Package 'genomes'

March 26, 2013

Type Package

Title Genome sequencing project metadata

Version 2.4.0

Date 2012-09-14

Author Chris Stubben

Maintainer Chris Stubben <stubben@lanl.gov>

License Artistic-2.0

Depends R (>= 2.10), XML, RCurl, GenomicRanges, IRanges, Biostrings

biocViews Annotation, Genetics

Description Collects genome sequencing project data from NCBI and the ENA.

R topics documented:

---

doublingTime   *Doubling time for genome projects*

Description

Calculates the doubling time of genome sequencing project releases

Usage

doublingTime(x, subset, time = "days", curdate=TRUE)

Arguments

x	genomes data frame with class 'genomes'
subset	logical vector indicating rows to keep
time	return doubling time in days (default), months, or years
curdate	include the current date in calculation, if false, then default is range of release dates

Value

the doubling time

Author(s)

Chris Stubben

Examples

```
data(proks)
doublingTime(proks)
doublingTime(proks, status == 'Complete', time='months')
```

---

efetch	*Entrez database downloads*

Description

Retrieve Entrez database records at NCBI in a variety of formats

Usage

```
efetch(id, db = "pubmed", rettype = "", retmode = "text", seq_stop = 700, ...)
```

Arguments

id	An EntrezHistory object or vector of Ids
db	An Entrez database, default pubmed
rettype	Retrieval type, see note for details
retmode	Retrieval mode, see note for details
seq_stop	Last sequence base to retrieve. The stop is set low to avoid unintentional downloads of large sequences. Set to NA or an empty string to download the entire sequence.
...	Other key-value pairs passed to the efetch url string

Value

A character vector for the given retrieval type and mode.

Note

See Table 1 http://www.ncbi.nlm.nih.gov/books/NBK25499/table/chapter4.chapter4_table1 for a list of valid retrieval types and modes.

If EntrezHistory results are the input, then the database listed in that object is used. If using a vector of Ids, the database option must be included. Also, do not pass more than 200 Ids to the url (use the History or see the NCBI help pages for other suggestions).

Author(s)

Chris Stubben

References

http://www.ncbi.nlm.nih.gov/books/NBK25499

Examples

```
## Not run:
# abstracts from recent bioC articles - use ids to limit the number
x <- esearch("bioconductor[TITLE]", usehistory="n", retmax=5, reldate=360 )
x
efetch(x, rettype="abstract")
# Sequence default is 700 bases
efetch( esearch( "Yersinia pestis CO92[ORGN] AND refseq[FILTER] AND plasmid[Filter]", "nuccore"), rettype="fasta")
# set seq_stop = "" for full sequence
efetch(16082679, "nuccore", "fasta", seq_stop="")

## End(Not run)
```

---

einfo   *Entrez database information*

Description

List all Entrez databases at NCBI or the indexing fields and available links for a specific database

Usage

```
einfo(db, links=FALSE)
```

Arguments

db   a valid Entrez database, if missing then all databases are listed

links   list database links, default is fields

Details

Runs Einfo and parses XML results

Value

A data.frame listing databases, fields, or links

Author(s)

Chris Stubben

References

http://www.ncbi.nlm.nih.gov/books/NBK25499

Examples

```
# einfo()   - not working Feb 2013
einfo("bioproject")
einfo("bioproject", TRUE)
```

---

elink   *Entrez database links*

Description

Find links between Entrez databases at NCBI

Usage

```
elink(id, cmd = "neighbor_history", parse = TRUE, ...)
```

Arguments

id	An EntrezHistory object or vector of Ids
cmd	Command mode
parse	Parse results into an EntrezHistory object (default) or vector of linked Ids (if cmd="neighbor"). All other cmd options return XML
...	Other key-value pairs such as dbfrom, db, linkname passed to the elink url string

Details

See einfo to find available links

Value

Same as esearch

Note

If EntrezHistory results are the input, then the database listed in that object is used as the dbfrom key. Some additional checks are needed to catch timeout and other errors returned by the NCBI servers.

Author(s)

Chris Stubben

References

http://www.ncbi.nlm.nih.gov/books/NBK25499

Examples

```
## Not run:
elink("15718680,157427902", dbfrom="protein", db="gene")
elink("15718680,157427902", dbfrom="protein", db="gene", cmd="neighbor")

# list linknames
einfo("genome", TRUE)[, 1:2]
x <- esearch("Nipah virus", "genome")
# dbfrom is set to "genome" and default link is "genome_nuccore"
y <- elink(x, db="nuccore")
y
# Links to reference AND genbank sequence the reference was derived from
esummary(y)
# OR link to Other genomes for Species
esummary( elink(x, db="nuccore", linkname="genome_nuccore_samespecies"))

## End(Not run)
```

---

enaExperiment	*ENA SRA experiment details*

Description

Return details about SRA experiments in the ENA

Usage

```
enaExperiment(accs, batchsize = 100)
```

Arguments

accs   a vector of SRA experiments or a range of accessions with prefix SRX, ERX,
                  DRX, etc.

batchsize   number of accs to include in a single comma-separated url string

Details

Parses some of the tags and values in the XML experiment report

Value

a data.frame with platform, model and library details like name, layout, source and selection

Author(s)

Chris Stubben

References

http://www.ebi.ac.uk/ena/about/browser#sra_xml

See Also

enaSRA

Examples

```
# compare to http://www.ebi.ac.uk/ena/data/view/ERX007105
 enaExperiment("ERX007105")

## Not run:
# chimps
pan<-enaSRA(9596)
head(pan)
# first experiment in sample
pan2<-enaExperiment(substr(pan$experiment, 1,9))
head(pan2)
table2(pan2$model)

## End(Not run)
```

