

# Package ‘idiogramFISH’

July 30, 2020

**Title** Idiograms with Marks and Karyotype Indices

**Version** 1.16.1

**Date** 2020-07-29

**Description** Plot idiograms of karyotypes, plasmids, circular chr. having a set of data.frames for chromosome data and optionally mark data. Two styles of chromosomes can be used: without or with visible chromatids (when not circular). Supports micrometers, cM and Mb or any unit. Two styles of centromeres are available: triangular and rounded; and six styles of marks: square (squareLeft), dots, cM (cMLeft), cenStyle, upArrow, downArrow; its legend (label) can be drawn inline or to the right of karyotypes. Idiograms can also be plotted in concentric circles. It is possible to calculate chromosome indices by Levan et al. (1964) <doi:10.1111/j.1601-5223.1964.tb01953.x>, karyotype indices of Watanabe et al. (1999) <doi:10.1007/PL00013869> and Romero-Zarco (1986) <doi:10.2307/1221906> and classify chromosomes by morphology Guerra (1986) and Levan et al. (1964).

**Depends** R (>= 3.0)

**Imports** crayon, dplyr, tidyr

**License** GPL (>= 2)

**Encoding** UTF-8

**LazyData** true

**Suggests** plyr, rmdformats, knitr, kableExtra, rvcheck, badger, rmarkdown, RCurl, ggpubr, ggtree, phytools, ggplot2, treeio, rentrez

**VignetteBuilder** plyr, rmdformats, knitr, kableExtra, rmarkdown, RCurl, rvcheck, badger, rentrez

**SystemRequirements** pandoc (>= 2.0)

**URL** <https://ferroao.gitlab.io/manualidiogramfish/>,  
<https://ferroao.gitlab.io/idiogramFISH>

**BugReports** <https://gitlab.com/ferroao/idiogramFISH/issues>

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**NeedsCompilation** no

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armRatioCI *FUNCTIONS armRatioCI and swapChrRegionDfSizeAndMarks.*

---

### Description

armRatioCI: reads a data.frame and produces AR (radius), CI, Guerra and Levan classifications.  
swapChrRegionDfSizeAndMarks: reads data.frames to swap arms

### Usage

```
armRatioCI(dfChrSize)
```

```
swapChrRegionDfSizeAndMarks(dfChrSize, dfMarkPos, chrNamesToSwap)
```

### Arguments

dfChrSize      name of data.frame with columns: shortArmSize, longArmSize  
dfMarkPos      name of data.frame of marks  
chrNamesToSwap name of chr. names to swap arms

**Value**

data.frame (armRatioCI)  
list of data.frames (swapChrRegionDfSizeAndMarks)

**References**

LEVAN A, FREDGA K, SANDBERG AA (1964) NOMENCLATURE FOR CENTROMERIC POSITION ON CHROMOSOMES. Hereditas 52:201–220.

Guerra. 1986. Reviewing the chromosome nomenclature of Levan et al. Braz. Jour. Gen. Vol IX, 4, 741-743

**See Also**

[chrbasicdatamono](#)

**Examples**

```
armRatioCI(dfOfChrSize)
armRatioCI(bigdfOfChrSize)

swapChrRegionDfSizeAndMarks(dfOfChrSize,dfOfMarks,"1")
```

---

asymmetry

*FUNCTIONS asymmetry and asymmetryA2.*

---

**Description**

asymmetry: calculates karyotype asymmetry A and A2.

asymmetryA2: calculates karyotype asymmetry A2

This functions read a data.frame with columns: shortArmSize and longArmSize

If several species present, use column OTU.

It returns a list with the A and A2 indices

$$A = \frac{\sum_{i=1}^n \frac{longArm_i - shortArm_i}{CL_i}}{n}$$

A: Watanabe et al. (1999) asymmetry of karyotype ranging from 0 (symmetric) to 1 (asymmetric)

$$A_2 = \frac{sCL}{xCL}$$

(s = std dev, CL = chr. length, x = mean) (Romero-Zarco 1986)

related to:

$$CV_{CL} = A_2 * 100$$

(CV = coeff. var.) (Paszko 2006)

**Usage**

```
asymmetry(dfChrSize)
asymmetryA2(dfChrSize)
```

**Arguments**

```
dfChrSize      name of data.frame
```

**Value**

```
list
```

**References**

Watanabe K, Yahara T, Denda T, Kosuge K. 1999. Chromosomal evolution in the genus *Brachyscome* (Asteraceae, Astereae): Statistical tests regarding correlation between changes in karyotype and habit using phylogenetic information. *Journal of Plant Research* 112: 145-161. 10.1007/PL00013869

A2: Romero-Zarco. 1986. A New Method for Estimating Karyotype Asymmetry. *Taxon* Vol. 35, No. 3 pp. 526-530

Paszko B. 2006. A critical review and a new proposal of karyotype asymmetry indices. *Plant Syst Evol* 258:39-48.

**See Also**

[chrbasicdatamono](#)

[chrbasicdatamono](#)

[chrbasicdataHolo](#)

**Examples**

```
asymmetry(dfOfChrSize)
myAlist<-asymmetry(bigdfOfChrSize)
as.data.frame(myAlist)
asymmetryA2(dfOfChrSize)
as.data.frame(asymmetryA2(bigdfOfChrSize))
asymmetryA2(dfChrSizeHolo)
as.data.frame(asymmetryA2(bigdfChrSizeHolo))
```

---

chrbasicdataHolo      *Chr. basic data Holo.*

---

### Description

dfChrSizeHolo: Example data for holocentrics for 1 species

bigdfChrSizeHolo: Example data for holocentrics for several species, OTU

parentalAndHybHoloChrSize: Example data for holocentrics for several species, OTU

bigdfOfChrSize3Mb: Example data in Mb without chr. arms for three species, OTU

### Usage

dfChrSizeHolo

bigdfChrSizeHolo

parentalAndHybHoloChrSize

bigdfOfChrSize3Mb

### Format

data.frame with columns:

**OTU** grouping OTU (species), optional if only one OTU

**chrName** name of chromosome

**chrSize** size of chromosome, micrometers or Mb

**group** chromosome group, optional

**chrNameUp** optional name over kar.

**Mbp** optional name to show size in Mbp, use only when chrSize is not in Mbp

An object of class data.frame with 12 rows and 3 columns.

