Functions

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2023-03-21

R Markdown

```
convert_pounds_to_grams <- function(pounds = 1)
{grams <- 453.6 * pounds
return(grams)}
```

```
convert_pounds_to_grams(pound = 10)
```

```
## [1] 4536
```

```
get_mass_from_length_theropoda <- function(length, a, b)
{mass <- a * length ^ b
return(mass)}
```

```
get_mass_from_length_theropoda(length = 26, a =214.44, b = 1.46)
```

```
## [1] 24955.54
```

Why do we use functions in programming?

- We already use functions a lot. Basically everything we run in R is a function.
- Reduce the amount of code we write
- No need to repeat code, so less chance of repeating errors or introducing new errors by mistyping code.
- Helps with reproducibility: no need to repeat code, allows others (and future self) to run code in a straightforward way, with accuracy.
- Make it easier to write modular code that you can reuse for other projects
- Makes it easier to run code and remember it.
- It allows for organization of analysis by putting code intended to run something together in the same function.

```
convert_kg_to_pounds <- function(kg = 1) {pounds <- 2.205 * kg
return(pounds)}
```

```
convert_kg_to_pounds(kg = 50)
```

```
## [1] 110.25
```

```
convert_kg_to_pounds(kg = get_mass_from_length_theropoda(a = 10.95, b = 2.64, length = 12))
```

```
## [1] 17055.37
```

```
length_in_pounds <- function(length, a, b){get_mass_from_length(length = 1, a = 1, b = 1) %>% convert_kg
```

Exercise 5: A function for the Portal data set

2. Combine the surveys and speices tables into a single data frame

There are several ways to create data frmaes within R. Depending on the data that we want as data frame, there are different functions that we can use to create a data frame object. - 'read.csv()': If you already have a file (either CSV or TSV) with data that we want to read into R as a data frame, - 'data.frame()': If we want to create a data frame from vectors - '_join()' funtion: If we already have a some data frames in R that we want to combine. - There are many functions that create a data frame as an output: - Summarize(): It creates a new data frame summarizing information from another data frame. - but there are many other packages that also generate data frames with different types of data

3. Write a function that: Takes three arguments - a data frame (the combined table created before), a genus name, and a species name, Uses functions from the dplyr package to produce a data frame with two colums: year and cout, where count is the number of individuals (i.e., the number of rows) for the speices indicated by genus or species in that year, the functions return the resulting data frame. Note that this data frame is a time series by year.

As opposed to data frames, there is one way to creat a function: the function 'function()':

''"{r} name_of_the_function <- function(argument1, argument2, arguent3,...){The body of the function where the operation usng the vaulse is stored in the arguement}"'

- Excercise 1

```
mass_from_length_theropoda <- function(length = 1)
{mass <- 0.73 * length^3.63
return(mass)}
```

```
theropoda_lengths <- c(17.8013631070471, 20.3764452071665, 14.0743486294308, 25.65782386974, 26.0952008
```

