Public Canine Cancer Research
The use of citizen science to study and research canine cancer

Tag Words: citizen science; canine cancer; neoplasia

Authors: Aakash Babaria, Alexander Walsh and Julie M. Fagan, Ph.D.

Summary (AB):
The current methods of cancer research on animals seem to focus on treating, rather than preventing, cancer. Therefore, it is necessary to do research on methods to prevent cancer in dog breeds that are prone to cancer. The focus of our project is to help dogs, and even human, prevent cancer by advocating preventative methods recommended to dog owners by veterinarians. Some preventative methods include changing the diet, promoting exercise, and spaying/neutering pets to ultimately prevent certain cancers. The project will be supplemented with a program created to guide citizens to do their research and properly report the data.

Video Link:
http://www.youtube.com/watch?v=1GvYmpqnAdU&list=UUts4_1WyqXMmVDfu9ZffstA

The need for a better cancer research model
Cancer related research often focuses on human cancers. However, rodents are commonly used as models for human cancer research. Although it may provide some benefits for cancer treatments, using rodents as models ultimately fails to provide feasible solutions for human cancers due to various differences in human and rodent biological systems. Many drugs have been discovered that can cure artificially induced cancers in mice, but they fail to work well in human cancers (1). Therefore, we need to focus our research on another animal that has similar characteristics of cancer as humans.

Dogs are better cancer research models for viable treatments of cancers in other dogs and in humans. Dogs can provide more accurate information regarding cancer because they tend to become afflicted with the same types of malignancies that affect people (1). According to Water & Wildasin, lymphoma affecting dogs mimics the lymphomas in people. Osteosarcoma in dogs also closely resembles the osteosarcoma in teenagers in its skeletal location and aggressiveness (1). Many other types of cancers show similarities between dogs and humans; therefore, it is beneficial to use dogs to study cancer because it would yield more feasible treatments for dogs and humans. Although many breeds of dogs can potentially get cancer, there are a few breeds that are more prone to cancers. The following breeds of canine are most prone to cancer: Rottweiler, Bernese Mountain Dog, Bouvier des Flandres, German Shepherd, Great Dane, Labrador Retriever, Bichon Frise, Boxer, and Golden Retriever. Common cancers in dogs include lymphoma, Hemangiosarcoma, Osteosarcoma, Mast cell tumors, Melanoma, Squamous cell carcinoma, Mammary carcinoma, Apocrine gland carcinoma, Transitional cell carcinoma, and Soft tissue sarcoma.

Some of the cancer treatments available to dogs include surgery, chemotherapy, radiation therapy, electrocautery, and cryosurgery. Depending on the type of cancer and the location of the tumor, one or more of the aforementioned treatments may be used to treat cancer in dogs.
Although these treatment options are available for canine cancer treatment, they can be very expensive; surgery that requires deep tumor removal in dogs will “range from about $1500 upward” (2) and radiation therapy for the cancer can “range from approximately $2000 to $6000 depending on the type of radiation therapy” (2). Despite the availability of these cancer treatments for dogs, many treatments fail to eradicate the cancers in dogs and ultimately fail to save the dog’s life. Dogs are starting to live longer due to the proper care provided by most pet owners. Autopsies done on 2000 dogs show the following results: “23% of all dogs, regardless of age, and 45% of dogs 10 years of age or older died of cancer.” (3) Therefore, it is crucial for research to focus on delaying the onset of cancers in dogs because the chance of getting cancer significantly increases as the dog gets older. However, we should focus on integrating citizen science and cancer research in order to discover preventative measures to delay the onset of cancer.

Research in many different fields can require a great deal of money whether it is taking care of subjects or something else. Citizen science is where the public participates as they record vital data for a certain experiment. (4) With citizen science, research can be done by people who are willing to volunteer their time to record data. In regards to certain studies that can take a long period of time, the citizen science model has shown to be cost effective in the long-term (5). For a program/procedure that such as studying canine cancer which takes time to develop, citizen science would be suitable. According to Cooper et al., citizen science projects are created by developing a team of educators/assistants who create data forms and protocols that public participants will be trained to use. (4) For one thing, citizen science can be a way to teach the public about some discipline of science that may ultimately affect some part of their life. Cronin states that approximately one in four Americans are scientifically literate.(6). Citizen science can be a way to introduce science into the daily lives of Americans. Something such as canine cancer research could be done with the help of citizen science.

