

# Animals (Scientific Procedures) Act 1986

Non-technical summaries for project  
licences granted during 2015

## Volume 2

Projects with a primary purpose of: Higher  
education or training for the acquisition,  
maintenance or improvement of vocational skills

## **Project Titles and keywords**

- 1. Education of *in vivo* Pharmacology to University Students**
  - Education, Pharmacology, in vivo, University Students
- 2. Pre-treatment of animals for student education**
  - Pharmacology, drug action, anaphylaxis
- 3. Education in the Principles of Laboratory Animal Anaesthesia**
  - Anaesthesia, analgesia, education, rodents, teaching
- 4. Education in in-vivo physiology and pharmacology**
  - Education, Physiology, Pharmacology, Undergraduate
- 5. Education in cardiovascular physiology**
  - Education, animal physiology, blood vessel cannulation, blood pressure, vagus

<b>Project 1</b>	<b>Education of <i>in vivo</i> Pharmacology to University Students</b>	
Key Words (max. 5 words)	Education, Pharmacology, <i>in vivo</i> , University Students	
Expected duration of the project (yrs)		
Purpose of the project as in ASPA section 5C(3)  (Mark all boxes that apply)	<input type="checkbox"/>	Basic research
	<input type="checkbox"/>	Translational and applied research
	<input type="checkbox"/>	Regulatory use and routine production
	<input type="checkbox"/>	Protection of the natural environment in the interests of the health or welfare of humans or animals
	<input type="checkbox"/>	Preservation of species
	<input checked="" type="checkbox"/>	Higher education or training
	<input type="checkbox"/>	Forensic enquiries
	<input type="checkbox"/>	Maintenance of colonies of genetically altered animals
Describe the objectives of the project (e.g. the scientific unknowns or scientific/clinical needs being addressed)	The objectives are to teach <i>in vivo</i> pharmacology to University Students via laboratory classes involving animals. The aim of these classes is to enhance knowledge, the conceptual understanding and skills of <i>in vivo</i> pharmacology.	
What are the potential benefits likely to derive from this project (how science could be advanced or humans or animals could benefit from the project)?	The potential benefits are in the development of student (1) knowledge, (2) conceptual understanding and (3) practical skills in <i>in vivo</i> pharmacology.  These gains in student knowledge, skills and understanding help to provide trained graduates for careers in (1) academic research and (2) pharmacological research.	
What species and approximate numbers of animals do you expect to use over what period of time?	We expect to use approximately 100 rats, 50 guinea pigs and 750 mice over 5 years.	

<p>In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected level of severity? What will happen to the animals at the end?</p>	<ul style="list-style-type: none"> <li>• Animals will undergo injections of substances to demonstrate pharmacological effects to students. The substances used are benign with no adverse effects. In some cases animals will undergo a mild behavioural test which stimulates natural exploratory behaviours.</li> <li>• Although non-specific and more harmful reactions to injections cannot be ruled out, they are not expected and are likely to occur with a very low incidence or not at all.</li> <li>• The level of severity for all procedures is either mild or the animals undergo terminal anaesthesia.</li> <li>• All animals will be humanely killed shortly after the injection of substances.</li> </ul>
<p><b>Application of the 3Rs</b></p>	
<p><b>1. Replacement</b></p> <p>State why you need to use animals and why you cannot use non-animal alternatives</p>	<p>Replacements such as computer simulations cannot entirely replace the use of animals to teach students <i>in vivo</i> pharmacological knowledge, concepts and skills. Furthermore, there are no suitable <i>in vitro</i> tests which can effectively simulate complex biological systems.</p>
<p><b>2. Reduction</b></p> <p>Explain how you will assure the use of minimum numbers of animals</p>	<p>The minimum number of animals that will enable adequate provision of teaching for the classes planned will be used. Each year we will assess whether a reduction in animal use can be achieved given the student numbers within the specific classes.</p>
<p><b>3. Refinement</b></p> <p>Explain the choice of species and why the animal model(s) you will use are the most refined, having regard to the objectives. Explain the general measures you will take to minimise welfare costs (harms) to the animals.</p>	<ul style="list-style-type: none"> <li>• Rats are the best choice of animal for a laboratory demonstrating pharmacokinetics, as they display drug elimination characteristics that comparable to human and have relatively large organs and blood vessels (by comparison to a mouse).</li> <li>• Guinea pigs are accepted as a preferred animal model to investigate type I hypersensitivity.</li> <li>• Mice are ideal laboratory animals for demonstrating behavioural measurements following drug administration, as they are small and easy for students to handle.</li> </ul> <p>We will minimise welfare costs to the animals by employing mild/non-recovery procedures and using simple protocols that ensure procedures can be carried humanely and efficiently. All animals will be dosed and the students observed at all times by appropriately trained personal licence holders.</p>