It is a vector of masses calculated from theropoda lengths using the function we created above (called 'mass_from_length_theropoda()')

```
mass_from_length_theropoda(length = theropoda_lengths)
```

```
##  [1]  25262.027  41253.332  10767.568  95233.732 101260.017  40775.516
##  [7]  24072.130   4785.145  39129.521  29666.193  26830.297  64700.869
## [13]  42768.180  94697.262  79013.471 103955.226  92798.465  41901.983
## [19]  17439.569  41055.045  37544.201  25198.303  12928.490  36388.290
## [25]  34962.862  80307.929   8854.525  50183.194  28846.165  35735.369
## [31] 115908.187  31765.368  58958.713   5561.862  28349.410  15418.314
## [37]   9218.648   1197.666  94407.873  19552.500
```

```r
theropoda_masses <- mass_from_length_theropoda(length = theropoda_lengths)

my_list <- list(theropoda_masses)
second_list <- c(my_list, list(c("Luna", "Avi", "Anita")))

second_list[1]
```

```
## [[1]]
##  [1]  25262.027  41253.332  10767.568  95233.732 101260.017  40775.516
##  [7]  24072.130   4785.145  39129.521  29666.193  26830.297  64700.869
## [13]  42768.180  94697.262  79013.471 103955.226  92798.465  41901.983
## [19]  17439.569  41055.045  37544.201  25198.303  12928.490  36388.290
## [25]  34962.862  80307.929   8854.525  50183.194  28846.165  35735.369
## [31] 115908.187  31765.368  58958.713   5561.862  28349.410  15418.314
## [37]   9218.648   1197.666  94407.873  19552.500
```

```r
data.frame(theropoda_masses, c("Anita", "Avi", "Luna", "Maria"))
```

```
##    theropoda_masses c..Anita....Avi....Luna....Maria..
## 1         25262.027                               Anita
## 2         41253.332                                 Avi
## 3         10767.568                                Luna
## 4         95233.732                               Maria
## 5        101260.017                               Anita
## 6         40775.516                                 Avi
## 7         24072.130                                Luna
## 8          4785.145                               Maria
## 9         39129.521                               Anita
## 10        29666.193                                 Avi
## 11        26830.297                                Luna
## 12        64700.869                               Maria
## 13        42768.180                               Anita
## 14        94697.262                                 Avi
## 15        79013.471                                Luna
## 16       103955.226                               Maria
## 17        92798.465                               Anita
## 18        41901.983                                 Avi
## 19        17439.569                                Luna
## 20        41055.045                               Maria
## 21        37544.201                               Anita
## 22        25198.303                                 Avi
## 23        12928.490                                Luna
## 24        36388.290                               Maria
## 25        34962.862                               Anita
## 26        80307.929                                 Avi
## 27         8854.525                                Luna
## 28        50183.194                               Maria
## 29        28846.165                               Anita
## 30        35735.369                                 Avi
## 31       115908.187                                Luna
## 32        31765.368                               Maria
## 33        58958.713                               Anita
```

```
## 34         5561.862                                 Avi
## 35        28349.410                                Luna
## 36        15418.314                               Maria
## 37         9218.648                               Anita
## 38         1197.666                                 Avi
## 39        94407.873                                Luna
## 40        19552.500                               Maria
```

```
a_values <- c(0.759, 0.751, 0.74, 0.746, 0.759, 0.751, 0.749, 0.751, 0.738, 0.768, 0.736, 0.749, 0.746,
```

```
b_values <- c(3.627, 3.633, 3.626, 3.633, 3.627, 3.629, 3.632, 3.628, 3.633, 3.627, 3.621, 3.63, 3.631,
```

```
dino_data <- data.frame(theropoda_lengths, a_values, b_values)
head(dino_data)
```

```
##   theropoda_lengths a_values b_values
## 1          17.80136    0.759    3.627
## 2          20.37645    0.751    3.633
## 3          14.07435    0.740    3.626
## 4          25.65782    0.746    3.633
## 5          26.09520    0.759    3.627
## 6          20.31115    0.751    3.629
```