**Ways to delay onset of canine cancers**

**Dietary factors/supplements** (AW)

When it comes to people’s dogs, cancer is a very serious health issue. While there are options to treat cancers such as chemotherapy or surgery, they can be somewhat expensive and have some side effects. However, delaying the onset of cancer is a better approach compared to the aforementioned methods. There are multiple ways as to delay the onset of neoplasia. While there is this possible correlation, there are some supplements that can be added to a canine’s diet to help suspend the onset of cancer. According to a study by Raghavan et al., approximately 175 Scottish terriers were studied to determine if vegetable consumption could reduce the possibility of transitional cell carcinoma of the urinary bladder(8). The results revealed that consumption of green leafy vegetables and yellow-orange vegetables can lower the risk of TCC in Scottish terriers. (8) Another dietary factor that can affect the probability of cancer is red meat intake according to Rutteman et al.(7) Rutteman et al. also discovered that the dogs in this study who had an intake of homemade meals were shown to have a higher incidence of tumors and dysplasias compared to dogs who had an intake of commercial foods. (7) Another supplement that could be added to a canine’s diet is Vitamin D. In an article by Ingraham, literature was reviewed concerning the potential of Vitamin D to possibly prevent cancer on a molecular basis(9). According to the findings, Vitamin D regulates certain cell functions which would be involved in the development of cancer(9). With these many studies in mind, it may be important
to consider a canine’s diet in the determining the probability of that canine developing some form of cancer. However, there are some more practical dietary supplements that people can give to their dogs. Carrots are not only a vegetable that can be given to a dog, but they may have certain compounds that lower the risk of cancer known as phytochemicals. (10). A good example of a phytochemical would be beta-carotene, which is found in most vegetables (11). In fact, there is a study in mice that shows beta carotene did in fact inhibit mammary tumor growth. (12). In an epidemiological study, it was seen that people with low beta carotene concentrations had a higher risk of stomach and lung cancer. (13). The one group of interest would be carotenoids which about 600 different kinds have been discovered. (14). The basic idea of carotenoids lowering the risk of cancer is that they are antioxidants which delay the damage done to DNA caused by oxidative stress which increases the risk of cancer. (14). In a study by Speizer et al., antioxidant intake and lung cancer was studied in middle-aged women. (15) The study revealed that carrot intake did significantly reduce the possibility of lung cancer. (15). As seen, there are many dietary factors that can increase or decrease the risk of cancer. With carrots, there is some evidence as they could decrease the risk of cancer, but also there is evidence that certain compounds in carrots may be reason.

Exercise (AW)
Exercise, whether it dogs or even humans, is a well known way of maintaining a good overall health. However, there may be possible links between obesity and probability of cancer. Lund et al. studied the prevalence of disease in canines with different body condition scores (16). In adult dogs, the prevalence of neoplasia is higher in obese canines compared to normal weight canines (16). In a similar study done by Rutteman et al., there is a higher prevalence of mammary tumors in canines diagnosed with obesity at 1 year of age (7). In regards to determining obesity in dogs, this is usually determined by what it known as a body conditioning score (BCS) that determines body fat by looking at the distribution of body fat on the body. (17). The BCS is usually on a scale from 1 to 5 with around 2.5 to 3 being normal weight. (17). When it comes to exercise, it helps maintain normal bodily functions such as energy balance and regulation of hormones. (18). In fact, exercise reduces the risk for many other diseases including cancer. (18). As German noted, exercise along with diet and behavioral management will help manage an animal’s weight (19). In a study regarding human obesity and potential links to cancer, Calle et al. notes that if the trends seen in the study were applied to solely the United States, it reveals that 14% of all cancer-related deaths in men and 20% of all cancer-related deaths in women are accountable to obesity. (20). While it has been noted that there is some kind of trend regarding an increased risk of cancer with obesity, it should be considered what can exercise do. Batty et al. noted that physical activity can lower risk for cancer as it regulates body weight (21). Another article analyzing the relation between physical activity and the risk of human breast cancer saw that with increased physical activity, the risk of breast decreased (22). In fact, there is an article that analyzed studies regarding exercise and prostate cancer in males (23). The average risk reduction was found to be between 10% and 30%. (23). With these articles, a high risk of cancer is associated with obesity not only in dogs, but in humans as well. Exercise does not only lower the risk of breast cancer in women, but prostate cancer in men as well. Exercise is a preferable way to not only maintain body health, but to lower the possibility of cancer. However, exercise will not be the only way to fight obesity and lower the risk. As previously stated by German, exercise along with dietary and behavioral control will help maintain a healthy weight in dogs. With the BCS, people can determine if their animal is obese or not.
Tap water (AB)

