of animal experimentation at the school level that at best can be called unscientific. We have been overwhelmed with anecdotal "evidence," insufficient sample size, out-of-date data being applied to current programs, incorrect information, and out-of-context quotations.

Frankly, these problems make me somewhat pessimistic about the possibility of coming to any sort of agreement. I can only hope that if we continue our dialogue, we may be able to lessen the chasm between us.

High School Science Fairs: Evaluation of Live Animal Experimentation—The Canadian Experience

Harry C. Rowsell

Abstract

When the Canadian Council on Animal Care was established in 1968, the Council, together with representatives from the Canadian Veterinary Medical Association in concert with the Youth Science Foundation, recognized the importance of well-conceived science fair projects involving live animals. It was recognized as well that poor science encouraged poor attitudes toward the animals involved, as well as a misunderstanding of scientific investigation. Numerous schemes were tried in an effort to ensure development of proper scientific investigational attitudes as well as a respect for living things. These will be discussed, outlining where such schemes failed.

In May, 1975, Regulations for Animal Experimentation in Science Fairs in Canada were adopted by the regional representatives at the Canada-wide Science Fair in Jonquiere, Quebec. These regulations state that vertebrate animals are not to be used in experiments for projects for Science Fairs, with the following exceptions:

A. Observations of normal living patterns of wild animals in the free living state or in zoological parks, gardens or aquaria.

B. Observations of normal living patterns of pets, fish or domestic animals.

Since these regulations were adopted, the biological exhibits have increased and have shown significant improvements in scientific input involving increased numbers of bacteria, fungi, cells, sera and tissue culture. The requirement for strict supervision because of possible abuses has decreased, thus lessening the anxiety and frustration of the regional science fair committees.

Introduction

The Youth Science Foundation (YSF) is the umbrella organization responsible for all out-of-school science activities in Canada. Its objective is to develop a scientific awareness amongst pre-university students as well as to encourage scientific literacy. The Science Fair program is one of the principle activities for which the Foundation is responsible. Others include the Summer Science Program, Careers Information Service, the Rocketry Association, its publications Youth Science News and Science Affairs, Science and Engineering Clubs of Canada (SECCAN) as well as international activities on the International Coordinating Committee for the Presentation of Science
and Development of Out-of-School Scientific Activities (ICS), with its secretariat in Brussels, Belgium.

The Youth Science Foundation programs are directed primarily to the English speaking students in Canada's ten provinces and territories. The Conseil de Jeunesse Scientifique (CJS) by mutual agreement with the YSF is responsible for similar activities for francophone students. However, the CJS has for the most part, limited its involvement to the French speaking students in Quebec, where the major concentration is located.

The YSF evolved from the Canadian Science Fairs Council; therefore, it should not be surprising that the Canada-wide Science Fair is the Foundation’s major activity both in terms of participants and overall cost of the program. Each year more than 50,000 students participate in local and regional science fairs. Of these a select group of approximately 200 finalists earn their way to the Canada-wide Science Fair.

The Canada-wide Science Fair is the highest level of the Canada-wide Science Fairs program. The Science Fair Foundation continues to maintain the position that the prizes it offers are the most prestigious awards, albeit not having the highest monetary value. There has been a sincere attempt on the part of the Foundation to have corporations and professional associations provide reasonably monetary awards or items such as books or plaques.

The Science Fair Committees of the YSF has accepted in the past, and will continue to accept, specific corporations' awards of all-expense-paid trips to various geographic locations. For the past several years Shell Canada has given “Science Fortnight in Great Britain” awards to two Canada-wide Science Fair participants annually. Canadian National Corporation Ltd. and Rockwell International Canada, Ltd. sponsor three winners to visit the NASA Space Center in California. Bell Northern sponsors a visit to its research laboratories in the Ottawa area. Syncrude Canada Ltd.—two students, three-day all expense trip to Edmonton, Fort Murray and the tar sands. Ontario Science Center—two students, all expense trip to Ontario Science Centre in Toronto to display their exhibits.

The 1979 Canada-wide Science Fair held in London, Ontario, had four winning exhibits from the 55 affiliated Regional Science Fairs. Of these 68 exhibits were awarded prizes.

