

**Supplementary table 1: Scoring system for comparison of quality of query system**

This table has been divided into four tables explaining the scoring criteria for:

- a. Flexibility for 'query set' input
- b. Available field selections
- c. Query refinement
- d. Other aspects of query system

**Supplementary table 1a: Scoring system for flexibility for query set input**

Features	Maximum scores given	Justification for scores	Score distribution (Scores are indicated in brackets)		Examples of tools																																	
<p><b>Number of query terms or characters allowed</b></p>	<p><b>10</b></p>	<p>The most important parameter that greatly influences the degree of flexibility allowed. If the number of words or characters are too less than none of the other features can prove to be useful. Term/character limit and possibility of grouping/ sub-grouping of terms together affect query design.</p>	<table border="0"> <tr> <td><b>Number of characters allowed</b></td> <td><b>Scores</b></td> </tr> <tr> <td>&gt; 3250</td> <td>7.0</td> </tr> <tr> <td>3000 – 3250</td> <td>6.5</td> </tr> <tr> <td>2750 – 3000</td> <td>6.0</td> </tr> <tr> <td>2500 – 2750</td> <td>5.5</td> </tr> <tr> <td>2250 – 2500</td> <td>5.0</td> </tr> <tr> <td>2000 – 2250</td> <td>4.5</td> </tr> <tr> <td>1750 – 2000</td> <td>4.0</td> </tr> <tr> <td>1500 – 1750</td> <td>3.5</td> </tr> <tr> <td>1250 – 1500</td> <td>3.0</td> </tr> <tr> <td>1000 – 1250</td> <td>2.5</td> </tr> <tr> <td>750 – 1000</td> <td>2.0</td> </tr> <tr> <td>500 – 750</td> <td>1.5</td> </tr> <tr> <td>250 – 500</td> <td>1.0</td> </tr> <tr> <td>100 – 250</td> <td>0.5</td> </tr> <tr> <td>50 – 100</td> <td>0.2</td> </tr> <tr> <td><b>Grouping and sub-grouping of query terms allowed</b></td> <td>3.0</td> </tr> </table>	<b>Number of characters allowed</b>	<b>Scores</b>	> 3250	7.0	3000 – 3250	6.5	2750 – 3000	6.0	2500 – 2750	5.5	2250 – 2500	5.0	2000 – 2250	4.5	1750 – 2000	4.0	1500 – 1750	3.5	1250 – 1500	3.0	1000 – 1250	2.5	750 – 1000	2.0	500 – 750	1.5	250 – 500	1.0	100 – 250	0.5	50 – 100	0.2	<b>Grouping and sub-grouping of query terms allowed</b>	3.0	<p>Scopus, PubMed and some of its interfaces have the highest word limit among all the tools considered. Scirus and HighWire Press have relatively lower word limits.</p>
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<b>Option for searching citations with all or any or without the query terms</b>	5	Basic need and common to all the tools mainly via Boolean operators. Useful for designing complex queries, especially those requiring grouping and sub-grouping of terms.	<b>Boolean operators with the option to group and subgroup the terms using brackets</b> AND (2.0) OR (2.0) NOT (1.0) <b>Boolean operators without that option</b> AND (1.0) OR (1.0) NOT (0.5)	All the tools except askMEDLINE and eTBLAST support Boolean operators. Some search engines like GS, HWP and Scirus also have easier substitutes for Boolean operators. GS and Brij.in do not support grouping of terms.
<b>Phrase searching</b>	3	Inclusion of exact phrases helps in designing more precise queries. Multiple phrases combined using Boolean operators provide more flexibility.	Single phrase searching allowed (1). Both single and multiple phrase searching allowed (1 to 1.5, depending on the efficiency). Inclusion of stop-words (such as ‘a’, ‘an’, ‘if’, ‘were’ etc) (0.5).	Most of the tools allow multiple phrase searching. Stop-words in the phrases are excluded by PubMed and all its interfaces except ReleMed. All the other tools like Google Scholar, Scopus, Scirus and HighWire Press etc include stop-words in phrases.
<b>Truncation</b>	2	Truncating terms provides a lot of flexibility in query designing and also saves time and effort by including a majority of the possible variations for a word.	Possible to vary only single character (0.2) Possible to vary only multiple characters (0.8) Possible to vary both single and multiple characters anywhere in the word (1) If no limit to the number of words that can be truncated (0.5), otherwise penalty (-0.1 to -0.5, depending on the number). Allowed when using phrases (0.5), if not then penalty -0.1.	Scirus allows truncation of terms even in phrases. askMEDLINE, BioAsk and PubMed Interact either do not or partially allow the terms to be truncated.
<b>Proximity searching</b>	2	Helps in separating query terms by a desired number of terms in order to get more specific results.	Present by default (1) Possible to set term distance (1 to 1.5, depending on the range of term distance that can be set)	ReleMed has proximity searching by default. Scopus, EBIMed and CiteXplore provide option for proximity

