Social Housing of Laboratory Animals Search Hedges

Animal Welfare Information Center, National Agricultural Library, US Department of Agriculture, https://www.nal.usda.gov/programs/awic

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What is a Search Hedge?

A **search hedge** is a prepared search string that can be plugged into a database to find citations on a particular topic or population. Hedges are used frequently in biomedical literature searches to find literature on diseases or populations. They include synonyms or variants of terms. Hedges can save searchers time because the relevant keywords have already been selected for them. Searchers can also combine hedges with the Boolean AND to find a subset of citations on a particular topic: for instance, combining an Environmental Enrichment hedge with a species hedge for Mice. AWIC has been working on developing hedges on Three Rs topics to facilitate searching for literature on animal use alternatives.

While hedges can help retrieve relevant citations on a particular topic, they are never 100% effective. Searchers will need to review results carefully and recognize that there may be other pertinent articles not retrieved by the hedge.

Introduction

The National Agricultural Library's Animal Welfare Information Center (AWIC) conducts annual workshops for scientists, Institutional Animal Care and Use Committee (IACUC) members, students, librarians, veterinarians, animal care personnel, and others constructing a "Three Rs" literature search.

Over the past few decades, members of the research community have made great strides in finding ways to address the Three Rs and have written a great body of literature on the topic. Despite this, scientists and researchers often cite the difficulty of finding Three Rs citations in bibliographic databases. AWIC has seen animal use protocols where researchers said that they did not find any Three Rs literature on their topic, yet their search terms consisted mainly of "refinement," "reduction," "replacement," "Three Rs," and "alternatives." We've found that people who use *only* these terms do not find a lot of relevant results.

One of the reasons why Three Rs articles are hard to locate is that authors may not include words such as "Three Rs," "alternatives," refinement, etc., in abstracts or keywords, even though they may discuss Three Rs concepts or practices in the body of their papers.

Hedges and search filters are constructed search strings used to find citations on a particular populations, diseases, or publication type. We have created search hedges for some of the Three

Rs concepts (such as environmental enrichment, noninvasive blood sampling methods, etc.) to help scientists, researchers, and librarians locate citations on alternatives.

Social Housing

Many animal species (such as mice, rats, guinea pigs, and nonhuman primates) are social and have developed complex social structures and behaviors. When individuals of social species are kept captive in isolation, , these animals are likely to experience stress that can impact their physical and psychological health. Animals raised in isolation may develop social stresses and behavioral issues later in life. Social factors may also impact animals' behavior, immunology, and endocrine levels which can have ramifications for the research studies using these animals.[1]

Increasingly, institutions that use animals as research models have made efforts to house social animals in pairs or groups to improve animal wellbeing and allow the animals to express natural social behaviors. Social housing may be considered part of environmental enrichment. However, care must be taken to make sure that animals housed together are compatible so that animals do not injure, fight, or kill each other.

AWIC developed the social housing hedges based upon previous literature searches that we have done on the topic. We employed previous versions of these search hedges in creating the Social Housing of Laboratory Animals bibliography (2021).

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[1] Olsson, I. A. S., & Westlund, K. (2007). More than numbers matter: The effect of social factors on behaviour and welfare of laboratory rodents and non-human primates. *Too Many, Too Few: The Effects of Group Size and Density in Captive Animals*, *103*(3), 229–254. https://doi.org/10.1016/j.applanim.2006.05.022

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Social Housing Hedges

AWIC designed the social housing hedges to be used in combination with keywords or search hedges particular to a certain species or group of animals. Although you may use this hedge by itself, we recommend combining it with keywords for an animal species to find the most relevant information.