<b>Project 2</b>	<b>Pre-treatment of animals for student education</b>	
Key Words (max. 5 words)	Pharmacology; drug action; anaphylaxis	
Expected duration of the project (yrs)	5 years	
Purpose of the project as in ASPA section 5C(3)  (Mark all boxes that apply)	<input type="checkbox"/>	Basic research
	<input type="checkbox"/>	Translational and applied research
	<input type="checkbox"/>	Regulatory use and routine production
	<input type="checkbox"/>	Protection of the natural environment in the interests of the health or welfare of humans or animals
	<input type="checkbox"/>	Preservation of species
	<input checked="" type="checkbox"/>	Higher education or training
	<input type="checkbox"/>	Forensic enquiries
	<input type="checkbox"/>	Maintenance of colonies of genetically altered animals
Describe the objectives of the project (e.g. the scientific unknowns or scientific/clinical needs being addressed)	The Project is designed to ensure the success of two specific experiments that form part of a second-year undergraduate Pharmacology course. By injecting animals with a protein or a hormone we can allow students using isolated tissues (segments of uterus or gut) from these animals to observe key pharmacological principles that would be impossible to demonstrate, or much less reliably demonstrated, without the pre-treatments.	
What are the potential benefits likely to derive from this project (how science could be advanced or humans or animals could benefit from the project)?	The experiments supported by this Project contribute to the success of the overall teaching goal. They ensure that students can carry out a full and balanced set of experiments that relate directly to the material they are taught in lectures. This enhances the learning outcome by allowing them to associate essential pharmacological principles with direct practical experience.	
What species and approximate numbers of animals do you expect to use	We will use approximately 20 adult rats and 4 adult guinea pigs per year. Over the five-year course of the	

over what period of time?	project we will thus use 100 rats and 20 guinea pigs.
In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected level of severity? What will happen to the animals at the end?	<p>No adverse effects expected (or previously observed). The likely level of severity is judged to be mild.</p> <p>Animals will be humanely culled and specific tissues isolated and used for experiments.</p>
<b>Application of the 3Rs</b>	
<p><b>1. Replacement</b></p> <p>State why you need to use animals and why you cannot use non-animal alternatives</p>	<p>The aims of this Project can not be achieved without the use of regulated procedures in live animals. The objective is to enable hands-on practical illustration of fundamental aspects of pharmacology through direct experimentation, using animal tissue. The experiments are key educational components of the course.</p>
<p><b>2. Reduction</b></p> <p>Explain how you will assure the use of minimum numbers of animals</p>	<p>By choosing well-characterized and reliable assays, students can routinely observe the desired pharmacological phenomena whilst using a minimal number of animals. Each animal provides tissue for multiple students. The number of animals is kept to the absolute minimum, according to class size, and has been determined over many years of similar experiments.</p>
<p><b>3. Refinement</b></p> <p>Explain the choice of species and why the animal model(s) you will use are the most refined, having regard to the objectives. Explain the general measures you will take to minimise welfare costs (harms) to the animals.</p>	<p>Relaxation of the isolated rat uterus provides a proven method by which the students can reliably observe the action of drugs that act on beta-2 adrenoceptors. Other tissues available for assessing such drug activity include the guinea-pig trachea and some vascular smooth muscle. These are technically more demanding to use, with the likelihood that some students would not get a definitive result.</p> <p>Contraction of the isolated guinea-pig ileum is a proven and a reliable way for the students to observe an anaphylactic response in tissue from a sensitised animal.</p> <p>No adverse effects are expected – nor have any been encountered during the previous licence periods. Experienced staff will carry out the</p>