			Number of terms to which this can be applied (0.1 to 0.5) If only two terms (0.1) If more (0.2 to 0.5)	searching, Scopus being the most efficient.
<b>Weighted terms (Boosting)</b>	<b>2</b>	Assigning higher significance to certain query terms can help in getting more relevant results.	Number of terms that can be boosted: 3 or less (1) more than 3 (2)	EBIMed and CiteXplore provide the option for boosting.
<b>Other features (like fuzzy searching, range searching, query types allowed etc)</b>	<b>1</b>	Features like “fuzzy searching” wherein terms similar to query term(s) are automatically recruited or “range searching” that allows setting upper and lower limits for numeric and certain text values , further enhance the quality of query system. Query inputs other than keywords are also useful in certain cases.	Feature present (0.1 to 1, depending on the usefulness of the feature(s)).	EBIMed allows range searching as well as fuzzy searching while CiteXplore supports fuzzy searching only. askMEDLINE accepts questions, ALIBABA accepts UniProt IDs while XplorMed accepts saved abstracts or a database entry as input.

**Supplementary table 1b: Scoring system for available field selections and subsets**

Easy search option for query restricted to	Maximum score given	Justification for scores	Score distribution (Scores are indicated in brackets)	Examples of tools
<b>Human/animal studies</b>	2	Human and animal <b>studies</b> subsets take into account the equivalent terms for the respective organisms. Thus, restricting the search to either subset saves effort and time required for designing an appropriate query yielding desired results.	Search: <ul style="list-style-type: none"> <li>• human studies (1.0)</li> <li>• animal studies</li> <li>• if organisms are distinctly specified (1.0) otherwise (0.5)</li> </ul> Penalty if tags need to be typed along with query terms but can't be selected (-0.4).	EBIMed, PubMed and all its interfaces (except askMEDLINE and ReleMed) have the option. For all PubMed interfaces, tags need to be applied along with appropriate codes.
<b>Age group</b>	1	Subset allows one to restrict the search to a particular age group for human study, which is difficult to incorporate in a query.	Option present (1.0).	PubMed, askMEDLINE (PICO interface) and PubMed Interact have this option.
<b>Gender</b>	1	Restricting a search to a specific gender for human study averts the need for including the gender as a query term, thereby simplifying the query.	Option present (1.0).	PubMed has this option.
<b>Other field or subset selections</b>	2.5	Topic subsets restrict the search to a specific subject/area like cancer or AIDS. They can help users to get higher recall which is otherwise difficult to achieve even with a carefully designed user query that requires time and effort.	0.5 to 2.5, depending on the number and importance of topics available for restriction. Penalty if tags need to be typed along with query terms but can't be selected (-0.4).	PubMed provides a list of major topics for restriction. All the PubMed interfaces allow restriction when appropriate codes tagged with [SB] are given in the query. Scopus and Scirus provide other options for searching fields like ISSN , keywords etc.
<b>Title</b>	4	A search for citations with query terms in the title can enhance the % of relevance in the results.	Option present (4). Penalty if tags need to be typed along with query terms but can't be selected (-0.4).	Most of the tools have the option. Brij.in, eTBLAST and askMedline do not have options for restricting the search to title, ReleMed does it by default.
<b>Title/abstract</b>	2	A search for citations with query terms in the title/abstract also helps to increase the precision to some extent.	Option present (1 to 2, depending on the efficiency) Penalty if tags need to be typed along with query terms but can't be selected (-0.4).	Brij.in, GS, Scirus, eTBLAST and askMEDLINE do not have any options for restricting the search to only title/abstract fields, all the other tools have.
<b>Entire text</b>	12	Searching for query terms in the entire text results in significantly higher recall and in some cases precision too.	Entire text as well as specific sections (like materials and methods; conclusion etc) of a full text article can be scanned (12) Entire text scan possible (10) Scanning of all fields in the citations	PMC, GS, Brij.in, Scirus and HWP are free tools available that are specialized in full text scanning of published scientific literature. Other than scanning entire text, PMC can search for terms

**Supplementary table 1c: Scoring system for query refinement**

<b>Features</b>	<b>Maximum score given</b>	<b>Justification for scores</b>	<b>Score distribution (Scores are indicated in brackets)</b>	<b>Examples of tools</b>
<b>Combination of multiple queries possible using 'history' (as in Pubmed)</b>	12	The large number of combinations possible from this provides a lot of scope for refinement in order to narrow down the results.	Feature present (12).	PubMed, PMC and Scopus have this unique option but Scopus is less efficient because it allows only 50 searches to be stored in history.
<b>Categorization based on relevant</b>	3	The output results grouped based on frequency occurrence of terms in the	Categorization based on relevant terms (0.2 to	HighWire Press categorizes based on both relevant terms