An object of class data.frame with 13 rows and 3 columns.

An object of class data.frame with 14 rows and 3 columns.

### See Also

[asymmetryA2](#)

[plotIdiograms](#)

[markdataholo](#)

---

chrbasicdatamono      *Chr. basic data Monocen.*

---

### Description

dfOfChrSize: Example data for monocentrics

bigdfOfChrSize: Example data for monocentrics for several species, OTU

humChr: Data for human karyotype, measured from Adler (1994)

allChrSizeSample: Example data for monocentrics for several species, OTU

parentalAndHybChrSize: Example data for monocentrics for GISH

traspadf: Example data for Tradescantia (Rhoeo) spathacea (Golczyk et al. 2005)

### Usage

dfOfChrSize

bigdfOfChrSize

humChr

allChrSizeSample

parentalAndHybChrSize

traspadf

### Format

data.frame with columns:

**OTU** OTU, species, optional if only one OTU (species)

**chrName** name of chromosome

**shortArmSize** size of short arm, micrometers

**longArmSize** size of long arm, micrometers

**group** chr group, optional

**chrNameUp** optional name over kar.

**Mbp** optional name to show size in Mbp, use only when shortArmSize is not in Mbp

An object of class data.frame with 50 rows and 4 columns.

An object of class data.frame with 24 rows and 4 columns.

An object of class data.frame with 75 rows and 4 columns.

An object of class data.frame with 13 rows and 4 columns.

An object of class data.frame with 12 rows and 4 columns.

**Source**

<http://www.pathology.washington.edu/research/cytopages/idiograms/human/>

**References**

Adler 1994. Idiogram Album. <http://www.pathology.washington.edu/research/cytopages/idiograms/human/>

Golczyk H, Hasterok R, Joachimiak AJ (2005) FISH-aimed karyotyping and characterization of Renner complexes in permanent heterozygote Rhoeo spathacea. *Genome* 48:145–153.

**See Also**

[plotIdiograms](#)

[armRatioCI](#)

[asymmetry](#)

[markposDFs](#)

---

`citrusSize`

*FUNCTIONS: citrusSize, citrusMarkPos, markOverCMA*

---

**Description**

Helper function to create data.frames with chr. size and mark size data for Citrus based on categories in Carvalho et al. (2005)

Special behaviour while plotting: normally you will get chr. names as: B\_1, B\_2, etc. to remove `_*`, use `chrIdPatternRem='_.*'` in `plotIdiograms`. However, for FL+ and FLO, this conversion is automatic. So, in plot you will never see FLO\_1, FLO\_2, for example.

**Usage**

```
citrusSize( A = 0, B = 0, C = 0, D = 0, E = 0, F = 0, FL = 0, FL0 = 0,
G = 0, shortArm = 1.2, longArm = 1.7, shortArmFL = 1.3, longArmFL = 1.8,
OTU = "OTU 1"
)

citrusMarkPos( chrSizeDf, mSizePter = 0.25, mSizeQter = 0.35, mSizePprox = 0.35,
mOther = 0.25, markName = "CMA"
)

markOverCMA( citrusMarkPosDF, chrType = "B", chrName, chrRegion = "p",
markName = "45S"
)
```

**Arguments**

A	number of A to calculate (citrusSize)
B	number of B to calculate (citrusSize)
C	number of C to calculate (citrusSize)
D	number of D to calculate (citrusSize)
E	number of E to calculate (citrusSize)
F	number of F to calculate (citrusSize)
FL	number of FL+ to calculate (citrusSize)
FL0	number of FL0 to calculate (citrusSize)
G	number of G to calculate (citrusSize)
shortArm	for A to G (not FL) (citrusSize)
longArm	for A to G (not FL) (citrusSize)
shortArmFL	for FL (citrusSize)
longArmFL	for FL (citrusSize)
OTU	name of species (citrusSize)
chrSizeDf	data.frame created with citrusSize function (citrusMarkPos)
mSizePter	numeric, default size for P(short) ter (terminal) bands. 0.25 (default) (citrusMarkPos)
mSizeQter	numeric, default size for Q(long) ter (terminal) bands. 0.35 (default) (citrusMarkPos)
mSizePprox	numeric, default size for P prox (proximal) bands. 0.35 (default) (citrusMarkPos)
mOther	numeric, default size for other bands. 0.25 (default) (citrusMarkPos)
markName	character, default name of mark "CMA", or "45S", respectively. (citrusMarkPos, markOverCMA)
citrusMarkPosDF	data.frame, with CMA marks (markOverCMA)
chrType	character, defaults to "B", chr. type to duplicate mark (markOverCMA)
chrName	character, defaults to "B", chr. name to duplicate mark (markOverCMA)
chrRegion	character, arm, defaults to "p". for mark duplication (markOverCMA)

**Value**

data.frame  
data.frame  
data.frame

**References**

Carvalho, R., Soares Filho, W. S., Brasileiro-Vidal, A. C., & Guerra, M. (2005). The relationships among lemons, limes and citron: A chromosomal comparison. *Cytogenetic and Genome Research*, 109(1–3), 276–282. <https://doi.org/10.1159/000082410>