Water is an essential part of our lives, and our pets’ lives. Although it may seem to be the least suspected source of carcinogens, many studies indicate the presence of harmful substances in tap water. Many households use tap water for their source of drinking water. Because many of the households in the U.S. use tap water for drinking, they also use tap water as a drinking source for their pets. The following paragraphs discuss the presence of harmful substances in tap water and their impacts on those who drink it.

Before tap water reaches the households, water companies must disinfect the water to make it safer for people and their pets to use. One common method used to disinfect tap water is chlorine. However, more and more treatment plants are using chloramine as a disinfectant (24). Chloramine has the following properties (24) that make it ultimately more harmful to our health and our pet’s health.

- Chloramine stays in the water longer than chlorine, and is more difficult to remove.
- Chloramine combines with organic matter in water supplies to create toxic byproducts.
- Its vapors can accumulate indoors and concentrate in an enclosed area.

Some of the chemicals byproducts that result from chloramine’s presence in tap water are trihalomethanes (THM), volatile organic compounds, and haloacetic acids (24).

Volatile organic compounds are various substances from different sources, including chlorination and fuel. Volatile organic compounds come from a wide variety of sources and ultimately make their way into our drinking water, ultimately increasing the risk for many health problems for us and our pets. Many of the volatile organic compounds in tap water are carcinogenic (25). Carbon tetrachloride, for example, ends up in tap water due to chlorination and has carcinogenic properties; carbon tetrachloride increases the risk of liver cancer. According to NJ department of health, other carcinogenic compounds that can end up in tap water include trichloroethylene, tetrachloroethylene, methylene chloride, vinyl chloride, and 1,2-dichloroethane (26). Volatile organic compounds from chlorinated solvents originate from home septic tanks, municipal landfills, hazardous waste dumps, and industrial facilities (26). Improperly discarded volatile organic compounds can easily end up in the tap water, ultimately increasing your dog’s chance of acquiring cancer.

Trihalomethanes are four compounds (Trichloromethane, Dibromochloromethane, Bromodichloromethane, and Tribromomethane) that end up in tap water due to chlorine reacting with organic and inorganic matter in water. Trihalomethanes can cause bladder cancer, and many other health problems; they may trigger the production of free radicals in the body (24) which ultimately increases the chance of cancerous cells’ arising. Haloacetic acids also end up in tap water due to chlorination of water, and they have been classified as carcinogens. Although the effects of carcinogenic substances in tap water may not seem apparent, the prolonged exposure pet owners and their pets get to these carcinogens can ultimately increase the chance of getting liver cancer and bladder cancer. Therefore, we must find a solution to reduce the exposure to these carcinogens in tap water.

An effective method for removing the aforementioned compounds from drinking water is carbon filtering. Carbon filters purify water by allowing the water to pass through the activated carbon,
which is essentially charcoal crushed into powder (27). Carbon filters work well due to the following properties of carbon; carbon has a high affinity for wide variety of substances and carbon in filters has high surface area to allow efficient filtering. Carbon filters can remove the following from tap water: chlorine, benzene, radon, trihalomethanes, and volatile organic compounds (28). One can purchase carbon filter attachments for their home faucets or can purchase pitcher-based filters for drinking water. Because carbon filtration can efficiently remove many carcinogens from tap water and is a relatively cheap method of purifying tap water, it seems to be a feasible solution for reducing your dog’s exposure to cancer-causing compounds in their drinking water.

**Spaying/Neutering (AB)**

One of the common cancer types in dogs is mammary gland tumors. In fact, female dogs have three times the risk of developing breast tumor compared to the risk of developing breast tumor in human females. Although the exact cause of mammary gland tumors is unknown, it can be inferred that the tumors arise due to genetic and hormonal factors (30). The result of the cancer is a slow-growing single mass or multiple masses in the mammary glands of dogs that can ultimately become malignant if left untreated for an extended period of time. Therefore, it is imperative that pet owners take action to delay or prevent mammary gland tumor in their dogs.