---

enaFiles   *ENA SRA submitted or fastq files*

Description

Retrieve a list of SRA submitted files or generated fastq files at the ENA

Usage

```
enaFiles(acc, file = "submitted")
```

Arguments

acc   a vector of SRA accession numbers

file   return submitted (default) or fastq file names

Value

a data.frame with experiment details and files names

Note

Only a single accession number is allowed in the URL string, so retrieving files from multiple accessions will be slow

Author(s)

Chris Stubben

References

http://www.ebi.ac.uk/ena/about/browser#sra_submitted_files

Examples

```
enaFiles("ERP000141")
##enaFiles("ERP000141", "fastq")
```

---

enaProject   *ENA projects*

Description

Search for projects at ENA using a taxonomy name or id

Usage

enaProject(tax, limit = 1000, refseq = TRUE)

Arguments

tax   a taxonomy ID or name

limit   total number of projects to return

refseq   include RefSeq projects

Details

Searches the project data from the taxonomy portal at ENA.

Value

a data.frame listing projects and submission details

Note

URL strings at ENA require a taxonomy ID, so searching by name uses a ncbiTaxonomy ID lookup
at NCBI.

This portal removed Feb 2013. See devel branch for fixes.

Author(s)

Chris Stubben

References

http://www.ebi.ac.uk/ena/about/browser#taxonomy_portal_options

See Also

enaSRA to search for SRA samples.

Examples

```
## Not run:
pan<-enaProject(9596)
pan

## End(Not run)
```

---

enaSRA   *ENA sequence read archive*

Description

Search for SRA samples at the ENA using a taxonomy name or id

Usage

enaSRA(tax, limit = 500)

Arguments

tax   a taxonomy ID or name

limit   total number of samples to return

Details

Searches the sra_sample data from the taxonomy portal at ENA.

Value

a data.frame listing SRA samples

Note

URL strings at ENA require a taxonomy ID, so searching by name uses a ncbiTaxonomy ID lookup.

Author(s)

Chris Stubben

References

http://www.ebi.ac.uk/ena/about/browser#taxonomy_portal_options

See Also

See enaTaxonomy to check the total number of SRAs before downloading

Examples

```
# chimps
## Not run:

pan<-enaSRA(9596)   # or pan<-enaSRA("Pan")
head(pan)
nrow(pan)
table2(pan$center)
bases(sum(pan$bases, na.rm=TRUE))
bases(sum(pan$reads, na.rm=TRUE), round=1)

# some taxonomy ID links are not working -- should be fixed in October 2012 ENA update
# in the meantime add limit to avoid downloading default (500) records.
# For example, 90 SRA samples from Cyanobacteria on Sep 14, 2012
enaTaxonomy(1117)
cyano <- enaSRA(1117, limit=90)
table2(genus(cyano$name))

## End(Not run)
```

---

enaStudy   *ENA SRA study details*

Description

Return details about SRA studies in the ENA

Usage

```
enaStudy(accs, batchsize = 100)
```

Arguments

accs	a vector of SRA studies or a range of accessions with prefix SRP, ERP, DRP, etc.
batchsize	number of accs to include in a single comma-separated url string

Value

a data.frame with study title, type, description, analysis

Note

only a few studies have secondary analysis

Author(s)

Chris Stubben

See Also

enaSRA

Examples

```
# compare to http://www.ebi.ac.uk/ena/data/view/ERP000054
enaStudy("ERP000054")

## Not run:
# chimps
pan<-enaSRA(9596)
head(pan)
pan2 <-enaStudy(pan$study)
head( pan2,2)
pan2[,1:2]
table2(pan2$type)

## End(Not run)
```

---

enaSubmission	*ENA SRA submission dates*

Description

Return details about SRA submissions in the ENA

Usage

enaSubmission(accs, batchsize = 100)

Arguments

accs	a vector of SRA submissions with prefix SRA, ERA, DRA, etc, or a range of accessions
batchsize	number of accs to inlcude in a single comma-separated url string

Details

Parses the submission date attribute in the submission tag

Value

a data.frame with acc number, title and submitted date

Author(s)

Chris Stubben

References

http://www.ebi.ac.uk/ena/about/browser#sra_xml

See Also

enaSRA

Examples

```
#compare to http://www.ebi.ac.uk/ena/data/view/ERA000746
enaSubmission("ERA000746")
# or ranges
# enaSubmission("SRA000600-SRA000610")

# chimps
#pan<-enaSRA(9596)
#head(pan)
#enaSubmission(pan$submission)
```

---

enaTaxonomy	*ENA taxonomy statistics*

Description

The number of linked records and total size in the taxonomy portal view at the European Nucleotide Archive (ENA)

Usage

```
enaTaxonomy(tax, h = TRUE, round = 0)
```

Arguments

tax	a taxonomy ID or name
h	return bases in human-readable format
round	number of digits to round bases

Value

a data.frame listing direct and subtree records in eight data classes: Assembled Nucleotide Sequences (release), Annotated Nucleotide Sequence update (std_update), Whole Genome Shotgun Sequence update (wgs_update), Genomic Contig Sequence update (con_update), Protein-coding Sequences (cds), Trace Archive (trace), SRA samples (sra_sample) and Projects (project).

Note

The ENA urls require a taxonomy ID and therefore searching by a taxonomy name will be slower since a separate query to the NCBI taxonomy database is needed.