**Examples**

```

citrusSizeDF <- citrusSize(B=1,D=11,F=4,FL0=2,OTU="C. jambhiri")
suppressMessages(
plotIdiograms(citrusSizeDF,
indexIdTextSize=.4,# font size
rulerNumberSize=.4,# font size
rulerTitleSize=.4, # font size
rulerPos =-.5,      # ruler pos.
xPosRulerTitle =1.5, # ruler title pos.
orderChr="original"# order of chr. as in d.f.
)
)
citrusSizeDF2 <- citrusSize(B=2,D=10,F=4,FL0=1,
FL=1,          # equivalent to FL+
OTU="C. limettioides")

suppressMessages(
plotIdiograms(citrusSizeDF2,      # FL^NA error corrected in 1.15.4
indexIdTextSize=.4,# font size
rulerNumberSize=.4,# font size
rulerTitleSize=.4, # font size
rulerPos =-.5,      # ruler pos.
xPosRulerTitle =1.5, # ruler title pos.
orderChr="original"# order of chr. as in d.f.
)
)

citrusMarkPosDF <- citrusMarkPos(citrusSizeDF)
suppressMessages(
plotIdiograms(dfChrSize= citrusSizeDF,      # chr. size data.frame
dfMarkPos= citrusMarkPosDF,# mark position data.frame (inc. cen.)
ruler=FALSE,          # remove
chrIndex=FALSE,      # remove
morpho=FALSE,        # remove
karIndex=FALSE,      # remove
indexIdTextSize=.4,  # font size
xlimRightMod=4,      # xlim mod.
orderChr="original", # order chr. as in d.f.
chrColor="blue",     # chr. color
legendHeight=3       # legend item height
)
)
citrusMarkPosDF45S<-markOverCMA(citrusMarkPosDF, chrType="B", chrRegion="p", markName="45S")
suppressMessages(
plotIdiograms(dfChrSize= citrusSizeDF, # chr. size data.frame
dfMarkPos= citrusMarkPosDF45S,# mark position data.frame (inc. cen.)
ruler=FALSE,          # remove ruler
chrIndex=FALSE,      # remove index
morpho=FALSE,        # remove morphol.
karIndex=FALSE,      # remove
indexIdTextSize=.4,  # font size chr.

```

```

xlimRightMod=4,      # modify xlim
orderChr="original", # as in d.f.
chrColor="blue",
legendHeight=5,      # height of legend item
colorBorderMark="black", # mark border color
OTUfont=3            # italics
)
)

```

---

dfMarkStyle

*Mark characteristics*


---

### Description

style column does not apply to cen. marks, only color.

dfMarkColor: Example General data for marks NOT position

humMarkColor: human bands' characteristics, from Adler (1994)

mydfMaColor: mark characteristics used in vignette of phylogeny

### Usage

dfMarkColor

humMarkColor

mydfMaColor

### Format

dfMarkColor a data.frame with columns:

**markName** name of mark

**markColor** use R colors

**style** character, use square or dots, optional

**protruding** numeric, modifies aspect of cM/cMLeft marks, see parameter protruding in [plotIdiograms](#), optional

An object of class data.frame with 395 rows and 3 columns.

An object of class data.frame with 6 rows and 3 columns.

### Source

<http://www.pathology.washington.edu/research/cytopages/idiograms/human/>

### References

Adler 1994. Idiogram Album. URL: <http://www.pathology.washington.edu/research/cytopages/idiograms/human/>

**See Also**[plotIdiograms](#)[markposDFs](#)[markdataholo](#)


---

genBankReadIF	<i>FUNCTION genBankReadIF</i>
---------------	-------------------------------

---

**Description**

genBankReadIF: creates a list of data.frames from a genbank format file or a rentrez object

Requires tidyr

**Usage**

```
genBankReadIF(filename.gb)
```

**Arguments**

filename.gb	name of file to read, downloaded from genBank, or, object from <code>rentrez::entrez_fetch(db="nuccore", id="theID", rettype="gbwithparts", retmode="text")</code>
-------------	--

**Value**

list

---

make.uniqueIF	<i>FUNCTION make.uniqueIF</i>
---------------	-------------------------------

---

**Description**

make.uniqueIF: produces unique strings from duplicated

**Usage**

```
make.uniqueIF(string, sep = "_", letter = FALSE)
```

**Arguments**

string	name of char. vector
sep	separator
letter	boolean, use numbers when FALSE

**Value**

character vector

**Examples**

```
make.uniqueIF(c(1,1,2,2))
```

---

markdataholo

*Mark Positional data - Holocen.*

---

**Description**

When several OTUs, some can be monocen. and others holocen. Marks distance for monocen. are measured from cen. and for holocen. from top or bottom depending on param origin. See vignettes.

bigdfMarkPosHolo: Example data for mark position of holocentrics with column OTU

dfMarkPosHolo: Example data for mark position of holocentrics

dfAlloParentMarksHolo: Example data for mark position of GISH

bigdfOfMarks3Mb: Example data for mark position in Mb

**Usage**

bigdfMarkPosHolo

dfMarkPosHolo

dfAlloParentMarksHolo

bigdfOfMarks3Mb

**Format**

data.frame with columns:

**OTU** OTU, species, optional

**chrName** name of chromosome

**markName** name of mark

**markPos** position from bottom or top (see parameter origin in plotIdiograms)

**markSize** size of mark in micrometers or Mb

An object of class data.frame with 6 rows and 4 columns.

An object of class data.frame with 13 rows and 4 columns.

An object of class data.frame with 12 rows and 5 columns.

**See Also**[markposDFs](#)[plotIdiograms](#)[chrbasicdataHolo](#)

---

`markposDFs`*Mark Positional data - monocentric*

---

**Description**

When several OTUs, some can be monocen. and others holocen. Marks distance for monocen. are measured from cen. and for holocen. from top or bottom depending on param origin. See vignettes.

`bigdfOfMarks`: Example data for mark position with column OTU

`dfOfMarks`: Example data for marks' position

`dfOfMarks2`: Marks' position including cen. marks

`humMarkPos`: human karyotype bands' (marks) positions, measured from Adler (1994)

`allMarksSample`: Example data for marks' position

`dfAlloParentMarks`: Example data for mark position of GISH of monocen.

`traspaMarks`: *T. spathacea* (Rhoeo) marks' positions, from Golczyk et al. (2005)

**Usage**

`bigdfOfMarks`

`dfOfMarks`

`dfOfMarks2`

`humMarkPos`

`allMarksSample`

`dfAlloParentMarks`

`traspaMarks`

**Format**

`bigdfOfMarks` a data.frame with columns:

**OTU** OTU, species, mandatory if in `dfChrSize`

**chrName** name of chromosome

**markName** name of mark

**chrRegion** use p for short arm, q for long arm, and cen for centromeric

**markDistCen** distance of mark to centromere (not for cen)

**markSize** size of mark (not for cen)

An object of class data.frame with 4 rows and 5 columns.