	injections. Any animal showing signs of distress beyond the expected short-lasting discomfort due to the injection itself would be immediately humanely culled.
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<b>Project 3</b>	<b>Education in the Principles of Laboratory Animal Anaesthesia</b>	
Key Words (max. 5 words)	Anaesthesia, analgesia, education, rodents, teaching.	
Expected duration of the project (yrs)	5 years	
Purpose of the project as in ASPA section 5C(3)  (Mark all boxes that apply)	<input type="checkbox"/>	Basic research
	<input type="checkbox"/>	Translational and applied research
	<input type="checkbox"/>	Regulatory use and routine production
	<input type="checkbox"/>	Protection of the natural environment in the interests of the health or welfare of humans or animals
	<input type="checkbox"/>	Preservation of species
	<input checked="" type="checkbox"/>	Higher education or training
	<input type="checkbox"/>	Forensic enquiries
	<input type="checkbox"/>	Maintenance of colonies of genetically altered animals
Describe the objectives of the project (e.g. the scientific unknowns or scientific/clinical needs being addressed)	<p>This Project Licence proposes to use laboratory animals in demonstrating the principles and practice of laboratory animal anaesthesia and analgesia. The practical demonstration will complement lectures on anaesthesia and surgery in Module 4 (Module 21) of the New Licensee Training Courses, sponsored animal technician training modules (CPD) and for training members of professional biomedical organisations, which are routinely presented.</p> <p>The specific objectives are:</p> <ul style="list-style-type: none"> <li>• To demonstrate how the use of analgesics, sedatives or local anaesthetics which can be employed for minor procedures, e.g. blood sampling, tattooing or ear notching, can prevent pain and reducing stress and anxiety, without loss of consciousness.</li> <li>• To demonstrate a range of anaesthetic regimens and best practice using injection and inhalation agents with monitoring, in rodents and rabbits.</li> </ul>	



	<ul style="list-style-type: none"> <li>• To demonstrate advanced anaesthetic monitoring systems and technical anaesthetic delivery. Candidates are also instructed in basic manual methods of anaesthetic maintenance methods and assessment in the event of equipment failure</li> </ul> <p>In our experience, lectures with slides, CD-ROMs, DVDs, television and videos and VLEs do not adequately replace direct observation of the correct and effective methods of laboratory animal anaesthesia for the individual. This has been consistently borne out by the post-course feedback from a wide range of candidates over the years, &gt; 790 since Sept. 2010. Each candidate is provided with comprehensive notes to support lectures and practical demonstrations, plus CD-ROM interactive course notes on Laboratory Animal Anaesthesia, Surgery and Perioperative Care and access to Virtual Learning Environments (VLEs). We present 12 courses annually.</p>
<p>What are the potential benefits likely to derive from this project (how science could be advanced or humans or animals could benefit from the project)?</p>	<p>Most textbooks and teaching aids assume students already have some knowledge or experience, which is usually inaccurate. Therefore there is a continuing need for appropriately formulated training courses to adequately train and prepare new research scientists and technologists to understand and undertake perioperative anaesthetic management.</p> <p>Inexperienced administration of general anaesthesia would normally result in serious adverse effects, causing pain and distress, which their use is intended to abolish or reduce to the absolute minimum. Effective methods of anaesthesia and analgesia will profoundly influence the health and welfare of laboratory animals. The educational experience, in turn, will positively affect the quality of meaningful scientific result obtained from the use of laboratory animals.</p> <p>Feedback for students includes: <i>In my case it was much clearer to see the “real” procedure than with a video and lecture slides. I won’t forget it, and this is the real difference which will help me when I do it by myself</i></p>

