



**RED KITE**  
VETERINARY CONSULTANTS

## Animal Husbandry, Care and Management

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## Introduction

- Captive animals are reliant on their caretakers
- Failure to provide for needs can affect welfare and impacts on validity and reproducibility of results
- Life events impact on physiology and increase variability
  - Contingent suffering – husbandry, handling
  - Direct suffering - procedures
- Knowledge of biology and behaviour essential to ensure appropriate environment
- Consider age, health and reproductive status and scientific needs

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LO 3.1.2

## Establishment licence conditions

- Environment, housing, freedom of movement, food, water and care provided appropriate
- Transported conditions appropriate
- Minimise restrictions on ability to satisfy physiological and ethological needs
- Environmental conditions checked daily
- Wellbeing and state of health of animals is monitored
  - prevent pain or avoidable suffering, distress or lasting harm
  - any defect discovered eliminated as quickly as possible
- Exemptions can be authorised where needed for scientific purposes.
  - Need PPL authority

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LO 3.1.3/4

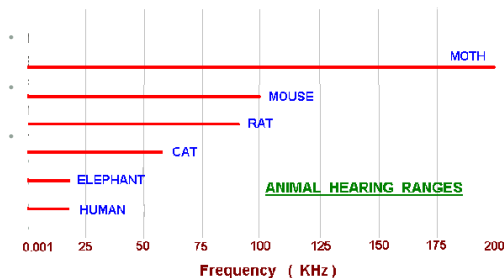
## Impact of environment on procedures

- **Increased variability results in larger samples and lack of reproducibility**
- Scientists may not be aware of the exact needs of the species, and apply inappropriate manipulations
  - E.g. keeping social animals singly, or housing at low temperatures to reduce aggression
- Husbandry-related causes of variability:
  - Fear and stress
  - Changes in light intensity/photoperiod
  - Exposure to light during the night
  - Genetic differences - often underestimated
  - Changing supplier - partly genetics, partly microbiome
  - Diet changes

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LO 3.1.4

## Impact of environment on procedures



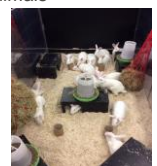
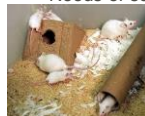
- Noise – may be ultrasound
- Position on the rack or in the room

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LO 3.1.3

## Husbandry

- Must provide for physiological and behavioural needs.
  - Quantity of space provided
  - Compatible groups
  - Species appropriate environmental enrichment
- Knowledge of biology and behaviour essential to ensure appropriate environment provided
- Age, health and reproductive status of the animals important
- Needs of scientific procedures considered



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LO: 4.4

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## Acclimatisation and habituation

- Transport causes stress and physiological changes
- Impacts on animal welfare and scientific outcomes
- Many facilities recommend acclimatisation periods
  - allows general health to be assessed
  - animals recover from transport stress
- Typically 3 to 14 days
- Habituate the animal to handling and restraint during acclimatisation
- Positive reinforcement training
  - positive effect welfare
  - minimise the impact of restraint stress on scientific output.
- Almost all animals can be trained

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LO: 7.9

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## Code of Practice - Care and Accommodation

- The Home Office has published guidance on how laboratory animals should be looked after
- This is to ensure animal welfare is optimal (avoid contingent suffering)
- Will also reduce variability and improve scientific quality
- Section A – General requirements for all species
- Section B – Species specific requirements

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LO: 7.9

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## Physical facilities

- Must cater for physiological and ethological needs
- Prevent unauthorised access or escapes
- Robust, easily cleaned
- Separate facilities for incompatible animals (e.g. predator and prey)
- Storage, procedure rooms, quarantine and housing for sick or injured animals required

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LO: 7.9

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## Environment



- Ventilation
  - Air changes, dust, gas concentrations appropriate
  - Too high - may cause draughts and chilling
  - Too low - build up of ammonia and damage to eyes and lungs
- Temperature and relative humidity controlled and logged
- Light levels and photoperiod – satisfy animal welfare and safe working environment
- Noise – including ultrasound. 'Silentone' alarms

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LO: 7.9

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## Temperature

**Too high** - Heat stress / exhaustion

- Increased respiratory rate
- May affect growth rates
- May reduce fertility



**Too low** - Hypothermia

- Need more feed
- Reduced breeding



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LO: 7.9

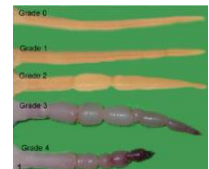
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## Humidity

- **Too high**
  - may lead to respiratory distress
  - encourages bacterial growth



