

# Package ‘Biostatistics’

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**Type** Package

**Title** Statistics Tutorials for Biologists

**Version** 1.0.4

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**Description** Tutorials for statistics, aimed at biological scientists.

Subjects range from basic descriptive statistics through to complex linear modelling. The tutorials include text, videos, interactive coding exercises and multiple choice quizzes. The package also includes 19 datasets which are used in the tutorials.

**Encoding** UTF-8

**LazyData** true

**Imports** learnr

**Suggests** ggplot2, car, plotrix, knitr, rmarkdown

**License** GPL-3

**VignetteBuilder** knitr

**RoxygenNote** 7.1.1

**NeedsCompilation** no

**Depends** R (>= 3.5.0)

**Repository** CRAN

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carnivores	<i>Brain and body mass for carnivore species</i>
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---

## Description

Data on mean brain and body mass for 199 species from the carnivora.

## Usage

```
data("carnivores")
```

## Format

A data frame with 199 observations on the following 7 variables.

Binomial binomial species name

order order name

family family name

genus genus name

species species name

Mean\_brain\_mass\_g mean brain mass for that species in g

Mean\_body\_mass\_Kg mean body mass for that species in Kg

## Source

Burger, Joseph Robert; George, Menshian Ashaki; Leadbetter, Claire; Shaikh, Farhin (2019), Data from: The allometry of brain size in mammals, Dryad, Dataset, <https://doi.org/10.5061/dryad.2r62k7s>

**References**

Burger, J.R., George, M.A., Leadbetter, C. & Shaikh, F. (2019) The allometry of brain size in mammals. *Journal of mammalogy*, 100, 276-283.

**Examples**

```
data(carnivores)
str(carnivores)
```

---

cricket_song	<i>Cricket song dataset</i>
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---

**Description**

Data on condition, resource availability (food quality) and sexual signalling (calling song) in the decorated cricket, *Gryllodes sigillatus*.

**Usage**

```
data("cricket_song")
```

**Format**

A data frame with 568 observations on the following 5 variables.

Diet total nutritional content of the diet in percent

Pronotum Pronotum width in mm

Mass0 mass at the start of the experiment in g

Delta\_smi change in weight over the first week in g

Song\_week1 Total amount of time the animal sang in the first week of the experiment in seconds

**Source**

Houslay, Thomas M. et al. (2017), Data from: Mating opportunities and energetic constraints drive variation in age-dependent sexual signalling, Dryad, Dataset, <https://doi.org/10.5061/dryad.tj693>

**References**

Houslay, T.M., Houslay, K.F., Rapkin, J., Hunt, J. & Bussiere, L.F. (2017) Mating opportunities and energetic constraints drive variation in age-dependent sexual signalling (ed C Miller). *Functional ecology*, 31, 728-741.

**Examples**

```
data(cricket_song)
str(cricket_song)
```

---

`finch_colours`*Finch colouration and mitochondrial function*

---

**Description**

Data on the hue of the red feathers and a series of measures of mitochondrial function in 36 male house finches *Haemorrhous mexicanus* at a time when they were moulting and therefore actively producing red carotenoids.

**Usage**

```
data("finch_colours")
```

**Format**

A data frame with 36 observations on the following 5 variables.

ID ID number for the individual bird

Hue Hue of the red feathers. Lower values are redder

C1RCR "Respiratory Control Ratio", calculated by dividing the maximum respiration rate by the basal rate

C1MMP Mitochondrial Membrane Potential

PGC\_1a The level of a protein which activates transcription in mitochondrial biogenesis

**Source**

Hill, Geoffrey et al. (2019), Data from: Plumage redness signals mitochondrial function in the house finch, Dryad, Dataset, <https://doi.org/10.5061/dryad.f0kr74v>

**References**

Hill, G.E., Hood, W.R., Ge, Z., Grinter, R., Greening, C., Johnson, J.D., Park, N.R., Taylor, H.A., Andreasen, V.A., Powers, M.J., Justyn, N.M., Parry, H.A., Kavazis, A.N. & Zhang, Y. (2019) Plumage redness signals mitochondrial function in the house finch. *Proceedings of the Royal Society B: Biological sciences*, 286, 20191354.

