

Package ‘biomaRt’

October 16, 2020

Version 2.44.4

Title Interface to BioMart databases (i.e. Ensembl)

Depends methods

Imports utils, XML, AnnotationDbi, progress, stringr, httr, openssl,
BiocFileCache, rappdirs, xml2

Suggests annotate, BiocStyle, knitr, rmarkdown, testthat

VignetteBuilder knitr

biocViews Annotation

Description In recent years a wealth of biological data has become available in public data repositories. Easy access to these valuable data resources and firm integration with data analysis is needed for comprehensive bioinformatics data analysis. biomaRt provides an interface to a growing collection of databases implementing the BioMart software suite (<<http://www.biomart.org>>). The package enables retrieval of large amounts of data in a uniform way without the need to know the underlying database schemas or write complex SQL queries. The most prominent examples of BioMart databases are maintain by Ensembl, which provides biomaRt users direct access to a diverse set of data and enables a wide range of powerful online queries from gene annotation to database mining.

License Artistic-2.0

LazyLoad yes

NeedsCompilation no

Encoding UTF-8

git_url <https://git.bioconductor.org/packages/biomaRt>

git_branch RELEASE_3_11

git_last_commit 32c79f5

git_last_commit_date 2020-10-12

Date/Publication 2020-10-16

Author Steffen Durinck [aut],
Wolfgang Huber [aut],
Sean Davis [ctb],
Francois Pepin [ctb],
Vince S Buffalo [ctb],
Mike Smith [ctb, cre]

Maintainer Mike Smith <gribmough@gmail.com>

R topics documented:

attributePages	2
biomartCache	3
exportFASTA	3
filterOptions	4
filterType	4
getBM	5
getBMlist	6
getGene	7
getLDS	8
getSequence	9
getXML	11
listAttributes	12
listDatasets	13
listEnsembl	14
listEnsemblArchives	15
listFilters	15
listMarts	16
Mart-class	17
NP2009code	17
searchFilterValues	18
select-methods	19
useDataset	20
useEnsembl	21
useMart	22
Index	24

attributePages	<i>Gives a summary of the attribute pages</i>
----------------	---

Description

Attributes in BioMart databases are grouped together in attribute pages. The `attributePages` function gives a summary of the attribute categories and groups present in the BioMart. These page names can be used to display only a subset of the available attributes in the `listAttributes` function.

Usage

```
attributePages(mart)
```

Arguments

`mart` object of class `Mart`, created with the `useMart` function.

Author(s)

Steffen Durinck

Examples

```
if(interactive()){  
  mart = useMart("ensembl", dataset="hsapiens_gene_ensembl")  
  attributeSummary(mart)  
}
```

biomartCache	<i>biomaRt result caching</i>
--------------	-------------------------------

Description

biomaRt makes use of a results cache to speedup execution of queries that have been run before. These functions provide details on the status of this cache, and allow it to be deleted.

Usage

```
biomartCacheInfo()  
biomartCacheClear()
```

Value

These functions do not return anything and are called for their side effects. `biomartCacheInfo()` prints the location of the cache, along with the number of files and their total size on disk. `biomartCacheClear()` will delete the current contents of the cache.

Author(s)

Mike Smith

exportFASTA	<i>Exports getSequence results to FASTA format</i>
-------------	--

Description

Exports `getSequence` results to FASTA format

Usage

```
exportFASTA(sequences, file)
```

Arguments

sequences	A data.frame that was the output of the <code>getSequence</code> function
file	File to which you want to write the data

Author(s)

Steffen Durinck

Examples

```

if(interactive()){
  mart <- useMart("ensembl", dataset="hsapiens_gene_ensembl")

  #seq<-getSequence(chromosome=c(2,2),start=c(100000,30000),end=c(100300,30500),mart=mart)
  #exportFASTA(seq,file="test.fasta")

  martDisconnect(mart = mart)
}

```

filterOptions	<i>Displays the filter options</i>
---------------	------------------------------------

Description

Displays a set of predetermined values for the specified filter (if available).

Usage

```
filterOptions(filter,mart)
```

Arguments

filter	A valid filter name.
mart	object of class Mar created using the useMart function

Author(s)

Steffen Durinck

Examples

```

if(interactive()){
  mart = useMart("ensembl", dataset="hsapiens_gene_ensembl")
  filterOptions("chromosome_name", mart)
}

```

filterType	<i>Displays the filter type</i>
------------	---------------------------------

Description

Displays the type of the filter given a filter name.

