



No clinical relevance of approved animal experiments after seventeen years

In 2005 we published an assessment of the medical impact of 17 research projects involving animal experiments and their 65 resulting primary publications (Lindl et al., 2005). Here we extend the original review, which covered the years 1993-2004, to include the period from 2005 to March 2011.

This investigation included all proposals for animal experiments from the universities of Wuerzburg, Erlangen, and Regensburg – as well as proposals from drug companies in northern Bavaria – that were approved by the Ethical Commission on Animal Experimentation in Wuerzburg, Germany between 1991 and 1993. Of the 51 proposals, 17 (33%) were retrospectively considered successful within the animal models on the basis of their aims stated in the written proposals (Lindl et al., 2001). These projects resulted in 65 primary publications. Citations of the primary publications were compiled using the aid of such international data banks as PubMed, DIMDI, and other science-oriented data retrieval systems, including MedLine and EMBASE.

We found 1,316 citations of the 42 primary publications arising from the 10 basic research proposals and 146 citations of the 23 primary publications arising from the seven applied research proposals. More than half the citations in each field were made in papers reporting other *in vivo* animal experiments. The citation maximum for basic research papers was observed in 1998 (129); for applied research papers in 1996 (29). The decline in citations of the original animal data to zero in 2010 exemplifies the lack of long-term impact of most animal experiments.

Of the citations to publications in the field of applied research, 132 were found in clinically oriented papers, of which only seven related the experimental animal data to therapeutic results in humans. Even these seven reviews or review-like publications did not provide evidence of a direct relationship between the data from animal experiments and human therapies. In some instances, the animal data did not predict the human response.

Our data are in line with other investigations that followed up animal experiments (Reines, 1991; Plous and Herzog, 2001; Grant et al., 2003; Dagg and Seidle, 2004; Pound et al., 2004; Knight, 2007, 2008), and also concluded that the clinical benefits

of animal experiments for humans are overestimated. Reasons for this may lie in the species difference (Pound et al., 2004) and/or in poor design, standardization, and statistical power of animal experiments (Faggion et al., 2009; Gruber and Hartung, 2004; Balls, 2010). This mounting evidence seriously undermines the dogma that animal experiments are indispensable for clinical research progress.

We recommend that applications to perform animal experiments must consider the species difference and include a detailed argument on why the experiments are indispensable. Authorities should have the right to require alteration of the proposals, e.g. regarding the study design, animal numbers, etc., before approval (Foster and Braddock, 2004). Harmful experiments on animals must be restricted more efficiently and be weighed more carefully against the potential gain of knowledge in light of this type of retrospective analysis (Lindl et al., 2005; Dagg and Seidle, 2004).

Our results, although obtained within a restricted geographical area, should be a cause for reflection, both for researchers and for the authorities responsible for licensing animal experiments.

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SATIS ethics ranking of universities in Germany regarding animal use in education

SATIS (latin: enough!) – the humane education project of People for Animal Rights Germany (PARG) – performed the first of its kind ethics ranking to assess the use of animals and need for alternatives in education and to create a guideline for high-school graduates and students, which is accessible at www.sattierrechte.de. We used a questionnaire-based telephone survey and called the responsible teachers for each course related to animal use at each faculty for biology, medicine and veterinary medicine in Germany to ask which animals or alternatives are used in practical classes and whether students have the possibility of conscientious objection. A university ranking was then established by means of specific ethical criteria.

Students of biology, medicine and veterinary medicine are often confronted with the use of animals for dissection or in physiological experiments. While future veterinarians and some biologists need hands on experience with animals, numerous high quality alternatives are available to avoid the harmful use of animals in education. These include models and mannequins, plastinated animals and animal body donation programs. A wide variety of alternatives is already established and evaluated in zoological institutes all over the world (see www.interniche.org;

www.humanelearning.info). In this study, we were interested in the use of animals and alternatives at German universities.

