The Medical Subject Headings (MeSH®) thesaurus is a controlled vocabulary produced by the National Library of Medicine and used for indexing, cataloging, and searching for biomedical and health-related information and documents.

MeSH includes the subject descriptors appearing in MEDLINE®/PubMed®, the NLM catalog database, and other NLM databases.

Many synonyms, near-synonyms, and closely related concepts are included as entry terms to help users find the most relevant MeSH descriptor for the concept they are seeking. In NLM's online databases, many terms entered by searchers are automatically mapped to MeSH descriptors to facilitate retrieval of relevant information.

Various online systems provide access to MeSH and the vocabulary is available in several online systems. These include the MeSH Browser, containing the complete contents of the vocabulary; the MeSH Entrez databases, which are designed to assist those searching MEDLINE®/PubMed®; and the UMLS Metathesaurus® with links to many other controlled vocabularies. Additional information about MeSH and direct access to MeSH data is provided on the Web at [//www.nlm.nih.gov/mesh](https://www.nlm.nih.gov/mesh).

**2. History of MeSH**

The first official list of subject headings published by the National Library of Medicine appeared in 1954 under the title Subject Heading Authority List. It was based on the internal authority list that had been used for publication of Current List of Medical Literature which in turn had incorporated headings from the Library's Index-Catalogue and from the 1940 Quarterly Cumulative Index Medicus Subject Headings. With the inception of Index Medicus (New Series) in 1960, a new and thoroughly revised Medical Subject Headings appeared.

With the 1954 Subject Heading Authority List, there appeared a "Categorical Listing" of standard subheadings. "Abnormalities," for instance, was listed as a standard subheading for use with terms for organs, tissues, and regions, and "anesthesia and analgesia" was to be used under surgical procedure headings. But such subheadings could be used only for subject headings which fell within the category of headings to which they were to be applied. There were over 100 such subheadings, some of which varied only slightly according to the category of main heading with which they were used. For instance, "therapeutic use" was used under physical agents and drugs and chemicals, and "therapy" was used with diseases. In the 1960 Medical Subject Headings, the number of subheadings was reduced to sixty-seven. They could be used under any kind of main heading if the combination was not patently foolish or impossible. These sixty-seven subheadings were applied with more generalized meanings. For instance, the subheading "therapy" was used to mean "therapy of," "therapeutic use of" or just "therapeutic aspects." Though this solution was simpler, many problems still remained. The use of one subheading might prevent the use of another. For instance, if a paper covered the etiology, pathology, and therapy of a disease, it might occur without further subdivision, or it might occur under the subheading which seemed most appropriate to the indexer. If "therapy" was chosen, the article would be lost to the searcher looking for the etiology of the disease under the subheading "etiology." In addition, if the subheading "diseases" had been appended to the term for an anatomic part, it would not be possible to subdivide further for the therapy or complications of such diseases. A related problem was the overlap in meaning of the subheadings themselves. It was difficult, for example, to decide whether a paper on chemical biosynthesis fit best under "chemistry" or "metabolism."

Categorized lists of terms were printed for the first time in the 1963 *Medical Subject Headings* and contained thirteen main categories and a total of fifty-eight separate groups in subcategories and main categories. These categorized lists made it possible for the user to find many more related terms than were in the former cross-reference structure. In 1963, the second edition of *Medical Subject Headings* contained 5,700 descriptors, compared with 4,400 in the 1960 edition. Of the headings used in the 1960 list, 113 were withdrawn in favor of newer terms. In contrast, the 2015 edition of MeSH contains 27,455 descriptors.

In 1960, medical librarianship was on the cusp of a revolution. The first issue of the new *Index Medicus* series was published. On the horizon was a computerization project undertaken by the National Library of Medicine (NLM) to store and retrieve information. The Medical Literature Analysis and Retrieval System (MEDLARS®) would speed the publication process for bibliographies such as *Index Medicus*, facilitate the expansion of coverage of the literature, and permit searches for individuals upon demand. The new list of subject headings introduced in 1960 was the underpinning of the analysis and retrieval operation. MeSH was a new and thoroughly revised version of lists of subject headings compiled by NLM for its bibliographies and cataloging. Frank B. Rogers, then NLM director, announced several innovations as he introduced MeSH in 1960.

*The adoption of a single subject authority list for both books and periodical articles is a departure from traditional practice. We take the view that subject cataloging and periodical indexing, as exemplified in the Index Medicus and in the NLM Catalog, are identical processes in their major dimensions. A single list can and should be used for both purposes. This has two major virtues: simplicity for users, in requiring familiarity with only a single scheme; and economy to the Library in the development and maintenance of a single scheme.*

*There is another departure from traditional practice represented in this list. This is the adoption of standard topical subheadings for cataloging books, as well as for indexing periodical articles. The topical subheading is in effect a substitute for a phrase heading, and on the whole it is a preferable substitute.*

*The main heading-topical subheading combination is a pre-coordination of terms, reducing the problem of term permutation, which looms large in most manual retrieval systems in book form.*

From its beginning, MeSH was intended to be a dynamic list, with procedures for recommending and examining the need for new headings. The content of the vocabulary related to the usage of terms in the literature itself and evolved to meet new concepts in the field. The use of the computer made revisions more practical and systematic, despite the difficulty in updating printed indexes and card catalogs.

