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EMF-Portal

Internet Information System and Literature Database on Biomedical Effects of Electromagnetic Fields

R. Wienert

femu – Research Center

for Bioelectromagnetic Interaction,

University Hospital, RWTH Aachen University

Aachen, Germany

Forschungszentrum für Elektro-Magnetische Umweltverträglichkeit
Universitätsklinikum - RWTH Aachen

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Objectives

Platform for the assessment of the current knowledge status regarding health effects of the low- and radiofrequency fields

- assistance & support for EMF experts
- information for decision makers (legal, medical, political, corporate …)
- unbiased information for lay persons

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Provided Information

- established scientific facts from peer-reviewed journals regarding health-related EMF effects
- comprehensible knowledge representation in English, German & additional languages
- interdisciplinary glossary of technical terms (biology, medicine, epidemiology, dosimetry)
- comprehensive EMF background information
- available without access restrictions and completely free of charge via Internet

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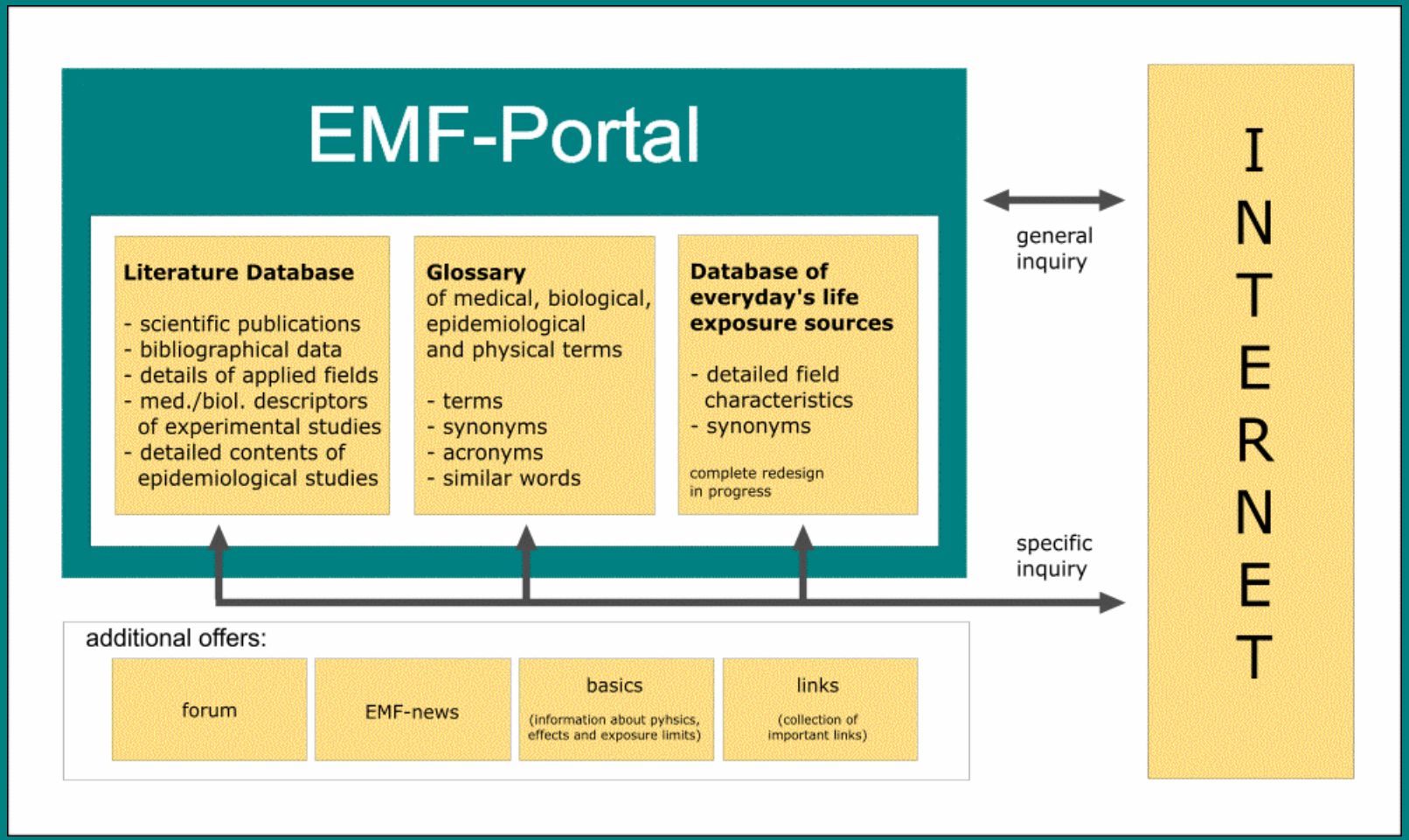
Structure of the EMF-Portal



