

'3Rs alternatives' refers to the replacement, reduction, and refinement of animal use in research, testing, teaching, and exhibition. The Animal Welfare Act (AWA) and its regulations require a researcher to consider alternatives to procedures that may cause more than momentary pain or distress to animals and to avoid unnecessarily duplicating previous experiments (see AWA references below). A thorough alternatives literature search can identify information to meet these requirements.

Animal Welfare Act (AWA) and Regulations
<https://www.nal.usda.gov/awic/animal-welfare-act>

AWA: United States Code Title 7 - Agriculture, Chapter 54 - Transportation, Sale, and Handling of Certain Animals
Sec. 2143 (a)(3)[A-B]

AWA Regulations: Code of Federal Regulations Title 9 - Animals and Animal Products, Chapter 1, Subchapter A - Animal Welfare
Sec. 2.31 (d-e)



Who We Are

The Animal Welfare Information Center (AWIC) was established in 1986 as part of the U.S. Department of Agriculture's (USDA) National Agricultural Library (NAL) in Beltsville, Maryland. As a library service, AWIC provides information, products, and services related to the improved care and use of animals in research, teaching, testing, and exhibition as described in the Animal Welfare Act.

AWIC was mandated as part of the 1985 amendment to the Animal Welfare Act [7 U.S.C. § 2143 (e)]:

The Secretary [of Agriculture] shall establish an information service at the National Agricultural Library. Such service shall, in cooperation with the National Library of Medicine, provide information-

- *pertinent to employee training;*
- *which could prevent unintended duplication of animal experimentation as determined by the needs of the research facility; and*
- *on improved methods of animal experimentation, including methods which could--*
 - *reduce or replace animal use; and*
 - *minimize pain and distress to animals, such as anesthetic and analgesic procedures.*

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September 2021



United States Department of Agriculture

National Agricultural Library,
Animal Welfare Information Center



3Rs ALTERNATIVES LITERATURE SEARCHING

<https://www.nal.usda.gov/awic/alternatives-literature-searching>

Conducting Literature Searches: Considering 3Rs (Replacement, Reduction, Refinement) Alternatives

1: Review the protocol and ask targeted questions

Find areas of the protocol that could potentially incorporate the 3Rs. Think about:

- The protocol's objective and study uniqueness
- Animal used and other animal/non-animal models
- Number of animals required
- Animal housing, care and painful/stressful procedures

2: Find databases and other 3Rs resources

Search multiple databases! No database covers all journals, subject areas, or types of materials. Talk to your library to find out what databases are available at your institution. Don't forget to search non-database resources as well.

AWIC provides links to useful databases here: <https://www.nal.usda.gov/awic/databases>. The databases are organized by subject area:

- **Biological and Biomedical**
- **Toxicology and Mandatory/Regulatory Testing**
- **Teaching and Education**
- **Federally-funded Research**
- **Technology**
- **Veterinary Medicine**

3Rs Web Resources**

- Altbib: <https://toxnet.nlm.nih.gov/altbib.html>
- AWI Enrichment and Refinement Databases: <https://awionline.org/content/enrichment-and-refinement-databases>
- ICCVAM: <https://ntp.niehs.nih.gov/go/regaccept>
- NC3Rs: <https://www.nc3rs.org.uk/>
- NORECOPA: <https://norecopa.no/>
- Procedures with Care: <http://www.procedureswithcare.org.uk>
- NA3RsC: <https://www.na3rsc.org/>

**Mention of commercial databases or external organizations does not constitute endorsement or imply preference by the U.S. Department of Agriculture.



3-4: Develop search strings and run searches

The search string consists of 3-4 components:

- Scientific terms related to the research protocol
- Animal terms (if applicable)
- 3Rs alternatives terms relevant to the protocol
- Search logic: Boolean operators, parentheses, quotation marks, truncations, etc. (database dependent)

Consider synonyms, acronyms, alternate spellings and variations of the words (such as tenses).

Search String Example in Web of Science:

```
TS=((recover* OR assess* OR collect* OR analy*  
OR process* OR sampl* OR measur*) NEAR/5  
(tissue* OR "tissue sample*" OR fluid* OR "fluid  
sample*" OR "blood sample*" OR "urine  
sample*"))
```

3Rs Keyword Examples:

<https://www.nal.usda.gov/awic/3Rs-terms-examples>

- analgesic or analgesia or "pain medication"
- anesthesia or anaesthesia or anasthesia
- housing or enclosure or caging
- welfare or wellbeing or "animal welfare"
- technique or procedure or method or process
- "in vitro" or culture or organoid
- virtual or simulation or digital or interactive
- mannequin or manikin or model
- endpoint or biomarker or noninvasive

5: Modify search strings

Literature searching is a trial-and-error process—if you find that your initial search string brings back a lot of irrelevant information, it might be time to modify your search string. Here are some quick ways to modify a search string:

- Change what field you're searching (e.g., title vs. title/abstract)
- Limit by publication year to decrease the number of citations you are receiving
- Remove irrelevant search terms using the Boolean operator 'NOT'
- Narrow the search by replacing general terms for terms specific to the disease, method, procedure, etc., that you're studying

6: Citation Management

- Save your search strings, databases searched, and years of search in a word document
- Export and save relevant citations into a citation manager (EndNote, Zotero, etc.) to help organize and quickly import citations into research papers

Tips for IACUC Members

- Ensure protocol forms clearly state what information is required from the researchers
- Inform researchers of available information resources and how to access them
- Encourage researchers to work with librarians and statisticians
- Here are some **RED FLAGS** to look out for in a literature search:
 - Only 1 database searched
 - The term "alternative" is used alone
 - Keywords listed are not relevant to protocol
 - Keywords and search logic linked incorrectly (e.g., wrong Boolean operators)
 - Search doesn't cover adequate time period