**3. Preface to the 1960 Edition (including organizing principles)**

The following organizing principles, reprinted from the *Medical Subject Headings*, 1st edition, 1960, continue to be used in the creation and maintenance of the MeSH vocabulary. This text was prepared when the *Index Medicus* was the primary finding tool of the National Library of Medicine for article citations and was an annual printed work. It is now replaced by the various online databases.

*Preface*

*Here is presented the subject heading authority list of the National Library of Medicine. These subject headings are used in the compilation of the new Index Medicus and in the National Library of Medicine Catalog, beginning 1960.*

*The list represents a combination, rationalization, and extensive modification of two previous authority lists. One was a list, maintained only as a card file, which was utilized in the subject cataloging of books. The other was the Subject Heading Authority List used in the old Current List of Medical Literature; this was published in 1954 and underwent several internal revisions over the course of the years.*

*The adoption of a single subject authority list for both books and periodical articles is a departure from traditional practice. The rationale of this position was set forth in "Applications and Limitations of Subject Headings: The Pure and Applied Sciences" a paper printed in the* Subject Analysis of Library Materials*, edited by Maurice F. Tauber, published by the School of Library Service, Columbia University, 1953. Much has been made of the presumed differences between headings used for cataloging and headings used for indexing; most of the difficulty lies in the ambiguity of the word "indexing". This has ordinarily thought of in terms of indexing a book. A book index is made up on an ad hoc basis; there is a brand new conceptual scheme evolved for every book indexed. It should be clear that the construction of continuing indexes in multiple periodicals is quite a different matter. We take the view that subject cataloging and periodical indexing, as exemplified in the Index Medicus and in the NLM Catalog, are identical processes in their major dimensions. A single list can and should be used for both purposes. This has two major virtues: simplicity for users, in requiring familiarity with only a single scheme; and economy to the Library in the development and maintenance of a single scheme.*

*The Introduction*

*Medical information "has been drawn from such a wide span of time and such a diversity of specialized fields that its doctrines belong to several different systems and its language problem is almost as bad as that of India. There is at least one major language for each major department, and each of these has several dialects. The situation is made even worse because in each language we teach a mixture of doctrines which range from Newtonian absolutism to Einsteinian relativism, including additive, reciprocal, exponential, and circular structures. It is tragic to contemplate the amount of effort we now waste because of our conflicting doctrines, and intriguing to wonder to what heights we might soar, each in his own way, once we manage to resolve the internal contradictions in the system by which we live and work."1 There will be less frustration on the part of librarians and other users of catalogs, indexes, and bibliographies if it is realized that the complexities of the field are such that simple, unequivocal solutions to the problem of the form and substance of medical subject headings are not easy to find.*

*From one point of view, subject headings may be looked at as an artificial language which bears only superficial resemblances to the natural language. Subject headings are more stilted, more stereotyped. From another point of view, in subject headings conceived of as pointers, rather than as labels, a certain amount of ambivalence is tolerable. Suppose, for example, we find a sign reading "San Francisco" pointing west on Independence Avenue in Washington, DC. This would not be very helpful. If, however, we see the same sign on the outskirts of Sacramento, it is likely to be very helpful indeed. And if we see the same sign on the approaches to the bridge outside of Oakland, we know we have arrived. It does not prejudice our case at all if some wise man comes up to us and says, "Exactly what do you mean by San Francisco? Do you mean the City of San Francisco, or the metropolitan area of San Francisco? Exactly where are the corporate city limits located?" A satisfactory answer might be that, having arrived, we will consult one of the local inhabitants if such distinctions seem important to us. On the other hand, we would like to be sure that the sign on the outskirts of Sacramento refers to the city in California rather than the city of the same name in Argentina. It is likely that in most cases we will be reassured on this point from the circumstances of the locale - the context - in which the sign is found. These headings are meant for use with biomedical literature and in biomedical libraries. They usually designate narrow and specific biomedical concepts. In peripheral fields headings used are more general in import: Automobiles appears in the list but not Hot-Rods, or Trucks. And when Vehicles appears, it may be assumed that in context this means pharmaceutical vehicles rather than vehicles of the four-wheeled kind Also, since medical libraries, are bibliothecal as well as medical, by definition, bibliothecal terms such as 'Subject Headings', may also be found in this list.*

*Form of Headings*

*General: There is a preference for headings using the direct rather than the inverted form; thus Mitral Valve, rather than Valve, Mitral. In a number of instances, however, inverted forms are used. This is particularly in evidence in those cases where it is possible, in a series of inverted headings, to provide built-in annotations by virtue of the fact that surrounding headings tend to define the scope of a particular headings. Thus,*

*Psychoses, AlcoholicPsychoses, InvolutionalPsychoses, Senil*

*are self-annotating as a group. Similar groups appear under Reflex, under Carcinoma, under Chemistry, and so forth. But there are always exceptions to the exceptions. Though we say Chemistry, Analytic nevertheless we say Biochemistry rather than Chemistry, Physiological. In most cases. Cross-references are provided.*

*Spelling:*

*American rather than British spelling is preferred: thus Anesthesia rather than Anaesthesia. Occasionally this leads to difficulties. For example, Amoeba is used rather than Ameba because that form of the name is preferred in taxonomical nomenclature' Nevertheless, when we name the disease, we say Amebiasis rather than Amoebiasis.*

*Bias:*

*If a hundred books and articles appear on Krebiozen, that is what they are about, and they will be so entered in the catalog. On the other hand, we try to avoid burdening the list with hundreds of terms for special practices.*