<p>What species and approximate numbers of animals do you expect to use over what period of time?</p>	<p>Mice (420) Rats (150) Rabbits (5) over 5 years</p>
<p>In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected level of severity? What will happen to the animals at the end?</p>	<p>The health of all the animals used is checked, described and discussed with the candidates as part of their instruction, prior to any animal undergoing induction of anaesthesia. During the procedures, each animal is continually observed, its reflexes to determine the level of anaesthesia tested and in most cases, some form of monitoring equipment employed to assess the animal's condition and vital responses during anaesthesia.</p> <p>All procedures are of a mild severity limit and previous retrospective actual severity assessment has been scored as sub threshold by experienced veterinary surgeons.</p> <p>There are no expected adverse effects. Animals will be Schedule 1 killed at the end of procedure. On rare occasions when rabbits are used they may be rehomed as per local Establishment animal welfare and ethical review policy and health assessment by a vet.</p>
<p><b>Application of the 3Rs</b></p>	
<p><b>1. Replacement</b></p> <p>State why you need to use animals and why you cannot use non-animal alternatives</p>	<p>Artificial alternatives do not provide the environment or experience gained from a "real life" situation, which is what candidates will be exposed to when undertaking general anaesthesia of laboratory animals themselves for the first time. The valuable practical experience offered by use of this project licence will demonstrate to all candidates, the anaesthetic agents, methods and equipment discussed in lectures and practical demonstrations.</p>
<p><b>2. Reduction</b></p> <p>Explain how you will assure the use of minimum numbers of animals</p>	<p>Overall numbers are kept to the minimum necessary to demonstrate an effect, i.e. general anaesthesia, e.g. the maximum use of two mice per injectable agent, one only heavily sedated, to demonstrate pedal response on one and not the other. The annual use of animals is small; all rodents are donated from commercial breeding colonies and are animals due for euthanasia. The use of these</p>

	<p>animals for educational purposes supports the 3Rs are they are put to good use (i.e. their tissues are not required by other research groups)</p>
<p><b>3. Refinement</b></p> <p>Explain the choice of species and why the animal model(s) you will use are the most refined, having regard to the objectives. Explain the general measures you will take to minimise welfare costs (harms) to the animals.</p>	<p>Animals will be continually monitored until effects of anaesthetic agents have worn off and normal function is observed. (Sensor connections are non-invasive, non-traumatic and non-distressing).</p> <p>Without compromising animal welfare, candidates will undertake physical examination and monitoring (e.g. pedal reflex, assessment of colour of mucus membranes, palpebral reflex, and auscultation of the heart, counting respiratory rate and observing pattern of respiration) under constant supervision from the personal licensees, NACWOs &amp; Veterinary Surgeons.</p>

<b>Project 4</b>	<b>Education in in-vivo physiology and pharmacology</b>	
Key Words (max. 5 words)	Education; Physiology; Pharmacology; Undergraduate	
Expected duration of the project (yrs)	5	
Purpose of the project as in ASPA section 5C(3)  (Mark all boxes that apply)	<input type="checkbox"/>	Basic research
	<input type="checkbox"/>	Translational and applied research
	<input type="checkbox"/>	Regulatory use and routine production
	<input type="checkbox"/>	Protection of the natural environment in the interests of the health or welfare of humans or animals
	<input type="checkbox"/>	Preservation of species
	<input checked="" type="checkbox"/>	Higher education or training
	<input type="checkbox"/>	Forensic enquiries
	<input type="checkbox"/>	Maintenance of colonies of genetically altered animals
Describe the objectives of the project (e.g. the scientific unknowns or scientific/clinical needs being addressed)	<p>There is a worldwide shortage of scientists with the knowledge and skills to be able to perform scientific and medical research using animals. The objectives of this project are to provide an education in and hands-on practical experience of whole animal physiology and pharmacology for a limited number of final year undergraduate students who intend to go in to careers in scientific and medical research.</p> <p>The studies using animals undertaken by students under this licence are delivered alongside lectures on animal welfare, ethics, alternatives to animal experimentation, and the use of animals in different areas of research. Together, they provide students with the broad education required by a modern whole animal (or in-vivo) scientist.</p>	
What are the potential benefits likely to derive from this project (how science could be	There is an increasing awareness that the use of whole animal experimental techniques, particularly in combination with emerging genetic technologies, is	

