

PubMed/MEDLINE Advanced: Tips and Tools for Effective Searches

(Radiology Focused)



National Library of Medicine
www.nlm.nih.gov

NLM brochures and handouts: <http://nmlm.gov/gmr/training/handouts.html>

NLM PubMed Online Training: <http://www.nlm.nih.gov/bsd/disted/pubmed.html>

NN/LM Non-English Guides to PubMed: <http://nmlm.gov/training/resources/intlpubmedlinks.html>

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Freely available at: <http://nmlm.gov/training/resources/pubmedadv8.pdf>

Searching PubMed



Natural Language Searching

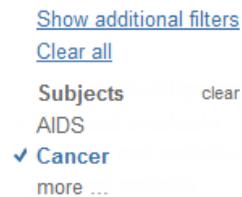
- Adding a specific radiological term increases the chances of getting appropriate citations (e.g. *breast cancer cat scan* or *lymph nodes MRI*)
- PubMed tries to match (or map) the term in the search box first with a **Medical Subject Heading (MeSH)** term, then as a **journal**, and then checks **author**; once a match is found, PubMed begins the citation search; this is called Automatic Term Mapping
- PubMed searches by the matched/mapped term(s) AND searches **All Fields** with the individual term(s)
- **NOTE:** PubMed may perform unexpectedly (see Example); review **Search details** after EVERY search

Using Boolean Operators – AND, OR, and NOT

- The default Boolean operator is AND
 - Boolean operators (AND, OR, and NOT) should be in upper case (e.g., *x-ray OR cat scan*)
 - PubMed processes the AND and OR Boolean operators in a left-to-right sequence
 - The NOT operator is processed first
- Nesting: PubMed creates nested arguments based on the information entered into the search box; changes to the PubMed-created order may be made in the Search details Query Translation box

Filters

PubMed offers filters to focus or limit searches.



- Use **Article Types** to select (for example) clinical trials and/or reviews
- Under **Show additional filters**, to limit to specific **Subjects**; the **Cancer** filter was created by NLM and the National Cancer Institute (NCI) to aid in searching for citations to cancer-related articles
- There are no radiological-specific Filters, but MEDLINE indexes more than 100 titles directly relevant to radiology

MeSH – Medical Subject Headings

The MEDLINE Medical Subject Headings (MeSH) is a powerful tool that collects together citations on specific topics (MeSH terms), no matter what related term or keyword an author uses. In the MESH database:

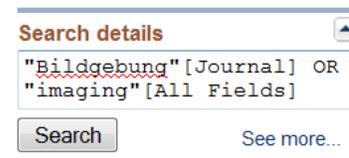


- Locate and select appropriate MeSH terms
- View the definition and other helpful information for a MeSH term including the MeSH hierarchy
- Attach subheadings for a search and/or limit MeSH terms to a major concept for a search
- Build PubMed search strategies

Example: How does PubMed map the term “imaging”? “Diffusion weighted imaging”?

Search PubMed by entering *imaging* in the Search box.

- Because PubMed did not find a MeSH term for *imaging*, PubMed next searched for a journal and found a match (*Imaging*, a.k.a. *Bildgebung*); PubMed then ran a citation search for the journal and for *imaging* in **All Fields** (including author, address, etc.)



- A similar problem occurs with the term *diffusion weighted imaging*; because the entire phrase is not recognized by PubMed, PubMed breaks apart the phrase, searching each term individually.

Click **See more** to access the full search details and to make changes and corrections in the **Search details** Query Translation box and search the **MeSH database** to locate the term PubMed uses to find related citations.

The MeSH Term Description Screen

Display Full shows all details on a term.

NCBI Resources How To My NCBI Sign In

MeSH MeSH diffusion weighted imaging Search

Save search Limits Advanced Help

Display Settings: Full

Send to:

Definition or meaning of the term is described. Compare this to your expected definition.

Diffusion Magnetic Resonance Imaging

A diagnostic technique that incorporates the measurement of molecular **diffusion** (such as water or metabolites) for tissue assessment by MRI. The degree of molecular movement can be measured by changes of apparent **diffusion** coefficient (ADC) with time, as reflected by tissue microstructure. **Diffusion** MRI has been used to study BRAIN ISCHEMIA and tumor response to treatment.