Author(s)

Chris Stubben

References

see http://www.ebi.ac.uk/ena/about/browser#taxonomy_portal_options for details

See Also

ncbiTaxonomy

Examples

```
## Not run:
# COMPARE to http://www.ebi.ac.uk/ena/data/view/display=html&Taxon:2
enaTaxonomy("Bacteria")
# common names
enaTaxonomy("human")
# root
enaTaxonomy(1)

## End(Not run)
```

---

esearch	*Entrez database search*

Description

Search Entrez databases at NCBI

Usage

```
esearch(term, db = "pubmed", usehistory = "y", parse = TRUE, verbose=TRUE, showURL=FALSE, ...)
```

Arguments

term	Any valid combination of Entrez search terms or a vector of accessions
db	An Entrez database, default pubmed
usehistory	Save results to History server for subsequent calls
parse	If false, the XML output is returned
verbose	Print number of results found
showURL	Print url string
...	Other key-value pairs passed to esearch url string

Details

See einfo() for a list of valid Entrez database names and search fields. If usehistory="n", the default number of ids returned is 20 (set a retmax option to increase the default limit). If a vector of accessions are input, the terms are pasted together in a comma-separated list for searching by Primary Acession.

Value

Either an EntrezHistory data.frame listing the database, query_key and WebEnv (default), a vector of Ids if usehistory="n", or the raw XML output if parse=FALSE. The default EntrezHistory object may be passed directly to the other E-utilities.

Author(s)

Chris Stubben

References

http://www.ncbi.nlm.nih.gov/books/NBK25499

Examples

```
## Not run:
# EntrezHistory object
esearch("bioconductor[TITLE]", showURL=TRUE)
# taxonomy IDs
esearch("mouse", db="taxonomy", usehistory="n")
esearch("AE017223 OR ACBJ00000000", db="nuccore")
# comma-separated (or vector) to search Primary accessions
esummary( esearch("AE017223,ACBJ00000000", db="nuccore"))

## End(Not run)
```

| esummary | *Entrez database summaries* |

Description

Summaries of Entrez database records at NCBI

Usage

```
esummary(id, db = "pubmed", parse = TRUE, ...)
```

Arguments

id	An EntrezHistory object or vector of Ids
db	An Entrez database, default pubmed
parse	Parse the XML results into a data.frame
...	Other key-value pairs passed to the esummary url string

Value

A data.frame or XML results if parse=FALSE

Note

If EntrezHistory results are the input, then the database listed in that object is used. If using a vector of Ids, the database option must be included. Also, do not pass more than 200 Ids to the url (use the History or see the NCBI help pages for other suggestions).

Some records may be missing fields and then constructing a data.frame will return warnings. For example, the DOI field is missing in many Pubmed records. You can also set the version="2.0" to return the version 2.0 ESummary XML.

Author(s)

Chris Stubben

References

http://www.ncbi.nlm.nih.gov/books/NBK25499

Examples

```
## Not run:
# BioC articles published in the last year
x <- esearch("bioconductor[TITLE]", reldate=360)
y <- esummary(x, version="2.0")
y[, c(1, 42, 6, 3, 8, 10)]


# Y. pestis CO92 refseqs
x <- esearch( "Yersinia pestis CO92[ORGN] AND refseq[FILTER]", "nuccore")
y <- esummary(x)
y[, c(2,3,5,10)]
# Taxonomy database
esummary(esearch("Mouse[Subtree]", db="taxonomy"))

## End(Not run)
```

---

euks   *Eukaryotic genomes at NCBI*

Description

Eukaryotic genome sequencing projects at NCBI

Usage

```
data(euks)
```

Format

A genomes data frame with observations on the following 17 variables.

acc BioProject Accession number

name Organism name

status Highest level of assembly; Chromosome, Scaffolds, SRA or No data

released First public sequence release

group Phylum

subgroup Class level

size Total length of DNA (Mb)

gc Percent GC (guanine or cytosine)

assembly Name of the genome assembly (from NCBI Assembly database)

chromosomes Number of chromosomes

    organelles Number of organelles

    plasmids Number of plasmids

    wgs Four-letter Accession prefix followed by version

    scaffolds Number of scaffolds

    genes Number of genes

    proteins Number of proteins

    modified Sequence modification date

Details

Excludes projects that represent only organelles

Source

downloaded from ftp.ncbi.nlm.nih.gov/genomes/GENOME_REPORTS/eukaryotes.txt

Examples

```
data(euks)
euks
t(euks[1,])
plot(euks)
summary(euks)
table2(euks$subgroup)
```

---

ftpList   *List FTP files and directories*

Description

List FTP files and directories from NCBI and other hosts

Usage

```
ftpList(ftp, fileonly = FALSE)
```

Arguments

ftp	ftp directory
fileonly	only list files

Value

a data.frame

Author(s)

Chris Stubben

Examples

```
## Not run:
 # all Y. pestis files
 ftp<- "ftp.ncbi.nih.gov/genomes/Bacteria/Yersinia_pestis_CO92_uid57621"
 x<-ftpList(ftp)
 x
#all genome directories
 ftp<-"ftp.ncbi.nih.gov/genomes/Bacteria"
 x <- ftpList(ftp)

## End(Not run)
```

---

genomes	*Introduction to the genomes package*

Description

Genomes sequencing project statistics from prokaryotes, eukaryotes, and metagenomes.

Author(s)

Chris Stubben <stubben@lanl.gov>

Examples

```
data(proks)
proks
summary(proks)
plot(proks)
## Not run: update(proks)
```

---

genomes-lines	*Add lines to a genomes plot*

Description

Add lines representing the cumulative number of genomes by released date to a genome plot.