'«-' the scope operator or double arrow, allows creating and modifying objects in parent variables

```
mass_from_length_max <- function(length) {
  if (length < 20) {
    mass <- 0.73 * length^3.63
    return(mass)
  } else {
    return(NA)
  }
}
```

```
dino_data %>% mutate(masses = mass_from_length_theropoda())
```

```
##    theropoda_lengths a_values b_values masses
## 1          17.801363    0.759    3.627   0.73
## 2          20.376445    0.751    3.633   0.73
## 3          14.074349    0.740    3.626   0.73
## 4          25.657824    0.746    3.633   0.73
## 5          26.095201    0.759    3.627   0.73
## 6          20.311154    0.751    3.629   0.73
## 7          17.566324    0.749    3.632   0.73
## 8          11.256343    0.751    3.628   0.73
## 9          20.081903    0.738    3.633   0.73
## 10         18.607163    0.768    3.627   0.73
## 11         18.099189    0.736    3.621   0.73
## 12         23.065969    0.749    3.630   0.73
## 13         20.579885    0.746    3.631   0.73
## 14         25.617925    0.744    3.632   0.73
```

```
## 15         24.371433    0.749    3.628   0.73
## 16         26.284725    0.751    3.626   0.73
## 17         25.475378    0.744    3.639   0.73
## 18         20.464209    0.754    3.626   0.73
## 19         16.073826    0.774    3.635   0.73
## 20         20.349417    0.751    3.629   0.73
## 21         19.854399    0.763    3.642   0.73
## 22         17.788981    0.749    3.632   0.73
## 23         14.801642    0.741    3.633   0.73
## 24         19.684091    0.754    3.629   0.73
## 25         19.468589    0.746    3.620   0.73
## 26         24.480778    0.755    3.619   0.73
## 27         13.335996    0.764    3.638   0.73
## 28         21.506599    0.758    3.627   0.73
## 29         18.464030    0.760    3.621   0.73
## 30         19.586153    0.748    3.628   0.73
## 31         27.084752    0.745    3.628   0.73
## 32         18.960937    0.756    3.635   0.73
## 33         22.482917    0.739    3.624   0.73
## 34         11.732572    0.733    3.621   0.73
## 35         18.375885    0.757    3.621   0.73
## 36         15.537505    0.747    3.632   0.73
## 37         13.484875    0.741    3.627   0.73
## 38          7.685612    0.752    3.624   0.73
## 39         25.596335    0.752    3.634   0.73
## 40         16.588285    0.748    3.621   0.73
```

```
mass_from_length_max <- function(length, a, b)
{mass <- a * length^b
return(mass)}
```

The 'apply' functoins allow us to apply a function to a vector or list of values iteratively. This helps minimize errors in code and makes the analyses more efficient.

With lapply() and sapply() functions, we can only provide one argument to iterate on

'sapply()' function simplifies the output to a vector (or the simplest data structure possible), while 'lapply()' returns an output in the form of a list.

