Norwegian veterinary training based on animal alternatives

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Abstract

This presentation describes the steps taken by a Norwegian veterinary student to complete her veterinary education using alternatives to laboratory animals. This included the use of computer simulations, student self-experiments in physiology, dissections on superfluous material from the pathology department and naturally dead animals, and surgical training through beneficial procedures in veterinary clinics.

Possible alternatives to laboratory animal use, and beneficial or neutral work with animals, will be described, building upon the authors´ experiences with databases such as NORINA (http://oslovet.veths.no) and organisations such as InterNICHE (http://www.interniche.org).

Introduction

Many veterinary students are highly motivated to use their future skills to help and to care for animals, and are drawn to the profession by their compassion for living beings. This motivation may be compromised by encountering animal experiments, and the use of animals whose lives were terminated for learning purposes. Some students choose to conscientiously object to such use of animals, and take the initiative to search for and implement humane alternatives. This poster describes this activity as achieved by Siri Martinsen, the first student to have officially graduated from the Norwegian School of Veterinary Science (NVH) without the conventional, harmful use of animals.

In this case the student's ethical position was in accordance with the InterNICHE Policy on the Use of Animals and Alternatives in Education[1] written to ensure a fully humane education. Harm is defined within the Policy as including any action, that impinges on an animal's current and future well-being by denying or limiting freedom to live and to express full natural behaviour; and freedom from discomfort, pain, injury, disease, fear and distress.

In the discussion the authors suggest how alternatives to such animal use could be replaced in the NVH curriculum for all veterinary students. Following the recent evaluation of the Education Committee of the European Association of Establishments for Veterinary Education (EAEVE) and the Federation of Veterinarians of Europe (FVE) 2004, which states that "The use of sacrificed animals for teaching experiments in the pre- and paraclinical disciplines should be replaced by other forms of experiments"[2], the authors are in their different ways promoting the introduction of alternatives as described in this discussion.

Methods

Methods for obtaining alternatives to anatomy dissections of purposely bought animals

For the main anatomy course the student could participate in the traditional course, as this was done on formalin-preparations of dogs from the NVH School Clinic. The decision to end their lives was not influenced by the fact that they would afterwards be used for dissection, but was a decision between the clinician and the owner. This was considered ethically acceptable by the student.

The subsequent additional anatomy courses and demonstrations, however, were conducted on animals that were bought and put down for education. The species involved were horse, cow, hen, sheep, pig and fish. For these species efforts were made to find animals that had died or been euthanised as a result of non-recoverable injury or terminal non-infectious illness.

These animals were in some instances obtained from farmers. Such cadavers cannot be considered 'ethically-sourced' according to the InterNICHE Policy on the Use of Animals and Alternatives in Education[1] but in most cases it was considered the only possible solution and was still acceptable within the Policy[3]. Relevant farmers within the district were telephoned to ask if any animals that happened to die from injury or non-infectious disease could be collected and used for dissections. It was important to underline the ethical reasons behind the request in all contact with the public in order to avoid misunderstandings. The importance due to legal restrictions of keeping animal cadavers within the district borders, and the importance of avoiding the risks associated with infectious diseases as a cause of death, were always kept in mind. Other major sources of large animal cadavers are large animal clinics and veterinary school pathology institutes. In this particular case, a combination of these turned out to be one of the most valuable sources of animals dead from natural causes, as NVH's Large Animal Clinic delivers all cases that terminate in death to the Departement of Pathology. Here the technicians were very helpful in informing the student about excess autopsy material.

The collection of animal cadavers from outside the School was done by car, as soon as the message of a death was received, and the animals were stored in plastic bags. The largest animals were obtained from the Departement of Pathology to avoid transportation. Storing arrangements were made in advance of anticipated collection, and access to the cool room in the pathology facilities was granted. Animals with thick coats (e.g. sheep), were skinned immediately after arrival in the cool room to ensure rapid cooling, and all animals were dissected within 2-3 days if stored here. For smaller animals like hens, freezing was used for long term storage. The cadaver was thawed one day before the dissection.

A suggestion from the student to learn fish anatomy by the means of computer programs and video was turned down by teachers, and finally fish that were due to be thrown away were obtained from fishing boats in the Oslo harbour. This was the least ideal solution of all the sourcing of animal cadavers, but it still did not create a market for animals used for educational purposes.

The dissections were carried out in the pathology facilities without a teacher, but with text books and dissection guides available. Photographs were taken to help memorise specific structures and be able to ask questions about the preparation afterwards. All lectures introductory to the conventional dissections performed by other students were attended together with the whole class.

Methods for obtaining alternatives to physiology experiments on animals

The experiments in physiology where animals were used included the following:

- the frog nerve-muscle preparation;
- the guinea pig ileum preparation;
- a mouse metabolism / temperature experiment;
- a sex hormone experiment, including castration of rats under terminal anaesthesia
- a circulation / respiration / rumen physiology demonstration on a sheep.

