

# First cancer immunotherapy for dogs developed

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The newly developed antibody brings hope for sick dogs. Credit: Michael Bernkopf / Vetmeduni Vienna

Nearly every second dog develops cancer from the age of ten years onward. A few therapies derived from human medicine are available for dogs. A very successful form of therapy by which antibodies inhibit tumor growth has not been available for animals so far. Scientists at the inter-university Messerli Research Institute of the Vetmeduni Vienna,

the Medical University of Vienna, and the University of Vienna have developed, for the first time, antibodies to treat cancer in dogs. The scientists published their research data in the journal *Molecular Cancer Therapeutics*.

As in humans, cancers in dogs have complex causes. The interaction of the environment, food, and genetic disposition are the most well known factors. Today nearly all methods of human medicine are basically available for dogs with cancer, but this was not true of cancer immunotherapy so far.

So-called cancer immunotherapy - which is the treatment of tumors by the use of antibodies - has been established and used very successfully in human medicine for about 20 years. Since [cancer cells](#) bear very specific antigens on the surface, the corresponding antibodies bind to these molecules and thus inhibit tumor growth. The mechanism that becomes effective is a destructive signal sent by the antibody to the inside of the cancer cell and initiates its death. In a second mechanism, the immune system of the patient also destroys the "marked" tumor in a more efficient way.

## **The target is nearly identical in humans and dogs**

Josef Singer and Judith Fazekas, both lead authors of the study, discovered that a receptor frequently found on human tumor cells (epidermal growth factor receptor or EGFR) is nearly 100 percent identical with the EGF receptor in dogs. In human medicine EGFR is frequently used as the target of [cancer immunotherapy](#) because many cancer cells bear this receptor on their surface. The so-called anti-EGFR antibody binds to cancer cells and thus triggers the destruction of the cells. "Due to the high similarity of the receptor in humans and dogs, this type of therapy should work well in dogs too," the scientists say. The binding site of the antibody to EGFR in man and dogs differs only in

respect of four amino acids.

## **Antibody trimmed to "dog"**

To ensure best possible binding of the antibody to cancer cells in dogs, the [human antibody](#) had to be trimmed to "dog" in the laboratory. In human medicine this process is known as the "humanization" of an antibody. The antibody originally produced in the mouse has to be adjusted to the species for which it is used. Singer and Fazekas replaced the corresponding elements in the "humanized" antibody with elements from the dog. In experiments on dog cancer cells in the laboratory it was found that the newly developed antibodies did, in fact, bind to canine cancer cells with greater specificity.

The head of the study, Professor Erika Jensen-Jarolim, explains as follows: "We expect dogs to tolerate these anti-cancer antibodies well. This will be investigated in clinical studies in the future and is expected to greatly improve the treatment as well as the diagnosis of cancer in dogs."

## **Improvement of diagnosis**

The newly developed antibody provides an additional benefit for dogs. As in human medicine, [antibodies](#) can be coupled with signal molecules. When the antibody binds to a cancer cell in the organism, the coupled antibody - in this case a radioactive isotope - can be rendered visible and is thus able to show where tumors and even metastases are located. When the selected isotope also contributes to the decay of cancer cells, the approach is known as "theranostics" (therapy and diagnostics).

"The Veterinary Medical University, Vienna will be the first center in the world to offer the most modern immunological cancer diagnosis

procedure for dogs. Of special interest to me as a doctor of human medicine is the fact that, by using this approach, we will be able to initiate improvements that will benefit humans as well," says Jensen-Jarolim.

The first anti-EGFR antibody (cetuximab) for cancer treatment in human medicine was developed by the company Merck. In humans it is primarily used for the treatment of bowel cancer. Cancer immunotherapy is mainly applied in combination with chemotherapy and radiotherapy. In veterinary medicine, immunotherapy will be employed for the treatment of mammary ridge cancer (milk line [cancer](#)) in [dogs](#). It may also be used as part of a combination therapy.

**More information:** The article "Generation of a Canine Anti-EGFR (ErbB-1) Antibody for Passive Immunotherapy in Dog Cancer Patients", by Josef Singer, Judit Fazekas, Wei Wang, Marlene Weichselbaumer, Mirosława Matz, Alexander Mader, Willibald Steinfeldner, Sarah Meitz, Diana Mechtcheriakova, Yuri Sobanov, Michael Willmann, Thomas Stockner, Edzard Spillner, Renate Kunert and Erika Jensen-Jarolim was published in the Journal *Molecular Cancer Therapeutics*. [DOI: 10.1158/1535-7163.MCT-13-0288](#)

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