With mapply(), we can provide multiple arguments to iterate on. It probably also returns a vector or simplified data structure as result.

```
dino_table <- read.csv(file = "../data-raw/dinosaur_lengths.csv")
head(dino_table)
```

```
##        species  lengths
## 1  Stegosauria 18.52588
## 2 Ankylosauria 16.43598
## 3 Ankylosauria 23.73421
## 4    Sauropoda 23.93411
## 5 Ankylosauria 21.68718
## 6 Ankylosauria 21.38363
```

```r
get_mass_from_length_by_name <- function(dino_length, dino_name) {
  if (dino_name == "Stegosauria") {
    a <- 10.95
    b <- 2.64
  } else if (dino_name == "Theropoda") {
    a <- 0.73
    b <- 3.63
  } else if (dino_name == "Sauropoda") {
    a <- 214.4
    b <- 1.46
  } else {
    a <- NA
    b <- NA
  }
  mass <- a * dino_length^b
  return(mass)
}

get_mass_from_length_by_name(dino_length = 100, dino_name = "Stegosauria")
```

```
## [1] 2086479
```

```r
dino_table
```

```
##          species   lengths
## 1    Stegosauria 18.525885
## 2   Ankylosauria 16.435982
## 3   Ankylosauria 23.734212
## 4      Sauropoda 23.934110
## 5   Ankylosauria 21.687176
## 6   Ankylosauria 21.383631
## 7      Theropoda 22.312167
## 8      Theropoda 15.177487
## 9      Theropoda 21.446707
## 10   Stegosauria 22.799622
## 11     Theropoda 13.874089
## 12     Sauropoda 18.630249
## 13     Theropoda 23.629352
## 14     Sauropoda 25.229956
## 15   Stegosauria 19.680160
## 16   Stegosauria 16.799397
## 17     Sauropoda 21.910793
## 18  Ankylosauria 20.935821
## 19     Sauropoda 22.041318
## 20     Sauropoda 19.202574
## 21  Ankylosauria 20.875224
## 22     Theropoda 21.526282
## 23     Sauropoda 19.150231
## 24   Stegosauria 19.946113
## 25     Sauropoda 18.514847
## 26     Sauropoda 16.616480
## 27     Theropoda 13.766857
## 28     Sauropoda 13.513882
```

```
## 29     Theropoda 21.395192
## 30   Stegosauria 18.382292
## 31     Theropoda 21.923531
## 32     Theropoda 21.869568
## 33  Ankylosauria 20.077169
## 34   Stegosauria 15.635502
## 35   Stegosauria 16.711957
## 36  Ankylosauria 21.673004
## 37  Ankylosauria 15.674131
## 38     Theropoda 24.662437
## 39     Sauropoda 20.714691
## 40     Theropoda 20.020150
## 41   Stegosauria 29.116277
## 42     Sauropoda 22.029638
## 43     Sauropoda 14.477335
## 44   Stegosauria 19.940483
## 45   Stegosauria 27.886823
## 46  Ankylosauria 23.681443
## 47     Theropoda 24.782679
## 48  Ankylosauria 20.712699
## 49   Stegosauria 19.072531
## 50   Stegosauria 17.757446
## 51     Theropoda 22.954382
## 52     Theropoda 11.684894
## 53     Theropoda 19.306435
## 54     Theropoda 17.300944
## 55     Sauropoda 17.344495
## 56   Stegosauria 17.566690
## 57     Sauropoda 20.497137
## 58     Theropoda 15.299351
## 59  Ankylosauria 15.815042
## 60     Sauropoda 17.527311
## 61     Theropoda 18.704207
## 62  Ankylosauria 19.122301
## 63   Stegosauria 13.850023
## 64     Theropoda 23.822637
## 65     Sauropoda 25.082211
## 66     Theropoda 23.022423
## 67     Theropoda 15.400667
## 68     Sauropoda 19.440595
## 69  Ankylosauria 10.921151
## 70  Ankylosauria 20.986008
## 71  Ankylosauria 21.265106
## 72   Stegosauria 11.920137
## 73  Ankylosauria 19.718387
## 74  Ankylosauria 18.046124
## 75  Ankylosauria 15.579136
## 76  Ankylosauria 16.922221
## 77     Theropoda 21.111917
## 78     Theropoda 23.620585
## 79     Sauropoda 13.402894
## 80  Ankylosauria 20.158619
## 81     Theropoda 23.416358
## 82   Stegosauria 23.373049
```