Usage

```
filterType(filter,mart)
```

Arguments

filter	A valid filter name. Valid filters are given by the listFilters function
mart	object of class Mart, created using the useMart function

Author(s)

Steffen Durinck

Examples

```
if(interactive()){
  mart = useMart("ensembl", dataset="hsapiens_gene_ensembl")
  filterType("chromosome_name", mart)
}
```

 getBM

Retrieves information from the BioMart database

Description

This function is the main biomaRt query function. Given a set of filters and corresponding values, it retrieves the user specified attributes from the BioMart database one is connected to.

Usage

```
getBM(attributes, filters = "", values = "", mart, curl = NULL,
  checkFilters = TRUE, verbose = FALSE, uniqueRows = TRUE, bmHeader = FALSE,
  quote = "\"", useCache = TRUE)
```

Arguments

attributes	Attributes you want to retrieve. A possible list of attributes can be retrieved using the function listAttributes.
filters	Filters (one or more) that should be used in the query. A possible list of filters can be retrieved using the function listFilters.
values	Values of the filter, e.g. vector of affy IDs. If multiple filters are specified then the argument should be a list of vectors of which the position of each vector corresponds to the position of the filters in the filters argument.
mart	object of class Mart, created with the useMart function.
curl	An optional 'CURLHandle' object, that can be used to speed up getBM when used in a loop.
checkFilters	Sometimes attributes where a value needs to be specified, for example upstream_flank with value 20 for obtaining upstream sequence flank regions of length 20bp, are treated as filters in BioMarts. To enable such a query to work, one must specify the attribute as a filter and set checkFilters = FALSE for the query to work.
verbose	When using biomaRt in webservice mode and setting verbose to TRUE, the XML query to the webservice will be printed.

uniqueRows	If the result of a query contains multiple identical rows, setting this argument to TRUE (default) will result in deleting the duplicated rows in the query result at the server side.
bmHeader	Boolean to indicate if the result retrieved from the BioMart server should include the data headers or not, defaults to FALSE. This should only be switched on if the default behavior results in errors, setting to on might still be able to retrieve your data in that case
quote	Sometimes parsing of the results fails due to errors in the Ensembl data fields such as containing a quote, in such cases you can try to change the value of quote to try to still parse the results.
useCache	Boolean indicating whether the results cache should be used. Setting to FALSE will disable reading and writing of the cache. This argument is likely to disappear after the cache functionality has been tested more thoroughly.

Value

A data.frame. There is no implicit mapping between its rows and the function arguments (e.g. filters, values), therefore make sure to have the relevant identifier(s) returned by specifying them in attributes. See Examples.

Author(s)

Steffen Durinck

Examples

```
mart <- useMart(biomart = "ensembl", dataset = "hsapiens_gene_ensembl")
getBM(attributes = c("affy_hg_u95av2", "hgnc_symbol", "chromosome_name", "band"),
      filters      = "affy_hg_u95av2",
      values      = c("1939_at", "1503_at", "1454_at"),
      mart        = mart)
```

getBMlist

Retrieves information from the BioMart database

Description

This function is the main biomaRt query function. Given a set of filters and corresponding values, it retrieves the user specified attributes from the BioMart database one is connected to

Usage

```
getBMlist(attributes, filters = "", values = "", mart,
          list.names = NULL, na.value = NA, verbose = FALSE, giveWarning = TRUE)
```

Arguments

attributes	Attributes you want to retrieve. A possible list of attributes can be retrieved using the function listAttributes.
filters	Filters (one or more) that should be used in the query. A possible list of filters can be retrieved using the function listFilters.

values	Values of the filter, e.g. vector of affy IDs. If multiple filters are specified then the argument should be a list of vectors of which the position of each vector corresponds to the position of the filters in the filters argument.
mart	object of class Mart, created with the useMart function.
list.names	names for objects in list
na.value	value to give when result is empty
verbose	When using biomaRt in webservice mode and setting verbose to TRUE, the XML query to the webservice will be printed.
giveWarning	Gives a warning about best practices of biomaRt and recommends using getBM instead of getBMlist

Author(s)

Steffen Durinck

Examples

```
if(interactive()){
  mart <- useMart("ensembl")
  datasets <- listDatasets(mart)

}
```

getGene

Retrieves gene annotation information given a vector of identifiers

Description

This function retrieves gene annotations from Ensembl given a vector of identifiers. Annotation includes chromosome name, band, start position, end position, gene description and gene symbol. A wide variety of identifiers is available in Ensembl, these can be found with the listFilters function.

