



Request to Department of Agriculture, Water and the Environment: Review of listing conditions for the Golden Hamster (*Mesocricetus auratus*).

1. Summary

The golden hamster has been shown to be a useful animal model for the SARS-CoV-2 virus, which causes COVID-19 and the Australian Centre for Disease Preparedness (ACDP) would like to import hamster for research into the disease and to contribute to the global response to the COVID-19 pandemic. Golden hamsters are a crucial component to SARS-CoV-2 research as they display clinical signs and can transmit the virus, unlike the ferret animal model. Golden hamsters are also valuable models for other high-consequence human pathogens such as Hendra, Nipah, Influenza and Ebola viruses. ACDP is a high containment microbiologically secure facility which has a long-standing record of safe and effective research of exotic pathogens in animals. The facility operates under, and complies with, strict government regulations which allows it to appropriately manage the risk of escape and any detrimental environmental or animal health impacts.

2. Taxonomy

The golden or Syrian hamster (*Mesocricetus auratus*) is a rodent belonging to the hamster subfamily, *Cricetinae*.

3. Purpose if imported into Australia

We request a review of the listing of intact male and female hamsters for research purposes only. Intact male and female hamsters are required to avoid any gender bias associated with the use of hamsters in disease research.

In the short term, there is an urgent need at ACDP to import hamsters for use in research on the Severe Acute Respiratory Coronavirus 2 (SARS CoV2), the causative agent of COVID-19. The golden hamster has been demonstrated by researchers at several institutes, including the University of Hong Kong, University of Wisconsin–Madison, and University of Tokyo as a useful small animal model for replicating human COVID-19 disease. Hamsters exposed to SARS-CoV-2 become infected with the virus, shed virus for up to 2 weeks post exposure with concurrent clinical signs such as weight loss and develop severe pathological lesions in the lungs similar to that of COVID-19 patients with pneumonia. Hamsters have also demonstrated horizontal transmission, where exposed individuals have transmitted virus to other co-housed naïve hamsters.

Although the ferret model has been established at ACDP for COVID-19 vaccine efficacy testing (sponsored by the Coalition for Epidemic Preparedness Innovation), the lack of overt clinical disease limits the use of ferrets for testing antivirals. The hamster model is therefore critical to support our COVID-19 vaccine and antiviral research programs and contribute to the global response to control this large-scale pandemic.

In the longer term, apart from SARS CoV-2, hamsters have also been demonstrated to be good models for human disease with a range of high-consequence pathogens that are worked on at ACDP, including the henipaviruses (Hendra and Nipah viruses), influenza viruses and hantaviruses.

4. Details of the research facility

ACDP provides the Australian government and industry with advice on emerging disease and biosecurity issues. This expertise is also used internationally to manage global and regional biosecurity to improve preparedness against pandemic and bioterrorist threats posed by emerging infectious diseases. ACDP has worked with a range of academic institutions as well as, public and private sector organisations to develop/evaluate vaccines for Henipaviruses (Hendra and Nipah viruses), Filoviruses (Ebola virus), Coronaviruses and Influenza viruses.

ACDP is one of the few facilities in Australia equipped to handle exotic pathogens and would be ideally placed to import exotic species such as hamsters due its physical containment and quarantine status and unique animal facilities. ACDP complies with a range of government legislation, including those administered by the Department of Agriculture, Water and the Environment (DAWE), the Office of the Gene Technology Regulator (OGTR) and the Department of Health Security Sensitive Biological Agents (SSBA). Biological controls include strict water and air handling and decontamination prior to release from site. Security measures for access to the site are also strict with 24-hour onsite surveillance, multiple card or PIN access points and all staff who work onsite are required to pass a National Health Security check or have a security clearance at Negative Vetting 1 level. This prevents any unwanted access to the areas where imported animals will be held and eliminates risk of prohibited activity such as removal of animals from site. In addition to this there are dedicated teams who manage biorisk and biosafety, occupational health and safety and Quality Assurance compliance staff. All studies conducted at ACDP are covered by Victoria State Prevention of Cruelty to Animals Act 1986 (Licence NoSPPL20268) and US Office of Laboratory Animal Welfare Assurance (Licence NoA5399-01), are licensed under the Drugs, Poisons and Controlled Substances Act 1981 and adhere to the “Australian Code for the Care and Use of Animals for Scientific Purposes (8th Edn.)”.

5. Housing and disposal

As previously mentioned, due to its high containment facilities, ACDP is one of the few facilities in Australia equipped to handle exotic pathogens and would be ideally placed to import exotic species such as hamsters. ACDP already has long-standing expertise working at high containment with a range of species, including ferrets, pigs, horses, chickens, mice, bats, fish and mosquitoes.