The Canada-wide Science Fair, like all activities of the Youth Science Foundation, is operated through a Committee structure. The Fair’s chairman-elect serves as chairman of the Science Fair Committee the year preceding “his/her” science fair, upon completion of which he/she steps down. The Science Fair Committee develops rules and regulations concerning the Canada-wide Science Fair as well as producing, through the Executive Director of the YSF, an information package on preparation and operation of a Science Fair. The Committee also holds discussions concerning the judging of Science Fairs. Some members have from time to time suggested that competition and the presentation of monetary awards are not the best way of teaching and developing an awareness and appreciation of science. However, a majority of members continue to opt for a competitive program.

All science fairs wishing to send representatives to the Canada-wide Science Fair must affiliate with the Canada-wide Science Fair and must follow its regulations and rules. Every effort is being made by the Canada-wide Science Fair Committee to ensure this is done before representatives are selected. Two weeks prior to the national event a list of local students must be submitted to the secretariat of the Youth Science Foundation, including all information on the exhibitor, the project title and abstract outlining content, objectives and results. These are reviewed in order to ensure they comply with size, contain no hazardous or dangerous compounds, and that the animal work meets the regulations. Unfortunately there are some regional science fairs that affiliate late. This produces problems because it is difficult to review protocols in order to ensure they comply with the regulations. One of the most difficult encounters is to tell student exhibitors that they cannot exhibit because their study does not comply with regulations.

At the time of the Canada-wide Science Fair a regional representatives’ meeting is held to discuss all aspects of the Regional Canada-wide Science Fairs. At this meeting the regulations for Science Fairs are reviewed and any proposed changes debated. Until 1975, the regulations concerning the use of animals in science fairs were vigorously discussed. In 1975, the regional representative meeting agreed that the regulations proposed by the Animal Care Committee of the YSF would eliminate this perennial problem: students seeing exhibits over regulation size admitted, but animal studies which didn’t comply with YSF regulations prohibited. This created a major problem for exhibitors. Elimination was psychologically disappointing and frustrating. The new regulations were specific. The students knew exactly the limitations regarding the use of animals. Since that date, the regulations for animal experimentation as presented in Appendix 1 have been in effect.

The Role of the Canadian Council on Animal Care

When the Canadian Council on Animal Care (CCAC) was established in January 1968 (Rowell, 1974), numerous complaints were brought to the attention of the CCAC secretariat concerning the abuse of animals by youthful exhibitors in Science Fairs.

Although the CCAC had been established specifically to develop guidelines for the improvement in the care of experimental animals at the university and research levels, nevertheless its terms of reference, which were purposely made very broad, stated that the Council was “to work for the improvement in the care and use of animals on a Canada-wide basis.” Such terms gave the Council the ability to make recommendations for improvements in the procurement and production of experimental animals, the facilities and care of experimental animals and the examination of procedures in experiments involving animals. Thus, the CCAC quickly became involved in the use of animals in experiments at the pre-university level. Its initial priority was at the level of the use of animals in science fairs.

The Council consists of representatives from 14 agencies. The chairman is appointed by the Association of Universities and Colleges of Canada (AUCC) which organization has two further seats in the CCAC occupied by academics and humanities affiliations. These two seats on Council are filled by representatives of the Canadian Federation of Humane Societies (CFHS) representing over 200,000 members. The remaining agencies on Council have one representative each. The majority of representatives on Council had heard about some of the studies involving animals being exhibited at Canada-wide Science Fairs which has resulted in unnecessary pain and distress. The CFHS representative had been requested by their membership to ensure the CCAC address itself to the problem in order to stop this frivolous and unnecessary use of animals.

The Canadian Veterinary Medical Association (CVMA) having heard similar concerns expressed, appointed the Executive Director of the CCAC as its representative on the Board of Directors of the Youth Science Foundation.

The Youth Science Foundation and its Science Fair Committee were aware that
each year there were numerous complaints about the use of animals in science fair projects which brought bad publicity to the Science Fair both regionally and nationally. It was always those projects that were poorly conceived and carried out, causing pain and distress to animals, that received most publicity through letters to the editor or press reports in the local media or by direct complaints to the Regional Science Fair Committee or the Youth Science Foundation secretariat.

