



Theme III

Incorporation of the Three Rs in Education and Training

Session III-1: Innovative teaching in the life sciences

Session III-1: Oral presentations

III-1-101

Is animal free teaching in the life sciences better teaching?

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Traditionally life science disciplines such as physiology and pharmacology employ, as part of a mix of teaching methods, practical classes based on experiments on whole animals or isolated organ or tissue systems. Such classes are designed to meet specific learning objectives: re-enforcement of (existing) student knowledge; and teaching a variety of generic and preparation-specific laboratory skills, and experimental design skills. They also provide vehicles for teaching data handling, scientific communication, and team working skills and of course they promote staff-student interaction. Over the last 20 years, at least in the UK, the number of life science students entering universities has increased significantly and to cope with such numbers courses have reduced the number and diversity of laboratory classes, sometimes replacing them with more innovative, often technology-based approaches.

This presentation will introduce Session III-1: “Innovative teaching in the life sciences” and will cover the various types of technology-based alternatives currently available to teachers and how they meet learning objectives. Methods of successful integration of resources into mainstream teaching will be described together with data drawn from a number of studies to compare the educational effectiveness of computer-based learning with more traditional methods.

It will provide an overview of how technology has changed the way life sciences are taught, how innovations have been implemented and explore whether today’s courses meet learning requirements.



III-1-062

Challenges of using alternatives to animals in laboratory classes in physiology: the Spanish experience

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Physiology is taught in all the life sciences, including medicine, pharmacy, biology, veterinary medicine, biochemistry and others. Teaching physiology entails both theoretical and practical classes, and the latter have traditionally involved the use of animals. Traditional practices include dissection, the muscle-nerve preparation of frogs or rats, the study of the effect of hormones on sex glands in rats, study of the heart in frogs, study of intestinal absorption in rats, and many others.

In recent years many efforts have been made to develop methods that do not use animals, such as models, mannequins, computer programs, and others. Similar efforts have been made to encourage members of the educational community to adopt such methods. Nevertheless, efforts to replace traditional prac-

tices using animals by these alternative methods have encountered many difficulties, especially the reluctance of teachers to change.

Directive 2010/63/EU of the European Parliament on the protection of animals used for scientific purposes clearly states: "The use of animals for scientific or educational purposes should therefore only be considered where a non-animal alternative is unavailable". Based on this, there is no justification to use animals, since there are many developed and marketed alternatives available.

In this talk we will examine the reality of the use of animals for educational purposes in Spain, the efforts to change the minds of teachers, and the opinion of students on this matter.

III-1-205

Alternatives to animals in teaching: Experience in an Indian medical school

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In the 1990s, the practical classes in pharmacology for the undergraduate medical course in JIPMER, Pondicherry, India included 15 animal experiments. It was mandatory for students to carry out animal experiments to pass the final examination. With the advent of the new curriculum prescribed by the Medical Council of India (MCI) in 1997, the number of animal experiments was reduced to seven. CAL software on the effect of drugs on dog blood pressure was developed in-house and introduced into the course, and it replaced the use of dogs completely. A set of clinical pharmacology exercises was also introduced as alternatives. As the feedback from students was encouraging, a few more computer simulated experiments developed in-house were introduced to replace some more animal experiments. At

present, five live animal experiments and two computer simulated animal experiments are conducted. The MCI in 2010 clarified that animal experiments can be replaced with suitable alternatives. This paved the way for complete replacement of animal experiments in teaching but due to difficulties in implementing the alternatives, the pace of replacement is slow. Our department has developed, distributed and used CAL packages from the late 1980s and set up a CAL laboratory in the last decade. It is expected that with the impending revision of the medical curriculum by the MCI, all animal experiments will be replaced soon. The results of a survey conducted among the teachers on the usefulness, acceptance and barriers with respect to the use of alternatives to live animal experiments will be presented.



III-1-413

Animal use in pharmaceutical drug discovery and development – current status and future directions

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The pharmaceutical industry researches and develops new, safe and efficacious medicines for patients. The process that leads to the development of a new medicine is long and complex and involves the use of animals at multiple points of the drug discovery and development process. While *in vitro* assays play a significant role in high throughput screening of potentially active molecules during the early stages of the discovery process, studies with animal models are essential to elucidate disease mechanisms and demonstrate efficacy. Furthermore, regulatory agencies require evaluation of the safety of potential medicines in animals before entry into humans and then later in the drug development process. Therefore, to successfully bring forth new medicines to patients, the pharmaceutical industry requires staff with a wide range of skills in the conduct of *in vivo* studies with both rodent and non-rodent species.