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

An object of class data.frame with 395 rows and 5 columns.

An object of class data.frame with 43 rows and 6 columns.

An object of class data.frame with 15 rows and 4 columns.

An object of class data.frame with 18 rows and 7 columns.

### Source

[Washington U](#)

### References

Adler 1994. Idiogram Album. URL: [Washington U](#).

Golczyk H, Hasterok R, Joachimiak AJ (2005) FISH-aimed karyotyping and characterization of Renner complexes in permanent heterozygote *Rhoeo spathacea*. *Genome* 48:145–153.

### See Also

[markdataholo](#)

[plotIdiograms](#)

[chrbasicdatamono](#)

[dfMarkColor](#)

---

namesToColumns

*FUNCTION that modifies marks' names into columns*

---

### Description

Reads a data.frame with marks' of styles downArrow, upArrow, cM, cMLeft positions. It separates names in columns, avoiding overlap when multiple close names

Exceptionally this function requires the column style in the data.frame of marks' positions.

Returns a data.frame

**Usage**

```
namesToColumns( marksDf, dfChrSize, markType = c("downArrow", "upArrow",
"cmLeft", "cM"), amountofSpaces = 13, colNumber = 2, protruding = 0.5,
protrudingInt = 0.5, circularPlot = TRUE, rotation = 0.5,
defaultStyleMark = "square", orderChr = "size", halfModDown = NA,
halfModUp = NA, rotatMod = 0
)
```

**Arguments**

marksDf	data.frame with columns: markName, style, markPos
dfChrSize	data.frame, size of chr. Same of plot.
markType	character, use c("downArrow", "upArrow", "cM", "cmLeft") or a subset
amountofSpaces	numeric, number of spaces for each column
colNumber	numeric, number of columns
protruding	numeric, same as plot, minimal protruding for arrow marks, equivalent to cM protruding
protrudingInt	numeric, spacing of columns in terms of width of chr. percent 1 = 100%. Defaults to 0.5
circularPlot	boolean, use TRUE for circular plots. Use FALSE otherwise
rotation	numeric, same as plot, anti-clockwise rotation, defaults to 0.5 which rotates chr. from top to -90 degrees. ( $-0.5 * \pi$ )
defaultStyleMark	character, if some data in column style missing fill with this one. Defaults to "square"
orderChr	character, replaces orderBySize -deprecated when "size", sorts chromosomes by total length from the largest to the smallest. "original": preserves d.f. order. "name": sorts alphabetically; "group": sorts by group name
halfModDown	numeric, for circ. plots, when plotting several chromosomes in a circular plot, using a small value 0.05 corrects for alignment problems of downArrows, cmLeft labels. Defaults to NA
halfModUp	numeric, for circ. plots, when plotting several chromosomes in a circular plot, using a small value 0.05 corrects for alignment problems of upArrows, cM labels. Defaults to NA
rotatMod	numeric, for circ. plots, when rotation $\neq 0$ (diff.), corrects alignment of labels. Defaults to 0

**Value**

data.frame

---

perMark *FUNCTION perMark*

---

### Description

calculates fraction (%) of chromosome for each mark

### Usage

```
perMark(dfMarkPos, listOfdfChromSize)
```

### Arguments

dfMarkPos            data.frame of marks' position  
listOfdfChromSize    list data.frames of chr. sizes. Require col. chrSize for all. Use armRatioCI

### Value

list

### Examples

```
# Beginning with two data.frames with column OTU
dfOfChrSize$OTU<-1
dfOfMarks2$OTU<-1

# add column chrSize if missing
dfOfChrSizeWithChrSize <- armRatioCI(dfOfChrSize)

#data.frame of chr. size to list
listOfdfChr<-idiogramFISH::dfToListColumn(dfOfChrSizeWithChrSize)

perMark(dfOfMarks2,listOfdfChr)
```

---

plotIdiograms *FUNCTION to plot idiograms of karyotypes with and without centromere*

---

### Description

This function reads a data.frame passed to dfChrSize with columns: chrName (mono/holo) and shortArmSize and longArmSize for monocentrics or a column chrSize for holocentrics and produces a plot of idiograms. If more than one species, a column named OTU is needed.

Optionally, it reads another data.frame passed to dfMarkPos with the position of marks (sites). Examples: [markposDFs](#). Another data.frame for mark characteristics can be used [dfMarkColor](#) or a character vector passed to mycolors



