Package 'europepmc'

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Title R Interface to the Europe PubMed Central RESTful Web Service

Version 0.3

License GPL-3

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URL http://github.com/ropensci/europepmc/

BugReports http://github.com/ropensci/europepmc/issues

Description An R Client for the Europe PubMed Central RESTful Web Service
(see <https://europepmc.org/RestfulWebService> for more information). It
gives access to both metadata on life science literature and open access
full texts. Europe PMC indexes all PubMed content and other literature
sources including Agricola, a bibliographic database of citations to the
agricultural literature, or Biological Patents. In addition to bibliographic
metadata, the client allows users to fetch citations and reference lists.
Links between life-science literature and other EBI databases, including
ENA, PDB or ChEMBL are also accessible. No registration or API key is
required. See the vignettes for usage examples.

LazyLoad yes

LazyData yes

VignetteBuilder knitr

Depends R (>= 3.00)

Imports httr, jsonlite, plyr, dplyr, progress, urltools, purrr, xml2

RoxygenNote 6.0.1

Suggests testthat, knitr, rmarkdown, ggplot2, readr

Encoding UTF-8

NeedsCompilation no

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R **topics documented:**

---

epmc_citations   *Get citations for a given publication*

Description

Finds works that cite a given publication.

Usage

```
epmc_citations(ext_id = NULL, data_src = "med", limit = 100,
  verbose = TRUE)
```

Arguments

ext_id   character, publication identifier

data_src   character, data source, by default Pubmed/MedLine index will be searched. The
                following three letter codes represent the sources Europe PubMed Central sup-
                ports:

                agr Agricola is a bibliographic database of citations to the agricultural literature
                    created by the US National Agricultural Library and its co-operators.

                cba Chinese Biological Abstracts

                ctx CiteXplore

                eth EthOs Theses, i.e. PhD theses (British Library)

                hir NHS Evidence

                med PubMed/Medline NLM

nbk Europe PMC Book metadata

pat Biological Patents

pmc PubMed Central

limit   integer, number of results. By default, this function returns 100 records.

verbose   logical, print some information on what is going on.

Value

Metadata of citing documents as data.frame

Examples

```
## Not run:
epmc_citations("PMC3166943", data_src = "pmc")
epmc_citations("9338777")

## End(Not run)
```

---

epmc_db   *Retrieve external database entities referenced in a given publication*

Description

This function returns EBI database entities referenced in a publication from Europe PMC RESTful Web Service.

Usage

```
epmc_db(ext_id = NULL, data_src = "med", db = NULL, limit = 100,
  verbose = TRUE)
```

Arguments

ext_id   character, publication identifier

data_src   character, data source, by default Pubmed/MedLine index will be searched. The following three letter codes represent the sources Europe PubMed Central supports:

agr Agricola is a bibliographic database of citations to the agricultural literature created by the US National Agricultural Library and its co-operators.

cba Chinese Biological Abstracts

ctx CiteXplore

eth EthOs Theses, i.e. PhD theses (British Library)

hir NHS Evidence

med PubMed/Medline NLM

nbk Europe PMC Book metadata

pat	Biological Patents
pmc	PubMed Central

db   character, specify database:

'ARXPR' Array Express, a database of functional genomics experiments <https://www.ebi.ac.uk/arrayexpress/>

'CHEBI' a database and ontology of chemical entities of biological interest <http://www.ebi.ac.uk/chebi/>

'CHEMBL' a database of bioactive drug-like small molecules <https://www.ebi.ac.uk/chembldb/>

'EMBL' now ENA, provides a comprehensive record of the world's nucleotide sequencing information <http://www.ebi.ac.uk/ena/>

'INTACT' provides a freely available, open source database system and analysis tools for molecular interaction data <http://www.ebi.ac.uk/intact/>

'INTERPRO' provides functional analysis of proteins by classifying them into families and predicting domains and important sites <http://www.ebi.ac.uk/interpro/>

'OMIM' a comprehensive and authoritative compendium of human genes and genetic phenotypes <http://www.ncbi.nlm.nih.gov/omim>

'PDB' European resource for the collection, organisation and dissemination of data on biological macromolecular structures <http://www.ebi.ac.uk/pdbe/>

'UNIPROT' comprehensive and freely accessible resource of protein sequence and functional information <http://www.uniprot.org/>

'PRIDE' PRIDE Archive - proteomics data repository <https://www.ebi.ac.uk/pride/archive/>

limit   integer, number of results. By default, this function returns 100 records.

verbose   logical, print some information on what is going on.

