

Package ‘tRNA’

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Title tRNA: Analyzing tRNA sequences and structures

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Description The tRNA package allows tRNA sequences and structures to be accessed and used for subsetting. In addition, it provides visualization tools to compare feature parameters of multiple tRNA sets and correlate them to additional data. The tRNA package uses GRanges objects as inputs requiring only few additional column data sets.

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Encoding UTF-8

LazyData true

biocViews Software, Visualization

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Imports stringr, S4Vectors, methods, assertive, BiocGenerics, IRanges, XVector, Biostrings, ggplot2, scales

Suggests knitr, rmarkdown, testthat, BiocStyle, tRNAscanImport

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'tRNA-structures.R' 'tRNA-subset.R' 'tRNA-utils.R'

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Author Felix GM Ernst [aut, cre]

Maintainer Felix GM Ernst <felix.gm.ernst@outlook.com>

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gettRNABasePairing *Accessing Dot Bracket annotation*

Description

getBasePairing converts a dot bracket annotation into a `data.frame`. Base pairing is indicated by corresponding numbers in the forward and reverse columns.

Usage

```

gettRNABasePairing(x)

gettRNALoopIDs(x)

## S4 method for signature 'GRanges'
gettRNABasePairing(x)

getBasePairing(dotBracket, sequence)

## S4 method for signature 'GRanges'
gettRNALoopIDs(x)

getLoopIDs(dotBracket)

```

Arguments

<code>x</code>	a <code>GRanges</code> object created by <code>import.tRNAscanAsGRanges</code> or <code>GRanges</code> with equivalent information. The <code>tRNA_str</code> and <code>tRNA_seq</code> columns will be used for input into <code>getBasePairing</code> .
<code>dotBracket</code>	character vectors describing a nucleotide sequence structure in the dot bracket annotations. Valid characters are: <code>.(\[><]\)</code>
<code>sequence</code>	optional: character vectors describing a nucleotide sequence. The same number of sequences with the same length as the dot bracket string have to be used. Each nucleotide sequence has to be a character vector. The identity of the nucleotides are not control, so in theory all letters can be used.

Value

`getBasePairing`: The result is a `data.frame` with following columns: `pos`, `forward`, `reverse`, `chr` and `base` (if `sequence` was provided or a `GRanges` objects was used). If a position is unpaired, `forward` and `reverse` will be `0`, otherwise it will match the base paired positions. `gettRNALoopIDs`, `getLoopIDs`: return a list of list of loop ids.

Examples

```
data("gr", package = "tRNA", envir = environment())
gettRNABasePairing(gr[1])
getBasePairing(gr[1]$tRNA_str)
gettRNALoopIDs(gr[1])
getLoopIDs(gr[1]$tRNA_str)
```

```
gettRNAFeaturePlots    Graphical summary of tRNA features
```

Description

gettRNAFeaturePlots generates a plot for every feature found with gettRNASummary. Based on the datatype, it will generate suitable point or bar plots. Names of the GRangesList will be used as sample identifiers and used for colouring.

The options tRNA_colour_palette, tRNA_colour_yes and tRNA_colour_no will be used for colours.

Usage

```
gettRNAFeaturePlots(x, plotScores = FALSE, scores = NA,
  scoreLabel = "Score")
```

```
## S4 method for signature 'GRangesList'
gettRNAFeaturePlots(x, plotScores = FALSE,
  scores = NA, scoreLabel = "Score")
```

Arguments

x	a named GRangesList object.
plotScores	logical value, whether to plot scores. If scores are not provided with an additional argument, it will try to use the column "score" of the GRanges objects.
scores	a list of scores, which have to have the same dimensions as the GRangesList or GRanges object.
scoreLabel	a string to use as a label for the x axis.

Value

a list of ggplot2 plots. These can be customized further.

Examples

```
data("gr", package = "tRNA", envir = environment())
data("gr_eco", package = "tRNA", envir = environment())
grl <- GRangesList(Sce = gr,
  Eco = gr_eco)
plots <- gettRNAFeaturePlots(grl)

# customized plots
plots$length$layers <- plots$length$layers[c(-1,-2)]
plots$length + ggplot2::geom_boxplot()
```

```
gettRNAstructureGRanges
```

tRNA structures and sequences

Description

gettRNAstructureGRanges returns a list of GRanges describing the boundaries of tRNA structures as extracted from the dot bracket annotation. The dot bracket annotation is parsed using gettRNABasePairing, which internally uses getBasePairing.

gettRNAstructureSeq returns split or partial tRNA sequences based on the structure information. Variations in the length of structure features can be padded to retrieve sequences of equal length. If sequences are joined by setting joinCompletely = FALSE, the boundaries of the tRNA structure are stored in the result as metadata. They can be accessed as an IRanges object by using metadata(seq)[["tRNA_structures"]].