*Englishing:*

*There are some terms in the foreign literature which defy translation into English; they designate concepts which are unknown in the English literature. In some cases we have found no solution except to anglicize the foreign term. Thus radiesthesia, and reflexotherapy, describe concepts appearing in the French and German literature, and in terms similar to the original French and German. In other instances such a practice would be extremely misleading. For instance, German literature has material on a concept best translated as respiratory therapy. we do not use such a designation because of the ambiguity it would hold for the English-speaking (and no doubt the Spanish-speaking and the Italian-speaking) community. The 'solutions' of such unusual cases are a good deal less than perfect, as witness our use of Breathing Exercises to cover the concept of Respiratory Therapy, since this seems to be the predominant element in this type of treatment.*

*Eponyms:*

*We avoid eponyms whenever and wherever possible. That so many eponymics remain in the list is merely an indication that in a great many instances satisfactory substitutes are unavailable.*

*Choice of terms:*

*We have tried to use terms in the form and with the definitions set forth in standard reference works, when these can be made to agree. Thus, the names of bacterial genera are from the latest edition of* Bergey's Manual*, the names of neoplasms are the terms preferred in the American Cancer Society's* Manual of Tumor Nomenclature*; the names of enzyme groups are those promulgated by a Committee of the National Research Council; the names of drugs are the generic terms proposed by the American Medical Association's Council on Drugs: and so forth. Exceptions do occur; excepting oversights, or those cases in which it has been necessary to accept a term prior to its normalization in a standard reference work, exceptions have been made only after due deliberation.*

1Swanson, M. *J Bowman Gray Sch Med.* 1959 Jun; 17:45-9.

MeSH Record Types

The following is a list of the three basic types of MeSH Records: Descriptors, Qualifiers, and Supplementary Concept Records (SCRs)

Descriptors

This record type plays a central role in MeSH vocabulary as a unit of Indexing and retrieval. With the exception of Class 3 Descriptors, all descriptors are organised into a numbered tree structure or hierarchy that allows users to browse in a orderly fashion from broader to narrower topics. Descriptors are divided into four classes.

**Class 1 Descriptors - Main Headings**

These records are topical headings that are used to index citations in NLM's MEDLINE database, for cataloging of publications, and other databases, and are searchable in PubMed as [MH]. Most Descriptors indicate the subject of an indexed item, such as a journal article, that is, what the article is about. Descriptors are generally updated on an annual basis but may, on occasion, be updated more frequently.

**Class 2 Descriptors - Publication Characteristics (Publication Types)**

These records indicate what the indexed item is, i.e., its genre, rather than what it is about, for example, *Historical Article*. They may include *Publication Components*, such as *Charts*; *Publication Formats*, such as *Editorial*; and *Study Characteristics*, such as *Clinical Trial*. They function as metadata, rather than being about the content. These records are searchable in PubMed as Publication Type [PT], and the terms in MEDLINE records are labeled as "PT" or <PublicationType> rather than "MH" or <MeSHHeading>. They are listed in category V of the **[MeSH Tree Structures](https://www.nlm.nih.gov/mesh/intro_trees.html)**. A list is available of [**Publication Types, with Scope Notes**](https://www.nlm.nih.gov/mesh/pubtypes.html).

**Class 3 Descriptors - Check Tags**

This class of descriptors is used solely for tagging citations that contain certain categories of information. They do not appear in the MeSH tree. Modernization has largely eliminated the need for the data type and many of the Check Tags have been changed to Class 1 headings that can be used either a MH or a Check Tag. Currently only two Class 3 descriptors remain: "Male" and "Female".

**Class 4 Descriptors - Geographics**

Descriptors which include continents, regions, countries, states, and other geographic subdivisions. They are not used to characterize subject content but rather physical location. They are listed in category Z of the **[MeSH Tree Structures](https://www.nlm.nih.gov/mesh/intro_trees.html)**.

Qualifiers

There are 81 topical Qualifiers (also known as Subheadings) used for indexing and cataloging in conjunction with Descriptors. Qualifiers afford a convenient means of grouping together those citations which are concerned with a particular aspect of a subject. For example, *Liver/drug effects* indicates that the article or book is not about the liver in general, but about the effect of drugs on the liver Qualifiers are searchable in PubMed as MeSH Subheadings [SH]. There is only a single type of Qualifiers in MeSH. The qualifers are listed below.

* [**Qualifiers, with Scope Notes**](https://www.nlm.nih.gov/mesh/topsubscope.html)
* [**Qualifiers by Allowable Category**](https://www.nlm.nih.gov/mesh/topcat.html) (also known as AQ Lists)
* [**Qualifier Tree Hierarchy**](https://www.nlm.nih.gov/mesh/subhierarchy.html)

Supplementary Records

Supplementary Records, also called Supplementary Chemical Records(SCRs), are used to index chemicals, drugs, and other concepts such as rare diseases for MEDLINE and are searchable by Substance Name [NM] in PubMed. Unlike Descriptors, SCRs are not organised in a tree hierarchy. Instead each SCR is linked to one or more Descriptors by the [**Heading Mapped To (HM) field**](https://www.nlm.nih.gov/mesh/xml_data_elements.html#HeadingMappedTo) in the SCR. They also include a [**Indexing Information (II) field**](https://www.nlm.nih.gov/mesh/xml_data_elements.html#IndexingInformation) field that is used to refer to other descriptors that are from related topics. SCRs are created daily and distributed nightly Monday-Thursday. There are currently over 230,000 SCR records with over 505,000 SCR terms. Like all MeSH records, SCRs are searchable in the **[MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html)**. Four classes of SCRs exist.