Usage

```
## S3 method for class 'genomes'
lines(x, subset, ...)
```

Arguments

x	genomes data frame with class 'genomes'
subset	logical vector indicating rows to keep
...	additional arguments passed to lines

Details

Use plotby to plot multiple lines within the same genome table. This function adds new lines from different genome tables to the same plot.

Author(s)

Chris Stubben

See Also

plotby

Examples

```
data(proks)
data(euks)

plot(proks, log='y', las=1, lty=3)
lines(euks, col="red", lty=2)
```

---

genomes-plot   *Genome table plots by release date*

Description

Generic function for plotting the cumulative number of genomes by released date for genome tables

Usage

```
## S3 method for class 'genomes'
plot(x, subset,
 xlab, ylab ="Genomes",
 type= "l", col = "blue", ...)
```

Arguments

x	a genomes data frame with class 'genomes'
subset	logical vector indicating rows to keep
xlab	x-axis label, default is date column name
ylab	y-axis label
type	type of plot, default is a blue line
col	color
...	additional arguments passed to plot

Details

Requires a released, created or submitted date column (and plots first column found)

Value

A plot of the cumulative total of genomes by release date.

Author(s)

Chris Stubben

See Also

plotby to plot release dates by any grouping column

Examples

```
data(proks)
plot(proks)
plot(proks, name %like% 'Yersinia*', ylab="Yersinia genomes")
```

---

genomes-summary   *Genome table summaries*

Description

Generic function for summarizing genome tables

Usage

```
## S3 method for class 'genomes'
summary(object, subset, top = 5, ...)
```

Arguments

object	a genomes data frame
subset	logical vector indicating rows to keep
top	number of recently released genomes to display, default is 5
...	additional arguments are currently ignored

Value

A list with 2 or 3 elements: the total number of genomes, counts by status (if column is present), and a table listing recent submissions.

Author(s)

Chris Stubben

See Also

plot.genomes

Examples

```
data(euks)
summary(euks)
summary(euks, group=='Fungi')
```

---

genomes-update   *Genome table updates*

Description

Generic function for updating genome tables.

Usage

```
## S3 method for class 'genomes'
update(object, ...)
```

Arguments

object	a genomes data frame to update
...	additional arguments are currently ignored

Details

update will retrieve the new genome table using the update string in attr(object, 'update'). The new table will replace the existing version, *but not permanently*, since reloading the dataset using data will restore the older version. If you have write permission, one option is to use system.file to replace the data set (see the example below).

Value

Returns the updated genome table and a count of the number of new IDs added and old IDs removed. Old IDs are typically assembly genomes in NCBI tables that have been released as a single complete genome.

Author(s)

Chris Stubben

See Also

genomes-summary, genomes-plot

Examples

```
## Not run: data(proks)
## Not run: update(proks)

# to replace the data set permanently
x <- system.file("data", "proks.rda", package="genomes")
x
## Not run: save(proks, file=x)
```

---

genus *Extract the genus name*

Description

Extracts the genus name from a scientific name (latin binomial)

Usage

genus(x)

Arguments

x   A vector of scientific names

Details

Returns the first word in the scientific name. For candidate species labeled *Candidatus*, then the second word is returned.

Value

A vector of genus names

Author(s)

Chris Stubben

See Also

species

Examples

```
genus("Bacillus anthracis Ames")
data(proks)
x <- table2(genus(proks$name))[1:10,]
dotchart(rev(x), xlab="Genomes", pch=16)
```

---

image2 *Display a matrix image*

Description

Creates a grid of colored rectangles to display a matrix

Usage

```
image2(x, col = rev(heat.colors(24)), breaks, log = FALSE,
 zeroNA=TRUE, sort01=FALSE, all=FALSE, border = NA, box.offset = 0.1,
 round = 3, cex, text.cex = 1, text.col = "black", mar = c(1, 3, 3, 1),
 labels = 2:3, label.offset = 0.1, label.cex = 1)
```

Arguments

x	A numeric matrix, typically with row and column names
col	A vector of colors for boxes
breaks	A numeric vector of break points or number of intervals into which x is to be cut. Default is the length of col
log	Cut values in x using a log scale, default TRUE
zeroNA	Set zeros to NA (and color white)
sort01	Sort rows in descending order using the entire string of numbers
all	Display entire matrix, default is first 50 rows and columns
border	The border color for boxes, default is no borders
box.offset	Percent reduction in box size (a number between 0 and 1), default is 10% reduction
round	Number of decimal places to display values of x in each box
cex	Magnification size of text and labels, if specified this will replace values in both text.cex and label.cex
text.cex	Magnification size of text in cells only
text.col	Color of text in cells, use NA to skip text labels
mar	Margins on four sides of plot
labels	A vector giving sides of the plot (1=bottom, 2=left, 3=top, 4=right) for row and column labels
label.offset	Amount of space between label and boxes
label.cex	Magnification size of labels

Details

Missing values (NAs) and zeroes are assigned to the color white (unless zeroNA is FALSE) and remaining values are cut into groups and colored using the assigned values.

Value

A image plot of the matrix in x

Author(s)

Chris Stubben

See Also

image

Examples

```
## top 20 Genus by year
data(proks)
z<-table2(genus(proks$name), year(proks$released), n=20)
 image2(z[,-ncol(z)], sort=TRUE, mar=c(1,10,3,1), cex=.8)
```

---

like   *Pattern matching using wildcards*

Description

Pattern matching using wildcards

Usage

```
x %like% pattern
```

Arguments

pattern	character string containing the pattern to be matched
x	values to be matched

Details

Only wildcards matching a single character '?' or zero or more characters '*' are allowed. Matches are case-insensitive. The pattern is first converted to a regular expression using glob2rx then matched to values in x using grep.