The Board of Directors of the YSF and the Science Fairs Committee quickly requested that the Executive Director of the CCAC and representatives of the CVMA develop an animal care committee whose responsibility it would be to advise the YSF on rules governing the use of animals in Science Fairs. Subsequently a six-member Animal Care Committee, chaired by the Executive Director of the CCAC, with representatives from the Ontario Veterinary Association, and L’Ordre des medecins vetérinaires du Quebec discussed the issue and developed initial regulations. The CVMA in order to encourage humane treatment of animals decided to present an annual award called the CVMA Science Fair Award with presentation based on the criterion that: “the winner should have expressed a scientific approach to the study which exemplified humane care and use of animal resources.”

Additionally, two CVMA members joined the judging committee in order to choose the winner and assist the committee on all animal projects.

**Untrained Students and Ill-Treated Animals**

The CCAC and YSF Animal Care Committee recognized that because the Science Fair program had “grown like topsy,” certain students prepared projects involving animals based upon articles in the popular press, or a science or nature program on television. In most cases the students undertaking projects involving animals would not discuss their plans with people familiar with the subject. Often they were too inexperienced to understand their own results, and typically they were unfamiliar with the basics of animal care and humane treatment; although no cruelty was intended, they simply did not understand and recognize they were in fact, causing suffering in the animals. The result, unfortunately, was often suffering for the animals with little benefit to the student with respect to developing an understanding of science methodology. Unfortunately, in some cases the student would receive an award of prize money because the judges themselves did not recognize that unnecessary suffering and distress had been caused and that the project actually was more spectacular than scientific.

Previous “bad press” that developed was exemplified by an article in the Hamilton Spectator following the 1970 Canada-wide Science Fair held at McMaster University in Hamilton, headlined “Science or Sadism?” It described a project in which rats had been exposed to nail polish remover until they died from liver and bone marrow destruction. The student responsible was unable to recognize the cause of death.

Projects such as these were far beyond the students’ level of training and comprehension. They inflicted useless suffering on experimental animals and failed to achieve the objective for which the Science Fair was instituted in the first place, namely a proper understanding and appreciation of scientific investigation, thus a scientific awareness. Such studies failed to develop responsible attitudes toward the care and use of animals. Such a lack of responsibility was obvious in the community in general where there were increasing numbers of unwanted dogs and cats being destroyed annually. Although selected as companion animals, they were often disposed of in a cruel manner, usually to fend for themselves on the streets or discarded in rural areas in surround-nings both hostile and unknown. Hopefully, attitudes developed by the rules and regulations established for animal use at the Science Fair level may create a more responsible society as these young people take their place in a mature world.

**Development of Guidelines for Animal Use**

The Youth Science Foundation developed initially a Canadian code of judging principles and standards for use at the Canada-wide Science Fair and the affiliated regional science fairs. The Animal Care Committee of the YSF presented to the Science Fair Committee and to the CCAC, Guiding Principles for Animal Care. The first principles proposed merely that certain projects involving vertebrate animals must be undertaken only under the supervision of an adult experienced in that field of research. A list of experts was developed by the Canadian Federation of Biological Societies (CFBS). Regional Science Fairs were notified of the existence of this list and students were sent letters indicating the availability in their area of scientists willing to assist in biological projects. This was a laborious procedure requiring considerable paper work and correspondence. Unfortunately, most students proceeded along on the projects on their own without consultation or advice from the scientist consultants.

The guiding principles were changed when it was recognized that students were continuing to undertake projects well beyond their level of comprehension unwittingly causing pain and distress to animals. The new version emphasized that any project involving vertebrate animals should not be undertaken if it caused pain or affected the health of the animal. At the time of the Canada-wide Science Fair as well as at the time of Regional Science Fairs, students apparently failed to recognize abnormalities in the health of the animal, or misinterpreted indications of distress. Following experience with animal projects in the 1971-72 Science Fair program, the guidelines were further revised in September, 1972, to describe specifically those animal studies which were prohibited (Secord and Rowzell, 1974). These guidelines stated that:

A. No experimental procedures shall be attempted on a vertebrate animal that would subject it to pain or distinct discomfort or interfere with its health.

