

# Curricula for the use of research animals

These curricula are intended to support undergraduate and taught masters degree programmes in which students are expected to analyse literature and/or data that have been generated from studies involving animals that are subject to regulation ("research animals"), for example under the [Animals \(Scientific Procedures\) Act 1986](#) - A(SP)A.

The statements cover the knowledge, skills and attitudes that should be acquired by students specifically with respect to the use of research animals. We have developed a set of core learning outcomes to support all students undertaking such degree programmes. It lists ideal learning outcomes and we appreciate that it may not be possible to apply it to all students at all institutions. We understand that different courses will have their own unique requirements and that the delivery of this curriculum will depend on the discipline. We have also developed a set of experiential learning outcomes intended to provide additional support for those who wish to go on to study research animals in their courses, placements, projects and careers. Our intention is not to be overly prescriptive, but we hope that the curricula will be a useful reference point in course design, delivery and review.

The curricula assume, but do not duplicate, the important generic skills and attributes provided by any scientific degree programme. Therefore, this curriculum should be read alongside relevant QAA benchmark statements e.g. [Biomedical Sciences](#), [Biosciences](#). Educators should use their own academic judgement, experience, resources, and knowledge of their students' needs in interpreting the curriculum and embedding it into their programmes. We hope that these curricula will help support consistency in the undergraduate educational experience, openness about the use of research animals and objective evaluation of the outputs of such research.

The curricula have been produced by the British Pharmacological Society through review and consolidation of previous work on undergraduate learning outcomes for the use of research animals. Statements were developed using an iterative Delphi process that drew on the expertise of 34 stakeholders (core) and 29 stakeholders (experiential) with educational, research, welfare, industrial and regulatory experience. This work was a direct response to a recommendation made in [an evaluation of the Integrative Pharmacology Fund](#) (IPF). The IPF was a £4m investment from Pfizer, AstraZeneca and GlaxoSmithKline, which was used to leverage a total of £22m through partnership funding from the research councils and other public bodies. The evaluation recommended the development of learning objectives for the use of research animals.

The curricula will support students to:

- develop knowledge and understanding of the appropriate scientific use of research animals
- develop knowledge and understanding of the ethical & welfare issues surrounding the use of research animals
- analyse literature and/or data that has been generated from studies involving research animals
- cultivate respectful attitudes to research animals
- make informed career choices

*The development of these curricula was led by a project team from the British Pharmacological Society. The team included Dr Dave Lewis (University of Leeds), Dr Manasi Nandi (KCL), Dr Mike Collis, Dr Anna Zecharia and Lisa Hevey.*

## Recommendations on practical exposure to the use of research animals

In addition to defining core and experiential knowledge, skills and attitudes, we make recommendations to guide the provision of practical exposure or experiential learning when implementing the curricula:

### Core Learning Outcomes

For these learning outcomes, the purpose of exposing students to the use of research animals is to put the knowledge, skills and attitudes statements into context. This curriculum does not require the student to undertake any hands-on research with animals. This exposure could be achieved through

observation of a research animal, through the use of reputable and realistic simulations/videos, or in a laboratory or animal facility if available.

Nonetheless, every student who wishes to, should be supported in gaining opportunities to observe the use of a research animal in a real-life setting: that is, in a laboratory or animal facility. The educational aims are for the student to understand:

- the reality of using research animals
- their personal moral and ethical boundaries
- their personal response of the use of research animals, and how this impacts upon their career choices

We are aware that not every institution has the capability to offer the opportunity to observe the real-life use of a research animal. We are working with partners to explore how we can realise this requirement.

### **Experiential Learning Outcomes**

For experiential learning outcomes, we think it is important that students are exposed to the use of research animals to provide experiential learning. Rather than being prescriptive, we ask educators/supervisors to decide how best to achieve the desired learning/research outcome. We endorse a tiered approach, taking the 3Rs into context. By this we mean that we recommend the appropriate use of reputable and realistic simulations, cadavers and experiments conducted under delegated authority. In addition, we would support the use of Home Office Personal Licences (or equivalent) with relevant supervisory conditions in circumstances where justified on educational/research grounds.

