

Package ‘gggenes’

July 5, 2026

Title Draw Gene Arrow Maps in 'ggplot2'

Version 0.7.0

Description A 'ggplot2' extension for drawing gene arrow maps.

License GPL-2

URL <https://wilcox.org/gggenes/>

BugReports <https://github.com/wilcox/gggenes/issues/>

Depends R (>= 3.6)

Imports cli (>= 3.6.1), ggfittext (>= 0.9.0), ggplot2 (>= 3.4.0), grid
(>= 3.3.0), rlang (>= 1.0.0)

Suggests knitr, rmarkdown, spelling, testthat (>= 3.0.0), vdiff

VignetteBuilder knitr

Config/testthat/edition 3

Encoding UTF-8

Language en-US

LazyData true

Config/roxygen2/version 8.0.0

NeedsCompilation no

Author David Wilkins [aut, cre],
Zachary Kurtz [ctb]

Maintainer David Wilkins <david@wilcox.org>

Repository CRAN

Date/Publication 2026-07-05 08:50:02 UTC

Contents

example_dummies	2
example_features	2
example_genes	3
example_terminators	4

geom_feature	4
geom_feature_label	6
geom_gene_arrow	7
geom_gene_label	9
geom_subgene_arrow	11
geom_subgene_label	12
geom_terminator	14
geom_terminator_label	15
make_alignment_dummies	17
theme_genes	17

Index	19
--------------	-----------

example_dummies	<i>A set of example dummy alignment genes.</i>
-----------------	--

Description

Dummy genes, similar to those generated with `make_alignment_dummies()`, for example purposes only.

Usage

`example_dummies`

Format

A data frame with eight rows and three variables:

- molecule** the genome
- start** the start position of the dummy
- end** the end position of the dummy
- gene** the name of the dummy gene

example_features	<i>A set of example genetic features.</i>
------------------	---

Description

Genetic features for example purposes only.

Usage

`example_features`

`example_features_polar`

Format

A data frame with 23 rows and five variables:

molecule the genome

name the name of the feature

type the type of the feature

position the position of the feature

forward is the feature oriented, and if so in the forward direction?

An object of class `data.frame` with 6 rows and 5 columns.

example_genes	<i>A set of example genes.</i>
---------------	--------------------------------

Description

Genes for example purposes only.

Usage

example_genes

example_genes_polar

example_subgenes

example_subgenes_polar

Format

A data frame with 72 rows and six variables:

molecule the genome

gene the name of the gene

start the start position of the gene

end the end position of the gene

strand the strand of the gene

orientation the orientation of the gene

example_subgenes (143 rows) also contains:

subgene the name of the subgene

from the start position of the subgene segment

to the end position of the subgene segment

An object of class `data.frame` with 18 rows and 6 columns.

An object of class `data.frame` with 143 rows and 9 columns.

An object of class `data.frame` with 40 rows and 9 columns.

example_terminators	<i>A set of example terminators.</i>
---------------------	--------------------------------------

Description

Terminators for example purposes only.

Usage

```
example_terminators
example_terminators_polar
```

Format

A data frame with two rows and three variables:

molecule the genome
name the name of the terminator
position the position of the terminator

An object of class `data.frame` with 2 rows and 3 columns.

geom_feature	<i>A 'ggplot2' geom to draw point genetic features</i>
--------------	--

Description

`geom_feature()` draws lines to indicate the positions of point genetic features, for example restriction sites, origins of replication or transcription start sites.

Usage

```
geom_feature(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = FALSE,
  feature_height = unit(3, "mm"),
  feature_width = unit(3, "mm"),
  arrowhead_width = unit(2, "mm"),
  ...
)
```

Arguments

- mapping, data, stat, position, na.rm, show.legend, inherit.aes, ...
As standard for ggplot2, inherit.aes is set to FALSE by default, as features are not likely to share any plot aesthetics other than y.
- feature_height `grid::unit()` object giving the height of a feature above the molecule line. Can be set as a negative value to draw features below the line. Defaults to 3 mm.
- feature_width `grid::unit()` object giving the width of a feature (distance from the elbow to the tip of the arrow). Only relevant for oriented features. Defaults to 3 mm.
- arrowhead_width
`grid::unit()` object giving the width of the arrowhead indicating the direction of an oriented feature. Only relevant for oriented features. Defaults to 2 mm.