PubMed

(Housing, Animal[mh] OR Environment[mh] OR "animal housing"[tiab:~5] OR "animals housing"[tiab:~5] OR "animal housed"[tiab:~5] OR "animals housed"[tiab:~5] OR caging[tiab] OR cage*[Title/Abstract] OR enclosure*[tiab] OR kennel*[tiab] OR vivarium[tiab] OR "housing condition*"[tiab] OR "laboratory hous*"[tiab] OR colony[tiab] OR "laboratory housing"[tiab:~5] OR "laboratory housed"[tiab:~5]) AND (Animals, Laboratory[mh] OR Models, Animal[mh] Laboratory Animal Science[mh] OR "research animal*"[tiab] OR "laboratory animal*"[tiab] OR "experimental animal*"[tiab] OR "animal model*"[tiab] OR "research animal"[tiab:~4] OR "research animals"[tiab:~4] OR vivarium[tiab] OR "research facilit*"[tiab] OR "animal studies"[tiab] OR "animal study"[tiab]) AND (Pair Bond[mh] OR Social Environment[mh] OR Social Interaction[mh] OR Social Isolation[mh] OR Social Behavior[mh] OR Nesting Behavior[mh] OR Social Group[mh] OR Group Dynamics[mh] OR "pair bond*"[tiab] OR "social environment"[tiab] OR "social interaction"[tiab] OR "social isolation"[tiab] OR "social behavior*"[tiab] OR "social behaviour*"[tiab] OR "social group*"[tiab] OR "group dynamic*"[tiab] OR "social enrichment*"[tiab] OR "socially enrich*"[tiab] OR "group hous*"[tiab] OR "group housed"[tiab:~5] OR "groups housed"[tiab:~5] OR "pair hous*"[tiab] OR "pairs housed"[tiab:~4] OR "paired with"[tiab] OR "singly-hous*"[tiab] OR "bachelor group*"[tiab] OR "single-sex housing"[tiab] OR "bonded pair*"[tiab] OR "co-housing"[tiab] OR "co-housed"[tiab] OR cohous*[tiab] OR compatibility[tiab] OR compatible[tiab] OR "cage divider*"[tiab] OR cage-division[tiab] OR "visual contact"[tiab] OR "social contact*"[tiab] OR conspecific[tiab] OR nesting[tiab] OR nest[tiab] OR nests[tiab])

Scopus

TITLE-ABS-KEY((hous* W/5 (animal* OR laboratory)) OR caging OR cage* OR enclosure* OR kennel* OR vivarium OR {housing condition} OR {housing conditions} OR colony) AND TITLE-ABS-KEY((animal* W/4 (laboratory OR research OR experimental OR model* OR study OR studies)) OR {laboratory animal science} OR vivarium OR {research facility} OR {research facilities}) AND TITLE-ABS-KEY((social* W/3 (environment* OR interaction* OR isolation* OR behavior* OR behaviour* OR group* OR enrichment* OR contact*)) OR {pair bond} OR {pair bonds} OR nest* OR {paired with} OR {bachelor group} OR {bachelor groups} OR {bonded pair} OR {bonded pairs} OR {co-house} OR {co-housed} OR {co-housing} OR cohous* OR compatib* OR {cage divider} OR {cage dividers} OR {cage division} OR {cage divisions} OR {visual contact} OR conspecific*)

Web of Science

((TS=((Hous* NEAR/5 (animal* OR laboratory)) OR caging OR cage* OR enclosure* OR kennel* OR vivarium OR "housing condition*" OR colony)) AND TS=((animal* NEAR/4 (laboratory OR research OR experimental OR model* OR study OR studies)) OR "laboratory animal science" OR vivarium OR "research facilit*")) AND TS=((Hous* NEAR/5 (group* OR social* OR pair* OR single OR singly OR "single-sex")) OR (social* NEAR/3 (environment* OR interaction* OR isolation* OR behavio$r* OR group* OR enrichment* OR contact*)) OR "pair bond*" OR "nesting behavio$r*" OR nest* OR "paired with" OR "bachelor group*" OR "bonded pair*" OR "co-hous*" OR cohous* OR compatib* OR "cage divider*" OR "cage division*" OR "visual contact*" OR conspecific*)

EBSCO

TX ("animal housing" OR cage* OR enclosure* OR kennel* OR 'vivarium' OR "housing condition*") AND ("experimental animal*" OR "laboratory animal*" OR "laboratory animal science" OR "animal model*" OR vivarium OR "research facilit*") AND ("social housing" OR "group housing" OR "pair hous*" OR "single housing" OR "social isolation" OR "social enrichment" OR "social behavio#r*" OR "pair bond*" OR "co housing" OR cohous* OR compatibility OR conspecific* OR "bachelor group*" OR "visual contact" OR "cage divider*")