```
## 83  Ankylosauria 23.557742
## 84   Stegosauria 24.006718
## 85   Stegosauria 14.050305
## 86  Ankylosauria 21.605897
## 87     Theropoda 21.752230
## 88  Ankylosauria 17.235685
## 89  Ankylosauria 17.743845
## 90  Ankylosauria 18.384039
## 91     Theropoda 20.253688
## 92   Stegosauria 22.123932
## 93   Stegosauria 20.272605
## 94     Sauropoda 21.668335
## 95  Ankylosauria 19.540805
## 96  Ankylosauria 20.219118
## 97     Sauropoda 12.630509
## 98     Sauropoda 22.056242
## 99  Ankylosauria 19.258500
## 100 Ankylosauria 24.511875
## 101  Stegosauria 14.781536
## 102  Stegosauria 20.826875
## 103    Sauropoda 14.719243
## 104    Theropoda 17.662684
## 105    Sauropoda 19.843013
## 106  Stegosauria 16.669995
## 107 Ankylosauria 20.586719
## 108  Stegosauria 17.081280
## 109    Theropoda 19.950237
## 110    Theropoda 21.854817
## 111  Stegosauria 17.935253
## 112 Ankylosauria 23.184109
## 113  Stegosauria 18.037832
## 114 Ankylosauria 17.835808
## 115    Sauropoda 17.167692
## 116    Theropoda 19.425964
## 117 Ankylosauria 19.582304
## 118  Stegosauria 16.749576
## 119 Ankylosauria 19.981305
## 120    Theropoda 26.110978
## 121  Stegosauria 30.291943
## 122 Ankylosauria 18.450472
## 123    Sauropoda 22.966281
## 124 Ankylosauria 20.748215
## 125    Sauropoda 24.022000
## 126  Stegosauria 26.023810
## 127 Ankylosauria 26.453796
## 128    Sauropoda 19.438928
## 129    Theropoda 17.294841
## 130 Ankylosauria 26.433893
## 131 Ankylosauria 15.144502
## 132 Ankylosauria 11.584650
## 133 Ankylosauria 22.214407
## 134    Sauropoda 26.731885
## 135    Theropoda 21.463400
## 136  Stegosauria 14.653452
```

```
## 137 Ankylosauria 21.577484
## 138  Stegosauria 20.575755
## 139 Ankylosauria 21.897141
## 140    Theropoda 15.957161
## 141    Sauropoda 14.705513
## 142    Theropoda 25.563801
## 143  Stegosauria 24.758633
## 144    Sauropoda 21.688789
## 145 Ankylosauria 27.081149
## 146    Sauropoda 17.460389
## 147 Ankylosauria 20.242038
## 148    Sauropoda 18.364710
## 149  Stegosauria 21.470875
## 150    Theropoda 28.555509
## 151  Stegosauria 17.348434
## 152    Theropoda 17.525493
## 153 Ankylosauria 17.087488
## 154 Ankylosauria 21.034986
## 155    Theropoda 15.479944
## 156    Theropoda 22.285273
## 157    Theropoda 17.468425
## 158    Theropoda 18.200778
## 159    Theropoda 24.941591
## 160 Ankylosauria 24.349404
## 161    Sauropoda 13.254200
## 162 Ankylosauria 12.705635
## 163 Ankylosauria 17.626038
## 164  Stegosauria 20.549772
## 165  Stegosauria 16.030294
## 166    Theropoda 12.925642
## 167 Ankylosauria 22.124472
## 168  Stegosauria 19.091268
## 169    Sauropoda 22.250676
## 170    Sauropoda 18.799335
## 171    Sauropoda 18.757874
## 172    Sauropoda 17.108957
## 173 Ankylosauria 20.142624
## 174    Theropoda 19.640269
## 175    Theropoda 20.535941
## 176 Ankylosauria 20.818615
## 177 Ankylosauria 14.340065
## 178  Stegosauria 24.631902
## 179 Ankylosauria 22.595632
## 180    Theropoda 20.757092
## 181    Sauropoda 13.452268
## 182    Theropoda 22.575036
## 183 Ankylosauria 20.582800
## 184 Ankylosauria 18.459268
## 185 Ankylosauria 21.725455
## 186  Stegosauria 23.345957
## 187    Theropoda 15.198763
## 188  Stegosauria 21.200605
## 189    Theropoda 14.260099
## 190 Ankylosauria 22.305495
```

```