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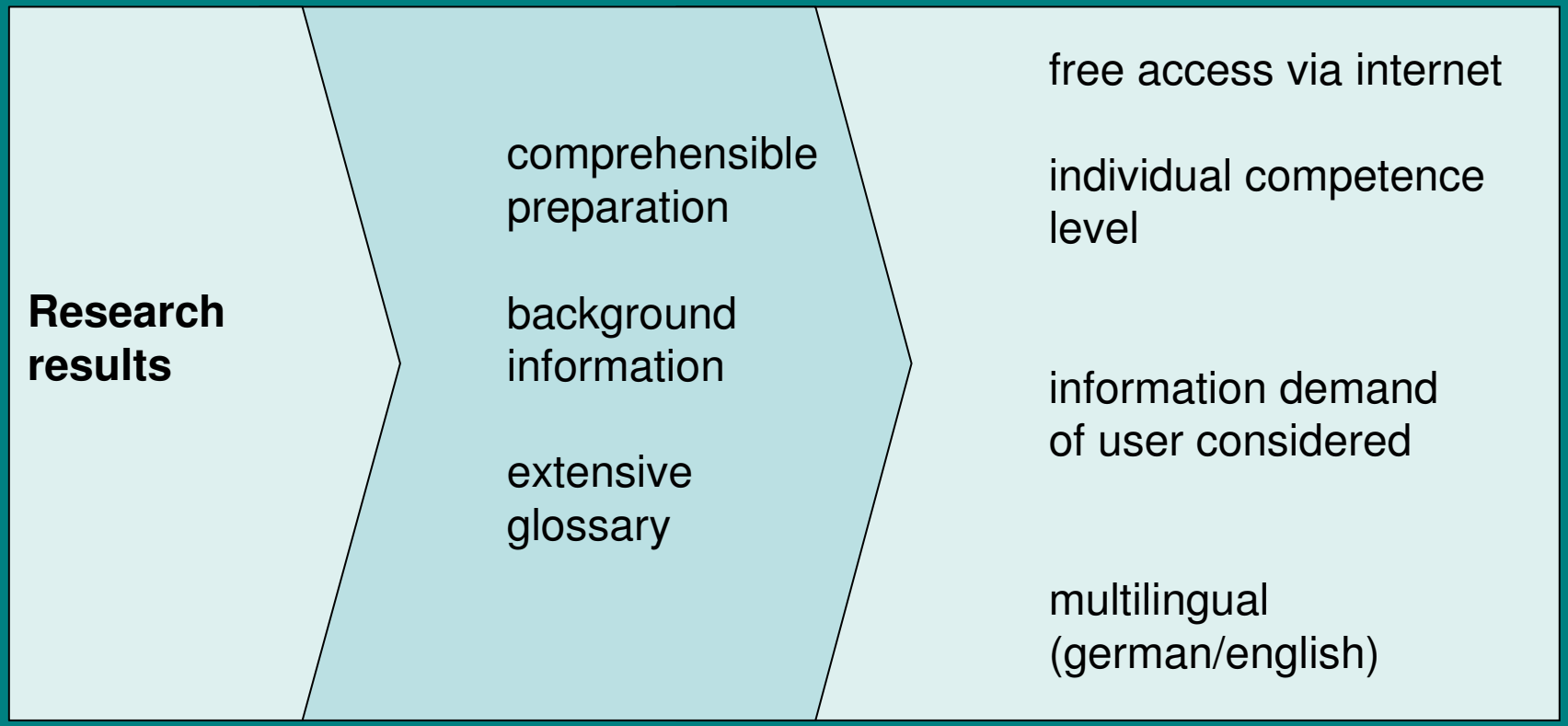
Information Processing



publications → *femu* → user

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Structure (Literature Database)

Custom-tailored database forms specific for

- experimental medical-biological studies
- epidemiological publications
- review categories
- studies on interference with cardiac pacemakers and other electronic implants*
- international recommendations & guidelines*

*shortly available

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Example
Med./Biol. Study

1) General bibliographic data

2) Aim of study

3) Endpoints

4) Exposure data

5) Methodical main details

6) Results

7) Study characteristics

8) Summary of all technical terms available in the glossary

Medical/biological Study (experimental study)

Mobile phone radiation causes changes in gene and protein expression in human endothelial cell lines and the response seems to be genome- and proteome-dependent.

by Nylund R, Leszczynski D
published in: Proteomics 2006; 6 (17): 4769 - 4780 (PubMed Entry)

Aim of study (according to author)
To study the effects of 900 MHz GSM mobile phone irradiation on the gene and protein expression in two closely related human endothelial cell lines.
Background/further details:
Gene expression changes were examined in three experiments and investigation of protein expression changes were replicated in ten experiments.
The work is part of the REFLEX project (Risk Evaluation of Potential Environmental Hazards From Low Energy Electromagnetic Field Exposure Using Sensitive in vitro Methods), funded by the European Union.

Endpoint

- molecular biosynthesis: gene and protein expression

Exposure

General: digital mobile phone, GSM

Field characteristics	Parameters
900 MHz pulsed (PW) exposure duration: continuous for 1 h	SAR: 2.8 W/kg mean value

FIELD View further expo parameters — link to detailed exposure parameters

Exposed system:
intact cell/cell culture (in vitro)
EA.hy926 cells and EA.hy926v1 cells

Methods
Measurement parameters:

- molecular biosynthesis: gene and protein expression (Atlas Human 1.2 cDNA Expression Array (DNA microarray); two-dimensional electrophoresis)

investigated material: isolated bio./chem. substance (in vitro), DNA/RNA (in vitro)

time of investigation: after exposure

blue: link to corresponding glossary entry

Main outcome of study (according to author)
The data showed that gene and protein expression are altered in both cell lines in response to mobile phone irradiation. Furthermore, different genes and different proteins were affected by the same exposure in both cell lines. This suggest that under these experimental conditions the cell responses might be genome- and proteome-dependent.

(Study character: medical/biological study, experimental study, full/main study)

Related articles

- **Belyaev IY et al. (2006)**: Exposure of rat brain to 915 MHz GSM microwaves induces changes in gene...
- **Qutob SS et al. (2006)**: Microarray gene expression profiling of a human glioblastoma cell line exposed...
- **Chauhan V et al. (2006)**: Analysis of proto-oncogene and heat-shock protein gene expression in human...
- **Remondini D et al. (2006)**: Gene expression changes in human cells after exposure to mobile phone...
- **Zeng Q et al. (2006)**: Effects of Global System for Mobile Communications 1800 MHz radiofrequency...
- **Leszczynski D et al. (2006)**: Questions and answers concerning applicability of proteomics and...
- **Whitehead TD et al. (2006)**: The number of genes changing expression after chronic exposure to Code Division...
- **Nikolova T et al. (2005)**: Electromagnetic fields affect transcript levels of apoptosis-related genes in...
- **Czyz J et al. (2004)**: High frequency electromagnetic fields (GSM signals) affect gene expression...
- **Leszczynski D et al. (2004)**: Applicability of discovery science approach to determine biological effects of...
- **Nylund R et al. (2004)**: Proteomics analysis of human endothelial cell line EA.hy926 after exposure to...
- **Leszczynski D et al. (2002)**: Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone...
- **Pacini S et al. (2002)**: Exposure to global system for mobile communication (GSM) cellular phone...
- **Leszczynski D (2001)**: Mobile phones, precautionary principle, and future research.

Glossary: array, biosynthesis, cDNA, cell, cell culture, cell lines, digital, DNA, DNA microarray, electromagnetic field, endothelial, exposure, expression, full/main study, gene, genome, GSM, human, in vitro, irradiation, mean value, MHz, mobile phone, molecular, potential, protein, proteome, pulsed, PW, REFLEX project, risk, RNA, SAR, two-dimensional electrophoresis

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Example
Exposure details

http://www.emf-portal.de - Glossary - Mozilla Firefox

Glossary

EMF-PORTAL

waveguide

Hohlleiter

Communications engineering. A hollow metal conductor with circular or rectangular cross section through which electromagnetic waves are propagated in microwave and RF communications.

domain: technical/dosimetric

Exposure details

Effects of Universal Mobile Telecommunications System (UMTS) electromag

by Franke H, Streckert J, Bitz A, Goeke J, Hansen V, Ringelstein EB, Nattkamper H, Galla HJ, Stogbauer F
published in: Radiat Res 2005; 164 (3): 258 - 269

Exposure 1:

Main characteristics	
frequency:	1.966 GHz
type of field:	electromagnetic field
field characteristics:	guided field
reference article:	**publication 11182**: Generic UMTS test signal for RF bioelectromagnetic studies.

