Best practice and alternatives in veterinary education and training

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Abstract

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The design of the veterinary curriculum and of courses for professional training involves choices about the tools employed to meet teaching objectives. Ensuring that a tool is the most appropriate requires an awareness of developments in the veterinary field and in technology, educational practice and ethics. Harmful use of animals such as animal experimentation and the dissection of purpose-killed animals continues to be employed in some practical classes and training courses. However, innovative and humane 'alternatives' are now widely available and are increasingly being implemented to enhance education and training and to replace harmful animal use. This process of transition reflects a growing commitment to best practice and fiscal responsibility, as well as the interest and demands of students and trainees.

Alternatives are humane educational aids and teaching approaches that can replace harmful animal use for effective knowledge and skills acquisition. They include non-animal alternative tools such as multimedia software and virtual reality (VR); digital video; and training models, mannekins and simulators. They also include alternative approaches such as student self-experimentation; the use of ethically sourced animal cadavers; and the learning opportunities associated with clinical work on animal patients. In this presentation, examples of alternatives employed within anatomy, physiology, pharmacology, clinical skills and surgery education and training at veterinary colleges worldwide will be given. A range of published studies will provide further evidence of the pedagogical, economic and ethical advantages of alternatives over harmful animal use, and case studies will show that these modern methods are often no longer considered ‘alternative’, but the norm. Selected products will be demonstrated in detail during the presentation, and a Multimedia Exhibition afterwards will provide hands-on access to the alternatives for all conference participants.

InterNICHE has been working internationally with teachers, students and campaigners for over 20 years to facilitate the implementation of alternatives and the replacement of harmful animal use in over 50 countries. The presentation will give examples of InterNICHE projects and resources. These include information resources such as the book and on-line database From Guinea Pig to Computer Mouse (2nd ed.), with case studies and details of over 500 alternatives; comprehensive multi-language website resources; Alternative Loan Systems to enable the trial, assessment and demonstration of alternatives; a Humane Education Award grant program to support local development and implementation of alternatives; empowerment of student conscientious objectors; a range of freeware and other low cost alternatives; and conferences, outreach visits and training worldwide.
The provision of these resources demonstrates the InterNICHE commitment to catalysing progressive curricular change, and a recognition of humane education’s broad positive impact on students, teachers, and the veterinary profession—as well as on the animals themselves.

Keywords: veterinary, education, training, animals, alternatives, experiments, InterNICHE

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This presentation provides a basic overview of alternatives to harmful animal use in education and training, and the resources that InterNICHE offers. Many readers will be familiar with some of these methods, and indeed may have developed and implemented such teaching and training aids already.

InterNICHE is the International Network for Humane Education. Formed in 1988 as EuroNICHE, we are based in England with National Contacts and Partners in over 50 stretching from Brazil to Belgium, Egypt to India.

As both a network and an organisation, InterNICHE works with teachers to introduce alternatives to harmful animal use, and with students to support freedom of conscience. We aspire to work in a fully inclusive way, looking for common ground and win-win solutions, and we are committed to supporting the most ethical and effective ways of gaining knowledge and skills in life science education.

Within biological science, medical and veterinary medical education, animals have often played a central role in laboratory practical classes. In anatomy, there has been widespread dissection of purpose killed animals. In biochemistry, physiology and pharmacology there have been experiments using living animals or parts of purpose killed animals. Live animals have also been used in clinical skills training and surgery.

The relationship between the animals and the students, therefore, has usually been one of harmful animal use. However, despite the many animals that are still used in experiments or killed for dissection every year, profound changes are taking place.

The InterNICHE vision is one of a fully humane education, where teaching objectives are met using humane alternative methods, and where compassion, respect for life and critical thinking skills are valued and developed. It is an education where students have freedom of conscience, and where the negative relationship with animals has been transformed to the positive through full replacement of harmful animal use.

I will show how full replacement is not an unrealistic vision but one that is reasonable and desirable, and in fact one that has already been achieved in a growing number of universities across the world.