- **Too low**
  - may lead to ringtail
  - (rats kept below 40% RH)



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LO: 4.3

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## Light

- **Increased intensity:**
- Can cause retinal damage, especially nocturnal or albino animals
- **Photo-period:**
- Can upset breeding cycles



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LO: 3.1.6

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## Animal care and health

- **Animals must be checked daily by a competent person**
  - Health status must be maintained at an appropriate standard to maintain welfare and scientific requirements
- **Social animals should be housed in compatible groups**
  - single housing kept to a minimum.
  - Care when removing animals or reintroducing them to groups.
- **Environment should allow wide range of normal behaviour.**
  - Offer some control and choice
  - Species/animal specific environmental enrichment

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LO: 3.1.6

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## Enrichment

- Complexity** – animal appropriate
- Control and choice** – exercise foraging cognitive



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LO: 3.1.3

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## Feeding

- Must meet nutritional and behavioural requirements
- Palatable and non-contaminated
- Packaged and transported to avoid contamination
- Feed hoppers cleaned regularly
- Sufficient feeding space



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LO: 3.1.3

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## Water

- Must be available at all times
  - bottles, troughs, or automatic systems
- Must be clean and uncontaminated
- Automatic watering systems must be serviced regularly
- Must minimise risks of flooding
- Special requirements for fish, amphibia and reptiles



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LO: 3.1.6

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## Resting and sleeping areas

- Bedding materials must always be provided
- Nesting materials where appropriate
- Solid, comfortable rest area
- Sleeping areas must be clean and dry



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LO: 4.7 &amp; 7.1 &amp; 7.2

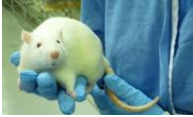
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## Handling and restraint

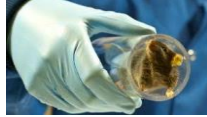
**Must cause minimal stress to animal** – good welfare  
- good science

**Should prevent injury to handler**

- Health and Safety
- accident books
- RIDDOR



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LO: 4.7 &amp; 7.1 &amp; 7.2

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## Handling and restraint

- Approach in a calm, quiet and confident manner
- Handle regularly. The earlier in life that animals are handled, the greater the effect.
- Male animals are often more aggressive than females
- Nursing mothers and sick animals may react differently
- Read the warning signs

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LO: 7.2

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## Warning signs

- Grimace
- Hair raised along spine
- Ears laid back
- Sneezing/snorting/hissing
- Stamping front foot or pawing at ground
- Rearing up on hind legs



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LO: 4.7 &amp; 7.1 &amp; 7.2

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## Handling and restraint

- Apply least restraint necessary to conduct the procedure safely
- Manual or physical restraint
- Chemical restraint – sedation or anaesthesia
- Positive reinforcement – food reward
- Training and habituation - reduces stress and improves scientific outcomes

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LO: 7.2

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## Handling and restraint

- Stress exacerbated by isolation from conspecifics and degree of immobilisation
- Experienced handler causes less stress than inexperienced handler
- Animals acclimatise to repeated gentle restraint
  - longer acclimatisation is needed to accustom animals to longer periods of restraint.

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LO: 3.1.2

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## Identification

- **Temporary**
  - **Felt tip marker** - lasts several days.
  - **Dyes** - last several weeks.
  - **Shave patch of fur** - lasts a few weeks.
- **Permanent**
  - **Ear Punch** - common for rodents. Can use a pin for marking.
  - **Ear Tagging** - can pull pinna in small animals.
  - **Microchips – s/c or i/p.** Reliable and permanent. Can be used on very small animals and may migrate.
  - **Tattoos** – Can cause discomfort and may be difficult to read on small animals.



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LO: 1.1

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## Record keeping

- **Establishment licence holder**
  - source, use and disposal of all animals entering a facility
  - may be delegated to the NACWO
- **Project licence holder**
  - Animals and procedures performed
  - personal licence holders
  - actual severity experienced
- **Personal licence holder**
  - regulated procedures they perform
  - whether they were supervised
  - declarations of competence
  - Records should be retained for at least five years.

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LO: 4.1.2

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## Transport

- Transport can be stressful
- Journeys need to be planned
- Welfare of animals (Transport) Order 2007 applies
- PPLh and PELh have responsibility to ensure animals are transported safely under conditions appropriate for the animal
- The person transporting them is responsible and should be aware of any special needs



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LO: 4.1.2

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## Transport

- Containers secure, comfortable and hygienic
  - Food, water and bedding as needed
  - Escape and leak-proof
  - Biosecure
- Checked before transport to ensure they are fit
  - Sick animals should not be transported
- Incompatible animals separated for transport
- Animals checked promptly on arrival and transferred to clean cages or pens



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LO: 4.9

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## A few words about bugs....

