PubMed

PubMed is a freely-accessible web platform provided by the US National Library of Medicine that can be used to search the Medline database. Medline is a database containing bibliographic citations and abstracts for articles from approximately 5,200 journals published worldwide. The database contains millions of citations dating back to the 1950’s.

PubMed is available freely at http://www.pubmed.gov

Getting Started

Open an internet browser and go to PubMed: www.pubmed.gov

You need to find some information on the following question: what research has been published regarding the bacterial biofilm formation? To start with, try brainstorming some of the keywords you would use to search for articles on this topic.

You are likely to have identified the words Bacteria (or bacterial), Biofilm and Formation.

Try searching with these words. Have a look through the results. Remember, these are not the complete articles, just records referring to complete articles. You’ll see:

- The title of the article
- Author(s)
- Journal Title. Year Month
- Volume(No.):page nos.

Can you identify which bits of information are which? Here’s an example of an article:

Adhesion of biofilms on titanium measured by laser-induced spallation.
Boyd JD, Korotkova N, Grady ME.

The journal the article was published in was Experimental Mechanics, in November 2019, in volume 59, part/issue 9, on pages 1275 to 1284.

Bear in mind that some articles won’t have an issue number (if the journal just publishes as whole volumes), some may not have pages (if the journal is online-only and only uses ‘article numbers’ instead), and some recent articles may not have volume, issue or
pages numbers yet (‘epub ahead of print’ means the articles are published online ahead of being officially published in a particular issue).

When assessing the potential relevancy of articles, you may also want to consult the abstract (the short summary of the article). Click the dropdown that currently says Format: Summary and select Abstract.

Have a browse through your results. Do they all seem relevant?

It’s very rarely possible to get a perfect search which only finds relevant results (and doesn’t miss any) so you’ll always have some sifting to do. However, we can improve this search to get more relevant results.

**Filtering Results**

Particularly when searches return a large number of results, you may wish to filter those results. For example, suppose you wanted to filter the results of the previous search to review articles published in the last five years in English. Reviews are articles where the authors are not reporting their own findings but are collating, comparing and assessing the findings from other articles (on a particular topic) – they are often a good way of getting an overview of research in an area.

Use the filtering options on the left of the results. From the Publication date options, select the last 5 years. From the Article Types options, select Review. Click Show additional filters and add Languages, then from Languages select English.

The filtered results will be displayed that should match the specific requirements that you’ve stipulated.

**Combinations and other search techniques**

Let’s see if we can improve results.

If you do have more than one keyword, you can use ‘AND’, ‘OR’ and ‘NOT’ to build up your search, finding results containing:

- one word AND another word
- one word OR another word
- one word NOT another word
Examples:

- biofilm AND formation will find results containing both words (but regardless of order or proximity)
- biofilm OR formation will find results containing either of the words (or both)
- biofilm NOT formation will find results containing ‘biofilm’ but not ‘formation’

AND, OR and NOT can be used when typing in your search terms.

As you'll have noticed, if the combinations aren't specified, 'AND' is assumed. So when you searched for bacterial biofilm formation it was the same as: bacterial AND biofilm AND formation.

Other techniques you can use:

- Brackets can be used to group concepts together before applying AND, OR or NOT to ensure the combinations are worked out in the right order (like maths equations)
- PubMed mostly assumes 'AND' between separate words in a search (unless it identifies a subject – see later), so if you're searching for a multiple word phrase, you can use “quotation marks” to specify a phrase
- Plurals: a search for a singular term should find results with both singular and plural forms of the term (unless it’s in quote marks)
- Wildcards: An asterisk * can be used to represent a variable number of any letters (from zero upwards) when you want to search for several similar terms, starting with the same root. e.g. oncolo* finds ‘oncology’ or ‘oncologist’ or ‘oncologists’ or ‘oncological’ etc.

Considering more terms

We know we can use 'OR' to combine alternative ways of saying the same thing, so it's important to consider alternative words to describe the subjects we're interested in.

Consider as many alternative ways of describing bacteria as you can.

How would you input those terms into PubMed?

