



Approaches to reducing distress



PENNY HAWKINS

RESEARCH ANIMALS DEPARTMENT

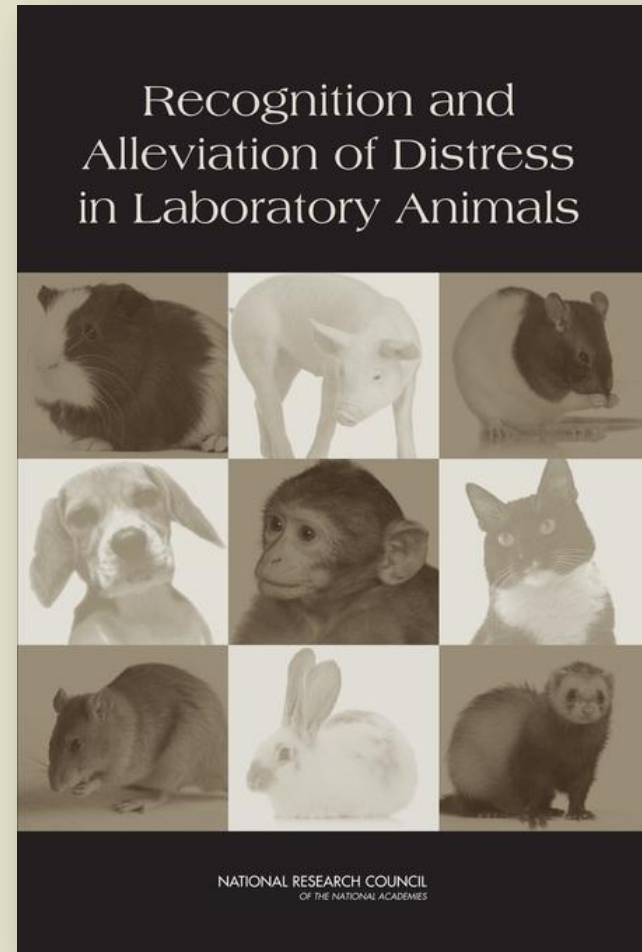
SCIENCE.RSPCA.ORG.UK/SCIENCEGROUP/RESEARCHANIMALS

EC Working Document on severity assessment

PRE-STUDY CONSIDERATIONS

All aspects of the study that may cause pain, suffering, **distress** or lasting harm should be identified, and consideration given to how their effects can be **minimised**, for example by consulting the **literature, colleagues, animal technologists**, the **veterinarian** and the **Animal Welfare Body** if appropriate

What do we mean by 'distress'?



nap.edu search for 'distress' and 'laboratory'