Exposure setup	
exposure source/structure:	radial waveguide
exposure time pattern:	continuous for 1 up to 3.5 days
chamber details:	Two radial waveguides each containing up to 28 samples were placed into an incubator and were used in turns as the exposure device or sham-exposure device. The samples in each waveguide were arranged symmetrically near the rim. The reflections were reduced by a 5-mm flat absorber along the waveguide perimeter.
setup details:	The filters carrying the cell cultures were installed in cylindrical tubes between two discoid gold electrodes. Each sample holder was equipped with a two-electrode system for impedance monitoring. The leads of the electrodes were conducted upward through the metal caps that sealed the cartridges. Thus simultaneous RF-field exposure and LF impedance measurement was possible.
add. information:	The barrier tightness was monitored continuously by TEER measurement using impedance spectroscopy described in detail by Wegener et al. in Brain Res. 853, 115-124 (2000). Impedance analysis was carried out in the frequency range from 1 Hz to 500 kHz applying a sinusoidal voltage of ~30 mV amplitude.

Exposure parameters

parameter:	value:	type:	method:	averaging mass:	additional information:
electric field strength	34 V/m	mean value	measured and calculated	-	± 40% SD
SAR	1.64 W/kg	average over mass	calculated	see remark	vessel with 3.5 ml solution
electric field strength	10.8 V/m	mean value	measured and calculated	-	-
electric field strength	3.4 V/m	mean value	measured and calculated	-	-

measurement and calculation details: The electromagnetic field and the temperature of the medium were monitored constantly by a field antenna and a thermistor probe installed inside a cell culture vessel. The field distribution inside the exposure device was calculated based on the FDTD method.

Glossary: amplitude, antenna, brain, cell culture, electric field strength, electrode, electromagnetic field, exposure, FDTD, frequency, GHz, Hz, incubator, LF, mean value, medium, probe, RF, SAR, sinusoidal, spectroscopy, UMTS, vessel, voltage, waveguide

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Example Epidemiological Study

Epidemiological Study (case-control study)

Case-control study of the association between the use of cellular and cordless telephones and malignant brain tumors diagnosed during 2000-2003.

by Hardell L, Carlberg M, Hansson Mild K
published in: Environ Res 2006; 100 (2): 232 - 241 (PubMed Entry)

Aim of study (according to author)

A case-control study on the use of cellular and cordless telephones and the risk for brain tumors was conducted in Sweden.
Background/further details:
This study reports results for malignant brain tumors whereas the results for benign brain tumors, mainly meningioma and acoustic neuroma, are presented in **publication 1/2068**.
Subjects who started their use of a mobile or cordless phone within one year prior diagnosis were classified as unexposed.

Endpoint/type of risk estimation

- brain tumor: malignant brain tumor

Estimate of incidence by odds ratio (OR)

Exposure

- mobile phone/mobile communication system, analog mobile phone, digital mobile phone, cordless phone
- type of exposure: personal
- assessment by questionnaire (mean number of daily calls and minutes, use in a car with fixed external antenna, use of hands-free device, ear most frequently used during calls, first part of telephone number (to differentiate between analog and digital cellular phones)); interview (supplementing data); calculation (cumulative use in hours)

groups of exposure:

Reference group 1:	unexposed
group 2:	analog, 1-5-year-latency
group 3:	analog, > 5-10-year latency
group 4:	analog, > 10-year latency
group 5:	analog, total, > 1-year latency
group 6:	analog, ≤ 80 h, 1-5-year-latency
group 7:	analog, ≤ 80 h, 5-10-year-latency
group 8:	analog, ≤ 80 h, > 10-year latency
group 9:	analog, ≤ 80 h, total, > 1-year latency
group 10:	analog, > 80 h, 1-5-year-latency
group 11:	analog, > 80 h, 5-10-year-latency
group 12:	analog, > 80 h, > 10-year latency
group 13:	analog, > 80 h, total, > 1-year latency
group 14:	digital, 1-5-year-latency
group 15:	digital, > 5-10-year latency
group 16:	digital, > 10-year latency
group 17:	digital, total, > 1-year latency
group 18:	digital, ≤ 64 h, 1-5-year-latency
group 19:	digital, ≤ 64 h, > 5-10-year latency
group 20:	digital, ≤ 64 h, > 10-year latency
group 21:	digital, ≤ 64 h, total, > 1-year latency
group 22:	digital, > 64 h, 1-5-year-latency
group 23:	digital, > 64 h, > 5-10-year latency
group 24:	digital, > 64 h, > 10-year latency
group 25:	digital, > 64 h, total, > 1-year latency
group 26:	cordless, 1-5-year-latency
group 27:	cordless, > 5-10-year latency
group 28:	cordless, > 10-year latency
group 29:	cordless, total, > 1-year latency
group 30:	cordless, ≤ 243 h, 1-5-year-latency
group 31:	cordless, ≤ 243 h, > 5-10-year latency
group 32:	cordless, ≤ 243 h, > 10-year latency
group 33:	cordless, ≤ 243 h, total, > 1-year latency
group 34:	cordless, > 243 h, 1-5-year-latency
group 35:	cordless, > 243 h, > 5-10-year latency
group 36:	cordless, > 243 h, > 10-year latency
group 37:	cordless, > 243 h, total, > 1-year latency

Population

- **case group**
  men and women, aged from 20 to 80 years
  diagnosis: malignant brain tumor, histopathologically verified
  observation period: July 2000 - December 2003
  study location: Uppsala/Örebro and Linköping regions, Sweden
  source of data: Cancer Registry
  exclusion criteria: deceased, medical conditions

- **control group**
  selection population-based
  matching: sex, age, area, 1:1 (case:control)

Further parameter acquired by questionnaire (exposure to certain agents, lifetime work history, socioeconomic index)

Study size	cases	controls
number eligible	359	820
number participating	317	692
rate of participating	88%	84%

Statistically significant results

group	endpoint	cases	controls	parameter (RR)	confidence interval
4	malignant brain tumor	48	40	3.5	2.0-6.4
5	malignant brain tumor	68	79	2.6	1.5-4.3
16	malignant brain tumor	19	18	3.6	1.7-7.5
17	malignant brain tumor	198	343	1.9	1.3-2.7
28	malignant brain tumor	30	35	2.9	1.6-5.2
29	malignant brain tumor	171	305	2.1	1.4-3.0

Statistical analysis using unconditional logistic regression (adjusted for age, sex, socioeconomic status, year of diagnosis)

Results/conclusion (according to author)

The results showed an increased risk for malignant brain tumors in association with the use of analog and digital cellular phones and cordless phones. The risk increased with the latency period and the number of hours use for phone calls.