**Usage**

```

plotIdiograms( dfChrSize, defaultFontFamily, revOTUs = FALSE,
karHeight = 2, karHeiSpace = 2.5, karSepar = TRUE, amoSepar = 10,
addMissingOTUAfter = NA, missOTUspacings = 0, moveKarHor, anchor,
anchorVsizeF = 0.5, pchAnchor = 23, moveAnchorV = 0, moveAnchorH = 0,
mkhValue = 0.5, n = 50, notes, leftNotes, notesTextSize = 0.4, notesLeft,
notesPos = 0.5, notesPosY = 0, leftNotesPos = 0.5, leftNotesPosY = 0,
propWidth = FALSE, MbThreshold = 10000, threshold = 35, MbUnit = "Mb",
yTitle = "µm", specialtyTitle = "cM", specialOTUNames = "", addOTUName = TRUE,
OTU textSize = 1, OTUfont, OTUfamily, OTUasNote = FALSE, orderChr = "size",
chrId = "original", classMbName = "Pm.", classcMName = "L.G.",
classChrName = "Chr.", classChrNameUp = "Type", classGroupName = "",
chrNameUp = FALSE, chrIdPatternRem, indexIdTextSize = 1, distTextChr = 1,
groupUp = FALSE, groupName = TRUE, groupSepar = 0.5, chromatids = TRUE,
arrowsBothChrt = TRUE, holocenNotAsChromatids = FALSE,
excHoloFrArrToSide = FALSE, xModifier, xModMonoHoloRate, chrWidth = 0.5,
chrSpacing = 0.5, specialChrWidth = 0.3, specialChrSpacing = 0.7,
chrColor = "gray", chrBorderColor, centromereSize = NA, cenColor, fixCenBorder,
roundedCen = TRUE, squareness = 4, lwd.chr = 0.5, lwd.cM, dfMarkPos,
dfCenMarks, defaultStyleMark = "square", markDistType = "beg",
protruding = 0.2, origin = "b", efZero = 1e-05, cMBeginCenter = FALSE,
arrowhead = 0.3, shrinkArrow = 0.3333, arrowheadWidthShrink = 0.1,
arrowsToSide = TRUE, dfMarkColor, mycolors, borderOfWhiteMarks = TRUE,
colorBorderMark, lwd.mimicCen, defCenStyleCol, pattern = "", legend = "aside",
remSimiMarkLeg = FALSE, bannedMarkName, legendWidth = 1.7, legendHeight = NA,
markLabelSize = 1, markLabelSpacer = 1, legendYcoord = 0, chrSize = FALSE,
nsmall = 1, chrSizeMbp = FALSE, markPer = "", showMarkPos = FALSE,
bToRemove = "", perAsFraction = FALSE, chrIndex = "both", morpho = "both",
nameChrIndexPos = 2, karIndex = TRUE, karIndexPos = 0.5, ruler = TRUE,
useMinorTicks = FALSE, miniTickFactor = 10, rulerPos = 0, ruler.tck = -0.02,
rulerNumberPos = 0.5, rulerNumberSize = 1, rulerInterval, rulerIntervalcM,
rulerIntervalMb, ceilingFactor = 0, xPosRulerTitle = 2.6, yPosRulerTitle = 0,
rulerTitleSize = 1, xlimLeftMod = 1, xlimRightMod = 2, ylimBotMod = 0.2,
ylimTopMod = 0.2, callPlot = TRUE, asp = 1, circularPlot = FALSE,
shrinkFactor = 0.9, separFactor = 1.5, labelSpacing = 0.7,
labelOutwards = FALSE, chrLabelSpacing = 0.5, radius = 0.5, rotation = 0.5,
useOneDot = TRUE, circleCenter = 1, circleCenterY = 1, OTUlabelSpacing = 0.3,
OTUsrt = 0, OTUplacing = "first", OTUlabelSpacerx = 0, OTUlabelSpacery = 0,
OTUcentered = TRUE, OTUjustif = 0, OTUlegendHeight = NA, roundness, ...
)

```

**Arguments**

**dfChrSize** mandatory data.frame, with columns: OTU (optional), chrName (mandatory), shortArmSize, longArmSize for monocen. or chrSize for holocen.

**defaultFontFamily** character. use this as the font family. No default value.

revOTUs	boolean, The order of species is the one in the main data.frame, use TRUE to reverse
karHeight	numeric, vertical size of karyotypes. See also karHeiSpace. Defaults to 2
karHeiSpace	numeric, vertical size of karyotypes including spacing. Proportional to karHeight, if overlap, increase. Default value 2.5
karSepar	boolean, reduce distance among karyotypes FALSE = equally sized karyotypes or TRUE = equally spaced karyotypes. Incompatible with addMissingOTUAfter
amoSepar	numeric, depends on karSepar=TRUE, if zero your karyotypes will have no distance among them, if overlap, increase this and karHeiSpace
addMissingOTUAfter	character, when you want to add space (ghost OTUs) after one or several OTUs, pass the names of OTUs preceding the desired space in a character vector i.e. c("species one", "species five")
missOTUspacings	numeric, when you use addMissingOTUAfter this numeric vector should have the same length and corresponds to the number of free spaces (ghost OTUs) to add after each OTU respectively
moveKarHor	character, OTUs' names of karyotypes that should be moved horizontally. See mkhValue
anchor	boolean, when TRUE, plots a parent progeny structure in karyotypes in moveKarHor
anchorVsizeF	numeric, factor to modify vertical size of anchor 0.5 (default). Size itself is equal to karHeiSpace
pchAnchor	numeric, symbol for anchor, see ?points and anchor
moveAnchorV	numeric, displace anchor vertical portion to right or left. See anchor
moveAnchorH	numeric, displace anchor horizontal portion to right or left. See anchor
mkhValue	numeric, value to move kar. hor. See moveKarHor
n,	numeric vertices number for round corners
notes,	data.frame, (to the right), with columns OTU and note for adding notes to each OTU, they appear to the right of chromosomes
leftNotes,	data.frame, (to the left), with columns OTU and note for adding notes to each OTU, they appear to the left of chromosomes
notesTextSize	numeric, font size of notes, see notes
notesLeft	deprecated, use a data.frame for leftNotes
notesPos	numeric, move right notes to the right or left (x axis)
notesPosY	numeric, move right notes to the down or up (y axis)
leftNotesPos	numeric, move left notes to the right or left (x axis)
leftNotesPosY	numeric, move left notes to the down or up (y axis)
propWidth,	boolean, defaults to FALSE. Diminishes chr. width with increasing number of OTUs
MbThreshold,	numeric, if greater than this number (defaults to 10000), MbUnit will apply and specialyTitle will not.

