

# Package ‘FastqCleaner’

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**Type** Package

**Title** A Shiny Application for Quality Control, Filtering and Trimming of FASTQ Files

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**Description** An interactive web application for quality control, filtering and trimming of FASTQ files. This user-friendly tool combines a pipeline for data processing based on Biostrings and ShortRead infrastructure, with a cutting-edge visual environment. Single-Read and Paired-End files can be locally processed. Diagnostic interactive plots (CG content, per-base sequence quality, etc.) are provided for both the input and output files.

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**Author** Leandro Roser [aut, cre],  
 Fernán Agüero [aut],  
 Daniel Sánchez [aut]

**Maintainer** Leandro Roser <learosser@gmail.com>

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adapter\_filter                      *Remove full and partial adapters from a ShortReadQ object*

---

## Description

This program can remove adapters and partial adapters from 3' and 5', using the functions [trimLRPatterns](#). The program extends the methodology of the [trimLRPatterns](#) function of **Biostrings**, being also capable of removing adapters present within reads and with other additional options (e.g., threshold of minimum number of bases for trimming). For a given position in the read, the two **Biostrings** functions return TRUE when a match is present between a substring of the read and the adapter. As [trimLRPatterns](#), `adapter_filter` also selects region and goes up to the end of the sequence in the corresponding flank as the best match. The default error rate is 0.2. If several valid matches are found, the function removes the largest subsequence. Adapters can be anchored or not. When indels are allowed, the second method uses the 'edit distance' between the subsequences and the adapter

## Usage

```
adapter_filter(
  input,
  Lpattern = "",
  Rpattern = "",
  rc.L = FALSE,
  rc.R = FALSE,
  first = c("R", "L"),
  with_indels = FALSE,
  error_rate = 0.2,
  anchored = TRUE,
  fixed = "subject",
  remove_zero = TRUE,
  checks = TRUE,
  min_match_flank = 3L,
  ...
)
```

## Arguments

|             |  |
|-------------|--|
| input       | <a href="#">ShortReadQ</a> object  |
| Lpattern    | 5' pattern (character or <a href="#">DNASTring</a> object)   |
| Rpattern    | 3' pattern (character or <a href="#">DNASTring</a> object)   |
| rc.L        | Reverse complement Lpattern? default FALSE   |
| rc.R        | Reverse complement Rpattern? default FALSE   |
| first       | trim first right('R') or left('L') side of sequences when both Lpattern and Rpattern are passed  |
| with_indels | Allow indels? This feature is available only when the error_rate is not null   |
| error_rate  | Error rate (value in the range [0, 1]) The error rate is the proportion of mismatches allowed between the adapter and the aligned portion of the subject. For a given adapter A, the number of allowed mismatches between each subsequence s of A and the subject is computed as: $error\_rate * L\_s$ , where $L\_s$ is the length of the subsequence s |

|                 |   |
|-----------------|---|
| anchored        | Adapter or partial adapter within sequence (anchored = FALSE, default) or only in 3' and 5' terminals? (anchored = TRUE)  |
| fixed           | Parameter passed to <a href="#">trimLRPatterns</a> Default 'subject', ambiguities in the pattern only are interpreted as wildcard. See the argument fixed in <a href="#">trimLRPatterns</a> |
| remove_zero     | Remove zero-length sequences? Default TRUE  |
| checks          | Perform checks? Default TRUE  |
| min_match_flank | Do not trim in flanks of the subject, if a match has min_match_flank of less length. Default 1L (only trim with >=2 coincidences in a flank match)  |
| ...             | additional parameters passed to <a href="#">trimLRPatterns</a>  |

**Value**

Edited [DNASTring](#) or [DNASTringSet](#) object

Filtered [ShortReadQ](#) object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
require('Biostrings')
require('ShortRead')

# create 6 sequences of width 43
set.seed(10)
input <- random_seq(6, 43)

# add adapter in 3'
adapter <- "ATCGACT"

input <- paste0(input, as.character(DNASTring(adapter)))
input <- DNASTringSet(input)

# create qualities of width 50
set.seed(10)
input_q <- random_qual(c(30,40), slength = 6, swidth = 50,
  encod = 'Sanger')