However, many pharmaceutical companies are committed to finding and implementing approaches that aim to Refine, Reduce and Replace (3Rs) the use of animals in discovery and development programs for new therapeutics. Through recent advances in scientific knowledge and technologies, alternatives to testing on animals, such as the use of physiologically based pharmacokinetics modeling, is increasingly being adopted as part of the drug discovery and development strategies.

While these methods enable reduction in the number of animal experiments and in the number of animals used in each experiment, they do not completely eliminate animal use in pharmaceutical development. Several examples will be provided to demonstrate how these approaches have been used in conjunction with animal studies during the drug discovery and development process.

III-1-448

Educating the next generation of *in-vivo* scientists: Meeting the needs of industry & academia

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The 2007 Association of British Pharmaceutical Industry report “*In-vivo* Sciences in the UK; Sustaining the supply of skills in the 21st Century” highlighted the need to continue to provide an education and training in *in-vivo* sciences in order to ensure that the United Kingdom has sufficient *in-vivo* scientists with the necessary skills to maintain its position as a world leader in biomedical research. The report also concluded that it is essential that this training is provided at the earliest possible opportunity.

This presentation will argue for the need to provide a select cohort of undergraduate students who intend to follow a career in biomedical research, either in industry or academia, with an education and practical experience in integrative studies. It

will also argue that all students on undergraduate courses in the biomedical sciences should be provided with some exposure to isolated tissue experimental preparations in the course of their studies. However, any such training must be accompanied by a substantial training in the ethics of the use of animals or animal tissues in research, complimentary experimental techniques and the principles of the 3Rs.

The presentation will also include the perspective of an undergraduate pharmacology student who has completed an *in-vivo* Industrial Placement year, a final year *in-vivo* techniques module and utilised an *ex-vivo* preparation in her Final Year project.



Session III-1: Poster presentations

III-1-250

Live zoology and digital technologies as effective alternatives for animal use in zoology curriculum: A success story from MDS University Ajmer, India

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A large number of animals are killed every year for laboratory exercises all over the world. This has caused great biodiversity loss and some animal species have even become endangered due to such practices. While analyzing the curriculum of zoology of most universities of the world, it has been observed that animal dissection has been overemphasized in schools, colleges and universities in the name of understanding external and internal organization of the body. Very little emphasis has been put on studying animals in nature. With the advancement of digital technologies and excellent documentaries on animal life, we took on a mission to replace dead zoology with live zoology at undergraduate as well as post-graduate levels at MDS University, Ajmer (Rajasthan), India and framed a new curriculum having exercises such as studying species in nature, their current status, threats, behavioral ecology, identification and monitoring based

on sound spectrum software (sonotaxonomy), understanding internal organization, molecular biology and physiology using software. The feedback response from students and teachers is very good. The highest regulatory bodies in school education (CBSE/NCERT) and higher education (UGC) have appreciated the idea and soon the recommendations are to be implemented in the remaining educational institutions in India. The result of implementation of this progressive curriculum based on live zoology is such that some new records, species and behavioral patterns have been identified by the young students. The change can potentially motivate a large number of students to opt for zoology programs. We are endeavoring to orient teachers and resource persons in the country and outside the country with the modern curriculum and related techniques.

III-1-307

***In vitro* toxicology training programs at Mahatma Gandhi-Doerenkamp Center (MGDC), India: a status report and a review**

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Mahatma Gandhi-Doerenkamp Center (MGDC) has been established in India by DZF, Switzerland, to motivate the teachers and students to take to “alternatives” in place of animals in life science education along the lines of the 3Rs principle. Additionally, it is also a mandate of the Center to inculcate non-animal methods in toxicity testing and research. The latter is aimed to be achieved by providing intensive training to the stakeholders in *in vitro* toxicology. A beginning has been made at MGDC in

this direction. Three 10 day workshops on “Methods in Animal Cell Culture Techniques & *In vitro* Toxicology” have been conducted. The participants include scientists, technicians, university and college teachers, research scholars and graduate students. Enrollment to each workshop is limited to 16 to ensure hands-on to each participant individually. There being no prototype course structure, the MGDC has designed one and covers exercises in primary and established cell line culture,



enumeration of cells, cell viability assays, genotoxicity testing, apoptosis/necrosis assays, determination of ROS, and molecular end points. This is a pilot attempt to motivate the stakeholders to change to humane science and sophisticated approaches to toxicology. More than the appreciation of the trainees, this series of

workshops has sparked tremendous enthusiasm to change to a more rationalized science in terms of *in vitro* toxicology. This presentation analyzes the feedback and reviews the opinions. It is also the aim of this presentation to obtain the suggestions of the WC8 participants for improvement.