In dogs, the chance of developing mammary gland tumors increases as the dog gets older. The risk of developing mammary tumors in unspayed female dogs is 26% (29). Apparently, most of the breast tumors in dogs occur when they are 6 years of age (29); however, the average age for dogs is 10 years. Therefore, there is a significant chance that many of our pets can acquire mammary tumors sometime during their life. One way to reduce the chances of mammary gland tumor in your dog is to neuter the dog at an early age.

The procedure of spaying, also referred to as ovariohysterectomy, involves removal of the ovaries and uterus while the dog is under anesthesia. The procedure, usually a single day event, involves incisions in the abdomen in order to remove the ovaries and uterus. The recovery takes approximately a week (33). In addition to reducing the chances of getting mammary cancer, spaying your dog also includes the following benefits: dogs are safer because they do not need to roam to look for a mate, spayed dogs do not develop a uterine infection called Pyometra, and female dogs do not have bloody discharge during Estrus (term used to refer to time in reproductive cycle when female becomes receptive to mating with males).

Spaying your dog protects it against breast cancer and the protective effect of spaying was only effective if the procedure had been done when the dog was younger than 2 – 2.5 years of age (31). The following data, from a study done in Alameda County, California, shows the variation in chances of dogs getting mammary tumor depending on time of spaying (31):

<table>
<thead>
<tr>
<th>Time of Spaying</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 1st Estrous cycle</td>
<td>0.005</td>
</tr>
<tr>
<td>Between 1st and 2nd Estrous cycle</td>
<td>0.080</td>
</tr>
<tr>
<td>After 2 or more Estrous cycles</td>
<td>0.260</td>
</tr>
</tbody>
</table>

According to the data, it is crucial for dogs to get neutered prior to their first estrous cycle, because that will allow the dog to maintain the lowest chances of acquiring mammary gland tumors. Estrous cycles, which are physiological changes cause by reproductive hormones, start in female dogs after they reach puberty. Although the average age for a dog’s reaching the
puberty stage is approximately 6 months, the actual age varies according to the size of the dog (32); smaller dog breeds tend to reach puberty earlier than 6 months and large dog breeds can take up to 2 years to reach puberty. Therefore, it is essential for pet owners to spay their dog relatively early, especially if it is a small breed. Spaying early may save the dog from acquiring mammary gland cancer in the future, ultimately allowing the pet to live healthier and longer, and saving the pet owner thousands of dollars that would otherwise be spent on cancer treatment.

**What are the Advantages of Citizen Science? (AW)**

While citizen science is an interesting way to get more assistance with research, there may be some benefits and detriments that need to be recognized. In an article about the utilization of urban bird studies, McCaffrey notes how citizen scientists are being used more often in long-term studies as to become more cost-effective as many citizen scientists are volunteers. (34). McCaffrey also writes how in a citizen science project known as the Tucson Bird Count, where citizen scientists had gathered a great deal of data over a large geographic space which would have not have possible without the use of citizen science. (34). While citizen scientists may help tremendously in many fields of research, it helps to remember what exactly a citizen scientist is. Cohn writes while these citizen scientists may not be able to analyze data, they are necessary to gather said data (35). However, the ability of the citizen scientist to follow the experiment should be taken into account. It is important to write specific protocols for citizen scientists as well as determine how well a citizen scientist can record data. (35). It may be important to consider how data gathered by volunteers compares to data gathered by professionals. In a study by Fore et al., the ability of volunteers to monitor streams and identify the taxonomy of certain organisms found in streams was compared to the ability of professionals (36). The study showed that while the data gathered by professionals was more precise, it was only ever so slightly. (36). In another study which involved citizen scientists identifying crab species/gender, it was shown that third and seventh grade students were able to identify a crab species correctly 80% and 95% respectively when it was expected seventh grade students would only be able to identify a crab species correctly 80% of the time. (37). If these young citizen scientists able to properly identify crab species than what was normally expected, it may be safe to say that data gathered by citizen scientists can be considered reliable. Another thing to note is the cost of a citizen science program. A canine study referred to as the Golden Retriever Lifetime Study is near underway and the cost of this 12 year study is approximately 25 million dollars. (38). While the cost of such projects may be expensive, it is important to consider that citizen scientists are mostly volunteers as previously stated. It is important to note data gathered by citizen scientists can be somewhat accurate. Not only that, citizen scientists possess the ability to gather larger quantities of data over a longer area. These are but a few of the many advantages of citizen science.

