Fighting cancer with targeted drugs

New, individual therapeutic approaches promise more effective cancer treatment

“Cancer” is a collective term that describes numerous different and malignant new tissue formations. Malignant tumors emerge from changes in DNA fragments when the body can no longer counteract these mutations, which is often associated with increased age. Yet the risk of developing cancer also depends on genetic factors, lifestyle habits and different environmental influences.

Chemotherapy – an optimized base
The classic triad of medical treatment, radiation therapy and surgery is a proven procedure. While radiation therapy uses ionizing radiation to completely inactivate or at least push back the tumor, cytostatic drugs are applied in chemotherapy to inhibit cell growth. The treatment planning depends on specific tumor characteristics, the patient’s overall health condition, as well as the stage of the disease.
Chemotherapy is almost always applied – mainly by infusion, while certain cytostatic drugs are also suited for oral administration. Since researchers have tested and recombined proven active ingredients in different doses, as well as introduced new substances, good results are now often achieved at higher tolerance. While emerging countries focus on chemotherapy, the standard treatment in the industrial world is more and more often combined with new, targeted therapeutic approaches.

**Revolution in cancer treatment**

The cell division of healthy people is strictly regulated. A cell is only reproduced when it receives an according signal. If this procedure is thrown out of balance, the result is uncontrolled cell growth. Unlike cytostatic drugs, which act as cellular toxin, modern therapies draw on the molecular bases of tumor development. A type of enzymes known as kinases plays an important role in transmitting the signals. Kinase inhibitors act as low-molecular agents and block their function. For instance, the treatment of chronic myeloid leukemia with the active ingredient Imatinib¹ has proven successful and spurred research. Most kinase inhibitors are administered orally and are partly based on highly complex formulations. Angiogenesis inhibitors are another example of targeted therapeutics. They block the development of blood vessels, which are indispensable for the growth of tumor cells.

**Immunotherapy against cancer**

In immunotherapy, the patient’s own immune system is stimulated to take independent action against tumor cells. This way, monoclonal antibodies can be developed, which attach themselves to the characteristic structures of the tumor surface. They inhibit cell proliferation (uncontrolled cell growth) or induce cell death. The targeted effect of monoclonal antibodies can also be combined with cell poison such as cytostatic agents or toxins. Like in a Trojan horse.

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Checkpoint inhibitors block the control points and are thus able to direct the immune system against the cancer. Since antibodies are complex protein structures that are “digested” by the gastrointestinal tract, this therapy is administered via infusion.

**Therapeutic differentiation**

The trend is toward individually tailored therapies. Companion diagnostics are consequently becoming the focus of active ingredient development to verify the effectiveness for each patient before treatment initiation. Conversely, this implies an even closer cooperation between pharmaceutical companies and manufacturers of laboratory diagnostics as well as medical devices. Ever more specific therapies reduce the number of patients available for clinical studies, increasingly blurring the line between drug development and treatment. This medicine, which is described as “translational”, offers great opportunities to fight tumors formerly known as difficult to treat. More targeted tumor therapies will hence change the image of cancer – from death sentence to a severe, yet manageable chronic condition.

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*Fighting cancer with Bosch technologies*

The portfolio from Bosch Packaging Technology is suited for nearly all forms of oncological drug development, production and filling. For instance, sterile filling lines can be combined with barrier systems to protect operators from highly potent active agents such as cytostatic drugs, while ensuring the highest possible quality. Oral cytostatic drugs such as the active ingredient Imatinib can be processed on capsule filling machines and tablet presses from Bosch, which in conjunction with containment systems protect the operators from product dust. Bosch also offers machines for all laboratory process steps for both liquid and solid pharmaceuticals.

Devices for the biopharmaceutical production of monoclonal antibodies and antibody-drug conjugates are among the core process competencies of the Bosch subsidiary Pharmatec. The production of antibodies requires a multi-stage process. First, the cells are cultivated in increasing scaling steps and harvested (upstream process). The active ingredients are then separated and purified using different technologies, followed by the formulation of the final injection solution (downstream process).