Year introduced: 2003

PubMed search builder options

[Subheadings:](#)

- | | | |
|--|--|--------------------------------------|
| <input type="checkbox"/> adverse effects | <input type="checkbox"/> instrumentation | <input type="checkbox"/> trends |
| <input type="checkbox"/> classification | <input type="checkbox"/> methods | <input type="checkbox"/> utilization |
| <input type="checkbox"/> contraindications | <input type="checkbox"/> standards | <input type="checkbox"/> veterinary |
| <input type="checkbox"/> economics | <input type="checkbox"/> statistics and numerical data | |

Use these check boxes to **restrict** the search to articles where the MeSH term is the major topic of the article or to use only the term in its broadest sense (**Do not...**).

- Restrict to MeSH Major Topic.
- Do not include MeSH terms found below this term in the MeSH hierarchy.

Entry Terms:

- Magnetic Resonance **Imaging, Diffusion**
- **Diffusion** MRI
- **Diffusion** MRIs
- **Diffusion Weighted** MRI
- MRI, **Diffusion Weighted**

Entry terms are terms that, when entered into the PubMed search box, will access this MeSH Heading.

Previous Indexing identifies terms that have changed over time and includes how PubMed identified articles on this same subject during the years listed.

Previous Indexing:

- [Magnetic Resonance Imaging \(1989-2002\)](#)
- [Magnetic Resonance Spectroscopy \(1964-1988\)](#)

PubMed search builder

Add terms to the PubMed search builder then Search PubMed

Add to search builder AND Search PubMed

Related information

Related Information allows quick searches in other databases.

- PubMed
- PubMed - Major Topic
- Clinical Queries
- NLM MeSH Browser

Search details

("diffusion"[MeSH Terms] OR diffusion[Text Word]) AND weighted[All Fields] AND imaging[All Fields]

Search See more...

Recent activity

diffusion weighted imaging (1) MeSH See more...

Subheadings provide a specific focus for a search. Use the check boxes to select the subheadings. Click on the Subheadings link to see a list of subheading definitions.

[All MeSH Categories](#)

[Analytical, Diagnostic and Therapeutic Techniques and Equipment Category](#)

[Diagnosis](#)

[Diagnostic Techniques and Procedures](#)

[Diagnostic Imaging](#)

[Magnetic Resonance Imaging](#)

Diffusion Magnetic Resonance Imaging

[Diffusion Tensor Imaging](#)

[All MeSH Categories](#)

[Analytical, Diagnostic and Therapeutic Techniques and Equipment Category](#)

[Diagnosis](#)

[Diagnostic Techniques and Procedures](#)

[Diagnostic Imaging](#)

[Tomography](#)

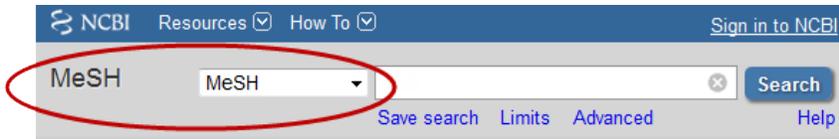
[Magnetic Resonance Imaging](#)

Diffusion Magnetic Resonance Imaging

[Imaging](#)

A MeSH term may appear in one or more **MeSH Hierarchy Trees**. In this case, the term is found in two places, under Tomography and under Magnetic Resonance Imaging.

- To find articles on a similar topic (to broaden your search), use a term above the selected MeSH term in the search.
- To narrow a search, making it more focused or specific, use the term below the selected term when available. In this case, Diffusion Magnetic Resonance Imaging is the most specific term (or lowest) on this MeSH Tree.



Access the MeSH Database in several ways

- From the drop-down menu in the search box, click **Search**
- From the *MeSH Database* link under **More Resources** on the PubMed homepage or in *Advanced*
- By accessing the *Abstract Supplemental Data*, (e.g. Publication Types, MeSH Terms) of a citation and clicking on a specific MeSH term



Finding the Accurate Term

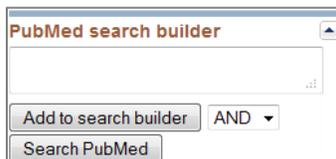
- A search in MeSH for *imaging* gives 585 results, the first of which is *Imaging, Three-Dimensional*; number 12 is *Diagnostic Imaging*

[Diagnostic Imaging](#)

12. Any visual display of structural or functional patterns of organs or tissues for diagnostic evaluation. It includes measuring physiologic and metabolic responses to physical and chemical stimuli, as well as ultramicroscopy.

