

Humane Education in Brazil: Organisation, Challenges and Opportunities

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Summary — Humane education and the debate on alternatives to harmful animal use for training is a relatively recent issue in Brazil. While animal use in secondary education has been illegal since the late 1970s, animal use in higher science education is widespread. However, alternatives to animal experiments in research and testing have recently received attention from the Government, especially after the first legislation on animal experiments was passed, in 2008. This article proposes that higher science education should be based on a critical and humane approach. It outlines the recent establishment of the Brazilian Network for Humane Education (RedEH), as a result of the project, *Mapping Animal Use for Undergraduate Education in Brazil*, which was recognised by the 2014 Lush Prize. The network aims to create a platform to promote change in science education in Brazil, starting by quantitatively and qualitatively understanding animal use, developing new approaches adapted to the current needs in Brazil and Latin America, and communicating these initiatives nationally. This paper explores the trajectory of alternatives and replacement methods to harmful animal use in training and education, as well as the status of humane education in Brazil, from the point of view of educators and researchers engaged with the network.

Key words: humane education, public policy, replacement, science education, Three Rs.

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Introduction

In Brazil, animal use in education has been a topic of academic study for approximately 15 years. Research papers have been publishing relevant data since the early 2000s, focusing mainly on undergraduate students' perception of the practice. These data helped establish animal use as a controversial issue in the Brazilian educational context, highlighting the need for the promotion of a more-humane approach to science education.

These conclusions were not only drawn from research studies. Students (mostly involved in animal rights activism) of different courses made their cases for conscientious objection public, and successfully attracted the attention of the local and

national media. In 1998, a biology student rescued a dog minutes before the start of a physiology practical class, initiating a debate within his university that culminated with the implementation of a replacement method for the practical (1). Nearly ten years later, a student sued a university, because it refused to recognise his right not to participate in classes involving harmful animal use (2). The national media covered this case, which helped spread the controversy regarding this common type of practice in biological and health science education.

By that time, organised civil society (especially animal rights groups) was already starting to draw attention to this topic, effectively promoting humane education. The Nina Rosa Institute, for

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instance, produced a DVD in 2006, entitled *Thou Shalt not Kill*, covering the issue of animal use in research and education, which contributed significantly to the expansion of the debate within academia.

What is clear, so far, is that there is a need for a radical change in the science education environment in Brazil. With this in mind, this paper explores the trajectory of alternatives and *Replacement* methods to harmful animal use in training and education, as well as the status of humane education in Brazil, from the point of view of educators and researchers engaged in a recently established network for humane education in Brazil.

The Early Concerns for Animals in Science

The debate on human consideration for animals spans a relatively long time in history. Aristotle, Porphyry, Voltaire and many other philosophers dedicated their time to this field of thought (3). However, it was Jeremy Bentham, who, in the 18th century, when discussing human actions and legislation, proposed that rights should be determined by the capacity to feel, and therefore suffer, rather than the ability to reason and speak. He also demonstrated the development of morality in society, by comparing human rights and legislation in different civilisations (4).

This debate gained momentum among the scientific community in the late 1950s, when Russell and Burch developed the concept of the Three Rs in animal experimentation — namely, the principles of *Reduction*, *Refinement* and *Replacement* (5). In Brazil, however, the impact of the Three Rs was felt only at the beginning of the 21st century: signs of this concept are present in the statutes of most animal ethics committees, and in Brazil's first legislation on animal use, where *Refinement* is by far the most predominant principle (6). The ethics applicable to science have been continuously evolving since then, firstly with regard to the role of humans in experiments, and secondly with regard to the use of experimental animals.

Besides ethical considerations, animal use in science also can be seen as a biotechnological and methodological problem. The extrapolation of results from animal experiments to predict health effects in humans has many uncertainties, considering that the extrapolation involves dealing with interspecies data, short-term to long-term exposure, and variation in the human population in terms of gender (female/male), age (infant/adult) and ethnicity (7). Animal experimentation still remains the recommended method for the assessment of new chemicals and pharmaceutical products. However, these methodological limitations

should be considered as a possible source of error during toxicological screening. Inadequacies in the *in vivo* testing process (which can also apply to current *in vitro* systems) can lead to tragic outcomes after large-scale commercial usage (8). The current low levels of success in the pharmaceutical industry demonstrate the fragility of the *in vitro* and *in vivo* tests used for that purpose — just 5% of the chemicals approved in the pre-clinical test batteries are approved in clinical Phase I testing (9).

