Deutsches Krebsforschungszentrum

German Cancer Research Center
in the Helmholtz Association


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The German Cancer Research Center at a glance

With over 450,000 new cases diagnosed and 270,000 deaths every year, cancer is one of the most dreaded diseases and the second most common cause of death in Germany.

Scarcely any other disease poses such challenges for researchers. Practically any organ can be affected, no two cancers are alike, and even tumors of the same organ differ from patient to patient.

The German Cancer Research Center (DKFZ) is the largest biomedical research institution in Germany. Our scientists in more than 60 different divisions and Junior Research Groups investigate how cancer develops and endeavor to identify cancer risk factors. In doing so, they lay the groundwork for novel approaches to cancer prevention, diagnosis, and treatment.

Over the past few years, the scientists of the German Cancer Research Center have made decisive progress both in basic research and in developing new forms of diagnosis, treatment, and prevention. The work of Harald zur Hausen has won widespread recognition. Having been the first to spot the link between an infection with human papillomaviruses and cervical cancer, he was awarded the Nobel Prize for Medicine 2008.

The center is a member of the Helmholtz Association of National Research Centers, Germany's largest research organization. Ninety percent of its funding comes from the Federal Ministry of Education and Research and the remaining ten percent from the state of Baden-Württemberg.

What are you doing to at last make the treatment of cancer more effective? What are you doing to improve early detection? What are you doing about cancer prevention?

We at the German Cancer Research Center are often asked questions such as these. And we would now like to answer them by opening the doors of our labs and inviting you to take a look at some of our most exciting research projects. See for yourself what we are doing to better understand cancer, to prevent more cases of cancer in the future, to diagnose tumors sooner and with greater precision, and to improve the chances of recovery with innovative forms of treatment.

Some of the research projects presented here are already far advanced and the substances and methods developed in our labs are already being put through their paces in clinical trials. Translating laboratory findings into clinical practice is a matter especially close to our heart and we are working intensively on speeding up this process. But we need strong partners, too. After all, research projects in the life sciences these days are often on a scale that would far exceed the capacity of any single institution.

We are fortunate in being able to draw on the support of national and international networks of high-caliber partners. Our close cooperation with all the Heidelberg University Hospitals in the National Center for Tumor Diseases (NCT), our strategic alliances with companies such as Siemens and Bayer Schering, and HI-STEM, a new kind of public-private partnership for researching stem cells, are all examples of this.

Our excellent and highly motivated employees are of course our greatest asset. In order to compete successfully among the world's top researchers, they have to perform at a consistently high level. Our job is to support them in every way we can, including by providing an adequate working environment. Following the comprehensive modernization of our main building, they now have state-of-the-art laboratories at their disposal. This is an essential precondition for winning the best minds in the business and pursuing a strategic research spectrum. Our system of Junior Research Groups has enabled us to seize on promising new departures in cancer research, while at the same time investing in brilliant young scientists.

We are deeply grateful both to the German government and to the state of Baden-Württemberg for their generous ongoing support of the German Cancer Research Center. Yet the sheer complexity of cancer is such that it calls for external input as well. A few years ago, we set up an Advisory Council to enable us to draw on the support and advice of patrons, private enterprise, institutions, and private individuals. The council is made up of policymakers, business people, and other leading personalities who with their invaluable experience and excellent contacts are helping us to develop and implement key strategies, to nurture new relationships, and to deepen existing ones, as well as gaining additional support.

Cancer research is currently in a revolutionary phase. Targeted drugs which act specifically against tumor cells have already become the standard therapy in some areas. Effective forms of prevention are also available. Among these is a cancer vaccine that rests on the research findings of Harald zur Hausen, who was for many years Chairman of the German Cancer Research Center and in 2008 was awarded the Nobel Prize for Medicine. Numerous other research findings from our labs are so far advanced that patients will soon be benefiting from them. We therefore saw this as an opportune moment to give you a glimpse behind the scenes and so win your support for the German Cancer Research Center—because cancer concerns us all.

PROF. DR. OTMAR D. WIESTLER
Chairman and Scientific Director

DR. JOSEF PUCHTA
Administrative-Commercial Director


Immunology
Prevention
HI-STEM
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7 Tesla MRI System
NCT Heidelberg
Strategic Alliances
Cancer Information Service

What are we doing to combat cancer?
Some examples from our research

The German Cancer Research Center website offers extensive and up-to-date information about cancer research. For further details about our research projects, please note that the link provided at the end of each contribution will take you directly to related articles.

What are we doing to prevent cancer?

We are improving vaccination against cervical cancer

Some strains of human papillomaviruses (HPV) cause cervical cancer. This connection was discovered by Harald zur Hausen, who for many years was Chairman of the German Cancer Research Center and in 2008 received the Nobel Prize for Medicine for his discovery. Zur Hausen's work was instrumental in creating vaccines to protect women against the development of cervical cancer.

Better and cheaper—these are the twin targets for the second-generation vaccines already being developed at DKFZ. The first cancer vaccine consists of a viral protein that binds together to form protein capsules. For the immune system, the capsules are almost indistinguishable from the genuine virus, but since they do not contain any DNA they do not cause infection. They are difficult to produce, however, and the vaccine is so sensitive that it constantly has to be kept cool. Unfortunately, this makes it unaffordable in precisely those Third World countries in which it is needed most urgently.

