Società Italiana di Fisiologia

The Italian Society of Physiology

SPERIMENTAZIONE ANIMALE

LAB MICE
Health Evaluation

Guide for the Care and Use of Laboratory Animals

The purpose of the Guide […] is to assist institutions in caring for and using animals in ways judged to be scientifically, technically, and humanely appropriate.

The Guide is also intended to assist investigators in fulfilling their obligation to plan and conduct animal experiments in accord with the highest scientific, humane, and ethical principles.

Replacement → use of methods that avoid using animals
- Absolute replacements: replacing animals with inanimate systems such as computer programs
- Relative replacements: replacing animals such as vertebrates with animals that are lower on the phylogenetic scale

Refinement → modifications of husbandry or experimental procedures to enhance animal well-being and minimize or eliminate pain and distress

Reduction → strategies for obtaining comparable levels of information from the use of fewer animals or for maximizing the information obtained from a given number of animals (without increasing pain or distress) so that in the long run fewer animals are needed to acquire the same scientific information.

Mouse physiological data

General

- Age and Body Weight: 20-40 gr at 6 weeks
- Average Body Temperature: 37° C
- Heart Rate (bpm): 310-840
- Water Consumption (per day): 4-7 ml
- Respiration rate: 163 (84-230)/minute
- Tidal volume (ml): 0.15 (0.09 - 0.23)
- Basal metabolism: 1530 mm3 O2/g per hr
- Resting metabolism: 3500 mm3 O2/g per hr

Life cycle

- Life Span: 1-3 years
- Breeding age: 50 days
- Gestation Period (days): 17-21 days
- Estrus cycle: 4-5 days
- Litter Size: 1-23 (10-12 avg.)
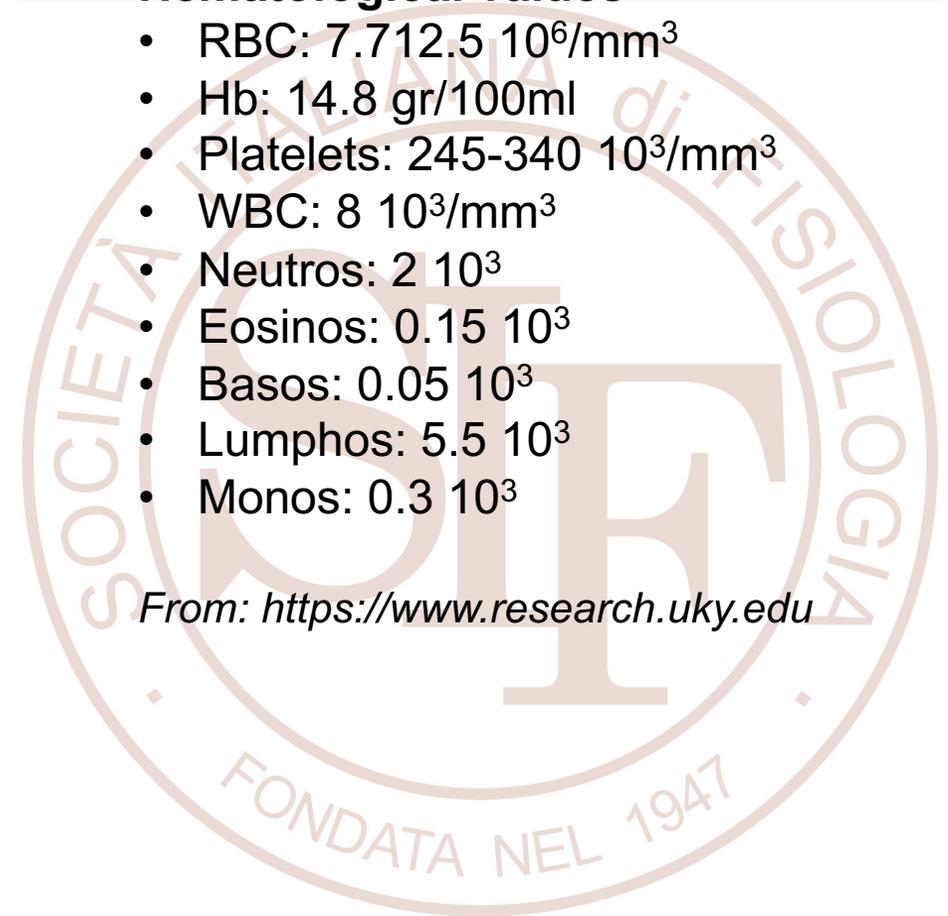- Breeding life: male 18 months; female 6-10 litters

From:
https://www.msdvetmanual.com/
http://www.informatics.jax.org/greenbook/contents.shtml