Year introduced: 1988

- Always read the definition
- Click on *Diagnostic Imaging* link to see the hierarchy tree
- Click on individual terms for more information
- Once you find your terms, select any desired **Subheadings** and if they search is to be a **Major Topic** of the article, then click the **Add to search builder** button



- Add other terms if desired
- Click the **Search PubMed** button

Note: If a term is NOT in MeSH, try searching for the term in PubMed (in quotation marks if necessary)

- Locate an indexed (MEDLINE) citation using the term;
- Then open the *Abstract Supplemental Data* of the citation (by clicking on the minus sign)

Publication Types, MeSH Terms and examine the MeSH terms assigned by an indexer

Example: Find MeSH terms for:

1. Mammogram
2. Gated Radionuclide Angiography
3. CCTA

Answers:

1. Mammography
2. Gated Blood-Pool Imaging
3. Unfortunately, CCTA (Cardiac Computed Tomographic Angiography) is not yet in MeSH. Use two terms: Coronary Angiography AND Tomography, X-Ray Compute

Searching Tips

The All Fields or Keyword Search

- [All Fields] refers to the fact that every field in PubMed will be searched for the term in question – including author, title, abstract, address, grantor, substance name, journal, dates, MeSH term, etc.
- PubMed breaks apart search terms to retrieve the maximum number of possible results – which may be more than desired
- Use **Search details** to eliminate unwanted terms
 - **Example:** A search for *cat scan* also includes a search for (*"cat"[All Fields] AND "scan"[All Fields]*) – scans of kitty cats
- Use a general (or keyword) search for terms that are not in MeSH (especially those new to the field)
 - Add [TIAB] to a search to restrict the search to terms found in the title or abstract of an citation
- Add MEDLINE[sb] to restrict a search to only those citations that have been indexed (are part of MEDLINE) and especially when seeking potential MeSH terms
 - **Example:** Search for CCTA in the title or abstract of an indexed citation
CCTA[tiab] AND medline[sb]

Know Related MeSH Terms

- Once a Medical Subject Heading (MeSH) term is known, enter it directly into the PubMed search box without going through the MeSH Database. Also be aware when the term was added to the database.
 - **Example:** *Chemoradiotherapy* was added to the MeSH database in 2012.
For a comprehensive search, use the broader term: *Combined Modality Therapy*.

Subheadings [sh]

- The most precise way to search in most disciplines is to use MeSH subheadings, also known as qualifiers
- For radiological applications, the subheadings/qualifiers are useful ways to limit the retrieval set to specific radiological applications; using subheadings provides searchers with a specific focus to their search
- Five subheadings related to radiology – and their two letter codes – are:

Radiation Effects	RE	Radiotherapy	RT
Radiography	RA	Ultrasonography	US
Radionuclide Imaging	RI		
- Attach subheadings directly to MeSH terms using the format: *MeSH heading/subheading*; use either the two letter abbreviations for subheadings or the full subheading name
 - **Example:** The following three searches on radiotherapy of brain cancers produce identical results:
brain cancer/rt, brain cancer/RT or brain cancer/radiotherapy.
- Only one subheading may be attached to a MeSH heading at a time; to attach multiple subheadings, combine each MeSH heading/subheading with the OR connector
 - **Example:** Search for either ultrasonography or radionuclide imaging on the spine.
Use: *spine/ultrasonography OR spine/radionuclide imaging*
This is an identical search: *spine/us OR spine/ri*
- Case and spacing do not matter
 - **Example:** *radiography[sh] = radiography [sh] = RADIOGRAPHY[SH]*

Free-floating subheadings [sh]

- You may also choose to “free-float” a subheading with a MeSH heading using the Boolean AND and the subheading field tag of [sh]
- This strategy searches for radiography attached to **any** MeSH term, whether heart, dementia or another indexed term; capitalize the Boolean operators when using subheading tags
 - **Example:** Find radiology studies on heart patients with dementia.
heart AND dementia AND radiography [sh]

Additional MeSH Tags

PubMed seeks to find the most related terms by **exploding** MeSH Terms. When a MeSH heading is identified, **every** term under that heading in the hierarchy tree is also retrieved. For example, searching **Magnetic Resonance Imaging**, retrieves articles not only on MRIs, but also those articles focusing solely on *Diffusion Magnetic Resonance Imaging* or on *Echo-Planar Imaging*.