This is a shortcut for a commonly used expression found in the subset example where nm %in% grep("^M", nm,value= simplifies to nm %like% 'M*'.

Value

A logical vector indicating if there is a match or not. This will mostly be useful in conjunction with the subset function.

Author(s)

Chris Stubben

See Also

grep, glob2rx, subset

Examples

```
data(proks)
subset(proks, name %like% 'Yersinia*', c(name, released))
# also works with date or numeric fields
subset(proks, released %like% '2008-01*', c(name, released))
```

---

ncbiGenome   *NCBI Genome links to the Nucleotide database*

Description

Search Entrez Genome at NCBI and retrieves linked genomes in the Nucleotide database

Usage

ncbiGenome(term, refseq=FALSE)

Arguments

term   Any valid combination of Entrez search terms

refseq   Include RefSeq genomes, default is GenBank submissions

Details

Searches Entrez Genome and finds linked sequences in Entrez Nucleotide using genome_nuccore (Assembly) and then finds related sequences using nuccore_nuccore_samespecies_rsgb (Other INSDC Genome Sequences). The genome_nuccore link includes the Reference and Genbank acc that Reference was derived from (and refseq option is used to exclude duplicate RefSeq from results).

Value

A genomes data frame with acc, name, created, taxid, size, gi and other fields.

Author(s)

Chris Stubben

References

A description of the Entrez programming utilities is at http://eutils.ncbi.nlm.nih.gov/.

Examples

Not run:
ncbiGenome('Nipah virus[orgn]')
ncbiGenome('Nipah virus[orgn]', refseq=TRUE)

End(Not run)

---

ncbiNucleotide *NCBI Nucleotide database*

Description

Search Entrez Nucleotide at NCBI and retrieve summary tables

Usage

ncbiNucleotide(term)

Arguments

term   Any valid combination of Entrez search terms or a vector of accessions numbers

Details

Returns a summary from Entrez Nucleotide.

Value

A genomes data frame with acc, name, released, taxid, size, gi and other fields

Author(s)

Chris Stubben

References

A description of the Entrez programming utilities is at http://eutils.ncbi.nlm.nih.gov/.

See Also

ncbiGenome

Examples

```
ncbiNucleotide("AL117189,AL109969,AL117211")[,1:6]

## Not run:
# Exclude Patents and Refseq
marb <- ncbiNucleotide( "Marburgvirus[ORGN] NOT gbdiv_pat[PROP] NOT srcdb_refseq[PROP]")
marb
# two peaks in size distribution (partial and complete sequences)
hist(marb$size, col="blue", br=30, main="Marburg virus sequences", xlab="Length (bp)")

## End(Not run)
```

ncbiProject	*NCBI BioProject database*

Description

Search the Entrez BioProject (Genome Project) at NCBI and retrieve a project summary table

Usage

ncbiProject(term, refseq = FALSE)

Arguments

term	any valid combination of Entrez search terms
refseq	include RefSeq and Overview projects, if false then only primary submissions excluding RefSeq.

Details

Searches the new BioProject database using the ESearch utility

Value

A genomes data frame with 32 summary fields columns

Author(s)

Chris Stubben

References

A description of the Entrez programming utilities is at http://eutils.ncbi.nlm.nih.gov/.

See Also

ncbiGenome

Examples

```
x <- ncbiProject("Yersinia[ORGN]")
x
summary(x)

#Metagenomes
# metag <- ncbiProject("metagenome[Project Data Type]")
# metag <- ncbiProject("metagenomes[Orgn]")
```

---

ncbiPubmed *NCBI PubMed database*

Description

Searches the PubMed database at NCBI and returns a short citation with author, year, title, journal and published date.

Usage

ncbiPubmed(term, abstract = FALSE)

Arguments

term	Any valid combination of Entrez search terms or a vector of pubmed IDs
abstract	Include abstract in result table, default FALSE

Details

The function searches the PubMed database and parses the efetch XML summary to return a short citation

Value

A data.frame with 9 or 10 columns

pmid	PubMed id
authors	first 3 author names
year	year journal was published
title	title
journal	journal name
volume	volume number
pages	pages
pubdate	date journal was published (from PubDate tag)
artdate	date electronic copy was available (from ArticleDate tag)
abstract	abstract

Author(s)

Chris Stubben

Examples

```
ncbiPubmed( c(7542800, 7569993))
# OR ncbiPubmed("7542800,7569993")
```

---

ncbiRelease   *NCBI revision history*

Description

Returns the date a sequence was first seen at NCBI using the revision history display.

Usage

ncbiRelease(ids, db="nuccore", common=TRUE, random=20)

Arguments

ids	A vector or comma-separated list of sequence accessions or GI numbers
db	Entrez sequence database to search, default nuccore
common	If replaced sequences are found, search for the earliest date in the common revision history
random	The number of replaced sequences to search

Details

Searches the revision history display and parses the line listing the date a sequence was *first seen at NCBI*. In some cases, a sequence replaces earlier IDs and if the common option is TRUE, the earliest date of the replaced sequences is returned instead. Also, since a sequence accession may replace 500 or more ids, a random sample of the replaced sequences will be checked.