B. Surgery shall not be performed on vertebrates.

C. Experimental procedures shall not involve the use of microorganisms which cause disease in man or animals, ionizing radiation, cancer producing agents, chemicals at toxic levels, drugs known to produce abnormal side effects or capable of producing teratogenic effects.

D. Experimental treatment should not include electric shock, exercise until exhaustion, or other distressing stimuli.

E. Food should be palatable, of sufficient quantity and balanced to maintain a good standard of nutrition. Clean drinking water should be available at all times. Food shall not be withdrawn for longer than 12-hour periods. Containers for food and clean water shall be of a design, made specifically for that purpose.

F. If egg embryos are subjected to experimental manipulations, the embryo must be destroyed humanely by the 19th day. If normal egg embryos are to be hatched, satisfactory humane considerations must be made for disposal of chicks.

G. All experiments shall be carried out under the supervision of a competent science teacher. It shall be the responsibility of a qualified science teacher to insure the student has the necessary comprehension for the study to be undertaken. Whenever possible specifically qualified experts in the field shall be consulted.
It would appear that these guidelines for science fairs would have the necessary information and requirements to ensure that animals in science fair projects would not be subject to unnecessary pain and suffering.

As a further safeguard, the YSF Animal Care Committee of the YSF called upon veterinarians and scientists experienced in animal care to serve on animal care committees for the regional science fairs. The Board of Directors for each fair was asked to appoint a member of the Youth Science Foundation on their own animal care committees or set up a committee of their own choosing. They were also asked to invite a member of the animal care committee to attend meetings of the regional science fair committee, to ensure that the Board of Directors understood the animal care guidelines and their own responsibilities. The animal care committee was required to ensure that all projects involving animals met the guidelines and their own responsibilities. Finally, it was required that all projects involving animals met the guidelines before the regional science fair was opened to judging and to the general public. The Animal Care Committee of the YSF created an additional safeguard by enforcing the means of insuring the application of the guiding principles, through an affidavit of approval for any project involving living vertebrate animals (Appendix 2). Without completion by the regional animal care committee, the project could not be shown. In order to obtain an affidavit the student contemplating such a project had to complete a questionnaire describing among other things, the purpose of the experimental study involving animals and the procedures they intended to carry out. Once the affidavit of approval was issued the students were not permitted to change any of their experimental procedures without the prior approval of the animal care committee.

In the Province of Ontario the Animals for Research Act requires that research using animals cannot cause unnecessary pain or distress. The affidavit of approval was accepted as evidence that the project met the requirements of the Act. Additionally, veterinarians and inspectors from the Veterinary Services Branch from the Ministry of Agriculture and Food visited each of the regional science fairs in Ontario.

It was considered that this program would eliminate improperly designed studies and preclude the objectionable studies causing pain and distress in animals that had plagued the science fair program in Canada for so many years. Instead, it was found that some chairs of animal care committees signed affidavits without closely examining the procedures and the scientific merit of the project as a worthwhile learning experience for the student.

Following the Canada-wide Science Fair in 1974 held in Calgary, Alberta during which one or two projects, albeit with signed affidavits of approval, violated the guidelines, the Animal Care Committee of the YSF met and decided that these continued, unnecessary abuses of animals in science fair projects must end. Indeed, one member who had acted as a judge in one of the large regional science fairs stated that those projects involving animals were the poorest designed and the worst science of any projects in the science fair. It was the desire to see all projects involving animals prohibited. The committee would not endorse this request. However, it recognized that despite the efforts that had been made improvements were necessary.

The Solution

In May 1975, Regulations for Animal Experimentation in Science Fairs in Canada were presented to the regional representatives at the Canada-wide Science Fair in Jonquiere, Quebec. These regulations which had been developed by and given approval of the Animal Care Committee of the YSF and the Canadian Council on Animal Care, were adopted without modification or amendment (Appendix 1). These regulations state that vertebrate animals are not to be used in experiments for projects for science fairs, with the following exceptions: a) observations of normal living patterns of wild animals in the free living state or in zoological parks, gardens or aquaria; b) observations of normal living patterns of pets, fish or domestic animals.

Since these regulations were adopted, the biological exhibits have increased and shown significant improvements in scientific input involving increased numbers of bacteria, fungi, cells, sera and tissue culture. The requirement for strict supervision because of possible abuses has decreased, thus lessening the anxiety and frustrations of the science fair committees and eliminating the adverse publicity that had followed so many of the previous science fairs.