**Class 1 Supplementary Records - Chemicals**

These records are dedicated to chemicals and are primarily heading mapped to the D tree descriptors.

**Class 2 Supplementary Records - Protocols**

These records are dedicated to Chemotherapy Protocols. They are heading mapped to the MeSH heading "Antineoplastic Combined Chemotherapy Protocols" and to chemicals used in the protocols found in D tree descriptors.

**Class 3 Supplementary Records - Diseases**

These records are dedicated to diseases and are primarily heading mapped to the C tree descriptors and anatomical headings found in the A tree.

**Class 4 Supplementary Records - Organisms (new for 2018 MeSH)**

These records are dedicated to organisms (e.g., viruses) and are primarily heading mapped to the B tree organism descriptors.

# Entry Terms and Other Cross-References

### **1. Entry Terms**

Entry terms, sometimes called "See cross-references" in printed listings, are synonyms, alternate forms, and other closely related terms in a given MeSH record that are generally used interchangeably with the preferred term for the purposes of indexing and retrieval, thus increasing the access points to MeSH-indexed data. Entry terms range from variations in form such as Heart Arrest and Arrest, Heart to substantial synonyms such as Heart Arrest and Asystole. Entry Terms are displayed as the **Entry Term** in the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html), and exist as the <[Term](https://www.nlm.nih.gov/mesh/xml_data_elements.html#Term)> element in XML MeSH.
Entry terms are not always strictly synonymous with the preferred term in the record or with each other. However, for the purpose of organizing the NLM-indexed literature, fine granularity is not always required, so the entry terms are equivalent to the preferred term for purposes of indexing and retrieval. Note, however, XML MeSH does identify strict synonymy between subsets of terms within a record. See the <[Concept](https://www.nlm.nih.gov/mesh/xml_data_elements.html#Concept)> element in XML MeSH and [Concept Structure in XML MeSH Data](https://www.nlm.nih.gov/mesh/concept_structure.html).

### **2. Other cross-references**

Three kinds of informative references suggest other Descriptors in MeSH that relate to the subject and that may be useful in indexing, cataloging, or searching a particular topic.

**2.1 See Related**

See related references, also known as "associative relationships" are used for a variety of relationships between Descriptor records where a user of one Descriptor is reminded of another Descriptor which may be more appropriate for a particular purpose. For example, the relationship may be between a disease and its cause:

 Factor XIII Deficiency **see related** Factor XIIIa

Or between an organ and a physiological process :

 Bone and Bones **see related** Osteogenesis

Or between an organ and a drug acting on it :

 Bronchi **see related** Bronchoconstrictor Agents

Or between an organ and a procedure:

 Bile Ducts **see related** Cholangiography

In the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html) the See Related reference is displayed as **See Also**, and is the <[SeeRelatedDescriptor](https://www.nlm.nih.gov/mesh/xml_data_elements.html%22%20%5Cl%20%22SeeRelatedDescriptor)> element in XML MeSH. For further discussion see [Relationships in Medical Subject Headings](https://www.nlm.nih.gov/mesh/meshrels.html).

**2.2 Consider Also**

Reference to other Descriptors having related linguistic roots, for example:

 Brain **consider also** terms at CEREBR- and ENCEPHAL-.

The Consider Also reference is used is primarily with anatomical Descriptors to refer to groups of Descriptors beginning with a common stem rather than to a single Descriptor. In the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html) the reference is displayed as **Consider Also**, and as the <[ConsiderAlso](https://www.nlm.nih.gov/mesh/xml_data_elements.html%22%20%5Cl%20%22ConsiderAlso)> element in XML MeSH.

**2.3 Entry Combination**

In some NLM systems using MeSH, certain Descriptor/Qualifier combinations are prohibited by a special MeSH data element called the <[EntryCombination](https://www.nlm.nih.gov/mesh/xml_data_elements.html%22%20%5Cl%20%22EntryCombination)> in XML MeSH, and **Entry Combination** in the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html). For example, the Descriptor Accidents cannot be used with the Qualifier  prevention & control, but instead of this combination, the Descriptor Accident Prevention should be used.

**2.4 MeSH Tree Structures**

In some thesauri the function cross references to broader and narrower terms is comparable to the hierarchical relationships in the [MeSH Tree Structures](https://www.nlm.nih.gov/mesh/intro_trees.html), though hierarchies enable multiple levels of specificity, as do the MeSH Trees. These relationships are displayed graphically in the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html) and the [online MeSH Tree Structures](https://www.nlm.nih.gov/mesh/trees.html). The Trees data are also used by PubMed for the default behavior of inclusive searching. The Trees data in XML MeSH are to be found in the [TreeNumber](https://www.nlm.nih.gov/mesh/xml_data_elements.html%22%20%5Cl%20%22TreeNumber) element

# MeSH Tree Structures

MeSH descriptors are organized in 16 categories: category A for anatomic terms, category B for organisms, C for diseases, D for drugs and chemicals, etc. Each category is further divided into subcategories. Within each subcategory, descriptors are arrayed hierarchically from most general to most specific in up to thirteen hierarchical levels. These trees should not be regarded as representing an authoritative subject classification system but rather as arrangements of descriptors for the guidance and convenience of persons who are assigning subject headings to documents or are searching for literature. The trees are not an exhaustive classification of the subject matter but contain only those terms that have been selected for inclusion in this thesaurus. Their structure frequently represents a compromise among the views and needs of particular disciplines and users, in the absence of any single universally accepted arrangement.

