

Scientific publishing

Part II: Scientific EMF literature databases

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The first part of this article, published in the last issue of the Newsletter, dealt with the process of scientific publishing in general, and with the classification of publications of scientific content. It was shown that not all publications that outwardly appear to be of scientific character do comply with valid qualitative criteria. On the other hand, the existing system of publishing scientific results seems to be, at least in part, out of date and needs to be changed. The following article will investigate where scientific literature dealing with research into electromagnetic field effects (EMF) on nature, the environment and health is found and can be systematically explored.

When talking about currently available scientific publications on EMF research, lectures, media coverage and other sources use to present numbers which are a true mystery. Where did authors or lecturers get them? Given numbers vary as much as the sources that are referred to. Quite often you get the impression that one author has copied his information from another, seeing as how unrealistically high numbers or much too small numbers are given – in the press, on the web, or in lectures. It depends on which side you are on: numbers of scientific publications on certain EMF-related topics are often used as part of the argumentation for or against mobile radio (and other radio applications), the sense or nonsense of granted research funds, or as a weapon in the debate over keeping or lowering limits for health protection. In many cases, the source of knowledge is even not mentioned at all.

Knowledge collection now and then

Not long ago, before the days of the internet and databases, scientists alone – university staff at different levels – were the keepers of knowledge, by way of personal collections of literature. Sooner or



later, every scientist has to decide on the direction his/her research will take, to concentrate, ie specialize his/her activity. A crucial issue is – and has been – to have as much and as good information as possible on one’s research branch. As scientific publications provide just this knowledge, it is a must to regularly obtain information about current and previous publications available in the respective special field as soon as possible and, in the best case, to read all there is. In the days before virtual data exchange this was feasible only by collecting printed articles or books, and by visiting the library and study literature there. Scientists used to exchange „special printings“ (scientific articles in printed version, taken from special journals, by request via standardized postcard), or later by copying them with a copy machine; an experienced staff member easily collected 5000 to 8000 single articles on a more or less limited knowledge area. Cartons or drawers filled with knowledge crowded the offices of scientific experts. Besides, a paper index was kept, to be later replaced by the computer. Today, paper copies have been replaced by electronic pdf (portable document format) files or scans. You only print what you need for better reading. Appearance and format of original publications are still the same or similar to that of the last century or before, though.

So it is no wonder that, in former times, you had to visit or invite an expert with his collection of literature and his knowledge based on this collection and on his own research in order to get sound information on a certain issue within a special field. The importance of such experts was enormous. You got the opinion of a person who had an admirable scientific background, but personal opinions they were. Nowadays it is much easier to collect, find, evaluate knowledge and to review available literature, due to electronic media. It is the time of *scientific (literature) databases*. But only the right use of these databases, their free availability and, above all, an under-

standing of contents can guarantee that current knowledge about a specific issue will really be available. Keyword searches and counting found scientific articles with positive or negative findings cannot replace the sound judgement of a special expert with broad background knowledge. As a consequence of the easier accessibility of knowledge, many non-experts like to participate in the search for the truth e.g. about the issue of harmful effects or harmlessness of weak electromagnetic fields. The fact that a huge mass of scientific knowledge is publicized in the form of literature databases does not mean there is a real scientific understanding in the public, as is seen in the largely biased public debate over the mentioned EMF limits. But there are first hopeful signs of improvement.

Where can first-hand scientific results of EMF research be obtained?

Reliable, understandable first-hand scientific results from scientific research can be found only in so-called *peer-reviewed original publications*, even though there are certain differences between them (see part I of this article, FGF Newsletter 1/2005 [1]). Quite often, free access is limited to so-called abstracts of the original publication in question, as electronic documents above all found on the internet, consisting of title, author(s), date of publication and a short summary, but not the complete publication (see also [1]). The original publication always starts with this identical abstract. Aside from that, the contents of *meeting contributions* (lectures or posters) are published in form of abstracts. Although they can be cited, they can be clearly identified as abstracts by their dates of publication, and are scientifically seen only as a preliminary statement of low value. They serve as a provisional presentation of information among researchers, before the results of a study are complete or have been fully evaluated or validated. Nevertheless, they are sometimes included in reference lists of original publications. Unfortunately, such abstracts



are often confused by non-experts or badly informed lecturers with abstracts from original publications. From a scientific point of view, this is not correct. Only their outer appearance is practically identical, with the exception of different publication dates. The full contents of meeting contributions can only be learnt during the meeting itself or, occasionally, via a special meeting volume (“proceedings”). Such meeting volumes are sometimes difficult to obtain (sometimes you can get them only during the meeting), if they are not published e.g. as a special issue of a regular journal, as they sometimes do. But quite often, “proceedings” as well contain only the abstracts of meeting contributions, which is not so helpful, but cannot be avoided in the case of larger meetings (in contrast to smaller so-called “workshops”). More recently, complete meeting volumes are increasingly made available on the internet, e.g. on the website of the respective meeting.