**Examples of Canine-related Citizen Science Projects (AW)**

While citizen science has been used in various activities, it should be considered if citizen science is applicable to canine cancer research. Some aspect that may need to be first explored is whether a companion canine can be used in such a study. One example of companion canines used in a citizen science project is called Dognition. (39). Dognition is where companion dog owners have their dog complete a series of tests to see how their dog understands the world which the owner can see in the form of a Dognition Profile Report. (39) For this project, the only thing that is required is a dog to play with these interactive games which will then determine what kind of cognition that dog may have. (39) Another example of a citizen science project
involving companion dogs is called the Canine Behavioral Assessment and Research Questionnaire (C-BARQ). (40). With the C-BARQ, canine owners can take a standardized evaluation to determine the temperament of their dog. (40). However, this questionnaire is mostly used by, but not limited to, veterinarians and shelters. (40). With these studies, companion canines are already used in behavior-related citizen science projects, but should be considered for canine health citizen science experiments.

Golden Retriever Lifetime Study (AB)
Golden Retriever Lifetime Study is a prime example of citizen science being integrated into canine cancer research. The study, currently ongoing, plans to recruit 3,000 Golden Retrievers younger than 2 years of age. By recruiting Golden Retrievers at a young age, the study will allow scientists to collect data to learn more the causes of cancer in Golden Retrievers and ways to prevent cancer in dogs. The study, launched in 2012 with a $25 million budget (38), expects to run over the next 10 to 14 years (41), so enough data can be collected throughout the lifetime of the dogs that are involved in the study.

By allowing citizens to participate in the study, scientists will be able to gather a large amount of data in a relatively short period of time do to simultaneous participation of the pet owners. Pet owners who choose to participate in the study are expected to carry out the following tasks: gather and report data about their dog for the dog’s whole life, complete online questionnaires to report data about the dog’s diet and environment, take the dog to a veterinarian each year for examination and sample collection, microchip their dog, and provide tumor samples when applicable. In order to study canine cancer in depth, the veterinarian collects the following from a dog during the annual examination: blood, urine, feces, hair, and toenail clippings (41). The veterinarian collects the samples from the dog and sends the samples to a laboratory for further analysis. Dog owners are responsible for the cost of examinations, sample collection, lab tests, and microchip; however, Morris Animal Foundation will reimburse owners $75 per year to help offset the costs of veterinary examinations and sample collections (41).

The study requires dogs, dog owners, and veterinarians to register for the Golden Retriever Lifetime Study. Dogs must be older than 6 months of age and younger than 2 years of age during registration (41); the age restriction ensures that the dogs start getting observed before the chances of cancer increase with age. Dogs must also be purebred Golden Retrievers with three-generation pedigree. Any pet owner whose dog meets the aforementioned requirements and is at least 18 years of age qualifies for participation in the study. Veterinarians must register for the study in order to access reports and tools he or she needs for the study (41).

Although the study is in its early stage, it has already recruited over 2100 of the 3000 dogs required for the study (41). When cancer is studied in rodents in laboratories, many animals are harmed to increase our understanding of cancer. However, by integrating citizen science into the Golden Retriever Lifetime Study, Morris Animal Foundation will learn a lot more about cancer without causing harm to animals. By using citizen science in the study, Morris Animal Foundation has not only eliminated the need to harm animals but also has sped up the process of analyzing the vast amounts of data required for a successful study.

Community Action: canine cancer research via citizen science.
Because there is less emphasis on canine cancer, it is imperative for us to focus more on canine cancer research. Cancer research usually involves sacrificing many rodents in order to understand a certain aspect of the disease. Using the dog as a cancer model while integrating citizen science into the research will eliminate the need to sacrifice animals; the Golden Retriever Lifetime Study is one example of this type of cancer research and serves as a good model for our newly designed canine cancer study.

