

# Boolean Logic



## USE IN SEARCHING THE BIOMEDICAL DATABASES

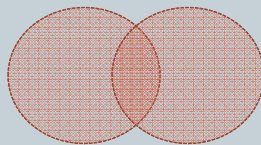


# Objectives

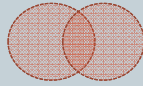
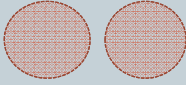
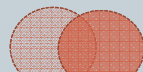


**You will be able to:**

- 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**  cats **AND** dogs
  - ✦ **OR**  nurses **OR** doctors
  - ✦ **NOT**  nursing **NOT** breastfeeding

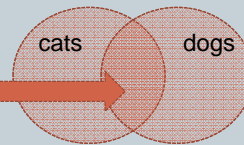
## AND, OR, NOT

- 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

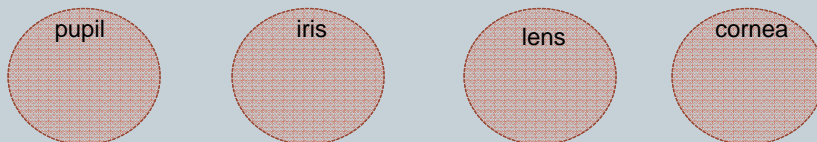
- **AND** Retrieves a set in which each citation/article contains *EACH* term in the strategy
- Usually *limits* search retrieval
- **EXAMPLE:** cats **AND** dogs  
Articles retrieved **MUST** discuss both animals

This search will only retrieve articles that mention cats AND dogs



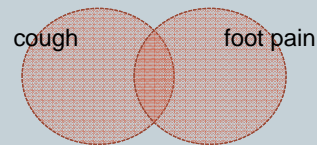
## OR

- **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 of 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

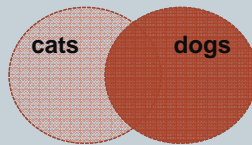


## NOT


- **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.



## 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....

If this is the search term you enter:	Will retrieve articles/citations containing:
earache	The word "earache" anywhere in the title, author, abstract or subject fields
earache AND cough	Both of the specific terms
earache OR cough	One or both of the specified terms
earache NOT cough	The words "earache" not the word cough
"earache and cough in flu"	The exact phrase, when enclosed in double (" ") marks

## 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

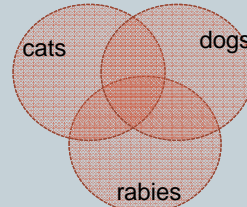
cats **OR** dogs **AND** rabies

2
1

## Computer Processing (continued)

If you really want (cats **OR** dogs) **AND** rabies

- Check to see if your database allows for use of parentheses



-OR-

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

## Computer Processing (continued)

- **NOT** is treated like **AND**
- It also is processed before **OR**
- For example:  
colic **OR** earache **OR** cough **OR** hiccup **NOT** child

## Computer Processing (continued)

- In the previous example the computer retrieves (hiccup **NOT** child) and then **OR**s all other terms – child will not be excluded from a search of those terms

colic **OR** earache **OR** cough **OR** hiccup **NOT** child

- Try instead:

- colic **OR** earache **OR** cough **OR** hiccup
- 1 **NOT** child

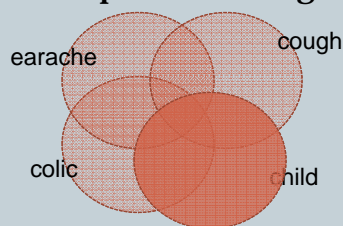
## Computer Processing (continued)

- You can also try this search


(colic **OR** earache **OR** cough ) **NOT** child

1 2

If the database allows the use of parenthesis to “nest” terms that should be processed together first

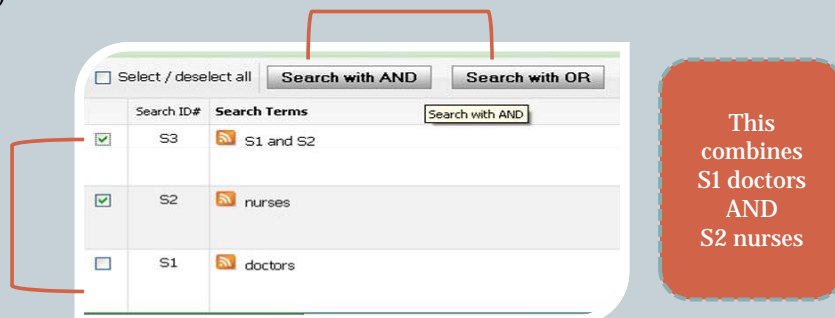





## Upper or Lower Case?

- 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 ID#	Search Terms
<input checked="" type="checkbox"/> S3	 S1 and S2
<input checked="" type="checkbox"/> S2	 nurses
<input type="checkbox"/> S1	 doctors

This combines S1 doctors AND S2 nurses

## 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 on 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

<input type="checkbox"/> Select / deselect all <span style="margin-left: 20px;">Search with AND</span> <span style="margin-left: 20px;">Search with OR</span>	
Search ID#	Search Terms
<input type="checkbox"/> S1	 cannabis AND memory

## Question 2: Search Strategy

2. *The effects of cannabis on memory **OR** thinking.*




**Search Strategy:**  
cannabis **AND**  
(memory **OR** thinking)

<input type="checkbox"/> Select / deselect all <span style="margin-left: 20px;">Search with AND</span> <span style="margin-left: 20px;">Search with OR</span>	
Search ID#	Search Terms
<input type="checkbox"/> S1	 cannabis (memory OR thinking)

**OR**

**OR**

- cannabis
- memory **OR** thinking
- 1 **AND** 2

<input type="checkbox"/> Select / deselect all <span style="margin-left: 20px;">Search with AND</span> <span style="margin-left: 20px;">Search with OR</span>	
Search ID#	Search Terms
<input type="checkbox"/> S3	 S1 and S2
<input checked="" type="checkbox"/> S2	 memory OR thinking
<input checked="" type="checkbox"/> S1	 cannabis

## 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

<input type="checkbox"/> Select / deselect all		Search with AND	Search with OR
Search ID#	Search Terms		
<input type="checkbox"/> S1	(cannabis OR mescaline) AND (memory OR thinking)		

**OR**

<input type="checkbox"/> Select / deselect all		Search with AND	Search with OR
Search ID#	Search Terms	Search with AND	
<input type="checkbox"/> S3	S1 and S2		
<input checked="" type="checkbox"/> S2	cannabis OR mescaline		
<input checked="" type="checkbox"/> S1	memory OR thinking		

## 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

<input type="checkbox"/> Select / deselect all		Search with AND	Search with OR
Search ID#	Search Terms		
<input type="checkbox"/> S1	(cannabis AND personality) NOT students		

**OR**

<input type="checkbox"/> Select / deselect all		Search with AND	Search with OR
Search ID#	Search Terms		
<input type="checkbox"/> S1	cannabis AND personality NOT students		