Full access to *complete scientific information* that meets research needs is rare, due to copyright limitations and, above all, the commercial interest of scientific publishing houses. Thorough research requires high expenditure. You often have to pay \$ 30 or more for the purchase of a single complete article in pdf format. There is always the traditional option of asking the author of a publication for a „special printing“ (who nowadays will be able to deliver it relatively fast electronically), or to order a relatively low-charge electronic copy at a library (e.g. [2], with 4 to 14 Euros per article, including copyright fee). The latter process, however, may take very long, up to several weeks for more recent literature (which is often the most important). The articles have to be processed first and made available electronically. There is also the possibility to go visit the library in person and check the journal out for making copies. Students enjoy certain (also financial) advantages in this case. All this results in perceiving scientific information – in our case of EMF research – largely through abstracts

or filtered search information (reports, summaries), at least with regard to users working outside of active research (e.g. media, interested public, public authorities, associations, etc.). A serious limitation is moreover that sample evaluations have shown evidence of lacking correspondence between abstracts and the contents of publications or meeting presentations [3], [4], [5]. Are scientific literature databases a way out of this dilemma between commercialized publication of complete research results and reduced knowledge that may be available only temporarily (and quickly)? To answer this question you have to take a closer look at the existing offer of literature databases containing (exclusively or in part) scientific literature from the field of EMF research.

Relevant information systems for scientific EMF literature

At present, six literature databases devoted *exclusively* to EMF research contents are available. Three are freely accessible on the internet, three are commercial or part of a commercial information packet. Besides, there is an extensive free database, “PubMed”, for this area with biomedical information from all subdisciplines, where most of the citations included in the other six databases is also found. Each of these databases has its own advantages, disadvantages and special features which are compared in the table overview included in this article (**figure 1**). You can see that the contents cover differ widely in size and quality. There are different foci, such as completeness, currency, the difference between scientific/non-scientific, searchability, multilanguage support, comprehensibility for non-scientists, accessibility or the inclusion of expert knowledge. The database ELMAR of the Swiss BUWAL (Federal Office of the Environment, Forestry and Landscape) e.g. emphasizes currency and the preparation of comprehensible information from scientific literature (also for non-experts). Preparation is cost- and time-inten-

sive, and has been completed for at least 700 titles; access is free. In contrast, the commercial American “EMF database“, an enterprise of Information Ventures, with limited access and more than 30,000 editorially prepared titles, puts the emphasis on completeness of information, covering the entire EMF research, without distinguishing higher and lower quality levels. Abstracts of meeting lectures are treated the same as high-ranking scientific publications. Currency is of lower importance.

Overall, it becomes clear that, without financial engagement (either of sponsors or public financing, for free access; or for commercial operation with limited access), no such database can survive.


Which EMF literature database is the best?

When taking a close look at the table overview of available information systems, it becomes clear that this question can only be rhetorical. Expectations and needs of users with regard to information services are just too different, and the same is true for the intentions and approaches of providers. Nonetheless, in the view of the author certain common needs are met better by some information systems than by others. The free-of-charge systems e.g. respond best to the concept of free, open and widely communicated knowledge that can be discussed in society. If there is also some degree of support to make these complicated matters more comprehensible (without influencing opinions), then this is a big step forward on the road to a generally improved (and not distorted) understanding of science.