Here's a few terms that you might have come up with:

- Germs
- Bacilli
- Microbes
- Organisms
- Pathogens

Search your terms in one long string with brackets:

biofilm AND (germs OR microbes OR organisms OR pathogens) AND (formation OR development OR creation)

(Alternatively, you could search each chunk (or even each term) separately one at a time, then click Advanced (under the search box) and add the searches together afterwards using the Search History.) How has this changed the number of results compared to your initial searches?

**Getting to articles**

When you find a useful reference on PubMed, the next step is to try and locate the full article. To check, note the details of the article, then search for the journal title on Library Search and if we have access to the journal (be that via an online subscription or physical printed copies of the journal), there'll be a record of which volumes/issues we have available which you check your article details against.

Slightly quicker, but less consistently, PubMed also provides direct links to publishers for some articles.

Search for biofilm AND (teeth OR tooth OR dental). Have a look through your results and click the following title:

Numerical investigation of cavitation generated by an ultrasonic dental scaler tip vibrating in a compressible liquid.


In the top right of the record is a link to Full Text. Click it.

You'll be taken to the article record on the publisher’s website. Click Read the full text and the article will display in HTML format in your web browser. Alternatively, you can download the PDF to see it as it was originally published.

E-journal articles will be available as either full text in your web browser (HTML), or a PDF document (viewed with e.g. Adobe Reader) – or both.
If given a choice, a PDF will appear exactly as the article was published (preferable if you are printing it or saving it), whereas a web version may be easier to work with online.

But what if the article hadn’t been accessible (without charge) via the link? Or if there simply hadn’t been a link?

Links provided on Pubmed do not check the University’s subscription details, so you’ll sometimes need to check the catalogue yourself to be sure whether or not material is available.

Open a new browser tab/window and go to http://www.ncl.ac.uk/library/

Search on Library Search for the journal title Ultrasonics Sonochemistry.

Find the correct records for the journal – two online.

Click the title for the second (current) online version. The View Online section provides a link to the e-journal provider where we have access to this journal.

Click the blue link button.

Click View All issues to get to the issue to list and locate the article (volume 63, May 2020, Article 104963)

One you’ve navigated your way back to the article, close the e-journal window and return to Library Search. Click Back to Results List.

**Subject Headings**

Sometimes you might want to find the most relevant articles that have specifically been classified as being about the subjects you’re interested in, regardless of the words and phrases used. MeSH terms (which stands for Medical Subject Heading) are the terms used to classify the articles on PubMed. For any search, it’s often useful to see if you can find suitable MeSH terms for your search concepts, since these will get you the best results.

PubMed will try to use MeSH terms when you search normally, but you have more control if you deliberately select your preferred options yourself. In the search box at the top, change PubMed to MeSH. Search MeSH for bacteria. It matches us straight to a subject heading Bacteria (at this point, we’re only searching for a subject heading – not the actual results yet).

You will see the various search options for this subject and, lower down the page, an indication of where the term fits in relation to other terms (with ‘narrower’ more specific terms and examples indented below the associated ‘broader’ concept).
The options:
You could choose to search only specific aspects of the topic, by using the subheadings – perhaps microbiology and growth and development.

Choosing to Restrict to MeSH Major Topic means the results would all have the subject as a main focus of the article - i.e. you'd get even fewer results, but even more targeted to your topic.

You can also choose to not include narrower terms. Usually this is unnecessary.

At the right side of the screen, click Add to search builder.
PubMed will add the details to the search box.

Now search MeSH again for biofilm
Click on the top suggested entry, and once you’re sure it’s right, click the option on the right to Add to search builder (and obviously you want to add with ‘AND’).

Now the search is set, click Search PubMed for the Search builder. The search will run.
Do results seem relevant? Generally, when sifting through results: remember to read abstracts, then you can see if there’s a link to the full text that works, otherwise search ‘Library Search’ (from the library homepage) for the journal title to see if we subscribe to the right volumes (either online or in print).

**A brief note about other databases**

Medline on the Ovid platform – is almost the same set of data as PubMed, but accessed on a different interface which supports Find It. It’s heavily geared to taking things in a step-by-step way using MeSH headings. There’s also another medical/dental database on Ovid platform – Embase, which covers more European (and pharmacology/toxicology) journals (whereas Medline covers more American journals).

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