# create names
input_names <- seq_names(length(input))

# create ShortReadQ object
my_read <- ShortReadQ(sread = input, quality = input_q, id = input_names)

# trim adapter
filtered <- adapter_filter(my_read, Rpattern = adapter)

# look at the filtered sequences
sread(filtered)
```

---

|         |                         |
|---------|-------------------------|
| asc2int | <i>ASCII to integer</i> |
|---------|-------------------------|

---

**Description**

ASCII to integer

**Usage**

```
asc2int(x)
```

**Value**

Integer

---

|                |                               |
|----------------|-------------------------------|
| check_encoding | <i>Check quality encoding</i> |
|----------------|-------------------------------|

---

**Description**

Check quality encoding

**Usage**

```
check_encoding(x = NULL, custom = NULL)
```

**Arguments**

|        |  |
|--------|--|
| x      | Quality values   |
| custom | custom encoding from the following:<br>'Sanger' ———> expected range: [0, 40]<br>'Illumina1.8' ———> expected range: [0, 41]<br>'Illumina1.5' ———> expected range: [0, 40]<br>'Illumina1.3' ———> expected range: [3, 40]<br>'Solexa' ———> expected range: [-5, 40] |

**Value**

List with encoding information

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
require(Biostrings)

x <- list(PhredQuality(0:40), SolexaQuality(-5:40), IlluminaQuality(3:40))
x <- lapply(x, function(i)utf8ToInt(as.character(i)[1]))
lapply(x, check_encoding)

SolexaQuality(0:40)
IlluminaQuality(0:40)
```

---

|                |                      |
|----------------|----------------------|
| check_onclick_ | <i>check onclick</i> |
|----------------|----------------------|

---

**Description**

Function to put a tickmark on click

**Usage**

```
check_onclick_(.menu_react, .butt_number, my_envir)
```

**Value**

Change value of reactive output, without return

---

|                |   |
|----------------|---|
| complex_filter | <i>Remove sequences with low complexity</i> |
|----------------|---|

---

**Description**

The program removes low complexity sequences, computing the entropy with the observed frequency of dinucleotides.

**Usage**

```
complex_filter(input, threshold = 0.5, referenceEntropy = 3.908135)
```

**Arguments**

|                  |   |
|------------------|---|
| input            | <a href="#">ShortReadQ</a> object   |
| threshold        | A threshold value computed as the relation of the H of the sequences and the reference H. Default is 0.5                      |
| referenceEntropy | Reference entropy. By default, the program uses a value of 3.908, that corresponds to the entropy of the human genome in bits |

**Value**

Filtered [ShortReadQ](#) object

**Author(s)**

Leandro Roser <learosero@gmail.com>

**Examples**

```
require('Biostrings')
require('ShortRead')

# create sequences of different width
set.seed(10)
input <- lapply(c(0, 6, 10, 16, 20, 26, 30, 36, 40),
               function(x) random_seq(1, x))

# create repetitive 'CG' sequences with length adequate
# for a total length:
# input + CG = 40

set.seed(10)
CG <- lapply(c(20, 17, 15, 12, 10, 7, 5, 2, 0),
             function(x) paste(rep('CG', x), collapse = ''))

# concatenate input and CG
input <- mapply('paste', input, CG, sep = '')
input <- DNASTringSet(input)

# plot relative entropy (E, Shannon 1948)

freq <- dinucleotideFrequency(input)
freq <- freq / rowSums(freq)
H <- -rowSums(freq * log2(freq), na.rm = TRUE)
H_max <- 3.908135 # max entropy
plot(H/H_max, type='b', xlab = 'Sequence', ylab= 'E')

# create qualities of width 40

set.seed(10)
input_q <- random_qual(c(30,40), slength = 9, swidth = 40,
                      encod = 'Sanger')

# create names
input_names <- seq_names(9)

# create ShortReadQ object
my_read <- ShortReadQ(sread = input, quality = input_q, id = input_names)

# apply the filter
filtered <- complex_filter(my_read)

# look at the filtered sequences
sread(filtered)
```

---

```
create_cleanfunction_ create_cleanfunction_
```

---

**Description**

Create a function to process FASTQ files in function of the Shiny parameters selected by the user

**Usage**

```
create_cleanfunction_(my_envir, .which_read = c("FORWARD", "REVERSE"))
```

**Value**

Function with selected cleaning operations

---

```
create_uniform_width Create fastq/sequences/qualities with uniform width
```