Within science education, the role of animals in teaching and training has been questioned, due to its contentious nature (it is difficult to justify harming or killing animals for teaching purposes when the knowledge and skills are already known) and the availability of new technologies and approaches (e.g. virtual reality training, video surgery in real patients, *in silico* and *in vitro* techniques) that make the learning experience much more attractive and interactive, without harming animals in the process.

Initiatives on Alternative Methods and the Three Rs in Brazil

Several low-key initiatives for alternative methods took place in Brazil from around the year 2005. Then, in 2007, a proposal was put forward for the creation of a governmental organisation for alternatives — the Brazilian Centre for Validation of Alternative Methods (BraCVAM; 10) — which was eventually approved in 2014. During this period, the cities of Rio de Janeiro and Florianopolis put pressure on legislators for a complete ban on animal use in science. As a result, members of the scientific community started lobbying the Federal Government in favour of animal experiments, leading to *Act 11794/2008* (11, 12). This act, known as Arouca's Law, created the National Council for Control of Animal Experimentation (CONCEA), which consists of delegates from several governmental, social, scientific and industrial bodies.

To encourage and implement new alternative methods, the Ministry of Science, Technology and Innovation (MCTI) invited the National Institute of Metrology, Quality and Technology (Inmetro), the Brazilian Biosciences National Laboratory (LNBio) and the Institute for Quality and Control of Health Products (INCQS), to organise the National Network for Alternative Methods (RENAMA), which would work alongside BraCVAM for the validation of methods. However, RENAMA, which was legally established in 2012, focuses on animal use for research and testing, and overlooks the use of animals in education (13). Indeed, CONCEA recently published an explanatory note, stating that: "It is important to emphasise that the validation of alternative methods is restricted to tests used in scien-

tific research, and that there is no validation process for alternative methods in teaching” (14). This is an important statement, as it clarifies that there is no need for harmonisation of teaching protocols, and avoids a frequent misconception about the effectiveness of replacement methods in education.

Subsequently, RENAMA, BraCVAM and the Postgraduate Programme of Science and Biotechnology (Fluminense Federal University), launched the first Latin-American Congress on Alternatives (COLAMA), held in Niterói in 2012. This event is scheduled to take place every three years — every year after the World Congress on Alternatives and Animal Use in the Life Sciences. At COLAMA 2012, the creation of a Brazilian Society for Alternative Methods (SBMAIt) was proposed; SBMAIt started its activities in 2013.

Humane Education in Brazil

The first significant co-working initiative started in 1999, when Brazil joined the European Network of Individuals and Campaigns for Humane Education (EuroNICHE). This collaboration helped spread humane education more effectively, and allowed the possibility of conscientious objection at undergraduate level. A year later, EuroNICHE became InterNICHE, due to the inclusion of non-European countries in the network. This collaboration remained active until 2006, when InterNICHE-Brasil became the 1Rnet website. Due to the favourable mood for alternative policies in government and society, the 1Rnet group considered that it was important to expand its academic projects, support new students and groups, and work toward *Replacement* as an independent and non-governmental group. It then became a non-profit organisation, as it allowed the group to collaborate more actively with society, governmental and non-governmental organisations, and to pursue work on, and support, alternatives to animal testing more efficiently, especially work on initiatives based on *Replacement* only (1R). Therefore, under the direction of Thales Tréz and Róber Bachinski, the 1R Institute (<http://www.instituto1r.org/>) was established in 2015. The founding group comprises experts in toxicology, biochemistry, cell biology, biotechnology, physiology, public health, science education, law and rights, and applied ethics.

The 1R Institute recently started a project to identify and recruit educators and researchers working on humane education in Brazil, establishing the Brazilian Network for Humane Education (RedEH; <http://www.instituto1r.org/#!/redeb/cn8r>). This network primarily aims to bring together researchers on (science) education currently working on, or interested in, the replacement of harmful animal use in teaching and training activities.

