TEST YOUR COMPREHENSION

1. According to the article, what is the major problem with current cancer research?
   a. a lack of understanding of the molecular biology of cancer
   b. a lack of understanding of the cell biology ("what cancer cells can do") of cancer
   c. a shortage of laboratory rats and mice to serve as models of human cancer
   d. the slow pace of translating basic knowledge into life-saving treatments
   e. all the above

2. Scientists who study the similarities and differences in cancer types that arise in humans and rats are
   a. rodent geneticists.
   b. comparative oncologists.
   c. veterinary clinicians.
   d. functional genomics.
   e. systems biologists.

3. Researchers evaluating new drugs for use against human cancers feel that the deck is stacked against success because
   a. the experimental drugs are tested on large, advanced tumors that have failed treatment with other agents.
   b. the Food and Drug Administration (FDA) places severe limits on drugs designed to control cell growth.
   c. the FDA allows drug testing in humans only on early-stage cancers, making it impossible to know how these drugs will act on late-stage tumors.
   d. recently enacted regulations prohibit the use of animal models for drug testing.
   e. only drugs that inhibit metastasis, not those that inhibit tumor growth, have been developed.

4. A strength of using dogs to study cancer is that
   a. their cancer incidence greatly exceeds that of humans.
   b. dogs are extremely resistant to developing cancer.
   c. tumors are much larger in dogs than in humans.
   d. dogs are far easier to breed than rodents and other common cancer models.
   e. dogs and humans develop very similar types of cancers.

5. Metastasis refers to
   a. the spread of cancer cells throughout the body.
   b. the rapid growth of a single tumor.
   c. the conversion of a solid tumor to a diffuse tumor.
   d. the form of blood cancer that involves rapidly dividing T cell populations.

6. If humans and dogs are both "built like Indy race cars" to quickly cross the finish line without concern for what comes afterward, what does the metaphorical finish line refer to?
   a. birth
   b. age at puberty
   c. average age at cancer diagnosis
   d. average age at death
   e. age at reproduction

7. In dogs and humans, the probability of contracting cancer
   a. increases at a steady rate with age.
   b. increases at an ever-increasing rate with age.
   c. increases with age up to a point, then declines for very old individuals.
   d. decreases with age until the reproductive years, then increases continuously afterward.
   e. increases with age until the reproductive years, then decreases continuously afterward.

8. Unlike studies in rats, studying cancer in pet dogs will
   a. allow the compassionate treatment of animals suffering from the disease.
   b. allow us to completely understand the disease.
   c. reveal mutated genes involved in cancer causation.
   d. lead to cures for the most common forms of cancer.
   e. eliminate the need for animal models of human disease.

9. The compressed life span of dogs is a benefit in cancer research because it
   a. allows us to quickly learn whether a new drug has the potential to be effective in humans.
   b. increases the frequency of particular types of canine cancers relative to human cancers.
   c. explains the similar cancer types in dogs and humans.
   d. allows the direct extrapolation of results in dogs to treatments in humans.
   e. makes cancers much easier to treat in dogs than in humans.

10. In contrast to cardiologists, oncologists have been slow to
    a. focus on cancer prevention.
    b. focus on cancer cures.
    c. devote significant effort to understanding cancer.
    d. propose testable hypotheses about cancer causes or treatments.
    e. understand anything about basic cancer biology.
BIOLOGY IN SOCIETY

1. In developed societies there is a close link between advances in human well-being and the well-being of their canine companions. What are two major developments of the past 100 years that have substantially increased human life expectancy in developed nations? How have these changes made cancer a disease that affects more Americans today than 100 years ago? Have these societal changes had a parallel effect on cancer in pet dogs?

2. An increasing number of people are opposed to research on any animal for any reason, including rats and mice used for cancer research. How does the use of pet dogs for cancer research differ from the ways rodents are used? Do you think that those opposed to traditional cancer research with rodents would also oppose the type of research on pet dogs described in the article?

THINKING ABOUT SCIENCE

1. Cancer hot spots are geographical areas where the rates of a particular cancer are elevated. When a cancer hot spot is found, such as the hot spot for breast cancer in Marin County, California, what can be concluded about the role of environmental factors, such as chemical exposure, versus genetic factors peculiar to the population? If pet dogs in the same areas are also found to have an elevated rate of the same cancer, what can be concluded? In contrast, if pet dogs in a human cancer hot spot do not have an elevated rate of that cancer, what conclusions can be drawn?

2. Draw a graph of the probability of developing cancer versus age in humans and dogs. How are these plots similar, and what makes them different? Propose at least two hypotheses for why cancer incidence declines with age in very old dogs and humans.

3. What may be wrong with the way rodents are used to study cancer? Why would researchers want to expose rodents to high levels of cancer-causing agents unlikely to be experienced by any human? Given the problems associated with this approach to cancer induction in rats and mice, why would researchers use it rather than allowing rodent tumors to develop naturally?

WRITING ABOUT SCIENCE

Imagine that you and your grandmother are close, and you e-mail each other every few weeks while you’re away at school. You mention a class on cancer biology you’ve just taken and tell her that the goal in today’s fight against cancer is turning a killer into a treatable nuisance. Your grandmother remembers when Richard Nixon launched the “War on Cancer” in 1971. She can’t understand why scientists today are setting the bar so low, when back in 1971 the War on Cancer aimed to eradicate all cancer. Write her an e-mail in which you describe what makes cancer such a complex disease, and why today’s goal may be practical while the goal of cancer elimination, even with today’s advanced medical science, is not. Be sure to provide examples of what makes fighting cancer so difficult, including how tumor detection and control of the spread of cancer remain major challenges.