---

**Description**

Create fastq/sequences/qualities with uniform width

**Usage**

```
create_uniform_width(input, type = c("fastq", "sequence", "quality"))
```

**Arguments**

|       |  |
|-------|--|
| input | input to edit  |
| type  | type of the input: 'fastq' (ShortReadQ), 'sequence' (DNASTringSet), 'quality' (BStringset) |

**Value**

ShortReadQ object or character vector with sequences or qualities, with uniform width (padded with Ns or })



---

`cutRseq`*Remove left and right full and partial patterns*

---

### Description

This set of programs are internal, and the function `adapter_filter` is recommended for trimming. The programs can remove adapters and partial adapters from 3' and 5'. The adapters can be anchored or not. When indels are allowed, the error rate consists in the edit distance. IUPAC symbols are allowed. The methods use the `trimLRPatterns` function of the **Biostrings** package, with some additions to take into account e.g., partial adapters. IUPAC symbols are allowed in all the cases. The present function also removes partial adapters, without the need of additional steps (for example, creating a padded adapter with 'Ns', etc). A similar result to the output of `trimLRPatterns` can be obtained with the option `anchored = TRUE`. When several matches are found, the function removes the subsequence that starts in the first match when `cutRseq` is used, or ends in the last match when `cutLseq` is used.

### Usage

```
cutRseq(  
  subject,  
  Rpattern,  
  with.indels = FALSE,  
  fixed = "subject",  
  error_rate = 0.2,  
  anchored = TRUE,  
  ranges = FALSE,  
  checks = TRUE,  
  min_match_flank = 2L,  
  ...  
)  
  
cutLseq(  
  subject,  
  Lpattern,  
  with.indels = FALSE,  
  fixed = "subject",  
  error_rate = 0.2,  
  anchored = TRUE,  
  ranges = FALSE,  
  min_match_flank = 3L,  
  checks = TRUE,  
  ...  
)
```

### Arguments

|                          |  |
|--------------------------|--|
| <code>subject</code>     | <code>DNASTring</code> or <code>DNASTringSet</code> object |
| <code>Rpattern</code>    | 3' pattern, <code>DNASTring</code> object                  |
| <code>with.indels</code> | Allow indels?  |

|                 |   |
|-----------------|---|
| fixed           | Parameter passed to <code>trimLRPatterns</code> Default 'subject', ambiguities in the pattern only are interpreted as wildcard. See the argument fixed in <code>trimLRPatterns</code>   |
| error_rate      | Error rate (value in [0, 1]). The error rate is the proportion of mismatches allowed between the adapter and the aligned portion of the subject. For a given adapter A, the number of allowed mismatches between each subsequence s of A and the subject is computed as: $\text{error\_rate} * L_s$ , where $L_s$ is the length of the subsequence s. |
| anchored        | Can the adapter or partial adapter be within the sequence? (anchored = FALSE) or only in the terminal regions of the sequence? (anchored = TRUE). Default TRUE (trim only flanking regions)   |
| ranges          | Return ranges? Default FALSE  |
| checks          | Perform internal checks? Default TRUE   |
| min_match_flank | Do not trim in flanks of the subject, if a match has min_match_flank of less length. Default 1L (only trim with $\geq 2$ coincidences in a flank match)   |
| ...             | additional parameters passed to <code>trimLRPatterns</code>   |
| Lpattern        | 5' pattern, <code>DNAStrng</code> object  |

### Value

Edited `DNAStrng` or `DNAStrngSet` object

### Author(s)

Leandro Roser <learoser@gmail.com>

### Examples

```
library(Biostrings)

subject <- DNAStrngSet(c('ATCATGCCATCATGAT',
  'CATGATATTA', 'TCATG', 'AAAAAA', 'AGGTCATG'))

Lpattern <- Rpattern <- 'TCATG'

FastqCleaner:::cutLseq(subject, Lpattern)
FastqCleaner:::cutLseq(subject, Lpattern, ranges = TRUE)
FastqCleaner:::cutRseq(subject, Rpattern)

FastqCleaner:::cutLseq(subject, Lpattern, anchored = FALSE)
FastqCleaner:::cutLseq(subject, Lpattern, error_rate = 0.2)
FastqCleaner:::cutLseq(subject, Lpattern, error_rate = 0.2,
  with.indels = TRUE)
```

