Reduction Through Education: The Insight of a Trainer

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Summary — One of the articles contained within European Council *Directive 86/609/EEC* states that "Persons who carry out experiments or take part in them, and persons who take care of animals used for experiments, including duties of a supervisory nature, shall have appropriate training". In effect, this article stipulates that only competent individuals are allowed to work with laboratory animals. At least three groups of individuals can be identified with different responsibilities toward experimental animals: animal technicians, scientists, and veterinarians/animal welfare officers. The responsibilities and duties of the individuals within each of these categories differ. This paper focuses on the training of scientists. The scientist designs, and often also performs, animal experiments. Therefore, scientists must be educated to develop an attitude of respect toward laboratory animals, and must be trained so that, if an experiment must be performed with animals, it is designed according to the highest possible scientific and ethical standards. In The Netherlands, the law stipulates that scientists intending to work with animals must have completed a course in laboratory animal science. This compulsory course started in 1986. The Department of Laboratory Animal Science at Utrecht University is responsible for the national coordination of this course. Participants must have an academic degree (at the level of MSc) in one of the biomedical sciences, such as biology, medicine or veterinary medicine. Although the course is an intensive 3-week, 120-hour long course, which covers both technical and ethical aspects of laboratory animal experimentation, it cannot provide full competence. It is designed to provide sufficient basic training and knowledge to enable students to design animal experiments, and to develop an attitude that will be conducive to the implementation of the Three Rs. However, full competence will always require further training that can only be acquired as a result of practical experience gained while working in the field of laboratory animal research. Evaluations subsequent to the course have revealed that more than 98% of the students regard the course as indispensable for all scientists working in a research area where animal experiments are performed. They agree that the course not only contributes to the quality of experiments and to the welfare of animals, but also to a decrease in the number of animals used in experiments.

Key words: *alternatives, education, laboratory animal science, Three Rs, training.*

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Introduction

The Netherlands Centre for Alternatives is part of the Faculty of Veterinary Medicine at the University of Utrecht. Its contribution to the laboratory animal science course, which by law must be completed by scientists intending to conduct animal research in The Netherlands, is a module on alternatives to animal experimentation. The module will form the focus of this paper. The legislation surrounding the training of laboratory animal scientists and specialists in The Netherlands, and the issues that are dealt with in the laboratory animal science course at the University of Utrecht, will be discussed. An idea of students' perceptions of the course, as evidenced by comments that have been made by students, will then be provided.

Legislation

European Council *Directive 86/609/EEC* contains a number of articles which point out that scientists and other individuals who intend to work with laboratory animals require special education (1). Article 7 states that animal experiments should be performed solely by competent authorised individuals or by individuals who are under the direct responsibility of such a person. Article 14 states that individuals who carry out procedures, or take part in procedures, or take care of animals that are used in procedures, including those with a supervisory role, must have appropriate education and training. Article 14 also states that individuals who supervise experiments must have received instruction in a relevant scientific discipline, and must have satisfied the authority that they have obtained a sufficient level of training in order to enable them

to carry out their tasks. The provisions of *Directive 86/609/EEC* are rather general. They do not dictate how any of the individuals referred to should be educated or for how long. Both the Federation of European Laboratory Animal Science Associations (FELASA; 2) and the Council of Europe (3) have published minimal requirements for education. Harmonising the requirements for education is important for the quality of the research and also for the welfare of the animals used, and it can also facilitate the exchange of scientists between countries.

Laboratory Animal Science Courses

FELASA (2) has identified four categories of individuals who work with experimental animals: individuals who take care of animals (category A); individuals who carry out animal experiments (category B); individuals who are responsible for designing animal experiments (category C); and laboratory animal science specialists (category D).

With regard to category C, the individual is considered competent when a full university graduate course has been completed, in a discipline such as biology, medicine or veterinary medicine, and when a basic course on laboratory animal science of not less than 80 hours, or their equivalent, has been completed. Within Europe, there are only six countries (Denmark, Finland, France, The Netherlands, Sweden and the UK) which have mandatory laboratory animal science courses for their scientists. In other countries, the law does not (yet) demand such an education. Different countries have different requirements regarding the duration of the mandatory laboratory animal science course. For example, in Finland the length of a course is 40 hours, whereas in The Netherlands a 120-hour long course is required.