**Examples**

```
data(finch_colours)
## maybe str(finch_colours)
```

---

`gabon_diversity`      *Data on relative animal abundances in Gabon*

---

**Description**

Data on the relative abundance (proportion of total observations) of a variety of animal groups as recorded on a network of transects in NE Gabon. A variety of land use variables are also recorded.

**Usage**

```
data("gabon_diversity")
```

**Format**

A data frame with 24 observations on the following 14 variables.

`TransectID` Identifier for each transect

`Distance` Distance from the nearest village in Km

`HuntCat` Estimate of the intensity of hunting

`LandUse` What the land is used for

`NumHouseholds` Number of households in the nearest village

`Veg_Rich` Vegetation species richness measured as the number of tree species present in a series of plots along the transect

`Veg_Canopy` Canopy cover as the percentage of the sky blocked by canopy in each plot, scored as 1 = 0-25, 2 = 26-50, 3 = 51-75, 4 = 76-100

`Veg_Understory` Understory cover as the percentage of the ground covered, scored as for canopy cover

`RA_Apes` Relative abundance of apes

`RA_Birds` Relative abundance of birds

`RA_Elephant` Relative abundance of elephants

`RA_Monkeys` Relative abundance of monkeys

`RA_Rodent` Relative abundance of rodents

`RA_Ungulate` Relative abundance of ungulates

**Source**

Koerner, Sally E. et al. (2017), Data from: Vertebrate community composition and diversity declines along a defaunation gradient radiating from rural villages in Gabon, Dryad, Dataset, <https://doi.org/10.5061/dryad.vs97>

**References**

Koerner, S.E., Poulsen, J.R., Blanchard, E.J., Okouyi, J. & Clark, C.J. (2017) Vertebrate community composition and diversity declines along a defaunation gradient radiating from rural villages in Gabon (ed S Cheyne). *The Journal of applied ecology*, 54, 805-814.

**Examples**

```
data(gabon_diversity)
## maybe str(gabon_diversity)
```

---

gnatocerus	<i>Weapon size and insulin-like signalling in the broad-horned flour beetle</i>
------------	---

---

**Description**

Data from an experiment testing how weapon size in insects is controlled by insulin-like peptides. The weapon in question is the enlarged mandibles of the broad-horned flour beetle *Gnatocerus cornutus*. Larvae were treated with RNAi to knock out a number of candidate ILPs and adult size (elytron width) and weapon size were measured once they had eclosed.

**Usage**

```
data("gnatocerus")
```

**Format**

A data frame with 144 observations on the following 3 variables.

treatment The RNAi knockout treatment used. GFP = control, 1-5 ILP are the 5 insulin-like peptides targetted

EW Elytron width in micrometres

ML Mandible length in micrometres

**Source**

<https://figshare.com/s/609486022a3df39169bf> DOI:10.6084/m9.figshare.9734780

**References**

Okada, Y., Katsuki, M., Okamoto, N., Fujioka, H. & Okada, K. (2019) A specific type of insulin-like peptide regulates the conditional growth of a beetle weapon. *PLoS biology*, 17, e3000541.

**Examples**

```
data(gnatocerus)
str(gnatocerus)
```

---

height_immunity	<i>Data on the relationship between immune system functioning and body height in healthy people.</i>
-----------------	--

---

### Description

Data from a study relating innate (complement & lysozyme activity, neutrophil function) and adaptive (lymphocyte count, IgA, IgG and vaccine response) to height. The subjects were a group of Polish volunteers.

### Usage

```
data("height_immunity")
```

### Format

A data frame with 193 observations on the following 16 variables.

sex Subject sex  
age Age in years  
body.height Height in mm  
BMI Body Mass Index  
body\_fat Percent body fat  
testosterone Free testosterone titre  
complement Complement activity  
lysozyme Lysozyme activity  
phagocytic Phagocytic uptake  
ROS Reactive Oxygen Species production  
IgA Immunoglobulin A levels  
IgG Immunoglobulin G levels  
CD3 CD3 lymphocytes  
CD19 CD19 lymphocytes  
flu\_post\_vaccination\_response Antibody response to 'flu vaccination  
tetanus\_post\_vaccination\_response Antibody response to tetanus vaccination

### Source

Pawlowski, Boguslaw et al. (2017), Data from: Body height and immune efficacy: testing body stature as a signal of biological quality, Dryad, Dataset, <https://doi.org/10.5061/dryad.2vn0d>

### References

Drulis-Kawa, Z. (2017) Body height and immune efficacy: testing body stature as a signal of biological quality. *Proceedings. Biological sciences / The Royal Society*, 284: 0171372

**Examples**

```
data(height_immunity)
str(height_immunity)
```

---

latitude\_diversity      *Tree diversity data*

---

**Description**

Data on tree diversity from 24 forest plots in locations ranging from the tropics to northern Europe and the USA

**Usage**

```
data("latitude_diversity")
```

**Format**

A data frame with 24 observations on the following 12 variables.

