Boolean Logic

USE IN SEARCHING THE BIOMEDICAL DATABASES

Objectives

You will be able to:

- Use Boolean logical operators within a search strategy to combine terms

- Identify search techniques which make efficient use of Boolean operators and system processing
What is Boolean Logic

- Boolean searches allow you to combine words and phrases using the words **AND**, **OR**, and **NOT** to limit, widen, or define your search.

- Boolean or Logical operators include the words:
  - **AND**
  - **OR**
  - **NOT**

![Diagram showing AND, OR, and NOT operators with examples: cats AND dogs, nurses OR doctors, nursing NOT breastfeeding.]

AND, OR, NOT

- Using **AND** narrows a search by combining terms; it will retrieve documents that use both the search terms you specify.
  
  *example: cats AND dogs*

- Using **OR** broadens a search to include results that contain either of the words you type in.
  
  *example: nurses OR doctors*

- Using **NOT** will narrow a search by excluding certain search terms.
  
  *example: nursing NOT breastfeeding*
**AND**

- **AND** Retrieves a set in which each citation/article contains *EACH* term in the strategy
- Usually *limits* search retrieval
- **EXAMPLE:** cats AND dogs
  Articles retrieved MUST discuss both animals

**OR**

- **OR** Retrieves a set in which each citation/article contains at least *ONE* of the search terms
- Usually *expands* retrieval
- Useful for grouping “like” or similar search terms, e.g. all parts or the eye – pupil OR iris OR lens OR cornea...
OR (continued)

- **OR** Can also use to group terms that have nothing in common into a set

- Searching foot pain **OR** cough
  Articles retrieved will discuss either cough **or** foot pain **or** both

```
+---------------------+---------------------+
<table>
<thead>
<tr>
<th>cough</th>
<th>foot pain</th>
</tr>
</thead>
</table>
```

NOT

- **NOT** Retrieves a set of citations from which the term(s) following **NOT** have been excluded

- Use with care: search engines are absolute when making exclusions – you may omit some citations/articles that would have been useful

- Citations may have both terms you want as well as terms you don’t want
**NOT** (continued)

- Only use **NOT** when you are really sure that you want to exclude something.

- **EXAMPLE:** cats **NOT** dogs
  Articles retrieved will only discuss cats; any articles that mentioned both will not be retrieved. Articles discussing other animals, humans, may be retrieved too.

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**Some Tips to Remember**

- The Boolean operator **AND** is assumed between all words.

- Two words, entered without a Boolean operator, (**AND, OR, NOT**) are searched as a phrase.

- If parentheses (   ) are used, the words *inside* the parentheses are searched first. This is called nesting.

- Always use the “help” section in each database you search to learn the particulars of each.
For Example....

<table>
<thead>
<tr>
<th>If this is the search term you enter:</th>
<th>Will retrieve articles/citations containing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>earache</td>
<td>The word &quot;earache&quot; anywhere in the title, author, abstract or subject fields</td>
</tr>
<tr>
<td>earache AND cough</td>
<td>Both of the specific terms</td>
</tr>
<tr>
<td>earache OR cough</td>
<td>One or both of the specified terms</td>
</tr>
<tr>
<td>earache NOT cough</td>
<td>The words &quot;earache&quot; not the word cough</td>
</tr>
<tr>
<td>“earache and cough in flu”</td>
<td>The exact phrase, when enclosed in double (&quot; &quot;) marks</td>
</tr>
</tbody>
</table>

Computer Processing

- Search engines process terminology near logical operators in an established order

- **AND** is processed before **OR**

- For example, if you type in – cats **OR** dogs **AND** rabies, what the computer searches dogs **AND** rabies first; then **ORs** in all articles about cats
cats **OR** dogs **AND** rabies
If you really want (cats OR dogs) AND rabies
-OR-

- Type the search in two steps, e.g.
  1. cats OR dogs
  2. 1 AND rabies or Rabies AND (Cats or Dogs)

- NOT is treated like AND

- It also is processed before OR

- For example:
  colic OR earache OR cough OR hiccup NOT child
In the previous example the computer retrieves (hiccup NOT child) and then ORs all other terms – child will not be excluded from a search of those terms

\[
\text{colic OR earache OR cough OR hiccup NOT child}
\]

Try instead:

1. colic OR earache OR cough OR hiccup
2. 1 NOT child

You can also try this search

\[
\text{\text{(colic OR earache OR cough \ NOT child)}}
\]

If the database allows the use of parenthesis to “nest” terms that should be processed together first
Upper or Lower Case?

- Typing Boolean operators in upper or lower case is database or system dependent
  - doctors and nurses or doctors AND nurses
- PubMed requires upper case; OVID does not
- To find out requirements, click on the help link or always use upper case as a default

Other Options

- Some databases allow you to combine search statements by clicking a “Combine” button, and marking which sets to combine. You can choose how you want to combine the sets with AND or OR.
Search Optimization

- Gather “like” terms (MeSH headings, synonyms) together into search statements using **OR**.

- Keep something that you may need to combine with several other terms in it’s own search statement.

- Use parentheses to group together terms that should be processed first if you have a complex search and want to type it all in at once.

Try It Yourself

Formulate search statements for each of the following sample searches, using **AND**, **OR**, or **NOT**

1. The effects of cannabis on memory.
2. The effects of cannabis on memory or thinking.
3. The effects of cannabis or mescaline on memory or thinking.
4. Any effects of cannabis on personality but exclude studies involving students.
Question 1: Search Strategy

1. The effects of cannabis on memory.

Search Strategy:
cannabis
AND
memory

Question 2: Search Strategy

2. The effects of cannabis on memory or thinking.

Search Strategy:
cannabis AND (memory OR thinking)

OR

- cannabis
- memory OR thinking
- 1 AND 2
Question 3 Search Strategy

3. The effects of cannabis or mescaline on memory or on thinking.

Search strategy:
(cannabis OR mescaline)
AND
(memory OR thinking)
OR
- cannabis OR mescaline
- memory OR thinking
-1 AND 2

Question 4 Search Strategy

4. Any effects of cannabis on personality but exclude studies involving students.

Search Strategy:
(cannabis AND personality)
NOT students
OR
- cannabis AND personality
- NOT students