(Study character: epidemiological study, case-control study)

Related articles

- **Hardell L et al. (2006)**: Pooled analysis of two case-control studies on the use of cellular and cordless...
- **Hardell L et al. (2005)**: Use of cellular telephones and brain tumour risk in urban and rural areas.
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Glossary: **acoustic neuroma, analog, antenna, benign, brain tumors, cancer registry, case-control study, cellular, cellular phones, confidence interval, cordless phones, cumulative, diagnosis, digital, ear, endpoint, epidemiological, exposure, histopathologically, incidence, latency, malignant, matching, mean, meningioma, OR, population-based, risk, RR, socioeconomic status, statistical, unconditional logistic regression**

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Background/further details:

This study reports results for malignant brain tumors whereas the results for benign brain tumors, mainly meningioma and acoustic neuroma, are presented in **publication 12068**.

Subjects who started their use of a mobile or cordless phone within one year prior diagnosis were classified as unexposed.

Endpoint/type of risk estimation

- brain tumor: malignant brain tumor

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Exposure

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Example Epidemiological Study (continued)

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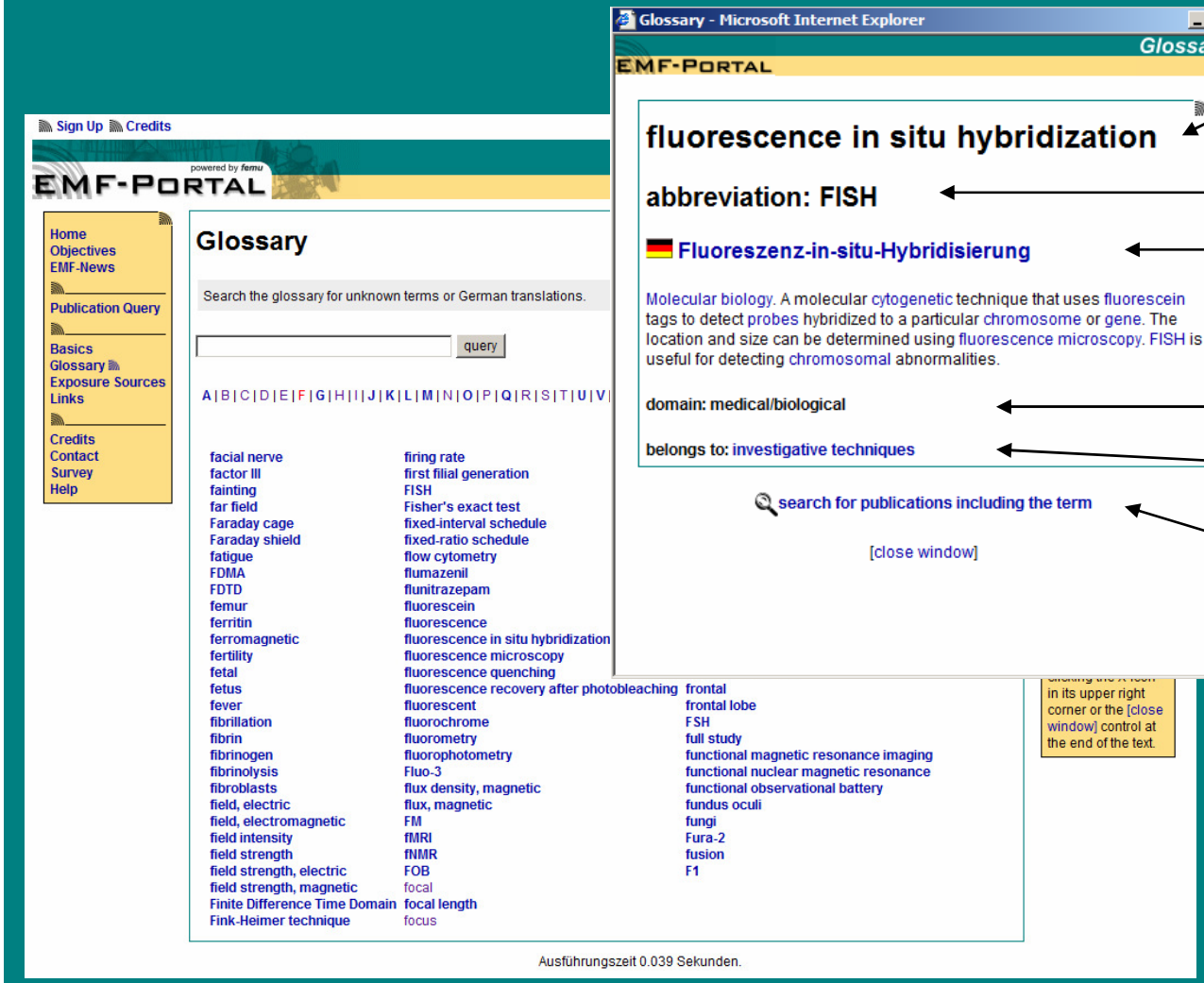
Glossary



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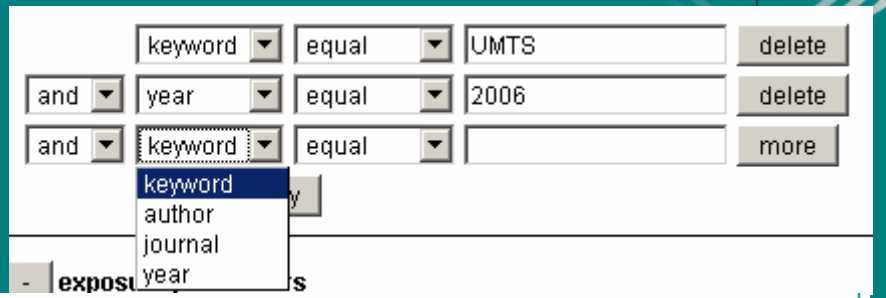
Queries options