Lutz Gissmann and his team at DKFZ have now discovered that vaccination works well even with simpler viral proteins. The protein complexes can be produced in undemanding bacteria and can be kept unrefrigerated. Better still, today's vaccines are directed against the viruses themselves. They provide protection against infection and the subsequent development of cancer, but only if vaccination takes place before first contact with the pathogen. They are not effective against cells that have already been infected by the virus or that have degenerated into cancer. The cancer cells themselves remain invisible for the body's immune system. For the second-generation vaccines, therefore, DKFZ scientists are incorporating additional proteins to focus the immune response on the cancer.

The new generation of vaccines will not only be cheaper but will kill two birds with one stone—preventing cancer and at the same time treating early forms of the disease.

www.dkfz.de/en/f020

We are protecting people against tobacco smoke

Cancer, cardiovascular disease, respiratory tract conditions—the list of tobacco-related illnesses is as long as it is unpleasant. Even worse is the fact that smoking not only damages the smoker's own health, for which he or she must take responsibility, but that it also endangers the health of passive smokers who happen to be nearby.

What are we doing about this? The DKFZ team headed by Martina Pötschke-Langer supplies scientific facts about the health-related and economic consequences of smoking. In addition, DKFZ provides recommendations for measures that have already proven effective in protecting the health of smokers and non-smokers alike.

One such measure is an increase in tobacco tax, it having been demonstrated that smoking declines as the price of tobacco rises. A ban on tobacco advertising also has the effect of reducing cigarette consumption. Children and young people are the main beneficiaries of such a ban, as they are far more susceptible to advertising than adults.

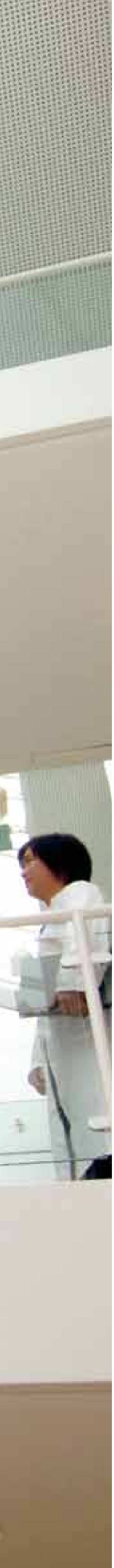
In Germany, 386 million cigarettes go up in smoke every day—most of them indoors. The smoke of every single cigarette contains more than 4,800 chemicals, including numerous carcinogenic substances. Tobacco smoke becomes embedded in walls, floors, and furniture and from there is constantly emitted into the ambient air. Rooms in which people have been smoking are therefore a permanent source of danger—and ventilation is not the answer!

Our key demand has always been for smoking to be banned in all public buildings, all public transport, and all restaurants. Such a ban would lessen the impact of passive smoking and help smokers to reduce their cigarette consumption or even quit smoking altogether.

We have already had some success in this endeavor. In the summer of 2008, Germany's Constitutional Court confirmed the position of the German Cancer Research Center and defined protection against passive smoking as an "eminently important goal for society." It is now up to the German states to translate the protection of non-smokers into loophole-free legislation.

www.tabakkontrolle.de


What are we doing to improve cancer treatment?



We are irradiating cancer more accurately

The objective of radiation therapy is simple: it aims to give the cancer a deadly dose of radiation without harming the healthy tissue surrounding it. While this works very well for tumors in an uncomplicated location, problems arise if the cancer is bordering on or even surrounding tissue that is sensitive to radiation.

Sometimes the tumor may even change its position in the body. Tumors change their position for various reasons, depending on the type of cancer. Tumor volume can change in the course of radiation, for example, or—as is often the case in prostate cancer—the degree to which the bladder or colon is filled may cause the tumor to shift. For lengthy courses of radiation treatment, therefore, the radiotherapists at DKFZ use computer tomography to check the position of the tumor. They do this every day, if necessary; after all, the beam may have to be directed close to highly sensitive tissue, whose destruction would have serious consequences for the patient. This makes it all the more important that even slight shifts in the position of the tumor are ascertained prior to radiotherapy.

Therapy becomes even more accurate if the beam can be adjusted to the moving tumor even during treatment, in other words if the beam can be made to track the tumor. DKFZ scientists in the team headed by Wolfgang Schlegel have been involved in the development of Artiste, a combination of X-ray tube and linear accelerator. With the help of a computer-controlled deflector made of tungsten leaves—a so-called "multileaf collimator"—the beam of Artiste uses X-ray images to track the tumor's movements.

One special challenge for researchers is that posed by rapid and large respiration-induced movements during the image-guided radiotherapy of lung tumors. Thanks to rapid X-ray imaging, here, too, it is now possible to track tumor movement in real time and immediately adjust the irradiated area. Using models that simulate the physical properties of various types of tissue, scientists are testing this method for use in practice so that image-guided therapy can benefit cancer patients as soon as possible.

www.dkfz.de/en/medphys

We are supporting the immune system in the battle against cancer

The greatest danger in cancer is posed not by the primary tumor as a rule, but rather by its metastases—the cancer lesions that spread to other areas of the body. Individual cancer cells separate off from the tumor and are deposited in other organs such as the lungs or the liver, where they develop into new tumors.