Its main objectives are the promotion and development of new teaching methods and public policies, and the dissemination of research and methodologies developed and applied in Brazil. In addition, it aims to provide a forum in which professors and educators can share their experiences on classes with no harmful animal use. By forging links between educators and researchers, RedEH also fosters potential collaborations for the application of new techniques and methods developed by its members, thereby diversifying and expanding research to a national level. RedEH already has assignees in seven different states (see Figure 1); as a country of continental proportions, Brazil has high potential for growth.

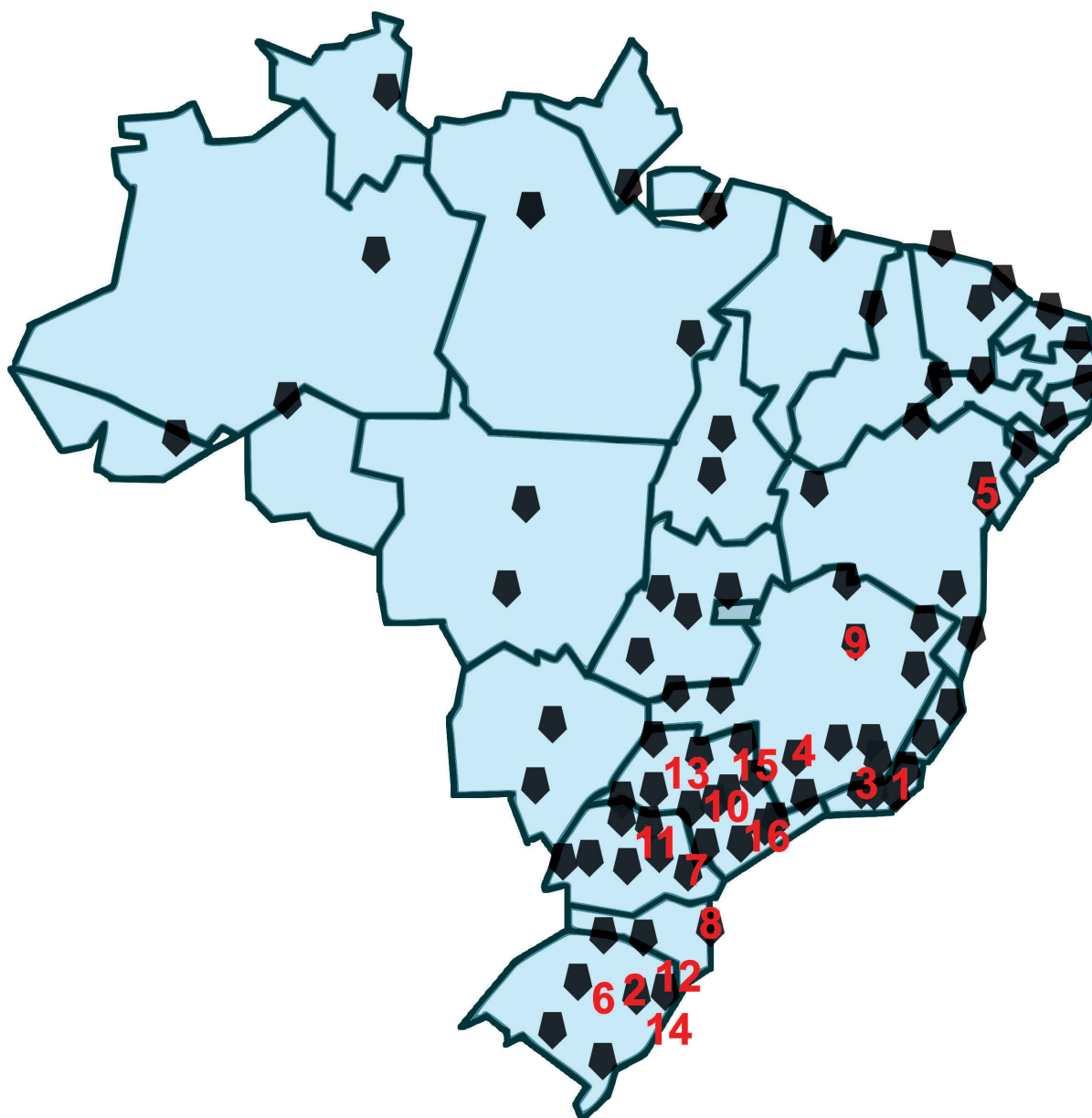
Transparency of Animal Use for Scientific Purposes in Brazil