Because of the branching structure of the hierarchies, these lists are sometimes referred to as "trees". Each MeSH descriptor appears in at least one place in the trees, and may appear in as many additional places as may be appropriate. Those who index articles or catalog books are instructed to find and use the most specific MeSH descriptor that is available to represent each indexable concept. For example, articles concerning Streptococcus pneumoniae will be found under the descriptor Streptococcus Pneumoniae rather than the broader term Streptococcus, while an article referring to a new streptococcal bacterium which is not yet in the vocabulary will be listed directly under Streptococcus. Accordingly, the user may consult the trees to find additional subject headings which are more specific than a given heading, and broader headings as well. For example, under Abnormalities, there are specific abnormalities:

Congenital Abnormalities C16.131
    Abnormalities, Drug Induced C16.131.042
    Abnormalities, Multiple C16.131.077
        22q11 Deletion Syndrome C16.131.077.019
            DiGeorge Syndrome C16.131.077.019.500
        Alagille Syndrome C16.131.77.65
        Alstrom Syndrome C16.131.77.80
        Angelman Syndrome C16.131.77.95

In the [MeSH Browser](https://www.nlm.nih.gov/mesh/2016/mesh_browser/MBrowser.html%22%20%5Co%20%22MeSH%20Browser), each descriptor is followed by the number that indicates its tree location. It may also be followed by one or more additional numbers, in smaller type, and truncated at the third level, indicating other tree locations of the same term. The numbers serve only to locate the descriptors in each tree and to alphabetize those at a given tree level. They have no intrinsic significance; e.g., the fact that D12.776.641 and D12.644.641 both have the three digit group 641 does not imply any common characteristic. The numbers are subject to change when new descriptors are added or the hierarchical arrangement is revised to reflect vocabulary changes

# Concept Structure in MeSH

Terms in a MeSH record which are strictly synonymous with each other are grouped in a category called a "Concept." (Not to be confused with Supplementary Concept Records.) See the [Concept](https://www.nlm.nih.gov/mesh/xml_data_elements.html#Concept) element in MeSH. Each MeSH record consists of one or more Concepts, and each Concept consists in one or more synonymous terms. For example,

Cardiomegaly [Descriptor]

 Cardiomegaly [Concept, Preferred]

 Cardiomegaly [Term, Preferred]

 Enlarged Heart [Term]

 Heart Enlargement [Term]

 Cardiac Hypertrophy [Concept, Narrower]

 Cardiac Hypertrophy [Term, Preferred]

 Heart Hypertrophy [Term]

This Descriptor record consists of two Concepts and five terms. Each Concept has a Preferred Term, which is also said to be the name of the Concept. And each record has a Preferred Concept. The name of the record - the term most often used to refer to the Descriptor - is the Preferred Term of the preferred Concept.

Within each Concept the terms are synonymous with each other. In contrast, the terms in one Concept are not strictly synonymous with terms in another Concept, even in the same record. For example, one concept in a record may be narrower than the Preferred Concept, as in the above example. Also note that the terms in a concept inherit this relationship and so are narrower, for example, than the terms in the other concept. However, all the terms in a record are equivalent for purposes of indexing and searching MEDLINE and so they are still entry terms for the record.

A more complex example, with three Concepts and 12 terms.

AIDS Dementia Complex [Descriptor]

 AIDS Dementia Complex [Concept, Preferred]

 AIDS Dementia Complex [Term, Preferred]

 Acquired-Immune Deficiency Syndrome Dementia Complex [Term]

 AIDS-Related Dementia Complex [Term]

 HIV Dementia [Term]

 Dementia Complex, Acquired Immune Deficiency Syndrome [Term]

 Dementia Complex, AIDS-Related [Term]

 HIV Encephalopathy [Concept, Narrower]

 HIV Encephalopathy [Term, Preferred]

 AIDS Encephalopathy [Term]

 Encephalopathy, HIV [Term, Preferred]

 Encephalopathy, AIDS [Term]

 HIV-1-Associated Cognitive Motor Complex [Concept, Narrower]

 HIV-1-Associated Cognitive Motor Complex [Term, Preferred]

 HIV-1 Cognitive and Motor Complex [Term]

Another example :

Exercise [Descriptor]

 Exercise [Concept, Preferred]

 Exercise [Term, Preferred]

 Exercise, Physical [Term]

 Exercise, Aerobic [Concept, Narrower]

 Exercise, Aerobic [Term, Preferred]

 Aerobic Exercise [Term]

 Exercise, Isometric [Concept, Narrower]

 Exercise, Isometric [Term, Preferred]

 Isometric Exercise [Term]

An example of a chemical (partial record).