While surgeons can do little to stem this spread, these lone tumor cells are perfect prey for the immune system. So how can we make the body's immune defenses more aware of them?

Cancer cells often spread into the bone marrow, where they attract the attention of the immune system's memory cells. These memory cells will "remember" the suspicious intruders for years after initial contact. Philipp Beckhove has discovered memory cells that "remember" cancer cells in the bone marrow of patients with different types of cancer.

Together with physicians from Heidelberg University Women's Hospital, Beckhove designed a pilot study to investigate whether memory cells can activate the body's own defenses against cancer. The scientists removed bone marrow from women with advanced breast cancer, isolated the memory cells from it, and refreshed the cells' "memory" of the breast cancer.

After being returned to the patient's body, it is the job of the memory cells to make the immune system produce anti-cancer immune cells to patrol the body on the lookout for tumor cells.

It is hoped that a clinical trial being prepared in Heidelberg will show whether these immune patrols can "disarm" single metastasizing breast cancer cells. The combat-ready immune cells may even be able to wipe out the tumor's long-lived stem cells. These stem cells are thought to be the root of all evil, being responsible for the return of the tumor and for metastases that develop even years after the initial disease.

www.dkfz.de/en/translationale-immunologie


What are we
doing to pioneer
new types of
treatment?

We are searching for new targets in cancer therapy

Modern cancer drugs are “targeted”, meaning that they act specifically on protein molecules that are characteristic of a tumor. These characteristic proteins evolve when genetic mutations, which occur with increasing frequency as cancer develops, alter these proteins.

In recent years, scientists have discovered far more DNA mutations in some types of cancer than was previously supposed—and consequently more targets for innovative medicines. However, it is also clear that no two cancers of the colon nor any two breast cancers are alike. Many characteristic genetic mutations are seen only in some patients with the same type of cancer, while others are found in several different types of cancer.

Scientists now plan to obtain a complete overview of all the genetic mutations characteristic of cancer. This would enable them to find out whether certain patients might benefit from a combination of several targeted medicines. The researchers have set themselves a gargantuan task. Teams all over the world will be involved in decoding the genome of 500 samples each of the 50 most common types of cancer. And as if that were not enough, the huge project will be made still more complex by the fact that the cancer cells will have to be compared with healthy cells from the same person, if the mutations characteristic of cancer are to be identified. This increases the number of samples to be examined to 50,000.

So far, scientists from 22 countries have joined the International Cancer Genome Consortium. The partners have divided the study of the different types of cancer among themselves, so that researchers in Germany are to concentrate on analyzing cancer in children. The scientists in the DKFZ department headed by Peter Lichter have already made significant advances in the study of brain tumors in children. DKFZ researchers expect especially rapid results for these diseases—and with them the promise of better forms of treatment for the children affected.

www.dkfz.de/en/genetics

We are developing viruses to treat cancer

Viruses—which are live molecules rather than true living organisms—have talents that physicians would dearly like to use. They are especially good at gaining access to cells and can even smuggle in additional genes together with their own DNA.