III-1-385

First ethics ranking of universities in Germany

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SATIS (Latin: enough!) – the project for humane education of People for Animal Rights Germany (PARG) performed the first ethics ranking to analyze the use of animals and needs of alternatives in education and to create a guideline for high-school graduates and students, accessible online at www.satis-tierrechte.de.

We used a questionnaire-based telephone survey and called the responsible teachers of all German institutes of biology (70), medicine (35) and veterinary medicine (5) to ask which animals or alternatives are used in practical classes and if students are able to conscientiously object. The university ranking was then established by means of specific ethical criteria.

73% of the teachers were prepared to answer the telephone interview. Five percent of all teachers showed a positive inter-

est in the project and asked for advice and information. These will be initial points for our future activities in implementing alternatives in education. Compared to earlier surveys of SATIS, several institutes for human medicine cancelled the use of animals. No degree without animal use exists for veterinary medicine or bachelor of science biology. Apart from possibilities like passive working in groups students do not have the chance to complete their study if they conscientiously object. We are however working at a political level to introduce conscientious objection into German law. The new EU Directive (2010/63/EU) and the German animal welfare law require that existing alternatives have to be used and we are advising academia and administration with regard to the implementation of alternative methods.

III-1-468

The 4th R

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In India under the guidance of the CPCSEA we impart the Three Rs as part of the teaching and training of medical students. Recent trend is to include the 4th R – rehabilitation. Presently the funding agencies in the public sector insist on allocating funds for the rehabilitation of the animals intended to be used in ex-

perimentation. The teaching at our institute seeks to highlight the 4th R. The results of encouraging the 4th R will be presented and discussed in the light of socio-religious tenets of Asian Indians of this country.



III-1-507

Master students' feedback on 3Rs education approach

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Although the implementation of the 3Rs in scientific research and education is fundamental nowadays, few are actively involved in teaching alternatives to animal use in Italy and consequently students taking life science courses are generally "under-exposed" to the 3Rs and related topics. We report here the critical evaluation provided by students after attending the 2010-2011 course "Alternative Methods to Animal Use in Toxicology" within the framework of the Master's Program in Veterinary Biotechnology Sciences at the Faculty of Veterinary Medicine in Milan. The students found the course to be helpful in terms of gaining a better understanding of the 3Rs and in improving the quality of science through teaching that was inspiring and interesting. The broader overview provided by the course of the current alternative approaches was believed to be of crucial importance to the *curricula*. The students deemed

that rapid development and implementation of alternative approaches in research and testing needed to be supported by familiarity with the techniques, and that practical classes could provide opportunities for the acquisition of skills applicable to a future career characterized by a modern and advanced approach. The course also offered opportunities to interact with research institutes and associations which are directly involved with the 3Rs. Students reported the need to further enrich the didactic material available such as videos, computer programs and specific textbooks. Finally, considering the interdisciplinary nature of the topic and the lack of established standardization, collaboration between teachers of disciplines involving the 3Rs through exchange of content and experiences was considered to be fundamental.

III-1-509

Investing in humane education: Provision of alternatives across India

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InterNICHE has worked with Indian teachers, students, campaigners and others since 2002, during which time a range of national and local projects have been initiated and supported. These have included outreach visits and seminars, demonstrations and training in alternatives, replacement-based grant projects, the establishment of a national alternatives library, and work at the level of government and academic councils. Within these, distribution of alternatives has played an important role, both to familiarise end users and other stakeholders with alternatives and to achieve replacement in specific practical classes. By funding the development of new software and negotiating with producers, InterNICHE has been able to offer many alternatives for free or at cost. Recent distribution includes at the 2009 national zoology alternatives seminar; the 2010 national conference of the CPCSEA, the government agency for animal

experimentation; the Dissection Committee of the UGC, who help define the curriculum for university zoology departments; and the 2010 national animal protection network conference. Often an alternatives pack, featuring a collation of software from across the disciplines, has been distributed. Software specific to one discipline has also been sent directly to teachers; the Indian Journal of Pharmacology disseminated 4000 copies of pharmacology freeware. By mid-2011, with support from the Marchig Animal Welfare Trust, InterNICHE had distributed products whose normal purchase value exceeds US\$ 500,000. With the UGC abandoning the requirement for dissection in zoology studies from 2011 onwards, a major new project is helping to provide alternatives to the estimated 17 million animals used annually in this field.