Usage

```
getGene( id, type, mart)
```

Arguments

id	vector of gene identifiers one wants to annotate
type	type of identifier, possible values can be obtained by the listFilters function. Examples are entrezgene_id, hgnc_symbol (for hugo gene symbol), ensembl_gene_id, unigene, agilentprobe, affy_hg_u133_plus_2, refseq_dna, etc.
mart	object of class Mart, containing connections to the BioMart databases. You can create such an object using the function useMart.

Author(s)

Steffen Durinck

Examples

```

if(interactive()){

mart = useMart("ensembl", dataset="hsapiens_gene_ensembl")

#example using affy id

g = getGene( id = "1939_at", type = "affy_hg_u95av2", mart = mart)
show(g)

#example using Entrez Gene id

g = getGene( id = "100", type = "entrezgene_id", mart = mart)
show(g)
}

```

getLDS

Retrieves information from two linked datasets

Description

This function is the main biomaRt query function that links 2 datasets and retrieves information from these linked BioMart datasets. In Ensembl this translates to homology mapping.

Usage

```

getLDS(attributes, filters = "", values = "", mart, attributesL,
filtersL = "", valuesL = "", martL, verbose = FALSE, uniqueRows = TRUE,
bmHeader=TRUE)

```

Arguments

attributes	Attributes you want to retrieve of primary dataset. A possible list of attributes can be retrieved using the function listAttributes.
filters	Filters that should be used in the query. These filters will be applied to primary dataset. A possible list of filters can be retrieved using the function listFilters.
values	Values of the filter, e.g. list of affy IDs
mart	object of class Mart created with the useMart function.
attributesL	Attributes of linked dataset that needs to be retrieved
filtersL	Filters to be applied to the linked dataset
valuesL	Values for the linked dataset filters
martL	Mart object representing linked dataset
verbose	When using biomaRt in webservice mode and setting verbose to TRUE, the XML query to the webservice will be printed. Alternatively in MySQL mode the MySQL query will be printed.
uniqueRows	Logical to indicate if the BioMart web service should return unique rows only or not. Has the value of either TRUE or FALSE

bmHeader Boolean to indicate if the result retrieved from the BioMart server should include the data headers or not, defaults to TRUE. This should only be switched off if the default behavior results in errors, setting to off might still be able to retrieve your data in that case

Author(s)

Steffen Durinck

Examples

```
if(interactive()){
  human = useMart("ensembl", dataset = "hsapiens_gene_ensembl")
  mouse = useMart("ensembl", dataset = "mmusculus_gene_ensembl")
  getLDS(attributes = c("hgnc_symbol", "chromosome_name", "start_position"),
        filters = "hgnc_symbol", values = "TP53", mart = human,
        attributesL = c("chromosome_name", "start_position"), martL = mouse)
}
```

getSequence	<i>Retrieves sequences</i>
-------------	----------------------------

Description

This function retrieves sequences given the chromosome, start and end position or a list of identifiers. Using getSequence in web service mode (default) generates 5' to 3' sequences of the requested type on the correct strand.

Usage

```
getSequence(chromosome, start, end, id, type, seqType,
            upstream, downstream, mart, verbose = FALSE)
```

Arguments

chromosome	Chromosome name
start	start position of sequence on chromosome
end	end position of sequence on chromosome
id	An identifier or vector of identifiers.
type	The type of identifier used. Supported types are hugo, ensembl, embl, entrez-gene, refseq, ensemblTrans and unigene. Alternatively one can also use a filter to specify the type. Possible filters are given by the listFilters function
seqType	Type of sequence that you want to retrieve. Allowed seqTypes are given in the details section.
upstream	To add the upstream sequence of a specified number of basepairs to the output.
downstream	To add the downstream sequence of a specified number of basepairs to the output.
mart	object of class Mart created using the useMart function
verbose	If verbose = TRUE then the XML query that was send to the webservice will be displayed.