### **Core Learning Outcomes**

#### **Knowledge**

Students will acquire an appreciation of:

#### ***Frameworks and principles***

- The relevant [legal](#) and [regulatory](#) structures and [ethical review](#) processes governing the use of research animals
- The [legal](#) and moral obligations and [intervention mechanisms](#) to protect the welfare of research animals
- The [ethical principles](#) of the use of research animals, including [harm-benefit analysis](#)
- The lifetime experience of research animals, including [care and husbandry](#)
- The principles of [Culture of Care](#)
- The existence of recognised methods for the [humane killing](#) of research animals
- [Societal attitudes](#) to animal research
- How animal welfare considerations should underpin all aspects of the use of research animals
- [Their personal ethical and moral boundaries and views](#)

#### ***How and when research animals are used***

- Why [research animals are used](#), including advantages and limitations
- The principle that research animals should only be used where there are no alternative approaches to address the same scientific question
- The rationale for the use of different species in research
- How research animals are used to understand fundamental physiology and pathophysiology
- How research animals are used in the drug discovery and development process, including regulatory obligations and translational studies
- The role of research animals in the acquisition of experimental cells, tissues and fluids
- The impact of the use of research animals on the prevention and/or treatment of disease in both humans and animals

#### ***Experimental design, analysis and communication***

- The [principles of the 3Rs](#) (replacement, reduction and refinement) in the use of research animals and how these impact upon research animal welfare and experimental outcomes

- The [importance of good experimental design](#) (e.g. randomisation, blinding, power calculations, managing variability) and correct analysis
- The concept that research animal welfare impacts upon [reproducibility](#) and [reliability](#) of data
- How [predictive models](#) (e.g. in silico) can complement and sometimes replace the use of research animals
- Appropriate [reporting standards](#) for sharing of research
- How to keep up to date with the relevant literature and developments, including [3Rs](#) and research animal welfare
- How to [openly and effectively communicate](#) the use of research animals to scientific and non-scientific audiences

### **Fundamental science**

- The [anatomy and physiology](#) of research animals
- The signs of stress and [pain](#) and the mechanisms that cause them
- How observed responses in research animals arise from the integration of a number of biological systems
- The relationship between the physiological responses of research animals and those in humans
- Appropriate [statistical tools](#) and analytical methods used to interpret data from studies using research animals
- The various ways research animals can be used, including ex vivo and non-recovery preparations as well as the use of conscious animals for the study of physiological, pharmacological, pathological and therapeutic problems
- How [genetically altered animals](#) are generated
- The effects genetic alteration may have on many body systems, with consequences for the data gathered
- New and emerging approaches, techniques and principles in animal research

### **Skills**

*Students will be able to:*

- Interpret and critically evaluate [experimental planning and design](#) for the use of research animals
- Interpret and critically evaluate data from research animals
- Make an informed choice about pursuing a career involving the use of research animals

### **Attitudes**

*Students will demonstrate awareness that anybody working with research animals should display:*

- A respectful and considerate attitude to research animals and their tissues
- Awareness of the [culture of care](#) within an animal facility and a willingness to actively participate in it
- The ability to recognise their limitations and be willing to ask for support
- A willingness to intervene appropriately when animal welfare is at risk
- A collegiate attitude to animal technicians, animal technologists, Named Veterinary Surgeons and other personnel
- A commitment to apply the 3Rs across the research process
- A commitment to animal welfare across the research process
- A commitment to working within the legal and ethical frameworks governing the use of research animals

## **Experiential Learning Outcomes**

### **Knowledge**

In addition to the knowledge statements in the core curriculum, students will acquire an appreciation of:

### **Frameworks and principles**

- Good practice in biosecurity to mitigate harms to humans, animals and the environment
- The important role of mentors and experienced personnel in education and training

### **Experimental design, analysis and communication**

- The need for [assessment of the welfare of research animals](#) including pre and post-operative care and the [use of anaesthetics](#) and analgesics
- Appropriate formulations and routes of administration of compounds used in experiments
- Recovery and non-recovery surgical techniques applicable to animal research
- How pharmacological agents (e.g. anaesthetic) or [environmental conditions](#) (e.g. subclinical infections) can affect experimental outcomes

### **Skills**

In addition to the skills statements in the core curriculum, students will be able to:

- Set appropriate exclusion and termination criteria with regard to welfare limits and the quality of experimental data
- Appropriately [handle](#) at least one species of research animal
- Gain experiential learning through direct involvement in at least one of the following:
  - Ex vivo (in situ/semi-intact) e.g. working heart brainstem
  - Terminally anaesthetised research animals
  - Conscious research animals e.g. behavioural or pharmacological study
  - Surgical techniques e.g. cadavers, use of reputable/realistic simulation
- [Engage in discourse \(at least with peers\) about the use of research animals](#)

For queries or questions regarding hyperlinked resources, or guidance on their use or delivery in educational settings, please contact Dave Lewis ([3rs@leeds.ac.uk](mailto:3rs@leeds.ac.uk))