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ACADEMIC DEGREES:

B.S.	Colorado State University
DVM	Colorado State University
M.S.	Colorado State University
PhD	MD Anderson Cancer Center

Diplomate ACVIM (Oncology)

PROFESSIONAL APPOINTMENTS:

1999 - 2007	Head, Donaldson-Atwood Cancer Center, Animal Medical Center (AMC)
2001 - 2007	Director, Flaherty Comparative Oncology Laboratory, AMC
2002 - Present	Adjunct Associate Faculty Member, MSKCC & Sloan-Kettering Institute
2007 - 2011	Chief Medical Officer, BrightHeart Veterinary Centers
2010 - 2014	Medical Director, Katonah-Bedford Veterinary Center
2011 - Present	Director, Clinical Studies, VCA Antech

RESEARCH INTERESTS:

- Cancer Immunotherapy
- Comparative Oncology
- Veterinary & Comparative Clinical Studies
- One Health & One Medicine
- Malignant Melanoma

The Evolving Science, Role & Clinical Applications of Immunotherapeutics in Veterinary Oncology

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The term "immunity" is derived from the Latin word immunitas, which refers to the legal protection afforded to Roman senators holding office. While the immune system is normally thought of as providing protection against infectious disease, the immune system's ability to recognize and eliminate cancer is the fundamental rationale for the immunotherapy of cancer. Multiple lines of evidence support a role for the immune system in managing cancer, including: 1) spontaneous remissions in cancer patients without treatment, 2) the presence of tumor-specific cytotoxic T-cells within tumor or draining lymph nodes, 3) the presence of monocytic, lymphocytic and plasmacytic cellular infiltrates in tumors, 4) the increased incidence of some types of cancer in immunosuppressed patients and 5) documentation of cancer remissions and prolonged survivals with the use of immunomodulators.

The immune system is generally divided into two primary components: the innate immune response, and the highly specific, but more slowly developing adaptive or acquired immune response. Immune responses can be further separated by whether they are induced by exposure to a foreign antigen (an "active" response) or if they are transferred through serum or lymphocytes from an immunized individual (a "passive" response). While both approaches have the ability to be extremely specific for an antigen of interest, one important difference is the inability of passive approaches to confer memory. The principal components of the active/adaptive immune system are lymphocytes, antigen-presenting cells and effector cells. Furthermore, responses can be sub-divided by whether they are specific for a certain antigen, or a non-specific response whereby immunity is attempted to be conferred by upregulating the immune system without a specific target. These definitions are helpful as they allow methodologies to be more completely characterized, such as active-specific, passive-nonspecific, etc.

We will review in the lecture a variety of cancer immunotherapy approaches, including biologic response modifiers, recombinant cytokines, growth factors, hormones, cancer vaccines and monoclonal antibodies (Mabs). With nearly 20 FDA-approved MAbs in the United States for treatment of various malignancies, passive immunotherapy is a key element in therapy guidelines in human oncology. Rituximab, a monoclonal antibody targeting the CD20 antigen on the surface of B-lymphocytes, was approved by the FDA in 1997 and has become a component of standard-of-care therapy for a number of human B-cell disorders. Expression of CD20 has been confirmed in canine B-cell lymphomas by immunohistochemistry using anti-human CD20 polyclonal antibodies that recognize the intracellular domains of CD20. Unfortunately, rituximab does not bind canine CD20 and thus cannot be utilized for passive immunotherapy in dogs. Development of canine monoclonal antibodies for treatment of B-cell and T-cell lymphomas would represent a huge potential step forward in our ability to more effectively treat these aggressive cancers in dogs. We will review in the lecture the currently available MAbs for use as cancer immunotherapeutics in veterinary oncology, including the recently fully USDA licensed CD20 MAb from Aratana, the conditionally licensed CD52 MAb also from Aratana as well as many others.

With the tools of molecular biology and a greater understanding of mechanisms to harness the immune system, effective tumor immunotherapy is becoming a reality. This new class of therapeutics offers a more targeted and therefore precise approach to the treatment of cancer. It is extremely likely that immunotherapy will have a strong place alongside the classic cancer treatment triad components of surgery, radiation therapy and chemotherapy within the next five to ten years. The veterinary oncology profession is uniquely able to greatly contribute to the many advances to come in this field. Unfortunately, what works in a mouse will often not reflect the outcome in human cancer patients. Therefore, comparative immunotherapy studies utilizing veterinary patients may be able better "bridge" murine and human studies. To this end, a large number of cancers in dogs and cats appear to be remarkably stronger models for counterpart human tumors than presently available murine model systems. This author ardently looks forward to the time when immunotherapy plays a significant role in the treatment and/or prevention of cancer in human and veterinary patients.