Details

The type of sequence returned can be specified by the `seqType` argument which takes the following values:

- `'cdna'`: for nucleotide sequences
- `'peptide'`: for protein sequences
- `'3utr'`: for 3' UTR sequences
- `'5utr'`: for 5' UTR sequences
- `'gene_exon'`: for exon sequences only
- `'transcript_exon_intron'`: gives the full unspliced transcript, that is exons + introns
- `'gene_exon_intron'` gives the exons + introns of a gene; `'coding'` gives the coding sequence only
- `'coding_transcript_flank'`: gives the flanking region of the transcript including the UTRs, this must be accompanied with a given value for the upstream or downstream attribute
- `'coding_gene_flank'`: gives the flanking region of the gene including the UTRs, this must be accompanied with a given value for the upstream or downstream attribute
- `'transcript_flank'`: gives the flanking region of the transcript excluding the UTRs, this must be accompanied with a given value for the upstream or downstream attribute
- `'gene_flank'`: gives the flanking region of the gene excluding the UTRs, this must be accompanied with a given value for the upstream or downstream attribute

In MySQL mode the `getSequence` function is more limited and the sequence that is returned is the 5' to 3'+ strand of the genomic sequence, given a chromosome, as start and an end position. So if the sequence of interest is the minus strand, one has to compute the reverse complement of the retrieved sequence, which can be done using functions provided in the `matchprobes` package. The `biomaRt` vignette contains more examples on how to use this function.

Author(s)

Steffen Durinck

Examples

```
if(interactive()){
  mart <- useMart("ensembl", dataset="hsapiens_gene_ensembl")

  seq = getSequence(id = "BRCA1",
                    type = "hgnc_symbol",
                    seqType = "peptide",
                    mart = mart)

  show(seq)

  seq = getSequence(id="1939_at",
                    type="affy_hg_u95av2",
                    seqType="gene_flank",
                    upstream = 20,
                    mart = mart)

  show(seq)
}
```

getXML	<i>Retrieves information from the BioMart database using an XML query</i>
--------	---

Description

DEPRECATED! - This function is a low level query function bypassing lots of biomaRts internal controls. It allows for a direct XML query to a known BioMart webservice host.

Usage

```
getXML(host="http://www.ensembl.org/biomart/martservice?", xmlquery)
```

Arguments

host	URL to BioMart webservice, is set to <code>http://www.ensembl.org/biomart/martservice?</code> by default
xmlquery	XML query that needs to be send to the webservice

Details

This function has now been deprecated. Similar functionality can be achieved using the unexported function `biomaRt:::submitQueryXML`. If you are still using this function and this affects your work, please contact the package maintainer at <https://github.com/grimbough/biomaRt/issues>

Author(s)

Steffen Durinck, Mike Smith

Examples

```
if(interactive()){
xmlquery="<?xml version='1.0' encoding='UTF-8'?>
  <!DOCTYPE Query>
  <Query virtualSchemaName = 'default' uniqueRows = '1'
    count = '0' datasetConfigVersion = '0.6'>
    <Dataset name = 'hsapiens_gene_ensembl'>
      <Attribute name = 'ensembl_gene_id' />
      <Filter name = 'chromosome_name' value = 'Y' />
    </Dataset>
  </Query>"
getXML(host = "www.ensembl.org/biomart/martservice?", xmlquery = xmlquery)
}
```

listAttributes	<i>lists the attributes available in the selected dataset</i>
----------------	---

Description

Attributes are the outputs of a biomaRt query, they are the information we want to retrieve. For example if we want to retrieve all EntrezGene identifiers of genes located on chromosome X, `entrezgene_id` will be the attribute we use in the query. The `listAttributes` function lists the available attributes in the selected dataset.

Usage

```
listAttributes(mart, page, what = c("name", "description", "page"))
searchAttributes(mart, pattern)
```

Arguments

<code>mart</code>	object of class <code>Mart</code> created using the <code>useMart</code> function
<code>page</code>	Show only the attributes that belong to the specified attribute page.
<code>what</code>	vector of types of information about the attributes that need to be displayed. Can have values like <code>name</code> , <code>description</code> , <code>fullDescription</code> , <code>page</code>
<code>pattern</code>	Character vector defining the regular expression (regex) to be used for the search. If left blank the default is to use <code>".*"</code> which will match everything.