Value

Cross-references as data.frame

Examples

```
## Not run:
epmc_db("12368864", db = "uniprot", limit = 150)
epmc_db("25249410", db = "embl")
epmc_db("14756321", db = "uniprot")
epmc_db("11805837", db = "pride")

## End(Not run)
```

---

epmc_db_count | *Retrieve the number of database links from Europe PMC publication database*

Description

This function returns the number of EBI database links associated with a publication.

Usage

```
epmc_db_count(ext_id = NULL, data_src = "med")
```

Arguments

ext_id   character, publication identifier

data_src   character, data source, by default Pubmed/MedLine index will be searched.

Details

Europe PMC supports cross-references between literature and the following databases:

'ARXPR' Array Express, a database of functional genomics experiments https://www.ebi.ac.uk/arrayexpress/

'CHEBI' a database and ontology of chemical entities of biological interest http://www.ebi.ac.uk/chebi/

'CHEMBL' a database of bioactive drug-like small molecules https://www.ebi.ac.uk/chembldb/

'EMBL' now ENA, provides a comprehensive record of the world's nucleotide sequencing information http://www.ebi.ac.uk/ena/

'INTACT' provides a freely available, open source database system and analysis tools for molecular interaction data http://www.ebi.ac.uk/intact/

'INTERPRO' provides functional analysis of proteins by classifying them into families and predicting domains and important sites http://www.ebi.ac.uk/interpro/

'OMIM' a comprehensive and authoritative compendium of human genes and genetic phenotypes http://www.ncbi.nlm.nih.gov/omim

'PDB' European resource for the collection, organisation and dissemination of data on biological macromolecular structures http://www.ebi.ac.uk/pdbe/

'UNIPROT' comprehensive and freely accessible resource of protein sequence and functional information http://www.uniprot.org/

'PRIDE' PRIDE Archive - proteomics data repository https://www.ebi.ac.uk/pride/archive/

Value

data.frame with counts for each database

Examples

```
   ## Not run:
   epmc_db_count(ext_id = "10779411")
   epmc_db_count(ext_id = "PMC3245140", data_src = "PMC")

   ## End(Not run)
```

---

epmc_details *Get details for individual records*

Description

This function returns full metadata for a given publication ID including abstract, full text links, author details including ORCID and affiliation, MeSH terms, chemicals, grants.

Usage

```
   epmc_details(ext_id = NULL, data_src = "med")
```

Arguments

ext_id   character, publication identifier

data_src   character, data source, by default Pubmed/MedLine index will be searched.
               Other sources Europe PubMed Central supports are:

   agr Agricola is a bibliographic database of citations to the agricultural literature
         created by the US National Agricultural Library and its co-operators.
   cba Chinese Biological Abstracts
   ctx CiteXplore
   eth EthOs Theses, i.e. PhD theses (British Library)
   hir NHS Evidence
   med PubMed/Medline NLM
   pat Biological Patents
   pmc PubMed Central

Value

list of data frames

Examples

```
   ## Not run:
   epmc_details(ext_id = "26980001")
   epmc_details(ext_id = "24270414")

   # PMC record
   epmc_details(ext_id = "PMC4747116", data_src = "pmc")
```

```
# Other sources:
# Agricolo
epmc_details("IND43783977", data_src = "agr")
# Biological Patents
epmc_details("EP2412369", data_src = "pat")
# Chinese Biological Abstracts
epmc_details("583843", data_src = "cba")
# CiteXplore
epmc_details("C6802", data_src = "ctx")
# NHS Evidence
epmc_details("338638", data_src = "hir")
# Theses
epmc_details("409323", data_src = "eth")

## End(Not run)
```

---

epmc_ftxt   *Fetch Europe PMC full texts*

Description

This function loads full texts into R. Full texts are in XML format and are only provided for the
Open Access subset of Europe PMC.

Usage

```
epmc_ftxt(ext_id = NULL)
```

Arguments

ext_id   character, publication identifier. All full text publications have external IDs start-
                ing with 'PMC___'.

Value

xml_document

Examples

```
## Not run:
epmc_ftxt("PMC3257301")
epmc_ftxt("PMC3639880")

## End(Not run)
```

---

epmc_ftxt_book   *Fetch Europe PMC books*

Description

Use this function to retrieve book XML formatted full text for the Open Access subset of the Europe PMC bookshelf.

Usage

```
epmc_ftxt_book(ext_id = NULL)
```

Arguments

ext_id   character, publication identifier. All book full texts are accessible either by the
                  PMID or the 'NBK' book number.