Many of us are aware of the concept of the 3R’s - the Reduction, Replacement and Refinement of animal use, as described by Russell and Burch (1959). But for education it is now possible to refine this conventional definition of an alternative. Developments in technology and in ethical thought, and the examples of replacement from within all the disciplines of the life sciences, demand such a refinement.
Specifically, the definition of alternatives within education can be made more strict so as to comprise only replacement alternatives; and can be broadened to include approaches that involve neutral or beneficial work with individual animals. Such a definition goes beyond the 3R’s of Russell and Burch. It is more appropriate to the nature of knowledge and skills acquisition within life science education, and reflects the present-day possibilities and opportunities for replacement.

Alternatives, therefore, are progressive learning tools and teaching approaches that can replace harmful animal use or complement existing humane education. But it is worth pointing out that for many people ‘alternative’ is not the right word, and indeed it has its limitations. Teachers who have replaced harmful animal use have done so usually because they are committed to better ways of teaching. And in some countries, humane approaches within certain fields are the tradition. ‘Alternative’ teaching approaches - by tradition or by modern choice - are therefore often the norm.

We also need to define harm. Harm comprises any action, deliberate or otherwise, that impinges on an animal’s current or future well-being by denying or limiting any of the following freedoms:

- Freedom to live
- Freedom to express full natural behaviour
- Freedom to be part of a social structure and ecosystem
- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain, injury and disease
- Freedom from fear and distress

This is a very strict definition of harm, but harm is a serious matter and should not be trivialised. Moreover, it is perfectly possible to meet the standard teaching objectives of life science practical courses - and many more objectives - using humane alternatives that involve no harm or can actually benefit individual animals.

Alternatives comprise a range of different tools and approaches, often used in combination:

- **Film and video**

  Film and video are used across the world to supplement practical work and to illustrate processes that need further explanation. They are also low-cost and easy to make. Professionally-performed dissections can often impart more knowledge than dissections performed by students themselves, or can better prepare students for real dissection using ethically sourced animal cadavers. Digital video is very flexible and can be incorporated into multimedia alternatives and presentations.

- **Models, mannekins and simulators**

  The model is the traditional anatomy learning tool, comprising a plastic or latex representation of an animal or organ, dissected or with removable parts. Life-like mannekins can support effective training of clinical skills such as animal handling, blood sampling and intubation. And basic surgery skills, from eye-hand co-ordination to suturing and anastomosis, can be gained using simulators. Perfusion of ethically sourced animal organs using dynamic simulators allows for realistic surgery practice, and advanced computer-
assisted simulators of the human body can better prepare students for critical care scenarios. These alternatives help students gain confidence and competence through repeated practice before entering the real life clinical situation with animal or human patients.

- **Multimedia computer simulation**

Software alternatives are what many people think of when alternatives are discussed, but software is just one learning tool that can be employed to support effective learning and mastery of skills. Computer-assisted learning (CAL) has brought great benefits to life science learning, and high quality powerful software has been available since the mid-1990s with programs that can offer virtual dissections for anatomy lessons, and well-equipped virtual laboratories for experimentation.

CAL can provide extra levels to the learning experience, as well as a degree of excitement due to its often innovative nature. Visualisation and understanding of structure and function can be enhanced through video clips, high-resolution graphics and images, the ability to highlight or dissolve away different organ systems, and options to magnify images or compare tissue between species. Virtual labs, typically simulating animal preparations and experiments in physiology and pharmacology, can support the development of enquiry skills and an understanding of the interplay between complex and related phenomena.

At the more expensive end of computer applications to learning there is true Virtual Reality (VR), currently used by only a few of the richer universities in some countries, and mostly within human medicine only. Specific clinical and surgical procedures can be practiced in an immersive, sensory environment, and even the sense of touch - haptics - can be simulated through the use of special ‘data gloves’. This is a rapidly evolving use of computer potential that has applications particularly in endovascular and endoscopic procedures, and over time it will no doubt be available to a greater number of students as well as to professionals who need to re-train specific procedures or perform a simulation in advance of the procedure itself.

