



Session 1.2

Replacement alternatives in education: Animal-free teaching

Poster

Animal-free teaching of reproductive physiology: Video replacement of gonadectomy, hormonal treatment and necropsy in rats

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In light of growing awareness of the need to improve animal welfare and to refine, replace and reduce the number of animals needed for demonstration purposes, a video was produced to replace the gonadectomy, hormonal treatment and necropsy in rats, traditionally made by veterinary students during reproduction physiology classes. The first module of this video, set in a laboratory environment, demonstrates restraint and intraperitoneal injection, inhalation anaesthesia, surgical preparation of patient, main surgical procedures, postoperative recovery and hormonal treatment. In the second module physiological response to hormonal treatment is shown and discussed by way

of animated diagrams. Covered topics include reproductive anatomy, hormonal function, hypothalamus-pituitary-gonad axis regulation and surgical technique. The 20 minutes DVD was filmed and edited by interns at University Multimedia Studio, which resulted in low cost but high professional quality. Using such an alternative resource we are now able to save many rats from pain, suffering and death. Moreover, the always short class time can be better employed for fruitful exchange of views between teachers and students about the main theme of the class: physiology.



Lecture

Alternatives to animal experimentation in undergraduate curricula at medical schools – analysis of current trends in the Czech Republic

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Experiments with animals continue to be a part of curricula at many medical schools. We believe that all undergraduate medical students should be both theoretically and practically informed about the existence of alternatives to the use of animals in research and in education. Therefore we have prepared a course based on the 3Rs concept. This course takes place in the first and the second study year. During the course students learned and practically mastered, among others, the following topics:

- The 3Rs concept – scientific background, ethical and legislative considerations.
- Mammalian cells cultivated *in vitro* as an alternative to experiments on animals.
- Non invasive students self-experimentation.
- Invasive (volunteered) self-experimentation.
- Screen-based alternatives (interactive computer programmes).

We prepared a written anonymous questionnaire to evaluate student's opinions about the course and their attitudes towards the alternatives. Results of the survey showed that our students were generally satisfied with the course and it seems that both experiments with cells *in vitro* and human experimentation could be a suitable alternatives in medical education.

Due to the fact that we organised the similar survey in 1995 and 2000 years, it was possible to analyse changes in the students' attitudes during the last 10 years. One general tendency is obvious, students are currently less strict in their opposition against animal experimentation, and substantial part of our respondents even required animal experimentation. Reason behind these changes will be discussed.

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Lecture

University of Virginia Medical School replaces canine lab with human patient simulator: A case study

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In 1985, all 126 medical schools in the US offered a live animal laboratory as a requirement for teaching physiology, pharmacology, and/or surgery. Currently, 80% of medical schools have eliminated these labs from their curricula. The remaining 20%, although not requiring participation, still offer live animal labs to civilian medical students.

Until recently, the University of Virginia School of Medicine (UVa) in Charlottesville continued to teach emergency techniques to medical students using a canine laboratory. Surgical procedures were performed on approximately 100 beagles (euthanised at the end of the lab). Medical students, physicians, veterinary technicians, and members of the community initiated a group effort, working with faculty and administration, to eliminate the use of live animals and implement superior training methods. In November 2004, a new life-saving techniques

course was implemented using a human patient simulator and other stand-alone stations, allowing students to practice techniques such as chest tube insertion, cricothyroidotomy, and venous cut-down for intravenous fluids.

Elimination of the canine lab marked a turning point for medical education at UVa, and follows a general trend since 1994 of a declining use of animals in medical education as determined in the 2001 survey by Drs. Hansen and Boss. Advantages of using human-based training methods include anatomical accuracy, repeating procedures for proficiency, and long-term cost benefits. Simulated human tissues and body fluids provide a realistic experience. Successful strategies for continuing this trend of replacing animal laboratories for training medical students, based on this case study, will be discussed in detail.



Lecture

RECAL: Creating computer-based alternatives using a sustainable learning objects approach

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The mainstay alternatives to using animals in higher education are multimedia computer-assisted learning (CAL) programs simulating pharmacology practical classes. They are intrinsically tied to the authoring application used to create them, are not editable and, with ever changing operating systems, rapidly become obsolete – the only options then being to recreate at further expense or to abandon.