Value

xml_document

Examples

```
## Not run:
epmc_ftxt_book("NBK32884")

## End(Not run)
```

---

epmc_hits   *Get search result count*

Description

Search over Europe PMC and retrieve the number of results found

Usage

```
epmc_hits(query = NULL, ...)
```

Arguments

query   query in the Europe PMC syntax
...   add query parameters from 'epmc_search()', e.g. synonym=true

See Also

epmc_search

Examples

```
  ## Not run:
  epmc_hits('abstract:"burkholderia pseudomallei"')
  epmc_hits('AUTHORID:"0000-0002-7635-3473"')

  ## End(Not run)
```

---

epmc_hits_trend	*Get the yearly number of hits for a query and the total yearly number of hits for a given period*

Description

Get the yearly number of hits for a query and the total yearly number of hits for a given period

Usage

```
epmc_hits_trend(query, synonym = TRUE, data_src = "med",
  period = 1975:2016)
```

Arguments

query   query in the Europe PMC syntax

synonym   logical, synonym search. If TRUE, synonym terms from MeSH terminology
               and the UniProt synonym list are queried, too. Disabled by default.

data_src   character, data source, by default Pubmed/MedLine index (med) will be searched.
               The following three letter codes represent the sources, which are currently sup-
               ported

      agr Agricola is a bibliographic database of citations to the agricultural literature
          created by the US National Agricultural Library and its co-operators.

      cba Chinese Biological Abstracts

      ctx CiteXplore

      eth EthOs Theses, i.e. PhD theses (British Library)

      hir NHS Evidence

      med PubMed/Medline NLM

      nbk Europe PMC Book metadata

      pat Biological Patents

      pmc PubMed Central

period   a vector of years (numeric) over which to perform the search

Details

A similar function was used in http://www.masalmon.eu/2017/05/14/evergreenreviewgraph/ where it was advised to not plot no. of hits over time for a query, but to normalize it by the total no. of hits.

Value

a data.frame (dplyr tbl_df) with year, total number of hits (all_hits) and number of hits for the query (query_hits)

Examples

```
## Not run:
# aspirin as query
epmc_hits_trend('aspirin', period = 2006:2016, synonym = FALSE)
# link to cran packages in reference lists
epmc_hits_trend('REF:"cran.r-project.org*"', period = 2006:2016, synonym = FALSE)
# more complex with publication type review
epmc_hits_trend('(REF:"cran.r-project.org*") AND (PUB_TYPE:"Review" OR PUB_TYPE:"review-article")',
  period = 2006:2016, synonym = FALSE)

## End(Not run)
```

---

epmc_lablinks   *Get links to external sources*

Description

With the External Link services, Europe PMC allows third parties to publish links from Europe PMC to other webpages or tools. Current External Link providers, which can be selected through Europe PMC's advanced search, include Wikipedia, Dryad Digital Repository or other open services. For more information, see <http://europepmc.org/labslink>.

Usage

```
epmc_lablinks(ext_id = NULL, data_src = "med", lab_id = NULL,
  limit = 100, verbose = TRUE)
```

Arguments

ext_id   publication identifier

data_src   data source, by default Pubmed/MedLine index will be searched. The following
                three letter codes represents the sources Europe PubMed Central supports:

                agr Agricola is a bibliographic database of citations to the agricultural literature
                    created by the US National Agricultural Library and its co-operators.

                cba Chinese Biological Abstracts

                ctx CiteXplore

                eth EthOs Theses, i.e. PhD theses (British Library)

                hir NHS Evidence

                med PubMed/Medline NLM

                nbk Europe PMC Book metadata

                pat Biological Patents

> **pmc** PubMed Central

lab_id   character vector, identifiers of the external link service. Use Europe PMC's
            advanced search form to find ids.

limit   Number of records to be returned. By default, this function returns 100 records.

verbose   print information about what's going on

Value

Links found as nested data_frame

Examples

```
## Not run:
# Fetch links
epmc_lablinks("24007304")
# Link to Altmetric (lab_id = "1562")
epmc_lablinks("25389392", lab_id = "1562")

# Links to Wikipedia
epmc_lablinks("24007304", lab_id = "1507")

# Link to full text copy archived through the institutional repo of
Bielefeld University
epmc_lablinks("12736239", lab_id = "1056")

## End(Not run)
```

---

epmc_lablinks_count   *Summarise links to external sources*

Description

With the External Link services, Europe PMC allows third parties to publish links from Europe
PMC to other webpages or tools. Current External Link providers, which can be selected through
Europe PMC's advanced search, include Wikipedia, Dryad Digital Repository or the institutional
repo of Bielefeld University. For more information, see <http://europepmc.org/labslink>.