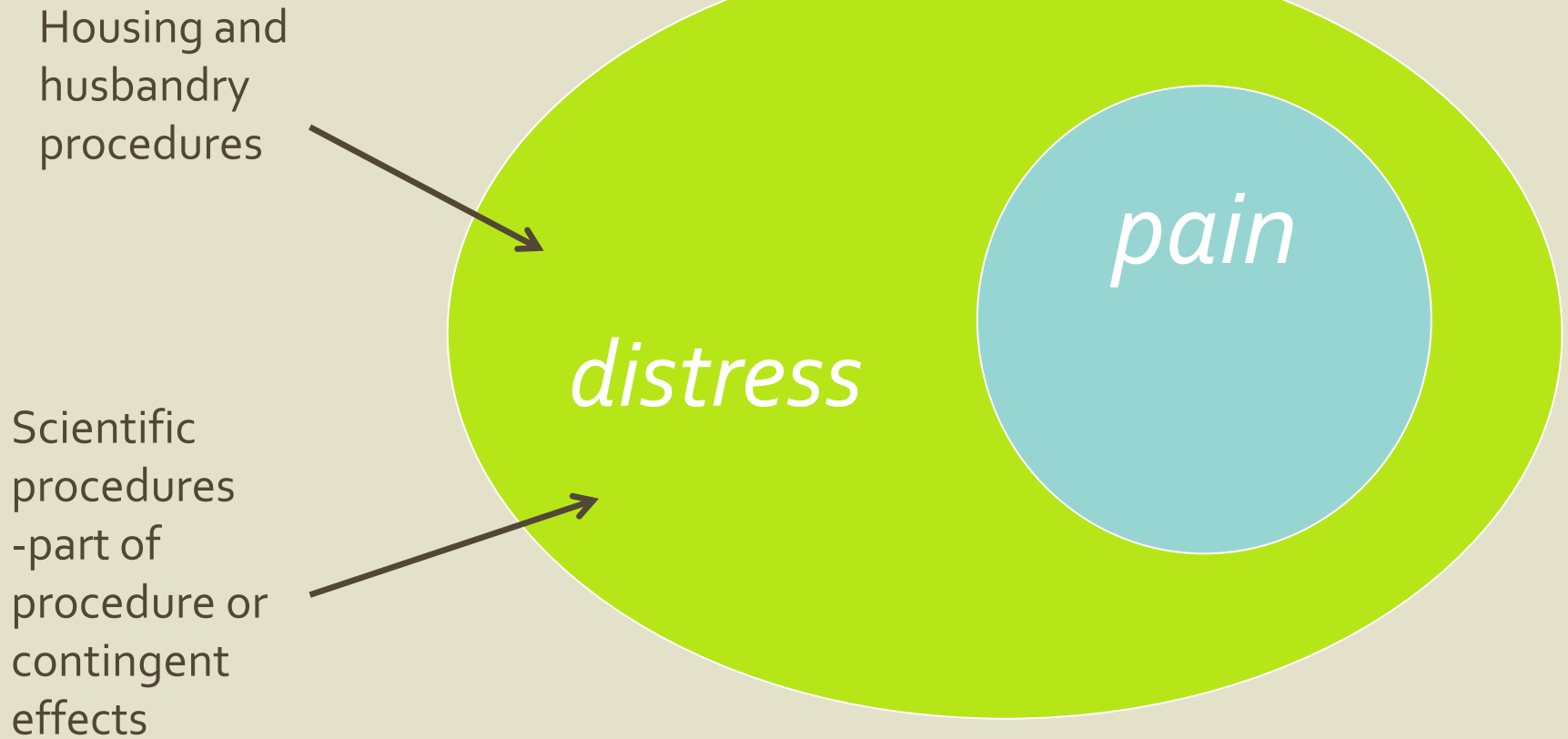
Definitions 1: stress

- Stress = a real or perceived perturbation to physiological homeostasis or psychological wellbeing
- The body uses behavioural or physiological mechanisms to counter the perturbation
- Stressors can elicit coping mechanisms or adaptive changes, e.g. behavioural reactions, activation of SNS, secretion of glucocorticoids

Definitions 2: distress

- Distress = an aversive (unpleasant) state in which the coping/adaptive mechanisms fail to return the organism to physiological/psychological homeostasis
- Distress = psychological distress; a negative emotional state; poor well-being
 - associated with pain and other negative experiences

Distress and pain



The Five Domains Model of animal welfare

Physical domains; survival-related factors (1 to 4)

1 - Nutrition	2 - Environment	3 - Health	4 - Behaviour
Negative – restricted water/food Positive – balanced and varied diet	Negative – uncomfortable physical features Positive – comfortable, pleasant environment	Negative – disease, injury Positive – healthy, fit	Negative – behavioural expression restricted Positive – able to express rewarding behaviours

Affective experience – Mental state (5)

Negative		Positive			
Thirst	Breathlessness	Anger, frustration	Drinking pleasure	Vigour of good health and fitness	Calm, in control
Hunger	Pain	Boredom, helplessness	Taste/chewing pleasure	Reward	Affectionate sociability
Malnutrition malaise	Debility, weakness	Loneliness, depression	Satiety	Goal-directed engagement	Maternally rewarded
Chilling/ overheating	Nausea, sickness	Anxiety, fearfulness	Physical comfort		Excited playfulness
Hearing discomfort	Dizziness	Panic, exhaustion			Sexual gratification

Mice are but
Nocturnal and crepuscular	they are housed in bright light
Highly dependent on smell and scent markings	their markings are completely destroyed whenever the cage is cleaned
Sensitive to ultrasound	there are many sources of ultrasound in the laboratory, and these are not always checked and minimised
Able to feel more secure when touching objects (thigmotaxis)	they are often housed in barren cages
Master diggers	they have no opportunity to burrow
Highly social (sex and strain dependent)	they are often housed in inappropriate groups or singly
Capable of covering long distances	they are housed in small cages
Omnivorous, trying new foods from different feeding sites	they are fed boring, monotonous diets from hoppers
Made extremely anxious when captured by the tail	most people catch them by the base of the tail
Most comfortable at a temperature of 26° to 34°C	many facilities house them at colder temperatures, and/or do not provide sufficient nesting material