## 191 Ankylosauria 21.044196
## 192 Ankylosauria 19.918394
## 193    Theropoda 17.136539
## 194    Sauropoda 21.999874
## 195    Sauropoda 16.829116
## 196 Ankylosauria 13.115608
## 197 Ankylosauria 21.003064
## 198    Theropoda 23.472346
## 199  Stegosauria 12.800283
## 200    Theropoda 25.268845
## 201  Stegosauria 18.937819
## 202  Stegosauria 24.442161
## 203  Stegosauria 26.391105
## 204    Sauropoda 22.443509
## 205 Ankylosauria 18.148462
## 206    Sauropoda 17.482025
## 207    Theropoda 15.554902
## 208  Stegosauria 14.218262
## 209    Theropoda 17.090753
## 210    Theropoda 21.946334
## 211    Sauropoda 17.338647
## 212    Sauropoda 12.001277
## 213    Sauropoda 23.210221
## 214    Theropoda 20.754197
## 215    Sauropoda 19.380586
## 216    Theropoda 23.577763
## 217    Sauropoda 14.992141
## 218    Sauropoda 24.459547
## 219  Stegosauria 22.546931
## 220    Sauropoda 20.223190
## 221    Sauropoda 21.097578
## 222    Theropoda 21.516562
## 223  Stegosauria 27.758468
## 224    Theropoda 18.396366
## 225  Stegosauria 22.660569
## 226 Ankylosauria 18.905341
## 227    Sauropoda 17.707042
## 228 Ankylosauria 18.481716
## 229 Ankylosauria 27.492288
## 230  Stegosauria 24.699768
## 231  Stegosauria 20.757105
## 232 Ankylosauria 14.877972
## 233    Sauropoda 15.661718
## 234    Sauropoda 20.758496
## 235    Theropoda 15.376012
## 236    Sauropoda 16.703436
## 237    Theropoda 24.115960
## 238  Stegosauria 16.813773
## 239 Ankylosauria 23.262213
## 240  Stegosauria 20.237508
## 241  Stegosauria 21.926815
## 242    Sauropoda 21.346381
## 243  Stegosauria 18.023325
## 244    Sauropoda 29.405760
```

```
## 245    Theropoda 20.584050
## 246 Ankylosauria 19.440752
## 247    Theropoda 20.693626
## 248    Theropoda 26.260017
## 249 Ankylosauria 17.399863
## 250 Ankylosauria 19.416675
## 251    Sauropoda 14.210877
## 252  Stegosauria 18.327572
## 253  Stegosauria 16.908694
## 254  Stegosauria 16.233725
## 255    Theropoda 18.316315
## 256  Stegosauria 25.129391
## 257 Ankylosauria 19.997763
## 258    Theropoda 16.841323
## 259    Sauropoda 16.873788
## 260 Ankylosauria 27.660750
## 261    Sauropoda 12.154013
## 262 Ankylosauria 20.189226
## 263    Theropoda 26.627688
## 264 Ankylosauria 22.038066
## 265    Theropoda 11.894576
## 266  Stegosauria 19.092455
## 267 Ankylosauria 24.372611
## 268    Theropoda 22.553797
## 269    Sauropoda 18.226947
## 270  Stegosauria 23.389595
## 271  Stegosauria 23.850883
## 272 Ankylosauria 18.146841
## 273 Ankylosauria 23.815888
## 274    Sauropoda 15.572433
## 275    Sauropoda 27.840167
## 276    Sauropoda 20.926769
## 277 Ankylosauria 22.682827
## 278    Sauropoda 23.930002
## 279  Stegosauria 21.004418
## 280 Ankylosauria 18.681384
## 281 Ankylosauria 16.234045
## 282 Ankylosauria 19.158517
## 283 Ankylosauria 14.896902
## 284  Stegosauria 23.549831
## 285  Stegosauria 18.241100
## 286    Theropoda 15.741441
## 287    Sauropoda 14.147412
## 288 Ankylosauria 13.929702
## 289  Stegosauria 18.434779
## 290  Stegosauria 20.907549
## 291 Ankylosauria 18.292703
## 292    Theropoda 15.634371
## 293    Theropoda 21.267830
## 294  Stegosauria 20.814950
## 295    Sauropoda 22.741084
## 296    Theropoda 17.003367
## 297    Theropoda 15.634806
## 298    Sauropoda 16.310406
```

```