Hematological values

- RBC: 7.712.5 10^6/mm^3
- Hb: 14.8 gr/100ml
- Platelets: 245-340 10^3/mm^3
- WBC: 8 10^3/mm^3
- Neutros: 2 10^3
- Eosinos: 0.15 10^3
- Basos: 0.05 10^3
- Lumphos: 5.5 10^3
- Monos: 0.3 10^3
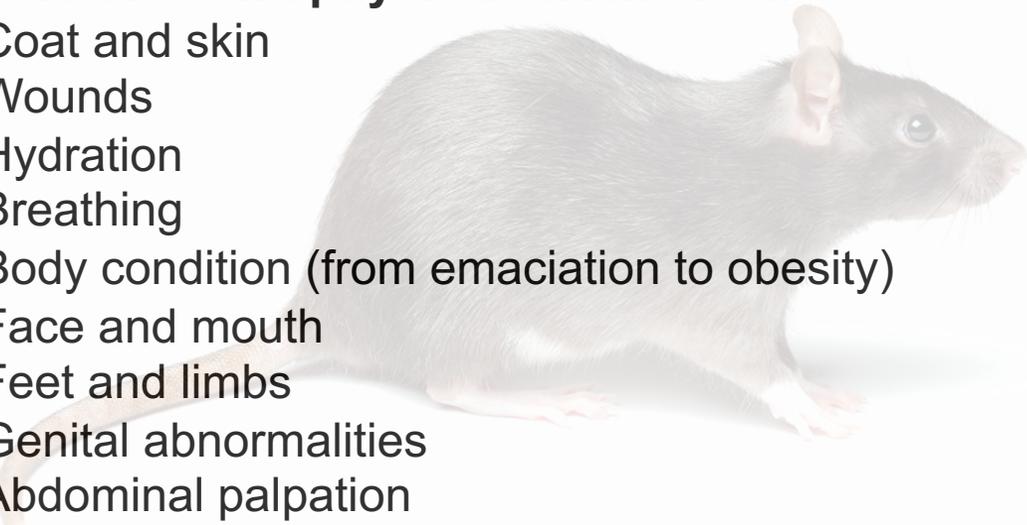
From: https://www.research.uky.edu

Mouse health assessment

Behavior
- Cage activity
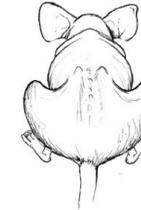- Motility, aggressiveness, fear, stereotypies

Observation and physical examination
- Coat and skin
- Wounds
- Hydration
- Breathing
- Body condition (from emaciation to obesity)
- Face and mouth
- Feet and limbs
- Genital abnormalities
- Abdominal palpation
- Presence of palpable tumors

BC1- Mouse is emaciated.
- Skeletal structure extremely prominent; little or no flesh cover.
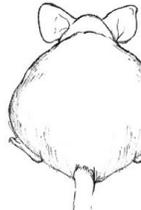- Vertebrae distinctly segmented

BC2 - Mouse is underconditioned.
- Segmentation of vertebral column evident.
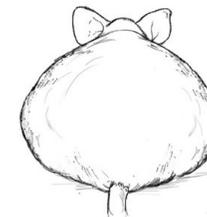- Dorsal pelvic bones are readily palpable.

BC3 - Mouse is well-conditioned.
- Vertebrae and dorsal pelvis not prominent; palpable with slight pressure.

BC4 - Mouse is overconditioned.
- Spine is a continuous column.
- Vertebrae palpable with only firm pressure.
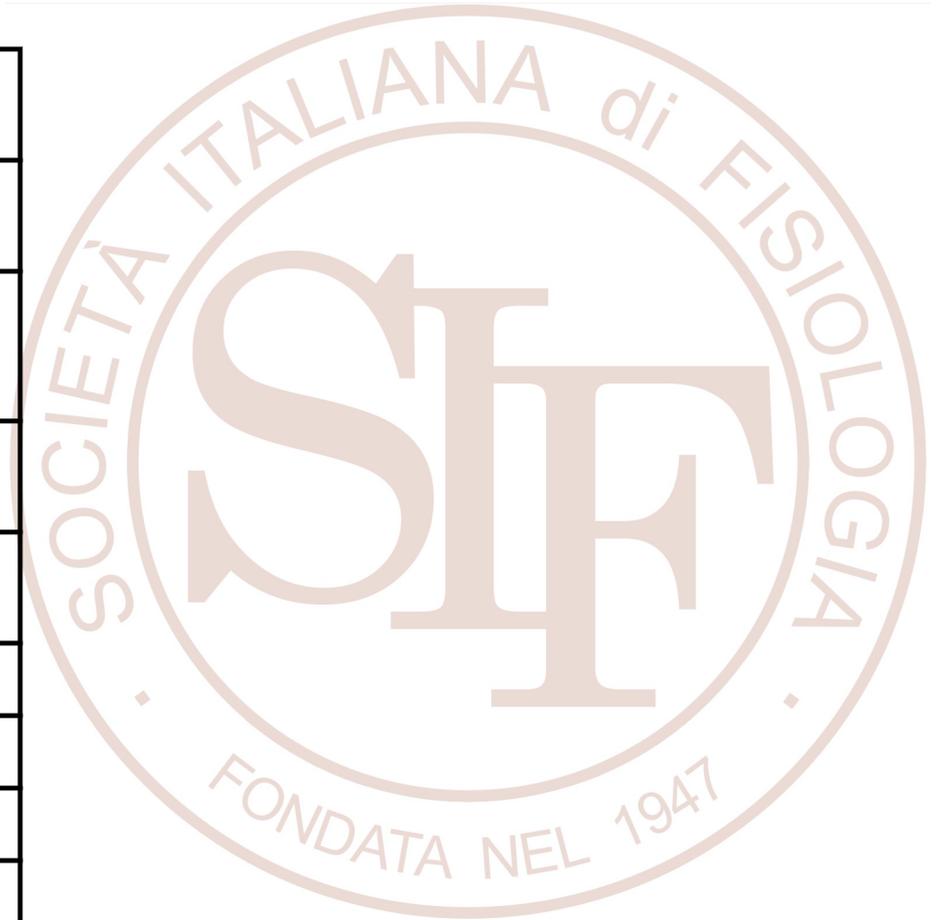
BC5 - Mouse is obese.
- Mouse is smooth and bulky.
- Bone structure disappears under flesh and subcutaneous fat.