Reducing the conflict

- BETWEEN NATURAL HISTORY AND HUMAN REQUIREMENTS

- Member States shall ensure that
 - any restrictions on the extent to which an animal can satisfy its physiological and ethological needs are kept to a minimum (Article 33 1b)
 - to help animals cope with procedures and other stressors
 - staff dealing with animals have information specific to the species housed in the establishment (Article 24 1b)
 - to help them understand what will cause distress, e.g. to 'prey' species

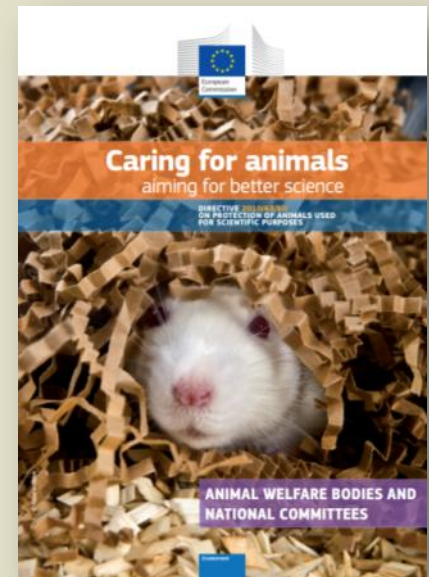
From the EC Working Document

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EC Working Document on AWBs and NCs

- Tasks include advising on animal welfare and Three Rs
- Core competencies – should include animal ethology, husbandry, care, health and welfare; welfare assessment
- Wider membership than minimum in Article 26 is advised





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APPLIED ANIMAL BEHAVIOUR SCIENCE

Applied Animal Behaviour Science 86 (2004) 261–289

www.elsevier.com/locate/applanim

From house mouse to mouse house: the behavioural biology of free-living *Mus musculus* and its implications in the laboratory

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researchgate.net

Georgia J Mason
'mouse house'

...cues, foraging, finding mates and rearing litters. The potential impact of these many differences and restrictions on laboratory mouse development, normalcy and welfare has only begun to be explored. © 2004 Elsevier B.V. All rights reserved.

Keywords: House mouse; *Mus musculus*; Sensory biology; Behaviour; Development; Welfare; Standardisation

1. Introduction

Understanding a species' natural biology and behaviour is important for good husbandry (e.g. Dawkins, 1980; Jensen, 2000; Mason et al., 2001). This has been acknowledged for

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What is it like to be a rat? Rat sensory perception and its implications for experimental design and rat welfare



Article in Applied Animal Behaviour Science 112(1):1-32 · July 2008

DOI: 10.1016/j.applanim.2008.02.007



1st Charlotte C Burn
MSc 25.9 · Royal Veterinary College

Abstract

researchgate.net

Charlotte C Burn
'what is it like'

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DOI: 10.1089/iaib.2004.0997

Zebrafish in the Wild: A Review of Natural History and New Notes from the Field

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ANDREW A. RAO, and DAVID M. PARICHY

ABSTRACT

The zebrafish, *Danio rerio*, has emerged as a major model organism for biomedical research, yet little is known about its natural history. We review the literature pertaining to the geographic range, biotic and abiotic habitats, and life cycle of the zebrafish. We also report our own field study to document several aspects of zebrafish natural history across sites in northeast India. We found zebrafish particularly abundant in silt-bottomed, well-vegetated ponds and rice paddies adjacent to slow moving streams at a range of elevations. We further identified co-occurring fishes likely to be zebrafish competitors and predators. Finally, we present observations that indicate substantial habitat degradation and loss, and suggest guidelines for documenting and preserving natural zebrafish populations.

INTRODUCTION

KNOWLEDGE OF ZEBRAFISH NATURAL HISTORY and ecology is critical for interpreting its behavior and physiology, extant genetic and phenotypic variation, and the evolutionary history of embryonic, larval, and adult traits. Yet we know surprisingly little about the natural

environment, and behavior. More fully realizing the potential of zebrafish for organismal biology, as well as integrative studies spanning multiple levels of organization, requires some knowledge of zebrafish natural history: its geographical distribution, physical habitat, diet, and its competitors and predators.