- **general data**

Please note that in your search for med./biol. parameters only publications will be taken into consideration
which have already been worked on (at present 1502 records with general data).

keywords:

exposed system:
- ☐ human
- ☐ animal
- ☐ plant
- ☐ in-vitro system

investigated system:
- ☐ human
- ☐ animal
- ☐ plant
- ☐ in-vitro system

endpoints:
- ☐ genotoxicity/mutation
- ☐ cell transformation
- ☐ molecular biosynthesis
- ☐ cell viability/cell division/proliferation
- ☐ cell function
- ☐ cancer
- ☐ effects on embryo/fetus
- ☐ effects on reproductive ability
- ☐ effects on immunological system
- ☐ effects on cardiovascular system
- ☐ morphological/histopathological changes
- ☐ endocrine changes
- ☐ effects on the neurological system
- ☐ cognitive/behavioural endpoints
- ☐ thermoregulation
- ☐ hypersensitivity/subjective complaints

- **exposure parameters**

Please note that in your search for field parameters only publications will be taken into consideration
which have already been worked on (at present 3319 records with exposure parameters).

frequency: Hz

frequency range: from Hz to Hz

modulation:
- ☐ amplitude modulation
- ☐ frequency modulation
- ☐ single pulse
- ☐ pulsed (PW)
- ☐ continuous wave (CW)
- ☐ not specified

SAR: from W/g to W/g

el. field strength: from V/m to V/m

magn. flux density: from T to T

power flux density: from W/m² to W/m²

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Query for “Non-Experts”

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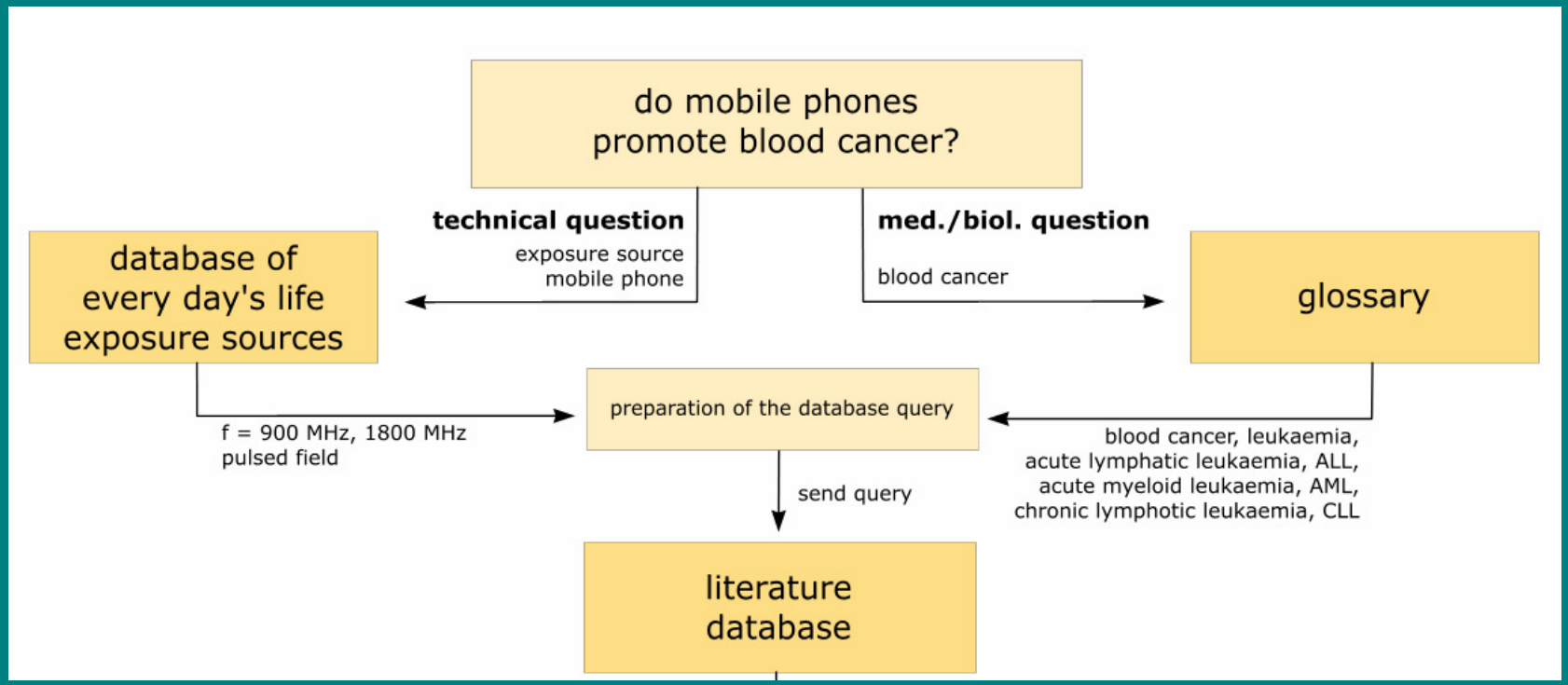
Query Question



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Query Answer

literature database

EMF-Portal answer
all publications related to the question

database of every day's life exposure sources

semantical and graphical preparation of the results

glossary

hit list (example)

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Current inventory

- more than 10,000 publications collected
- almost 1,600 articles already summarized
- exposure data from 3,300 publications
- bilingual glossary of more then 2000 terms & acronyms
- database of 200 exposure sources
- collection of recommendations & guidelines