Author(s)

Steffen Durinck, Mike Smith

Examples

```
if(interactive()){
  ## list the available Ensembl marts and use Ensembl Genes
  listEnsembl()
  ensembl <- useEnsembl(biomart = "ensembl", dataset = 'hsapiens_gene_ensembl')

  ## list the available datasets in this Mart
  listAttributes(mart = ensembl)

  ## the list of attributes is very long and gets truncated by R
  ## we can search for a term of interest to filter this e.g. 'start'
  searchAttributes(mart = ensembl, pattern = "start")

  ## filter the attributes to give only entries containing 'entrez' or 'hgnc'
  searchAttributes(mart = ensembl, 'entrez|hgnc')
}
```

listDatasets	<i>List or search the datasets available in the selected BioMart database</i>
--------------	---

Description

Lists or search the datasets available in the selected BioMart database

Usage

```
listDatasets(mart, verbose = FALSE)
searchDatasets(mart, pattern)
```

Arguments

mart	object of class Mart created with the useMart function
verbose	Give detailed output of what the method is doing, for debugging purposes
pattern	Character vector defining the regular expression (regex) to be used for the search. If left blank the default is to use "." which will match everything and return the same as listDatasets.

Author(s)

Steffen Durinck, Mike Smith

Examples

```
if(interactive()){
  ## list the available Ensembl marts and use Ensembl Genes
  listEnsembl()
  ensembl <- useEnsembl(biomart = "ensembl")

  ## list the available datasets in this Mart
  listDatasets(mart = ensembl)

  ## the list of Ensembl datasets grows ever larger (101 as of Ensembl 93)
  ## we can search for a term of interest to reduce the length e.g. 'sapiens'
  searchDatasets(mart = ensembl, pattern = "sapiens")

  ## search for any dataset containing the word Rat or rat
  searchDatasets(mart = ensembl, pattern = "(R|r)at")
}
```

listEnsembl	<i>lists the available BioMart databases hosted by Ensembl</i>
-------------	--

Description

This function returns a list of BioMart databases hosted by Ensembl. To establish a connection use the useMart function.

Usage

```
listEnsembl(mart = NULL, host = "www.ensembl.org", version = NULL,  
            GRCh = NULL, mirror = NULL, verbose = FALSE)  
listEnsemblGenomes(includeHosts = FALSE)
```

Arguments

mart	mart object created with the useEnsembl function. This is optional, as you usually use listMarts to see which marts there are to connect to.
host	Host to connect to if different then www.ensembl.org
version	Ensembl version to connect to when wanting to connect to an archived Ensembl version
GRCh	GRCh version to connect to if not the current GRCh38, currently this can only be 37
mirror	Specify an Ensembl mirror to connect to. The valid options here are 'www', 'uswest', 'useast', 'asia'. If no mirror is specified the primary site at www.ensembl.org will be used.
verbose	Give detailed output of what the method is doing, for debugging purposes
includeHosts	If this option is set to TRUE a more detailed output is produced, including the URL used to access the corresponding mart.

Author(s)

Steffen Durinck, Mike L. Smith

Examples

```
if(interactive()){  
  listEnsembl()  
}
```

listEnsemblArchives *Lists the available archived versions of Ensembl*

Description

Returns a table containing the available archived versions of Ensembl, along with the dates they were created and the URL used to access them.

Usage

```
listEnsemblArchives()
```

Author(s)

Mike Smith

Examples

```
listEnsemblArchives()
```

listFilters *List or search the filters available in the selected dataset*

Description

Filters are what we use as inputs for a biomaRt query. For example, if we want to retrieve all EntrezGene identifiers on chromosome X, chromosome will be the filter, with corresponding value X.

Usage

```
listFilters(mart, what = c("name", "description"))
searchFilters(mart, pattern)
```

Arguments

mart	object of class Mart created using the useMart function
what	character vector indicating what information to display about the available filters. Valid values are name, description, options, fullDescription, filters, type, operation, filters8, filters9.
pattern	Character vector defining the regular expression (regex) to be used for the search. If left blank the default is to use ".*" which will match everything.