---

|              |  |
|--------------|--|
| fixed_filter | <i>Remove a fixed number of bases of a ShortReadQ object from 3' or 5'</i> |
|--------------|--|

---

### Description

The program removes a given number of bases from the 3' or 5' regions of the sequences contained in a ShortReadQ object

### Usage

```
fixed_filter(input, trim3 = NA, trim5 = NA)
```

### Arguments

|       |                                   |
|-------|-----------------------------------|
| input | ShortReadQ object                 |
| trim3 | Number of bases to remove from 3' |
| trim5 | Number of bases to remove from 5' |

### Value

Filtered ShortReadQ object

### Author(s)

Leandro Roser <learoser@gmail.com>

### Examples

```
require('Biostrings')
require('ShortRead')

# create 6 sequences of width 20

set.seed(10)
input <- random_seq(6, 20)

# create qualities of width 20

set.seed(10)
input_q <- random_qual(c(30,40), slength = 6, swidth = 20,
  encod = 'Sanger')

# create names
input_names <- seq_names(6)

# create ShortReadQ object
my_read <- ShortReadQ(sread = input, quality = input_q, id = input_names)

# apply the filter
filtered3 <- fixed_filter(my_read, trim5 = 5)

filtered5 <- fixed_filter(my_read, trim3 = 5)
```

```
filtered3and5 <- fixed_filter(my_read, trim3 = 10, trim5 = 5)

# look at the trimmed sequences
sread(filtered3)
sread(filtered5)
sread(filtered3and5)
```

---

inject\_letter\_random *Inject a letter in a set of sequences at random positions*

---

## Description

Inject a letter in a set of sequences at random positions

## Usage

```
inject_letter_random(  
  my_seq,  
  how_many_seqs = NULL,  
  how_many_letters = NULL,  
  letter = "N"  
)
```

## Arguments

|                  |  |
|------------------|--|
| my_seq           | character vector with sequences to inject  |
| how_many_seqs    | How many sequences pick to inject Ns. An interval [min_s, max_s] with min_s minimum and max_s maximum sequences can be passed. In this case, a value is picked from the interval. If NULL, a random value within the interval [1, length(my_seq)] is picked.   |
| how_many_letters | How many times inject the letter in the i sequences that are going to be injected. An interval [min_i max_i] can be passed. In this case, a value is randomly picked for each sequence i. This value represents the number of times that the letter will be injected in the sequence i. If NULL, a random value within the interval [1, width(my_seq[i])] is picked for each sequence i. |
| letter           | Letter to inject. Default: 'N'   |

## Value

character vector

## Author(s)

Leandro Roser <learoser@gmail.com>

**Examples**

```
# For reproducible examples, make a call to set.seed before
# running each random function

set.seed(10)
s <- random_seq(slength = 10, swidth = 20)

set.seed(10)
s <- inject_letter_random(s, how_many_seqs = 1:30, how_many= 2:10)
```

---

|         |                         |
|---------|-------------------------|
| int2asc | <i>Integer to ASCII</i> |
|---------|-------------------------|

---

**Description**

Integer to ASCII

**Usage**

```
int2asc(n)
```

**Value**

ASCII character

---

|                 |                          |
|-----------------|--------------------------|
| isNaturalNumber | <i>Is natural number</i> |
|-----------------|--------------------------|

---

**Description**

Is natural number

**Usage**

```
isNaturalNumber(x)
```

**Value**

Logical

---

|            |  |
|------------|--|
| launch_fqc | <i>Launch FastqCleaner application</i> |
|------------|--|

---

**Description**

Launch FastqCleaner application

**Usage**

```
launch_fqc(launch.browser = TRUE, ...)
```

**Arguments**

launch.browser Launch in browser? Default TRUE  
 ... Additional parameters passed to [runApp](#)

**Value**

Launch the application, without return value

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
# Uncomment and paste in te console to launch the application:
# launch_fqc()

NULL
```

---

|               |   |
|---------------|---|
| length_filter | <i>Filter sequences of a FASTQ file by length</i> |
|---------------|---|

---

**Description**

The program removes from a ShortReadQ object those sequences with a length lower than rm.min or/and higher than rm.max

**Usage**