Comprehensible extraction of basic contents from complicated scientific publications will be more useful than an overall evaluation done by an (isolated) expert. Expert opinions – in the best case, of expert teams – are of course desirable, if they refer to methodological basics of their disciplines. In contrast, overall evaluations of single experts, even if they are

acknowledged experts in the respective field, are always biased and thus invite general critique. The approaches used by the “EMF portal“ of the Femu Aachen (see article in this issue) and the database ELMAR of the BUWAL do largely meet this objective – in spite of the fact that they are still lacking in size resp. number of included items. However, the biomedical database “PubMed“ of the NCBI with its nearly “official“ thoroughness and competence will remain a standard. Other portals, meta search engines and literature order services offer other useful services to professionals or people otherwise dealing with these matters, but are too much for people who are searching for more general information. Criticizable are the overlappings of similar or even identical information included in the different (free) literature databases. As an outsider, you may think that there is some sort of running competition as to who will create the best database or portal of all, and who will get the greatest number of users. This is not what the user is looking for. At present, a veritable “jungle“ of information is developing out there in the field of EMF research, which will diversify even further (thus becoming highly redundant). In the end, it will be part of a “grey mass“ of information for the inexperienced user. It will be more and more difficult for laypersons to distinguish between trustworthy and not so trustworthy information resp. between good and bad, or neutral and biased information services.

It would make much more sense for acknowledged databases to improve communication with each other and to better coordinate their efforts (e.g. the WHO). Users then would know from the start: When using the WHO’s database, I’ll find this and this information, when using the “EMF portal“, I’ll find that and that information, when using ELMAR – and so on. Of course, there would have to be transparent linking. Moreover, it should be more obvious who is the intended user (national/international, public/expert circles, health/technological aspects, etc.).



This contribution is a first attempt to provide an overview of existing services and to address possibilities of improvement.

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References/links

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- [7] <http://www10.who.int/peh-emf/emfstudies/IEEEdatabase.cfm>, WHO (World Health Organization), Geneva
- [8] http://www.umwelt-schweiz.ch/buwal/de/fachgebiete/fg_nis/auswirkungen/literatur/, BUWAL (Federal Office of the Environment, Forestry and Landscaping), Bern.
- [9] <http://infoventures.com/emf/database/>, Information Ventures, Inc., Philadelphia, USA.
- [10] <http://www.rs-inc.com/>, Resource Strategies, Inc., „Gateway Information Services“ with the sections „RF Gateway“ and „ELF Gateway“, here especially: „RF Gateway“ for the area of radio applications. Information service with headquarters at Madison, USA.
- [11] <http://rfsciencefaqs.com>. London.
- [12] <http://www.ncbi.nlm.nih.gov/entrez>, NCBI (National Center for Biotechnology Information, Washington, DC).
- [13] <http://www.doaj.org>. DOAJ (Directory of Open Access Journals), a project of the Lund University Libraries, Sweden.
- [14] <http://www.ncbi.nlm.nih.gov/gquery/gquery.fcgi>. Entrez (The Life Sciences Search Engine), operated by the NCBI, see [12].
- [15] <http://www.medpilot.de>. MedPilot, a service of the ZB MED (German Central Library of Medicine) and the DIMDI (German Institute for Medical Documentation and Information), both Cologne. Promoted by the DFG (German Research Association) and BMBF (Federal Ministry of Education and Research).
- [16] <http://www.sciencegateway.org>. Internet portal with scientific contents, operated by a free, anonymous „group of scientists from Europe and Northern America“, which is not specified.
- [17] <http://scholar.google.com>. Google Inc., headquarters at Mountain View, USA. Branch of the well-known internet search engine Google, limited to scientific and technical contents, but with similar functions.