<b>terms or predefined topics in the results page</b>		retrieved citations or under different subjects including biological entities help in analyzing the results easily. This saves time and effort that would have gone in scanning all the articles for getting the relevant ones or in rephrasing queries for getting precise results.	1.4, depending on their number and usefulness) Topics (0.2 to 1.4, depending on their number and usefulness). Frequency of terms/ number of articles mentioned (0.1 to 0.2)	and predefined topics. askMEDLINE, CiteXplore, eTBLAST, GS, PubMed, PubMed Assistant, PubMed Central and PubMed Interact lack this feature. Other tools have this feature with varying efficiencies.
<b>Search within search</b>	2	Term(s) related to the query terms can be used for finding the articles of interest within the retrieved results without going through all the citations.	Feature present (0.1 to 2, depending on the usefulness of the feature for refining results).	Brij.in, GoPubMed, Scopus and ClusterMed have this feature. ALIBABA and HWP have option for searching terms in the graphical output display.
<b>Rephrasing the query/ Resetting the limits</b>	2	If the conducted search doesn't fetch the desired results, one needs to spend time for rephrasing the query and/or resetting the limits in order to get more refined results. The ease with which this can be done depends a lot on the features that are available for different tools.	Feature present (0.1 to 2, depending on the number of options available and their ease of use).	PubMed Interact has most of the PubMed limits represented as slider bars, making it easy to reset them. Majority of other tools require shuffling of pages for rephrasing the query or resetting the limits.
<b>Confidence limit settings possible/ weighted term filtering</b>	2	The output results can further be refined by identifying the terms related to the query terms and assigning weights/ setting confidence limits for them in order to get more precise results.	Feature present (0.5 to 2, based on the precision of results one gets after refining the search using the feature). Confidence limit setting not allowed but assigning weights to different query terms possible (0.1 to 0.2).	ALIBABA, BioAsk, HWP and XplorMed have options for setting the confidence limits or threshold values with varying efficiencies. EBIMed has boosting option.
<b>Refining search results based on closely related</b>	2	A few relevant articles from the output can be selected and further used for recursively getting related results	Feature present (0.5 to 1, based on the precision of results obtained by using	Only PubMed Assistant and XplorMed have this option.

<b>results</b>		which are more precise.	the option).	
<b>Other options</b>	1.5	Any other features that can help refine the results without putting in much effort.	Other features present (0.1 to 1.5, based on the usefulness of the feature for refining results).	CluterMed clusters results based on relevant terms as well as different fields like title, MeSH and Title/abstract etc. EBIMed allows large number of permutations and combinations.

**Supplementary table 1d: Scoring system for other aspects of query system**

<b>Parameters</b>	<b>Maximum score given</b>	<b>Justification for scores</b>	<b>Score distribution (Scores are indicated in brackets)</b>	<b>Examples of tools</b>
<b>Automatic term mapping(ATM) / translations / synonyms /inbuilt dictionary</b>	5	Inclusion of translations or synonyms for query terms helps in getting a higher recall and saves time and effort required for designing an appropriate query.	Feature present (1 to 4.5, based on the extent of translations available). Possible to turn it on/off as and when required. (0.5) Feature seems to be present but nothing specified. (0.5 to 3)	ATM is present by default in PubMed and all its interfaces. Translations or synonyms present in other tools are not as extensive as in PubMed.
<b>Spell check</b>	1	Automatic identification of	Feature present (1).	Feature present in askMEDLINE,

		misspelled words and correction can help to avoid misleading results and save time.		Brij.in, GS, GoPubMed, PubMed, Scopus and Scirus.
<b>Ease for a new user:</b> Ease of querying (availability of user friendly substitutes for Boolean operators)	1	Some new searchers may not be aware of Boolean operators. Also significant time is consumed when designing queries, especially complex queries (require typing of 'AND', 'OR' etc multiple times).	Only Boolean operators can be used for designing queries (-1). Both Boolean operators and their alternatives available either can be used as per the need (0.1 to 0.5). Boolean operators not required (0).	askMEDLINE and eTBLAST do not require Boolean operators. GS, HWP, Scirus, BioAsk and EBIMed allow the use of either Boolean operators or their substitutes.
<b>Ease for a new user:</b> Quality of tutorials or help files etc.	2	Tutorial aids a user to get acquainted with the features of a particular tool. This is very important for one to be able to exploit the available features judiciously in order to get desired results.	Feature present (0.5 to 2, depending on the user friendliness and the extent of information provided in the form of help file/ tutorial).	PubMed has the most exhaustive tutorial content. askMEDLINE does not need a tutorial because of its simple interface and querying system. PubMed and GoPubMed provide visual tours also for illustrating their major features.
<b>Multi-query processing</b>	2	Multiple queries if processed simultaneously can save a lot of time.	Feature present (2).	BioAsk has this feature.