Aspirin [Descriptor]

 Aspirin [Concept, Preferred]

 Aspirin [Term, Preferred]

 Acetylsalicylic Acid [Term]

 2-(Acetyloxy)benzoic Acid [Term]

 Solprin [Concept, Narrower]

 Solprin [Term, Preferred]

 Ecotrin [Concept, Narrower]

 Ecotrin [Term, Preferred]

The Descriptor/Concept/Term structure makes it possible to attach various data elements in MeSH to the appropriate object. For example, thesauri have long distinguished between "broader terms" and "narrower" terms, but it is clear that these are relations between concepts and only derivatively between terms in the concepts. (See the [ConceptRelation](https://www.nlm.nih.gov/mesh/xml_data_elements.html%22%20%5Cl%20%22ConceptRelation) element.) Similarly, [Scope Notes](https://www.nlm.nih.gov/mesh/xml_data_elements.html#ScopeNote) are properly attributed to Concepts, while the [Annotation](https://www.nlm.nih.gov/mesh/xml_data_elements.html#Annotation) applies to the record level. The Concept structure also provides a precise way to specify strict synonymy since Concepts by definition consist of synonymous terms.

Note that this three-tiered structure is within a given record, not between separate records. This is in contrast to the [MeSH Tree Structures](https://www.nlm.nih.gov/mesh/intro_trees.html), which are hierarchical in structure, but the relationships are between different Descriptor records. MeSH includes both types of relationships. See "Concepts, Synonyms, and Descriptor Structure" in [Introduction to MeSH in XML format](https://www.nlm.nih.gov/mesh/xmlmesh.html).

The MeSH Concept structure is not currently used in MEDLINE indexing or PubMed searching but is used by MeSH analysts in creating and updating the MeSH vocabulary and it supports relationships with other systems such as NLM's [Unified Medical Language System](https://www.nlm.nih.gov/research/umls/umlsmain.html). The Concept structure is also used by The MeSH Translation Maintenance System\* and has potential use for more advanced technology in information retrieval and other applications. For more information see the following:

1. "Concepts, synonyms, and Descriptor structure" in [Introduction to MeSH in XML format](https://www.nlm.nih.gov/mesh/xmlmesh.html).

2. NLM Technical Bulletin article [Changes in MeSH Data Structure](https://www.nlm.nih.gov/pubs/techbull/ma00/ma00_mesh.html) (includes the example "AIDS Dementia Complex").

3. Book Chapter [Relationships in Medical Subject Headings](https://www.nlm.nih.gov/mesh/meshrels.html)

# Use of MeSH in Online Retrieval

The MeSH vocabulary is designed for use by NLM for indexing and searching of the MEDLINE database of journal citations and other data. This enables retrieval systems, such as NLM's PubMed, to provide subject searching of the data. The following includes features of MeSH used for searching. See also [Use of MeSH in Indexing](https://www.nlm.nih.gov/mesh/intro_indexing.html).

### **1. Combining specific MeSH Descriptors in searching for complex subjects**

Often a particular subject of a journal article is represented by multiple MeSH Descriptors or Qualifiers. For example, the subject of jejunal enteritis is expressed by the use of the Descriptors Jejunum and Enteritis, so in PubMed a searcher would combine these Descriptors in a query. Similarly Qualifiers can be used in conjunction with appropriate Descriptors. For example, a deficiency of monoamine oxidase is retrieved by the Descriptor Monoamine Oxidase combined with the Qualifier /deficiency. Information about combining a particular MeSH Descriptor is sometimes stored in the [Annotation](https://www.nlm.nih.gov/mesh/xml_data_elements.html#Annotation) field, which may be viewed in the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html).

Not all complex subjects require a combination of terms. When a particular complex subject occurs frequently in the indexed literature, a single Descriptor may be created. For example, to search the subject of arm injuries, instead of combining the Descriptor Arm with the Qualifier/injuries, the single Descriptor Arm Injuries is used.

### **2. Inclusive retrieval and MeSH Tree Structures**

When using a MeSH Descriptor to search, PubMed automatically searches on narrower Descriptors indented under it in the [MeSH Tree Structures](https://www.nlm.nih.gov/mesh/intro_trees.html). Thus, for example, searching Pneumoconiosis retrieves not only articles indexed with that Descriptor but also citations indexed to each of the specific pneumoconioses under it in the Tree Structures:

 Pneumoconiosis

 Asbestosis

 Berylliosis

 Byssinosis

 Caplan's Syndrome

 Siderosis

 Silicosis

 Anthracosilicosis

 Silicotuberculosis

(The Tree Structure for a given Descriptor is automatically displayed in the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html).) This type of search is sometimes called "exploding" the Descriptor. If a PubMed searcher wants to search only the broader subject - without the indented subjects, the search is qualified with the tag "[mh:noexp]".

### **3. Finding the desired MeSH indexing concept by iterative searching of citations**

If the searcher has no idea what MeSH term or terms have been used in indexing relevant literature, a useful strategy is to begin with a text word search. Having found a few good citations, then the searcher may look at the MeSH terms used in indexing and identify those that will retrieve further relevant citations. One of the greatest advantages of an online system is the opportunity it affords one to perform a heuristic iterative search in this manner. This is particularly helpful for the occasional searcher or when searching in areas of very rapid change where MeSH may be less developed or indexing less consistent. For example, if a user is interested in "scalp diseases" - a term not in MeSH, they could search this term in PubMed (title and/or abstract). Then seeing citations that looked particularly relevant, the user could look at the citation record (MEDLINE format), and find the MH term Scalp Dermatoses. This term would then be the basis of a new search.

### **4. Using the MeSH Browser to find an appropriate MeSH search term**

If a searcher is not familiar with the MeSH vocabulary the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html) provides an excellent means for searching MeSH to find an appropriate Descriptor.

