

Husbandry Matters: How do we better embed husbandry practices into 3Rs (plus Reproducibility) delivery?

BRF Meeting 18th December 2023



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Talk Outline

- Husbandry Matters: Setting the scene
- What are the husbandry challenges in aquatic animal research?
- What are the solutions?



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Husbandry Matters: Setting the Scene

- Good husbandry underpins good welfare which leads to good science
- Control welfare outcomes through careful management of husbandry and animal 'experience'
- Husbandry related variables within experiments contribute to reproducibility crisis
 - Provenance
 - Life stage, sex, social housing
 - Tank size and shape
 - Noise
 - Handling



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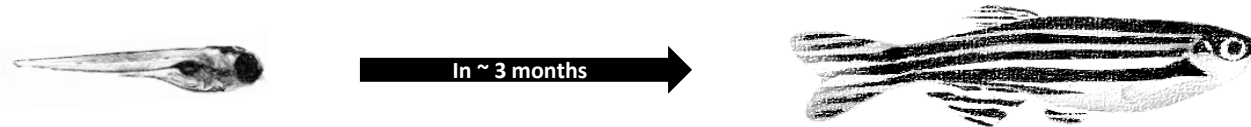
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Husbandry Matters for Research Outcomes

Diet

- Impacts growth, development, performance, microbiome.....
- Wide range of diets used in fish and rodent facilities
 - Nutrition-associated variability decreased with standardised reference and open formulated diets (Watts *et al.*, 2012)



- Seizure susceptibility and growth differed in mice on different diets (Westmark *et al.*, 2022)



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Husbandry Matters for Research Outcomes

Disease

- Health monitoring is essential for identifying the presence of infectious agents that might confound animal research (Livingston 2003)
- Microsporidium *Pseudoloma neurophilia* in zebrafish facilities
 - Alters zebrafish response to neurobehavioural tests
 - Caution is warranted in interpreting zebrafish behaviour (Midttun et al., 2020)
- Rodent viral infections impact research results (Livingston 2003)
 - “Cleaner is not always better” – microbiome composition affects disease phenotypes and research data (Buchheister & Bleich 2021)



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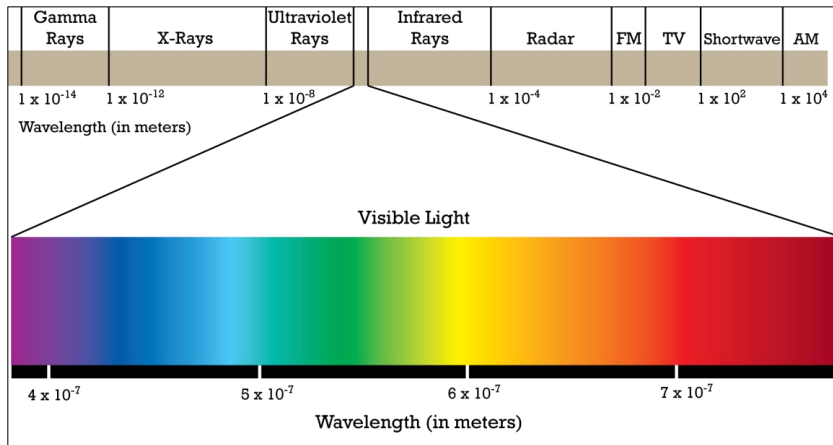
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Husbandry Matters for Research Outcomes

Lighting

➤ Influences physiology and behaviour of most lab animals



- Impacts hatching, growth, development, spawning and behaviour in zebrafish
- Disrupt circadian rhythms of rodents, prompts changes in the timing of their movements, food intake and impacts anxiety-like behaviours (Villamizar et al., 2014; Engeszer et al., 2004; Meier et al., 2018; Suboski et al., 1990; Emmer et al., 2018; Fernandez et al., 2023)



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Husbandry Matters for Research Outcomes

Environmental Enrichment

- Enrichment increases forebrain cell proliferation in zebrafish
- Rearing environment affects brain size in guppies
- Enrichment delays onset of neurodegeneration in mouse model of AD (Berardi 2007)
- Enrichment can lead to new areas of scientific enquiry (Bayne 2018)
- Mouse enrichment may provide conflicting outcomes (health, welfare, variability in data)
- **But**, Opinion trending toward acknowledging enrichment normalizes data outcomes



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Husbandry Matters for Research Outcomes

Challenge 1

- We need a detailed understanding of the study species (line) such that we can provide appropriate husbandry for its care and welfare
 - Limited information to a few commonly used species
 - PPLs provide almost no useful husbandry information
 - HO legislation provides no husbandry information for fish
 - Regulatory guidelines are not comprehensive/accurate to species level
 - Few studies report husbandry information in enough detail to ensure lessons learnt



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Husbandry Matters for Research Outcomes

Challenge 2

- Science and husbandry conflict
 - Experimental settings at odds with husbandry
- Practical considerations
 - Availability/cost of chemical in (eco)toxicology testing
 - Lack of technology, budget, facility space and available 'hands'
- Adds another level of complication/nuance of husbandry expertise
 - Factor in mitigation steps



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Husbandry Matters for Research Outcomes