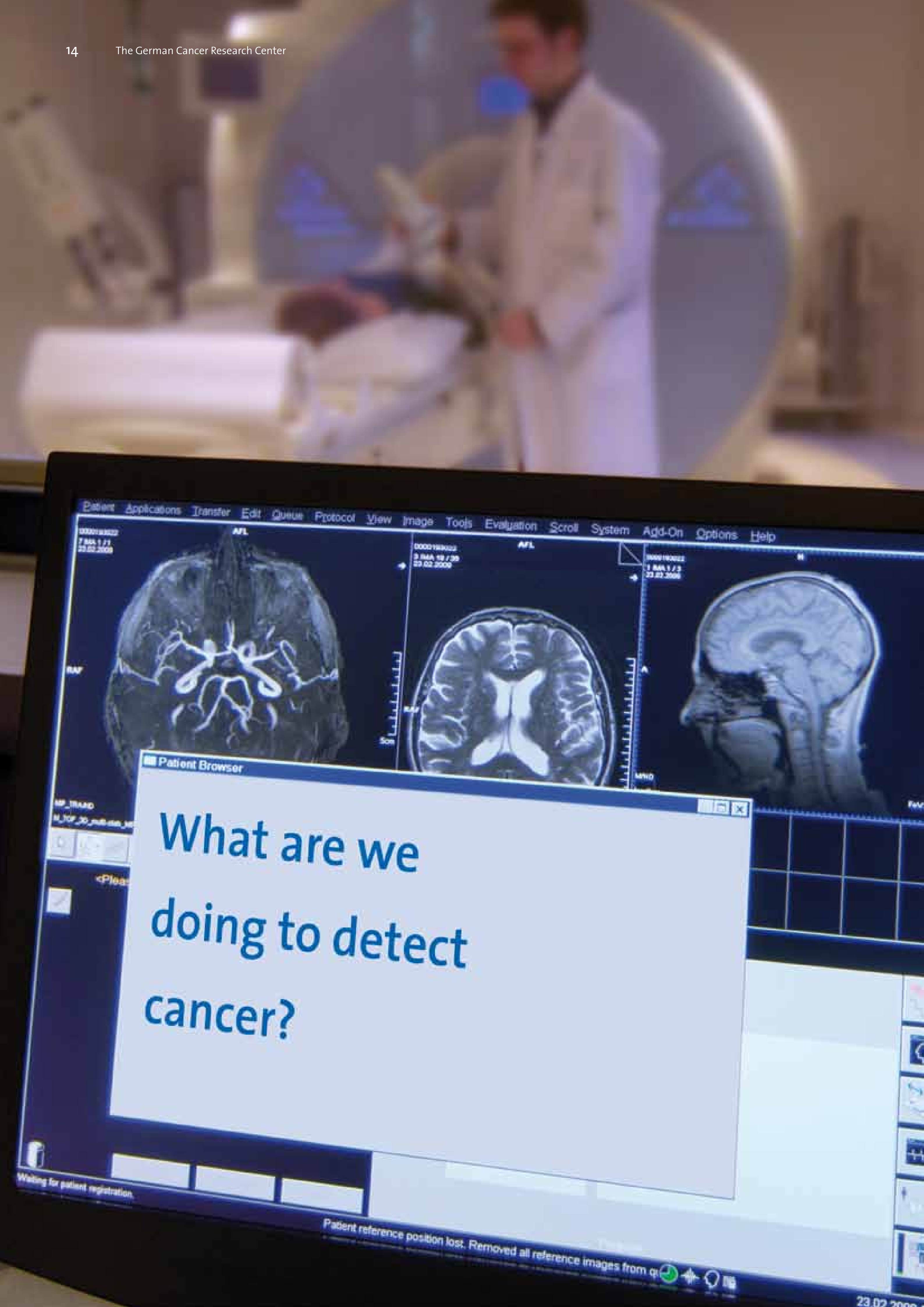
Provided they cause only harmless infections such as the common cold, viruses of this kind are ideal for use in medicine. Adenoviruses are among the best known such viruses and can infect almost any cell. In cancer therapy, however, a more targeted approach is needed to rule out undesirable side effects. The pathogens selected should have a marked predilection for tumor cells and possess the ability to kill off these cells after infection.

Dirk Nettelbeck could be called a “virus engineer,” since he and his team design special viruses for use in cancer therapy. The replication of viruses designed on the drawing board depends on certain molecular switches that are present only in the tumor’s target cells. The team has already developed a virus which replicates only in cells that produce the skin pigment melanin, for example. These tailor-made pathogens are to be deployed to combat melanoma, a form of skin cancer.

Beating this cancer involves far more than merely infecting tumor cells with the virus, however. Nettelbeck therefore equips the viruses with additional genes which once inside the cell transform the harmless precursor stages of a cancer drug into a deadly poison. The drug therefore acts inside the target tumor only and healthy tissue is spared.

The research scientists are working in close cooperation with doctors at Heidelberg University Dermatology Clinic. Their goal is to test these tailor-made viruses for their efficacy in patients. Before they do that, however, Nettelbeck and his co-workers first want to arm their cancer killers even more lethally, providing them with additional genes to activate the immune system against melanoma. This would then destroy any cancer cells that the virus fails to reach.

www.dkfz.de/en/onkolytische-adenoviren



What are we doing to detect cancer?

We are looking for genetic markers for prostate cancer

If an elevated level of prostate-specific antigen (PSA) points to the presence of prostate cancer, the suspicion must first be confirmed before doctors plan treatments that may have far-reaching consequences.

The urologist therefore takes tiny tissue samples from the prostate gland and examines these under the microscope for the presence of malignant cells. Often, though, the fine biopsy needles miss the minuscule tumor foci inside the organ so that the sample contains only unsuspicious cells, even though there is good reason to believe that the tissue has already changed.

HOLGER SÜLTMANN at DKFZ and his partners at the Martini Clinic in Hamburg-Eppendorf are therefore looking for ways of detecting prostate cancer more reliably and earlier—regardless of whether or not the biopsy sample actually contains cancer cells. The scientists are doing this by comparing gene activity in tissue surrounding tumors in the prostate gland with gene activity in prostate tissue from healthy men.

They surmise that in men with prostate cancer, certain changes in gene activity specific to the cancer take place in the tissue surrounding the cancer foci as well. And they have in fact identified around a hundred genes whose activity is characteristically higher or lower in prostate glands affected by cancer than in the cells of a healthy prostate gland. This activity pattern is probably due to the effect of malignant cell changes on neighboring tissue.