**4.1 Text word searching of MeSH terms and notes**

For example, if you are interested in "SARS" [Severe Acute Respiratory Syndrome], a search of the MeSH Browser will retrieve all MeSH terms containing the text word "sars", including synonyms and other entry terms. In this example, the user will easily see SARS Virus on the list, which will have additional information. Searching MeSH Scope Notes (definitions) can also be helpful, particularly if the text word is not common. Using the "SARS" example, if a user checks the radio button "Text words in Annotation & Scope Note."



**4.2 Navigating the MeSH Tree Structures**

The MeSH Tree Structures are a hierarchical display so that broader and narrower Descriptors are displayed. For example,

 Neoplasms [C04]>

 Neoplasms by Site [C04.588]

 Abdominal Neoplasms [C04.588.033] +

 Anal Gland Neoplasms [C04.588.083]

 Bone Neoplasms [C04.588.149] +

 Breast Neoplasms [C04.588.180]

 Breast Neoplasms, Male [C04.588.180.260]

 Carcinoma, Ductal, Breast [C04.588.180.390]

 Phyllodes Tumor [C04.588.180.762]

 Digestive System Neoplasms [C04.588.274] +

A user might begin the search with Breast Neoplasms but realize after viewing the hierarchy that they really wanted the more specific Descriptor Breast Neoplasms, Male.

**4.3 Pharmacological Action**

A user interested in a particular drug may also be interested in the pharmacological activity of the drug. For example, a searcher interested in aspirin, might be interested in the common pharmacological actions of the drug as noted in the MeSH Browser:

|  |  |
| --- | --- |
| **MeSH Heading** | Aspirin |
| **Tree Number** | D02.455.426.559.389.657.410.595.176 |
| **Pharm. Action** | Anti-Inflammatory Agents, Non-Steroidal |
| **Pharm. Action** | Antipyretics |
| **Pharm. Action** | Cyclooxygenase Inhibitors |
| **Pharm. Action** | Fibrinolytic Agents |
| **Pharm. Action** | Platelet Aggregation Inhibitors |
| **Unique ID** | D001241 |

### **5. Entry Terms**

Entry terms, sometimes called "See cross-references" in printed listings, are synonyms, alternate forms, and other closely related terms in a given MeSH record that are generally used interchangeably with the preferred Descriptor term\* for the purposes of indexing and retrieval. This greatly increases the access points to the citations since a searcher may not know the exact preferred term for a MeSH Descriptor and there are frequently terms which mean the same thing when the article is indexed. For example, the entry terms Lung Cancer and Pulmonary Cancer are entry terms to the Descriptor Lung Neoplasms. When an entry term is used, the computer automatically substitutes the MeSH descriptor to which the entry term refers. See also [Entry Vocabulary](https://www.nlm.nih.gov/mesh/intro_entry.html).

\* The preferred term is one of possibly several equivalent terms in a MeSH Descriptor record. See [Concept Structure in XML MeSH](https://www.nlm.nih.gov/mesh/concept_structure.html). The MeSH preferred term is tagged as [MeSH Term] in a PubMed query.

### **6. Using MeSH in Searching PubMed - the [mh] and other MeSH record tags**

A searcher may constrain a query in the PubMed query box by using specific tags, such as [mh] and [pa]. (See [PubMed Search Field Descriptions and Tags](https://www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.Search_Field_Descrip).) Both the [mh] and [pa] are used in searching for MeSH Descriptors. Searching is also enhanced by the MeSH Translation tables.

**6.1 Terms in the MeSH Records**

A principal method of searching PubMed is by using the terms in MeSH records. To ensure a search by a MeSH term the query uses the [mh] tag, for example:

 Asthma [mh]

This query retrieves every citation indexed with this Descriptor. It also retrieves citations indexed to Descriptors which are narrower in the MeSH Tree Structures, in this case:

 Asthma

 Asthma, Exercise-Induced

 Status Asthmaticus

If a PubMed searcher wants to search only the broader subject - without the indented subjects, the search uses the tag "[mh:noexp]".

Entry terms may be used interchangeably with the preferred term in the record. For example

 Bronchial Asthma [mh]

As an entry term to Asthma, this term is equivalent to Asthma for purposes of indexing and searching in PubMed.

MeSH Qualifiers and Supplementary Concept Records (SCRs) may also be used in PubMed. A query using an SCR would be:

 Agent Orange [nm]

Notice that a distinct tag is used for SCRs. Inclusive searching ("exploding") is not available for SCRs since these records are not part of the MeSH Tree Structures.

An example of a MeSH Qualifier search would be:

 adverse effects [sh]

However, Qualifiers in MEDLINE are always used in conjunction with a Descriptor record, so a more likely search would be like:

 Adverse effects [sh] AND Anticoagulants [mh]

Note that PubMed has a "Details" feature which displays the query in the format actually used by PubMed. For example the entry term search:

 Bronchial Asthma [mh]

becomes:

 "asthma" [MeSH Terms]

Note the mapping to the MeSH preferred term as well as the different tag.

For more on the three main types of records see [MeSH Record Types](https://www.nlm.nih.gov/mesh/intro_record_types.html).

**6.2 The MeSH Translation Table**

Additional retrieval capabilities in PubMed are provided by an internal table which includes terms not available in the MeSH database itself.

"PubMed's logic for parsing unqualified terms entered in the query box involves automatic translation tables, one of which incorporates not only MeSH but also enhancements from the Unified Medical Language System (UMLS®). . . . NLM has made UMLS mapping available through the PubMed query box with no additional steps or clicks needed by the user. For example, a user's search for "heart attack" maps as: "myocardial infarction" [MeSH Terms] OR heart attack [Text Word]." (Lou Knecht and Stuart J. Nelson. J Med Libr Assoc. 2002 October; 90(4): 475. [Mapping in PubMed](https://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=128965).