```
length_filter(input, rm.min = NA, rm.max = NA)
```

**Arguments**

input [ShortReadQ](#) object  
 rm.min Threshold value for the minimum number of bases  
 rm.max Threshold value for the maximum number of bases

**Value**

Filtered [ShortReadQ](#) object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
require('Biostrings')
require('ShortRead')

# create ShortReadQ object with widths between 1 and 100

set.seed(10)
input <- random_length(100, widths = 1:100)

# apply the filter, removing sequences length < 10 or length > 80
filtered <- length_filter(input, rm.min = 10, rm.max = 80)

# look at the filtered sequences
sread(filtered)
```

---

messageFun\_

*messageFun\_*

---

**Description**

messageFun\_

**Usage**

```
messageFun_(.who, .chunk, .which_read, my_envir)
```

**Value**

Changes the state of reactive vector, without return

---

myPlot

*myPlot*

---

**Description**

Construction of diagnostic plots. The function depends of the values created by plotObject

**Usage**

```
myPlot(isPaired, location, sampleSize, kmerLength, theFile, maxFreq)
```

**Value**

List with Highcharts plots

---

|          |   |
|----------|---|
| n_filter | <i>Remove sequences with non-identified bases (Ns) from a ShortReadQ object</i> |
|----------|---|

---

### Description

This program is a wrapper to [nFilter](#). It removes the sequences with a number of N's above a threshold value 'rm.N'. All the sequences with a number of N > rm.N (N >= rm.N) will be removed

### Usage

```
n_filter(input, rm.N)
```

### Arguments

|       |  |
|-------|--|
| input | <a href="#">ShortReadQ</a> object  |
| rm.N  | Threshold value of N's to remove a sequence from the output (sequences with number of Ns > threshold are removed) For example, if rm.N is 3, all the sequences with a number of Ns > 3 (Ns >= 4) will be removed |

### Value

Filtered [ShortReadQ](#) object

### Author(s)

Leandro Roser <learoser@gmail.com>

### Examples

```
require('Biostrings')
require('ShortRead')

# create 6 sequences of width 20
set.seed(10)
input <- random_seq(50, 20)

# inject N's
set.seed(10)
input <- inject_letter_random(input, how_many_seqs = 1:30,
                              how_many = 1:10)

input <- DNASTringSet(input)

# watch the N's frequency
hist(letterFrequency(input, 'N'), breaks = 0:10,
      main = 'Ns Frequency', xlab = '# Ns')

# create qualities of width 20
set.seed(10)
input_q <- random_qual(50, 20)
```



```
# create names
input_names <- seq_names(50)

# create ShortReadQ object
my_read <- ShortReadQ(sread = input, quality = input_q, id = input_names)

# apply the filter
filtered <- n_filter(my_read, rm.N = 3)

# watch the filtered sequences
sread(filtered)

# watch the N's frequency
hist(letterFrequency(sread(filtered), 'N'),
main = 'Ns distribution', xlab = '')
```

---

outputClean\_

*outputClean\_*

---

### Description

outputClean\_

### Usage

```
outputClean_(.myFile, .lengthWidthVec, my_envir)
```

### Value

Vector with chunks length and width information

---

plotA

*plotA*

---

### Description

plotA

### Usage

```
plotA(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

### Value

Per cycle quality plot

---

|       |              |
|-------|--------------|
| plotB | <i>plotB</i> |
|-------|--------------|

---

**Description**

plotB

**Usage**

```
plotB(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Per cycle mean base quality plot

---

|       |              |
|-------|--------------|
| plotC | <i>plotC</i> |
|-------|--------------|

---

**Description**

plotC

**Usage**

```
plotC(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Mean quality of reads distribution plot

---

|       |              |
|-------|--------------|
| plotD | <i>plotD</i> |
|-------|--------------|

---

**Description**

plotD

**Usage**

```
plotD(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

percent of reads with quality &gt; threshold plot

---

|       |              |
|-------|--------------|
| plotE | <i>plotE</i> |
|-------|--------------|

---

**Description**

plotE

**Usage**

```
plotE(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Per cycle base proportion plot

---

|       |              |
|-------|--------------|
| plotF | <i>plotF</i> |
|-------|--------------|

---

**Description**

plotF

**Usage**

```
plotF(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Per cycle base proportion plot (lineplot)