Usage

```
gettRNAstructureGRanges(x, structure = "")

gettRNAstructureSeqs(x, structure = "", joinCompletely = FALSE,
  joinFeatures = FALSE, padSequences = TRUE)

## S4 method for signature 'GRanges'
gettRNAstructureSeqs(x, structure = "",
  joinCompletely = FALSE, joinFeatures = FALSE, padSequences = TRUE)

## S4 method for signature 'GRanges'
gettRNAstructureGRanges(x, structure = "")
```

Arguments

x	a GRanges object with tRNA information. It has to pass the istRNAGRanges function.
structure	optional parameter for returning just partial sequences. The following values are accepted: anticodonStem, Dprime5, DStem, Dloop, Dprime3, acceptorStem, anticodonloop, variableLoop, TStem, Tloop, discriminator. (default: structure = "")
joinCompletely	Should the sequence parts, which are to be returned, be joined into one sequence? (default: joinCompletely = FALSE) Setting this to TRUE excludes joinFeatures be set to TRUE as well. In addition, joinCompletely = TRUE uses automatically all sequence structures.
joinFeatures	Should the sequence parts, which are to be returned and are from the same structure type, be joined into one sequence? (default: joinCompletely = FALSE) Setting this to TRUE excludes joinCompletely be set to TRUE as well. joinCompletely takes precedence.
padSequences	parameter whether sequences of the same type should be returned with the same length. For stems missing positions will be filled up in the middle, for loops at the ends. (default: padSequences = TRUE). If joinCompletely == TRUE this is set to TRUE automatically.

Value

a list of GRanges or DNASTringSet objects. In case joinCompletely is set to TRUE a single DNASTringSet is returned.

Examples

```
data("gr", package = "tRNA", envir = environment())
gettRNAstructureGRanges(gr, structure = "anticodonLoop")
gettRNAstructureSeqs(gr, structure = "anticodonLoop")
gettRNABasePairing(gr[1:10])
getBasePairing(gr[1:10]$tRNA_str)
```

gettRNASummary

Summary of tRNA features

Description

gettRNASummary prepares a DataFrame with the aggregated features of tRNAs from a GRanges object. Logical values are converted to numeric values.

Usage

```
gettRNASummary(x)

## S4 method for signature 'GRangesList'
gettRNASummary(x)

## S4 method for signature 'GRanges'
gettRNASummary(x)
```

Arguments

x a GRanges or a GRangesList object. All elements have to pass the is tRNAGRanges test.

Value

a DataFrame object

Examples

```
data("gr", package = "tRNA", envir = environment())
gettRNASummary(gr)
```

hasTStem

Subsetting tRNAs

Description

The functions `has*` can be used to subset the `GRanges` object containing information about tRNAs.

Please note that the settings `mismatches` and `bulged` take precedence before `unpaired` or `paired`. This means that by setting either `mismatches` or `bulged` to either `TRUE` or `FALSE`, `unpaired = TRUE` or `paired = TRUE` are automatically set to allow specific subsetting. If this removes elements from the results, please consider constructing a logical vectors with two calls as suggested in the examples.

Usage

```
hasTStem(x, length = NA, unpaired = NA, mismatches = NA, bulged = NA)
```

```
hasDStem(x, length = NA, unpaired = NA, mismatches = NA, bulged = NA)
```

```
hasAcceptorStem(x, length = NA, unpaired = NA, mismatches = NA,
  bulged = NA)
```

```
hasAnticodonStem(x, length = NA, unpaired = NA, mismatches = NA,
  bulged = NA)
```

```
hasTloop(x, length = NA)
```

```
hasDloop(x, length = NA)
```

```
hasAnticodonLoop(x, length = NA)
```

```
hasVariableLoop(x, length = NA, paired = NA, mismatches = NA,
  bulged = NA)
```

```
## S4 method for signature 'GRanges'
hasTStem(x, length = NA, unpaired = NA,
  mismatches = NA, bulged = NA)
```

```
## S4 method for signature 'GRanges'
hasDStem(x, length = NA, unpaired = NA,
  mismatches = NA, bulged = NA)
```

```
## S4 method for signature 'GRanges'
hasAcceptorStem(x, length = NA, unpaired = NA,
  mismatches = NA, bulged = NA)
```

```
## S4 method for signature 'GRanges'
hasAnticodonStem(x, length = NA, unpaired = NA,
  mismatches = NA, bulged = NA)
```

```
## S4 method for signature 'GRanges'
```

```

hasTloop(x, length = NA)

## S4 method for signature 'GRanges'
hasDloop(x, length = NA)

## S4 method for signature 'GRanges'
hasAnticodonLoop(x, length = NA)

## S4 method for signature 'GRanges'
hasVariableLoop(x, length = NA, paired = NA,
  mismatches = NA, bulged = NA)

```

Arguments

x	a GRanges object from a tRNAscan import or with equivalent information
length	the length as integer
unpaired	logical: has unpaired nucleotides
mismatches	logical: has mismatched nucleotides
bulged	logical: has mismatched nucleotides of different length creating a bulge
paired	logical: has paired nucleotides (only used for loops)

Value

a logical vector of the length or input GRanges object

Examples

```

data("gr", package = "tRNA", envir = environment())
hasTStem(gr, length = 5, mismatches = TRUE)
gr[hasTStem(gr, length = 5, mismatches = TRUE)]
gr[hasDStem(gr, unpaired = FALSE) & hasDStem(gr, mismatches = FALSE)]

```

istRNAGRanges	<i>tRNA compatibility check</i>
---------------	---------------------------------

Description

istRNAGRanges checks whether a GRanges object contains the information expected for a tRNA result. This is used internally to ensure the the required data is present in the input.

Usage

```

istRNAGRanges(x)

## S4 method for signature 'GRanges'
istRNAGRanges(x)

```

Arguments

x	the GRanges object to test for compatibility.
---	---

Value

a logical value

Examples

```
data("gr", package = "tRNA", envir = environment())
istRNAGRanges(gr)
```

tRNA

tRNA: analyzing tRNA sequences and structures

Description

title

Author(s)

Felix G M Ernst [aut]

tRNA-data

tRNA example data

Description

Example data for using the tRNA package

Usage

tRNA

gr_human

gr_human2

gr_eco

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