The research team's aim is to enable reliable cancer diagnosis even when biopsy samples appear unremarkable when examined under the microscope. In a pilot study, the team studied some 200 samples to determine whether this characteristic pattern of gene activity really is suitable for diagnosing cancer. Using this approach, they could spare patients another unpleasant biopsy procedure—or else give the all-clear.

www.dkfz.de/en/mga

We are detecting minute cancer foci

Many cancer patients become acquainted with magnetic resonance imaging, or MRI, in the course of their disease. Most of the tomographs used for cancer diagnosis these days are 1.5 or 3-Tesla scanners. The 7-Tesla high field MRI scanner that was installed at the German Cancer Research Center in 2008 looks much the same as these devices. But the powerful new machine needed a building of its own to provide a shield against the 32-ton unit's huge magnetic field. The 7-Tesla MRI scanner in Heidelberg is the first one to be used solely for cancer research.

DKFZ scientists hope that the 7-Tesla MRI scanner will deliver a wealth of information. It can display the finest anatomical structures, show stronger tissue contrasts, provide improved display of tissue functions such as blood circulation, and analyze the chemical composition of tissue more precisely.

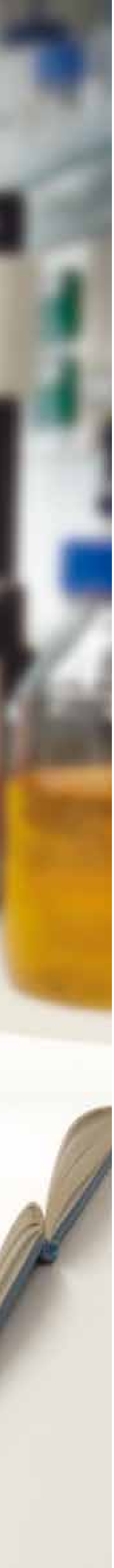
Patients with brain tumors are already being examined with the 7-Tesla MRI scanner at DKFZ. The aim in most cases is to determine the type of tumor or to review the progress of therapy. Project manager MICHAEL BOCK is enthusiastic about the high spatial resolution of the 7-Tesla images. This enables doctors to distinguish tumors from healthy tissue much more clearly and to plan treatment far more precisely, thus sparing sensitive brain structures such as the optic nerve.

Siemens supplied the high field scanner on loan as part of a strategic alliance with DKFZ, which is responsible for its operation and maintenance. DKFZ researchers are also involved in the technical development of the 7-Tesla MRI scanner and are designing special "antennas" to receive signals from inside the human body.

MICHAEL BOCK and his colleagues are already working on improvements to the 7-Tesla MRI scanner so that it can be used to investigate other types of cancer and to help an even wider circle of patients.

www.dkfz.de/en/radiologie/patients/patient_info.html


What are we doing to better understand cancer?



We are targeting cancer stem cells

A tumor is not a mass of identical cells, but according to the latest theory often has a strictly hierarchical structure. At the top of the hierarchy are so-called cancer stem cells, which in turn give rise to large numbers of "simple" tumor cells.

Like tissue stem cells, cancer stem cells are considered immortal, since their job is to ensure a fresh supply of "simple" cancer cells, while at the same time maintaining their status as stem cells.

Stem cells have been identified in various types of cancer: in all leukemias, in breast, colon, and prostate cancer, and even in brain tumors. The stem cell theory also explains why cancer therapy so often fails; cancer stem cells possess a number of unpleasant properties, including mechanisms that make them resistant to radiotherapy and chemotherapy.

DKFZ researcher Andreas Trumpp has discovered another reason for therapy resistance in the stem cells of the blood. He found that these cells resist treatment by falling into a kind of lifelong deep sleep, from which they awake with a start only in emergencies, such as significant hemorrhaging. As chemotherapy acts primarily on cells that are dividing, however, it is of all cells the dangerous stem cells that tend to elude attack by anti-cancer drugs.

Trumpp recently discovered a means of waking up cancer stem cells in order to kill them off. Interferon-alpha, a messenger substance of the immune system, activates sleeping stem cells, making them receptive to drug therapy. Together with doctors from Mannheim and Jena University Hospitals, DKFZ scientists are now conducting clinical trials to try out a completely new way of getting to the root of the cancer problem. They are trying to find out whether interferon-alpha wakes up cancer stem cells in leukemia patients, too. If this were the case, subsequent treatment with the available new drugs would be effective in combating cancer stem cells as well.

www.dkfz.de/en/stammzellen-und-krebs

We are studying how cancer genes are controlled

The cells of the some 200 different types of tissue in the human body can do their job only if they specifically regulate the activity of the genes needed for the task. While every gene is equipped with its own switch elements, this alone is not sufficient for the complex coordination involved. A second code serves as an additional regulation level; genes can be switched on or off by the chemical marking of the DNA or DNA packaging proteins as well as by the gene switches incorporated directly in the DNA molecule. The most common of these so-called epigenetic mutations is the binding of methyl groups. These small chemical compounds act to turn off the gene so that it can no longer be translated into proteins.

For reasons that are still not understood, parts of the DNA of cancer cells are often switched off by methyl groups. Very often, this affects precisely those genes that are instrumental in impeding pathological cell growth. Christoph Plass and his team are therefore investigating how healthy methyl patterns differ from those in cancer cells, and why it is the cancer "brakes" that are so often switched off.

Epigenetic changes are a promising field of research. Unlike genetic mutations, which change the sequence of DNA building blocks with permanent effect, chemical marking can be reversed by drug therapy.