From Burkholder et al. Health Evaluation of Experimental Laboratory Mice. Curr Protoc Mouse Biol. 2012;2:145-165.

Mouse health assessment

Clinical Presentations Associated with Strain or Background

Strain or Stock	Predisposed to conditions
C57BL/6	Hydrocephalus, Microphthalmia, Anopthalmia, Age related hearing loss, Malocclusion, Barbering, Ulcerative dermatitis
BALB/c	Male aggression, Heart ventricular mineralization, Corneal opacities, Conjunctivitis, Blepharitis, Periorbital abscesses, Age related hearing loss
C3H/He	Blindness, Corneal opacities, Age related hearing loss, Mammary tumors
FVB/N	Blindness, Seizures, Mammary hyperplasia (tumors rare), Hyperactivity
129	Blepharitis, Conjunctivitis, Megaesophagus
Swiss	Retinal degeneration, Amyloidosis
SJL/J	Blindness
A/J	Early hearing loss
DBA/2J	Audiogenic seizures, Early hearing loss

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Mouse health assessment

PAIN AND DISTRESS ASSESSMENT	EXAMPLES
1) no indication of pain and distress	Normal; well groomed; alert; active; good condition; asleep or calm; normal appetite; BCS=3,4 or 5
2) mild or anticipated pain and distress	Not well groomed; awkward gait; slightly hunched; looks at wound or pulls away when area touched; mildly agitated; BCS=2
3) moderate pain and distress	Rough hair coat; dirty incision; squinted eyes; moves slowly; walks hunched and/or slowly; depressed or moderately agitated; slight dehydration; pruritic; restless; uncomfortable; not eating or drinking; BCS=2-.
*4) severe pain and distress	Very rough hair coat; eyes sunken (severe dehydration); slow to move or non-responsive when coaxed; hunched; large abdominal mass; dyspnea; self mutilating; violent reaction to stimuli or when approached; BCS=1

From Burkholder et al. Health Evaluation of Experimental Laboratory Mice. Curr Protoc Mouse Biol. 2012;2:145-165.

Human Endpoints

CLINICAL CONDITIONS
- Score of 3 or 4 in the pain and distress scale
- BC 1 score on the body condition scale and/or rapid or progressive weight loss ≥ 20% of body weight
- Combination of the following indicators: poor physical appearance (very coarse hair, abnormal posture, rales); abnormal behavior (reduced mobility or lethargy, self-mutilation, abnormal responses to external stimuli such as excessive aggression, flight or escape during operator manipulation)
- Severe respiratory distress
- Presence of a serious injury or trauma from which recovery is unlikely
- Neurological signs (e.g. persistent seizures, paresis) that interfere with the ability to feed and hydrate and from which recovery is unlikely
- Blood loss from any orifice
- One or more skin ulcers that do not heal, depending on the type and severity of the ulcers.
- Presence of masses (greater than 15% of normal body weight) that interfere with normal function or ulcerate without the possibility of healing.
- Debilitating diarrhea
- Noticeable abdominal enlargement or ascites
- Any condition that interferes with daily activities (e.g. eating or drinking, walking)

Sample Animal Monitoring Sheet

Date	Cage	Mouse	Procedure	Indicator	Indicator	Indicator	Notes	Signature
xx/xx/xx	#	#, geno, sex	Behavior or Treatment	General conditions • Weight • Hydration • Body condition • Breathing • Coat • Skin • Masses	Behavior • Motility • Aggressiveness • Sterotypies	Other • Eyes • Mose • Mouth • Urine • Fecis		