It has been the Canadian experience, regrettably, to learn the hard way. We should have listened to the statement of Dr. Chauncey D. Leake, President of Pharmacology of Ohio State University when he wrote: "It seems to me that it is wise to avoid getting our youngsters so enthused over biological sciences that they are anxious to undertake extensive animal experimentation without the background, the experience, the judgement, or the ways that are necessary in handling animals appropriately for complicated biological experimentation" (Animal Welfare Institute, 1960).

Because of our mistakes in attempting to develop programs that on paper sounded good but in practice were impractical and unrealistic, we had to turn to a recognition by ourselves and students preparing studies that lower orders such as bacteria, fungi, protozoa and insects can reveal much basic biological information. We were pleased to encourage Dr. Barbara Orland (1977) in her preparation of her book entitled "Animal Care from Protozoa to Small Mammals". The diverse selection of organisms for study noted in this publication encourage a proper understanding of the science of life and scientific technique. The student wishing to pursue a career in the biological sciences is provided with information of such clarity that all aspects of any experimental studies involving the species listed in this book should be within his or her comprehension and capabilities.

The Canadian Council on Animal Care, following the acceptance of the regulations for animal experimentation in science fairs and their implementation, turned to the need to ensure proper guidelines governing the use of animals in the classroom at the pre-university level. To this end guiding principles in this regard (Appendix 3) were prepared for use by Departments of Education and Boards of Education across Canada to ensure adequate safeguards exist for the proper care and use of animals in experimentation in the classroom. It is emphasized that "these guidelines are not for use by students preparing projects for exhibit in science fairs. Students preparing projects for science fairs must adhere to the Youth Science Fair Regulations for Animal Experimentation, as prepared and distributed by the Youth Science Foundation."

Along with these guidelines were distributed suggestions for experiments involving animals at the pre-university level (Appendix 4). Additionally, collaboration has been undertaken with various school educational authorities in preparation of manuals and course outlines, involving animals and teaching programs at the pre-university level (Bartlett et al., 1972; Frontenac County Board of Education et al., 1972).

It is essential that man continue to use animals in scientific exercise striving at all levels to insure proper stewardship of these animals, recognizing that even the Judeo-Christian ethic of man's dominion over animals carries concomitant obligations toward them. The replacement of animals in the classroom or science fair is possible and
should be encouraged (Borden and Herrin, 1972; Godwin, 1979; FRAME, 1979). Therefore, we must recognize our responsibility for insuring stewardship to insure the prevention of pain and suffering amongst animals (Rowse and McWilliam, 1980). All those using animals must be consistent in recognizing that creatures be treated equally and not designated as first class, second class, etc. Snakes have the same rights as dolphins, whales and seals. All are vertebrates. All can feel pain. Only human beings can recognize and prevent pain and suffering amongst their animals. This is the objective of the Canadian Council on Animal Care in insuring proper use of animals in science fairs or in the classroom at the pre-university level.

References


FRAME (Fund for the Replacement of Animals in Medical Experiments) 1979 Xenopus Tissue Culture Kit. Frame Tech News 1:1.


Appendix 1

Regulations for Animal Experimentation in Science Fairs

A. Biological experimentation is essential for an understanding of living processes. Such studies should lead to a respect for all living things. Capable students, anxious to pursue a career in biological sciences must receive the necessary encouragement and direction. All aspects of the project must be within the comprehensions and capabilities of the student undertaking the study.

B. Lower orders such as bacteria, fungi, protozoa and insects can reveal much basic biological information. If experiments are to be conducted on living subjects for science fair projects then only lower orders of life may be used.

C. Vertebrate animals are not to be used in experiments for projects for science fairs, with the following exceptions:

1. Observations of normal living patterns of wild animals in the free living state or in zoological parks, gardens or aquaria.

2. Observations of normal living patterns of pets, fish or domestic animals.

D. No living vertebrate animal shall be displayed in exhibits in science fairs.

E. Cells such as red blood cells, other tissue cells, plasma or serum purchased or acquired from biological supply houses or research facilities may be used in science fair projects.