Methyl marking, moreover, can act as an early warning system for cancer. Plass and his co-workers discovered that in mice suffering from leukemia, changes in the methyl pattern appear long before the first signs of the disease.

They are now trying to find out whether the same is true in humans. A similar finding would make the methyl pattern typical of cancer an early sign of cancer developing. Physicians might then be able to intervene prophylactically. Medicines that prevent or reverse methyl binding might be able to delay the onset of cancer. These are already being studied in clinical trials.

www.dkfz.de/en/tox

Cooperation: Cancer research needs strong partners

Cancer is such a complex disease that it is vital we focus our energies effectively. Strategic alliances, research collaboration, and international partnerships are becoming increasingly important in the interdisciplinary battle against cancer.

The research findings from our labs can improve patients' chances of recovery only if they are translated into clinical practice as swiftly as possible. Close ties with clinical partners are therefore a top priority for the German Cancer Research Center. By founding the National Center for Tumor Diseases (NCT) in Heidelberg, we have already created an excellent basis for this (see p. 20).

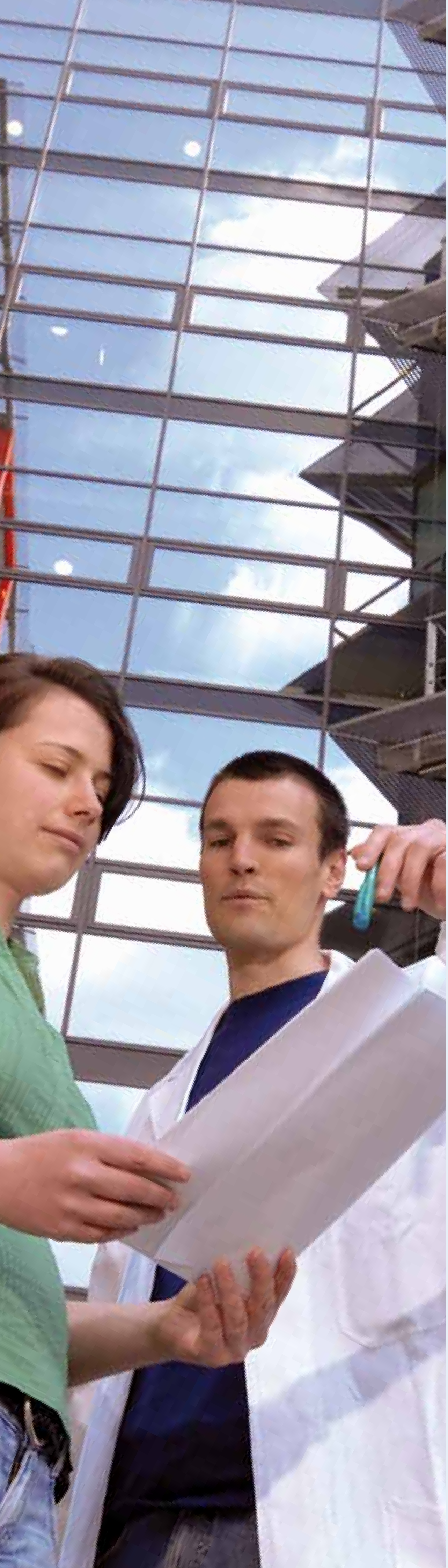
The National Consortium for Translational Cancer Research is also breaking new ground. Here, DKFZ acts as the nationwide hub for excellent partners from Germany's university medical schools and teaching hospitals. That this ambitious project was able to go ahead was thanks to a joint effort by both public and private partners. Germany's Federal Ministry of Education and Research, the German states, and German Cancer Aid are all supporting the consortium.

Our alliance with the Center for Molecular Biology Heidelberg (ZMBH) represents a new kind of cooperation model between university research and DKFZ as a non-university research center. The alliance between these two institutions is set to make Heidelberg one of the world's leading sites for molecular life sciences. The concept of DKFZ-ZMBH alliance was one of the key factors that marked out Heidelberg as an elite university.

In a separate venture, DKFZ and Max Planck Society have set up a joint research team which is developing high-resolution optical microscopy.

DKFZ researchers are involved in many major research projects, including the International Cancer Genome Consortium and the National Genome Research Network (NGFN). They are also playing a leading role in the Helmholtz Alliances for Systems Biology and Immunotherapy of Cancer.

The newly founded Institute for Stem Cell Technology and Experimental Medicine (HI-STEM) has made Heidelberg a base for the fascinating and highly promising field of cancer stem-cell research. HI-STEM is a public-private partnership between academic science and private enterprise. The institute's goal is not only to accelerate clinical trials of the new therapy options emerging from stem-cell research, but also to secure patent protection for them and win the interest of commercial partners.



This model was crucial to the success of the BioRN Cluster in the German government's Top Cluster contest. The project has the support of the Dietmar Hopp Foundation, and the Federal Ministry of Education and Research has agreed to double the funding the Foundation provides. Any revenues generated will be reinvested in HI-STEM's own research.