Plot Plot name

Country Country

Latitude Plot latitude

Longitude Plot longitude

Plot\_size\_Ha Size of the plot in Ha

Total\_individuals Total number of trees >1cm DBH

Species\_richness Total number of tree species

Rarified\_sp\_richness Rarified species richness

Shannon\_diversity Shannon diversity index

Mean\_local\_richness Mean richness per 20m quadrat

Mean\_local\_richness\_rarified Rarified richness per 20m quadrat

Mean\_local\_Shannon Shannon diversity index per 20m quadrat

**Source**

Table S1 in [https://science.sciencemag.org/content/sci/suppl/2017/06/28/356.6345.1389.DC1/aam5678\\_LaManna\\_SM.pdf](https://science.sciencemag.org/content/sci/suppl/2017/06/28/356.6345.1389.DC1/aam5678_LaManna_SM.pdf)



## References

LaManna, J.A., Mangan, S.A., Alonso, A., Bourg, N.A., Brockelman, W.Y., Bunyavejchewin, S., Chang, L.-W., Chiang, J.-M., Chuyong, G.B., Clay, K., Condit, R., Cordell, S., Davies, S.J., Furniss, T.J., Giardina, C.P., Gunatilleke, I.A.U.N., Gunatilleke, C.V.S., He, F., Howe, R.W., Hubbell, S.P., Hsieh, C.-F., Inman-Narahari, F.M., Janik, D., Johnson, D.J., Kenfack, D., Korte, L., Kral, K., Larson, A.J., Lutz, J.A., McMahon, S.M., McShea, W.J., Memiaghe, H.R., Nathalang, A., Novotny, V., Ong, P.S., Orwig, D.A., Ostertag, R., Parker, G.G., Phillips, R.P., Sack, L., Sun, I.-F., Tello, J.S., Thomas, D.W., Turner, B.L., Vela Diaz, D.M., Vrska, T., Weiblen, G.D., Wolf, A., Yap, S. & Myers, J.A. (2017) Plant diversity increases with the strength of negative density dependence at the global scale. *Science*, 356, 1389-1392.

## Examples

```
data(latitude_diversity)
str(latitude_diversity)
```

---

longevity

*Data on maximum lifespan for 909 species of mammal and bird*

---

## Description

A dataset used to explore the ecological correlates of longevity in mammals and birds.

## Usage

```
data("longevity")
```

## Format

A data frame with 909 observations on the following 9 variables.

```
species Species name
class Class: mammalia = mammals, aves = birds
order Order
maximum_lifespan_yr Maximum lifespan in years
mass_g Average body weight in g
volancy Does it fly?
fossoriality Does it live in holes in the ground?
foraging_environment Environment where it forages
daily_activity When is it active?
```

## Source

<https://royalsocietypublishing.org/doi/suppl/10.1098/rspb.2014.0298>

## References

Healy, K., Guillerme, T., Finlay, S., Kane, A., Kelly, S.B.A., McClean, D., Kelly, D.J., Donohue, I., Jackson, A.L. & Cooper, N. (2014) Ecology and mode-of-life explain lifespan variation in birds and mammals. *Proceedings. Biological sciences / The Royal Society*, 281, 20140298.

## Examples

```
data(longevity)
str(longevity)
```

---

malawi_carbon	<i>Carbon exposure and lung immunity</i>
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---

## Description

Data on two lung immunity measures (oxidative burst activity and phagocytic activity) from people exposed to chronic carbon particulates in their homes in Malawi

## Usage

```
data("malawi_carbon")
```

## Format

A data frame with 29 observations on the following 4 variables.