---

|       |              |
|-------|--------------|
| plotG | <i>plotG</i> |
|-------|--------------|

---

**Description**

plotG

**Usage**

```
plotG(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

CG content distribution plot

---

plotH                      *plotH*

---

**Description**

plotH

**Usage**

```
plotH(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Read length distribution

---

plotI                      *plotI*

---

**Description**

plotI

**Usage**

```
plotI(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Read occurrence distribution plot

---

plotJ                      *plotJ*

---

**Description**

plotJ

**Usage**

```
plotJ(x, nplots = 1, theFile = c("input", "output"), sampleSize)
```

**Value**

Relative kmer diversity plot

---

|             |  |
|-------------|--|
| plotObjects | <i>plotObjects Create the information required to construct the plots. This is the input of myplot, which uses the values created for this function to construct the plots</i> |
|-------------|--|

---

**Description**

plotObjects Create the information required to construct the plots. This is the input of myplot, which uses the values created for this function to construct the plots

**Usage**

```
plotObjects(fq, klength, basename, maxFreq, sampleSize)
```

**Value**

List with information to construct the diagnostic plots

---

|                     |                            |
|---------------------|----------------------------|
| processingFunction_ | <i>processingFunction_</i> |
|---------------------|----------------------------|

---

**Description**

This function is the core of the application. It is used for the program to process the FASTQ file/s in the environment of the Shiny app. Note that this program makes a call to create\_cleanfunction

**Usage**

```
processingFunction_(my_envir)
```

**Value**

Processes the input FASTQ file, without return

---

|              |  |
|--------------|--|
| qmean_filter | <i>Filter sequences by their average quality</i> |
|--------------|--|

---

**Description**

The program removes the sequences with a quality lower the 'minq' threshold

**Usage**

```
qmean_filter(input, minq, q_format = NULL, check.encod = TRUE)
```

**Arguments**

|             |   |
|-------------|---|
| input       | ShortReadQ object   |
| minq        | Quality threshold   |
| q_format    | Quality format used for the file, as returned by check.encoding                 |
| check.encod | Check the encoding of the sequence? This argument is incompatible with q_format |

**Value**

Filtered ShortReadQ object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
require(ShortRead)

set.seed(10)
# create 30 sequences of width 20
input <- random_seq(30, 20)

# create qualities of width 20
## high quality (15 sequences)
set.seed(10)
my_qual <- random_qual(c(30,40), slength = 15, swidth = 20,
                      encod = 'Sanger')
## low quality (15 sequences)
set.seed(10)
my_qual_2 <- random_qual(c(5,30), slength = 15, swidth = 20,
                       encod = 'Sanger')

# concatenate vectors
input_q<- c(my_qual, my_qual_2)

# create names
input_names <- seq_names(30)

# create ShortReadQ object
my_read <- ShortReadQ(sread = input, quality = input_q, id = input_names)

# watch the average qualities
alphabetScore(my_read) / width(my_read)

# apply the filter
filtered <- qmean_filter(my_read, minq = 30)

# watch the average qualities
alphabetScore(my_read) / width(my_read)

# watch the filtered sequences
sread(filtered)
```

---

|               |   |
|---------------|---|
| random_length | Create a named object with random sequences and qualities |
|---------------|---|

---

## Description

Create a [ShortReadQ](#) object with random sequences and qualities

## Usage

```
random_length(
  n,
  widths,
  random_widths = TRUE,
  replace = TRUE,
  len_prob = NULL,
  seq_prob = c(0.25, 0.25, 0.25, 0.25),
  q_prob = NULL,
  nuc = c("DNA", "RNA"),
  qual = NULL,
  encod = c("Sanger", "Illumina1.8", "Illumina1.5", "Illumina1.3", "Solexa"),
  base_name = "s",
  sep = "_"
)
```