The RECAL project, funded by the Lord Dowding Fund, is developing methods and tools to break this cycle of redundancy and reinvention. The approach is to disaggregate existing CAL programs to separate the learning objects (media elements, sequencing and runtime instructions) from the runtime environment. This allows the learning objects to be changed independently of each other and thereby facilitates reuse and sharing.

Development has so far focused on a Macromedia Flash run-time tool that can read a standards-based XML parameter file, call down the appropriate resources from the repository, in which the resources are catalogued and stored, and provide the interface for the user. Over time, new run-time shells can be built for new platforms or applications.

Rendering the pedagogical design is achieved using IMS Simple Sequencing, which can describe a single learner's navigation path(s) through a group of learning activities. A RECAL editor will allow teachers to create or adapt both the content and sequencing.

The RECAL project, by adopting principles of standards, objects and reusability, has both improved the long-term viability of CAL alternatives and facilitated their adaptation by teachers to meet local needs and processes.

Poster

The current Japanese students' activities for alternatives in veterinary education

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This paper presents the activities of "Network of Japanese Students for the Ethical Treatment of Animals in Education", which include Alternatives Tour in Japan in 2003, the result of questionnaires about animal use in Japanese veterinary education, on-going activities, the trend of ethical education in national veterinary universities, and our perspective and mission for the future. In Japanese veterinary education, quite a few animal experiments and related practices, which are not in line with the concept of 3Rs, are still conducted, but in recent years some changes have been observed.

Some teachers have developed alternatives to the use of animals in education and some practices that harm and kill animals have been replaced with alternatives.

Besides that, there're increasing number of students who cannot accept or sometimes express objections to traditional harmful use of animals from their ethical standpoints.

Such students began to organise groups for animal welfare within and beyond universities. The aforementioned network was established by two veterinarians in 2002. Now our network has developed nation wide. In the Alternatives Tour, voluntary members of our network held presentations of alternatives at all sixteen Japanese veterinary universities. During this tour, we distributed a questionnaire intended for students and teachers about animal use in veterinary education. We're working for specific issues, as well as enlightening teachers and students on the concept of alternatives.

Our present goal is to establish the client donation program in Japanese universities.



Poster

Development of anatomical models for surgical training – replacement of animal organs and tissues

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Surgeons have to be well trained to achieve sufficient skills before operating on humans which is often done in animal laboratories. In order to reduce or even replace the use of animals we developed a new technique for production of anatomical models which can be used for skilled training of surgical techniques. The models are made by casting anatomical specimens from human cadavers (e.g. heart, lung) in a flexible silicon resin mold which is then duplicated using differentially hardened polyurethane. The phantoms are characterised by nature-like qualities of tissues and organs and they show all important anatomical details.

If necessary the models are adjusted to mechanical or electronic devices in order to simulate the function of the organs.

By this procedure a model for coronary artery surgery on beating heart was made which allows to avoid training courses on pigs or sheep. Another phantom consists of a *retrositus* of the human body with an aneurysmatic aorta which is successfully used for training of aorto-iliaco bypass surgery. Finally a phantom for training of microvascular surgery was developed consisting of artificial blood vessels sized between 1 and 5 mm which in future may replace the use of rodents for training.

Due to its nature-like characteristics the models can be used not only for skilled training of surgeons but also for testing newly developed surgical instruments and devices which is usually done in animal laboratories.