Cooperation with industrial partners is becoming increasingly important. Our strategic alliance with Siemens Healthcare was launched with the aim of developing new imaging diagnostics and new methods of radiotherapy and applying these in practice. The research projects being pursued as part of our alliance with Bayer-Schering Pharma are aimed at speeding up the development of innovative substances to combat cancer.

DKFZ also collaborates internationally with, for example, the French Institut National de la Santé et de la Recherche Médical (Inserm) and has worked together with the Israeli Ministry of Science for more than 30 years, to name just two. In addition, DKFZ has a Sister Institution Agreement with the renowned MD Anderson Cancer Center in Houston, Texas.

www.dkfz-zmbh-allianz.de/index_en.html
www.ngfn.de/index_en.htm
www.dkfz.de/en/sbcancer
www.dkfz.de/en/allianz-immuntherapie
www.dkfz.de/en/israel

The National Center for Tumor Diseases Heidelberg

In 2004, Heidelberg broke new ground by founding the National Center for Tumor Diseases (NCT). Supported by German Cancer Aid (Deutsche Krebshilfe), the German Cancer Research Center (DKFZ), Heidelberg University Hospital, and the Heidelberg Thorax Clinic together established Germany's first comprehensive cancer center. This new form of organization was launched with the mission of combining optimized interdisciplinary patient care with excellence in translational cancer research.

NCT's Tumor Outpatient Unit is the central point of entry for all cancer patients in Heidelberg. Here, interdisciplinary tumor boards develop individual diagnostic plans and therapy recommendations for each and every patient.

Our paramount goal at NCT is to expedite the transfer of knowledge from the laboratory to the clinical arena. To achieve this, the German Cancer Research Center has contributed two application-oriented research areas to NCT: while Translational Oncology aims to translate the latest research findings into new therapeutic strategies to combat cancer, Preventive Oncology is concerned primarily with the development of strategies for the prevention and early detection of cancer and precancerous conditions. In addition, all DKFZ's research programs use the NCT as a platform for application-oriented projects.

With its clinical cancer register, centralized databases and tissue banks, and center for clinical studies, NCT provides all the interfaces needed to bridge the gap between research and clinical practice.

Tumor Outpatient Unit of NCT Heidelberg
Telephone: +49 (0)6221.56-4801
ambulanz@nct-heidelberg.de

www.nct-heidelberg.de

The Cancer Information Service

The demand for reliable information on cancer is very great indeed, among both those who have the disease and those who are healthy. Those who know what the risk factors are can do more to prevent it; just as those who understand their condition can have more of a say in the treatment options.

The Cancer Information Service provides cancer patients, their families, and anyone else who is interested with information that is readily understandable, scientifically founded, impartial, and up-to-date. The information is provided nationwide by telephone, e-mail or via the Internet, and at NCT Heidelberg is available by appointment as well.

The Cancer Information Service is currently being enlarged with funding from the Federal Ministry of Education and Research to make it a national reference center for cancer information.

Cancer information is just a phone call away:

0800 - 4203040
(toll-free number, only within Germany)

+49(0)6221.9998000
(for calls from outside Germany, international telephone rates)

Lines are open daily from 8 am to 8 pm.

E-mail:
krebsinformationsdienst@dkfz.de

www.krebsinformationsdienst.de

Our greatest asset: Brilliant minds

The German Cancer Research Center goes out of its way to support young scientists at every stage of their scientific training.

We have created the Heidelberger Life-Science Lab as an attractive program for schoolchildren from grade 8 and up. The largely autonomous participants are invited to join various teams in which, under the supervision of scientific mentors, they can tackle some of the pressing research problems of the day. Lectures, weekend seminars, and summer school events on scientific subjects are also part of the program.

DKFZ scientists are also involved in the teaching of the Cancer Biology module of the new English-language Master's degree course in Molecular Biosciences at the University of Heidelberg.

Structured, high-caliber, and quality-assured training for our own 400 doctoral candidates is provided by the Helmholtz International Graduate School of Cancer Research whose interdisciplinary curriculum covers the entire breadth of cancer research.

One especially successful model is that of the Junior Research Groups. By providing talented young researchers with the necessary equipment and autonomy, these groups enable them to prove what they are capable of and lay the groundwork for a career in science. As an additional incentive, we have created tenure track positions, meaning that excellent group leaders whose work is rated positively can have their research group established at DKFZ.

But it is not just junior employees who merit our support. Helmholtz professorships for senior researchers enable scientists of international renown to continue their research on strategically important questions even after retirement.

www.dkfz.de/en/phd-program
www.dkfz.de/en/major-cancer-biology
www.life-science-lab.org

Technology transfer: Bridging the gap between research and industry

Without the protection of intellectual property, there can be no progress for cancer patients. Industry will invest in the costly and time-consuming development of new anti-cancer drugs only if the research findings on which these are based are patent-protected. The Office of Technology Transfer of the German Cancer Research Center files more than 20 patent applications every year. The most interesting of these are licensed to partners in industry and the license revenues used to fund still more of our research.

This also allows industry to bring new technologies and substances onto the market for the benefit of cancer patients. One outstanding example of this is the vaccine against cervical cancer, in the development of which DKFZ had a key role to play.

www.dkfz.de/en/techtrans

Family-friendly research

These days, raising a family and pursuing a career count as equally important aspects of a fulfilled life for both men and women. We create working conditions that enable our employees to find the right work-life balance for them.