## Arguments

|               |  |
|---------------|--|
| n             | number of sequences  |
| widths        | width of the sequences   |
| random_widths | width must be picked at random from the passed parameter 'widths', considering the value as an interval where any integer can be picked. Default TRUE. Otherwise, widths are picked only from the vector passed.   |
| replace       | sample widths with replacement? Default TRUE.  |
| len_prob      | vector with probabilities for each width value. Default NULL (equiprobability)   |
| seq_prob      | a vector of four probabilities values to set the frequency of the nucleotides 'A', 'C', 'G', 'T', for DNA, or 'A', 'C', 'G', 'U', for RNA. For example = c(0.25, 0.25, 0.5, 0). Default is = c(0.25, 0.25, 0.25, 0.25) (equiprobability for the 4 bases). If the sum of the probabilities is > 1, the values will be normalized to the range [0, 1]. |
| q_prob        | a vector of range = range(qual), with probabilities to set the frequency of each quality value. Default is equiprobability. If the sum of the probabilities is > 1, the values will be normalized to the range [0, 1].   |
| nuc           | create sequences of DNA (nucleotides = c('A', 'C', 'G', 'T')) or RNA (nucleotides = c('A', 'C', 'G', 'U'))?. Default: 'DNA'  |
| qual          | quality range for the sequences. It must be a range included in the selected encoding:<br>'Sanger' = [0, 40]<br>'Illumina1.8' = [0, 41]<br>'Illumina1.5' = [0, 40]   |

```

'Illumina1.3' = [3, 40]
'Solexa' = [-5, 40]
example: for a range from 20 to 30 in Sanger encoding, pass the argument =
c(20, 30)

encod      sequence encoding
base_name  Base name for strings
sep        Character separating base names and the read number. Default: '_'

```

**Value**

[ShortReadQ](#) object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```

# For reproducible examples, make a call to set.seed before
# running each random function

set.seed(10)
s1 <- random_seq(slength = 10, swidth = 20)
s1

set.seed(10)
s2 <- random_seq(slength = 10, swidth = 20,
prob = c(0.6, 0.1, 0.3, 0))
s2

```

---

random\_qual

*Create random qualities for a given encoding*

---

**Description**

Create a [BStringSet](#) object with random qualities

**Usage**

```

random_qual(
  slength,
  swidth,
  qual = NULL,
  encod = c("Sanger", "Illumina1.8", "Illumina1.5", "Illumina1.3", "Solexa"),
  prob = NULL
)

```



**Arguments**

|         |  |
|---------|--|
| slength | number of sequences  |
| swidth  | width of the sequences   |
| qual    | quality range for the sequences. It must be a range included in the selected encoding:<br>'Sanger' = [0, 40]<br>'Illumina1.8' = [0, 41]<br>'Illumina1.5' = [0, 40]<br>'Illumina1.3' = [3, 40]<br>'Solexa' = [-5, 40]<br>example: for a range from 20 to 30 in Sanger encoding, pass the argument = c(20, 30) |
| encod   | sequence encoding  |
| prob    | a vector of range = range(qual), with probabilities to set the frequency of each quality value. Default is equiprobability. If the sum of the probabilities is > 1, the values will be normalized to the range [0, 1].   |

**Value**

[BStringSet](#) object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
q <- random_qual(30, 20)
q
```

---

random\_seq

*Create random sequences*

---

**Description**

Create a [DNAStrngSet](#) object with random sequences

**Usage**

```
random_seq(  
  slength,  
  swidth,  
  nuc = c("DNA", "RNA"),  
  prob = c(0.25, 0.25, 0.25, 0.25)  
)
```

**Arguments**

|        |   |
|--------|---|
| length | Number of sequences   |
| width  | Width of the sequences  |
| nuc    | Create sequences of DNA (nucleotides = c('A', 'C', 'G', 'T')) or RNA (nucleotides = c('A', 'C', 'G', 'U'))?. Default: 'DNA'   |
| prob   | A vector of four probability values used to set the frequency of the nucleotides 'A', 'C', 'G', 'T', for DNA, or 'A', 'C', 'G', 'U', for RNA. For example = c(0.25, 0.25, 0.5, 0). Default is = c(0.25, 0.25, 0.25, 0.25) (equiprobability for the 4 bases). If the sum of the probabilities is > 1, the values will be normalized to the range [0, 1]. |

**Value**

`DNAStrngSet` object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
# For reproducible examples, make a call to set.seed before
# running each random function

set.seed(10)
s1 <- random_seq(length = 10, width = 20)
s1

set.seed(10)
s2 <- random_seq(length = 10, width = 20,
prob = c(0.6, 0.1, 0.3, 0))
s2
```

---

seq\_filter

*Remove a set of sequences*

---

**Description**

Removes a set of sequences

**Usage**