Lecture

Mainstreaming alternatives in North American veterinary school curricula

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Euthanasia of animals for use in veterinary education in North America has declined as new resources and methods have been developed at veterinary schools and mainstreamed into the curricula. This process has included substantial curricular changes in four areas, coinciding with students no longer performing terminal surgeries. First, the creation and preparation of models and plastinated organs, prosections of tissues and organs, and software programs for teaching anatomy have supplanted the former practice of dissection conducted by students. Some teaching materials are available for purchase (website: <http://calf.vetmed.ucdavis.edu/>). Second, ongoing experiences are now provided to afford clinical exposure throughout the four years of veterinary medical education. In this arrangement, students' clinical skills with clients assume a higher priority in

their training. Third, students practice with mechanical devices, surgical tools, and physiological instrumentation as preparation for the manipulative aspects of animal handling and surgery. Fourth, students practice as surgeon and anaesthetist in spaying and castrating dogs, benefiting from close surgical supervision from faculty. The animal's post-operative recovery is monitored by students. These changes have replaced students' previous optional choices for alternatives. This presentation highlights innovative curricula developed at North American veterinary schools by teaching faculty, including a new webpage with information on veterinary curricular contributions. Veterinary students have welcomed the mainstreamed curricular experiences in animal handling, anatomy, physiology, and surgery.



Lecture

The InterNICHE policy on the use of animals and alternatives in education

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The InterNICHE “Policy on the Use of Animals and Alternatives in Education” is a comprehensive document in 10 sections that addresses all aspects of work with animals and alternatives in life science education. The Policy presents guidelines to ensure effective and fully ethical acquisition of knowledge and skills. It includes a definition of alternatives in education and of harm, and presents individual policies on dissection, the sourcing of animal cadavers and tissue, work with live animals for clinical skills and surgery training, and ethical field studies. It also addresses the use of animals for the production of alternatives themselves. While the ideal “replacement alternative” is defined as “non-animal” within the 3Rs philosophy of Russell and Burch (1959), the Policy highlights a shortcoming of the 3Rs approach for education. Not only is there a

requirement for some students to work with animals, animal tissue and clinical procedures in their education, there is widespread evidence of the ability to fully meet all teaching objectives in ways that are neutral or beneficial to individual animals and that do not involve animal experimentation or killing. As well as non-animal learning tools like multimedia computer simulation, digital video, training models and mannekins, replacement alternatives also include the use of ethically-sourced animal cadavers for dissection and skills training, and apprenticeship into clinical practice with animal patients. A definition of “ethically-sourced”, and of ethical educational opportunities within clinical work, are included in the Policy which demonstrates the possibilities for full replacement of harmful animal use in education.

Poster

A package of simulation softwares as an alternative of animal use with enhancing teaching quality for pharmacology practical classes

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Introduction: Large number of animals have been replaced by the use of simulation softwares in life science education with certain limitations that the dissection, tissue mounting and animal experimentation skills cannot be gained with the use of simulation softwares. To overcome such limitations in a part and further reduction of animal use, a package of simulation softwares has been developed for undergraduate pharmacology practical classes.

Objectives: The simulation softwares have been developed with two main objectives. First is, to provide alternative of animal use for pharmacology practical classes. Second is, to provide simulation softwares that not only reduce animal use but also enhance the teaching quality and attract the experts of education for their use in teaching.

Methods: The softwares have been developed by a pharmacy teacher with the help of computer-programmers.

Results: Majority of pharmacology experiments has been covered in the simulation with provision of student evaluation mode with password protection. The package covers experiments of perfused and isolated frog’s heart preparation, frog’s *rectus abdominus* muscle preparation, rat and guinea pig *ileum* preparation as per pharmacy syllabus.

Discussion: The software will be useful for computer aided learning and practice examination and to replace number of animals. Various standard steps of animal experiments have been incorporated to thoroughly ground the users (students) with the procedure of the animal experiment. These features will be helpful not only for teaching but also for training the students for real tissue experiments and hopefully attract the teachers for their use in teaching.



Poster

The InterNICHE alternative loan system: facilitating implementation through access to alternatives

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The InterNICHE Alternatives Loan System is an evolving library of alternatives for application in life science education and training. Based in Slovenia, the alternatives are available for free loan world wide. The Alternatives Loan System was established during 2001-2002 as a resource primarily for borrowers to familiarise themselves with the diversity and quality of existing alternatives, and to trial individual products. Over 100 CD-ROMs, videos, simulators and training mannequins are included for their pedagogical value and potential to replace common dissections and animal experiments within all life science disciplines. Borrowers include teachers, students, animal ethics committees, government ministries, organisations and campaigners in over 30 countries. The Alternatives Loan

System has serviced over 100 loans, comprising over 1000 usages of individual alternatives. The loans have successfully given access to alternatives where none existed before, provided a resource for demonstrations at conferences, outreach tours and training, and supported the work of campaigners. As a tool for facilitating implementation, the value of the Loan System is indicated by a number of positive results: significant teacher use and the high number and wide geographical range of loans, subsequent purchase and implementation of products, direct replacement of harmful animal use, and providing an international resource for campaigners. Small-scale "micro-Loan Systems" have now been established in Brazil, Russia, India and Japan.