Details

Features are drawn as vertical lines extending from the horizontal line representing the molecule. The position of the feature is expressed with the x aesthetic. Optionally, the forward aesthetic can be used to specify an orientation for the feature (e.g. the direction of transcription), in which case an angled arrowhead will be added. The forward aesthetic assumes that the x-axis is oriented in the normal direction, i.e. increasing from left to right; if it is not, the values in forward will need to be inverted manually.

Aesthetics

- x (required; position of the feature)
- y (required; molecule)
- forward (optional; if TRUE, or a value coercible to TRUE, the feature will be drawn with an arrowhead pointing right, if FALSE, pointing left, if NA, the feature will be drawn as a vertical line)
- alpha
- colour
- linetype
- linewidth (the former size aesthetic has been deprecated and will be removed in future versions)

Note that, unlike `geom_gene_arrow()` and ggplot2 convention, linewidth in `geom_feature()` is expressed in points rather than millimetres, with a default value of 1. This inconsistency is retained for backwards compatibility, and will be reconciled when these point-feature geoms are superseded in gggenes 1.0.0.

See Also

[geom_feature_label\(\)](#), [geom_terminator\(\)](#)

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                             y = molecule, fill = gene)) +
  geom_gene_arrow() +
  geom_feature(data = example_features, ggplot2::aes(x = position, y = molecule,
                                                    forward = forward)) +
  ggplot2::facet_wrap(~ molecule, scales = "free")
```

geom_feature_label	A 'ggplot2' geom to add text labels to point genetic features
--------------------	---

Description

geom_feature_label() adds text labels to features drawn with geom_feature().

Usage

```
geom_feature_label(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  na.rm = FALSE,
  show.legend = FALSE,
  inherit.aes = FALSE,
  feature_height = unit(4, "mm"),
  label_height = unit(3, "mm"),
  ...
)
```

Arguments

mapping, data, stat, position, na.rm, show.legend, inherit.aes, ...

As standard for ggplot2, inherit.aes is set to FALSE by default, as features are not likely to share any plot aesthetics other than y.

feature_height grid::unit() object giving the offset from the molecule line to the inner edge of the label's bounding box. Can be set as a negative value to position labels on the opposite side of the molecule line. Defaults to 4 mm, which provides a 1 mm gap between feature and label when used with the default feature_height of geom_feature() (3 mm).

label_height grid::unit() object giving the height of the label text. Defaults to 3 mm.

Details

Standard 'ggplot2' aesthetics for text are supported (see Aesthetics).

Aesthetics

- x (required; position of the feature)
- y (required; molecule)
- label (required; the label text)
- forward (optional; will draw text in the appropriate location for features with angled arrow-heads)
- colour
- size
- alpha
- family
- fontface
- angle

See Also

[geom_feature\(\)](#)

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                             y = molecule, fill = gene)) +
  geom_gene_arrow() +
  geom_feature(data = example_features, ggplot2::aes(x = position, y = molecule,
                                                    forward = forward)) +
  geom_feature_label(data = example_features,
                    ggplot2::aes(x = position, y = molecule, label = name,
                                forward = forward)) +
  ggplot2::facet_wrap(~ molecule, scales = "free")
```

geom_gene_arrow

A 'ggplot2' geom to draw genes as arrows

Description

geom_gene_arrow() draws genes as arrows, allowing gene maps to be drawn.

Usage

```
geom_gene_arrow(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  na.rm = FALSE,
```

```

show.legend = NA,
inherit.aes = TRUE,
arrowhead_width = grid::unit(4, "mm"),
arrowhead_height = grid::unit(4, "mm"),
arrow_body_height = grid::unit(3, "mm"),
...
)

```

Arguments

mapping, data, stat, position, na.rm, show.legend, inherit.aes, ...