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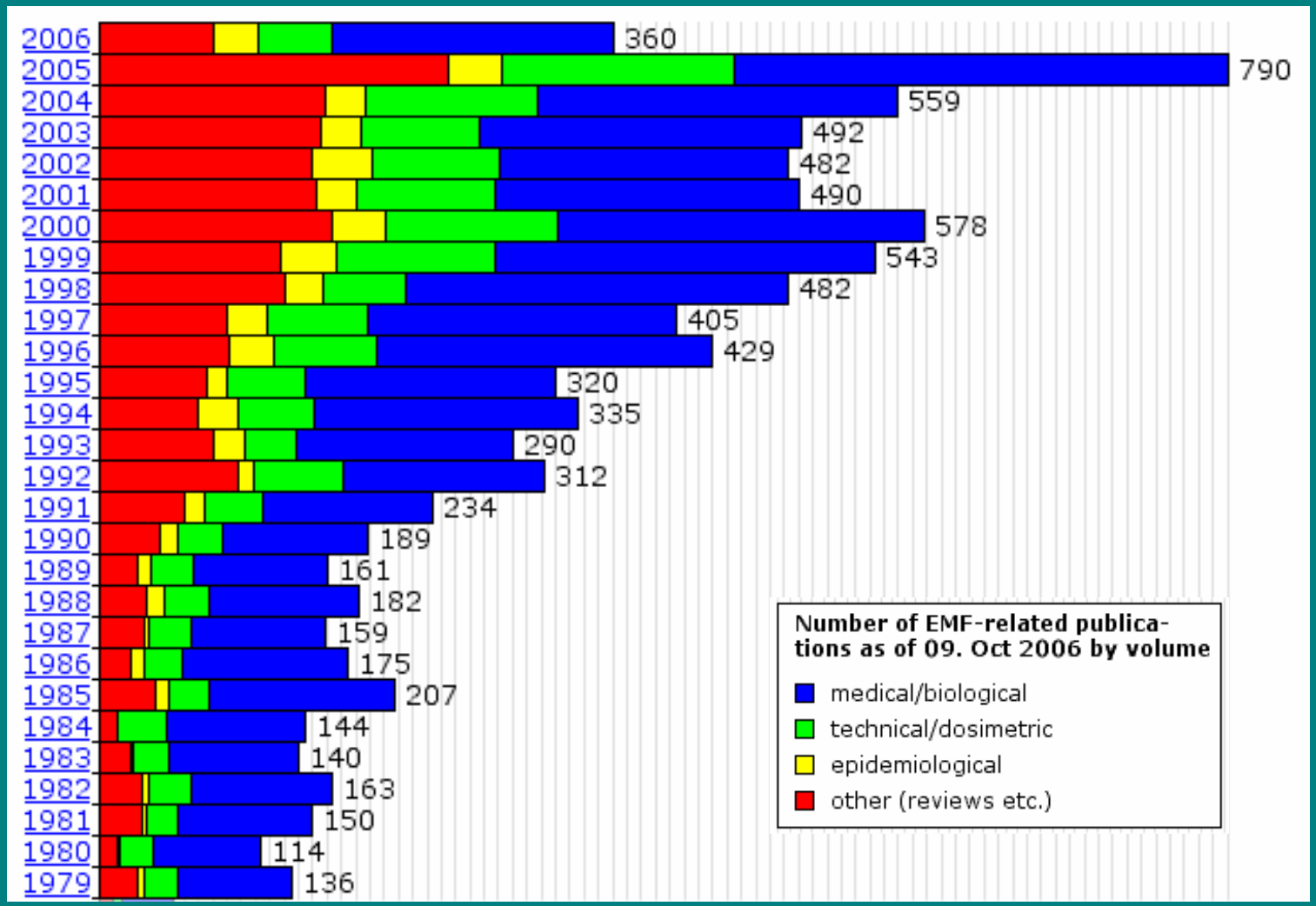
Number of publications (per year)



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Official Launch of the EMF-Portal on July 13, 2005 by Press Release of the Bundesamt für Strahlenschutz (BfS)

→ favorable reception by the press (published in 50+ newspapers/online-information services)

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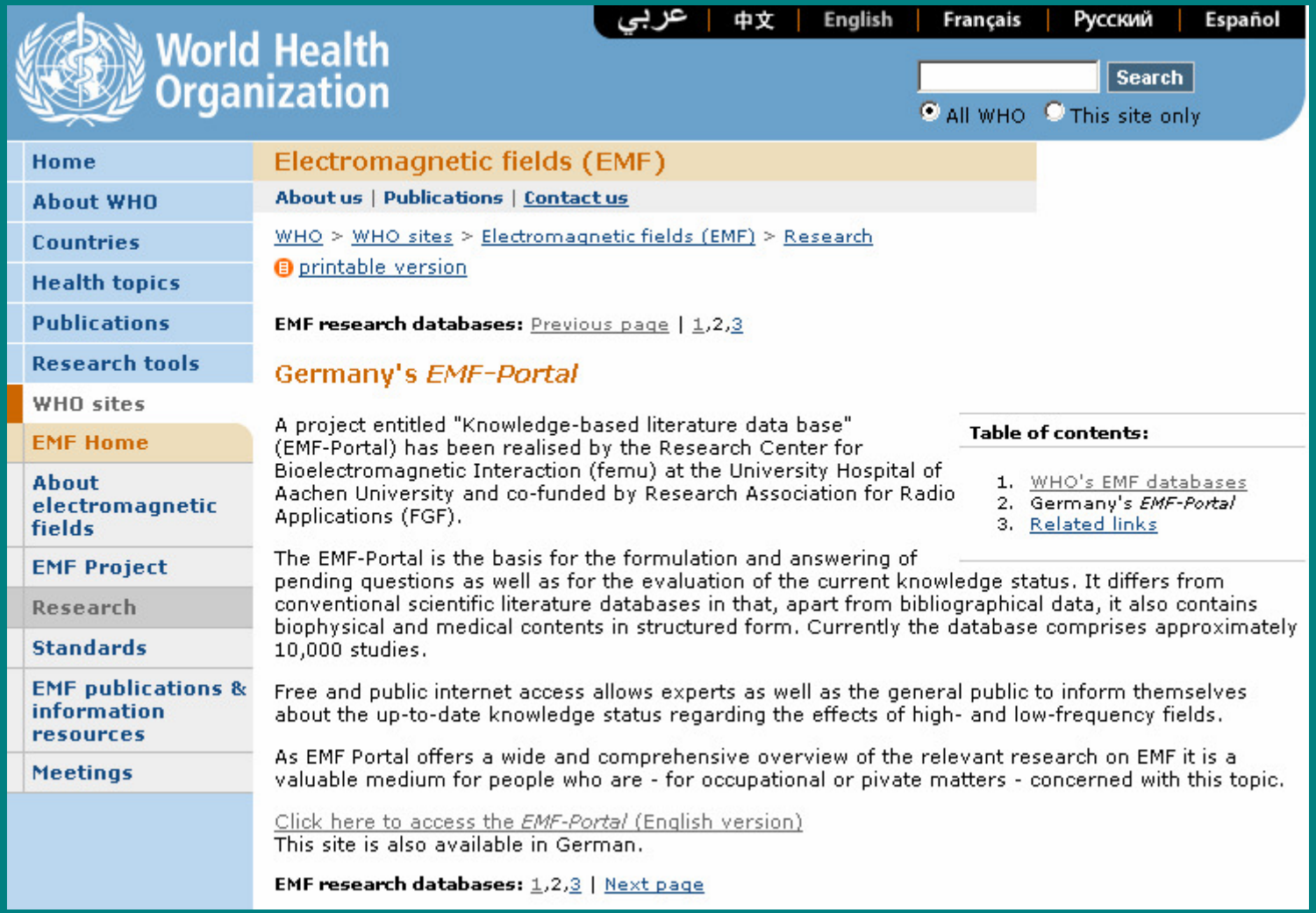
Recommendation as EMF research reference database by the WHO



World Health Organization

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printable version

EMF research databases: Previous page | 1,2,3

Germany's *EMF-Portal*

A project entitled "Knowledge-based literature data base" (EMF-Portal) has been realised by the Research Center for Bioelectromagnetic Interaction (femu) at the University Hospital of Aachen University and co-funded by Research Association for Radio Applications (FGF).