Thus the query term "heart attack" functions in PubMed like a MeSH entry term though the term itself is not part of the MeSH thesaurus. The search "heart attack [mh]" produces the query:

 "myocardial infarction" [MeSH Terms]

Another situation addressed by the Translation Table is when a term may have multiple meanings. For example:

"The MeSH term, Cold is the concept of 'an absence of warmth or heat or a temperature notably below an accustomed norm.' However, the word 'cold' is used by many people to mean the 'common cold'. [//www.nlm.nih.gov/pubs/techbull/jf99/jf99\_pubmed.html](https://www.nlm.nih.gov/pubs/techbull/jf99/jf99_pubmed.html)

The MeSH thesaurus does not allow identical terms having different meanings so the Translation Table maps the query for "cold" to Descriptor Cold [temperature], the Descriptor Common Cold, and the Descriptor Chronic Obstructive Lung Disease. The PubMed query is:

 "pulmonary disease, chronic obstructive"[MeSH Terms] OR

 "common cold" [MeSH Terms] OR

 "cold" [MeSH Terms]

**6.3 Search by PubMed [pa] tag (Pharmacological Action)**

Some MeSH Descriptors refer to the Pharmacological Action of a given drug or substance. For example, an article about the anti-inflammatory effect of ibuprofen would be indexed with Ibuprofen and Anti-Inflammatory Agents, Non-Steroidal. Like other MeSH Descriptors, these are searchable in PubMed by the search field tag [mh]. However, a search is also available using the search tag [pa] which consists in citations indexed to MeSH Descriptor substances having that pharmacological action in the MeSH Pharmacological Action (PA) field. For example, the following PubMed search:

 Anti-Inflammatory Agents, Non-Steroidal [pa]

retrieves not only citations retrieved by the [mh]-tagged search but also retrieves citations like the following:

 PMID- 16818845

 MH - Ibuprofen/\*administration & dosage/adverse effects

This is because the Descriptor Ibuprofen has Anti-Inflammatory Agents, Non-Steroidal in the MeSH PA field:

Example from the MeSH Browser:

|  |  |
| --- | --- |
| **MeSH Heading** | Ibuprofen |
| **Tree Number** | D02.241.223.701.430 |
| **Scope Note** | A nonsteroidal anti-inflammatory agent withanalgesic properties used in the therapy ofrheumatism and arthritis. |
| **Pharm. Action** | Analgesics, Non-Narcotic |
| **Pharm. Action** | **Anti-Inflammatory Agents, Non-Steroidal** |
| **Pharm. Action** | Cyclooxygenase Inhibitors |
| **Unique ID** | D007052 |

PAs are added to the record when the MeSH Section determines that the specific chemical is known to have these pharmacological effects.

Note that while a [pa] query and [mh] query may overlap, they are not the same queries and must be specifically combined (OR-ed) if both are desired.

The MeSH PA data used by PubMed are available as separate XML files via the [Download MeSH Data](https://www.nlm.nih.gov/databases/download/mesh.html) page. Note [PA XML documentation](https://www.nlm.nih.gov/mesh/pa_abt.html). For historical background to the [pa] tag, see Pharmacologic Action Headings: PubMed®. NLM Technical Bulletin. July - August, 2003. [//www.nlm.nih.gov/pubs/techbull/ja03/ja03\_papx.html](https://www.nlm.nih.gov/pubs/techbull/ja03/ja03_papx.html).

**6.4 MeSH Treetops - "category" key word**

The highest level of the MeSH Tree Structures consists of 16 broad categories, such as "Anatomy". (See the [MeSH Browser](https://www.nlm.nih.gov/mesh/MBrowser.html), "Navigate from tree top".) These terms are not part of MeSH data as maintained and distributed, however, they can be used to search PubMed by use of the search word "category". For example, the search "anatomy category [mh]" will retrieve all citations indexed to any MeSH Descriptor in any of the A category. See Searching MeSH® Treetops. NLM Technical Bulletin. March - April, 2005. [//www.nlm.nih.gov/pubs/techbull/ma05/ma05\_mesh\_trees.html](https://www.nlm.nih.gov/pubs/techbull/ma05/ma05_mesh_trees.html).

### **7. PubMed searching without tags**

As likely as not a PubMed searcher will not use tags in a search but will just enter the plain term. In this situation PubMed applies a number of rules to expand the search behind the scenes. NLM refers to the application of these as "Automatic Term Mapping. " For these rules see the following:

PubMed's® Automatic Term Mapping Enhanced. NLM Technical Bulletin, November-December, 2004. [//www.nlm.nih.gov/pubs/techbull/nd04/nd04\_atm.html](https://www.nlm.nih.gov/pubs/techbull/nd04/nd04_atm.html)

How PubMed works: automatic term mapping. [//www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.How\_PubMed\_works\_aut](https://www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.How_PubMed_works_aut)

PubMed's® Enhanced Translation for Entry Terms Expands to Substance Names. NLM Technical Bulletin, March-April, 2005. [//www.nlm.nih.gov/pubs/techbull/ma05/ma05\_technote.html#pubmed](https://www.nlm.nih.gov/pubs/techbull/ma05/ma05_technote.html#pubmed)