Usage

```
epmc_lablinks_count(ext_id = NULL, data_src = "med")
```

Arguments

ext_id   publication identifier

data_src   data source, by default Pubmed/MedLine index will be searched. The following
            three letter codes represents the sources Europe PubMed Central supports:

> **agr** Agricola is a bibliographic database of citations to the agricultural literature
> created by the US National Agricultural Library and its co-operators.

    cba Chinese Biological Abstracts

    ctx CiteXplore

    eth EthOs Theses, i.e. PhD theses (British Library)

    hir NHS Evidence

    med PubMed/Medline NLM

    nbk Europe PMC Book metadata

    pat Biological Patents

    pmc PubMed Central

Value

data.frame with counts for each database

Examples

```
## Not run:
epmc_lablinks_count("24023770")
epmc_lablinks_count("PMC3986813", data_src = "pmc")

## End(Not run)
```

---

epmc_profile   *Obtain a summary of hit counts*

Description

This functions returns the number of results found for your query, and breaks it down to the various
publication types, data sources, and subsets Europe PMC provides.

Usage

```
epmc_profile(query = NULL, synonym = TRUE)
```

Arguments

query	character, search query. For more information on how to build a search query, see <http://europepmc.org/Help>
synonym	logical, synonym search. If TRUE, synonym terms from MeSH terminology and the UniProt synonym list are queried, too. Enabled by default.

Examples

```
## Not run:
  epmc_profile('malaria')
  # use field search, e.g. query materials and reference section for
  # mentions of "ropensci"
  epmc_profile('(METHODS:"ropensci")')

## End(Not run)
```

---

epmc_refs   *Get references for a given publication*

Description

This function retrieves all the works listed in the bibliography of a given article.

Usage

```
epmc_refs(ext_id = NULL, data_src = "med", limit = 100, verbose = TRUE)
```

Arguments

ext_id   character, publication identifier

data_src   character, data source, by default Pubmed/MedLine index will be searched. The
                following three letter codes represent the sources Europe PubMed Central sup-
                ports:

                agr Agricola is a bibliographic database of citations to the agricultural literature
                    created by the US National Agricultural Library and its co-operators.

                cba Chinese Biological Abstracts

                ctx CiteXplore

                eth EthOs Theses, i.e. PhD theses (British Library)

                hir NHS Evidence

                med PubMed/Medline NLM

                nbk Europe PMC Book metadata

                pat Biological Patents

                pmc PubMed Central

limit   integer, number of results. By default, this function returns 100 records.

verbose   logical, print some information on what is going on.

Value

returns reference section as tibble

Examples

```
## Not run:
epmc_refs("PMC3166943", data_src = "pmc")
epmc_refs("25378340")
epmc_refs("21753913")


## End(Not run)
```

---

epmc_search *Search Europe PMC publication database*

Description

This is the main function to search Europe PMC RESTful Web Service (http://europepmc.org/RestfulWebService). It fully supports the comprehensive Europe PMC query language. Simply copy & paste your query terms to R. To get familiar with the Europe PMC query syntax, check the Advanced Search Query Builder https://europepmc.org/advancesearch.

Usage

```
epmc_search(query = NULL, output = "parsed", synonym = TRUE,
  verbose = TRUE, limit = 100, sort = NULL)
```

Arguments

query   character, search query. For more information on how to build a search query,
               see http://europepmc.org/Help

output   character, what kind of output should be returned. One of 'parsed', 'id_list' or
               'raw' As default, parsed key metadata will be returned as data.frame. 'id_list'
               returns a list of IDs and sources. Use 'raw' to get full metadata as list. Please be
               aware that these lists can become very large.

synonym   logical, synonym search. If TRUE, synonym terms from MeSH terminology
               and the UniProt synonym list are queried, too. Disabled by default.

verbose   logical, print progress bar. Activated by default.

limit   integer, limit the number of records you wish to retrieve. By default, 100 are
               returned.

sort   character, relevance ranking is used by default. Use `sort = 'cited'` for sorting
               by the number of citations, or `sort = 'date'` by the most recent publications.