- Disease prevention is an essential component of laboratory animal care
- Animals are colonised with microbes in all environmentally exposed locations
  - Bacterial cells outnumber host cells by 10:1
  - About 6000 microbe species found - most cannot be cultured
  - Mostly these are not harmful, many are beneficial



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LO: 7.9

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## Types of micro-organisms

- **Opportunists**
  - Usually harmless but may cause problems under some circumstances, e.g. procedures
- **Pathogens**
  - Usually associated with disease
- **Predisposing factors**
  - Strain
  - Immune status
  - Nutrition
  - Stress



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LO: 7.9

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## Beneficial effects of microbes

- Gut microbes produce compounds used for energy by gut cells
- Microbes produce vitamin K
- Microbes enhance water absorption
- Commensals can prevent entry by pathogens
- Gut microbes are involved in maturation of immune system



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LO: 7.9

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## Detrimental effects of micro-organisms

- May cause ill health, compromising welfare
  - Can affect experimental results
    - reduces reliability and reproducibility
    - leads to increased numbers of animals, wastage of animals and resources
  - Experimental procedures or environmental factors cause stress - convert subclinical infection into clinical
  - Some infectious agents pose a risk to staff
- **“Bad animals mean bad science.”**
- Michael Festing, New Scientist 1977

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LO: 7.9

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## How do we proceed?

- Keep animals free from opportunists and pathogens, but with a range of commensal microbes
- Health of laboratory animals needs to be maintained
- FELASA Guidelines
- Health surveillance allows the researcher to be confident that they have the animals that they think they do.
- Part of quality assurance (GLP, AAALAC, ISO)

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LO: 4.5

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## Biosecurity

- **Measures taken to identify, contain, prevent, and eradicate known or unknown infections that may cause clinical disease or alter physiologic and behavioural responses or otherwise make the animals unsuitable for research.**
- Different units vary in the degree of biosecurity required
  - Depends on species, needs of science, practicalities

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LO: 4.5

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## Health status of animals

- Conventional
  - Normal, undefined flora
- Specified pathogen free (SPF)
  - Free from particular pathogens
- Barrier bred
  - refers to the controls in place at the source facility
- Gnotobiotic
  - One or more known micro-organisms
- Axenic (germ-free)
  - Free from all micro-organisms

Increasing degrees of **biosecurity** are required to maintain animals as **microbiological status** increases

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LO: 4.5

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## Implementing Biosecurity



- Three main principles
- Requires consideration of physical plant layout and operational practices.
- **Prevention** – take steps to maintain the microbiological standard of the animals
- **Identification** – put systems in place to detect any changes/breakdowns at an early stage
- **Resolution** – have plans in place for eliminating any unwanted organisms and investigating the cause to prevent a recurrence of any outbreak

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LO: 4.5

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## Prevention

- Aim:
  - stop infectious agents entering
  - minimise the spread should they enter.
- Four main sources of infectious agents:
  - animals
  - environment
  - people
  - experimental procedures
- Facilities are designed and managed so that there are several layers of protection from infection, each layer reducing the risk of contamination.

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LO: 4.5

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LO: 4.5

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## Prevention



### • Design measures

- Building location and security
- Facility integrity
- Design of animal holding

### • Entry procedures

- Animals - approved suppliers, Isolate on arrival, treatment
- Biological materials – screen for contamination
- Personnel - limit access, exclusion times, protective clothing, showers, no pets
- Equipment, goods and consumables – **sterile**, autoclave or VHP
- Diet/bedding – reject damaged bags, disinfect, autoclave or irradiate. Water – autoclave, acidify, filter (e.g. ultrafiltration or reverse osmosis)

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## Prevention ctd

### • Entry procedures

- Air – HVAC, HEPA filter maintained. Containment cages and change station.



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LO: 4.5

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## Prevention - ctd

### • Ongoing management

- husbandry practises and SOPs
- protective clothing, separation of 'clean' and 'dirty'
- cleaning and disinfection regime
- Separation of animals from different sources
- Containment caging or housing
- Separation of animals by species

- Following standard procedures is important
- Non compliance can put the integrity of the barrier at risk.

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LO: 4.5

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LO: 4.5

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LO: 4.5

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## Individually Ventilated Cages



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LO: 4.5

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LO: 4.5

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## Preventive measures – Limitations:

- No preventive measure will be 100% effective.
- The more preventive measures there are, the lower the contamination risk is.
- At some point breakdown is likely.
- Ongoing monitoring is required to identified breakdowns promptly.