The detailed questionnaire for teachers of zoological institutes asked which and how many animals are used in different courses, which alternatives are established and if not, whether students have the right to conscientious objection. Additional questions included the goals of the course using animals or alternatives, the fate of surviving animals after the course and whether there was interest in implementing alternatives. The four-page questionnaire was to be either filled in by us during a telephone interview with the responsible teacher or sent to the teacher as a writeable pdf file by email. Contact details of responsible teachers and basic information on degrees and curricula were found in a systematic web search.

We contacted the responsible instructors of all 5 faculties for veterinary medicine, 35 medical faculties and 70 biological faculties in Germany. No teacher was ready to perform a detailed telephone interview because of time constraints or lack of interest. While one third of the teachers ordered the writable questionnaire, only four filled it in and returned it. Most information was gathered in shortened telephone calls concentrated on the



Tab. 1: Extract of the Ethical Ranking, see online pdf at www.satis-tierrechte.de for full information

Humane education without harmful animal use	Courses including harmless field studies or giving students the right to conscientious objection	Conservative animal use, including invasive, harmful experiments
Bochum Fac. Medicine Bonn B.Sc. Applied Biology Frankfurt Fac. Medicine Gelsenkirchen B.Sc. Molecular Biology Hannover Fac. Medicine Kaiserslautern B.Sc. Applied Life Science Kiel Fac. Medicine Kleve B.Sc. Bioscience and Health Lüneburg B.Sc. Environmental Science Marburg Fac. Medicine Münster Fac. Medicine Witten/Herdecke Fac. Medicine	Berlin Charité Fac. Medicine Heidelberg Fac. Medicine Vechta B.Ed. Biology Würzburg B.Sc. Biology	Aachen Fac. Medicine Magdeburg Fac. Medicine all 5 Fac. Veterinary Medicine all B.Sc. Biology

most important questions like the use of animals and types of alternatives. 73% of the teachers were prepared to answer these basic questions. Five percent of all teachers showed a positive interest in the project and asked for advice and information.

To present our results we listed all information regarding each university, branch and discipline. We then evaluated the courses by ethical criteria and ranked the faculties accordingly (Tab. 1).

The German federal statistics of animals in experiments indicate an annual use of 60,000 animals in education (including postgraduate courses). Our survey shows that students of human medicine often use spare animals from institutional laboratories (rodents, frogs) and factory farming (chicks), while students of veterinary medicine mostly learn using large animals from abattoirs or euthanized pets from animal clinics. Biology students dissect different animal species and use especially invertebrates and frogs in physiological experiments. Our results, compared to earlier selective surveys of SATIS asking students for information, show a decrease in the use of animals only in institutes for human medicine. No degree not involving animal use exists for veterinary medicine or the bachelor of biology. Apart from minor accommodations, like passive working in groups, students cannot complete their studies as conscientious objectors. Several institutes use alternatives such as virtual labs or student self-experimentation, but the curricula, teaching goals and course contents form a confusing mosaic – clearly opposing the aspired harmonization of bachelor degrees in Europe.

The survey show the use of and need for alternatives, which could be an important input for producers of models, software or other material. For this reason, SATIS has started to establish working relationships with alternatives producers. We are also working at the political level to introduce conscientious objection into German law. The new EU Directive (2010/63/EU) and the German animal welfare law both require that existing alternatives are used and we are providing advice to academia on the implementation of alternative methods. This first ethical rank-

ing of universities in the country will allow German students to make informed decisions on the universities they want to attend, based on which branches of study do not include harmful animal use. Unfortunately for students with strong ethical principles, not every desired degree can be acquired without harmful animal use. Instructors who showed interest in alternatives in the telephone survey will now be initial contact points for SATIS' future activities in implementing alternatives in education.

As the success of our survey depends in part on the online presentation of the project, we have relaunched our webpage www.satis.tierrechte.de on which we provide detailed insight into alternatives including publications, awards and links to databases. In close partnership with InterNICHE, the International Network for Humane Education, we translated the InterNICHE alternatives database into German, loan a variety of material for humane education for free, and offer freeware and cheap software for different disciplines. By advising teachers and administrations on implementing alternatives in education, we are improving the ethical and humane development of students and their motivation to start a career in the innovative field of non-animal research.

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