threshold,	this is the max. value allowed for the main two significant digits, otherwise scale will shrink. For example, after 35 $\mu m$ (Default), apparent size will be 3.5 and scale interval will change. See also ceilingFactor, you may have to use -1. Introduced in 1.13
MbUnit,	character, text of units of title when MbThreshold met and OTU not in specialOTUNames. See specialtyTitle Defaults to "Mb", but anything can be used. Introduced in 1.13. See specialtyTitle
yTitle	character, units for common title. Defaults to $\mu m$
specialyTitle,	character, title of ruler if OTU is in specialOTUNames. Will not apply if MbThreshold met. In that case use MbUnit
specialOTUNames	character vector, normally title of ruler is micrometer or Mb (big numbers). Use this param. to be able to put a different unit in ruler title. See "specialyTitle"
addOTUName	boolean, if TRUE adds OTU (species) name to karyotype
OTU textSize	numeric, font size of OTU name (species). Defaults to 1. When OTUasNote is TRUE, use notesTextSize instead
OTUfont	numeric, 1 for normal, 2 for bold, 3 for italics, 4 for bold-italics
OTUfamily	character, font family for OTU name.
OTUasNote	boolean, if TRUE adds OTU (species) name to the right, see notes
orderChr	character, replaces orderBySize -deprecated when "size", sorts chromosomes by total length from the largest to the smallest. "original": preserves d.f. order. "name": sorts alphabetically; "group": sorts by group name
chrId	character, print name of chromosome, "original" uses the original name in OTU column of dfChrSize, "simple" (just 1 to ...) or "" (none).
classMbName	character, name of "chromosome" when in Mbp. Defaults to "Pm". See MbUnit
classcMName	character, name of "chromosome" when OTU in specialOTUNames. Defaults to "L.G."
classChrName	character, name of "chromosome" when in micrometers (apparently). Defaults to "Chr.". See specialOTUNames, classMbName, classcMName
classChrNameUp	character, name of "chromosome" for col. "chrNameUp". Defaults to "Type"
classGroupName	character, name of groups. Defaults to ""
chrNameUp	boolean, when TRUE adds secondary chromosome name from col. chrNameUp over chrs. Defaults to FALSE
chrIdPatternRem	character, regex pattern to remove from chr. names
indexIdTextSize	numeric, font size of chr. and kar. indices and chromosome name. Defaults to 1
distTextChr	numeric, distance from name of chromosome to chromosome, also affects vertical separation of indices. Defaults to 1
groupUp	boolean, when TRUE when groups present, they appear over the chr. name. Defaults to FALSE
groupName	boolean, when TRUE (default), shows group names. When FALSE only line

groupSepar	numeric, factor for affecting chr. spacing chrSpacing among groups. Defaults to 0.5
chromatids	boolean, when TRUE shows separated chromatids. Defaults to TRUE
arrowsBothChrt	boolean, when TRUE (default) (for chromatids=TRUE) shows upArrow, downArrow styles of marks in both chromatids when arrowsToSide=TRUE.
holocenNotAsChromatids	boolean, when TRUE and chromatids=TRUE does not plot holocen kar. with chromatids. Defaults to FALSE. A value of TRUE modifies excHoloFrArrToSide to TRUE always.
excHoloFrArrToSide	boolean, when arrowsToSide=TRUE, excludes holocen. from this behaviour, plotting a centered arrow only.
xModifier	numeric, for chromatids=TRUE, separation among chromatids
xModMonoHoloRate	numeric, factor to shrink xModifier for holocen. 5 means 5 times smaller (quotient).
chrWidth	numeric, relative chromosome width. Defaults to 0.5
chrSpacing	numeric, horizontal spacing among chromosomes, see also chrWidth. Defaults to 0.5
specialChrWidth	numeric, relative chromosome width. Defaults to 0.5 for OTUs in specialOTUNames
specialChrSpacing	numeric, horizontal spacing among chromosomes for OTUs in specialOTUNames, see also chrWidth. Defaults to 0.5
chrColor	character, main color for chromosomes. Defaults to "gray"
chrBorderColor	character, color for border of chromosomes, defaults to chrColor
centromereSize	numeric, optional, this establishes the apparent size of cen. in the plot in $\mu\text{m}$ . Automatic when NA. Default: NA
cenColor	character, color for centromeres, if GISH use NULL or NA. Defaults to chrColor
fixCenBorder	boolean, when TRUE uses chrColor as centromere (and cen. mark) border color. See also cenColor, chrColor, colorBorderMark, borderOfWhiteMarks. No default value.
roundedCen	boolean, when FALSE, cen has triangular aspect. When TRUE, it has rounded aspect (Default).
squareness	numeric, shape of vertices of chromosomes and square marks, higher values more squared. Defaults to 4
lwd.chr	thickness of border of chr., marks; ruler. Also thick of cM marks if lwd.cM absent Defaults to 0.5
lwd.cM	thickness of cM marks. Defaults to lwd.chr
dfMarkPos	data.frame of marks (sites): columns: OTU (opt), chrName, markName (name of site), chrRegion (for monocen. and opt for whole arm (w) in holocen.), markDistCen (for monocen.), markPos (for holocen.), markSize; column chrRegion: use p for short arm, q for long arm, cen for centromeric mark and w for whole

	chr. mark; column markDistCen: use distance from centromere to mark, not necessary for cen. marks (cen), w, p, q (when whole arm). See also param. markDistType
dfCenMarks	data.frame, specific for centromeric marks. columns: chrName and markName. See also dfMarkPos for another option to pass cen. marks
defaultStyleMark	character, default style of mark, only used when style column of dfMarkColor data.frame is missing or in absence of this data.frame. Use "square" (default), "squareLeft", "dots", "cM" "cM", "cMLeft", "cenStyle", "upArrow", "downArrow".
markDistType	character, if "cen" = the distance you provided in data.frame (dfMarkPos) column markDistCen or markPos is to the center of the mark, if "beg" = the distance you provided is to the beginning of the mark (Default)
protruding	numeric, when style of mark is "cM", fraction of chrWidth to stretch marker. Defaults to 0.2. Introduced in 1.13
origin,	For non-monocentric chr. (for holocentrics only) Use "b" (default) if distance to mark in ("markPos" column in "dfMarkPos") data.frame measured from bottom of chromosome, use "t" for distance to mark from top of chr.
efZero,	numeric, numbers below this one will be considered as zero, for comparison purposes. Defaults to 1e-5
cMBeginCenter,	boolean, start position of cM and cMLeft marks. If TRUE, starts in the center (width) of chr. . Defaults to FALSE
arrowhead	numeric, proportion of head of arrow (mark styles: upArrow, downArrow). Defaults to 0.3
shrinkArrow	numeric, proportion, shrinks body of arrow. Defaults to 0.3333
arrowheadWidthShrink	numeric, proportion, shrinks head of arrow. Defaults to 0.1
arrowsToSide	boolean, when FALSE use a centered arrow, instead of an arrow next to chr. margins (TRUE, default). See arrowsBothChrt
dfMarkColor	data.frame, optional, specifying colors and style for marks (sites); columns: markName, markColor, style. style accepts: square, squareLeft, dots, cM, "cMLeft", "cenStyle", "upArrow", "downArrow". (if column style missing all (except 5S) are plotted as in param. defaultStyleMark).
mycolors	character vector, optional, i.e. c("blue", "red", "green") for specifying color of marks in order of appearance. if diverges with number of marks will be recycled if dfMarkColor present, mycolors will be ignored. To know the order of your marks use something like: unique(c(dfMarkPos\$markName, dfCenMarks\$markName) )
borderOfWhiteMarks	boolean, if TRUE (Default) uses black border for white marks. See dfMarkColor. Does not apply to marks with style cenStyle
colorBorderMark	character, without default, pass a name of a color to use as border of marks. See borderOfWhiteMarks