Embase

('animal housing'/de OR 'animal housing' OR 'cage'/de OR 'cage' OR 'enclosure' OR 'kennel' OR 'vivarium' OR 'housing quality'/de OR 'housing quality' OR 'housing condition*') AND ('experimental animal'/de OR 'experimental animal' OR 'laboratory animal*' OR 'laboratory animal science'/de OR 'laboratory animal science' OR 'animal model'/de OR 'animal model' OR 'vivarium' OR 'research facilit*') AND ('social housing'/de OR 'social housing' OR 'group housing' OR 'pair housing' OR 'pair housed' OR 'single housing' OR 'social isolation'/de OR 'social isolation' OR 'social enrichment'/de OR 'social enrichment' OR 'social behavior'/de OR 'social behavior' OR 'pair bonding'/de OR 'pair bonding' OR 'co housing' OR 'compatibility'/de OR 'compatibility' OR 'conspecific*' OR 'bachelor group*' OR 'visual contact' OR 'cage divider*')

Other Databases

("animal housing" OR cage* OR enclosure* OR kennel* OR "vivarium"OR "housing condition*") AND ("experimental animal*" OR "laboratory animal*" OR "laboratory animal science" OR "animal model*" OR vivarium OR "research facilit*") AND ("social housing" OR "group housing" OR "pair hous*" OR "single housing" OR "social isolation" OR "social enrichment" OR "social behavior*" OR "social behaviour*" OR "pair bond*" OR "co housing" OR cohous* OR compatibility OR conspecific* OR "bachelor group*" OR "visual contact" OR "cage divider*")

How to Use These Hedges

Below are instructions on how to combine these hedges with species terms in a few selected databases.

PubMed
1. Select and copy the hedge.
2. Go to https://pubmed.ncbi.nlm.nih.gov/ and select Advanced to access the Advanced Search Builder
3. Paste the hedge into the Query Box and select Search.
4. You will see the results. Return to the Advanced Search Screen by selecting Advanced below the search box.
5. You are going to combine search terms for animals with the social housing search hedge.
    a. You can use an existing animal species hedge, such as the AVIS Search Strategies Working Group Selected Animal Search Hedges available for free download from Open Science Foundation.
6. Return to the Advanced Search Screen.
7. Under History and Search Details, go to Actions next to the animal search hedge, select the three dots, and select "Add query" from the dropdown menu. PubMed will add this hedge to the Query box.
8. Under History and Search Details, go to Actions, select the three dots, and select "Add with AND."
9. Once both search hedges have been added to the query box, select Search.
10. You will see the search results on the following page sorted by relevance. You may narrow down the number of results using the filters on the left-hand side, such as narrowing down results by restricting the date of publication.
11. You don't have to use an animal search hedge but can use your own search terms instead.
    a. Example: ((Housing, Animal[mh] OR Environment[mh] OR "animal housing"[tiab:~5] OR "animals housing"[tiab:~5] OR "animal housed"[tiab:~5] OR "animals housed"[tiab:~5] OR caging[tiab] OR cage*[Title/Abstract] OR

