- (a) Basic research

sensory neurobiology, multisensory integration, bird, neuroanatomy, locomotion

Taeniopygia guttata adult

Outputs of this project will be maximised through internal collaborations and dissemination of new knowledge at national and international conferences. We will employ cutting edge neural recording techniques. This expertise can be applied in other animal systems, and we will form collaborations to ensure that these techniques are broadly available. National and international conferences provide important opportunities to discuss new findings and research pathways with colleagues, present data, and to establish new collaborations.

- Other birds: No answer provided

We have expertise identifying and recording from discrete sensory brain regions in small birds. We will use zebra finches (T. guttata), a captive species that perform rapid sensorimotor transformations. Many

Our protocols are based on well-established procedures that have undergone considerable refinement. Surgical anaesthesia will be induced at the start of the procedure. All procedures are non-recovery and anaesthesia will be monitored regularly. Animals will not suffer more than transient pain and distress and no lasting harm from handling and the initial injection, and there will be no cumulative effect from repeated injections as these are non-recovery procedures.

All procedures carried out under the proposed licence will be non-recovery procedures under general anaesthesia. Animals may be used for non-regulated procedures prior to their use on this licence.

- Killed

The research addresses gaps in our understanding of how vertebrates fuse visual motion and tactile information in the cerebellum to support complex locomotion and navigation. The research requires measurement of neural activity from multisensory sites. There is no alternative to live animals for studying these sensorimotor circuits. Developing computer models to make predictions about multisensory integration requires empirically observed activity as an input. Simultaneous recordings of neural activity during sensory stimuli allows us to characterise population-level responses and inform models that will generate future avenues of research.

There are no non-animal alternatives that can address systems neuroscience questions about how neurons respond to sensory stimuli.

In all the protocols to be used, alternatives are not available that replicate the response of neurons in discrete brain regions to complex sensory stimuli or how this activity is impacted by pharmacologically blocking specific inputs.

(target number of cells) / (expected cell yield/individual) = number of individuals

80 cells / (0.8 * 0.6 * 9 cells) = 18 individuals

Protocol 1: We expect to need a maximum 20 birds for each study, and to perform eleven studies on this project licence (maximum 220 individuals total). Other studies in birds using similar approaches have achieved a similar yield.

We are investigating the implementation of tools that may increase the yield of each recording site -- for example, using cutting-edge neural recording technology (high-density probes; single multi-valued recording) to collect rich datasets from each individual, thus reducing the number of animals required, keeping with the 3Rs objectives. Recent studies with these probes have acquired 10-25 individual cells per site, and >200 units for multi-site network analyses. Typical recordings yield 6-10 single units per site with a 32-channel array.

Protocol 2: Up to 10 animals will be used in Protocol 2 for control tissues and setting up immunohistochemistry or other in vitro assays.

I have expertise in performing electrophysiological recordings in zebra finches and other avian species and have mapped the locations of several visual and somatosensory brain regions. This expertise has the potential to increase the number of successful recording tracks, thus reducing animal numbers.

We are able to use relatively few animals because we rely on response properties of cells when placing our injections and determining recording sites. We will increase the yield of each recording site by using cutting-edge neural recording technology (high-density probes; single multi-valued recording) to collect rich datasets from each individual, keeping with the 3Rs objectives.

The procedures described in the proposed project are terminal and carried out under general anaesthesia, minimising pain, suffering, distress, or lasting harm to the animals.

Adult, male zebra finches will be sourced from a local commercial or other approved supplier in the UK. Zebra finches are a common avian model for neuroscience studies. The neural activity of the zebra finch song system is well-described. The project described in this licence proposal will address

We will plan, conduct, and record our experiments so that we are able to publish our results following the ARRIVE and PREPARE guidelines.

We will have regular contact with AWERB, the NACWO and animal technicians at the housing facility to review current approaches and whether there are any new 3Rs opportunities. AWERB and the NVS will be consulted regularly to ensure the most refined approaches are being used. LASA guidelines are being used for preparing for surgical procedures. We will use NC3R newsletters and other resources to stay abreast of advances in the 3Rs.

We have the unique advantage of wide-ranging expertise and state-of-the-art veterinary resources. We will take advantage of these resources to work with specialist anaesthesiologists to optimise protocols.