Lecture

Observations on a novel universal skills-based approach to veterinary clinical skills education

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To expand upon the achievable outcomes of established approaches, we developed a clinical skills curriculum grounded in universal skills, self-direction and self-evaluation that emphasised beneficial, and eliminated harmful, animal involvement. The novel aspect of this design was the focus on universal skills as foundational to professional physical performance as basic sciences are viewed as foundational to clinical cognition. The goal was preparing pre-clinical veterinary students in the psychomotor, behavioural, perceptive and cognitive skills necessary for safely and successfully performing procedures in the apprenticeship format of the clinical years. Course content and delivery progressed from basic skills training on simple/abstract learning tools to integrated skills training on procedural simulation learning tools to performance in closely supervised apprentice training with patient learning tools. The course was temporally progressive in complexity, challenge,

and responsibility while allowing unlimited learning tool repetition. Training in problem solving, knowledge integration and life-long learning skills were threaded throughout. Evaluation was by faculty observation, pre- and post-training testing, and student logbook review. While the course structure provides a promising framework for limiting animal use and harm in veterinary clinical skills education, progress in professional performance was affected by student acceptance of the pedagogy. In fact, improvement in metacognition, self-reliance, and physical performance closely paralleled individual student acceptance of the curricular approach, and was limited in highly teacher-dependent learners. Factors that promoted acceptance were learning tool design, student introspection, and instructor feedback. To overcome these problems curricular redesign will address student compliance and validation studies will be conducted.



Poster

Virtual dog for demonstrating the cardiovascular effects of drugs

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Introduction: Dogs are used for undergraduate medical, dental, pharmacy and veterinary practical classes to demonstrate the effects of drugs on the blood pressure (BP) and heart rate (HR). This experiment can be replaced by simulating it on a computer using Computer Assisted Learning (CAL) software. Since CAL rather than the live experiment is sufficient to meet the objectives of a practical class, a CAL software to simulate the effects of drugs on dog BP and HR was developed.

Methods: The software (developed in VisualBasic for Windows) displays a simulated chart recorder on which the animated tracings of BP and HR are recorded continuously. The user can choose any drug (and the dose) from the list provided, administer it to the virtual dog and measure its effects on BP and

HR. When the software is run under the “tutorial mode”, it allows the user to interactively test all the drugs in the list and observe their effects. In the “examination mode”, an unknown drug is given and the student is asked to find out its nature by comparing its effects with those of known drugs.

Discussion: The software can serve as a replacement for the dog experiment. Its design, user-friendliness and realistic simulation of drug effects will make it an acceptable alternative for the live experiment. Since the software is available free of cost, it will be useful for students and teachers who cannot afford similar, commercially available packages. The software will be demonstrated to the delegates.

Poster

Role of computer-based technology as an animal alternative – digital transformation in animal science and zoology curricular

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Animal science and zoology teachers have to be prepared to expose students to the virtual laboratory, an innovative digital technology that transforms conventional animal dissections into multimedia learning. The students can perform dissections on screen as full virtual reality simulations with a very high degree of interactivity. In the present digital age, keyboard, mouse and interactive multimedia software packages on CD-ROM can no doubt not only supplement black board learning but also play a significant role in the conservation of animals in animal sciences. Further, computer-aided CD-ROM alternatives may aid the creativity of teachers and give them new perspectives. The practical advantages include financial savings, the wise use of resources and reduced environmental impact. The programmes allow quick access and can easily be used during a lecture or in

a practical course. Creative utilisation of this technology can provide a highly effective learning/teaching aid. The process of developing something new or reforming something old, using creative methods to improve the curriculum design is an important process. The zoology practical curriculum has been changed by the Bharathidasan University, Tiruchirapalli, Tamilnadu, South India at graduate (Bachelor of Science) and post-graduate (Master of Science) level. At post-graduate level, dissections involving the killing of frogs, calotes, rat and sharks have been substituted with the available CD-ROMS. In India, the attitude of teachers towards animals dissections is changed/changing. The responsibility lies with the planners of the curriculum and the teachers. Education is a challenge.