We do this by offering flexible working hours, numerous opportunities to work from home, a special room for parents and children, and by constantly adding to the childcare services on offer at “Die Wichtel,” our institute’s day-care center.

A special mentoring program is in place to improve our researchers’ professional prospects and we have a reintegration program for scientists returning to work after parental leave.

An audit by the not-for-profit berufundfamilie gGmbH in 2009 led to DKFZ being certified to the Beruf und Familie standard, Germany’s work-life balance benchmark.

www.dkfz.de/en/gleichstellungsbeauftragte

Perseverance rewarded with the Nobel Prize

The idea was revolutionary back in 1973. Flying in the face of prevailing expert opinion, Harald zur Hausen hypothesized that the viruses that cause warts might also play a role in the development of cervical cancer.

Supplying the evidence turned out to be more difficult than he had anticipated. In 1983, however, after years of indefatigable searching, zur Hausen and his team at last succeeded in isolating the DNA of this pathogen, also known as human papillomaviruses (HPV), in a biopsy. What they had found was HPV16, a hitherto unknown representative of the large and complex family of papillomaviruses. In the years following, it transpired that the two high-risk virus types HPV16 and HPV18 are responsible for around 70 percent of all cases of cervical cancer worldwide. A total of 15 of the 125 HPV so far identified now count as carcinogenic. The DNA of papillomaviruses is found in more than 99 percent of all tissue samples taken from women with cervical cancer.

This type of cancer affects around half a million women every year. The disease often ends in death, especially in Third World countries which cannot afford cancer screening programs.

Following their discovery of carcinogenic papillomaviruses, zur Hausen and his team studied how the pathogens survive in the cell and how the cells eventually mutate into cancer. It was their understanding of the biology of infection that enabled them to develop a vaccine to protect women against cervical cancer.

Harald zur Hausen was Chairman of the German Cancer Research Center from 1983 to 2003. In 2008, he was awarded the Nobel Prize for Medicine in honor of his outstanding contribution to science.

www.dkfz.de/en/zurhausen/nobelpreis-uebersicht.html

Cancer concerns us all

Many people are so afraid of falling sick and dying that they prefer not to think about it at all. Others are more accepting of their own mortality and able to give thought to a future that might not be theirs.

What is needed is the personal dedication of people willing and able to take responsibility. Understanding how cancer cells evolve and how they behave is helping us to translate our research findings into more effective clinical practice. And not a moment too soon either, for the number of people with cancer is rising, even if the chances of recovery are improving at the same time.

By supporting a scientist, an excellent Junior Research Group, or a specific research project, you can become part of this effort. You will also be supporting Germany as a research base, because investing in innovation and in young brains means investing in the future.

Please address any questions you may have to Elisabeth Hohensee. Talk to us! We look forward to hearing from you and to having you on our side.

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DKFZ: Facts and figures

History

1964 The German Cancer Research Center is founded on the initiative of Professor Karl Heinrich Bauer, a surgeon in Heidelberg.

1977 The center becomes a member of the Deutsche Forschungsgemeinschaft (DFG), the German Research Foundation.

2001 The center becomes a member of the Helmholtz Association of National Research Centers.

2004 The German Cancer Research Center (DKFZ), Heidelberg University Hospital, Heidelberg Thorax Clinic, and German Cancer Aid (Deutsche Krebshilfe) together found the National Center for Tumor Diseases (NCT), Heidelberg.

2007 The German Cancer Research Center enters into an alliance with the University of Heidelberg's Center for Molecular Biology (ZMBH).

2008 Harald zur Hausen, for many years Chairman of DKFZ, is awarded the Nobel Prize for Medicine.

Employees

Of the **2,258** employees, **1,046** are **scientists**, including **398 doctoral candidates**, and **117** are **trainees** *(as of 12/2009)*.
There were **148 guest scientists** from **45 different countries** working at DKFZ in 2009.

Funding 2009

Total budget of **€ 155,6** million, of which **€ 116,6 million** is **basic funding** (90 percent of it provided by the German government and the remaining 10 percent by the state of Baden-Württemberg), while **€ 28 million** is **external project funding**, and **€ 11 million licence revenues** and **donations**.

Technology transfer

DKFZ patent portfolio currently comprises **1,011 rights** or **227 patent families**. Some 55 new licensing and cooperation agreements are signed and more than 120 existing agreements monitored every year.

DKFZ supports five spin-offs and holds a stake in nine companies, which between them have created more than 200 new jobs for the region.

Research programs

The 43 Research Divisions and Groups, 15 Junior Research Groups, and 9 Clinical Cooperation Units are allocated to 7 Research Programs, all of which are subject to regular international reviews:

Cell Biology and Tumor Biology

Structural and Functional Genomics

Cancer Risk Factors and Prevention

Tumor Immunology

Imaging and Radiooncology

Infection and Cancer

Translational Cancer Research

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We are fortunate in being able to draw on the experience and advice of policymakers, business people, and other leading personalities. We are deeply indebted to them for their support.

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