In order to successfully implement such studies, the involvement of veterinarians is essential. The veterinarian plays an important role in the citizen science canine study because he or she must perform checkups on the dog’s health and must collect the various samples required for proper monitoring of the dog’s health. The veterinarian is also responsible for signing up dogs and their owners for the canine cancer study, and providing guidelines to the owners of the dogs that are already signed up for the study. However, citizen science in canine cancer research is a new approach, so it is essential for us to notify veterinarians about the concept and to get their input about the feasibility of citizen science in canine cancer research. In order to get their input, we created a survey for veterinarians. The following questions were included in the survey:

- Are you involved in any canine health studies?
- Are you familiar with the concept of citizen science?
- Would you consider being involved in a canine cancer study that incorporates citizen science?
- Would you consider being involved in a citizen science study that involved dog owners visiting their veterinarians on a regular basis for study-related checkups?

The survey allowed us to get veterinarians thinking about getting involved in citizen science canine cancer studies. It also allowed us to get their opinions about various aspects of canine cancer and the integration of citizen science in canine cancer. We were able to get the following responses from 10 veterinarians located in New Jersey:

<table>
<thead>
<tr>
<th>Vet 1</th>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
<th>Question 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Vet 2</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vet 3</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vet 4</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Vet 5</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vet 6</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vet 7</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vet 8</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Vet 9</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vet 10</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

The results of this survey suggest that although these veterinarians are not familiar with the concept of citizen science, most of them are willing to get involved in a citizen science canine cancer study if it includes their patients visiting them for study-related checkups.

This study involves recruiting 250 dogs to study the various factors that may delay the onset of cancer in dogs or prevent cancer in dogs. Because Golden Retrievers tend to have a high risk of
acquiring cancer sometime in their lives, we will be setting the following restrictions for the dogs involved in the study:

- Dog must be a Golden Retriever.
- Dog must be relatively young; preferably younger than 2 years of age.

The study will require pet owners to record data and will require help from veterinarians. Pet owners will be required to visit their veterinarian each year for an examination. During the examination, they must get a form filled out by their veterinarian that has data regarding their pet’s state of health. Pet owners will also be required to periodically report data regarding their pet; however, the reported data will vary depending on the factor being tested on their dog.

The factors being tested on dogs will include the following: diet, exercise, drinking water, spaying. The 250 dogs being observed will be split into five groups, four of which will be testing one of the aforementioned factors and one of which will be the control group. The pet owners will record various data about their pet while allowing their dog to live like it normally would; however, the non-control groups will be changing a single factor, which will be assigned to them when they sign up for the study. In order to implement this canine cancer study, we would require the help of veterinarians. Veterinarians would help increase the number of registered dog participants in the study, perform relevant examinations and fill out forms for pet owners, and provide proper guidelines to pet owners who are involved in the study. Pet owners will be assigned a group number between 1 through 5 when he or she registers a dog for the study depending on the following system: group 1 will be the control group and groups 2 through 5 will correspond to each factor being tested on the dogs, so rotating the group assignment until the 250 dogs are registered will ensure equal distribution of dogs in each group.

50 dogs will be assigned to group 1, which corresponds to the control group. This group of dogs will be allowed to live their everyday lives without changing any factors in their lifestyle. Throughout the course of their lives, the pet owner should continue to record data regarding their dog and will ultimately submit it via an online survey. The online survey will send data to the institution in charge of managing the canine cancer project. The pet owner will be required to annually visit a veterinarian for an annual examination; during the visit, the veterinarian should fill out a form for the pet owner to submit with the data recorded at home. The veterinarian should also collect various samples from each dog for laboratory testing. For instance, if a dog develops a tumor, the veterinarian should perform a biopsy to collect and analyze the tumor sample.

The remaining 200 dogs will be split into group 2, group 3, group 4 and group 5. Each group will correspond to a specific factor to be tested; group 2 will be tested for diet, group 3 will be tested for exercise, group 4 will be tested for drinking water, and group 5 will be tested for effects of spaying. Each group will be given specific guidelines to follow during the course of the study, so the variable can be properly controlled and accurately measured. The guidelines will vary by group and will require pet owners to keep track of the factor being tested so they can report it periodically. The following paragraph provides group-specific guidelines for pet owners to follow during the course of the study.
Group 2 pet owners should allow their pet to live normally but change one thing, the diet. To test the dietary factor for delaying the onset of canine cancer, a practical method must be used. Therefore, pet owners should include relatively high amounts of carrots in their dog’s diet. Whether the carrots are given as snacks or as part of each meal, the pet owner must record how many carrots (in grams) are given to their dog each day. The data regarding the amount of carrots fed to the dog should be reported every month via the survey.

