



Theme 1 Education

Chairs:

Miroslav Cervinka (Czech Republic)
Nicole Duffee (USA)

Session 1.1 Refinement and reduction alternatives in education: Teaching humane science

Poster

Making cadavers live for laboratory surgical training. An alternative model for surgical training (a cadaver based model)

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Laboratory training models are essential for developing and refining surgical skills, especially for microsurgery. The lack of an accurate vascular model has necessitated the use of living models when bleeding, and vascular liquid filling is required. To avoid the use of live anaesthetised animals in surgical training, particularly in training on procedures that must simulate the living human in terms of ability of bleeding, and liquid filling of vessels to practice vascular and microsurgical procedures. We have developed a new method using human cadavers for surgical training by connecting the vessels of the cadaveric specimen to coloured liquid reservoirs and using a pump to provide pulsating pressure transmitted to the vessels. This method provides a condition that simulates live surgery in

terms of bleeding, pulsation, and fluid filling of the vascular tree, being an excellent alternative model. It can be applied to the whole cadaver or to a particular cadaveric parts (head, arm, leg...) or to an isolated organ (heart, liver, kidney...) and can be applied in the same manner to ethically sourced animal cadaveric specimens for veterinary surgical training instead of using live healthy animals. We used this model in courses where rats, rabbits, and other small animals been used for practising vascular dissection and anastomosis saving hundreds of live healthy animals in few courses.

Utilising this technique will eliminate, and forever the use of live anaesthetised healthy animals for surgical training. Video and PowerPoint presentation.

United States Patent No.: US 6,790,043 B2, Sep 2004.



Lecture

Teaching humane science: A European perspective

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In an increasing number of European countries some specific system of training exists for persons (wanting to become) involved in animal experimentation. Aiming at furthering the harmonisation and standardisation of such education programmes the Council of Europe adopted in its Convention ETS 123 for the protection of vertebrate animals used for experimental and other scientific purposes (1986) the recommendations of the Federation of European Laboratory Animal Science Associations. FELASA developed educating and training programmes for laboratory animal caretakers (Cat. A), research technicians (Cat. B), scientists (Cat. C) and laboratory animal science specialists (Cat. D). In addition FELASA started in 2004 an accreditation system to guarantee the quality of laboratory animal science education and training programmes. It is generally expected that the European Union will also include manda-

tory training of personnel involved in animal experimentation in its Directive 86/609/EC which is currently being revised.

The principles of the 3Rs can be recognised throughout the curriculum of the recommended training programmes. Apart from training skills each programme focuses on developing an attitude towards the humane treatment of the animals used for scientific purposes. Without neglecting the importance to seek possibilities to replace the use of animals, the emphasis is laid on adequately designing animal experiments. Students are thought that proper *a priori* statistics as well as standardisation of procedures can reduce the numbers of animals needed without jeopardising the quality of the results. Also the principle that methods that induce less discomfort are beneficial to both animals and science are elementary in the training programmes.

Lecture

Online learning to teach humane science

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Training programs for animal researchers focus on reducing the use of animals in research and on refining animal handling and treatment when animal use is necessary. As an adjunct to face-to-face training, online learning provides depth in knowledge of concepts, prepares a learner for personal training, and reinforces lessons learned.

In the USA, online training of scientists on the ethics of animal research is addressed in many institutions by the courses Working with the IACUC and Writing a Protocol for Research in Animals, administered through Research Training Org (www.researchtraining.org) and the AALAS Learning Library (www.aalaslearninglibrary.org). These courses encompass all US regulatory and ethical requirements. Since their release in 2001, over 40,000 US researchers have completed these training courses, and access continues to grow monthly at the rate of 1,500 individuals.

AALAS has undertaken an initiative to expand the course curriculum to fully support the 3Rs via promoting the competence of all members of the animal research team. The AALAS Online Learning Committee has developed curricula for five categories of research personnel: researchers, technicians, managers, veterinarians, and institutional animal care and use committees. Initial courses for researchers feature ethical decision-making, mouse bioengineering, breeding, methodologies, pain and distress, and anaesthesia. Additional courses are in progress for managers and veterinarians. To better integrate with institutional training programs of different sizes and types, the AALAS Learning Library architecture provides access on the basis of individuals and groups and allows a customisation of course materials for tailoring to an institution's specific needs.



