Cancer and the Inheritance Factor

Cancer: The word strikes fear in the heart of any dog owner.

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Cancers are uncontrolled growth and proliferation of somatic (non-reproductive) cells, usually because of mutations that either disable tumor suppressor genes, which normally inhibit cell division, or enable oncogenes, which promote cell division. Every time a cell replicates there's a chance of a mutation; in fact, as many as one mutation per 1 million bases (the A, T, C, and G nucleotides that make up DNA). If the mutations occur in the nucleotides that code for tumor suppressor cells or oncogenes, then those replicating cells may give rise to a population that grows uncheckedin other words, a tumor.

Most cancers occur in later age; about 80 percent of all older dogs will develop cancer. This may be because each time a cell divides there is a risk of mutation, a risk that may be increased by exposure to carcinogens. In humans, about 80 percent of all cancers are related to what we inhale, eat, or drink, or to a lesser degree, our exposure to radiation (usually sunlight) or environmental carcinogens, such as chemicals, metals, or pesticides. Well-known examples include asbestos, benzene, cadmium, nickel, radon, and vinyl chloride. Our dogs tend to be exposed to the same or more carcinogens, including secondhand smoke.

It's important to remember that these mutations occur in somatic cells, which are the cells that make up the body, rather than germ cells, which are the cells that pass on genes to the next generation. So the fact that a dog has a cell mutation that leads to cancer doesn't mean his offspring are any more likely to develop canceror does it? Heredity can influence cancer in several ways. Some genes have an overall effect on controlling cell growth, and an inherited mutation could disable normal braking mechanisms, or amplify somatic cell mutations. Cancers directly caused by genes are called hereditary cancers. Some cancers seem to occur more often in certain families or breeds, without having a known genetic cause or pattern of heredity. These are called familial cancers. Finally, individual differences caused by normal genetic variation can make some individuals better able to detoxify carcinogens, repair damage that would otherwise lead to cancer, or respond to certain drugs for treatment.

The inheritance of cancer has been an intensely researched issue for years. In order to estimate the role of genetic factors, a recent study of 44,000 pairs of human identical twins compared how often both members of a pair developed the same type of cancer. In most cases, if one member of the pair developed cancer, the odds of the other twin developing the same cancer were less than 15 percent, meaning that environmental or random factors were more influential. Those that occurred most often in both twins were prostate, colorectal, stomach, breast, and lung cancers.