As standard for ggplot2.

arrowhead_width

grid::unit() object giving the width of the arrowhead. Defaults to 4 mm. If the gene is drawn smaller than this width, only the arrowhead will be drawn, compressed to the length of the gene.

arrowhead_height

grid::unit() object giving the height of the arrowhead. Defaults to 4 mm.

arrow_body_height

grid::unit() object giving the height of the body of the arrow. Defaults to 3 mm.

Details

This geom draws genes as arrows along a horizontal line representing the molecule. The start and end locations of the gene are expressed with the `xmin` and `xmax` aesthetics, while the molecule can be specified with the `y` aesthetic. Optionally, an additional `forward` aesthetic can be used to reverse the orientation of some or all genes from that implied by `xmin` and `xmax`.

Unless the plot is faceted with a free x scale, all the molecules will share a common x axis. This means that if the locations are very different across different molecules, the genes might appear very small and squished together with a lot of unnecessary empty space. To get around this, either facet the plot with `scales = "free_x"`, or normalise the gene locations if their exact locations are not important.

See `make_alignment_dummies()` for a method to align genes between molecules.

Aesthetics

- `xmin,xmax` (start and end of the gene; will be used to determine gene orientation)
- `y` (molecule)
- `forward` (if any value that is not TRUE, or coercible to TRUE, the gene arrow will be drawn in the opposite direction to that determined by `xmin` and `xmax`)
- `alpha`
- `colour`
- `fill`
- `linetype`
- `linewidth` (the former `size` aesthetic has been deprecated and will be removed in future versions)

See Also

`theme_genes()`, `make_alignment_dummies()`, `geom_gene_label()`

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                             y = molecule, fill = gene)) +
  geom_gene_arrow() +
  ggplot2::facet_wrap(~ molecule, scales = "free")
```

geom_gene_label	A 'ggplot2' geom to add text labels to gene arrows
-----------------	--

Description

`geom_gene_label()` can be used to add a text label to genes drawn with `geom_gene_arrow()`.

Usage

```
geom_gene_label(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  na.rm = FALSE,
  show.legend = FALSE,
  inherit.aes = TRUE,
  padding.x = grid::unit(1, "mm"),
  padding.y = grid::unit(0.1, "lines"),
  align = "centre",
  min.size = 4,
  grow = FALSE,
  reflow = FALSE,
  height = grid::unit(3, "mm"),
  ...
)
```

Arguments

`mapping`, `data`, `stat`, `position`, `na.rm`, `show.legend`, `inherit.aes`, ...
 Standard geom arguments as for `ggplot2::geom_text()`.

`padding.x`, `padding.y`
`grid::unit()` object, giving horizontal or vertical padding around the text. Defaults to 1 mm and 0.1 lines respectively.

`align`
 Where inside the gene to place the text label. Default is 'centre'; other options are 'left' and 'right'.

<code>min.size</code>	Minimum font size, in points. If provided, text that would need to be shrunk below this size to fit inside the gene arrow will not be drawn. Defaults to 4 pt.
<code>grow</code>	If TRUE, text will be grown as well as shrunk to fill the arrow.
<code>reflow</code>	If TRUE, text will be reflowed (wrapped) to better fit the arrow.
<code>height</code>	<code>grid::unit()</code> object giving the maximum height of the text. Defaults to 3 mm, which is the default height of gene arrows drawn with <code>geom_gene_arrow()</code> .

Details

`geom_gene_label()` uses the 'ggfittxt' package to fit text to genes. All text drawing options available in `ggfittxt::geom_fit_text()` (growing, reflowing, etc.) are also available here. For full details on how these options work, see the documentation for `ggfittxt::geom_fit_text()`.

Standard 'ggplot2' aesthetics for text are supported (see Aesthetics).

Aesthetics

- `xmin,xmax` (start and end of the gene; required)
- `y` (molecule; required)
- `label` (the label text; required)
- `colour`
- `size`
- `alpha`
- `family`
- `fontface`
- `angle`

See Also

`geom_gene_arrow`

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
  y = molecule, fill = gene, label = gene)) +
  geom_gene_arrow() +
  geom_gene_label() +
  ggplot2::facet_wrap(~ molecule, ncol = 1, scales = "free") +
  theme_genes()
```

geom_subgene_arrow	A 'ggplot2' geom to draw subgene segments of gene arrows
--------------------	--

Description

geom_subgene_arrow() draws subgenes segments within gene arrows drawn with geom_gene_arrow().