Just as an airline pilot is expected to train using flight simulators in order to be fully versed with all likely scenarios, so must all students who will be working with patients have achieved the required mastery. The risks and ethical constraints of a pilot practicing in a real airline with real passengers are clear enough; we should be making sure that the future doctor or surgeon trains effectively with the best tools, and will be taking no risks nor violating any ethics in that training.

- **Ethically sourced animal cadavers and tissue**

Although few students will actually use animals in their careers, many zoology students and all future veterinarians will require hands-on experience of animals and animal tissue. The use of ethically sourced cadavers and tissue is an alternative to the killing of animals for dissection and surgery practice. The term ‘ethically sourced’ in this context refers to cadavers or tissue obtained from animals that have died naturally or in accidents, or that have been euthanised secondary to natural terminal disease or serious non-recoverable injury. Animals that have been harmed or killed to provide cadavers and tissue are not considered ethically sourced, nor are those sourced from places where harming or killing is commonplace. The InterNICHE Policy provides a more comprehensive definition of this term and addresses other uses of animals and alternatives too.
Body donation programs linked to veterinary teaching hospitals and independent practices can provide supplies of cadavers and tissue ethically. Tufts University School of Veterinary Medicine in the US has a ‘client donation program’ whereby companion animal guardians can consent to donating the cadaver of an animal for use in teaching. All the cadaver requirements for veterinary anatomy, clinical skills and surgery training are met through this program, which was initiated by an individual student and adopted by the teachers and administrators. The animal guardians choose between the donation program and having the animal cremated or returned for burial, but they are aware that cadavers donated to education spare others being killed. Members of the public are therefore consciously involved in supporting replacement in life science education, and such links between the public and the university are very positive.

- **Clinical work with patients**

Experience with patients is the norm within medical education, and the growing use of problem-based learning approaches is providing further clinical experience to enhance the education. In veterinary medicine, clinical learning opportunities could be expanded considerably to replace animal experiments and to better prepare students for the professions. A progressive approach to learning veterinary surgery might involve the student mastering basic skills using non-animal alternatives, moving on to ethically sourced cadavers for experience with real tissue, and finally performing a significant amount of supervised work with animal patients to gain skills such as wound management and basic surgery.

Shelter sterilisation programs are a huge potential resource for students, with castration and spays observed, assisted and then performed by students. This is realistic and relevant training for students who may graduate to perform many sterilisations in their careers. The clinic can also teach students many other skills that the lab cannot: experiencing and dealing with the clinical environment and its demands, appreciation of the diversity of patients and clinical situations, and communication skills with work colleagues and animal guardians. Crucially, the students will have been present and involved in the whole process of dealing with a patient, including diagnosis, the operation, and post-operative care.

Companion animal ‘volunteers’, such as visiting dogs, can provide other clinical skills learning opportunities. In these cases only rewards are provided and the animal is in control of whether the non-invasive practical continues.

- **Student self-experimentation**

For further experience of the living body, the consenting student is an excellent experimental animal. We do not need animal experiments to bring engagement and excitement. The intense involvement and self-reference of such experiments makes them highly memorable and supports effective learning. EEG, ECG, nerve conduction and many other tests can be performed using basic lab equipment or specially produced apparatus. Self-experimentation may also be useful for future veterinarians, who, like rats, dogs and cats are also mammals and who can perhaps better understand the nature of being a patient if they themselves have been consenting subjects of non-harmful experiments.

- **In vitro labs**

A number of recent published studies have shown that for some toxicity tests, *in vitro* technology is providing results that are more repeatable and more reliable. In other words, it is better science in comparison with animal-based tests - and certainly better value for
money. The rapid development and uptake of *in vitro* technology in research and testing needs to be supported by student familiarity with the techniques, and *in vitro* practicals can provide this experience. Animal tissue and cells used for such work can be sourced ethically, and within some cell biology practicals, the use of animal tissue and cells can be replaced directly with plant material. For studying cell respiration and electron transport, for example, mitochondria can be sourced from turnips, potato or beet instead of rat liver. With ethically sourced animal preparations, or with plant material, therefore, such *in vitro* practicals can then be considered as alternatives.