Initially the computer simulation SimNerv[4] was presented by the student to the teachers at the Departement of Physiology as an alternative. When this was not accepted, the addition of SimMuscle[4] was suggested, but this was also not considered adequate either, and therefore not presented by the student. However, both programs were bought privately and used.

Contact was made with the University of Oslo, Institute of Biology, to obtain permission to attend a student self-experimentation practical showing nerve-muscle physiology. Permission was granted from the Institute of Biology, but was not accepted by the Departement of Physiology at the NVH. The course was nevertheless attended, and a report from the practical was written.

Enquiries were sent to the InterNICHE Alternative Loan System and relevant producers, to obtain information about the following alternatives:

- Guinea Pig Ileum, Sheffield BioScience Programs.[5]
- Ileum, Biosoft.[5]
- Microlabs for Pharmacologists (including guinea pig ileum and circulation experiment), University of Amsterdam.[5]
- Effect of Size on Mouse Metabolism, Intellimation.[5]
- Experiments in metabolism, Educational Images Ltd, Science Audio Visuals and Software.[5]
- Mechanical Circulation Simulator, University of Uppsala, Department of Environmental Toxicology.[5]
- Simulations in physiology – The respiratory System, National Resources for Computers in Life Science Education.[5]
- Motility of the gastric system of ruminants, IWF.[5]

Literature studies were conducted and a selection of the above alternatives were used to replace the experiments on animals. All lectures introductory to the conventional experiments were attended, but not the experiments themselves.

To replace the sex hormone experiment, where a main element of the experiments was the surgery, another approach to replacement was used. Literature studies were conducted to learn the hormone physiology. Private veterinary clinics were contacted in order to attend and assist in castration / sterilisation surgery. Three different veterinarians agreed to mentor the surgery, and castrations and sterilisations of rabbits and cats were done at their clinics. All animals were in the student's care as part of volunteer animal rescue work, and waiting for adoption. Thus not only preoperative care, assisting in surgery and postoperative care was included in the experience, but also observation of the animals' reactions to castration / sterilisation and their long term recovery from surgery. Written confirmation of the participation was obtained from all veterinarians.

Results

Alternatives to anatomy dissections of purposely bought animals

In total seven offers from sheep farmers were received, but only one animal was needed and collected. After calling seven pig farmers, four offers were received in one week. Two pigs were collected and dissected. From a farm with laying hens, one hen was obtained. One fish was obtained from waste fish at the fish market.

In addition, autopsies of animals were attended in the pathology facilities, including two full autopsies on horses, and one on a cow. Due to excess material at the Departement of Pathology, a full dissection could be carried out on an adult horse, and a foetal calf, which had died within the mother after her euthanasia.

The anatomy exam was attended as normal and passed with grade 11 out of a possible 12. Written confirmation from the Departement of Anatomy was obtained confirming that the dissections of naturally dead and diseased animals had their approval.

Alternatives to physiology experiments on animals

The self-experiment in nerve-muscle physiology was attended at the University of Oslo. In addition, the computer programs SimNerv and SimMuscle[4] were bought and used as an alternative to the frog nerve-muscle preparation. As an alternative to the guinea pig ileum preparation, the computer program Microlabs[6] which shows a range of practicals including this preparation, was chosen.The practicals on mouse metabolism/temperature and sheep circulation/respiration/rumen physiology were mainly replaced by literature studies. However, circulation physiology and cardiovascular physiology in general were also learnt through programs such as Microlabs[6], Sheffield Bioscience Programs[7] and the Virtual Physiology Series[4] To replace the sex hormone practical, literature studies were combined with assisting three different veterinarians in castration of four male rabbits and castration/sterilisation of two male and two female cats.

The physiology exam was attended and the result was passed with grade 10 out of a possible 12. The alternatives used and the exam result were validated and approved by NVH on completion of the veterinary course.

Discussion

NVH has recently been evaluated by the EAEVE and FVE (2004). The suggestions for improvement included replacement of the use of animals put down for educational purposes.[2]

Focusing on the particular situation at NVH, there are two main areas for potential replacement: the replacement of animals put down for dissection and the replacement of conventional animal-based physiology practicals.