ACDP manages three animal facilities, which cover all levels of biocontainment and are designated quarantine facilities, from Biosecurity Containment (BC) level 1 to BC4. As hamsters are an exotic species to Australia, if imported, they would be housed at BC2 or higher to ensure there is no risk of release to the environment. The containment facilities at ACDP are well suited for this containment and can be configured to accommodate specific needs of each species, in an environment that is physically separated and quarantined from other animals.

As a microbiologically secure facility biological material, including live animals, is managed according to requirements set by the relevant Australian government regulatory bodies such as

the DAWE and the OGTR. Under these requirements no live animal ever leaves the site and all biological material derived from animals is appropriately disposed of or decontaminated using an appropriate and approved method, such as incineration, 4% Paraformaldehyde and 10% formalin. These methods of disposal and decontamination would also apply to imported hamsters, and samples collected from them.

6. Conditions and restrictions for imported animals

Should intact male and female hamsters be approved for inclusion on the live import list, ACDP would comply with conditions and restrictions set by the relevant government authorities for import and housing of these animals. For similar animals, such as ferrets imported for research purposes, imported animals meet the following requirements and ACDP would comply with similar requirements for the importation of hamsters for research purposes.

- Prior to export animals are certified, by an official government veterinarian of the exporting country, that they have met specific animal health and disease testing requirements
- Animals are appropriately identified through microchip.
- Animals travel under specific International Air Transport Association (IATA) Live Animal Regulations.
- Upon arrival in Australia animals are inspected by DAWE and, when approved, are transported and held at specific Approved Arrangements sites for use.
- End use is restricted to research purposes only.

In addition to these restrictions, environmental impact is also significantly reduced through the following measures:

- Hamsters would be kept at either the ACDP Geelong or Werribee sites, both allow for hamsters to be housed at BC2 or higher to ensure there is no risk of release to the environment.
- Once fulfilling their purpose animals are disposed of within the high containment facility at ACDP.

At the ACDP Geelong site, there are additional measures that further reduce environmental impact:

- All effluent, including wastewater and sewerage, is decontaminated and sterilised before release from the site.
- ACDP has extensive air handling management with the facility operating under strict negative air pressure gradients for research laboratories and outgoing air is double HEPA-filtered prior to release from the site.

7. Environmental risk assessments

ACDP is not aware of any environmental risk assessments or analysis of overall potential impacts that have been conducted for golden hamsters.

8. Ecology of the species

Golden hamsters are ubiquitous worldwide as pets and research animals, however wild populations are restricted to a small area of the Middle East around the Aleppinian plateau in Syria. The climate where hamsters are naturally located is seasonal with hot summers (35-38°C) and cold, wet winters (approx. 10°C) with low precipitation, approximately 330mm/year. This is a similar climate to much of temperate southern Australia. Hamsters inhabit open grassland or savanna habitat but have also shown an affinity for agricultural areas where burrows can often be found in legume plots or near irrigation wells.

Golden hamsters typically weigh between 100-125g and are between 13-13.5cm long. They have a short lifespan of 1.5-2 years but this can increase to up to 4 years in captivity (usually 2-2.5 years). They are solitary nocturnal animals and highly territorial, marking territory with scent glands on their flanks. They spend the day in their burrows and wake at dusk to feed on seeds, nuts, insects including ants, flies, cockroaches and wasps. In winter golden hamsters exhibit a period of torpor.

Golden hamsters are a food source for many predators such as foxes, birds of prey and snakes and they also disperse seeds due to their dietary behaviour and habit of caching food. They will avoid predation by seeking shelter in their burrow and their high reproductive rate means they can withstand high rates of predation.

9. Reproductive biology of species

Golden hamsters are seasonal diurnal breeders with ovulation induced by long photoperiod (>12.5hrs) which continues as long as the photoperiod remains long. In a laboratory environment where females are exposed to complete darkness to prevent ovulation, females will acclimate and begin spontaneously ovulating after 5 months.

Sexual maturity is achieved at 26-30 days and 42 days for females and males respectively and the gestation period is 16 days, the shortest period among placental mammals. Females can give birth every month or so during the breeding season, delivery between 4-15 offspring at each breeding period.

Female golden hamsters cannot store sperm and will cannibalise their young to reduce the size of the litter during periods of limited resources or stress. Golden hamsters are not known to hybridise or be capable of parthenogenesis or sequential hermaphroditism.

10. Status of the species

Golden hamsters (*M. auratus*) are ubiquitous as pets and research animals and are therefore in no danger of becoming extinct. The species has no special status under the Convention on International Trade in Endangered Species of wild fauna and flora (CITES) and is listed as vulnerable on the International Union for Conservation of Nature's red list (ICUN). The vulnerable ICUN listing is due to wild populations being under threat due to their small geographic range and localised distribution however domestic populations are in no danger of extinction.