Usage

```
geom_subgene_arrow(  
  mapping = NULL,  
  data = NULL,  
  stat = "identity",  
  position = "identity",  
  na.rm = FALSE,  
  show.legend = NA,  
  inherit.aes = TRUE,  
  arrowhead_width = grid::unit(4, "mm"),  
  arrowhead_height = grid::unit(4, "mm"),  
  arrow_body_height = grid::unit(3, "mm"),  
  ...  
)
```

Arguments

mapping, data, stat, position, na.rm, show.legend, inherit.aes, ...

As standard for 'ggplot2'.

arrowhead_width

grid::unit() object giving the width of the arrowhead. Defaults to 4 mm. If the gene is drawn smaller than this width, only the arrowhead will be drawn, compressed to the length of the gene.

arrowhead_height

grid::unit() object giving the height of the arrowhead. Defaults to 4 mm.

arrow_body_height

grid::unit() object giving the height of the body of the arrow. Defaults to 3 mm.

Details

The start and end locations of the subgene are given with the xsubmin and xsubmax aesthetics. geom_subgene_arrow() requires some information about the 'parent' gene, provided with the same aesthetics used for geom_gene_arrow(): start and end locations of the 'parent' gene with the xmin and xmax aesthetics, the molecule with the y aesthetic, and optionally the direction with the forward aesthetic. If the geometry of the parent gene has been changed with arrowhead_width, arrowhead_height or arrow_body_height, identical parameters should be given to geom_subgene_arrow().

Aesthetics

- xmin,xmax (start and end of the gene; will be used to determine gene orientation)
- xsubmin,xsubmax (start and end of subgene segment). Should be consistent with xmin/xmax
- y (molecule)
- forward (if FALSE, or coercible to FALSE, the gene arrow will be drawn in the opposite direction to that determined by xmin and xmax)
- alpha
- colour
- fill
- linetype
- linewidth (the former size aesthetic has been deprecated and will be removed in future versions)

See Also

[geom_gene_arrow\(\)](#), [geom_subgene_label\(\)](#)

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                              y = molecule)) +
  geom_gene_arrow() +
  geom_subgene_arrow(data = example_subgenes,
                    ggplot2::aes(xmin = start, xmax = end, xsubmin = from, xsubmax = to,
                                y = molecule, fill = gene)) +
  ggplot2::facet_wrap(~ molecule, scales = "free")
```

geom_subgene_label *A 'ggplot2' geom to add text labels to subgenes*

Description

geom_subgene_label() can be used to add a text label to subgenes drawn with geom_subgene_arrow().

Usage

```
geom_subgene_label(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  na.rm = FALSE,
  show.legend = FALSE,
  inherit.aes = TRUE,
```

```
padding.x = grid::unit(1, "mm"),
padding.y = grid::unit(0.1, "lines"),
align = "centre",
min.size = 4,
grow = FALSE,
reflow = FALSE,
height = grid::unit(3, "mm"),
...
)
```

Arguments

mapping, data, stat, position, na.rm, show.legend, inherit.aes, ...
 Standard geom arguments as for `ggplot2::geom_text()`.

padding.x, padding.y
`grid::unit()` object, giving horizontal or vertical padding around the text. Defaults to 1 mm and 0.1 lines respectively.

align
 Where inside the subgene to place the text label. Default is 'centre'; other options are 'left' and 'right'.

min.size
 Minimum font size, in points. If provided, text that would need to be shrunk below this size to fit inside the subgene will not be drawn. Defaults to 4 pt.

grow
 If TRUE, text will be grown as well as shrunk to fill the subgene.

reflow
 If TRUE, text will be reflowed (wrapped) to better fit the subgene.

height
`grid::unit()` object giving the maximum height of the text. Defaults to 3 mm, which is the default height of gene arrows (and therefore of subgenes) drawn with `geom_gene_arrow()`.

Details

`geom_subgene_label()` uses the 'ggfittext' package to fit text to genes. All text drawing options available in `ggfittext::geom_fit_text()` (growing, reflowing, etc.) are also available here. For full details on how these options work, see the documentation for `ggfittext::geom_fit_text()`. Standard 'ggplot2' aesthetics for text are supported (see Aesthetics.)

Aesthetics

- xsubmin, xsubmax (start and end of the subgene; required)
- y (molecule; required)
- colour
- size
- alpha
- family
- fontface
- angle

`geom_terminator`*A 'ggplot2' geom to draw transcription terminators*

Description

`geom_terminator()` draws a 'T-shaped' glyph representing the position of a transcription terminator.

Usage