Lecture

Learning research skills in the life sciences without using animals

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Practical teaching for students in the life sciences is commonly focused on traditional, recipe-driven experiments, mostly in animals, and completed in a 3 hour session. They are intended to complement factual material presented in lectures but given that the protocols are designed for all students to obtain the same result, their ability to motivate students is poor and recycling of practical results from previous years is common practice. The Department of Physiology in Adelaide has abandoned this traditional approach in its second year courses in Medicine and Science and replaced it with student-driven research projects where the central theme is to provide practical experience in the scientific method of problem-solving. Five to seven students, working as self-sufficient research teams, conceive, design and execute individual research projects, lasting

an entire 12 week semester, using themselves and colleagues as the experimental subjects. They are supported by an academic staff member acting as project supervisor and they work in a small laboratory module equipped with the basic research infrastructure appropriate for data collection and analysis of the physiological system under investigation. Student performance is assessed progressively with each assessment designed to reinforce the research experience. Although developed in the context of physiology, the focus is more on “process” than “content”, and as such the concept can be applied in any discipline at any stage of education. This new teaching methodology not only provides the students with an important life-long learning experience but is also an unambiguous opportunity to remove animals from teaching.

Poster

Empowerment and training in the use replacement alternatives in education – the success stories in Italy, India and Romania

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Introduction: Most often, life science education comprises of mandatory didactic experiments that involve live animals. A students desire not to participate in vivisection and choice “not to kill” i.e. “conscientious objection” is both a human rights issue and an animal rights issue.

Methods: Empowerment, through education and training in the use of alternatives, creation of alternatives libraries and promulgation of laws for “conscientious objection” or a ban in the use of animals in education were used to propagate 100% replacement of animals in teaching.

Results: Since 2000, a series of training/talks in the use of alternatives in veterinary, pharmacology, medicine and biology education have been conducted in Italy, India and Romania,

where over 1000 of teachers/students have participated to learn the use of alternatives like CD’s, models, mannekins etc. This has resulted in a drastic reduction in the use of animals in several universities, 100 percent replacement in yet others and the creation of virtual labs.

Discussion: The realisation that the use of live animals in education is inferior or harmful from a pedagogic, psychological and ecological point of view and knowledge of the negative impact of vivisection on the psyche of a student has resulted in this change. The paper discusses the success stories in replacing the use of animals in education, in Italy, India and Romania and the efforts of teachers, students and animal welfare personnel that made this possible.



Poster

Humane education in Portugal: Innovation in teacher's training

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Introduction: Portuguese Secondary Schools, as the majority of educational institutions around the world, use animals in lab works. Although no accurate numbers can be found, visits to several schools, and informal conversations with teachers point out that a significant number of mice, rabbits, pigeons, and organs of different farm animals are used. In this way, teachers try to comply with programs which completely ignore the existence of alternative methods to the use of animals in education. The programs are intended to adolescent students (ages 16 to 18) who will at higher educational levels, accept the use of animals for experimental purposes without any constraint.

Methods: Secondary School curricula study enabled us to organise the first official Humane Education Course in Portugal.

The 25 hours Course has been accepted by the Ministry of Education, and covers areas important for the implementation of a humane school system, such as animal sentience, animal rights and welfare, anthrozoology, and alternative methods to the use of animals in education. Different loan systems for alternatives were used.

Results and Discussion: The twenty teachers had a fruitful “hands on” experience, and became the ambassadors of a long due change in mentalities, and attitudes. Their relationship with computers, and multimedia changed. These are now currently used as tools for a humane teaching. These teachers are demonstrating the powerful and encouraging network effect.