- **Field studies**

Students of biology, zoology, ethology and ecology may often find themselves in situations where animals are studied in a laboratory setting as a model for nature, or they will be faced with interaction with wild animals that is invasive or otherwise harmful to the animals or their habitat. But biology is not just experimentation, nor does its study require harm. Much of the knowledge gained about animals and nature has come from observation and other non-invasive field studies. This tradition of studying animals within their natural environment is a particularly rewarding alternative to harmful animal use which could be developed and explored in order to replace some lab animal practicals in the above disciplines.

When considering alternatives such as those described above, the range of tools and approaches that are suitable to implement at a university will be defined partly by the economic and practical opportunities and limitations that it faces.

The successful implementation of alternatives impacts on many spheres:

- **Pedagogics and quality of learning**

I believe it is a mistake to see alternatives as ‘not the real thing’, as ‘not authentic’. The assumption behind this is that animal experiments are the real thing, but this is not true – we are focussing on acquisition of knowledge and skills and the best ways to do that – so the ‘real thing’ is how well the students learn, for specific practical classes and specific learning objectives – such as basic eye hand co-ordination, practicing a specific procedure, and so on. For many students, hands-on experience of animals, which is sometimes confused with ‘the real thing’, is never needed (indeed, a significant proportion of pharmacology students in the UK go into the field of insurance). But for those for whom it is needed, the ethical alternatives that do involve living animals comes in to play, as another authentic experience that complements the authentic non-animal approaches.

As well as the advantages of different types of alternatives, already described, over 35 published academic studies have shown that students using alternatives perform at least as well as those using animals in conventional, harmful ways. Combinations of alternatives applied to the educational process will clearly do even better: teachers committed to good curricular design will have ‘audited’ their courses and chosen the best tools and approaches to meet the identified teaching objectives. The negative lessons of the hidden curriculum – that animals are disposable tools, for example – will no longer be learned, and many positive messages will have been given. Positive attitudes towards animals can be engendered, the need for conscientious objection is obviated, and the learning environment is further improved as a result.
But perhaps we should also ask whether the animal experiments have themselves been assessed or audited. It is rare that this is the case, and of course it is typical of the culture of an orthodoxy to require only the challenger to defend his or her ideas.

Furthermore, I’d like to challenge the assumption that if a live animal or animal tissue is really needed in education or training then that must involve killing or another form of harm – in other words an animal experiment. Our solution is to secure ethically sourced material, and to provide the opportunities for clinical learning experiences, to meet these needs.

- **Life science philosophy**

The roots of medicine and veterinary medicine are in healing, not harming. The imperative *Primum non nocere* is not an idle comment of no relevance, and the harmful use of animals is contrary to the fundamental tenets of these professions. While the physician may occasionally harm in order to heal, this is not the case when educating the future professional. Similarly within biology, harmful animal use is counter-intuitive. Biology often seems to be more necrology than the study of life. Studying and affirming life can be achieved with alternatives, and such approaches help reconnect the life sciences to their positive roots.

Alternatives can also help support the practice of critical thinking. The scientific method itself is really just a formalisation of critical thinking, and essential scientific skills such as problem-solving and good experimental design are often treated as very important in many software products. And when students or teachers question the orthodoxy - which is often the orthodoxy of animal experimentation - and look for innovative, alternative ways of doing things, they are involved in critical thinking. This practice should be nurtured.

- **Emotional and ethical literacy**

Sensitivity, empathy and compassion all play essential roles in society, and reflect cultural values, practices and skills that are important to protect and develop. They are essential within science too, because it is people - thinking and feeling people - who are practicing science and who are engaging with other people and with animals.

There is significant evidence of the desensitisation of students through harmful animal use. This may be a result of the hidden curriculum, which teaches that life can be violated, or it may be a deliberate policy to ‘harden’ students, in the belief that this is a necessary part of moral development or the cost of scientific endeavour.