F. Observational type studies on only chicken egg embryos may be used in science fair projects. If normal egg embryos are to be hatched, satisfactory humane considerations must be made for disposal of the chicks. If such arrangements cannot be made then the chicken embryos must be destroyed on the 19th day of incubation. No eggs capable of hatching may be exhibited in science fairs.

G. All experiments shall be carried out under the supervision of a competent science teacher. It shall be the responsibility of the qualified science teacher to ensure the student has the necessary comprehension for the study to be undertaken. Whenever possible specifically qualified experts in the field shall be consulted.

For information and names of qualified experts write to:

Canadian Council on Animal Care
1105-151 Slater St.
Ottawa, Ont.
K1P 9H3 Canada

Youth Science Foundation
302-151 Slater St.
Ottawa, Ont.

Accepted by Regional Representatives, Canada Wide Science Fair, May 23, 1975
Appendix 2

YOUTH SCIENCE FOUNDATION
ANIMAL CARE COMMITTEE

AFFIDAVIT

FOR USE OF ANIMALS IN YOUTH SCIENCE PROJECTS

This is to Certify that

NAME OF STUDENT

ADDRESS OF STUDENT

SCHOOL NAME

Has received the approval of the Animal Care Committee to show this project involving experimental animals. The project has followed the Youth Science Foundation guiding principles for animal experimentation at the pre-university level.

DATE

CHAIRMAN
REGIONAL ANIMAL CARE COMMITTEE
YOUTH SCIENCE FOUNDATION

Appendix 3

Guiding Principles Governing the Use of Animals in the Classroom at the Pre University Level

I. Purpose

These guiding principles have been prepared by the Canadian Council on Animal Care. They are recommended for use by Departments of Education and Boards of Education across Canada in order to ensure adequate safeguards exist for the proper care and use of animals in experimentation in the classroom, in the schools, in their jurisdiction.

These guidelines are not for use by students preparing projects for exhibit in Science Fairs. Students preparing projects for Science Fairs must adhere to the Youth Science Fair Regulations for Animal Experimentation, as prepared and distributed, by the Youth Science Foundation, Suite 302, 151 Slater St., Ottawa, Ontario K1P 5H3.

II. Philosophical Considerations

Biological experimentation involving animals in the classroom is essential for an understanding of living processes. Such studies should lead to a respect for all living things. All aspects of the study must be within the comprehensions and capabilities of the student undertaking the study.

Lower orders of life are preferable subjects for experimentation at the pre-university level. Such lower orders as bacteria, fungi, protozoa, and insects can reveal much basic biological information; they should be used for experimentation, wherever and whenever possible.

III. Care of Experimental Animals

The care of experimental animals in the school should embody the principles laid down in the Care of Experimental Animals, a Guide for Canada, as prepared and distributed by the Canadian Council on Animal Care.

The following principles are necessary in order to provide optimal animal care:

A. The maintenance of animals in a classroom shared by students on a long term basis, is not recommended. Therefore, animal quarters specifically for housing of animals should be provided.

B. All experimental animals used in teaching programs must be properly cared for. Animal quarters should be made comfortable by provisions for sanitation, protection from the elements and have sufficient space for normal behavioural and postural requirements of the species. The living quarters shall have surfaces that may be easily cleaned, good ventilation and lighting; well regulated temperatures and cages of sufficient size to prevent overcrowding. Animals must be protected from direct sunlight or other environmental factors which may disturb the well-being of the animal.

C. Food should be palatable, of sufficient quantity and balance to maintain a good standard of nutrition. Animals shall not be allowed to go below the maintenance level of nutrition. Clean drinking water shall be available at all times. Containers for
food and water should be of a design, made specifically for that purpose.

D. Colonies and animal quarters shall be supervised by a science teacher experienced in animal care. The students and other animal care staff shall be trained and required to handle the animals gently and humanely.

E. All animals must be disposed of in a humane manner. If euthanasia has to be carried out an approved humane method must be used and carried out by an adult experienced in the use of such procedures.

F. The use of animals must comply with existing local, provincial or federal legislation.

G. The procurement and use of wild animals and birds must comply with the Migratory Birds Convention Act of Canada, the Convention on International Trade in Endangered Species of Wild Fauna & Flora (ratified by Order in Council July 3, 1975) as well as any existing legislation at the provincial level concerned with wild animals and exotic species.