Lecture

Three barriers obstructing mainstreaming alternatives in K-12 education

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Although veterinary schools increasingly have mainstreamed alternatives in their curricula and many resources are available for secondary education, alternatives are not widely adopted for teaching high school biology in the United States, a growing paradox. Viewing the practice of dissection as recalcitrance of teachers is an oversimplified perspective. Three barriers mitigate against adoption of alternatives in classrooms. First, a curricular gap exists; dissection is not considered in course outlines. Though common in high school biology, dissection receives little attention in research and curricular standards. Second, instrumental and technical support for science laboratories has been reduced. County districts formerly provided resources integrated with laboratories in lesson plans, supported by subject matter specialists. Now teachers must acquire their teaching materials to enhance their courses. Small budgets are sufficient only for a

few clerical supplies. Information is available on abundant, though costly, resources (website: http://www.vetmed.ucdavis.edu/Animal_Alternatives/altsearch.htm). Planning ahead is required for resources available on loan. Third, to teachers, supplying motivating and informative materials for students is of prime importance. Teachers dream of motivating students to learn, and seek to inspire them. High quality laboratory exercises are difficult to muster. Consideration of whether to use animal specimens and other resources in high school classrooms is not supported within the texts of curricular standards and science frameworks, nor are such resources and relevant expertise offered by school districts. Thus, the teachers' highest goal of inspiring their students in biology becomes ever more unattainable.

Lecture

Teaching humane science: Should live animals be used when educating future biomedical scientists?

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National laws and regulations require that individuals who work with laboratory animals must have appropriate skills and qualifications for performing experimental procedures. FELASA has produced proposals concerning educational and training requirements for technicians and scientists working with laboratory animals. Maximal implementation of refinement and reduction through ensuring that all staff is competent with respect to the species of animals they are going to work with will usually require animals to be used in hands-on practicals in well structured courses. Handling and restraining animals require that conscious animals are used, whereas injection techniques, assessment of the effect of anaesthesia and euthanasia can be trained on fully anaesthetised animals in non-recovery practical sessions. The use of live animals on mandatory courses for

scientists allows the teaching of the most humane attitudes to animals as well as proper ways to handle, restrain and anaesthetise animals. On-the-job training is unlikely to be of the same quality and result in uniform good results as compared with high quality courses. On training courses it is possible to emphasise the importance of prioritising animal welfare above the scientific results, and to introduce the students gradually to humane techniques by using AV-materials and dummies. Experience demonstrates that the course-item that young scientists rank as the most important is the practical sessions during which they are taught how to handle the animals, how to gentle and condition them and how to restrain them without stressing the animals and how to perform common simple procedures on anaesthetised animals.



Reduction and refinement alternatives in veterinary instruction in the US

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Veterinary medical educators have traditionally used live animal models for instruction in handling, diagnostic and surgical techniques. Animals used in laboratories can experience from very little to a substantial degree of stress and pain. Having recently received enhanced scrutiny from regulatory agencies and criticism from animal protection groups, veterinary medical instructors in the U.S. should be increasingly looking for alternative approaches to animal laboratories. Current alternative methods typically involve cadavers, models and computer simulations. Continuing resistance to adoption of alternative methods results from lack of evidence of the existence and effectiveness of such methods. A systematic approach for reduction and refinement of animal use in training of basic and clinical veterinary skills begins with assessment of the necessary procedural knowledge required. The continuum of training

should involve video presentation, model or cadaver demonstration and practice, simulations, and laboratory animal use only when unavoidable. Competency at each step should be assessed and required for progression to the next phase. Veterinary trainees and instructors must also be educated as to the value of using a more humane approach. Outcome assessments should be developed to monitor efficacy of training exercises, improvements in clinical skills, and student and instructor confidence. Additional efforts and resources should be directed to development of more advanced models and simulations in veterinary medicine. Our presentation will outline specific indications, barriers, and benchmarks for alternatives in this field. Implementation of alternative methods for teaching has potential to greatly reduce pain and distress in animals used for veterinary medical instruction.

Lecture

Animal use in higher education in Bosnia and Herzegovina and Serbia and Montenegro

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The work represents the results of independent questionnaires on opinions and experiences on animal use in higher education of the students studying at Faculty of Sciences in Banjaluka (Bosnia and Herzegovina), Faculty of Veterinary Medicine in Belgrade (Serbia and Montenegro) and Faculty of Sciences in Novi Sad (Serbia and Montenegro). The questionnaire explores their personal experience and opinions about animal use at the higher educational institutions providing reliable results on the number of used animals and procedures performed in animal use in higher education at the region.

The work presents the results of one year long research of the author working on behalf of the group within the Student Organisation of Faculty of Science in Banjaluka which has been

dealing on assessment of the animal use in higher education and promotion of alternatives and the 3R concept. The presentation of the results shows information on the current situation on animal use in higher education in Bosnia and Herzegovina and Serbia and Montenegro, the source of experimental animals, most often experimental procedures within particular subjects, survey on students' attitude toward dissection and vivisection, the presence of alternatives and current methods used for increasing welfare of the used animal in higher education.

Also, within the conclusion the author proposes possible forward steps in improving the presence of alternatives and the 3R concept in higher education at the region.