<p>advanced or humans or animals could benefit from the project)?</p>	<p>essential if significant advances are to be made in our understanding of how our bodies function in health and disease. However, there has been a gradual decline in the number of scientists with the necessary skills and expertise to undertake these studies which, if not reversed will affect the UK pharmaceutical industry ability to compete in the global marketplace.</p> <p>The benefits of this programme are long-term. It will produce a group of well-educated graduates who have received an in-depth education in the use of animals in research and who are equipped with the knowledge and skills required by a modern in-vivo scientist. They will contribute to reversing the shortage of in-vivo scientists in the UK and, through their research, help maintain the UK's position in the forefront of biomedical research.</p> <p>There are also long-term benefits for animal welfare. By ensuring the students are well educated in the discipline, it will ensure that, in their future research careers, they don't waste animals or inflict avoidable suffering due to ill-considered, inexpertly-designed or poorly-conducted experiments. They will also have the knowledge and understanding to see the place of in-vivo studies in modern biomedical research and how such studies integrate with alternative, non-animal techniques.</p>
<p>What species and approximate numbers of animals do you expect to use over what period of time?</p>	<p>Rats and mice, approximately 330 over 5 years</p>
<p>In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected level of severity? What will happen to the animals at the end?</p>	<p>All studies are either of mild severity (unlikely likely to experience more than short-term mild pain, suffering or distress) or will be undertaken under general anaesthesia from which the animals will not recover from. The adverse effects will therefore be, at worst, minimal. All animals will be culled at the end of each study or re-used, following a suitable period of recovery, in another study.</p>
<p><b>Application of the 3Rs</b></p>	

<p><b>1. Replacement</b></p> <p>State why you need to use animals and why you cannot use non-animal alternatives</p>	<p>The aims of this programme include providing students with a practical education in in-vivo sciences. Whilst we are utilising alternatives where possible, for example, cadavers will be used to provide practical experience of surgical techniques, injections and the cannulation of blood vessels, the hands-on practical experience and understanding of the problems/management/limitations of whole animal experimental preparations, essential skills for future in-vivo scientists, can only be gained from actual participation in or direct observation of such studies. They could not be obtained from other teaching methods. Thus, this restricted use of animals will significantly student learning. It will also enhance and reinforce the knowledge and understanding provided through other teaching sessions in the course.</p>
<p><b>2. Reduction</b></p> <p>Explain how you will assure the use of minimum numbers of animals</p>	<p>All steps to minimise the number of animals required whilst ensuring that the educational outcomes of the course are met have been taken. Thus, the animals used for training in animal handling will then be used for behavioural experiments. They will then either be culled and the cadavers used to provide training in surgery, injection techniques and cannulations or re-used, following a suitable period of recovery, in another study. For each experimental session, the number of students per group (3-5) is the maximum number that can be accommodated per preparation or animal without diminishing an individual students learning experience. To further minimise the overall number of animals used whilst increasing the volume and value of data obtained from these studies, students will utilise data obtained from both their preparation and those of the other groups in their scientific reports/abstracts.</p>
<p><b>3. Refinement</b></p> <p>Explain the choice of species and why the animal model(s) you will use are the most refined, having regard to the objectives. Explain the general</p>	<p>Rodents have been chosen because we have substantial experience of the use of these species particularly in the protocols outlined in this application. They are the species most commonly used in biomedical research, the most commonly utilised species within individual protocols and therefore most appropriate to provide student</p>