Challenge 3

- Time pressure: funding, studentship deadline, research delivery, pressure to publish, lead-in time to plan animal study
- Disproportionate amount of time needs investing in animal studies?
- Practicalities of providing a reliable source of animals
- Required to develop new husbandry practices for newly kept species
- Time for training and competence assessment
- **Husbandry is the last thing to be considered!**



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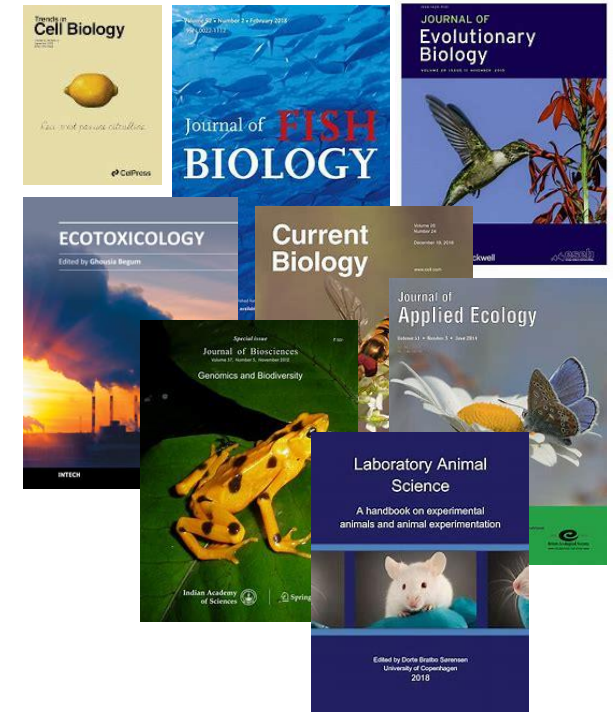
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Husbandry Matters for Research Outcomes

The Solutions

- **ARRIVE Guidelines** (Animal Research: Reporting of In Vivo Experiments)
 - Improved reporting of published research
 - 20 categories for validity and reproducibility
- **PREPARE Guidelines** (Planning Research and Experimental Procedures on Animals)
 - Quality, reproducibility and translation of animal studies
 - Dialogue between scientists and animal facility
 - 15 categories for validity and reproducibility



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Husbandry Matters for Research Outcomes

The Solutions



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→ Aquatic Resources Centre Study Request Form

The ARC requires a study request form to be completed in order to permit work within our facility. Please complete this form with as much detail as possible and contact the Deputy Facility Manager on p.a.tyson@exeter.ac.uk if you are unsure about any of the sections. Please note, no animals will be permitted into the facility without ARC manager written approval. No procedures on animals will be permitted without an appropriate training record and required ethical or home office approvals.



BIOLOGICAL SERVICES UNITS STUDY REQUEST FORM

Page 1

This form must be completed prior to animals being ordered/or a study starting and sent to NACWOS@exeter.ac.uk

Cells in grey are for Animal Unit Management to complete after form received.

BSU SRF Ref Number		(Reviewing BSU Manager to allocate)	
Study Title/ Reference			
Faculty/ Department/ Institute			
COST CODE (for animal Purchase Order)		COST CODE (for BSU husbandry charges)	
BSU Facility where work will take place:			
<input type="checkbox"/> LSI BSU	<input type="checkbox"/> Hatherly BSU	<input type="checkbox"/> GP BSU	<input type="checkbox"/> MRC BSU

APPROVALS (Must be completed before study commences)



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The Solutions

- Detailed reporting of experimental variables at the University of Exeter
 - **Without which we are limited to individual experience**
 - Lessons learnt come from publishing and accurate record keeping
- Community
 - Better engagement between researchers and animal care staff will make this work
 - Be aware of the time needed to get these aspects right before studies start
 - Understand the limits of facilities and teams
- Championing our own strategy?



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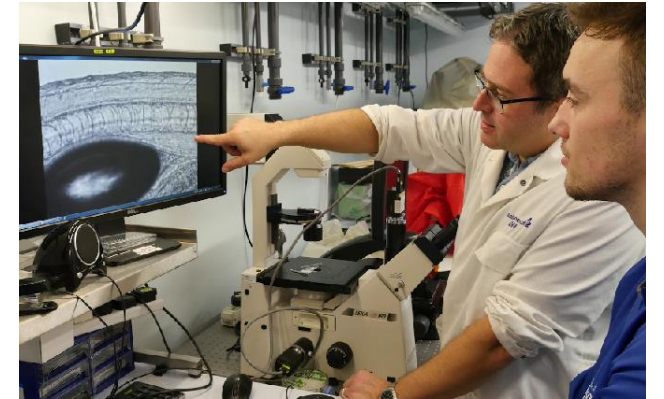
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Husbandry Matters for Research Outcomes

The Solutions

- Better engagement between science and husbandry
 - Identify ongoing research that can help address husbandry questions
 - Specific husbandry requirements should be factored into grants/pilot studies
- Approach we should take when developing:
 - Husbandry protocols
 - Procedure policies
 - Best welfare practices



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Conclusions

- To ensure best husbandry procedures, high welfare practices, and reliable and consistent experimental data we need:
 - **Time** to prepare for animal studies
 - **Time** to carry out animal studies
 - **Time** to publish husbandry details according to ARRIVE/PREPARE guidelines



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