IV. Experimental Studies

A. All experiments should be carried out under the supervision of a competent science teacher. It is the responsibility of the qualified science teacher to ensure the student has the necessary comprehension for the study to be undertaken.

B. Students should not be allowed to take animals home to carry out experimental studies. All studies involving animals must be carried out in a suitable area in the school.

C. All students carrying out projects involving vertebrate animals must adhere to the following guidelines:
   1. No experimental procedures shall be attempted on a vertebrate animal that should subject it to pain or distinct discomfort, or interfere with its health.
   2. Students shall not perform surgery on vertebrate animals.
   3. Experimental procedures shall not involve the use of:
      a. microorganisms which can cause diseases in man or animals.
      b. ionizing radiation.
      c. cancer producing agents.
      d. drugs or chemicals at toxic levels.
      e. alcohol in any form.
      f. drugs that may produce pain.
      g. drugs known to produce adverse reactions, side effects, or capable of producing birth deformities.
   4. Experimental treatments should not include electric shock, exercise until exhaustion, or other distressing stimuli.
   5. Behavioural studies should use only reward (positive reinforcement) and not punishment in training programs.
   6. If egg embryos are subjected to experimental manipulations, the embryo must be destroyed humanely 2 days prior to hatching. If normal egg embryos are to be hatched, satisfactory humane considerations must be made for disposal of the young birds.
   7. The use of anaesthetic agents, by students, is not recommended and in the case of some anaesthetics not permitted by law.
   8. Information on the care, housing and management for individual species, as well as suitable experiments for use at the pre university level, may be obtained from the Canadian Council on Animal Care, 151 Slater St., Suite 1105, Ottawa, Ont. K1P 5H3.

Appendix 4

Suggestions for Experiments Involving Animals at the Pre University Level

In order to give guidance to Youth Science Fair participants, Biology Teachers and Science Fair Directors, the following presents ten broad acceptable areas of animal experimentation at the pre university level. It is supplementary to the Source of Information on Animal Care and Experimentation for Pre University Biology.

A. Physiology—measure normal physiological parameters such as respiratory rate, heart rate, temperature, eating habits, measurement of the length of the time dye-markers take to pass through the gastro intestinal tract and appear in the feces. Fecal output, urine production measuring when animal is fed greens as source of water as compared to water ad lib.

B. Reproductive Biology may be done with mice, hamsters, gerbils or rats, allowing the species to be studied to live under a variety of conditions. Studies may be repeated on the same animals because of the short gestation. The animals may be treated in the following manner or modifications of these.
   1. Before breeding the animal is gently handled and given kind treatment by the student each day. After breeding the gentling continues.
   2. A second group of animals does not receive this gentling treatment but instead are left in their cages to breed.
   3. A group of animals are placed in a darkened room and not allowed any light, one group is removed each day and handled and the other group is not. Many variations of this may be carried out without causing any distress to the animal. The number of the! young born is observed and recorded in the same manner the number of young weaned is observed. Additionally, in the study one can also look at the habits the habits the animals have with respect to the provision of proper bedding materials or nest boxes etc.
   4. Maze studies—many variety of studies can be carried out using mazes, all with positive reinforcement, timing the animals, again modifying the handling of the animals, modifying the type of environment in which the animal lives i.e. darkness, light, exposure to soft music, rock music four to six hours a day etc. All of this is given on positive reinforcement, no electric shock or food deprivation etc.
   5. Behavioural studies—The effect of enriched environments on the behaviour of the animals i.e. provision in a gerbil's cage of bottles, containers in which the animals may wash; the study of an enriched environment as compared with an environment in which only the necessities are provided such as water, food. The student may let his imagination carry into many areas by providing balls, round objects, square objects, etc. etc. Many psychology departments have basic studies in which behavioural scientists look at the effect of enriching an environment. This has good application to modern day human sociological problems.
   6. Nutritional Studies—Again none of these studies should involve producing deficiencies and disease in the animals; however, there are many studies that can be

*Available from Canadian Council on Animal Care, 151 Slater St., Ottawa, Ontario K1P 5H3 or Youth Science Foundation at same address.
carried out where animals can eat a balanced diet, for example one diet fed in a cubic state giving recognition that most of the rodents are gnawers; then another group fed on a powdered ration or a meal mixture and a third group fed on a ration which is moistened by water. The animals should be in a growing stage; they are weighed each day and measurements such as body weight gains recorded. In this the student learns to handle the animal and to make accurate measurements. In such studies fecal and urinary output are possible adaptations.