Author(s)

Steffen Durinck, Mike Smith

Examples

```

if(interactive()){

  ## list the available Ensembl marts and use Ensembl Genes
  listEnsembl()
  ensembl <- useEnsembl(biomart = "ensembl", dataset = 'hsapiens_gene_ensembl')

  ## list the available datasets in this Mart
  listFilters(mart = ensembl)

  ## the list of filters is long and not easy to read
  ## we can search for a term of interest to reduce this e.g. 'gene'
  searchFilters(mart = ensembl, pattern = "gene")

  ## search the available filters to find entries containing 'entrez' or 'hgnc'
  searchFilters(mart = ensembl, 'entrez|hgnc')
}

```

listMarts	<i>lists the available BioMart databases</i>
-----------	--

Description

This function returns a list of BioMart databases to which biomaRt can connect to. By default all public BioMart databases are displayed. To establish a connection use the useMart function.

Usage

```

listMarts(mart = NULL, host="www.ensembl.org", path="/biomart/martservice",
port, includeHosts = FALSE, archive = FALSE,
ensemblRedirect = NULL, verbose = FALSE)

```

Arguments

mart	mart object created with the useMart function. This is optional, as you usually use listMarts to see which marts there are to connect to.
host	Host to connect to. Defaults to <code>www.ensembl.org</code>
path	path to martservice that should be pasted behind the host to get to web service URL
port	port to use in HTTP communication
includeHosts	boolean to indicate if function should return host of the BioMart databases
archive	Boolean to indicate if you want to access archived versions of BioMart database. Note that this argument is now defunct and setting this value to TRUE will produce an error. A better alternative is to specify the url of the archived BioMart you want to access. For Ensembl you can view the list of archives using listEnsemblArchives
ensemblRedirect	This argument has now been deprecated.
verbose	Give detailed output of what the method is doing, for debugging purposes

Details

If you receive an error message saying 'Unexpected format to the list of available marts', this is often because there is a problem with the BioMart server you are trying to connect to, and something other than the list of available marts is being returned - often some like a 'down for maintainance' page. If you browse to the provided URL and find a page that starts with '<MartRegistry>' this is the correct listing and you should report the issue on the Bioconductor support site: <https://support.bioconductor.org>

Author(s)

Steffen Durinck, Mike Smith

Examples

```
if(interactive()){
  listMarts()
}
```

Mart-class

Class Mart

Description

Represents a Mart class, containing connections to different BioMarts

Methods

show Print summary of the object

Author(s)

Steffen Durinck

NP2009code

Display the analysis code from the 2009 Nature protocols paper

Description

This function opens an editor displaying the analysis code of the Nature Protocols 2009 paper

Usage

```
NP2009code()
```

Details

The `edit` function uses `getOption("editor")` to select the editor. Use, for instance, `options(editor="emacs")` to set another editor.

Author(s)

Steffen Durinck, Wolfgang Huber

See Also[edit](#)**Examples**

```
if(interactive()){
  NP2009code()
}
```

searchFilterValues *List or search the options available for a specified filter.*

Description

Some filters have a predefined list of values that can be used to search them. These functions give access to this list of options for a named filter, so you can check in the case where your biomaRt query is not finding anything.

Usage

```
listFilterValues(mart, filter)
searchFilterValues(mart, filter, pattern)
```

Arguments

mart	object of class Mart created using the useMart , or useEnsembl functions
filter	The name of the filter whose options should be listed or searched. You can list available filters via listFilters
pattern	Character vector defining the regular expression (regex) to be used for the search. If left blank the default is to use <code>".*"</code> which will match everything.

Author(s)

Mike Smith

See Also[listFilters](#)**Examples**

```
if(interactive()){

  ## Use the Ensembl human genes dataset
  ensembl <- useEnsembl(biomart = "ensembl", dataset = "hsapiens_gene_ensembl")

  ## we can search for the name of a filter we're interested in e.g. 'phenotype'
  ## we need to use the name of the filter in the next function
  searchFilters(ensembl, pattern = "phenotype")

  ## list all the options available to the 'phenotype_source' filter
```

```

listFilterValues(mart = ensembl, filter = "phenotype_source")

## search the 'phenotype_description' filter for the term 'crohn'
searchFilterValues(mart = ensembl,
                   filter = "phenotype_description",
                   pattern = "crohn")
}

```

Description

`select`, `columns` and `keys` are used together to extract data from a Mart object. These functions work much the same as the classic `biomaRt` functions such as `getBM` etc. and are provide here to make this easier for people who are comfortable using these methods from other Annotation packages. Examples of other objects in other packages where you can use these methods include (but are not limited to): `ChipDb`, `OrgDb`, `GODb`, `InparanoidDb` and `ReactomeDb`.