```
seq_filter(input, rm.seq)
```

**Arguments**

|        |  |
|--------|--|
| input  | <code>ShortReadQ</code> object             |
| rm.seq | Ccharacter vector with sequences to remove |

**Value**

Filtered [ShortReadQ](#) object

**Author(s)**

Leandro Roser <learoser@gmail.com>

**Examples**

```
require(ShortRead)

set.seed(10)
input <- random_length(30, 3:7)
rm.seq = c('TGGTC', 'CGGT', 'GTTCT', 'ATA')

# verify that some sequences match
match_before <- unlist(lapply(rm.seq,
  function(x) grep(x, as.character(sread(input)))))

filtered <- seq_filter(input, rm.seq = rm.seq)

# verify that matching sequences were removed
match_after <- unlist(lapply(rm.seq,
  function(x) grep(x, as.character(sread(filtered)))))
```

---

seq\_names

*Create sequences names*

---

**Description**

Create [BStringSet](#) object with names

**Usage**

```
seq_names(n, base_name = "s", sep = "_")
```

**Arguments**

|           |   |
|-----------|---|
| n         | Number of reads   |
| base_name | Base name for strings   |
| sep       | Character separating base names and the read number. Default: '_' |

**Value**

[BStringSet](#) object

**Examples**

```
snames <- seq_names(10)
smnames
smnames2 <- seq_names(10, base_name = 's', sep = '.')
smnames2
```

---

|               |  |
|---------------|--|
| trim3q_filter | <i>Filter sequences with low quality in 3' tails</i> |
|---------------|--|

---

### Description

The program removes from the 3' tails of the sequences a set of nucleotides showing a quality < a threshold value in a ShortReadQ object

### Usage

```
trim3q_filter(
  input,
  rm.3qual,
  q_format = NULL,
  check.encod = TRUE,
  remove_zero = TRUE
)
```

### Arguments

|             |  |
|-------------|--|
| input       | ShortReadQ object  |
| rm.3qual    | Quality threshold for 3' tails   |
| q_format    | Quality format used for the file, as returned by check_encoding                                  |
| check.encod | Check the encoding of the sequence? This argument is incompatible with q_format.<br>Default TRUE |
| remove_zero | Remove zero-length sequences?  |

### Value

Filtered ShortReadQ object

### Author(s)

Leandro Roser <learoser@gmail.com>

### Examples

```
require('Biostrings')
require('ShortRead')

# create 6 sequences of width 20
set.seed(10)
input <- random_seq(6, 20)

# create qualities of width 15 and paste to qualities
# of length 5 used for the tails.
# for two of the sequences, put low qualities in tails

set.seed(10)
my_qual <- random_qual(c(30,40), slength = 6, swidth = 15,
  encod = 'Sanger')
```

```
set.seed(10)
tails <- random_qual(c(30,40), slength = 6, swidth = 5,
  encod = 'Sanger')

set.seed(10)
tails[2:3] <- random_qual(c(3, 20), slength = 2,
  swidth = 5, encod = 'Sanger')
my_qual <- paste0(my_qual, tails)
input_q <- BStringSet(my_qual)
# create names
input_names <- seq_names(6)

# create ShortReadQ object
my_read <- ShortReadQ(sread = input,
  quality = input_q, id = input_names)

# apply the filter
filtered <- trim3q_filter(my_read, rm.3qual = 28)

# look at the trimmed sequences
sread(filtered)
```

---

unique\_filter

*Remove duplicated sequences in a FASTQ file*

---

## Description

This program is a wrapper to [occurrenceFilter](#). It removes the duplicated sequences of a FASTQ file.

## Usage

```
unique_filter(input)
```

## Arguments

input            [ShortReadQ](#) object

## Value

Filtered [ShortReadQ](#) object

## Author(s)

Leandro Roser <learoser@gmail.com>

## Examples

```
require('Biostrings')
require('ShortRead')

set.seed(10)
s <- random_seq(10, 10)
s <- sample(s, 30, replace = TRUE)
```

```
q <- random_qual(30, 10)
n <- seq_names(30)

my_read <- ShortReadQ(sread = s, quality = q, id = n)

# check presence of duplicates
isUnique(as.character(sread(my_read)))

# apply the filter
filtered <- unique_filter(my_read)

isUnique(as.character(sread(filtered)))
```

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