Part of the project, *Mapping the Animal Use for Undergraduate Education in Brazil* (proposed by Róber Bachinski, recognised by the 2014 Lush Prize, and now incorporated as a 1R Institute project) is to identify and quantify animal use for educational purposes in Brazil. Understanding the size and nature of this situation in Brazil is the first step in developing public policies and strategies to support and encourage humane education. In order to achieve this, there is a need to work with governmental agencies, and specifically, CONCEA, which is the council responsible for the collection of scientific protocols involving animal use. Bachinski contacted CONCEA, in order to propose a partnership with the 1R Institute, to assist in the collection and organisation of the data. CONCEA’s official position was a refusal to deliver data on animal use to either individuals or civil organisations, even for academic purposes, or even after the inclusion of several mechanisms to ensure researcher/institution anonymity. It is important to note that such refusal may also be related to a political agenda against supporters of *Replacement* above the other Rs, such as the 1R Institute. Nevertheless, in view of the Brazilian Transparency Law (15), it is a civil right to request data on animal experimentation for scientific and educational purposes, and for the data to be made available for investigation.

Brazilian National Network for Humane Education

Currently, there are 839 undergraduate state-run and campus-based (i.e. excluding remote-learning) courses on the health, agricultural and biological sciences in Brazil. This comprises 130 courses on Biology, 91 on Agronomy, 84 on Nursing, 83 on Physical Education, 74 on Medicine, 65 on

Figure 1: Distribution of state-run undergraduate campus-based courses on health, agricultural or biological sciences in Brazil (black markers) and the current distribution of members of Brazilian National Network for Humane Education (numbered)



- 1 = UFF: Federal Fluminense University.
- 2 = IFRS: Federal Institute of Education, Science and Technology of Rio Grande do Sul.
- 3 = UFRRJ: Federal Rural University of Rio de Janeiro.
- 4 = UNIFAL-MG: Federal University of Alfenas.
- 5 = UFBA: Federal University of Bahia.
- 6 = UFCSPA: Federal University of Health Science of Porto Alegre.
- 7 = UFPR: Federal University of Paraná.
- 8 = UFSC: Federal University of Santa Catarina.
- 9 = UFVJM: Federal University of the Jequitinhonha and Mucuri Valley.
- 10 = UnG: Guarulhos University.
- 11 = CESCAGE: Higher Education Centre of Campos Gerais.
- 12 = FACCAT: Integrated Faculties of Taquara.
- 13 = UNIP: Paulista University.
- 14 = UniRitter: Ritter dos Reis University Centre.
- 15 = UNICAMP: University of Campinas.
- 16 = USP: University of São Paulo.

RedEH also contains members in Spain: International University of La Rioja (Unir) and University of Barcelona (UB); and in Portugal: Lusophone University of Humanities and Technologies (ULHT).

Zootechnics, 55 on Pharmacology, 54 on Veterinary Medicine, 54 on Psychology, 46 on Physiotherapy, 44 on Dentistry, 28 on Biotechnology, 24 on Biomedicine and seven on Biochemistry. The early modules in these courses may involve classes with animals, such as for physiology, pharmacology, biochemistry, surgery training, animal anatomy, and behavioural studies. If we consider all the undergraduate courses in Brazil, including those run by private institutions and distance-learning courses, then these numbers are significantly increased.