In fact, desensitisation and the denigration of the emotional realm help neither students nor science. Understanding and exploring the often complex emotions associated with challenging aspects of the life sciences is surely preferable to denial and ignorance. The mind and the emotions are always present and are never separable. It is not emotion that hinders objectivity, but a lack of critical thinking or of awareness of the whole picture.

A commitment to ethical science and to open ethical discussion in the classroom will help the future professional to be more able in ethical decision-making and can encourage a strong sense of personal and social responsibility. Emotional and ethical literacy will always benefit science, but they may demand the use of alternatives rather than the killing or harming of animals.
• Accessibility and civil liberties

A leading Jain academic advised adherents of Jainism that they should not enter medicine because of the required dissection and vivisection. Should life science education discriminate according to religion and ethical commitment? Recognition and validation of such commitment through the use of alternatives will ensure that all students who would not have entered the life sciences because of harmful animal use can now participate and contribute. This increased accessibility is relevant for all students, but in many countries this will also have a significant positive impact on increasing the number of women in the life sciences.

For those who are already students, the threat of academic or psychological penalty when conscientiously objecting is a form of discrimination, and the lack of opportunities to use alternatives is limiting students’ experience of best practice learning tools and approaches. Compulsory harmful animal use is unacceptable coercion, and can cause psychological trauma for students. It also risks costly court cases - one university was ordered to pay US$95,000 to a student for denying her freedom of conscience. The implementation of replacement alternatives allows for co-operative resolution of the problem of harmful animal use, and is preferable to such court cases. Animal use in education is clearly an ethical issue, and by dealing with it through discussion and action, teachers will demonstrate that science and ethics can be compatible and that problems can be faced rather than denied. This is a good lesson for future scientists for learn.

• Practical impact

Environmental and animal welfare
Animals caught in the wild, animals bred, caged, killed or experimented on do suffer harm, and the scale of the suffering is as great as it is unnecessary. Conventional animal use is not acceptable from the perspective of animal ethics. Taking animals from the wild can seriously disturb local ecosystems, and has contributed to the decline of some species, such as leopard frogs. Threatened or endangered species, including dogfish, are also caught for educational use in some countries. Moreover, the toxic chemicals used for preparing the millions of animals killed each year have a damaging environmental and health and safety impact. If high quality alternatives can replace such use, then from the animal welfare and environmental perspectives alone the logical conclusion is replacement.

Economic benefits
Several studies have shown that the use of alternatives provides significant economic benefits to universities. The direct and indirect costs associated with the use of animals are removed, and after purchase or development most alternatives can be used for several years. While the initial outlay of computer hardware may be high, many universities in the west and elsewhere already have such equipment, and the costs are anyway recovered over time. Software with hundreds of high quality anatomy images or a well-equipped virtual laboratory is inexpensive compared to the cost of the real laboratory with similar equipment. Moreover, some alternative approaches just make good use of existing untapped resources, and are therefore free – for example, those of clinical learning opportunities.

Teachers can also make their own learning tools, using their own experience and according to their specific course requirements. Indeed, it is the teachers themselves who have developed most alternatives that are currently available, usually motivated by the economic and pedagogical advantages. As many of these alternatives are western, there is great
potential in many countries to begin developing alternatives, supporting greater diversity and localisation.

Life science education deserves further investment to provide all students with the most effective and ethical methods for acquisition of knowledge and skills.

**Personal and institutional reputation**
Many producers of alternatives have found their personal and institutional reputations enhanced by their work, and some high quality software has won awards for multimedia design or teaching innovation and success. Many academic papers have been published by teachers who have developed and implemented alternatives. The enhanced reputation of teachers amongst students has also been a positive result of efforts to improve teaching and to respect students’ ethical concerns. Reputations can also be seriously damaged by negative media publicity or legal challenges occasioned by communication breakdown and student-teacher conflict. Resolution of ethical problems in the classroom in advance of such action is clearly preferable, especially as co-operative solutions can usually be found.