## 299    Theropoda 18.376383
## 300    Sauropoda 14.277598
## 301    Theropoda 20.364058
## 302    Sauropoda 19.779111
## 303    Theropoda 18.591663
## 304  Stegosauria 19.752793
## 305    Sauropoda 23.568634
## 306 Ankylosauria 21.092777
## 307  Stegosauria 19.196293
## 308    Sauropoda 21.308801
## 309    Sauropoda 14.717348
## 310    Sauropoda 16.696776
## 311  Stegosauria 21.328726
## 312    Sauropoda 20.105810
## 313    Sauropoda 22.050987
## 314  Stegosauria  6.528009
## 315 Ankylosauria 24.766086
## 316  Stegosauria 13.949455
## 317  Stegosauria 16.015998
## 318    Theropoda 25.639282
## 319    Sauropoda 13.367563
## 320  Stegosauria 25.463799
## 321 Ankylosauria 17.608617
## 322    Theropoda 21.232368
## 323  Stegosauria 19.407797
## 324    Theropoda 17.732135
## 325    Sauropoda 16.457857
## 326  Stegosauria 21.132347
## 327 Ankylosauria 19.203134
## 328  Stegosauria 16.912635
## 329    Sauropoda 13.012892
## 330 Ankylosauria 22.884836
## 331    Sauropoda 22.644286
## 332    Sauropoda 11.554321
## 333    Sauropoda 18.723718
## 334 Ankylosauria 21.642562
## 335    Theropoda 14.325845
## 336 Ankylosauria 24.894147
## 337    Sauropoda 23.344275
## 338  Stegosauria 16.193233
## 339    Theropoda 17.648221
## 340  Stegosauria 16.998220
## 341    Theropoda 22.789438
## 342 Ankylosauria 21.806641
## 343    Theropoda 18.510961
## 344    Theropoda 21.837643
## 345  Stegosauria 16.486595
## 346  Stegosauria 17.726416
## 347    Theropoda 17.052268
## 348    Sauropoda 17.429040
## 349  Stegosauria 17.741674
## 350 Ankylosauria 20.043909
## 351    Sauropoda 14.393911
## 352  Stegosauria 20.494209
```

```
## 353    Theropoda 20.988563
## 354    Sauropoda 19.500086
## 355 Ankylosauria 25.283007
## 356  Stegosauria 17.524672
## 357    Sauropoda 13.417468
## 358 Ankylosauria 19.215688
## 359    Sauropoda 15.643802
## 360    Sauropoda 17.153166
## 361 Ankylosauria 28.921318
## 362    Theropoda 19.098517
## 363    Theropoda 21.543505
## 364    Sauropoda 24.718945
## 365    Theropoda 16.882051
## 366  Stegosauria 19.382310
## 367    Theropoda 21.678605
## 368    Theropoda 21.746023
## 369    Theropoda 18.227640
## 370  Stegosauria 22.559946
## 371  Stegosauria 19.184022
## 372  Stegosauria 18.177737
## 373  Stegosauria 23.066528
## 374    Theropoda 20.772165
## 375    Theropoda 22.632652
## 376    Sauropoda 19.076144
## 377  Stegosauria 27.724371
## 378    Sauropoda 20.288979
## 379    Sauropoda 14.212386
## 380    Theropoda 19.450469
## 381 Ankylosauria 22.517699
## 382  Stegosauria 23.150742
## 383 Ankylosauria 16.751426
## 384    Theropoda 13.888346
## 385  Stegosauria 18.526589
## 386 Ankylosauria 25.511200
## 387    Theropoda 17.448391
## 388    Theropoda 15.462906
## 389  Stegosauria 22.371936
## 390  Stegosauria 20.305639
## 391 Ankylosauria 15.299113
## 392  Stegosauria 21.553737
## 393    Theropoda 18.441159
## 394    Sauropoda 23.427956
## 395 Ankylosauria 18.404205
## 396    Theropoda 18.309119
## 397    Theropoda 15.103791
## 398 Ankylosauria 21.128045
## 399 Ankylosauria 23.976432
## 400    Theropoda 20.919648
## 401  Stegosauria 17.718086
## 402    Theropoda 14.755350
## 403 Ankylosauria 21.424007
## 404 Ankylosauria 19.447438
## 405 Ankylosauria 14.552851
## 406    Theropoda 23.960125
```

```