Value

A data frame listing the accession, release date, and whether replaced sequences are found

Author(s)

Chris Stubben

Examples

```
## Not run:
#Yersinia pestis - 1 chromosome and 3 plasmids
ncbiRelease("AL590842,AL117189,AL109969,AL117211")
# or skip common revision history
ncbiRelease("AL590842", common=FALSE)

## End(Not run)
# Protein acc
ncbiRelease("CAA21395", db="protein")
```

ncbiSubmit   *NCBI submission dates*

Description

Returns the date a sequence was submitted to NCBI using the Direct Submission line in the GenBank file

Usage

ncbiSubmit(term, db = "nuccore")

Arguments

term   Any valid combination of Entrez search terms or a vector of accessions numbers

db   Entrez sequence database to search, default nuccore

Details

Searches an Entrez sequence database, downloads GenBank files and parses the JOURNAL line containing a submitted date, for example, JOURNAL   Submitted (03-SEP-1999) ....

Value

a data.frame with accession, definition, and submitted date

Note

If more than two submitted dates are found, then the earliest date is returned. This script uses E-fetch, so retrievals to the genome and other database will not work.

Author(s)

Chris Stubben

See Also

ncbiRelease

Examples

```
#Yersinia pestis  reference sequences
ncbiSubmit("Yersinia pestis CO92[ORGN] AND refseq[FILTER]")
## Not run:
# Ebola virus - no patents or references
ebola<- ncbiSubmit("Ebolavirus[ORGN] NOT gbdiv_pat[PROP] NOT refseq[FILTER]")
head(ebola)
# a few early submissions may be missing
subset(ebola, is.na(submitted))
table(year(ebola$submit))

## End(Not run)
```

---

ncbiTaxonomy   *NCBI taxonomy database*

Description

Search the Entrez taxonomy database at NCBI

Usage

ncbiTaxonomy(term, summary=TRUE)

Arguments

term   either a valid Entrez search term or a vector of taxonomy Ids or names

summary   return results using Esummary (default) or Efetch

Details

This function uses either Esummary or Efetch to return taxonomy data from NCBI. The Efetch XML include parent ids and lineage tags not found in Esummary XML. The term may be also be a vector of taxonomy Ids (joined using a comma) or taxonomy names (joined using "OR").

Value

a data.frame

Author(s)

Chris Stubben

References

NCBI taxonomy database http://www.ncbi.nlm.nih.gov/sites/entrez?db=taxonomy

See Also

einfo for a list of fields in the taxonomy database.

Examples

```
ncbiTaxonomy("Yersinia pestis")
ncbiTaxonomy("Yersinia pestis", summary=FALSE)

## Not run:
ncbiTaxonomy(c("Bacillus anthracis", "Yersinia pestis"))
ncbiTaxonomy("cellular organisms[Next Level]")
# new Hantavirus species added in 2012
ncbiTaxonomy("Hantavirus[subtree] AND 2012[date] AND species[rank]")

# can also use Lineage field with esummary
ncbiTaxonomy("Necocli virus[Lineage]")
# compare to efetch results
```

ncbiTaxonomy (1145238, FALSE)

End(Not run)

| plotby | *Plot groups of genomes by release date* |

Description

Plots the cumulative number of genomes by released date for different groups of genomes

Usage

plotby(x, groupby = "status", subset = NA, top = 5,
labels = FALSE, curdate=TRUE, abbrev = TRUE, flip = NA,
 legend = "topleft", lbty = "o", lcol = 1, ltitle = NULL, lcex = 1,
 lsort = TRUE, cex = 1, inset=0, ylim = NA, las = 1, lwd = 1, log = "",
xlab = "Release Date", ylab = "Genomes", type='l',
col = c("blue", "red", "green3", "magenta", "yellow"),
lty = 1:top, pch = c(15:18, 1:3), ...)

Arguments

x	a genomes data frame
groupby	a column name in the genomes table or a vector to group by
subset	logical vector indicating rows to keep
top	number of top groups to display
labels	plot a single line with labeled points using genome name column
curdate	include the current date on x-axis, if false, then default is range of release dates
abbrev	abbreviated genome names
flip	a number indicating where to flip labels from right to left, default is middle of plot
legend	a legend keyword or vector of x,y coordinates, defaults to top-left corner. Use NA for no legend
lbty	legend box type
lcol	number of columns in legend
ltitle	legend title
lcex	legend size expansion
inset	inset legend distances(s)
lsort	sort legend by decreasing order of genomes, default true
cex	label size expansion
ylim	y axis limits
las	rotate axis labels
lwd	line width
log	log scale

xlab	x axis label
ylab	y axis label
type	plot type
col	line or point colors
lty	line type
pch	point type
...	additional items passed to plot

Details

Two different plot types are available. The default is to plot multiple lines, one for each group (like matplot). If labels=TRUE, then a single line is drawn with different labeled points for each group.

Value

A plot of released dates by group

Author(s)

Chris Stubben

See Also

plot.genomes

Examples

```
data(proks)
# default group is status
plotby(proks, top=2)

## groupby can be a vector
plotby(proks, genus(proks$name), log='y', lcex=.7)

# OR plot labels
plotby(proks, subset=name %like% 'Haemophilus influenzae*', labels=TRUE, cex=.7, lbty='n')
```

---

print.genomes	*Print genome tables*

Description

Print method for genome tables

Usage

```
## S3 method for class 'genomes'
print(x, ...)
```

Arguments

x	a genomes data.frame
...	additional arguments ignored

Details

Prints the first four columns and first five and last row of a genomes data.frame. To view all the columns in a genome table, you can either select fewer than 7 rows or convert the object to a data.frame (data.frame(proks))

Author(s)

Chris Stubben

Examples

```
data(proks)
proks
## full table printed  if 6 rows or less
proks[1,]
```

---

proks	*Prokaryotic genomes at NCBI*

Description

Prokaryotic genome sequencing projects at NCBI.