X Row number  
log\_carbon Log carbon particulate exposure  
oxidative\_burst Lung oxidative burst activity  
phagocytosis Phagocytic activity in the lung

## Source

Rylance, Jamie et al. (2016), Data from: Chronic household air pollution exposure is associated with impaired alveolar macrophage function in Malawian non-smokers, Dryad, Dataset, <https://doi.org/10.5061/dryad.89nj3>

## References

Rylance, J., Chimpini, C., Semple, S., Russell, D.G., Jackson, M.J., Heyderman, R.S. & Gordon, S.B. (2015) Chronic Household Air Pollution Exposure Is Associated with Impaired Alveolar Macrophage Function in Malawian Non-Smokers. *PloS one*, 10, e0138762.

## Examples

```
data(malawi_carbon)
str(malawi_carbon)
```

---

mammal\_longevity      *Data on maximum lifespan for 375 species of mammal*

---

**Description**

A subset of a dataset used to explore the ecological correlates of longevity in mammals and birds, with only the mammals represented.

**Usage**

```
data("longevity")
```

**Format**

A data frame with 375 observations on the following 10 variables.

X Row number

species Species name

class Class: mammalia = mammals, aves = birds

order Order

maximum\_lifespan\_yr Maximum lifespan in years

mass\_g Average body weight in g

volancy Does it fly?

fossoriality Does it live in holes in the ground?

foraging\_environment Environment where it forages

daily\_activity When is it active?

**Source**

<https://royalsocietypublishing.org/doi/suppl/10.1098/rspb.2014.0298>

**References**

Healy, K., Guillerme, T., Finlay, S., Kane, A., Kelly, S.B.A., McClean, D., Kelly, D.J., Donohue, I., Jackson, A.L. & Cooper, N. (2014) Ecology and mode-of-life explain lifespan variation in birds and mammals. *Proceedings. Biological sciences / The Royal Society*, 281, 20140298.

**Examples**

```
data(mammal_longevity)
str(mammal_longevity)
```

---

`mhc`*MHC promiscuity and pathogen diversity data*

---

**Description**

Data relating the breadth of the MHC response for the HLA-DRB1 MHC gene from a number of populations worldwide, and an estimate of the diversity of intracellular and extracellular pathogens that the population is exposed to

**Usage**

```
data("mhc")
```

**Format**

A data frame with 28 observations on the following 4 variables.

Population Population identifier

Extracellular Diversity of extracellular pathogens

Intracellular Diversity of intracellular pathogens

Promiscuity\_in\_vitro Estimated range of epitopes that the MHC can bind to

**Source**

<https://doi.org/10.1371/journal.pbio.3000131.s017>

**References**

Manczinger, M., Boross, G., Kemeny, L., Muller, V., Lenz, T.L., Papp, B. & Pal, C. (2019) Pathogen diversity drives the evolution of generalist MHC-II alleles in human populations. *PLoS biology*, 17, e3000131.

**Examples**

```
data(mhc)  
str(mhc)
```

---

mouse_activity	<i>Locomotor activity in offspring of mice exposed to nicotine</i>
----------------	--

---

**Description**

Data on the spontaneous locomotor activity of the F1 offspring of nicotine exposed or control males mated with unexposed females over a 12 hour period.

**Usage**

```
data("mouse_activity")
```

**Format**

A data frame with 54 observations on the following 3 variables.

Treatment Parental treatment

Sex Sex of the animal in question

SLA Spontaneous locomotor activity (the count of all the recorded times an infra-red beam was broken during the 12-hour period)

**Source**

<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2006497>

**References**

McCarthy, D.M., Morgan, T.J., Jr, Lowe, S.E., Williamson, M.J., Spencer, T.J., Biederman, J. & Bhide, P.G. (2018) Nicotine exposure of male mice produces behavioral impairment in multiple generations of descendants. PLoS biology, 16, e2006497.

**Examples**

```
data(mouse_activity)  
str(mouse_activity)
```

---

parrots2

*Parrot lifespan data*

---

### Description

A dataset on maximum lifespan for 69 species of parrot. A subset of the larger longevity dataset with further information on family and subfamily added.

### Usage

```
data("parrots2")
```

### Format

A data frame with 69 observations on the following 11 variables.

species Species name  
class Class: aves = birds  
order Order  
family Family  
subfamily Subfamily  
maximum\_lifespan\_yr Maximum lifespan in years  
mass\_g Average body weight in g  
volancy Does it fly?  
fossoriality Does it live in holes in the ground?  
foraging\_environment Environment where it forages  
daily\_activity When is it active?