- Use the *Do Not Explode* tag [**mh:noexp**] to restrict searches to articles focusing on the broader concept
 - **Example:** Find general articles on radionuclide imaging.
Radionuclide Imaging [mh:noexp]
- [**Majr**] is the tag for **Major Topics** which restricts a search to citations where the selected term is the major topic or a main focus of the article. Note: [majr] = [MAJR] = [Majr]
 - *Major Topics* may be used in combination with the *Do Not Explode* command: [**majr:noexp**]

Tips Summary

- Use **Search details** to add to, subtract from and adjust a search
- Use **Search History** in *Advanced Search* to combine searches previously saved in My NCBI with new information and/or searches
- Use the **Search Builder** in the **Advanced** to identify MeSH terms and build PubMed searches
 - Use the drop down menu to select a field to search
 - Use the **Show Index** feature to reveal the number of citations used by that term

PubMed Advanced Search	
Search Builder	
Author	angiocardiography AND Add to Search Box
Location ID	
MeSH Major Topic	Show Index
MeSH Subheading	

- Use the **MeSH Database** to identify correct and appropriate search terms
- Use **MeSH Subheadings** and **Field Tags** to focus a search; Note: Tags should always follow the term, indicating the field to be searched
 - Incorrect entry: *[sh] radiotherapy*
 - Correct entry: *radiotherapy [sh]*
- Use **PubMed My NCBI** to save search strategies that may be used in future searches – and to save collections of citations
- Use the **NLM Catalog** to build a search based on specific journals (i.e. radiology-oriented), then run the search in PubMed and save it in My NCBI
- Use the online **PubMed Help** manual or the **Advanced PubMed Searching Resource Packet** for more information on the shorthand codes and a complete list of the possible search tags.
 - PubMed Help: <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=helppubmed>
 - Advanced PubMed Searching Resource Packet: <http://nmlm.gov/training/resources/pubmedpacket.doc>

Use My NCBI Customized services

- **My Bibliography:** Citations by a single author
- **Recent Activity:** Search strategies and viewed items are stored for six months
- **Collections:** Save individual citations to new or existing collections; share collections with others
- **Saved Searches:** Includes the option to have PubMed send email updates of the latest citations
- **Filters:** Available on the search results page

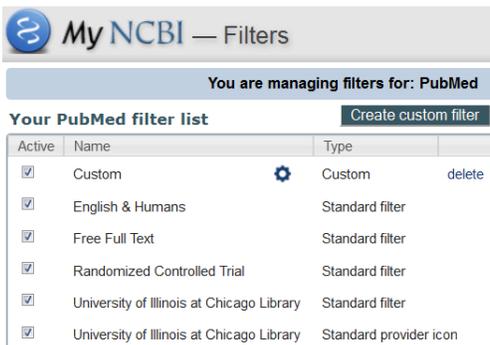
Set NCBI Site Preferences which include

- **Highlighting:** For search terms
- **Auto Suggest:** May be turned off
- **Shared settings:** That visitors may use
- **Abstract Supplemental Data:** Set **Open** to view MeSH headings while in Abstract view
- **Document delivery:** Options may be set
- **Result Display Settings:** Set how the search Results page will appear when signed in

Manage Filters

Filters groups search results by areas of interest. Access filters from **Manage Filters** either from the search **Results** page or in My NCBI

- Filters may be added to a PubMed search by first clicking on the filter link, then using the **Plus** sign; exception, Custom filters do not have plus signs
- A maximum of **fifteen** active filters may be set using My NCBI
- An infinite number of provider icons may be selected; these appear in the Abstract display format



- The **filter list** includes all currently active filters
- **Popular** identifies nine common filter options
- **LinkOut** provides filters from outside sources
- **Properties** includes filters related to Limits
- **Links** accesses citations with links to other NCBI databases



- **Custom Filters** permits the creation of a filter based on the search of your choice; however, a custom cannot be added to a search as other filters can

Add a Filter for a Specific Library

- First, verify there are less than fifteen active filters. If not, deselect a filter by unchecking the box of a filter no longer needed; the new library filter will become the fifteenth filter.
- Under **Browse/Search for PubMed Filters**, click **LinkOut** then search for all or part of the library name. Alternatively, click **Libraries** and then on the first letter of the organizational name.

