

Committed to Tradition: How Dresden Benefits Human Health

Human beings are becoming healthier and as a result are living longer. This demographic change presents new challenges for the treatment of diseases like cancer, dementia and diabetes, and Dresden's researchers and entrepreneurs are working to find therapies and treatment options for these common diseases of our time.

Innovations to improve health have a long-standing tradition in Dresden. While Dresden's scientists and entrepreneurs are mainly focused on the medical implications resulting from demographic changes, in the past, the city's founding fathers were dedicated to a basic concept: improve human hygiene. Back then, Dresden pharmacists looked for options to prevent infectious diseases, which, at the time, were the most frequent cause of death with the mouth as the main port of entry for pathogenic germs. Ottomar Heinsius of Mayenburg, owner of the Lions Pharmacy at Dresden's Old Market Square, developed the Chlorodont toothpaste. The Leo-Works, founded in 1917, became Europe's largest producer of mouth-and-dental hygiene products and, under the name Dental Kosmetik GmbH, the company's production continues today.

Cancer, Dementia and Diabetes: the Common Diseases of Our Time

Today, scientists face different challenges than they did 100 years ago. People are living longer because of improved hygienic conditions and excellent medical care. As a result, other diseases have become the center of attention. In order to foster collaboration among researchers in the field, the German Federal Ministry of Education and Research established six **German Health Research Centers**. They share their search for causes and therapy options for the 'new' common diseases such as diabetes, lung disease, infections, cardio-vascular disease, cancer and neurodegenerative diseases. International experts selected participating researchers and Dresden scientists who are actively engaged in three of the centers.

Dresden Researchers Take on the Fight against Cancer

In industrial nations cancer is the second most common cause of death. The German Robert Koch Institute records an average of 480,000 new cancer cases every year and an estimated 220,000 yearly deaths from the disease. The institute's most recent report predicts that almost half of the population will have to deal with the possibility of developing cancer at some point in their lives. Every fourth man and every fifth woman, the experts say, will die due to the disease. Early detection, diagnosis, treatment and prevention are the main focus for today's health researchers.

In 2012, the **German Consortium for Translational Cancer Research (DKTK)** was established to strengthen and coordinate the activities in the field. The network connects the German Cancer Research Center in Heidelberg (DKFZ) as the primary center with seven partner institutes that are among Germany's best cancer research and therapy centers. One of these centers is located in Dresden and is a joined effort by the University Cancer Center

(UCC), the Helmholtz-Center Dresden-Rossendorf, and the Max-Planck-Institute for Molecular Cell Biology and Genetics.

Moreover, as an official partner location of the National Center for Tumor Diseases (NCT) Heidelberg, Dresden plays a central role in the German medicinal cancer research.

The Saxon scientists together with site coordinator Dr. Michael Baumann, Professor of Radiation Oncology at the Technical University of Dresden, and Director of the Dresden University Cancer Center, are working to improve the efficiency of treatment methods. In the future, radiotherapy won't be used to kill tumor cells exclusively, but will also administer medicine more gently and accurately: radiation changes the cells' membranes and the medicine can dock on to the place where it is needed most, directly at the diseased cells – according to the researchers' goal.

Dresden Scientists Trace the Roots of the Self-Healing Power of the Body

Why do physical and cognitive activities protect the body, to a certain extent, from dementia and neurodegeneration? Together with experts from the neurological department and the memory clinic of the psychiatry department of the Carl Gustav Carus University Hospital Dresden, the scientists at the Excellence Cluster of the Center for Regenerative Therapies (CRTD) are searching for answers to such questions. The scientists have successfully applied to become a location of the **German Center for Neurodegenerative Diseases (DZNE)**. They investigate how it is possible that targeted training is able to influence the course of diseases such as Alzheimer and Parkinson's. The research group plans to develop biologically-founded strategies that are able to activate and make use of the body's own compensation and regeneration potentials; while damage of the brain tissue does not revert, significant progress has been made to understand the brain's ability to cope: only 20 years ago scientists were convinced that even the healthy brain, beyond a certain age, would steadily lose its capacity. This is no longer believed to be true. The so-called 'adult neurogenesis', the new formation of nerve cells in the adult brain is based on stem cells, which remain viable for an entire lifetime. How to activate these cells and the potential changes they facilitate is what the Dresden scientists plan to find out.

Dresden, a Pioneer in Diabetes Research: The World's First Transplantation of an Artificial Pancreas

One of the major common diseases is diabetes mellitus and the number of patients with this disease continues to increase. According to estimates, about 6 million Germans currently live with the disease. The number of patients is particularly high among the 60 to 79 year olds, the International Diabetes Federation (IDF) says. In order to advance diabetes research in Germany, five renowned research organizations including the Paul Langerhans Institute, a subdivision of Dresden's Carl Gustav Carus University Hospital, have joined together to form the **German Center for Diabetes Research (DZD)**.

The Paul-Langerhans-Institute was founded in 2009 and deals with diabetes mellitus types 1 and 2. The scientists' research entails finding the mechanisms that lead to reduced functioning and destruction of the beta cells of the pancreas. The beta cells are located in the Langerhans islets of the human pancreas and are responsible for insulin production – the only hormone that lowers blood sugar levels. When the blood sugar level goes beyond a certain point causes severe damage to the body.