lwd.mimicCen	thickness of lines of cenStyle marks; affects only lateral borders. Defaults to lwd.chr
defCenStyleCol	character, color of outer part of cenStyle marks. Defaults to white
pattern	REGEX pattern to remove from names of marks
legend	character, "" for no legend; "inline" prints labels near chromosomes; "aside" prints legend to the right of karyotypes (default). See markLabelSpacer
remSimiMarkLeg	boolean, when legend="aside", if you use pattern, you can have several marks with same name. When TRUE this remove this pseudoduplicates from legend. Be sure that this pseudoduplicates have the same color, otherwise you should use FALSE (default).
bannedMarkName	character, character string or vector with mark names to be removed from plot. Not the marks but the labels.
legendWidth	numeric, factor to increase width of squares and of legend. Defaults to 1.7
legendHeight	numeric, factor to increase height of squares and dots of legend. Automatic.
markLabelSize	numeric, only if legend != (not) "", size of the text of labels of marks (legend). Defaults to 1
markLabelSpacer	numeric, only if legend="aside", space from the rightmost chr. to legend. Defaults to 1
legendYcoord	numeric, modify Y position of legend when legend="aside"
chrSize	boolean, when TRUE adds total chr size under each chr. Defaults to FALSE
nsmall	numeric, rounding decimals for chrSize parameter. Defaults to 1
chrSizeMbp	boolean, when TRUE adds total Mbp chr. size to each chr. provided, there is a Mbp column in dfChrSize data.frame. Defaults to FALSE. If data in columns shortArmSize, or col. chrSize is in millions ("Mbp"). Use chrSize=TRUE not this one (not column Mbp, you don't need this).
markPer	character, name of mark to calculate % of mark in chr. and add it to plot. See perAsFraction
showMarkPos	boolean, adds position of marks under karyotype (fraction 0-1) when TRUE. Defaults to FALSE
bToRemove,	character, bands to remove from calc. of pos.
perAsFraction	boolean, when TRUE % is shown as fraction. Defaults to FALSE. See markPer
chrIndex	character, add arm ratio with "AR" and centromeric index with "CI", or "both" (Default), or "" for none
morpho	character, if "both" (default) prints the Guerra and Levan classif of cen. position, use also "Guerra" or "Levan" or "" for none. See also ?armRatioCI.
nameChrIndexPos	numeric, modify position of name of chr. indices
karIndex	logical, add karyotype indices A (intrachromosomal - centromere pos.) and A2 (interchromosomal asymmetry, variation among chromosome sizes)
karIndexPos	numeric, move karyotype index
ruler	boolean, display ruler to the left of karyotype, when FALSE no ruler

useMinorTicks	boolean, display minor ticks between labeled ticks in ruler. See miniTickFactor. Defaults to FALSE. (ticks without label)
miniTickFactor	numeric, number of minor ticks for each labeled tick. See useMinorTicks. Defaults to 10
rulerPos	numeric, absolute position of ruler, corresponds to pos argument of axis R plot
ruler.tck	numeric, tick size of ruler, corresponds to tck argument of axis R plot. Defaults to -0.02
rulerNumberPos	numeric, modify position of numbers of ruler. Defaults to 0.5
rulerNumberSize	numeric, size of number's font in ruler. Defaults to 1
rulerInterval	numeric, intervals in ruler. No default, automatic. Introduced in 1.13
rulerIntervalcM	numeric, intervals in ruler of OTU in specialOTUNames. No default. Introduced in 1.13
rulerIntervalMb	numeric, intervals in ruler of OTU with data in Mb (>MbThreshold) and absent from specialOTUNames. No default. Introduced in 1.13
ceilingFactor	numeric, affects number of decimals for ceiling. Affects max. value of ruler. Defaults to 0. When threshold is greater than 35 this may have to be negative. Introduced in 1.13
xPosRulerTitle,	numeric, modify position of ruler title. See yTitle, specialyTitle, MbUnit. Defaults to 2.6. A value of 2.6 means 2.6 times the value of chrSpacing to the left, from the first chr.
yPosRulerTitle,	numeric, affects vertical position of ruler title. Defaults to 0
rulerTitleSize,	numeric font size of units of ruler. See also xPosRulerTitle
xlimLeftMod	numeric, modifies xlim left argument of plot
xlimRightMod	numeric, xlim right side modification by adding space to the right of idiograms. Defaults to 2
ylimBotMod	numeric, modify ylim bottom argument of plot
ylimTopMod	numeric, modify ylim top argument of plot
callPlot	boolean, create new plot in your device. Defaults to TRUE
asp,	numeric, y x aspect of plot. Defaults to 1
circularPlot	boolean, if TRUE chromosomes are plotted in concentric circles. Defaults to FALSE
shrinkFactor	numeric, for circularPlot=TRUE percentage of usage of circle. Defaults to 0.9
separFactor	numeric, for circularPlot=TRUE modify separation of concentric karyotypes. Defaults to 1.5
labelSpacing	numeric, for circularPlot=TRUE. Spacing of mark labels. Defaults to 0.7
labelOutwards	boolean, inline labels projected outwards