Value

tibble

See Also

http://europepmc.org/Help

Examples

```
## Not run:
#Search articles for 'Gabi-Kat'
my.data <- epmc_search(query='Gabi-Kat')

#Get article metadata by DOI
```

```
my.data <- epmc_search(query = 'DOI:10.1007/bf00197367')

#Get article metadata by PubMed ID (PMID)
my.data <- epmc_search(query = 'EXT_ID:22246381')

#Get only PLOS Genetics article with EMBL database references
my.data <- epmc_search(query = 'ISSN:1553-7404 HAS_EMBL:y')
#Limit search to 250 PLOS Genetics articles
my.data <- epmc_search(query = 'ISSN:1553-7404', limit = 250)

# exclude MeSH synonyms in search
my.data <- epmc_search(query = 'aspirin', synonym = FALSE)

# get 100 most cited atricles from PLOS ONE publsihed in 2014
epmc_search(query = '(ISSN:1932-6203) AND FIRST_PDATE:2014', sort = 'cited')

# print number of records found
attr(my.data, "hit_count")

# change output


## End(Not run)
```

---

epmc_search_   *Get one page of results when searching Europe PubMed Central*

Description

In general, use epmc_search instead. It calls this function, calling all pages within the defined limit.

Usage

```
epmc_search_(query = NULL, limit = 100, output = "parsed",
  page_token = NULL, ...)
```

Arguments

query	character, search query. For more information on how to build a search query, see http://europepmc.org/Help
limit	integer, limit the number of records you wish to retrieve. By default, 25 are returned.
output	character, what kind of output should be returned. One of 'parsed', 'id_list' or 'raw' As default, parsed key metadata will be returned as data.frame. 'id_list returns a list of IDs and sources. Use 'raw' to get full metadata as list. Please be aware that these lists can become very large.
page_token	cursor marking the page
...	further params from epmc_search

See Also

[epmc_search](#)

---

epmc_tm   *Get text-mined terms*

Description

Retrieve a count and a list of text-mined terms gathered by Europe PMC.

Usage

```
epmc_tm(ext_id = NULL, data_src = "med", semantic_type = NULL,
  limit = 100, verbose = TRUE)
```

Arguments

ext_id	character, publication identifier
data_src	character, data source, by default Pubmed/MedLine index will be searched. The only sources relevant to this methods are med and pmc.
	med Publications from PubMed and MEDLINE
	pmc Publications from PubMed Central
semantic_type	controlled vocabulary. Specify the semantic type you wish to retrieve. The following types are supported:
	ACCESSION accession IDs for DNA or protein sequences
	CHEMICAL chemicals
	DISEASE diseases
	EFO Experimental Factor Ontology (<http://www.ebi.ac.uk/efo/>)
	GENE_PROTEIN gene proteins
	GO_TERM Gene Ontology Terms (<http://geneontology.org/>)
	ORGANISM organism
limit	Number of records to be returned. By default, this function returns 100 records.
verbose	print information about what's going on

Value

Terms found as tibble

Examples

```
## Not run:
epmc_tm("25249410")
epmc_tm("25249410", semantic_type = "GO_TERM")
epmc_tm("PMC4340542", data_src = "pmc", semantic_type = "GO_TERM")

## End(Not run)
```

epmc_tm_count   *Retrieve the number of database links from Europe PMC publication*
                                 database

Description

This function returns the number of database links for each EBI database from Europe PMC REST-ful Web Service.

Usage

```
epmc_tm_count(ext_id = NULL, data_src = "med")
```

Arguments

ext_id	character, publication identifier
data_src	character, data source, by default Pubmed/MedLine index will be searched.

Details

Europe PMC supports the following semantic types:

ACCESSION accession IDs for DNA or protein sequences

CHEMICAL chemicals

DISEASE diseases

EFO Experimental Factor Ontology (<http://www.ebi.ac.uk/efo/>)

GENE_PROTEIN gene proteins

GO_TERM Gene Ontology Terms (<http://geneontology.org/>)

ORGANISM organism

Value

data.frame with counts for each semantic type

Examples

```
   ## Not run:
   epmc_tm_count("PMC4340542", data_src = "pmc")

## End(Not run)
```

| europepmc | *europepmc - an R client for the Europe PMC RESTful article API* |

Description

europepmc - an R client for the Europe PMC RESTful article API

What is europepmc?

europepmc facilitates access to Europe PMC RESTful Web Service. Europe PMC covers life science literature and gives access to open access full texts. Coverage is not only restricted to Europe, but articles and abstracts are indexed from all over the world. Europe PMC ingests all PubMed content and extends its index with other sources, including Agricola, a bibliographic database of citations to the agricultural literature, or Biological Patents.

Besides searching abstracts and full text, europepmc can be used to retrieve reference sections and citations, text-mined terms or cross-links to other databases hosted by the European Bioinformatics Institute (EBI).

For more information about Europe PMC, see their current paper: Levchenko, M., Gou, Y., Graef, F., Hamelers, A., Huang, Z., Ide-Smith, M., ... McEntyre, J. (2017). Europe PMC in 2017. Nucleic Acids Research, 46(D1), D1254–D1260. https://doi.org/10.1093/nar/gkx1005.

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