`columns` shows which kinds of data can be returned from the Mart object.

`keytypes` allows the user to discover which keytypes can be passed in to `select` or `keys` as the keytype argument.

`keys` returns keys from the Mart of the type specified by it's keytype argument.

`select` is meant to be used with these other methods and has arguments that take the kinds of values that these other methods return. `select` will retrieve the results as a `data.frame` based on parameters for selected keys and columns and keytype arguments.

Usage

```

columns(x)
keytypes(x)
keys(x, keytype, ...)
select(x, keys, columns, keytype, ...)

```

Arguments

<code>x</code>	the Mart object. The dataset of the Mart object must already be specified for all of these methods.
<code>keys</code>	the keys to select records for from the database. Keys for some keytypes can be extracted by using the <code>keys</code> method.
<code>columns</code>	the columns or kinds of things that can be retrieved from the database. As with <code>keys</code> , all possible columns are returned by using the <code>columns</code> method.
<code>keytype</code>	the keytype that matches the keys used. For the <code>select</code> methods, this is used to indicate the kind of ID being used with the <code>keys</code> argument. For the <code>keys</code> method this is used to indicate which kind of keys are desired from <code>keys</code>
<code>...</code>	other arguments. These include: pattern: the pattern to match (used by <code>keys</code>)

column: the column to search on. This is used by keys and is for when the thing you want to pattern match is different from the keytype, or when you want to simply want to get keys that have a value for the thing specified by the column argument.

fuzzy: TRUE or FALSE value. Use fuzzy matching? (this is used with pattern by the keys method)

Value

keys, columns and keytypes each return a character vector or possible values. select returns a data.frame.

Author(s)

Marc Carlson

Examples

```
## 1st create a Mart object and specify the dataset
mart<-useMart(dataset="hsapiens_gene_ensembl",biomart='ensembl')
## you can list the keytypes
keytypes(mart)
## you can list the columns
columns(mart)
## And you can extract keys when this is supported for your keytype of interest
k = keys(mart, keytype="chromosome_name")
head(k)
## You can even do some pattern matching on the keys
k = keys(mart, keytype="chromosome_name", pattern="LRG")
head(k)
## Finally you can use select to extract records for things that you are
## interested in.
affy=c("202763_at", "209310_s_at", "207500_at")
select(mart, keys=affy, columns=c('affy_hg_u133_plus_2', 'entrezgene_id'),
       keytype='affy_hg_u133_plus_2')
```

useDataset

Select a dataset to use and updates Mart object

Description

This function selects a dataset and updates the Mart object

Usage

```
useDataset(dataset, mart, verbose = FALSE)
```

Arguments

dataset	Dataset you want to use. List of possible datasets can be retrieved using the function listDatasets
mart	Mart object created with the useMart function
verbose	Give detailed output of what the method is doing, for debugging

Author(s)

Steffen Durinck

Examples

```
if(interactive()){
  mart=useMart("ensembl")
  mart=useDataset("hsapiens_gene_ensembl", mart = mart)
}
```

useEnsembl

Connects to the selected BioMart database and dataset hosted by Ensembl

Description

A first step in using the biomaRt package is to select a BioMart database and dataset to use. The useEnsembl function enables one to connect to a specified BioMart database and dataset hosted by Ensembl without having to specify the Ensembl URL. To know which BioMart databases are available see the [listEnsembl](#) and [listEnsemblGenomes](#) functions. To know which datasets are available within a BioMart database, first select the BioMart database using useEnsembl and then use the [listDatasets](#) function on the selected Mart object.