Group 3 pet owners should allow their pet to live normally but change one thing, exercise levels. Pet owners must allow their dog to exercise daily. It is preferred that owners take their dogs outside each day and allow the dog to run. The pet owner should take their dog to the veterinarian to measure the dog’s BCS (body conditioning score) during the annual veterinarian visit. Each year, the pet owner should report the BCS determined by their veterinarian. They should also report the days their dog exercised, how much their dog exercised, and which type of exercise activity the dog generally takes part in.

Group 4 pet owners should allow their pet to live normally but change one thing, drinking water. To test this factor, dog owners must purchase carbon filters for their household. Pet owners can purchase carbon filters that come with pitchers or carbon filters that can be attached to the faucet. The filter will remove the potential carcinogens and other toxic materials from the tap water. The dogs in this group should be given only filtered drinking water. Pet owners should report the days they were not able to provide their dog with filtered drinking water via the online survey.

Group 5 pet owners should allow their pet to live normally but should get their dog spayed before the age of two. The dogs should get spayed early enough to show a significant impact on the onset of cancer. After the dog is recovered from the spaying procedure, the pet owner should allow the dog to live normally without attempting to change any other factors. The date of spaying must be reported so that the exact age during the spaying procedure can be determined.

References
http://www.nature.com/scientificamerican/journal/v295/n6/full/scientificamerican1206-94.html
http://www.wearethecure.org/more_cancer_facts.htm


Dear Targum Editor,

I would like to discuss an alternative method for cancer research. When we hear about research related to diseases like cancer, we tend to imagine the study being done in a laboratory setting where little rodents are the cancer model. Although scientists have learned many things about cancer by using rodent cancer models like rat and mice, they have not unlocked the full potential of cancer research by relying too often on these models.

A better model for cancer research is the dog because of the nature of cancer in dogs. Dogs tend to get cancer naturally like human cancer. However, cancer is induce in rodents like rat and mice. Therefore, the artificial cancer is not as effective for cancer studies as a naturally occurring cancer in dogs. In fact, some drugs that cure cancers in lab rodents do not cure similar cancers in humans. Dog cancers have shown similar characteristics to cancers in humans. Osteosarcoma in dogs tends to have similar skeletal location and aggressiveness to osteosarcoma in humans. Unfortunately, there is little data on cancer research in dogs.

Cancer research should focus more on dogs as cancer model. A good start is researching cancer-causing factors in dogs by integrating citizen science, where pet owners get involved in the study. Dr. Fagan, a professor at Rutgers University, and undergraduate researchers have started studying various factors (diet, exercise, and environment) that play a role in canine cancer. A program, currently under development, will provide guidelines for pet owners who volunteer for this study to control certain variable and record the appropriate data about their dogs.

-Aakash Babaria

Using Citizen Science to research cancer in canines

In many canine companions, a considerable amount may be diagnosed with some form of cancer in their lives. For dogs, it can be incredibly painful for not only dealing with cancer, but also the chemotherapy treatments they may need to undertake. For people, it can be hard to see their beloved companion suffering. The question that could be asked is if there is something a dog owner can do.

Cancer research is commonly known to be done on rats and mice, but it may not be well known that dogs are a good research model for cancer as they may get certain types of cancers not found in other animals. While it maybe not that enticing to research cancer in an animal most people
see as pets, the data that comes from such research may affect human cancer research as well. With cancer research, there may be a way for people to become involved in more ways than one.

Citizen Science is the practice of using citizens to gather data about a field of scientific interest. Some fields of science that utilize citizen science include ornithology, ecology and so on. Citizen science is not only a cost-effective way of collecting data over a period of time, but is a way of educating everyday citizens about scientific research that may come to affect some facet of their daily life.

While people may donate their money to help fight many types of cancers, people should consider donating their time as well. There may be a citizen science project out there that researches some cancer that may not only affect someone’s pet dog, but a person as well.

-Alexander Walsh