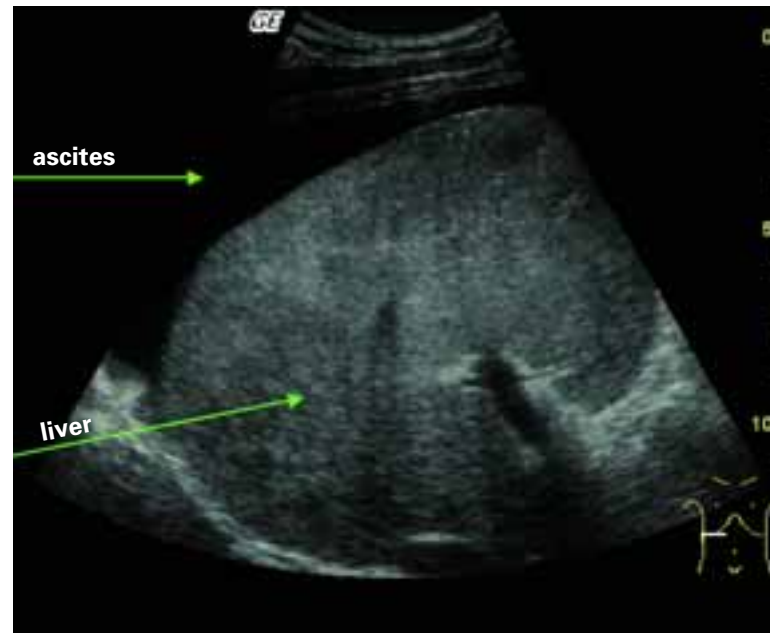
National and international networking initiative

In the year 2002, a nationwide hepatitis C research association was founded: the “Competence Network” – which was, in no small part, the result of the intensive efforts of the university researchers in Schleswig-Holstein. Together, they have developed novel designs for diagnostic and therapeutic procedures for liver diseases. The anti-SARS basic research is also jointly underway in two large EU projects with funding on the order of 15 million Euros. And industry partners are also taking part: The Schleswig-Holstein virus researchers are cooperating intensively with domestic and international corporations including Roche Diagnostics, Bayer Healthcare and Novartis, as well as the US firms Schering-Plough and Vertex Pharmaceuticals.

Corporations in Schleswig-Holstein are also involved with the diagnostics of viral diseases: for example, EUROIMMUN AG in Lübek and eBiochip Systems in Itzehoe.

eBiochip Systems utilizes a proprietary platform technology based on electronic biochips, and produces analysis devices for special biotechnological applications, including clinical diagnostics for hepatitis C, avian influenza and antibiotic-resistant, nosocomial bacteria.

Together with the Robert-Koch Institute in Berlin and a few other research facilities, EUROIMMUN has developed and marketed the first diagnostic procedure for detecting the SARS virus in serum. This is now being used in all of the important centers that are involved with this disease, and is helping to prevent new outbreaks.

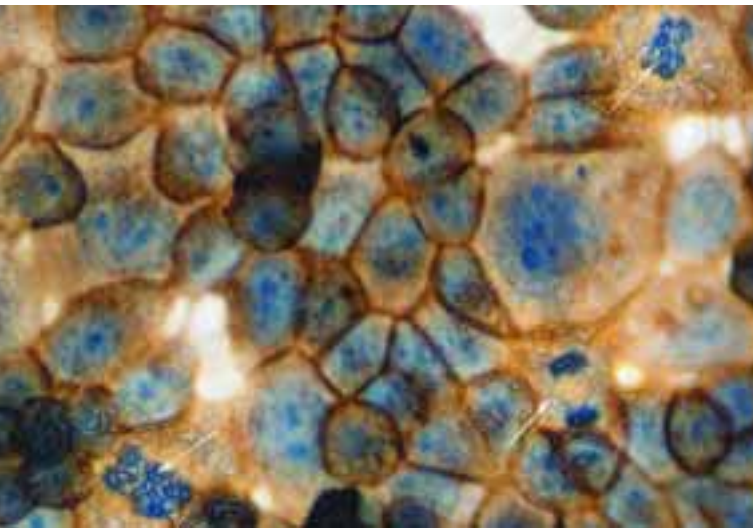


Ultrasound image of the liver – severe liver cirrhosis in chronic hepatitis C with ascites. © Dr.Holger Hinrichsen, Kiel

Interdisciplinary Cancer Research

Integrated approaches
for tumor treatment

Individually tailored treatment systems, innovative research approaches and sensitive psychosocial support - there is scarcely any other illness in which such a balanced program of care is so desirable as in patients with a diagnosis of cancer. A cooperative network of licensed physicians and hospitals can work to fulfill this wish with an integrated therapy



The picture shows the ovarian carcinoma cells of a cell line from the primary tumor material. The cells have been stained with an antibody. Counterstaining has been used to visualize the cell nucleus in blue. The classic, brick-like growth pattern for cancer cells of epithelial origin can be recognized in this picture; the contact inhibition has been overridden, and the cells grow over each other to some extent. The arrow indicates cells that are undergoing division.