Table of contents:

1. WHO's EMF databases
2. Germany's *EMF-Portal*
3. Related links

The EMF-Portal is the basis for the formulation and answering of pending questions as well as for the evaluation of the current knowledge status. It differs from conventional scientific literature databases in that, apart from bibliographical data, it also contains biophysical and medical contents in structured form. Currently the database comprises approximately 10,000 studies.

Free and public internet access allows experts as well as the general public to inform themselves about the up-to-date knowledge status regarding the effects of high- and low-frequency fields.

As EMF Portal offers a wide and comprehensive overview of the relevant research on EMF it is a valuable medium for people who are - for occupational or pivate matters - concerned with this topic.

Click here to access the *EMF-Portal* (English version)
This site is also available in German.

EMF research databases: 1,2,3 | Next page

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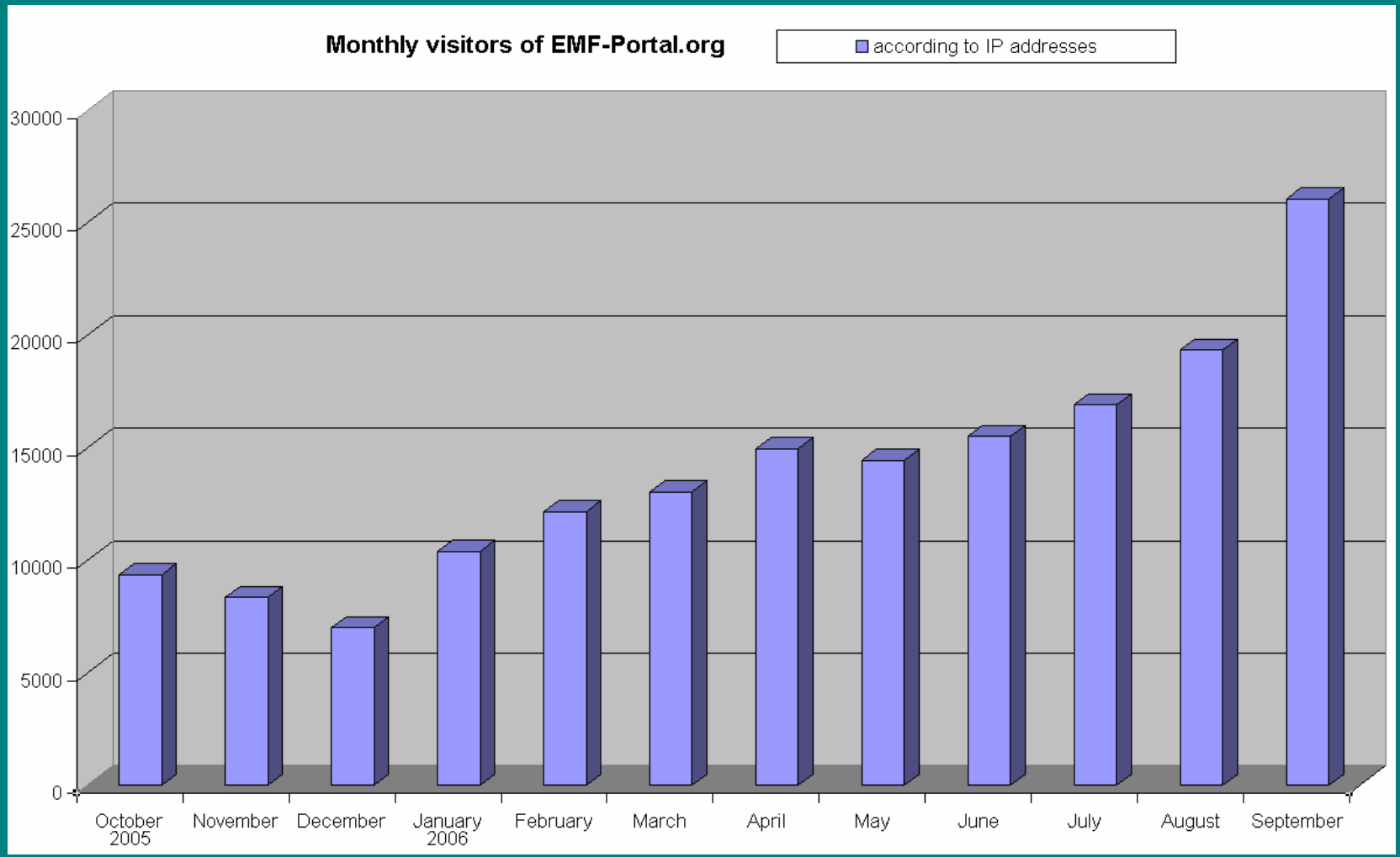