**Legislative requirements**
Personal and collective responsibility for curricular change is always preferable to that forced by diktat. Until such responsibility is widely taken, however, legislation is a useful tool for implementing alternatives and for modernising education. The use of alternatives accords with the letter and spirit of many national laws and international conventions and directives which state that alternatives should be used wherever possible. As there are examples of alternatives being successfully used for practical course in all disciplines, it could be asked whether harmful animal use is in fact illegal.

How does InterNICHE help realise the vision of full replacement of harmful animal use? The network offers a range of information and other resources to teachers, students and others to empower them to facilitate change. These resources include:

- **from Guinea Pig to Computer Mouse book**

Published in 2003, and with several updates since, *from Guinea Pig to Computer Mouse* is a major 520-page book in 4 parts.

Part A provides the background to animal use in education, describing alternatives and their pedagogical advantages, and looking at their broader impact. Dr Jonathan Balcombe reviews published papers that assess alternatives in terms of student and trainee performance, and Dr Lara Rasmussen addresses the concept of curricular design and the best ways to meet teaching objectives. Part A also looks at the role of conscientious objection in curricular transformation, and gives a review of the philosophy and practice of InterNICHE.

Part B comprises case studies written by university heads of department who have implemented alternatives and replaced harmful animal use. They share their experiences of the process of change and the advantages of using alternatives. The authors include:

*Dr Hans Braun* from the Institute of Physiology at Marburg University in Germany. Braun co-developed the award-winning Virtual Physiology series of virtual laboratories, such as SimNerv, which have fully replaced the animal experiments in his institute for students. Although he was initially very much in favour of continuing the conventional animal experiments in the face of student protest, Braun found that the students were much more
active in practical classes with the simulations, and were learning successfully how to
eperiment and make use of their knowledge.

Dr Henk van Wilgenburg, pharmacologist from the University of Amsterdam in the
Netherlands. Van Wilgenburg developed the ‘Microlabs’ collection of computer simulations,
and in his chapter questions the relevance of conventional animal experiments when
obtaining and interpreting data can be achieved so effectively with advanced computer
software. He also advises on the process of implementation of alternatives, particularly
preparation of staff and the lab environment, and cost allocation between hardware, software
and support.

Dr Mykola Makarchuk from Kyiv State University in the Ukraine. Makarchuk is a biologist
who has successfully replaced animal practicals with student self-experimentation and
computer simulation for the teaching of human and animal physiology. He explains the
challenges facing replacement in former Soviet countries, especially in terms of cost,
availability and opportunities to trial alternatives, and also draws a comparison between
broader social changes in the Ukraine and improved attitudes towards animals.

Prof Garry Scroop, physiologist from the University of Adelaide in Australia. Scroop has
implemented ‘research project practicals’ for students, which comprise semester-long self-
experimentation practicals based on research methodologies to support learning of problem-
solving strategies. Instead of students producing contrived results from brief, poorly-
supervised animal experiments - which Scroop sees as typical of many practical classes - the
alternative approach is specifically designed to encourage critical thinking. It also provides
opportunities for teamwork, and fully replaces the animal use. The approach has been
recognised nationally as an example of best practice, and has now been emulated at other
departments and universities.

Dr Amarendhra Kumar from Tufts University in Boston, USA. Tufts University School of
Veterinary Medicine runs the sustainable client donation program for ethically sourced
cadavers. In a survey, 97.5% of students questioned preferred to use donor - ie ethically
sourced - animals. 0% wanted to use animals that had been killed for the purpose, and 2.5%
didn’t care either way. The School’s reputation for using just ethically sourced cadavers is
part of the attraction for new students.

