



Quertle and KNALIJ: searching PubMed has never been so easy and effective

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Quertle and KNALIJ are two innovative tools created to search PubMed in a easier and more effective way. They dramatically reduce time to discover meaningful results. Quertle allows a semantic search in multiple biomedical databases (PubMed included) and runs a query via relationships between concepts, so that you retrieve at ease more pertinent results and can navigate them by "key concepts". KNALIJ is a visualization tool which searches PubMed and presents the results in the form of visual, interactive maps you can zoom, scale, and explore according to new paths.

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The National Library of Medicine (NLM), part of the National Institutes of Health, is the world's largest medical library and a leader in the use of technology to improve access to biomedical and health information. NLM provides a wide variety of information online by developing databases and software tools that enable people to explore medical literature, clinical trials, historical images, DNA sequences: they created PubMed, the public interface to the MEDLINE medical database. Additionally, for more than 40 years, the library has been a pioneer in the Open Data framework, making the data it compiles for its electronic resources available for use in systems produced by others. Anyone can use NLM data to develop their own products, tools and services. In November 2011 the library's software development challenge ended, Show off Your Apps: Innovative Uses of NLM Information. Five innovative software applications which are expected to help researchers, health professionals, and the

general public in their quest for medical and scientific information received an award. We just mention GLAD4U - Gene List Automatically Derived for You (<http://bioinfo.vanderbilt.edu/glad4u/>), which automates the process of creating gene lists and answers such questions as "Which genes are related to stroke?"; iAnatomy (<http://itunes.apple.com/us/app/ianatomy/id328875702?mt=8>), an electronic anatomy atlas available for iPhone and iPod: you can learn anatomy interactively with the ability to zoom in on images; and NLMplus (<http://nlmplus.com/>), a semantic search and knowledge discovery application which simultaneously searches 59 NLM databases in all areas of biomedicine and health.

We shall focus on Quertle and KNALIJ, specifically developed to run easier and more effective searches within PubMed.

Quertle: key concept to navigate PubMed

Quertle (<http://quertle.info/>) is a free interface which allows a semantic search in multiple biomedical databases (PubMed included). Using advanced semantics, Quertle retrieves at ease relevant results, not just long lists. The way Quertle works is simple: it finds relationships, not only keywords. So, all the terms in your query are found together in a meaningful way. The concept of relationship relies upon semantic triplets: subject-verb-object which repre-

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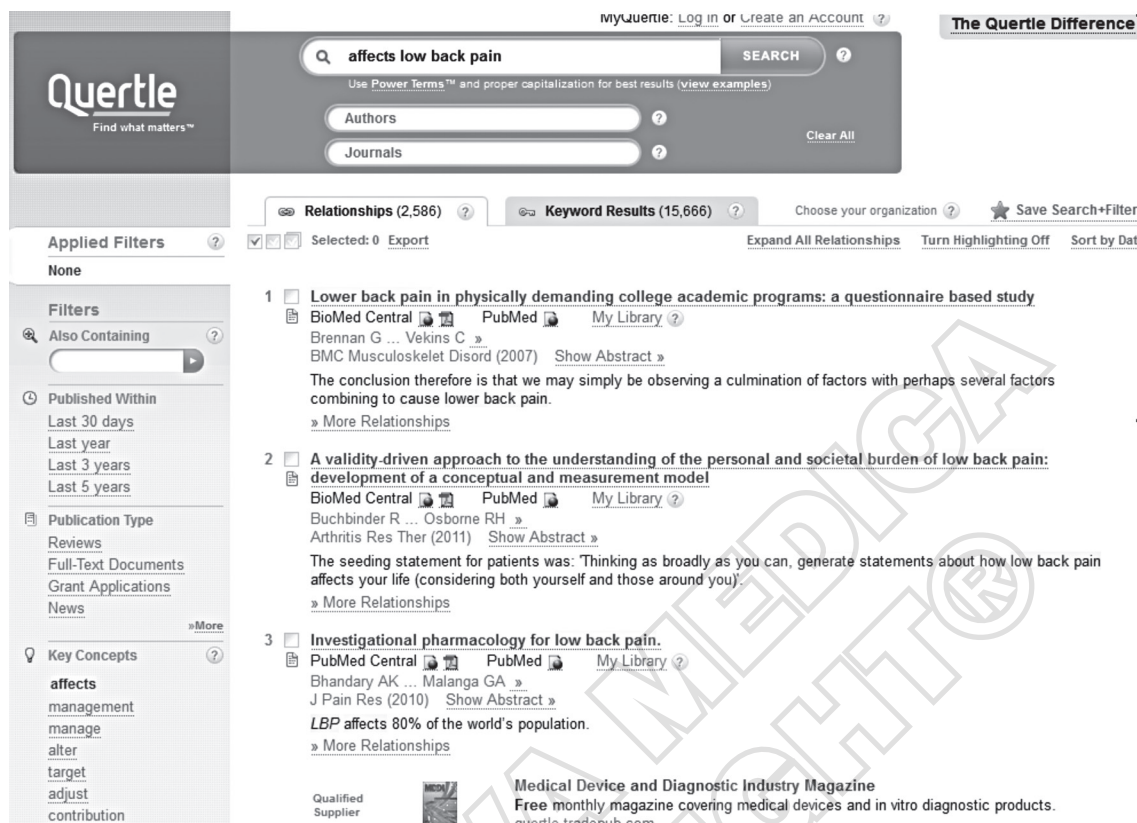