Usage

```
useEnsembl(biomart, dataset, host, version = NULL,
           GRCh = NULL, mirror = NULL, verbose = FALSE)
useEnsemblGenomes(biomart, dataset)
```

Arguments

biomart	BioMart database name you want to connect to. Possible database names can be retrieved with the function listEnsembl
dataset	Dataset you want to use. To see the different datasets available within a biomaRt you can e.g. do: mart = useEnsembl('genes'), followed by listDatasets(mart).
host	Host to connect to. Only needs to be specified if different from www.ensembl.org
version	Ensembl version to connect to when wanting to connect to an archived Ensembl version
GRCh	GRCh version to connect to if not the current GRCh38, currently this can only be 37
mirror	Specify an Ensembl mirror to connect to. The valid options here are 'www', 'uswest', 'useast', 'asia'. If no mirror is specified the primary site at www.ensembl.org will be used. Mirrors are not available for the Ensembl Genomes databases.
verbose	Give detailed output of what the method is doing while in use, for debugging

Author(s)

Steffen Durinck & Mike Smith

Examples

```

if(interactive()){

  mart <- useEnsembl("ensembl")

  ## using the US West mirror
  us_mart <- useEnsembl(biomart = "ensembl", mirror = "uswest")
}

```

useMart

*Connects to the selected BioMart database and dataset***Description**

A first step in using the biomaRt package is to select a BioMart database and dataset to use. The useMart function enables one to connect to a specified BioMart database and dataset within this database. To know which BioMart databases are available see the listMarts function. To know which datasets are available within a BioMart database, first select the BioMart database using useMart and then use the listDatasets function on the selected BioMart, see listDatasets function.

Usage

```

useMart(biomart, dataset, host="https://www.ensembl.org",
        path="/biomart/martservice", port, archive=FALSE, ensemblRedirect = NULL, version, verbose = FALSE)

```

Arguments

biomart	BioMart database name you want to connect to. Possible database names can be retrieved with the function listMarts
dataset	Dataset you want to use. To see the different datasets available within a biomaRt you can e.g. do: mart = useMart('ensembl'), followed by listDatasets(mart).
host	Host to connect to. Defaults to www.ensembl.org
path	Path that should be pasted after to host to get access to the web service URL
port	port to connect to, will be pasted between host and path
archive	Boolean to indicate if you want to access archived versions of BioMart databases. Note that this argument is now deprecated and will be removed in the future. A better alternative is to leave archive = FALSE and to specify the url of the archived BioMart you want to access. For Ensembl you can view the list of archives using listEnsemblArchives
ensemblRedirect	This argument has now been deprecated.
version	Use version name instead of biomart name to specify which BioMart you want to use
verbose	Give detailed output of what the method is doing while in use, for debugging

Author(s)

Steffen Durinck

Examples

```
if(interactive()){  
  
  mart = useMart("ensembl")  
  mart=useMart(biomart="ensembl", dataset="hsapiens_gene_ensembl")  
}
```

Index

* IO

biomartCache, 3

* methods

attributePages, 2

exportFASTA, 3

filterOptions, 4

filterType, 4

getBM, 5

getBMlist, 6

getGene, 7

getLDS, 8

getSequence, 9

getXML, 11

listAttributes, 12

listDatasets, 13

listEnsembl, 14

listEnsemblArchives, 15

listFilters, 15

listMarts, 16

Mart-class, 17

NP2009code, 17

searchFilterValues, 18

select-methods, 19

useDataset, 20

useEnsembl, 21

useMart, 22

attributePages, 2

biomartCache, 3

biomartCacheClear (biomartCache), 3

biomartCacheInfo (biomartCache), 3

columns (select-methods), 19

columns, Mart-method (select-methods), 19

edit, 17, 18

exportFASTA, 3

filterOptions, 4

filterType, 4

getBM, 5

getBMlist, 6

getGene, 7

getLDS, 8

getSequence, 9

getXML, 11

keys (select-methods), 19

keys, Mart-method (select-methods), 19

keytypes (select-methods), 19

keytypes, Mart-method (select-methods),
19

listAttributes, 12

listDatasets, 13, 21

listEnsembl, 14, 21

listEnsemblArchives, 15, 16, 22

listEnsemblGenomes, 21

listEnsemblGenomes (listEnsembl), 14

listFilters, 15, 18

listFilterValues (searchFilterValues),
18

listMarts, 14, 16, 16

Mart-class, 17

NP2009code, 17

regex, 12, 13, 15, 18

searchAttributes (listAttributes), 12

searchDatasets (listDatasets), 13

searchFilters (listFilters), 15

searchFilterValues, 18

select (select-methods), 19

select, Mart-method (select-methods), 19

select-methods, 19

show, Mart-method (Mart-class), 17

useDataset, 20

useEnsembl, 18, 21

useEnsemblGenomes (useEnsembl), 21

useMart, 15, 16, 18, 22