Dr Daniel Smeak from Ohio State University, USA. Smeak has developed a range of
portable skin/suture pattern and hollow organ simulators for use with training videos for
highly effective manual skills acquisition. Students can practice again and again, both in the
lab and at home, and then progress on to ethically sourced animal cadavers before their
clinical rotations. Over 5000 animals from shelters have been sterilised by students working
under supervision, increasing student exposure to clinical experience as well as increasing
the rate of adoption of animals to nearly 100%. The experience of Smeak is that mastery of
surgery skills can best be achieved through application of such alternative tools and
approaches.
Dr Lara Rasmussen and colleagues from Western University of Health Sciences, USA. The country’s newest veterinary college is zero animal consumptive and has a ‘reverence for life’ philosophy. A skills-oriented curriculum which optimises the use of progressive, humane learning tools and has a strong focus on clinical work and strategic alliances will ensure only beneficial or neutral interaction with animals for veterinary students. And if this can be done within veterinary medicine, then it can certainly be done in human medicine, where the focus should surely be on the human body rather than animal experiments.

Part C of the book is the Alternatives File, which comprises the majority of the publication. This is a database of over 500 alternative products, detailing for each their application, specifications, and source. The section is divided according to discipline, such as anatomy, anaesthesia and critical care, physiology and pharmacology. Each discipline is then subdivided according to medium - software, video, models, mannekins and simulators, and finally web-based alternatives. The Alternatives File comprises up-to-date and original research, and includes some alternatives that have never before been marketed or shared.

Part D comprises over 1000 further resources such as on-line curricular material, printed resources, recommended reading, details of alternatives loan systems and organisations worldwide, as well as full contact details of producers.

The Appendix presents the comprehensive 10-part InterNICHE Policy on the Use of Animals and Alternatives in Education. Over 10 language translations of the book are under production, and a CD-ROM, DVD and web version with searchable database will also be produced. The book is available for free download on-line at the InterNICHE website www.interniche.org

- Alternatives in Education film

This 33-minute film, produced in 1999 and available in nearly 20 languages, is an exploration of alternatives within anatomy, physiology, pharmacology, clinical skills and surgery. Interviews with university teachers who have developed and implemented alternatives are complemented by visual demonstrations of a range of tools and approaches. The multiple benefits and pedagogical superiority of alternatives compared to conventional lab animal use are explained using specific examples. The film is also available on-line.

- Alternative Loan Systems

These are evolving libraries of over 100 of the best alternatives, established to practically support the process of replacement worldwide. Contents include multimedia software, videos, models, mannekins and simulators from a variety of disciplines, chosen for their pedagogical value and potential for replacement. Teachers, students and others can borrow items from the Loan Systems to assess their relevance to their own specific curricula and to familiarise themselves with some of the best products available.

The international library is co-ordinated from Europe, with alternatives available for free loan to all countries worldwide. Borrowers pay only the return shipping costs. The project has made over 200 loans to 40 countries, comprising over 4000 usages of individual alternatives, since its establishment in 2001/2002. Borrowers include teachers, students, animal ethics committees, government ministries, organisations and campaigners. The loans have successfully given access to alternatives where none or little existed before, provided a resource for demonstrations at conferences, outreach tours and training, and supported the
work of campaigners by providing a powerful international resource. 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, positive feedback on the resource from borrowers, subsequent purchase and implementation of products, and direct replacement of harmful animal use.

New Alternative Loan Systems have been established in Mexico, Peru, Brazil, Russia, Ukraine and India, providing local resources under the management of National Contacts. These facilitate ease of borrowing by avoiding international shipping costs and by catering for particular cultural challenges and opportunities. These seed projects of the international Loan System illustrate how much can be done with seed funding to support small-scale but highly effective and sustainable projects that are designed to facilitate replacement of harmful animal use. The establishment of new resources regionally and in different countries is to be encouraged.

- **Humane Education Award**

This annual Award of 20,000 Euro is a grant program targeted at teachers and others who can bring about replacement through the production of new alternatives or the purchase and implementation of existing products. The Award has historically focused on different regions, and now has a fully international focus.

One project comprised the production in Romania of veterinary physiology software and the establishment of a computer simulation laboratory using reconditioned computers. Together these have replaced the annual use of nearly 1000 animals, and with the alternative being freeware, it is available for free worldwide distribution and use. A second project comprised a compilation of pharmacology freeware. This has been distributed free to over 3000 pharmacology and pharmacy teachers across India, and is also available worldwide.