Active	Filter	Link Icon	Name	Description
<input type="checkbox"/>	<input type="checkbox"/>		Add a result filter for items in the Libraries category.	
<input type="checkbox"/>	<input type="checkbox"/>		University of Ibadan-E. Latunde Odeku Medical Library, Nigeria (website)	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		University of Illinois at Chicago Library (website)	
<input type="checkbox"/>	<input type="checkbox"/>		University of Kansas Libraries (website)	

- Check the box(es) under Filter and, optionally, Link Icon. The filter will appear in the filter list and on the Results page after every search (see the highlighted **uiclib** above).

Exercises

Exercise 1: Find articles discussing diffusion weighted imaging on the lymph nodes of patients with either breast or liver cancer.

- In the MeSH database, locate the correct term for *diffusion weighted imaging* and use the search builder to send the term to PubMed
- In PubMed, add the remaining search terms; recommended – use capitalized Boolean terms with parentheses: AND lymph nodes AND (breast cancer OR liver cancer)
- Click **Search**
- Go into **Search Details** by clicking **See more**; adjust the search to accurately reflect the search question by changing misplaced parentheses and deleting the unneeded (split apart) terms
- Click the **Search** button to identify ~9 citations

Search Details

Query Translation:

```
"Diffusion Magnetic Resonance Imaging"[Mesh]
AND ("lymph nodes"[MeSH Terms] OR "lymph nodes"[All Fields])
AND (("breast neoplasms"[MeSH Terms] OR "breast
neoplasms"[All Fields] OR "breast cancer"[All Fields])
OR ("liver neoplasms"[MeSH Terms] OR "liver neoplasms"[All
Fields] OR "liver cancer"[All Fields]))
```

Search

URL

Exercise 2. Use the MeSH Database to identify articles discussing the adverse effects of MRIs in cancer patients. Limit these to articles focusing either on brain or breast cancer patients.

- In the MeSH database, search for **MRI**; click the correct MeSH term. Under **Subheadings**, select the box for **adverse events**, then use the **Add to Search builder** button
- Still in MeSH, search for **brain cancer** and select the correct term. Check **Restrict to MeSH Major Topic** and again use **Add to Search builder AND**
- Find the MeSH term for **breast cancer**, again select **Restrict to MeSH Major Topic**, but this time use **Add to Search builder OR**
- In the search box, adjust PubMed's default parentheses to reflect the correct search strategy
- Click the **Search PubMed** button for ~10 results

Subheadings:

- adverse effects
- classification
- contraindications

- Restrict to MeSH Major Topic.
- Do not include MeSH terms found

```
"Magnetic Resonance Imaging/adverse effects"[Mesh] AND
("Brain Neoplasms"[Majr] OR "Breast Neoplasms"[Majr])
```

Exercise 3: Find articles on clinical trials on the risk of stroke with Cardiac CT Angiography on female patients.

- Searching PubMed for *Cardiac CT Angiography* gives inaccurate results (see Search details). Either:
 - Search PubMed with the term in quotation marks ("Cardiac CT Angiography"); look for an indexed citation ([indexed for MEDLINE]; and examine the Publication types
 - OR Search MeSH and review terms related to Angiography and CT scans

The results of the above show the two MeSH terms currently used to identify articles on CCTA are: **Coronary Angiography [MeSH] AND Tomography, X-Ray Computed [MeSH]**. Search using this phrase.

- Use the **Filter** links for **Article types – Clinical Trial** and **Sex – Female**. (~303 citations.)
- Add *stroke* to the search to retrieve ~12 citations.
 - Either add **AND stroke** to the end of the search string (in the Search box or in Search details box)
 - Alternatively, search for *stroke* separately and use the Advanced search builder to combine the two searches

Exercise 4: Optional: Add a My NCBI filter to identify articles available through your library.

- Follow the steps listed on page 7.