Usage

```
data(proks)
```

Format

A genomes data frame with observations on the following 17 variables.

acc BioProject Accession number

name Organism name

status Highest level of assembly; Complete, Assembly, SRA or No data

released First public sequence release

group Phylum

subgroup Class level

size Total length of DNA (Mb)

gc Percent GC (guanine or cytosine)

refseq Refseq chromosome sequence accessions

insdc GenBank chromosome sequence accessions

prefseq Refseq plasmid sequence accessions

pinsdc GenBank plasmid sequence accessions

wgs Four-letter Accession prefix followed by version

scaffolds Number of scaffolds

genes Number of genes

proteins Number of proteins

modified Sequence modification date

Details

Excludes projects that represent only plasmids

Source

downloaded from ftp.ncbi.nlm.nih.gov/genomes/GENOME_REPORTS/prokaryotes.txt

Examples

data(proks)
proks
#single row (long format)
t(proks[1,])
class(proks)
attributes(proks)[c("date","url")]
summary(proks)
check for missing release dates
table2(!is.na(proks$released), proks$status, dnn=list("Released Date?", "Status"))
plot(proks)
plotby(proks, log='y', las=1, top=2)
download recent table from NCBI
Not run: update(proks)

---

read.genemark   *Read a GeneMark output file*

Description

Read a GeneMark HMM version 2.6 file from NCBI (version 3)

Usage

read.genemark(file)

Arguments

file   GeneMark HMM file

Details

GeneMark HMM files are available from the NCBI genomes ftp directory, ftp://ftp.ncbi.nih.gov/genomes.

Value

GRanges with 2 elementMetadata columns: id and class.

Note

Two GeneMark predictions are available from teh NCBI genomes ftp. This function currently reads the HMM version 2.6 files only

Author(s)

Chris Stubben

References

see http://exon.gatech.edu for details about GeneMark

See Also

read.ncbi.ftp

Examples

```
file <- "ftp://ftp.ncbi.nih.gov/genomes/Bacteria/Yersinia_pestis_CO92_uid57621/NC_003132.GeneMarkHMM-2.6r"
x <-read.genemark(file)
x
metadata(x)
```

---

read.gff   *Read a GFF file from NCBI*

Description

Read a GFF file from NCBI genomes ftp (version 3)

Usage

```
read.gff(file,  locus.tags = TRUE, nrows = -1)
```

Arguments

file	a GFF file
locus.tags	only return genes with locus tags
nrows	number of rows to read

Details

GFF files are available from the NCBI genomes ftp directory, ftp://ftp.ncbi.nih.gov/genomes.

Value

GRanges with 4 elementMetadata columns: locus, feature, description and gene name. If all rows are returned (locus.tags=FALSE), then score, phase and tags are included. The seqid and source are saved in metadata.

Note

By default, the GFF file is parsed to return only features with locus_tag keys. Gene types, products and names are assigned from child records by matching Parent tags.

The function is intended to load GFF files from NCBI only. GFF files from other sources have not been tested and may not parse.

Author(s)

Chris Stubben

References

see http://www.sequenceontology.org/gff3.shtml for details about Generic Feature Format

See Also

read.ncbi.ftp

Examples

```
file<-"ftp://ftp.ncbi.nih.gov/genomes/Bacteria/Yersinia_pestis_CO92_uid57621/NC_003132.gff"
x <-read.gff(file)
x
metadata(x)
```

---

read.glimmer   *Read a Glimmer output file*

Description

Read a Glimmer3 gene output file from NCBI

Usage

```
read.glimmer(file)
```

Arguments

file   Glimmer3 file

Details

Glimmer files are available from the NCBI genomes ftp directory, ftp://ftp.ncbi.nih.gov/genomes.

Value

GRanges with 3 elementMetadata columns: id, frame and score

Author(s)

Chris Stubben

References

Details about Glimmer3 are available at http://www.cbcb.umd.edu/software/glimmer

See Also

read.ncbi.ftp

Examples

```
file<-"ftp://ftp.ncbi.nih.gov/genomes/Bacteria/Yersinia_pestis_CO92_uid57621/NC_003132.Glimmer3"
x <-read.glimmer(file)
x
metadata(x)
table(values(x)$frame)
```

---

read.ncbi.ftp *Read files from the NCBI genomes FTP*

Description

Read files from the NCBI genomes FTP

Usage

```
read.ncbi.ftp(org, filePattern = "ptt$|rnt$", ftp = "genomes/Bacteria", ...)
```

Arguments

org	organism directory
filePattern	load files matching a specific pattern, default is protein and rna tables
ftp	name of base FTP directory
...	other options passed to read functions

Details

This function reads files in the genomes FTP and loads sequence files (faa=protein, fna=genone, ffn=gene, frn=rna) using Biostring functions or converts coordinate files (gff, ptt, rnt, GeneMarkHMM, Glimmer, Prodigal) to GRanges

Value

a Biostring or GRanges object

Note

Does not read asn, gbk, val, GeneMark 2.5 and rpt files. Use ftp = "genbank/genomes/Bacteria" for genbank submissions

Author(s)

Chris Stubben

See Also

read.gff, read.ptt, read.genemark, read.glimmer, read.prodigal

Examples

```
## Not run:
# list organism directories
ftp<-"ftp.ncbi.nih.gov/genomes/Bacteria"
ftpList(ftp)
read.ncbi.ftp(org)          # Protein and rna tables
read.ncbi.ftp(org, "Prod") # Prodigal annotations
read.ncbi.ftp(org, "gff")  # GFF
read.ncbi.ftp(org, "fna")  # Genome sequences
read.ncbi.ftp(org, "313.*ffn")   # Plasmid genes

## End(Not run)
```

---

read.prodigal   *Read a Prodigal gene finding output file*

Description

Read a gff formatted Prodigal gene output file from NCBI (version 2.5)

Usage

```
read.prodigal(file, allScores = FALSE)
```

Arguments

file	Prodigal gff output file
allScores	include all scores

Details

Prodigal output files are available from the NCBI genomes ftp directory, ftp://ftp.ncbi.nih.gov/genomes.