Figure 1.—Semantic search in Quertle, where “low back pain” can be both subject or object of the relationship.

sents a statement, i.e. your information need: “What affects low back pain?” In Quertle you can put all on any part of a relationship in the Search box to run the query; the system automatically looks for all the synonyms. Semantics implies that a noun can be subject or object, so if you just type “affects low back pain” Quertle will look both for “what affects low back pain” and “how back pain affects one’s life”, as shown in Figure 1. So, entering a verb or a pronoun is not required, but it could help defining your perspective: “low back pain induces what” will treat it just as subject of the relationship. Results are shown by default via relationships, with the search terms highlighted to provide immediate context. The label “keyword” above the search box gives you back a more traditional search, whit documents containing your terms anywhere also matched with the MeSH terms.

On the left side of the screen, you find filter options going from the traditional “Published within” or

“Publication type” to the innovative “Key concepts”: you can narrow your search by the “action” implied by your search (in this case, “affects”) or by General concepts such as “chronic, acute, disability, care” and so on. In the cited example, by clicking on Disability you reduce your results from 2586 to 173. Key concepts are identified within the resulting relationships and not simply extracted from anywhere in the document. They are organized in order to help and foster navigation. The first key concepts directly stem from your query, so, in our example, they are potential answers to “what” low back pain affects. You can also refine you research by introducing a new keyword in the upper left box “Also containing”.

A dramatically innovative tip is the “Power Term” feature, where Power Terms represent entire classes of object. They are represented with an initial \$ before the term. You can use: \$Disease, \$Adverse effects, \$Proteins, \$Genes, \$Positive actions (induce, activate, stimulate...), \$Negative actions (block, in-



Figure 2.—KNALIJ visual map for “stroke rehabilitation”, with clustered results

hibit, prevent...); you cannot create a new one by yourself but you can suggest the staff to. Running a search with “Scoliosis \$Genes” means that the system automatically explode the query with each gene known in literature somehow relating to scoliosis, not expecting you to type each time a different gene name in the Search box. The same with diseases: if you’re looking for possible disease implication of hip replacement, typing “hip replacement \$Diseases” you will be shown results concerning osteoarthritis, pain, dislocation, necrosis and so on without having typed any of them.

Another smart search tip is capitalization: Quertle knows biology and chemistry, so if you type NO in capital letters it will be searched as Nitric Oxide, such as MAID will correctly retrieve the protein and not your household help.

Each search with all its filters and options can be saved just clicking the Save search link on the right upper side of the results page. You can Register and then Login into My Quertle feature, to re-run your saved searches and to get a weekly email containing new articles matching your search criteria.

KNALIJ: visual PubMed for unexpected search pathways

KNALIJ (<http://knalij.com/>), pronounced as “knowledge”, is a visualization tool based on the

assumption that the best pattern recognition system is a person’s own visual system. Presenting information in the form of visual, interactive maps can significantly improve researchers’ abilities to scan large amounts of information and dramatically reduce their time to discovery.

You can run a simple search within the Search box or open the Advanced Search and use PubMed Search Builder to combine different fields with Boolean operators.

When you run a search, the system first discovers the pertinent articles in PubMed, then maps complex relationships in real time, and visualizes and identifies meaningful correlations and connections. Results are visually presented as interconnected colored knots in the middle of the screen, where each small point is an article, and in textual clusters on the left end. You can zoom in-on the visual map and explore it, looking for the article narrowest to the one you’re interested in, which could belong to a different cluster. So KNALIJ, as said in the homepage, “look at information sets in new ways that tell you things, and answer questions that you have yet thought of asking”.

If you run a search for “stroke rehabilitation”, the screen will appear as in Figure 2.

You can see your results in the map as the colored knots, corresponding to the conceptual clusters you find on the left: Activities of day living, Physical therapy modalities, Disability evaluation, Exercise

therapy, Recovery of Functions, Quality of life, Orthotic devices, Outcome assessment and so on.

Knots on the map are connected via single items (the articles), each pointing in a direction, connecting with the narrowest related concept. If you click on the map, and zoom in, you can visualize at once the article, or exploring its narrowest points, finding new research paths, unexpected connections which can open to new questions and scientific curiosity, or unpredicted answers.

If you zoom for instance on Activities of day liv-

ing, you can see some lines pointing to Disability evaluation, while some other go towards a sub-cluster Personal satisfaction and others to Outcome assessment, in a network of relationships and paths.

Technically, you can set your preferences about graph size, layout, scale, and colors. You can also visualize results by co-authorship map, journal cluster map or impact of funding map. As academics also use social networks day by day more, you can also share your results map via Facebook, Twitter, and all the options of Share This.



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| 1. B | 4. C |
| 2. A | 5. D |
| 3. E | 6. B |