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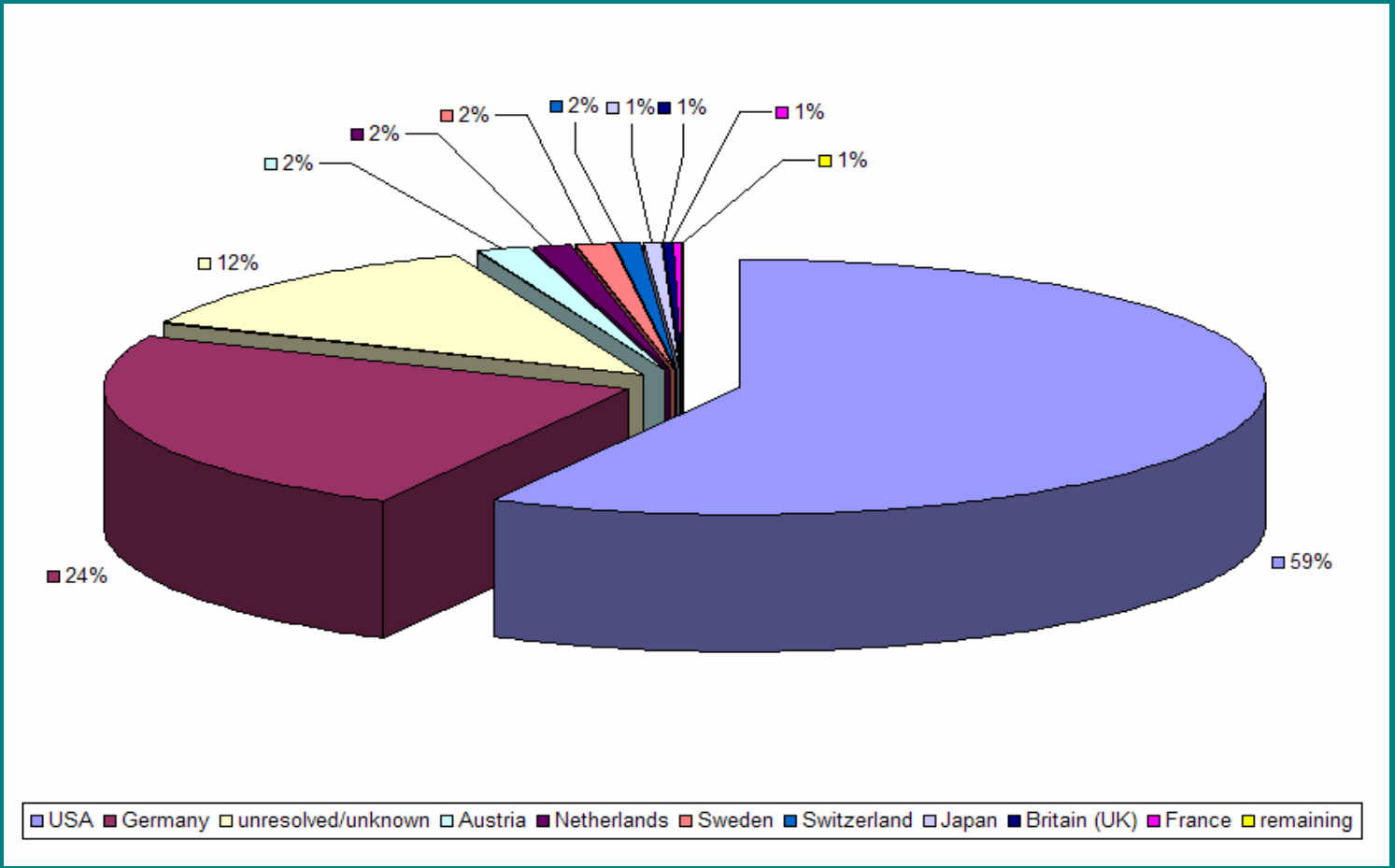

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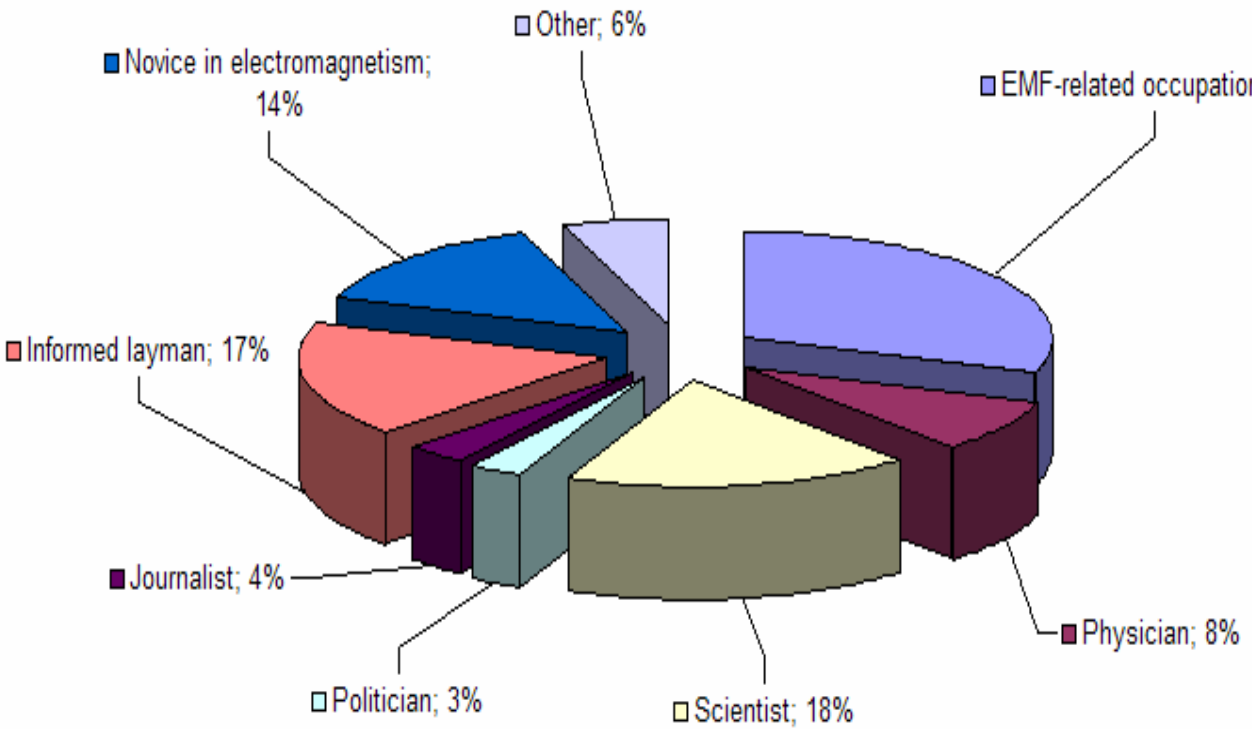

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Recurrent tasks

- literature research and acquisition
- extraction of exposure parameters
- extraction of medical, biological and epidemiological descriptors
- software development & maintenance
- hardware maintenance

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Outlook

- additional languages can be implemented
- international collaboration intended
- only continuous processing and maintenance can secure completeness and up-to-dateness

→ continuous funding required!

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Access via Internet

http://www.**emf-portal**.org

Your feedback is welcome!

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