F. Environmental Studies — Again in this area light, darkness, temperature may be measured against weight gains in young animals or food intake or urinary output. The animals can be maintained in the darkness, handled or not handled and then brought into the light; handled regularly and increasing or decreasing weight gains observed under these different regimens. With respect to temperature only a normal temperature for the animal should be studied or one where the temperatures are increased five to ten degrees above the recommended normal maintenance temperature for the animal. For example, if the normal temperature for rats is considered as 72° Fahrenheit then raising the temperature to 78 or 80 degrees could be studied. It is not recommended that anyone study effects of temperatures above 80° F or below 65° F.

G. Anatomical Preparations — The bodies of dead animals may be obtained from humane societies or research laboratories where animals have been killed humanely. The preparation of skeletons from these animals, clearing the bones and reforming the body is a giant task. Comparison of the various bones in animals is another interesting detail, particularly if function is also brought into the study.

H. Genetics — Under this heading, various colours of mice or rats, hamsters or rabbits may be bred and the colour adaptations recorded. Similarly, in this one can study the effects of random breeding, brother and sister matings, and line breeding with respect to number of young-born, colours, sex, etc.

I. Field Studies — Data collecting of information concerning numbers of wild animals within a given area i.e. woodpecker population in an area close to an industrialized or a built up area and one far removed. There are all kinds of combinations of studies that can be made studying the influence of various changes in the environment inflicted on the animal by man. Into this study as well one could build feeding stations and study bird population or animal populations as they arise. One such field study that would be worthwhile would be observation of animals in a dump.

Study of the senses — studies on sight, smell, taste, the type of exposure should be on only those things which we may contact daily. Various studies can be done here where behaviour of animals can be observed when exposed to various colours in their environment, or by the exposure of the environment say of a heavy peppermint smell or an onion odour. Ordinary food stuffs fed laboratory animals can be coloured with vegetable dyes or can be altered with respect to taste by adding spices etc. Nothing should be added which would be regarded as unacceptable to human senses.

September 1976

The Challenge and Motivation of Students through Live Animal Projects

Thurman S. Graffon

Abstract

The subject of use of live animals by secondary schools either in classroom work or science fairs is a very controversial and often emotional issue. The author emphasizes the dedication to humane treatment of animals while at the same time explaining the process by which rules have been formulated to provide for the appropriate use of live animals. The difference between permission and mandate is clarified for the purpose of explaining the need to provide for the more effective challenge and motivation of the high achiever while still allowing for more modest undertakings by the average student. The perils of overregulation are stated. Recommendations for the further improvement of the program are offered.

Introduction

The biomedical scientific community has a serious responsibility to participate in the development of its own replacements from subsequent generations. We have learned the problems of affirmative action for admission to professional and graduate schools must be addressed to preparation at the elementary levels of education in terms of basic learning of reading, writing, and mathematical skills. Likewise, it is important to introduce students to the biological sciences early in the educational process if motivation for career in the biological, life, and health sciences is to be achieved (NABT, 1966).

Educators generally agree that participation of students is one of the crucial ingredients in learning. Individual research projects are one means of insuring student participation. The proper use of live animals in science fair competitions has been recognized as one that generates enthusiastic participation (Bellipanni, 1977).

An article by W. B. Cannon, M.D., Professor of Physiology at Harvard, in 1912 clearly identified the significant difference between observation and the experimental method. He placed this transition at about 1890. Prior to then “to account for sickness, all sorts of theories were advanced such as bad air, the influence of stars and mysterious humours and mystasms; but these theories were subjected to almost no experimental tests.” (Cannon, 1912) Thus the scientific method was established.

Many secondary school students will not continue into higher education. This represents a greater challenge to the teacher to stimulate and motivate the student to pursue these lines of study. For these, the occasion to participate in a well-planned in-