```
geom_terminator(  
  mapping = NULL,  
  data = NULL,  
  stat = "identity",  
  position = "identity",  
  na.rm = FALSE,  
  show.legend = NA,  
  inherit.aes = FALSE,  
  terminator_height = unit(3, "mm"),  
  terminator_width = unit(3, "mm"),  
  ...  
)
```

Arguments

`mapping`, `data`, `stat`, `position`, `na.rm`, `show.legend`, `inherit.aes`, ...

As standard for ggplot2. `inherit.aes` is set to `FALSE` by default, as terminators are not likely to share any plot aesthetics other than `y`.

`terminator_height`

`grid::unit()` object giving the height of the vertical 'pillar' of the terminator glyph above the molecule line. Can be set as a negative value to draw terminators below the line. Defaults to 3 mm.

`terminator_width`

`grid::unit()` object giving the width of the horizontal 'beam' of the terminator glyph. Defaults to 3 mm.

Aesthetics

- `x` (required; position of the terminator)
- `y` (required; molecule)
- `alpha`
- `color`
- `linetype`

- linewidth (the former size aesthetic has been deprecated and will be removed in future versions)

Note that, unlike `geom_gene_arrow()` and `ggplot2` convention, `linewidth` in `geom_terminator()` is expressed in points rather than millimetres, with a default value of 1. This inconsistency is retained for backwards compatibility, and will be reconciled when these point-feature geoms are superseded in `gggenes` 1.0.0.

See Also

[geom_terminator_label\(\)](#), [geom_feature\(\)](#)

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                             y = molecule, fill = gene)) +
  geom_gene_arrow() +
  geom_terminator(data = example_terminators, ggplot2::aes(x = position, y = molecule)) +
  ggplot2::facet_wrap(~ molecule, scales = "free")
```

`geom_terminator_label` A 'ggplot2' geom to add text labels to transcription terminators

Description

`geom_terminator_label()` adds text labels to terminators drawn with `geom_terminator()`.

Usage

```
geom_terminator_label(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  na.rm = FALSE,
  show.legend = FALSE,
  inherit.aes = FALSE,
  terminator_height = unit(4, "mm"),
  label_height = unit(3, "mm"),
  ...
)
```

Arguments

`mapping`, `data`, `stat`, `position`, `na.rm`, `show.legend`, `inherit.aes`, ...

As standard for `ggplot2`, `inherit.aes` is set to `FALSE` by default, as terminators are not likely to share any plot aesthetics other than `y`.

terminator_height `grid::unit()` object giving the offset from the molecule line to the inner edge of the label's bounding box. Can be set as a negative value to position labels on the opposite side of the molecule line. Defaults to 4 mm, which provides a 1 mm gap between terminator and label when used with the default `terminator_height` of `geom_terminator()` (3 mm).

label_height `grid::unit()` object giving the height of the label text. Defaults to 3 mm.

Details

Standard 'ggplot2' aesthetics for text are supported (see Aesthetics).