### Source

<https://royalsocietypublishing.org/doi/suppl/10.1098/rspb.2014.0298>

### References

Healy, K., Guillerme, T., Finlay, S., Kane, A., Kelly, S.B.A., McClean, D., Kelly, D.J., Donohue, I., Jackson, A.L. & Cooper, N. (2014) Ecology and mode-of-life explain lifespan variation in birds and mammals. *Proceedings. Biological sciences / The Royal Society*, 281, 20140298.

### Examples

```
data(longevity)  
str(longevity)
```

---

pinniped

*Pinniped brain sizes and mating system*

---

### Description

A data set of body and brain mass for 33 species of pinniped (seals, sea lions and walruses) along with the type of mating system for that species.

### Usage

```
data("pinniped")
```

### Format

A data frame with 33 observations on the following 6 variables.

Species Binomial species name

Male\_brain\_g Brain mass for males in g

Female\_brain\_g Brain mass for females in g

Male\_mass\_Kg Body mass for males in Kg

Female\_mass\_Kg Body mass for females in Kg

Mate\_type Mating system: mono = monogynous, poly = polygynous

### Source

<https://onlinelibrary.wiley.com/doi/10.1111/j.1420-9101.2012.02520.x>

### References

Fitzpatrick, J.L., Almbro, M., Gonzalez-Voyer, A., Hamada, S., Pennington, C., Scanlan, J. & Kolm, N. (2012) Sexual selection uncouples the evolution of brain and body size in pinnipeds. *Journal of evolutionary biology*, 25, 1321-1330.

### Examples

```
data(pinniped)
str(pinniped)
```

quolls

*Data on physical performance in Northern Quolls***Description**

Data from a study of physical performance and morphology in Northern Quolls, *Dasyurus hallucatus*. These data were collected to test hypotheses about trade-offs between different types of physical activity. NB all physical measurements are standardised to a mean of 0 and an SD of 1.

**Usage**

```
data("quolls")
```

**Format**

A data frame with 63 observations on the following 23 variables.

```
name Number of the individual
sex Sex
mass mass in g
bodylength length in mm
taillength tail length in mm
taildiameter tail diameter in mm
headwidth head width in mm
headlength head length in mm
meanforearm mean forearm length in mm
meanhindlimb mean hind limb length in mm
meanfootlength mean length of feet in mm
bodysize_PC1 PC1 of body size measurements
acceleration Acceleration
sprint sprint speed
jump jump speed
grasp grasping strength
bite bite force
motorcontrol A measure of motor control
maneuverability maneuverability
Max_O2_consump Maximum oxygen consumption
Performance_PC1 Principal component 1 from a PCA of performance variables
Performance_PC2 Principal component 2 from a PCA of performance variables
Performance_PC3 Principal component 3 from a PCA of performance variables
```



**Source**

Charters, Jordan E. et al. (2019), Data from: Multidimensional analyses of physical performance reveal a size dependent trade-off between suites of traits, Dryad, Dataset, <https://doi.org/10.5061/dryad.k0v636g>

**References**

Charters, J.E., Heiniger, J., Clemente, C.J., Cameron, S.F., Amir Abdul Nasir, A.F., Niehaus, A.C. & Wilson, R.S. (2018) Multidimensional analyses of physical performance reveal a size-dependent trade-off between suites of traits. *Functional ecology*, 32, 1541-1553.

**Examples**

```
data(quolls)
str(quolls)
```

---

ragwort

*Data on how plant-soil feedback affects growth of ragwort*

---

**Description**

Data from an experiment looking at how the removal of soil biota affects plant-soil feedback and hence the growth of ragwort, *Jacobaea vulgaris*.

**Usage**

```
data("ragwort")
```

**Format**

A data frame with 45 observations on the following 3 variables.

`inoculum` Mesh size of the filter used to process water from soil used to inoculate otherwise sterile soil. Smaller mesh = less microbiota

`root_mass` plant root mass in g (dry weight)

`leaf_mass` plant leaf mass in g (dry weight)

**Source**

Wang, M., Ruan, W., Kostenko, O., Carvalho, S., Hannula, S.E., Mulder, P.P.J., Bu, F., van der Putten, W.H. & Bezemer, T.M. (2019) Removal of soil biota alters soil feedback effects on plant growth and defense chemistry. *The New Phytologist*, 221, 1478-1491.