<p>measures you will take to minimise welfare costs (harms) to the animals.</p>	<p>education in this area. They are also the least sentient species that we could use. The models we have chosen encompass different research areas (psychopharmacology, gastrointestinal, cardio-respiratory, renal) and also different techniques (freely moving animals, terminally anaesthetised and ex-vivo preparations). They also compliment and reinforce the accompanying lecture series.</p> <p>All protocols are of mild severity or are non-recovery and therefore animal suffering will be, at worst, minimal. All animals will be immediately humanely culled at the end of each protocol</p>
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<b>Project 5</b>	<b>EDUCATION IN CARDIOVASCULAR PHYSIOLOGY</b>	
Key Words (max. 5 words)	Education, animal physiology, blood vessel cannulation, blood pressure, vagus	
Expected duration of the project (yrs)	5	
Purpose of the project as in ASPA section 5C(3)  (Mark all boxes that apply)	<input type="checkbox"/>	Basic research
	<input type="checkbox"/>	Translational and applied research
	<input type="checkbox"/>	Regulatory use and routine production
	<input type="checkbox"/>	Protection of the natural environment in the interests of the health or welfare of humans or animals
	<input type="checkbox"/>	Preservation of species
	<input checked="" type="checkbox"/>	Higher education or training
	<input type="checkbox"/>	Forensic enquiries
	<input type="checkbox"/>	Maintenance of colonies of genetically altered animals
Describe the objectives of the project (e.g. the scientific unknowns or scientific/clinical needs being addressed)	To educate undergraduate students in the biomedical sciences in the field of cardiovascular and gastrointestinal physiology and to increase the number of graduates with <i>in vivo</i> experience. This is crucial to the research efforts within the disciplines of biomedical sciences, medicine and veterinary medicine.	
What are the potential benefits likely to derive from this project (how science could be advanced or humans or animals could benefit from the project)?	<ol style="list-style-type: none"> <li>1. Students will acquire improved understanding of the complex processes involved in cardiac and intestinal physiology and the modulatory effects of known drugs.</li> <li>2. Provision of bioscience graduates with a thorough appreciation of how to design and execute <i>in vivo</i> experiments. Also how to treat the data obtained to reach meaningful conclusions</li> <li>3. Students will gain experience of due ethical consideration of the live animals used in scientific</li> </ol>	



	studies, and in the application of the 3Rs (refinement, reduction and replacement).
What species and approximate numbers of animals do you expect to use over what period of time?	Adult rats will be used. Over the five years of the project licence, a total of not more than 280 will be used
In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected level of severity? What will happen to the animals at the end?	<p>All experiments will be performed under terminal anaesthesia and therefore the animal will not be recovered at the end of the procedure. Very occasionally animals may receive compounds via drinking water or no more than 5 injections in order to gain maximum benefit from the studies under anaesthetic so that the animal numbers used can be as low as possible.</p> <p>The only adverse effect expected is anticipated to be momentary discomfort when the animal initially inhales the anaesthetic gas mixture or receives an injection .</p>
<b>Application of the 3Rs</b>	
<b>1. Replacement</b>  State why you need to use animals and why you cannot use non-animal alternatives	<ul style="list-style-type: none"> <li>• The complexity of the <i>in vivo</i> systems and integrated responses to drugs being measured in the proposed project cannot be replicated in a non-animal alternative.</li> <li>• The purpose of this educational licence is to train undergraduates in <i>in vivo</i> physiology techniques and for that reason therefore the work has to involve the use of animals.</li> <li>• Alternatives have not been rejected but instead form an integral part of the course preceding the <i>in vivo</i> studies described in this Project Licence.</li> </ul>
<b>2. Reduction</b>  Explain how you will assure the use of minimum numbers of animals	<ul style="list-style-type: none"> <li>• Students will work in small groups (sharing an animal) rather than on individual animals.</li> <li>• The design of the experiments has been based on studies published in peer reviewed scientific journals and a professional biostatistician in our University has been consulted to minimise animal numbers.</li> <li>• We anticipate running this course annually for a maximum of 12 students. Animal numbers used will be reviewed as part of our Ethical Review Process</li> </ul>
<b>3. Refinement</b>	<ul style="list-style-type: none"> <li>• All experiments are conducted under terminal general anaesthesia to minimise the welfare</li> </ul>

<p>Explain the choice of species and why the animal model(s) you will use are the most refined, having regard to the objectives. Explain the general measures you will take to minimise welfare costs (harms) to the animals.</p>	<p>costs to the animals used, with very occasional pre-dosing with safe compounds, usually in the drinking water (but only rarely used).</p> <ul style="list-style-type: none"><li>• Under the previous licence we used an injectable anaesthetic but now propose to using an inhaled anaesthetic. This is considered a better anaesthetic with more predictable effects and will also allow the students to monitor and adjust the depth of anaesthesia more accurately.</li><li>• During the procedure, the animals will supported through administration of fluids and maintenance of core body temperature using a thermal blanket.</li></ul>
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