Aesthetics

- `x` (required; position of the terminator)
- `y` (required; molecule)
- `label` (required; the label text)
- `colour`
- `size`
- `alpha`
- `family`
- `fontface`
- `angle`

See Also

[geom_terminator\(\)](#)

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                             y = molecule, fill = gene)) +
  geom_gene_arrow() +
  geom_terminator(data = example_terminators,
                  ggplot2::aes(x = position, y = molecule)) +
  geom_terminator_label(data = example_terminators,
                        ggplot2::aes(x = position, y = molecule, label = name)) +
  ggplot2::facet_wrap(~ molecule, scales = "free")
```

make_alignment_dummies

Prepare dummy data to visually align a single gene across faceted molecules

Description

make_alignment_dummies() helps you to visually align genes across molecules that have been faceted with a free x scale. The output of this function is a data frame of dummy genes. If these dummy genes are added to a 'ggplot2' plot with ggplot2::geom_blank(), they will extend the x axis range in such a way that the start or end of a selected gene is visually aligned across the facets.

Usage

```
make_alignment_dummies(data, mapping, on, side = "left")
```

Arguments

data	Data frame of genes. This is almost certainly the same data frame that will later be passed to ggplot2::ggplot().
mapping	Aesthetic mapping, created with ggplot2::aes(). Must contain the following aesthetics: xmin, xmax, y, and id (a unique identifier for each gene).
on	Name of gene to be visually aligned across facets. This gene must be present in 'data', in the column mapped to the id aesthetic.
side	Should the visual alignment be of the 'left' (default) or 'right' side of the gene?

Examples

```
dummies <- make_alignment_dummies(example_genes, ggplot2::aes(xmin = start,
  xmax = end, y = molecule, id = gene), on = "genE")

ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
  y = molecule, fill = gene)) +
  geom_gene_arrow() +
  ggplot2::geom_blank(data = dummies) +
  ggplot2::facet_wrap(~ molecule, scales = "free", ncol = 1)
```

theme_genes

A 'ggplot2' theme for drawing gene maps

Description

This theme removes extraneous plot elements for drawing an 'arrows-on-a-string' style gene map in 'ggplot2'. theme_genes_flipped() is like theme_genes(), but for flipped coordinates.

Usage

```
theme_genes()

theme_genes_flipped()
```

Details

This theme removes strip text (the text that labels facets when you use `ggplot2::facet_wrap()` or `ggplot2::facet_grid()`). This makes it easier to draw molecules on different x scales by setting the y aesthetic to the molecule, then faceting with `facet_grid(~ molecule, scales = "free")`.

See Also

[geom_gene_arrow\(\)](#)

Examples

```
ggplot2::ggplot(example_genes, ggplot2::aes(xmin = start, xmax = end,
                                              y = molecule, fill = gene)) +
  geom_gene_arrow() +
  ggplot2::facet_wrap(~ molecule, scales = "free") +
  theme_genes()
```

Index

* datasets

- example_dummies, [2](#)
- example_features, [2](#)
- example_genes, [3](#)
- example_terminators, [4](#)

- example_dummies, [2](#)
- example_features, [2](#)
- example_features_polar
 - (example_features), [2](#)
- example_genes, [3](#)
- example_genes_polar(example_genes), [3](#)
- example_subgenes(example_genes), [3](#)
- example_subgenes_polar(example_genes),
[3](#)
- example_terminators, [4](#)
- example_terminators_polar
 - (example_terminators), [4](#)

- geom_feature, [4](#)
- geom_feature(), [7](#), [15](#)
- geom_feature_label, [6](#)
- geom_feature_label(), [5](#)
- geom_gene_arrow, [7](#)
- geom_gene_arrow(), [12](#), [18](#)
- geom_gene_label, [9](#)
- geom_gene_label(), [9](#)
- geom_subgene_arrow, [11](#)
- geom_subgene_label, [12](#)
- geom_subgene_label(), [12](#)
- geom_terminator, [14](#)
- geom_terminator(), [5](#), [16](#)
- geom_terminator_label, [15](#)
- geom_terminator_label(), [15](#)

- make_alignment_dummies, [17](#)
- make_alignment_dummies(), [9](#)

- theme_genes, [17](#)
- theme_genes(), [9](#)
- theme_genes_flipped(theme_genes), [17](#)