Other projects include the production of the first-ever camel anatomy software, for replacement in North Africa, the Middle East and elsewhere; the purchase and implementation of advanced physiology self-experimentation apparatus; and the establishment of specially perfused cadaver labs for ‘live’ surgery practice in veterinary medicine.

- **Freeware and cheapware**

The freeware funded through the Award is being produced in other languages to support effective implementation. The ‘Physiology Simulators’ CD is now available in Russian, for example, and that of the ‘CAL Pharmacology Compilation’ CD is under production. It is planned that new translations and new freeware will become available in the future. Other software that is free or low cost is also available for wide distribution.

- **Website:** [www.interniche.org](http://www.interniche.org)

The InterNICHE website is the largest existing website on alternatives in education. It provides a wide range of information and resources on-line, including comprehensive background to the issues, news, student testimonies, and links to producers, product reviews and external resources. This is currently available also in a range of languages, and new resources are continually being added. Greater interactivity will also be integrated.

- **InterNICHE Conference**
InterNICHE holds a major international conference every few years, offering leading international and local speakers, challenging workshops, an alternatives centre with some of the latest teaching products, and room for discussion and networking. Delegates include teachers, product developers, students, legislators and animal protection campaigners. The most recent conference, ‘Alternatives in the Mainstream: Innovations in life science education and training’ was held in Oslo, and had delegates from 32 countries. The next is to be held in Oxford, England.

- Other conference visits, outreach tours and training

The author and InterNICHE National Contacts have co-organised and spoken at a wide range of international and national events on alternatives. Larger outreach tours have also taken place, including visits to Russia, India and Latin America. These visits allow the presentation of the InterNICHE vision, demonstrations of alternatives, distribution of resources, and support for local humane education initiatives.

A 7-week nationwide speaking tour of India in early 2003 also allowed the distribution of 1200 copies of from Guinea Pig to Computer Mouse to teachers and students of dozens of institutes from cities across the country. Using the Loan System and the skills of local trainers, over 400 university educators were trained in alternatives and animal welfare in 2004 at seminars in over 10 cities across India. This project was organised by InterNICHE in conjunction with the World Society for the Protection of Animals (WSPA) and many committed local organisations, and was the first of its kind worldwide that provided training at a national level.

The Multimedia Exhibitions at the 5th and 7th World Congresses on Alternatives and Animal Use in the Life Sciences in 2005 and 2009, respectively, were also organised by InterNICHE using Loan System items, with National Contacts and collaborators as trainers.

A 6-week series of seminars was held across Latin America in 2008. The outreach tour, titled Alternative Methods for a Humane Education: Best Practice and Innovation in the Life Sciences, was organised by InterNICHE and partner organisations in Bolivia, Peru, Brazil, Argentina and Mexico. Full-day seminars were held at up to 6 universities and independent venues across each country.

In 2009 the First Pan-African Seminar on Alternatives to Animal Experiments in Education and Training was held in Kenya, and in 2010 the same for North Africa and the Middle East. Further demonstrations and training are planned for conferences and outreach tours across the world during 2011.

Provision of the above resources and events reflect the InterNICHE belief in the importance of catalysing progressive curricular change and implementing best practice approaches.

Conclusion

Until curricular transformation involving full replacement has been achieved, we believe that ethics committees should deny permission for all harmful animal use in education and training. They should also support teachers in effective information retrieval on alternative tools and approaches, and on curricular design issues. Student choice policies should be implemented so that conscientiously objecting students are not denied access to superior
learning methods. Legislation itself should reflect the widespread availability, existing use and multiple benefits of alternatives by banning harmful animal use for education and training.

The replacement of harmful animal use has been gaining momentum across the world, supported by developments in technology and the evolution of ethical thought. The multiple positive impact of alternatives means that this replacement is to the benefit of students, teachers, animals and the life sciences. It is a win-win situation, with a guarantee of ethical and effective acquisition of knowledge and skills in life science education and training.

References


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