[redacted]

G: NON-TECHNICAL SUMMARY (NTS)

Please attach the Non-technical Summary as generated by your application in ASPeL.

Project Title	Advanced Education in Pharmacology
Key Words	education, pharmacology, CNS, cardiovascular
Expected duration of the project	5 year(s) 0 months

Purpose of the project (as in ASPA section 5C(3))

Purpose	
No	(a) basic research;
	(b) translational or applied research with one of the following aims:
No	(i) avoidance, prevention, diagnosis or treatment of disease, ill-health or other abnormality, or their effects, in man, animals or plants;
No	(ii) assessment, detection, regulation or modification of physiological conditions in man, animals or plants;
No	(iii) improvement of the welfare of animals or of the production conditions for animals reared for agricultural purposes.
No	(c) development, manufacture or testing of the quality, effectiveness and safety of drugs, foodstuffs and feedstuffs or any other substances or products, with one of the aims mentioned in paragraph (b);
No	(d) protection of the natural environment in the interests of the health or welfare of man or animals;
No	(e) research aimed at preserving the species of animal subjected to regulated procedures as part of the programme of work;
Yes	(f) higher education or training for the acquisition, maintenance or improvement of vocational skills;
No	(g) forensic inquiries.

Describe the aims and objectives of the project (e.g. the scientific unknowns or scientific/clinical needs being addressed):

The purpose of the licence is to provide advanced education in pharmacology and *in vivo* skills training for undergraduates seeking a career in academia or the pharmaceutical industry.

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)?

Training delivered under this licence will provide students with an understanding of in vivo experimental design, application of the 3Rs and detailed knowledge of drugs affecting the central nervous system and cardiovascular system. Students will be better equipped for careers in academia or the pharmaceutical industry where they will contribute to the development of new treatments for diseases affecting both humans and animals.

What types and approximate numbers of animals do you expect to use and over what period of time?

We will use up to 2000 mice and 650 rats over five years.

In the context of what you propose to do to the animals, what are the expected adverse effects and the likely/expected levels of severity? What will happen to the animals at the end?

Experiments using mice involve (a) the injection of drugs that act as pain killers and (b) drugs that affect mood. In order to test the response to pain killers, mice will be placed on a hotplate set at 55oC which is likely to cause discomfort. However as soon as the animal reacts, it will be removed; no animal will be allowed to stand on the hotplate for more than 30 seconds. Some of the mood altering drugs may cause the animals to become aggressive; however they will be housed separately during the period of observation so there is no opportunity for fighting. Drug injection will cause only transient pain. The level of severity is mild. Experiments using rats involve the administration, directly into a vein, of drugs affecting the heart and blood pressure. There is a risk of blood loss when inserting catheters into blood vessels which is minimised by students practicing the technique on cadavers to ensure competence. Students are supervised closely be experienced staff at all times. There is a risk that the dose of drug injected will cause blood pressure to fall or increase too much, which could lead to death of the animal. This will be minimised by starting at very low doses of the drug and only increasing to a higher dose if the response of the animal is small. These experiments are undertaken under non-recovery anaesthesia. In all cases, animals are killed by a Schedule 1 method at the end of the experiment.

Application of the 3Rs

Replacement

State why you need to use animals and why you cannot use non-protected animal alternatives

Replacement

The properties of drugs can be explained in lectures or by using computer simulations; however these are no substitute for the first hand observation of the effects of drugs administered to the whole animal. Students value their experience working with animals highly, as it makes them more aware of the properties of the drugs, the technical challenges and the ethical concerns of *in vivo* work. As a result they have a far better educational experience and are better equipped for future careers.

Reduction

Explain how you will ensure the use of minimum numbers of animals

Reduction

The estimated number of animals required is based on maximum class sizes, statistical advice and our experience of teaching this course over the past 20 years. Once the scientific and educational goals of a particular experiment have been achieved, no further use of animals will be authorised for that particular cohort of students.

Refinement

Explain the choice of animals 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.

Refinement

We will use mice and rats as the effects of the drugs that will be administered are well characterised in these species. Therefore there is a high chance that the experiments will be successful and that the students will obtain the maximum educational value. We anticipate that the majority of our students will go on to a higher degree and/or progress to careers in the pharmaceutical industry where these species are still the most commonly used in drug development.

Prior to commencing experimental work, students work though computer simulations and observe a video in which a member of the teaching staff demonstrates the relevant surgical techniques so that they are familiar with both the methods that they will use and the anticipated experimental outcomes.

In testing the properties of pain killers, mice will be placed on a hotplate set at 55^{o}C which is hot enough to provoke a rapid response (e.g. withdrawal of the paw) but not so hot that

permanent damage or lasting pain will be produced in the 30 second (maximum) test period. Animals that do not respond in this timescale will be removed from the heat source. This approach is used commonly in the pharmaceutical industry and is accepted as causing only mild discomfort.

In testing the properties of drugs that affect mood, some mice may become more aggressive than usual. Animals will be kept apart to prevent fighting and injury, so the chances of harm are minimal.

In testing the properties of drugs that affect the heart and blood pressure, rats will undergo surgical implantation of catheters into blood vessels while under non-recovery surgery. Students will not be allowed to progress to using live animals until they have shown that they are competent in the techniques using cadavers. They will be supervised closely by experienced staff at all times in order to ensure that the surgical procedure is successful. The depth of anaesthesia will be monitored throughout the experiment to ensure that an appropriate level is maintained such that the animals do not experience any pain or discomfort.

All animals will be killed by a Schedule 1 method at the end of the experiment.