**Examples**

```
data(ragwort)
str(ragwort)
```

---

weaver

*Oxidative stress and group size in social weaver birds*

---

## Description

Data from an experiment looking at the oxidative stress brought on by reproduction in white-browed sparrow weavers *Plocepasser mahali*. The birds live in groups but only one pair reproduces. Either eggs were left alone or some eggs were removed to reduce the stress caused by reproduction. Two measures of oxidative stress were made.

## Usage

```
data("weaver")
```

## Format

A data frame with 34 observations on the following 6 variables.

Bird\_ID Individual bird identifier

Treatment either control (eggs left) or some eggs removed to reduce the cost of reproduction

GrpSize Size of the social group

SOD\_final Superoxide dismutase activity

MDA\_final Malondialdehyde concentration

mass\_final mass of the bird in g

## Source

Cram, Dominic L.; Blount, Jonathan D.; Young, Andrew J. (2015), Data from: The oxidative costs of reproduction are group-size dependent in a wild cooperative breeder, Dryad, Dataset, <https://doi.org/10.5061/dryad.j1305>

## References

Cram, D.L., Blount, J.D. & Young, A.J. (2015) The oxidative costs of reproduction are group-size dependent in a wild cooperative breeder. *Proceedings. Biological sciences / The Royal Society*, 282, 20152031.

## Examples

```
data(weaver)
str(weaver)
```

worldbank

*Data comparing 186 countries originally published by the World Bank***Description**

A variety of geographical, economic, environmental and social measures for 186 countries from the year 2014. Compiled from data published by the World Bank.

**Usage**

```
data("worldbank")
```

**Format**

A data frame with 186 observations on the following 25 variables.

Climate\_region a factor with levels Temperate or Polar Tropical

Income\_binary a factor with levels High Low

Country\_Name Name of the country

Country\_Code Three letter code for the country

Region Geographic region

Income\_group Divides countries into one of four income groups

Population Population size

Land\_area Area of the country in km<sup>2</sup>

Forest\_area Area forested as percent of land area

Precipitation Annual precipitation in mm

Population\_density People per km<sup>2</sup>

Capital\_lat Latitude of the capital

GNP\_per\_Cap Gross National Product per capita in US\$

Population\_growth Annual population growth in percent

Cereal\_yield Cereal yield in Kg per Ha

Female\_life\_expectancy Average life expectancy of women in years

Under\_5\_mortality Deaths of children under 5 per 100000

Renewables. Renewable energy consumption (percent of total final energy consumption)

CO2 CO2 production in tonnes per capita

PM25 PM2.5 air pollution, mean annual exposure (micrograms per cubic meter)

Women\_in\_parliament Percent of seats held by women in national parliaments

GINI\_index Gini index of wealth inequality

Govt\_spend\_education Government expenditure on education, total (percent of GDP)

Secondary\_school\_enrolment School enrollment, secondary (percent net)

School\_gender\_parity Index of gender parity for school enrollment

**Source**

<https://data.worldbank.org/indicator>

**Examples**

```
data(worldbank)
str(worldbank)
```

---

zebra\_bacteria      *Data on bacterial adaptation to host gut environments.*

---

**Description**

Data from a study on bacterial adaptation to host gut environments. These data are measures of the competitive ability a bacterium called *Aeromonas veronii* after either 4 or 18 passages through the gut of an otherwise germ-free larval zebrafish.

**Usage**

```
data("zebra_bacteria")
```

**Format**

A data frame with 208 observations on the following 4 variables.

Line Which of three lines

Host Wild type (WT) or an immunodeficient myd88- mutant

Passage Number of passages

CI Competitive index

**Source**

[https://figshare.com/articles/dataset/Experimental\\_bacterial\\_adaptation\\_to\\_the\\_zebrafish\\_gut\\_reveals\\_a\\_primary\\_role\\_for\\_i](https://figshare.com/articles/dataset/Experimental_bacterial_adaptation_to_the_zebrafish_gut_reveals_a_primary_role_for_i)

**References**

Robinson, C.D., Klein, H.S., Murphy, K.D., Parthasarathy, R., Guillemin, K. & Bohannan, B.J.M. (2018) Experimental bacterial adaptation to the zebrafish gut reveals a primary role for immigration. *PLoS biology*, 16, e2006893.

**Examples**

```
data(zebra_bacteria)
str(zebra_bacteria)
```

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