In Brazil, there are no data, not even estimates, on the number of animals used for educational purposes. This contrasts with the situation in the European Union, where, for instance, this type of animal use is responsible for 1.56% of all animal use in science (197,000 animals in 2012; 16). In Brazil, the use of animals in basic and secondary education has been banned since 1979 (12, 17), but we do have significant data about students' perception of animal use in higher education. For instance, 75% of Biology students were against animal use when alternatives were available, and 50% of the interviewed students reported that tutors were not interested in debating, when questioned by the students (18). In addition, it has been estimated that animal use in education can have a negative psychological impact on about half of the students (19). Another study showed that nearly 44% of students in the first term of their undergraduate degree, would already prefer to use alternatives rather than animals for training (20). A good way of ensuring a smooth transition from classes with harmful animal use to humane education is to work with teaching staff on the development of methods that fit within the faculty's culture and the curriculum. Alternatively, the current professors could be trained in new teaching technologies (21), thus increasing the acceptance of new methods and approaches.

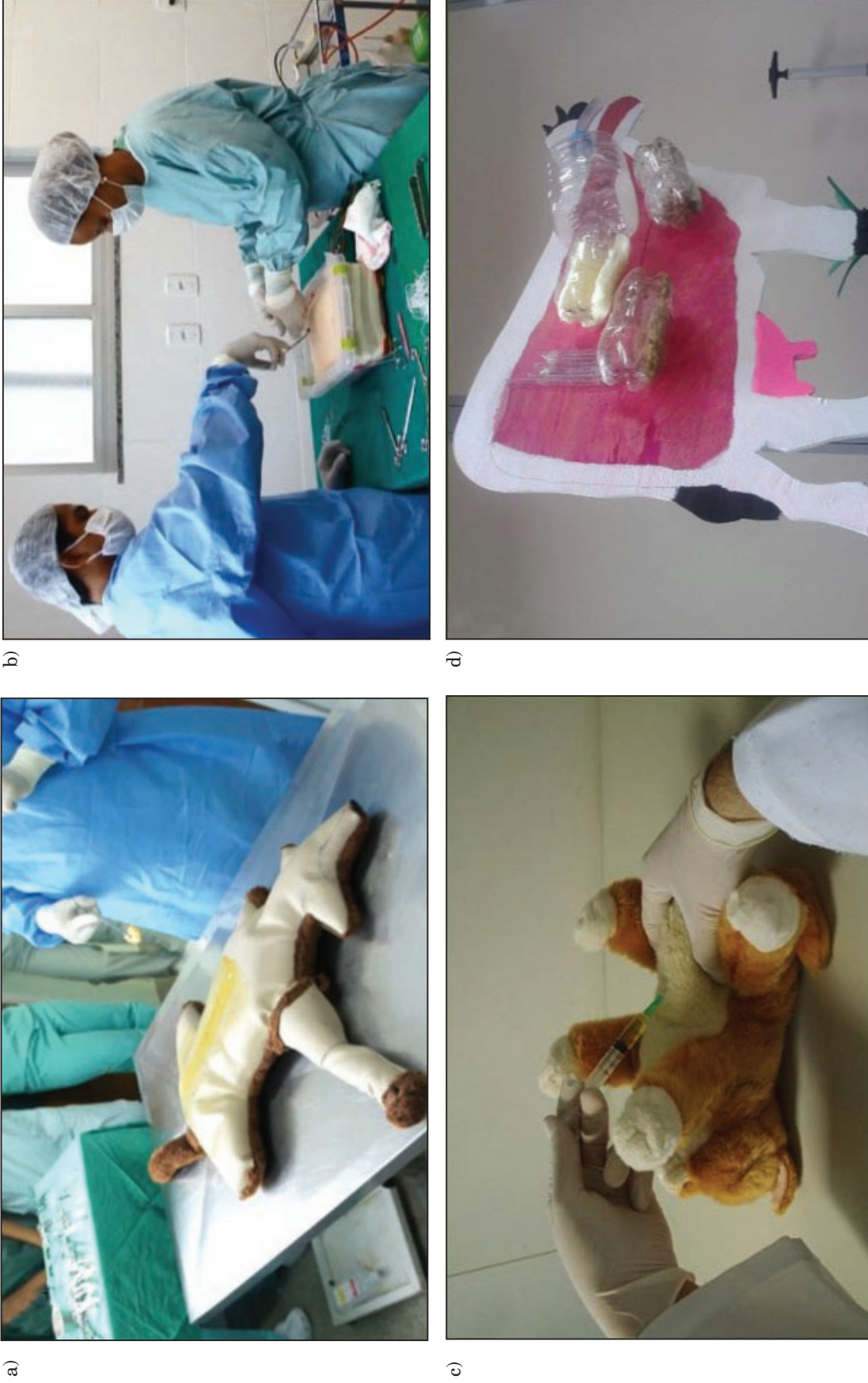
As Brazil is in the process of developing new learning approaches and tools for the replacement of harmful animal use, some isolated initiatives in particular courses can already be found. RedEH intends to disseminate these alternatives and initiatives. For instance, in 2003, Rosane Silva (under the supervision of Julia Matera) developed a method for the conservation of ethically-obtained animal cadavers, allowing the use of the same anatomical piece up to 10 times in anatomy, surgical technique and orthopaedics classes. This technique was implemented at the Veterinary School of the University of São Paulo, the biggest university in Brazil, and received high levels of acceptance by students and professors (22, 23). João M.C. Neto's research group, at the Veterinary School of the Federal University of Bahia, has been working on the development of several alternative materials for surgery classes (see Figure 2a and b). These