In The Netherlands, three Articles of the *Experiments on Animals Act 1996* (4) address competence. Article 9 addresses the competence of the scientist as the person responsible for the design of experiments. Article 12 addresses the competence of the animal caretakers and the animal technicians. For animal caretakers, a 2-year course must be completed, whereas, for animal technicians, the length of the course is 3 years. Only after successfully completing such a course are animal caretakers and animal technicians considered to be qualified to work with animals. Article 14 addresses the animal welfare officer, who must have completed a full-time 1-year postgraduate training course in order to qualify as an animal welfare officer. In The Netherlands, every institute which breeds or uses animals for experiments has to be licensed, and every licence holder must employ an animal welfare officer.

The Netherlands Course on Laboratory Animal Science

The discussion here will focus on the individuals referred to in Article 9, namely, the scientists. These are the individuals who design, supervise and often also perform, animal experiments. The course on laboratory animal science in The Netherlands which, after completion, provides an Article 9 qualification, aims to contribute to the quality of research and to the welfare of experimental animals. It is designed as an introduction to the field, but does not provide full competence. Full competence can only be achieved by extensive training undertaken while conducting animal research.

The Three Rs are the guiding principles for the contents of the course. The students must be able to consider non-animal alternatives and the expected degree of suffering involved with any animal experiment. They have to evaluate the suffering caused by various techniques, and then judge whether the expected suffering experienced by the animal will outweigh the benefits of undertaking the experiment. They should be able to design an experiment so that accurate, reproducible and meaningful results can be obtained with the lowest number of animals possible. Furthermore, the students must explore the possibilities for improving the welfare or reducing the suffering of the animals.

During the course, ample time is allocated for discussion, for example, during the introduction to the course, during the part of the course which addresses ethics, and during a workshop on alternatives. Most of the discussion topics are presented as problem-based learning topics. Students have to review research articles and decide whether the experiments that are described have been set up according to the criteria that were taught during the course. It is very interesting to note that, in many of the published articles that the students study, they find mistakes with regard to the design of the experiments, the ways that the animals were used, and the numbers of animals that were used. Students are also given a scientific problem, for which they have to develop a research protocol. They not only have to consider how to set up the experiment, and how to reduce the suffering that would be experienced by the animals, but also how to implement alternatives. In addition, workshops and demonstrations covering specific techniques are included in the course.

The outline of the course is as follows (5–9):

1. biology and husbandry of laboratory animals;
2. genetic standardisation and quality control;
3. notobiology and disease control;
4. animal models and experimental design;

5. experimental procedures;

6. anaesthesiology and analgesia;

7. animal alternatives; and

8. ethics and animal welfare.

After the biology, husbandry and genetic standardisation of laboratory animals has been addressed, students are taught how to handle laboratory animals. The students then learn about microbiology, disease, health hazards and safe practices in the animal house. The design and conduct of animal experiments is an important topic. Students have to prepare and then defend a protocol for an animal experiment. They are taught how to use the Internet to find information on animal experimentation, and how to search the literature to determine whether alternatives are available. They are also provided with information on anaesthesia, analgesia and experimental procedures, microsurgery and preoperative procedures, and alternatives to animal experimentation. One whole day of the course is devoted to ethical aspects of animal experimentation. This consists of a problem-based workshop, where the participants are confronted with several cases that they have to discuss, which often results in interesting discussions. Students also study comparative anatomy and new techniques that can reduce both the number of animals required for an experiment and animal suffering.

During the module on alternatives to animal experiments which forms part of the course, the participants are taught to recognise and apply the concept of the Three Rs — *reduction*, *refinement* and *replacement*. In order to ensure that the students gain knowledge of the major categories of alternative methods, examples of *reduction*, *refinement* and *replacement* models are discussed, and the students are given an insight into the potentials and also the limitations of the alternatives that may be used in the future.