© Prof. Norbert Arnold, Kiel

program. Schleswig-Holstein provides the structural framework to make such a program a reality.

“We want to provide more patients with access to therapies that are effective and targeted, while at the same time gentle,” say the physicians and researchers who are responsible for this ambitious project in the university and its medical center; the program combines basic research with modern therapies, in-depth follow-up care and palliative treatment together in a single, comprehensive organization. This type of concerted approach to cancer research and therapy is already well-established in the USA, and also provides a platform from which to acquire new knowledge about malignant tumor disorders. Taking the lead in Germany, a fundamentally new interface between innovative cancer research and clinical patient care has now been realized in Schleswig-Holstein.

Achieving a comprehensive understanding of cancer

The Kiel facilities provide the perfect location for this new venture; its world-renowned competence in oncology, its existing ultramodern diagnostics and therapy units, in addition to its being the home of the Proton Therapy Center, all form the basis for an ideal integrated tumor treatment facility. Moreover, in contrast to the usual pattern of German tumor centers that have a narrow focus on treatments while leaving patient care to their affiliated practices and outpatient clinics, the Schleswig-Holstein University Medical Center focuses broadly on integrated care for the patients, with the goal that all cancer patients should be treated with individualized diagnostic plans and therapeutic strategies. These will be developed from a wide-ranging study that fol-

Norgenta

Support for cooperation
between research and industry

lows the guidelines of the German Cancer Society, which will also ensure an uncompromising approach to quality control. In addition, the new Cancer Center will not only implement the fundamental research findings in treatments delivered to the hospital bed, but at the same time the data on treatment efficacy and patient response can be fed back into the research effort. The Schleswig-Holstein network will provide the opportunity to put all of the existing methodologies to the test as a way to develop innovative approaches to fighting cancer.

However, it doesn't end here; there are a number of medical and pharmaceutical companies that operate in Schleswig-Holstein, in the manufacture of tumor diagnostics as well as antitumor drugs and medications.

Based in Wedel, the Medac company develops, produces and markets therapeutics and diagnostics for a number of indications such as oncology, hematology, urology and autoimmune disorders. Their diagnostics division offers products for the detection of bacterial and viral infections as well as for tumor and bone metabolic markers.

Also based in Wedel, the Oncoscience company is active in the field of oncology with the investigation of rare diseases and the improvement of the corresponding therapeutic options. A monoclonal antibody co-developed by Oncoscience is currently in the final phase of clinical evaluation for brain tumors in children.

In addition, the pharmaceutical company AstraZeneca, a global leader in the exploratory drug industry, headquartered in Wedel, develops, produces and markets drugs and medications, for example in the therapeutic area of oncology, particularly for the treatment of breast and prostate cancer.

Norgenta – Norddeutsche Life Science Agentur GmbH (North German Life Science Agency) – is the inter-regional marketing and service organization of Hamburg and Schleswig-Holstein for the support and coordination of life science in Northern Germany. This agency links together the competencies of companies, universities, research institutions and hospitals. It initiates and supports innovative projects that contribute to the economic and scientific profile of the region. In this way, the expertise and know-how of the North German universities and research institutions are directed toward the development and commercialization of new products. The goal of Norgenta is to foster the growth of the region and surrounding area into a leading location for life-sciences research and commercialization on an international scale.

The missions of Norgenta include:

Networking

To bring together and coordinate the activities of the partners in the scientific, economic and political arenas;

To build upon and support local networks;

To promote selected bi- and multilateral collaborations with the life science organizations of other regions.

Promotion

To promote innovative collaborative projects in the areas of medicine, medical technology, biotechnology and pharmaceuticals;

To attract funding for the support of life science projects at the EU, national and regional levels.

Marketing

To disseminate information on the regional life sciences capabilities at trade fair presentations within Germany and internationally;

To support and organize regional life science meetings;

To produce content for various forums for dialog and informational exchange, both off- and online; for example, the magazine "Life Science NORD (Life Science North)".

Life Science NORD – a region takes shape

The life sciences are an important part of the future for the Hamburg and Schleswig-Holstein regions. Close cooperation between them is bringing together the existing potential in the areas of medicine, medical technology, biotechnology and pharmaceuticals in northern Germany to form a Life Science Cluster that is competitive at the international level. Start-up companies, established major corporations, internationally renowned research institutes, universities and targeted collaborations are ready today to offer a high level of competence in fields such as molecular diagnostics, cell biology and drug discovery, as well as in the areas of biobanks, imaging and e-health. Moreover, the promising interdisciplinary technologies of the future, such as nanomedicine and bioinformatics, are becoming established in these regions.

Contact

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More on support.



...at the pharmaceutical company **NORDMARK GmbH & Co. KG**, in Uetersen. Once the expansion is complete, the snake farm will be able to accommodate up to 1,500 snakes. A drug called **ancrod** is derived from the venom gland secretions of the Malaysian pit viper (photo). This substance is currently being tested worldwide in clinical phase III trials for cerebrovascular accidents (stroke). © **NORDMARK**, Uetersen

More on economics.

SCHLESWIG-HOLSTEIN

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