alternative methods were evaluated as very useful for training surgical skills and for increasing self-confidence and technical ability, mitigating the risk for real patients and promoting an ethical education and training with a focus on animal welfare (24–27). Examples of alternatives used in veterinary science training include the home-made models developed by Simone T. Oliveira and her team for vascular access training, for cystocentesis in dogs and cats with stuffed animals (see Figure 2c), and models for prostate palpation (28–30). Valeska R.R. Ruiz implemented a practical class where students would produce alternative methods, as a tool for developing new course materials and learning approaches (see Figure 2d; 31). At the Fluminense Federal University, Rita L. Paixão has been working on humane education in the biosciences since 2008, especially showing students new approaches and perspectives on the animal–human relationship. A colleague at the same university, Gutemberg Alves, who also works toward introducing the concept of humane education and *in vitro* sciences in cell biology classes, demonstrated a new approach to problem-based learning when teaching the concept of Toxicity Testing in the 21st Century. He achieved beneficial results by showing the importance of *in vitro* testing for the development of new drugs (32). Julio X. Heck created a textbook criticising animal use in biochemistry teaching, and changed biochemistry practical classes to include only non-animal procedures, by using enzymes and materials from milk and vegetable ingredients.

Horizons and Future Prospects for Humane Education in Brazil

The promotion of the replacement of harmful animal use in science education in Brazil faces many challenges. Perhaps the most difficult task is that of changing a deep-rooted tradition in higher education that usually promotes an oppressive culture of hierarchy between students and professors — this, of course, proves to be antagonistic to constructivist-based and problem-based approaches. Such an environment does not promote critical thinking, which is a fundamental aspect of science education. Instead it promotes a dangerous impasse in the learning–teaching process. In terms of the establishment of a humane-based approach, this scenario has consequences: from students being afraid of missing out on theoretical and professional skills if they adopt replacement options, to those who effectively abandon their courses due to the serious ethical concerns instigated by animal use. Professors are also tied to their former educational reference points, and tend to make little effort to consider changes to their way of teaching. Nonetheless, as we pointed out at the

Figure 2: Examples of training tools developed by members of RedEH



Models developed by João C. Neto's team (at UFBA) for aseptic surgical field preparation, and training of veterinary surgery and surgical haemostasis are shown in a) and b), respectively. A model for cystocentesis practice with stuffed animals, developed by Simone Oliveira's team (at UFPR), is shown in c). A model for use in lectures on the gastrointestinal tract of ruminants, developed by Valeska Ruiz's team (at CESCAGE), is shown in d).

beginning of this article, there are many examples in support of changes to science education in Brazil.

Brazil, for the first time, is working collectively toward the compilation of replacement initiatives in education, propagating and empowering local efforts to achieve change nationally. Hopefully, this will encourage new research groups on humane education, as well as encourage the implementation of those methods and approaches, paving the way for change to the current traditional paradigm in the education of future researchers. In this manner, the educational system will finally be more democratic and more humane, for both students and for animals.

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