We review the scant literature on zebrafish in the wild and document our own recent work aimed at developing a deeper understanding of zebrafish natural history. We present a hypothesis for zebrafish life history in the wild, suggest how studies of natural populations can inform research in the laboratory, and make recommendations for future work in this area.

LITERATURE REVIEW

traits that make it convenient for laboratory study, not for a broad understanding of the organism in its native environment.¹⁻⁶ Despite the wealth of information on developmental and genetic mechanisms and the arsenal of resources and techniques for studying zebrafish, this species remains underexploited for organismal research, comprising studies of ecology,

An extensive literature exists on Central Asian fishes and specifically on Indian fishes.⁷⁻¹³ Yet, these works focus on taxonomy and regional

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...on, and somatosensation, and describes how rat perception differs from that of other mammals. This work (1974) implies, we cannot truly know what it is like to be a rat. This is because of perceptual biases. These primarily nocturnal rodents are suffering frequently causing retinal degeneration, and their vision extends into the ultrasonic hearing means they are influenced by environmental factors that humans do not perceive. Rat and human gustation are similar, being somewhat largely redundant in the laboratory, where rodents typically do not experience the same range of natural food sources as they do in the wild. This knowledge of rat sensory perception and somatosensation is important for the development of improved husbandry practices that can not only improve the health of laboratory rats, but also shows that the laboratory rat is a valuable model organism. In addition, they are an important part of the history of science and human culture.

Welcome to RATLIFE.org the web site for the film:

THE LABORATORY RAT: A NATURAL HISTORY



ratlife.org



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Hearing discomfort	Dizziness				Sexual gratification

'Critical anthropomorphism'

= *empathy* + objective,
knowledge-based
consideration of what is likely
to be significant to the animal

The animal's life 'story'



- each procedure is just one event

Whole life experience

- Early maternal separation
- Transport
- Marking for identification
- Genotyping
- Housing in inappropriate social groups (or individually, for social animals)
- Understimulating and/or uncomfortable housing
- Husbandry procedures
- **Scientific procedures** – and their after effects
- The humane killing process



- all of these can cause, or add to, distress

Contingent effects/cumulative severity





www.nc3rs.org.uk/mouse-handling-tutorial



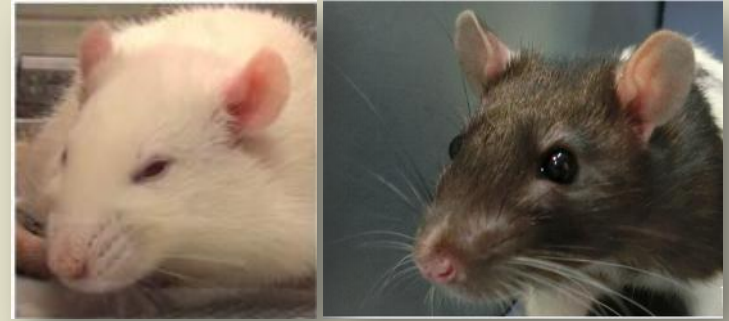
Rheumatoid arthritis

[DOI 10.1007/S10787-015-0241-4](https://doi.org/10.1007/S10787-015-0241-4)

Cause of distress	How to reduce this
Capture, handling and restraint to administer inducer	Competent, empathetic capture and handling (e.g. tunnel, not tail)
After effects of anaesthesia; dehydration, inappetance	Treats – Nutella™, sunflower seeds; ensure animals can reach water and food with high water content
Disability, vulnerability due to arthritis	<ul style="list-style-type: none">• Husbandry refinements, e.g. spacious refuges; soft litter; short and soft nesting material; long drinking nozzles; soft, appetising diet• Very gentle, empathetic handling, e.g. using Vetbed®• Environmental enrichment including group housing for social animals
Behavioural problems, e.g. aggression	<ul style="list-style-type: none">• Use littermates where possible• Review group size and nest box provision• If single housing is necessary, ensure adequate enrichment

Detecting distress

NEED TO KNOW WHEN AN ANIMAL ...



- is acutely distressed
- has become sensitised to repeated procedures
 - exaggerated responses to a 'routine' procedure?
- is no longer coping with life in the laboratory
 - chronic distress, depressive symptoms ...?
 - not using enrichment, poor self-care ...?