The contents of this part of the course are as follows. Firstly, the reasons for performing animal experiments are discussed. It is surprising to note that some participants, even the students that are undertaking a biomedical course, do not seem to know or realise the purposes for which animal experiments are conducted. The reasons why we still use animals today are considered, and the motives for developing alternatives, such as ethical reasons, scientific arguments, economic motives, and pressure from the community, are identified. Various examples of *reduction*, *refinement* and *replacement* models are discussed.

Following these discussions, the students have to suggest alternatives to the Draize eye test. The validation process is discussed. This is important, because the students are not always aware that, when an alternative has been developed, a stringent validation process has to be completed before regulatory authorities can accept the procedure. Finally, the various centres that are devoted to the validation of alternative methods are discussed.

The Draize eye test is the model that is used throughout this lecture on the Three Rs. The participants have to recognise the purposes of the test and the problems involved in performing it. This test is used to teach the students to use the "substrate selection approach", in order to identify the best model to answer a specific research question. At the end of the course, the participants are provided with a biomedical research problem and they must select the proper substrate to solve it.

The Dutch course on laboratory animal science started in 1986. The course is compulsory for all scientists who intend to work with animals in The Netherlands. This means that students in the last part of their graduate training, or students beginning a PhD study, have to complete the course. The length of the course is 120 hours, and a maximum of 20 participants is permitted to attend each course, in order to improve the participation during workshops and discussions. The course is now organised at seven national universities, but is coordinated by the Chair of Laboratory Animal Science at Utrecht University. As a consequence, the contents of the courses are similar at all of the universities. Since 1986, more than 5000 students have successfully completed the course.

Two or three times a year, the course is also offered as an international course for students from abroad, as well as for foreign students working in The Netherlands. The international course is organised by Utrecht University. Between 1993 and 2001, approximately 250 participants from 46 different countries completed the international course. The handbook that is used for the international course has been translated into several languages, including English, German, Greek, Italian and Spanish (10).

Conclusions

After each course, the students receive a questionnaire in which they are asked to evaluate the course and to indicate whether or not the course has influenced their attitude to animal experiments. The comments made by the students, which are mostly very positive, include "Carefully chosen and relevant topics", "It's very intensive", and "It's great". However, more importantly, students often state that "It is an awakening of consciousness — we see things related to animal experimentation that we were not aware of before we started this course". That is one of the important achievements that we are trying to accomplish during the course. Scientists who are currently undertaking scientific

work and who have followed this course also support the view that it improves the quality of their research. But, most importantly, it is felt that the course really contributes to the welfare of the animals. Participants believe that completion of the course will also decrease animal use. We feel that, based on the comments that we have received from the students, the course really succeeds in its aims of decreasing the number of animals used in experiments, and also in improving both the welfare of the animals used and the quality of the research conducted. The organisers are also convinced that the course improves the attitude of the students toward laboratory animals.

Question and Answer Session

Q.1 *Could you please say a couple of words about the examination at the end of the course?*

A.1 The examination consists of two parts: a) the evaluation of specific tasks; the preparation and presentation of research protocols; and the analysis of a research publication; and b) a written examination which is based on the contents of the course book, *Principles of Laboratory Animal Science: A Contribution to the Humane Use and Care of Animals and to the Quality of Experimental Results* (10).

Q.2 *What is the failure rate for the international course?*

A.2 Well, there are hardly any failures. Most students (99%) pass the examination, and they receive a written qualification (a certificate) which indicates that they have followed the course successfully.

Q.3 *Do you mean that most or do you mean that all of the students pass the examination?*

A.3 99% of the participants pass the examination.

Q.4 *Do you have any hard evidence that you have achieved reduction through education?*

A.4 Yes, that's a good question, but it's very difficult to measure this objectively, because the work of students before the course should be compared with that after the course, and nobody has ever done that. We therefore have to rely on the comments of the students.

Acknowledgements

We would like to thank the organisers of the LASA Alternatives Section/FRAME Reduction Committee meeting for inviting us to provide some insight into The Netherlands laboratory animal science course.

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