Poster

The use of animals in medical education: A paradigm shift

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Studies show that the use of live animals in medical education reduces the ability to retain information, thereby reducing actual learning, due to the stress that the student experiences when causing suffering and death to his “patient”. Today there are hundreds of substitute models that generate effective learning. The objective of this study is to understand the perception of students about the use of animals in education and its importance in medical learning. A questionnaire was responded to by 61 medical students. Results showed that 54.1% believe that animal use is fundamental to learning the medical profession, 59% don’t feel comfortable in replicating this learning in their professional practice, 72.1% aren’t aware of substitute methods, 55.7% believe that it is ethical to use live animals, 70.5% acknowledge

unpleasant feelings during the process, 60.7% don’t recommend the practice as a good learning method and 55.7% would prefer the use of substitute models if they were capable to produce good learning. The contradiction in the responses regarding the necessity of animals for good learning must be due to a lack of knowledge about efficient substitute methods for medical teaching. In light of the emphasis on humanisation and positive doctor-patient relationship in professional education, we should stimulate the publication and use of these methods, reflecting on the true importance of this type of education. It is necessary to emphasise the option of conscientious objection and compliance with Federal Law 9605/98 (makes illegal the use of live animals when substitutes exist).

Poster

Moral agency: An essential for research scientists and animal carers

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Animals are not moral agents and so cannot be accused of holding virtues and vices, cunning and slyness, and so on, even though this is classic terminology for horses and foxes respectively. Humans on the other hand have choices of what they do, and as moral agents are held accountable for their actions. In animal research the “right actions” will often determine the welfare of the animals in their care and in their use. Having the right attitude towards animals therefore is one essential contribution to refinement and good laboratory practices. In this context

come several activities that are important for the wellbeing of animals such as providing of good conditions for their housing and husbandry, daily and regular checks of animal health and welfare, good statistical design and research strategies, provision of pain relief etc. So in what ways do we incorporate this notion into our training and ethical teachings? Too often such teaching deals only with the 3Rs, but making people with responsibilities for the care and use of animals aware of their duties is more fundamental than any debate over animal rights.

**Poster**

The protective effect of selenium against cadmium cytotoxicity in WEHI 164 cells

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Selenium is an essential trace element that occurs in active site of antioxidative enzymes directly involved in redox reactions. Numerous literature data indicate also that selenium plays an important role in protection against toxic effects of cadmium which is one of the most toxic substances in the environment.

The aim of our study was to evaluate the effect of 48-hour preincubation of WEHI 164 mouse fibrosarcoma cells in the presence of sodium selenite (0.3 μM) and medium containing 2% foetal bovine serum (FBS) (with decreased selenium concentration) on their viability after exposure for 24 h to cadmium chloride (7 μM). In order to intensify the effect of cadmium, hydrogen peroxide (H_2O_2) at the concentration of 0.1 mM was

added to culture medium. Cytotoxicity of the chemicals was determined using MTT reduction assay.

We observed that the viability of WEHI 164 cells pre-treated with selenite and exposed to cadmium was increased in comparison to the cells exposed to cadmium alone. We also showed that the viability of the cells growing in medium containing 2% of FBS was significantly decreased in comparison to control cells cultured in the presence of 10% FBS. In our study H_2O_2 had no significant effect on cadmium cytotoxicity. These results suggest that the concentration of selenium in culture medium can have a significant influence on WEHI 164 cells viability and decrease cadmium cytotoxicity.

Poster

Preclinical cell culture models for early onset colon cancer: a novel approach for cancer prevention

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Introduction: Germline mutation in the tumor suppressor and DNA mismatch repair genes represent primary predisposing genetic defects for early onset familial/hereditary colon cancer. Similar mutations in mice produce intestinal adenomas. Reliable cell culture models with quantifiable carcinogenic risk offer a mechanism-based approach for rapid screening of efficacious preventive agents. **Methods:** The cell cultures maintained in serum containing DME/F12 medium were monitored for growth kinetics, cell cycle progression and anchorage-independent colony formation (AICF) that represent quantitative endpoint biomarkers. **Results:** Subculturable colon epithelial cell lines developed from APC [+/-] and APC [+/-]/Mlh1 [+/-] mice exhib-

ited aberrant hyperproliferation and high incidence of AICF. Treatment with low dose combinations of mechanistically distinct Coxibs, polyamine synthesis inhibitor and Thymidylate synthase inhibitor produced cytostatic growth arrest, altered cell cycle progression and inhibited AICF representing *in vitro* surrogate endpoints for carcinogenesis *in vivo*. **Conclusion:** These data validate a novel cell culture approach for rapid screening and for rational prioritising of efficacious combinations of chemopreventive agents for subsequent preclinical and clinical trials on colon cancer prevention.

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