(EMF) database provider reference	present number titles	time period	cost	language	abstracts	also meeting contributions and other non-original literature	search: exposure parameters	search: biol./med. parameters	preparation/extraction of content by special experts	special features
free EMF-only literature databases										
EMF portal Fenu, RWTH Aachen (D) [6]	> 8,000 > 2,500 on radio-frequency fields	1980 => and selection of relevant older publications	free	German + English (expandable)	yes (original, via link)	no	full-text search in DB + detailed descriptor search by signal type	Full-text search in DB + detailed descriptor search	yes	extraction of important data into fact sheets is ongoing; at present available for > 1000 titles; extensive additional information (glossary, field source database, etc.); optional extracted information in several degrees of detail; graphic preparation of found hits
WHO Int. EMF Research Database (Citation List) WHO (CH) [7]	2470	1949 =>	free	English	no	no	descriptors for 6 frequency ranges	detailed descriptors for study types	no (planned by IEEE Commission)	Planned commentary of IEEE Commission lacks in most cases.
ELMAR BUWAL (CH) [8]	710	HF: 2000 => NF: 2002 => and selection of some older publications	free	German	yes (copy of the original, if available)	yes	full-text search in DB + descriptor search by application areas, not by signal type	Full-text search in DB + descriptor search by targets and study types	yes	extraction of important data into fact sheets; partially with commentaries; contains also book contributions, published statements, etc.; lesser additional information (e.g. small glossary)
Subscribable commercial EMF-only literature databases and information services										
EMF Database Information Ventures, Inc. (USA) [9]	> 31,500	1895 =>	3,850 US\$ per year	English	yes (expanded, by own special editors)	yes (mostly meeting contributions)	full-text search in title, abstract + keyword list	full-text search in title, abstract + keyword list	yes	the most extensive collection of EMF-only research contents; offered summaries beyond original abstracts; quarterly updated via CD; also printed version available („BENER abstracts“)
RF Gateway Resource Strategies, Inc. (USA) [10]	> 500 entries on radio-frequency fields	1998 => (selection)	staggered, several thousand US \$ per year	English	yes (if available, revised or newly written by own special editors)	yes	full-text search in title + abstract, only bibliographic descriptor search	full-text search in title + abstract, only bibliographic descriptor search	yes	literature database is part of a comprehensive subscribable information service + online; complete articles of limited size directly available to subscribers; foci: recent scientific EMF literature, meeting reports
RFsciencefacts Helpdesk Rfsciencefacts.com (UK) [11]	> 1,500	1948 => (selection)	500 - 1000 per year (for 1 - 3 accesses)	Englisch	yes (in part)	yes	full-text search in DB	full-text search in DB	yes (partially with commentaries, „questions and answers“ related to articles)	Literature database is part of a comprehensive online information service; focus is on expert evaluation of available documents related to mobile radio debate; extensive additional information (international standards, position papers, etc.)

(EMF)-Datenbank Anbieter Verweis	present number titles	time period	cost	language	abstracts	also meeting contributions and other non-original literature	search: exposure parameters	search: biol./med. parameters	preparation/extraction of content by special experts	special features
Free scientific literature databases, portals and meta search engines for EMF literature										
PubMed NCBI (USA) [12]	> 15 mill.; < 17,000 related titles to EMF	1950 => (1950 - 1965 selection, without abstracts)	free	English	yes (copy of the original)	no	full-text search in title, abstract + keyword list	full-text search in title, abstract + keyword list	no	Most extensive collection of bio- medical original articles; different searches possible (e.g. data of all included journals); no information beyond bibliographic data and original abstracts; no special search for EMF literature
DOAJ Universität Lund (SE) [13]	> 73,900 (total, all science areas)	?	free	English	yes	no	full-text search	full-text search	no	search engine, specialized on presently included 1602 freely accessible full-text online journals of all science areas; 400 journals directly searchable up to full-text article level
Entrez NCBI (USA) [14]	- meta search engine	-	free	English	yes, if accurate (copy of the original)	yes, e.g. also books, genetic databases	Full-text search in many DB inventories	Full-text search in many DB inventories	no	Meta search engine for science databases; offers access e.g. to PubMed (see above, [12]), online book databases, free full-text online journal databases or genetic databases
Medpilot ZB MED and DIMDI, Cologne (D) [15]	- meta search engine	-	free	German+ English	yes, if available (copy of the original if longer, only the first part)	Yes, optional data basis for search, e.g. also book contributions, non-peer- reviewed journal articles	Full-text search in many DB inventories	Full-text search in many DB inventories	no	Meta search engine for contents of German (and some international) biomedical databases; offers direct access to the total inventory of ZB MED (see [2]) with option to place an order; via DIMDI access to free and commercial DB with the focus of medicine, health care system (e.g. ICD codes for physicians, etc.)
Science Gateway free provider [16]	- (science portal)	-	free	English	yes, if available (original or copy of the original)	yes (access to different DB)	Full-text search in many DB inventories	Full-text search in many DB inventories	no	Metasearch engine and link portal for scientific databases and other contents; offers similar possibilities as „Entrez“ (see above, [14]); also, links to extensive additional offers (encyclopedias, thesaurus, impact factor lists, etc.)
Google Scholar (Beta) Google, Inc. (USA) [17]	- (search engine)	-	free	English	yes, if available (original or copy of original via link)	jaYes (access to the entire internet, limited to scientific and technical contents))	Full-text search of the entire internet, limited to scientific and technical contents	Full-text search of the entire internet, limited to scientific and technical contents	no	Internet search engine, limited to scientific and technical contents and authors over the entire internet (beta version); full-text search by keywords; many hits, sorted by relevance according to the query; a citation index is considered, etc.

Figure 1: Overview table of the most important available information systems for scientific EMF literature. Details on the providers are found in the [references] under „references/links“ at the end of the article