chrLabelSpacing	numeric, for circularPlot=TRUE. Spacing of chr. labels. Defaults to 0.5
radius	numeric, for circularPlot=TRUE. Affects radius of karyotypes. Defaults to 0.5
rotation	numeric, anti-clockwise rotation, defaults to 0.5 which rotates chr. from top to -90 degrees. ( $-0.5 * \pi$ )
useOneDot	boolean, for circularPlot=TRUE. use one dot instead of two in style of marks dots. Defaults to TRUE
circleCenter	numeric, for circularPlot=TRUE. Coordinate X of center of circles. Affects legend="aside" position. Defaults to 1
circleCenterY	numeric, for circularPlot=TRUE. Coordinate Y of center of circles. Affects legend="aside" position. Defaults to 1
OTUlabelSpacing	numeric, for circularPlot=TRUE. Spacing for OTU names. Defaults to 0.3
OTUsrt	numeric, for circularPlot=TRUE. Angle to use for OTU names. Defaults to 0
OTUplacing	character, for circularPlot=TRUE. location of OTU name. Defaults to "first" plots name near first chr. "number" places number near 1st chr. and index and name to the right or center. "simple" place name to the right or center without numbering. See also OTUcentered
OTUlabelSpacex	numeric, for circularPlot=TRUE and OTUplacing="number" or "simple". Modifies x names position
OTUlabelSpacery	numeric, for circularPlot=TRUE and OTUplacing="number" or "simple". Modifies y names position
OTUcentered	boolean, for circularPlot=TRUE and OTUplacing="number" or "simple". OTU name in center of circle when TRUE, otherwise, to the right.
OTUjustif	numeric, for circularPlot=TRUE and OTUplacing="number" or "simple". Justification of OTU name. 0 = left (Default); use 0.5 for centered. See ?text -> adj
OTUlegendHeight	numeric, for circularPlot=TRUE and OTUplacing="number" or "simple". Modifies y names separation
roundness	deprecated, use squareness
...	accepts other arguments for the plot, see, ?plot

**Value**

plot

**See Also**

[asymmetry](#)  
[armRatioCI](#)



```

chrbasicdatamono
chrbasicdataHolo
markposDFs
markdataholo
dfMarkColor

```

## Examples

```

data(dfOfChrSize)
plotIdiograms(dfOfChrSize, ylimBotMod = .75, rulerPos=-.5)
plotIdiograms(dfOfChrSize, circularPlot = TRUE, chrLabelSpacing = 1)
plotIdiograms(dfChrSizeHolo, rulerPos=-.5)

```

---

posCalc	<i>FUNCTION posCalc</i>
---------	-------------------------

---

## Description

calculates position of marks in fraction of (%) chromosome units (0-1)

## Usage

```

posCalc(
  dfMarkPos,
  listOfdfChromSize,
  bToRemove = "",
  markDistType = "beg",
  origin = "b",
  result = "tibble"
)

```

## Arguments

dfMarkPos	data.frame of marks' position
listOfdfChromSize	list data.frames of chr. sizes. Require col. chrSize for all. Use armRatioCI
bToRemove,	character, bands to remove from calc. of pos.
markDistType	markDistType character, if "cen" = the distance you provided in data.frame (dfMarkPos) column markDistCen or markPos is to the center of the mark, if "beg" = the distance you provided is to the beginning of the mark (Default)
origin,	For non-monocentric chr. (for holocentrics only) Use "b" (default) if distance to mark in ("markPos" column in "dfMarkPos") data.frame measured from bottom of chromosome, use "t" for distance to mark from top of chr.
result	character, use "tibble" to get results in tibble, other string results in a list

**Value**

list, tibble

**Examples**

```
# Monocentrics - Beginning with two data.frames with column OTU
require(idiogramFISH)

dfOfChrSize$OTU<-1
dfOfMarks2$OTU<-1

# check missing data

dfOfMarks2[which(is.na(dfOfMarks2$markSize) & dfOfMarks2$chrRegion %in% c("p","q") ),]
# markSize and markDistCen missing

# add markDistCen
dfOfMarks2$markDistCen <- ifelse( is.na(dfOfMarks2$markDistCen) &
dfOfMarks2$chrRegion %in% c("p","q"),
0,
dfOfMarks2$markDistCen)

# add markSize
XshortSize <- dfOfChrSize[which(dfOfChrSize$chrName=="X"),]$shortArmSize
dfOfMarks2[which(dfOfMarks2$chrName=="X" & dfOfMarks2$chrRegion=="p") ,]$markSize<-XshortSize

# add column chrSize if missing
dfOfChrSizeWithChrSize <- armRatioCI(dfOfChrSize)

# data.frame of chr. size to list
listOfdfChr <- idiogramFISH::dfToListColumn(dfOfChrSizeWithChrSize)

ti<-posCalc(dfOfMarks2,listOfdfChr)
as.list(ti[[1]][,1])
posCalc(dfOfMarks2,listOfdfChr, result="list")

# holocentrics example

dfChrSizeHolo$OTU<-2
dfMarkPosHolo$OTU<-2

# data.frame of chr. size to list
listOfdfChrHolo <- idiogramFISH::dfToListColumn(dfChrSizeHolo)

ti2<-posCalc(dfMarkPosHolo,listOfdfChrHolo)
ti2

posCalc(dfMarkPosHolo,listOfdfChrHolo, result="list")

as.list(ti[[1]][,1] )
```

---

robert                                      *FUNCTION to produce a Robertsonian translocation*

---

### Description

This function reads a data.frame with chr. sizes `chrbasicdatamono` and another with marks' positions, `markposDFs` and gets as arguments two chr. names and two arms, respectively.

It returns a list with two data.frames. One with the chr. size of the resulting translocation and another with the marks' positions for the derivative chr.

### Usage

```
robert(dfChrSize, dfMarkPos, chr1, chr2, arm1, arm2)
```

### Arguments

<code>dfChrSize</code>	name of data.frame of chr. sizes
<code>dfMarkPos</code>	name of data.frame of chr marks' positions
<code>chr1</code>	name of chr.
<code>chr2</code>	name of chr.
<code>arm1</code>	arm of chr1 to be included
<code>arm2</code>	arm of chr2 to be included

### Value

list

### References

Robertson, W. R. B. (1916). Chromosome studies. I. Taxonomic relationships shown in the chromosomes of Tettigidae and Acrididae: V-shaped chromosomes and their significance in Acrididae, Locustidae, and Gryllidae: chromosomes and variation. *Journal of Morphology*, 27(2), 179-331.

### Examples

```
data(humChr)
data(humMarkPos)
chrt13q14q<-robert(humChr,humMarkPos,13,14,"q","q")
```

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