The sourcing of animals that have died naturally can be challenging for a single student. The experiences described in this paper show that this practice is indeed possible. However, the Departement of Anatomy at NVH, with greater resources available than those of a single student, would have the possibility to arrange this process more smoothly and efficiently and on a much greater scale. NVH is currently obtaining dogs put down for medical reasons in the clinic. The possibility of obtaining farm animal species in this way is also present, as NVH has its own Large Animal Clinic. Storage problems, though real, have been shown possible to overcome through the process of a formal client donation program. A successfully implemented program of obtaining cadavers from diseased and seriously injured animals has been described by Dr Amarendhra Kumar.[8] According to Kumar, students appear to have a better appreciation of anatomy and exhibit more mature behaviour when dealing with animals provided by the client donation program.[8] Anatomy teaching could be supplemented with some of the computer simulations now available. One particular program showing the possibilities of modern technology in anatomy teaching is ProDissector Frog.[9]

Replacing the animal practicals in physiology by those based on computer simulations is a possibility for most pre-clinical courses at NVH. The authors suggest that computed-aided learning (CAL) could play a large role in education at NVH, facilitated by use of the international NORINA alternatives database, set up and managed at the NVH by Karina Smith and Adrian Smith (http://oslovet.veths.no). As the use of such educational tools becomes increasingly mainstreamed,[10] a shift from physiology animal practicals to CAL at NVH is in accordance with the School's profile as a competence centre on the use of these educational tools. Experiments such as the frog nerve preparation, the guinea pig ileum preparation, cardiovascular physiology and respiration physiology are particularly suited to be replaced by CAL. Programs also exist in most other areas of physiology and likewise for pharmacology. The possibility for introducing new experiments without considerable extra cost or loss of time is available with the use of CAL. The Virtual Physiology Series of simulations (Georg Thieme Verlag),[4] the Sheffield BioScience Programs[7] and Interactive physiology (Benjamin Cummings)[11] are some of the possible replacements of typical animal-based practicals. Within pharmacology a range of programs exist, a number of which are compiled into the CAL Pharmacology Compilation CD by Dr R Raveendran, distributed through the Indian Journal of Pharmacology as part of the InterNICHE 2003 Humane Education Award.[12]

Demonstrations of specific physiological processes not so commonly presented in the conventional experiments, could be presented by video in combination with CAL to compare the specific and general physiological aspects. This is possible for example in the demonstration of rumen physiology, one relevant video being Experimental Study on Gastric Complex Motility in Sheep (SFRS).[13]

The authors also note that possibilities for new approaches in physiology teaching are present, in particular those based on self-experimentation as described by Dr G Scroop[14] at the Department of Thoracic Medicine, Royal Adelaide Hospital, South Australia. This teaching approach was identified by the Higher Education Council of Australia as an example of Best Teaching Practice in Australia.[15] Practicals within nerve/muscle physiology, metabolism, cardiovascular and respiratory physiology are particularly suitable candidates for self-experimentation courses. Specialised devices such as the Biopac,[16] can facilitate the introduction of such self-experimentation based learning.

The intention to prepare students in animal handling and basic surgery from an early stage in their education, reflected in the castration exercise in one physiology practical at NVH, can also be achieved by a combination of alternatives. A range of mannequins are available that can offer training in standard techniques such as handling, blood sampling, intubation and thoracentesis. The latest Critical Care Jerry canine mannequin[17] is an example of a complex veterinary mannequin, that integrates a digital heart and breath sounds. Simulated skin, hollow organ and intestinal anastomosis simulators and microsurgical trainers provide realistic tools for skills acquisition. Smeak[18] and Rasmussen[19] describe the multi-step process for students acquiring a high level of clinical skills utilising a number of these tools in combination with clinical apprenticeship. For complex surgery at higher level of veterinary training, specialised simulators such as the Pulsating Organ Perfusion (POP) Trainer,[20] that can be used for training the management of bleeding, and the techniques described by Aboud et al.[21] on 'live surgery' performed on prepared ethically-sourced cadavers, are methods that should be taken into consideration. The possibilities offered by the techniques of virtual reality (VR) and haptics can spare animals from possible harm from the effects of familiarisation with standard techniques for examination – an example being the Bovine Rectal Palpation Simulator developed at University of Glasgow Veterinary School.[22]

Conclusion

This poster shows that efforts made by a single student can successfully replace harmful animal use in veterinary education, and may illustrate the opportunities that are available for veterinary schools to mainstream alternatives for all students. Recent technological innovations as well as increased ethical awareness are facilitating a shift away from harmful animal use to non-animal methods and the use of ethically sourced animal cadavers derived from client donation programs. A combination of alternatives – including client donation programs, self-experimentation, computer assisted learning, mannequins and simulators – has helped ensure best practice teaching. Being a resource centre for alternatives, NVH aims to be an example of a success-story of teaching approaches that do not compromise animal lives.

The Dean of NVH has initiated a project to address the recommendations of the EAEVE on animal use in the curriculum by 2006. Moreover, NVH's Standing Committee on the Use of Animals in Teaching, utilising among other things an evaluation form on the School's Intranet, provides a valuable forum for students and teachers alike to discuss ethical issues as they arise.

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A reference list can be obtained from the authors.