Value

GRanges with 7 elementMetadata columns: id, partial flag for genes continuing off the edge of a contig, start codon, RBS motif, RBS spacer, coding potential/score and start score.

If allScores is TRUE, then four additional score columns are included: total score (sum of coding and start score) and RBS motif score, upstream region score, and codon type score (which usually sum to start score). See the README file in the Prodigal distribution for complete details.

Author(s)

Chris Stubben

References

Prodigal is a microbial gene finding program developed at University of Tennessee and Oak Ridge National Laboratory. See http://prodigal.ornl.gov for details

See Also

read.ncbi.ftp

Examples

```
file<-"ftp://ftp.ncbi.nih.gov/genomes/Bacteria/Yersinia_pestis_CO92_uid57621/NC_003143.Prodigal-2.50"
x <-read.prodigal(file)
x
metadata(x)
table2(values(x)$start_type)
table2(values(x)$rbs_motif)
hist(values(x)$sscore, br=40, col="blue", main="", xlab="Start score")
```

---

read.ptt   *Read a NCBI protein or RNA feature table*

Description

Read a protein or RNA table from NCBI genomes ftp.

Usage

```
read.ptt(file)
```

Arguments

file   a protein table

Details

Protein and RNA table (*.ptt and */rnt) are available in the NCBI genomes ftp directory at ftp://ftp.ncbi.nih.gov/genomes

Value

GRanges with 6 elementMetadata columns including locus tag id, length (aa), genbank ID, gene name, cog id and product.

Note

Protein tables downloaded from Entrez Genome overview pages have a different format

Author(s)

Chris Stubben

See Also

read.ptt

Examples

```
file<-"ftp://ftp.ncbi.nih.gov/genomes/Bacteria/Yersinia_pestis_CO92_uid57621/NC_003143.ptt"
x <-read.ptt(file)
x
table2(substr(values(x)$cog, 1,7), n=6)
```

---

species   *Extract the species name*

Description

Extracts the species name from a scientific name

Usage

species(x, abbrev=FALSE, epithet=FALSE)

Arguments

x	A vector of scientific names
abbrev	Abbreviate the genus name
epithet	Return only the specific epithet (default is genus + specific epithat)

Details

Returns the species name. For candidate species labeled *Candidatus*, the qualifier is not included

Value

A vector of species names

table2 41

Author(s)

Chris Stubben

See Also

[genus](#)

Examples

```
species("Bacillus anthracis Ames")
species("Bacillus anthracis Ames", abbrev=TRUE)
species("Bacillus anthracis Ames", epithet=TRUE)
data(proks)
x <- table2(species(proks$name))[1:10,]
dotchart(rev(x), xlab="Genomes", pch=16)
## abbreviate genus name
x <- subset(proks, name %like% 'Bacillus*')
x <- table2(species(x$name))[1:10, ]
names(x) <- species(names(x), TRUE)
dotchart(rev(x), xlab=expression(italic(Bacillus) ~ genomes), pch=16)
```

---

table2   *Format and sort a contigency table*

Description

Formats the output of [table](#) into an matrix ordered by total counts in descending order

Usage

```
table2(..., n = 10)
```

Arguments

...	one or more objects passed to [table](#)
n	number of rows to display, default 10

Details

Currently limited to 1 or 2 dimensional table arrays.

Value

A matrix, sorted by total counts in descending order. Any rows or columns with zero counts are also removed from the matrix.

Author(s)

Chris Stubben

See Also

table

Examples

data(euks)
table(euks$subgroup)
table2(euks$subgroup)
to display all rows, use NA or a large number...
table2(euks$subgroup, n=100)
# 2-d table
table2(euks$group, year(euks$released))

---

virus   *Virus genomes at NCBI*

Description

Viral reference genome sequencing projects at NCBI

Usage

data(virus)

Format

A genomes data frame with the following 13 variables.

acc BioProject Accession number

name Organism name

status Highest level of assembly; Complete, SRA or No data

released First public sequence release

group Phylum

subgroup Class level

size Total length of DNA (Mb)

gc Percent GC (guanine or cytosine)

host Natural host of a virus

segments Number of segments

genes Number of genes

proteins Number of proteins

modified Sequence modification date

Details

Includes only data represented in the RefSeq dataset.

Source

downloaded from ftp.ncbi.nlm.nih.gov/genomes/GENOME_REPORTS/viruses.txt

Examples

```
data(virus)
plot(virus)
summary(virus)
table(virus$segments)
table2(virus$host)
## most common phages
table2(species(grep("phage", virus$name, value=TRUE)))
## Not run:
# TABLE only includes RefSeq genomes - see ncbiGenome for links
subset(virus, name=="Nipah virus")
ncbiGenome('Nipah virus[ORGN]')

## End(Not run)
```

---

year	*Parse a date string*

Description

Parses the year or month from a date

Usage

```
year(x)
month(x)
```

Arguments

x   a date

Details

functions are a shortcut for as.numeric(format.Date(x, "%Y"))

Value

the year or month

Author(s)

Chris Stubben

Examples

```
data(proks)
table(year(proks$released))
# just complete genomes
table(year(proks$released[proks$status=="Complete"]))
```

Index