Assessing distress



- Welfare assessment protocols should include indicators and humane endpoints relating specifically to distress
- This should be part of the project evaluation
 - Article 38: 'project is designed so as to enable procedures to be carried out in the most humane ... manner possible; an assessment of compliance of the project with ... Refinement'
 - Annex VIII: methods used to reduce or eliminate pain, suffering or distress; humane endpoints

Positive welfare

- Good self-care, including grooming and 'comfort' behaviours
- Normal activity levels and time budget, including sleep patterns
- Seeking interactions with humans
- Curiosity and interest in exploring
- Appropriate social interactions with conspecifics, including allogrooming
- Mating
- 'Anticipatory' behaviour
- Using enrichment items, especially for 'luxury' behaviours
- Interest in food treats
- Play
- Vocalizations associated with positive welfare
- Normal learning and cognitive functions

Working Party Report

A guide to defining and implementing protocols for the welfare assessment of laboratory animals: eleventh report of the BVA/AFW/FRAME/RSPCA/UFWA Joint Working Group on Refinement*

P Hawkins (Editor)¹, D B Morton (Chair)², O Burman³, N Dennison⁴, P Honess⁵, M Jennings¹, S Lane⁶, V Middleton⁷, J V Roughan⁸, S Wells⁹ and K Westwood¹⁰

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*The UK Joint Working Group on Refinement (JWGR) was established in 1999 by the British Veterinary Association Animal Welfare Foundation (BVA/AFW), the Fund for the Replacement of Animals in Medical Experiments (FRAME), the Royal Society for the Prevention of Cruelty to Animals (RSPCA) and the Universities Federation for Animal Welfare (UFWA). The aim is to provide up-to-date practical information on refinement. The JWGR prepares reports on specific topics, drawing together experts in each field to define contemporary best practice and ideals to aspire to. Professor David Morton chairs the Group and the secretariat is provided by the RSPCA. See <http://www.rspca.org.uk/sciencegroup/researchanimals/implementing3rs/refinement> (last checked 26 May 2010). Corresponding author: P Hawkins. Email: phawkins@rspca.org.uk

Abstract

The refinement of husbandry and procedures to reduce animal suffering and improve welfare is an essential component of humane science. Successful refinement depends upon the ability to assess animal welfare effectively, and detect any signs of pain or distress as rapidly as possible, so that any suffering can be alleviated. This document provides practical guidance on setting up and operating effective protocols for the welfare assessment of animals used in research and testing. It sets out general principles for more objective observation of animals, recognizing and assessing indicators of pain or distress and tailoring these to individual projects. Systems for recording indicators, including score sheets, are reviewed and guidance is set out on determining practical monitoring regimes that are more likely to detect any signs of suffering. This guidance is intended for all staff required to assess or monitor animal welfare, including animal technologists and care staff, veterinarians and scientists. It will also be of use to members of ethics or animal care and use committees. A longer version of this document, with further background information and extra topics including training and information sharing, is available on the Laboratory Animals website.

Keywords: Refinement, welfare assessment, pain assessment, score sheets, humane endpoints

Laboratory Animals 2011; 45: 1–13. DOI: 10.1258/la.2010.01.0031

1 Introduction and aims

Reducing animal suffering through the refinement of husbandry and procedures is an important component of good science.^{1–5} It is also essential for humane reasons

and is a specific requirement of legislation in some countries. If reducing animal suffering is to be effectively achieved, suffering must be detected as rapidly as possible so that appropriate action may be taken such as providing

Laboratory Animals 2011; 45: 1–13



If 'distress' is an objective

FORCED SWIM, TAIL SUSPENSION, CHRONIC MILD STRESS 'MODELS'

- There is debate regarding the validity and translatability of these screens and models
- Might another paradigm be more appropriate, e.g. cognitive bias, anhedonia?
- Could compounds be screened without creating a model at all?



Action points 1

- Recognise that *distress* is distinct from *pain*
- Set a goal to identify and minimise distress for all projects
- Make time to set out each animal's 'life story', with input from different viewpoints and expertise
 - use your Animal Welfare Body
- Make sure the named person in Article 24 1b is adequately resourced and supported



Action points 2

- Understand the biology and behaviour of animals you work with or care for, to help identify events that will distress them
- Research and define indicators of distress and include these in project applications
- Facilitate positive welfare
- Critically review whether and how 'models' that involve causing distress will be employed

Thank you!



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