enclosure*[tiab] OR kennel*[tiab] OR vivarium[tiab] OR "housing condition*"[tiab] OR "laboratory hous*"[tiab] OR colony[tiab] OR "laboratory housing"[tiab:~5] OR "laboratory housed"[tiab:~5]) AND (Animals, Laboratory[mh] OR Models, Animal[mh] Laboratory Animal Science[mh] OR "research animal*"[tiab] OR "laboratory animal*"[tiab] OR "experimental animal*"[tiab] OR "animal model*"[tiab] OR "research animal"[tiab:~4] OR "research animals"[tiab:~4] OR vivarium[tiab] OR "research facility"[tiab] OR "animal studies"[tiab] OR "animal study"[tiab]) AND (Pair Bond[mh] OR Social Environment[mh] OR Social Interaction[mh] OR Social Isolation[mh] OR Social Behavior[mh] OR Nesting Behavior[mh] OR Social Group[mh] OR Group Dynamics[mh] OR "pair bond*"[tiab] OR "social environment"[tiab] OR "social interaction"[tiab] OR "social isolation"[tiab] OR "social behavior*"[tiab] OR "social behaviour*"[tiab] OR "social group*"[tiab] OR "group dynamic*"[tiab] OR "social enrichment*"[tiab] OR "socially enrich*"[tiab] OR "group hous*"[tiab] OR "group housed"[tiab:~5] OR "groups housed"[tiab:~5] OR "pair hous*"[tiab] OR "pairs housed"[tiab:~4] OR "paired with"[tiab] OR "singly-hous*"[tiab] OR "bachelor group*"[tiab] OR "single-sex housing"[tiab] OR "bonded pair*"[tiab] OR "co-housing"[tiab] OR "co-housed"[tiab] OR cohous*[tiab] OR compatibility[tiab] OR compatible[tiab] OR "cage divider*"[tiab] OR cage-division[tiab] OR "visual contact"[tiab] OR "social contact*"[tiab] OR conspecific[tiab] OR nesting[tiab] OR nest[tiab] OR nests[tiab])) AND (((((Callithrix[MeSH Terms]) OR (Saguinus[MeSH Terms])) OR (Callithrix[Title/Abstract]))

Scopus

1. Scopus is a subscription database produced by Elsevier, a company which also publishes peer-reviewed journals and books. You will need to access Scopus through your library's website.
2. Go to Scopus' main search page and follow the link for the Advanced Document Search option.
3. Copy and paste the social housing search hedge into the Advanced search query box where it says "Enter query string."
4. Next, you need to add a species hedge or keywords joined by the Boolean **AND**. Place your cursor at the end of the hedge in the query box. Enter a space and add **AND** and another space.
5. Then go to the menu on the right, select Textual Content and then the downward arrow which will display the options for searching fields. Select the plus sign to the right of the field tags you wish to search. This will add the tags to the query box. For instance, you might decide to search the species hedge in TITLE-ABS-KEY (this searches the title, the abstract, and any keywords).
6. Paste the species hedge or keywords into the open- and close-parentheses and select Search. Example: marmoset* OR Callithrix OR Saguinus OR callitrichid*
7. Scopus sorts results by default to show the highest cited articles first. Switch the sort order to Relevance so that the most on-target citations display first.

Example:

TITLE-ABS-KEY((hous* W/5 (animal* OR laboratory)) OR caging OR cage* OR enclosure* OR kennel* OR vivarium OR {housing condition} OR {housing conditions} OR colony) AND TITLE-ABS-KEY((animal* W/4 (laboratory OR research OR experimental OR model* OR study OR studies)) OR {laboratory animal science} OR vivarium OR {research facility} OR {research facilities}) AND TITLE-ABS-KEY((social* W/3 (environment* OR interaction* OR isolation* OR behavior* OR behaviour* OR group* OR enrichment* OR contact*)) OR {pair bond} OR {pair bonds} OR nest* OR {paired with} OR {bachelor group} OR {bachelor groups} OR {bonded pair} OR {bonded pairs} OR {co-house} OR {co-housed} OR {co-housing} OR cohous* OR compatib* OR {cage divider} OR {cage dividers} OR {cage division} OR {cage divisions} OR {visual contact} OR conspecific*) AND TITLE-ABS-KEY(marmoset* OR Callithrix OR Saguinus OR callitrichid*)