The research project combines research and patient care, and Dresden's Carl Gustav Carus University Hospital is the only hospital in Germany capable to transplant islet cells. In 2008, a team of internists, surgeons and researchers extracted these cells from a pancreas, and processed and implanted them for the first time. Currently the scientists are working on creating a bioreactor that will produce insulin inside the body of type 1 diabetics. A prototype with human Langerhans islet cells was implanted into a patient and has been successful. In the future, the artificial pancreas system could make it possible to dispense with immune suppression, and lead the way to using insulin-producing cells from pigs without posing a health risk to patients.

In addition, the team of Dr. Michele Solimena, Professor of Molecular Diabetology, and Director of the Paul Langerhans Institute is exploring options to detect diabetes at its earliest stages in order to prevent the disease altogether. Since there are so many different varieties of diabetes this approach requires individualized strategies. Dr. Ezio Bonifacio, Professor of Pre-clinical Stem Cell Therapy at the Center for Regenerative Therapies Dresden (CRTD), developed one of these strategies. Using vaccine, Dr. Bonifacio wants to protect the beta cells that are destroyed in type 1 diabetics by the body's own immune system. The researchers at the CRTD are also working on stimulating the body to form new islet cells. If the scientists are successful, Dresden will see the formation of new companies that will transform this new knowledge into medicines and innovative therapies. The conditions are ideal – the **BioInnovations Center** located in close proximity to the Biotechnology Center of the Technical University Dresden offers space to start-up companies.

Several successful local enterprises are proof Dresden's Bio Technology is vital. One of the established companies is Biotype Diagnostics GmbH, a Dresden biotechnology enterprise that has been developing and producing test kits for DNA analysis for the past ten years. RESprotect GmbH Dresden, which emerged from the Fraunhofer Gesellschaft, specializes in the development of medical agents that prevent cancer cells from becoming resistant against chemotherapy and radiotherapy. The young company has been honored with several renowned awards and was granted the Orphan-Drug Designation for its first submission, a pharmaceutical agent. The Orphan-Status for a pharmaceutical substance grants permission for marketing and application of a pharmaceutical substance that treats a rare disease (orphan disease). Following the city's tradition, Dresden researchers and enterprises follow a common path; science and economics focused on research for current medical problems for the sake of humanity and to conquer those problems through innovations.

In order to strengthen its diabetes and cancer research activities, the Technical University of Dresden is the first university in Germany to create a joint research platform with a foreign university. In 2015, Kings College London and the Technical University of Dresden established the first official Trans-campus Program in Europe. The joint efforts of two leading universities in Europe will create a robust partnership of scientific strength in Biomedicine, able to compete with other leading institutions in the United States and across the rest of the globe.

History: Dresden's Hygiene Pioneer Designs Odol Mouthwash

Karl August Lingner also dedicated himself to the fight against pathogens. In 1892, he founded the Dresden Chemical Laboratories Lingner that he later expanded under the name Lingner-Werke. The famous Odol mouthwash made Lingner rich and allowed him to advocate for better hygiene.

In 1897, Lingner founded Dresden's outpatient department for children that included a baby nursery, and only one year later, Lingner founded the world's first infant clinic. He then opened a central office for dental hygiene and a Public Center for Disinfection including a school for disinfection; and the Dresden Reading Room. In 1911, Lingner organized the world's first international hygiene exhibition, and in 1912, the German Hygiene Museum, which, after more than 100 years continues to attract visitors.

The Dresden pioneer also recognized the potential of immunization. In 1911, he founded the Saxon Serum Works, which quickly became one of the most important producers of serums and vaccines. The company still exists today: GlaxoSmithKline Biologicals Dresden delivers flu vaccine to 70 countries worldwide.

The world's first industrial scale ingredient synthesis also happened in Dresden. In 1874, Friedrich von Heyden founded his salicylic acid factory in Saxony's state capital and began the production of the substance that continues to play an important role in pharmacy today. Together with German chemist Rudolf Wilhelm Schmitt, Heyden transferred the procedure that had just been discovered by August Wilhelm Kolbe in Leipzig, from laboratory to production. This happened 20 years before Bayer in Elberfeld for the first time produced its Acetylsalicylic acid – the world-famous Aspirin – in 1897. Simultaneously, Schmitt's apprentice Richard Seifert had made the same discovery in Dresden.

During WWII Robert Thren had been searching for a process to produce penicillin at the Biological Institute of the Madus-Company. The antibiotic is medical standard today, but back then it was an innovation that international scientists were competing over. After the war ended, Thren's work made it possible to start a penicillin-producing factory in Radebeul. The factory was, just as the Chemical Factory von Heyden, nationalized by GDR-officials and became part of the Arzneimittelwerk Dresden. Since 2007, the ingredient synthesis operates as Arevipharma GmbH. The Italian Menarini Group bought the medicine production at its Dresden location in 2006 and in homage to the tradition named the company "Menarini von Heyden".