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## Identification

- Ongoing evaluation of animal health is essential
  - Observe frequently for signs of ill health
  - Report and investigate unexpected deaths and illness
- Health surveillance program to identify breakdowns early.
  - Evaluation of animal health in vivo
  - Post mortem examination
  - Diagnostic tests e.g. serology, PCR, microbiology, biochemistry, and histopathology.

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## Health surveillance

- Animals/samples taken routinely from the population specifically for health screening.
- Colony animals
  - Spare animals, ex breeders
- Sentinel animals
  - Acquired specifically
  - Exposed to other animals from colony or dirty bedding.



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## What to screen for?

- Viruses, bacteria, fungi, parasites (helminths, arthropods, protozoa)
- Diseases affecting animals
  - E.g. mouse hepatitis virus, Coccidia
- Diseases affecting research
  - E.g. mouse parvovirus, BVD
- Zoonotic diseases
  - E.g. Salmonella, Campylobacter
- Guidelines for some species e.g. FELASA

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LO: 7.9

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## Sample size and frequency

- Sample size - depends on agent and housing system
- Sample frequency – depends on risk of introducing infection
  - Low risk - short experiments, animals from known source, clean on arrival, all in all out
    - May not need to screen further
  - High risk - multipurpose units, long experiments, breeding, animal movements, personnel move freely
    - Constant source of susceptible animals
    - Screen colony quarterly

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LO: 7.9

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## Health screening reports

- These form part of the experimental data and should be evaluated for likely influence on results
  - Negative results mean not detected: could still be there
  - Agents known to be present may not be monitored
  - Take advice from NACWO and NVS
- Check historical as well as current results – more likely to show positive results

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Agent		Frequency	Current result	Historical result (18m)
Viruses	Mouse hepatitis virus	3m	0/4	1/16
	Mouse rotavirus (EDIM)	3m	0/4	0/16
	Minute virus of mice	3m	0/4	0/16
	Mouse parvovirus	3m	0/4	0/16
	Pneumonia virus of mice	3m	0/4	0/16
	Sindai virus	3m	0/4	0/16
	Theiler's murine encephalitis virus	3m	0/4	0/16
	Lymphocytic choriomeningitis virus	Annual	-	0/8
	Mouse adenovirus type 1/2	Annual	-	0/8
	Mouse cytomegalovirus	Annual	-	0/8
Reovirus type 3	Annual	-	0/8	
Bacteria, mycoplasmas and fungi	Citrobacter rodentium	3m	0/4	0/16
	Clostridium piliforme	3m	0/4	0/16
	Corynebacterium kutscheri	3m	0/4	0/16
	Mycoplasma spp	3m	0/4	0/16
	Pasteurellaceae	3m	1/4	4/16
	Salmonella spp	3m	0/4	0/16
	Streptococcus pneumoniae	3m	0/4	0/16
	Helicobacter spp	Annual	-	1/8
	Streptobacillus moniliformis	Annual	-	0/8
	Parasites	Ectoparasites	3m	0/4
Endoparasites		3m	0/4	2/16

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LO: 7.9

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## Resolution: what about positives?

- Health monitoring is pointless unless there is a plan for dealing with positives
- DO NOTHING on the basis of a single positive – confirm the result
- May take no action, may be treatable, or may need to cull entire colony
- May cast doubt on the validity of results since last health screen
- Get advice from vet and NACWO

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LO: 4.13

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## Hazards of working with laboratory animals

- Laboratory Animal Allergy (LAA)
  - Reportedly common – mostly mild signs, can be anaphylaxis
  - Control – containment cages, environment, personal protective equipment (PPE)
- Injuries – bites, scratches, kicks, needle sticks etc.
  - Control – handle carefully, understand animals, chemical restraint, crush cages
- Microbiological and parasite hazards (zoonoses)
  - Control – high health animals, regular screening, containment cages, environment, protective clothing

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## Keeping bugs in - Biocontainment

- Organisms classified by relative danger to the surrounding environment
- Biological safety levels (BSL)
  - BSL1 – Hazard low. E.g. some E. coli
  - BSL2 – Hazard moderate. E.g. Salmonella
  - BSL3 – Hazard moderate to high. E.g. TB
  - BSL4 – Hazard high. E.g. Ebola



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## Summary

- How animals are cared for can affect their welfare
- Many life events can impact on an animal's physiology and increase variability
- Contingent suffering must be minimised
- Variability must be minimised
- The Code of Practice aims to define appropriate standards of care for different species and should be adhered to
- Deviation from the Code is only permitted for scientific reasons, and will need to be authorised on the project licence

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