Web of Science

1. Web of Science is a subscription database produced by Clarivate Analytics. You will need to access Web of Science through your library's website.
2. Go to Web of Science's search page and select the Advanced Search option below the query box.
3. Copy the social housing search hedge and paste it into the Advanced Search Query Builder.
4. You will next need to add the search hedge or search terms for the species. Under "Add terms to search query," select from the drop down menu the field(s) in which you want to search the species terms. Once you've added these terms, select Add to Query with AND. Web of Science will add these terms in the query box to the social housing hedge with the Boolean AND.
   Example: Add the Rabbits species hedge searching the Topic (TS) field (searches title, abstract, keywords, and Keywords Plus): Rabbit* OR "New Zealand white" OR "New Zealand Red" OR "NZR rabbit*" OR "NZW rabbit*" OR "Polish rabbit*" OR "California rabbit*" OR "Dutch belted" OR "Oryctolagus cuniculus" OR "O cuniculus" OR "domestic rabbit*" OR lagomorph* OR Leporidae

5. Search results will be displayed sorted by Relevance. Here is the final search string from the example:

((TS=((Hous* NEAR/5 (animal* OR laboratory)) OR caging OR cage* OR enclosure* OR kennel* OR vivarium OR "housing condition*" OR colony)) AND TS=((animal* NEAR/4 (laboratory OR research OR experimental OR model* OR study OR studies)) OR "laboratory animal science" OR vivarium OR "research facility*")) AND TS=((Hous* NEAR/5 (group* OR social* OR pair* OR single OR singly OR "single-sex")) OR (social* NEAR/3 (environment* OR interaction* OR isolation* OR behavio$r* OR group* OR enrichment* OR contact*)) OR "pair bond*" OR "nesting behavio$r*" OR nest* OR "paired with" OR "bachelor group*" OR "bonded pair*" OR

"co-hous*" OR cohous* OR compatib* OR "cage divider*" OR "cage division*" OR "visual contact*" OR conspecific*) AND TS=(Rabbit* OR "New Zealand white" OR "New Zealand Red" OR "NZR rabbit*" OR "NZW rabbit*" OR "Polish rabbit*" OR "California rabbit*" OR "Dutch belted" OR "Oryctolagus cuniculus" OR "O cuniculus" OR "domestic rabbit*" OR lagomorph* OR Leporidae)

Embase

Embase is the largest subscription biomedical database, produced by Elsevier. It also searches Medline and has its own controlled vocabulary, Emtree, which is based on MeSH.

1. Copy the search hedge and paste it into Embase's Quick Search dialog box and select the Show Results button. The Search History and a list of results will appear on the next screen.
2. If you wish to add a species term, go back to the top menu and select Search.
3. You'll see the existing search hedge pre-populated in the search field.
4. Select + Add field
5. Select from the Add field menu "Emtree term – exploded."
6. Enter a species term, such as Rabbits. Embase will suggest the Emtree term for Rabbits, Leporidae.
7. Select the blue results button to show citations.
8. The text of the resultant search string is the following:

('animal housing'/de OR 'animal housing' OR 'cage'/deOR 'cage' OR 'enclosure' OR 'kennel' OR 'vivarium' OR 'housing quality'/deOR 'housing quality' OR 'housing condition*') AND ('experimental animal'/deOR 'experimental animal' OR 'laboratory animal*' OR 'laboratory animalscience'/de OR 'laboratory animal science' OR 'animal model'/de OR 'animalmodel' OR 'vivarium' OR 'research facilit*') AND ('social housing' OR 'grouphousing' OR 'pair housing' OR 'pair housed' OR 'single housing' OR 'socialisolation'/de OR 'social isolation' OR 'social enrichment' OR 'social behavior'/deOR 'social behavior' OR 'pair bonding'/de OR 'pair bonding' OR 'cohousing' OR 'compatibility' OR 'conspecific*' OR 'bachelor group*' OR 'visualcontact' OR 'cage divider*') AND 'leporidae'/exp

For additional help

1. You can also translate search strings using Polyglot, a free online tool from Bond University's Institute for Evidence-Based Healthcare.
2. For more information on conducting searches in PubMed, please refer to the Network of the National Library of Medicine's How PubMed Works instructional video series and PubMed's User Guide.
3. For additional information on search best practices, search syntax, and related topics, see the Literature Searching: How to Find Animal Use Alternatives, on the National Agricultural Library's (USDA) website.
4. If you have questions or suggestions, please reach out to AWIC at awic@usda.gov.