## 407    Theropoda 16.517232
## 408    Theropoda 16.610536
## 409    Theropoda 20.066724
## 410 Ankylosauria 21.662099
## 411 Ankylosauria 18.293286
## 412    Sauropoda 13.366428
## 413  Stegosauria 20.812542
## 414 Ankylosauria 24.096192
## 415    Theropoda 17.489952
## 416    Sauropoda 18.763987
## 417    Sauropoda 17.060766
## 418    Sauropoda 11.214438
## 419    Theropoda 22.912957
## 420    Theropoda 20.279257
## 421    Sauropoda 22.298560
## 422 Ankylosauria 17.154490
## 423 Ankylosauria 16.186443
## 424    Sauropoda 27.363421
## 425 Ankylosauria 22.971664
## 426    Sauropoda 20.867939
## 427    Theropoda 27.711182
## 428 Ankylosauria 13.792734
## 429 Ankylosauria 17.566802
## 430    Sauropoda 17.835361
## 431 Ankylosauria 25.882954
## 432    Theropoda 22.801215
## 433    Theropoda 22.611716
## 434  Stegosauria 21.655309
## 435 Ankylosauria 25.542956
## 436 Ankylosauria 19.059172
## 437  Stegosauria 20.563393
## 438 Ankylosauria 21.254484
## 439    Theropoda 23.333491
## 440    Sauropoda 20.491284
## 441  Stegosauria 18.476770
## 442    Sauropoda 26.682534
## 443    Theropoda 23.298383
## 444 Ankylosauria 22.280893
## 445    Sauropoda 20.548215
## 446    Sauropoda 21.496001
## 447    Sauropoda 16.745317
## 448    Sauropoda 20.225919
## 449  Stegosauria 22.820939
## 450    Sauropoda 24.898180
## 451    Theropoda 27.277970
## 452 Ankylosauria 21.160621
## 453    Sauropoda 20.917672
## 454 Ankylosauria 19.434040
## 455  Stegosauria 23.734146
## 456 Ankylosauria 17.549466
## 457  Stegosauria 24.918262
## 458    Theropoda 17.372396
## 459  Stegosauria 18.976956
## 460 Ankylosauria 18.844082
```

```
## 461  Stegosauria 23.890839
## 462 Ankylosauria 19.640004
## 463    Theropoda 27.807810
## 464 Ankylosauria 27.198110
## 465    Sauropoda 16.026426
## 466    Sauropoda 25.513351
## 467  Stegosauria 15.614805
## 468    Sauropoda 19.265651
## 469  Stegosauria 15.790534
## 470    Theropoda 21.978444
## 471 Ankylosauria 20.033497
## 472 Ankylosauria 20.569070
## 473    Sauropoda 17.811687
## 474    Theropoda 29.277012
## 475    Theropoda 22.502256
## 476    Sauropoda 21.199521
## 477    Theropoda 12.103778
## 478  Stegosauria 14.862825
## 479 Ankylosauria 20.562641
## 480 Ankylosauria 14.391395
## 481  Stegosauria 24.174902
## 482    Theropoda 26.280632
## 483  Stegosauria 21.943576
## 484  Stegosauria 22.586902
## 485 Ankylosauria 20.477159
## 486    Theropoda 18.666861
## 487  Stegosauria 22.737870
## 488  Stegosauria 17.234142
## 489  Stegosauria 18.447708
## 490 Ankylosauria 18.033631
## 491 Ankylosauria 19.216290
## 492    Sauropoda 12.423338
## 493    Sauropoda 25.565633
## 494 Ankylosauria 20.637215
## 495 Ankylosauria 17.972465
## 496    Theropoda 20.860254
## 497  Stegosauria 19.066745
## 498    Sauropoda 19.894607
## 499    Sauropoda 17.878476
## 500 Ankylosauria 12.386286
```

```
mapply(FUN = get_mass_from_length_by_name, dino_length = dino_table$lengths,
       dino_name = dino_table$species)
```

```
##   [1]  24341.681         NA         NA  22110.065         NA         NA
##   [7]  57349.470  14160.494  49677.749  42105.917  10221.747  15337.127
##  [13]  70624.102  23879.370  28552.864  18801.370  19435.047         NA
##  [19]  19604.313  16029.854         NA  50350.112  15966.099  29582.848
##  [25]  15198.621  12978.119   9937.867   9597.624  49245.963  23846.751
##  [31]  53805.661  53326.467         NA  15554.977  18544.119         NA
##  [37]         NA  82492.318  17905.701  38694.503  80303.181  19589.147
##  [43]  10612.805  29560.809  71658.477         NA  83961.661         NA
##  [49]  26284.040  21766.002  63571.873   5480.255  33917.314  22778.032
##  [55]  13816.588  21154.149  17631.809  14577.594         NA  14029.723
```

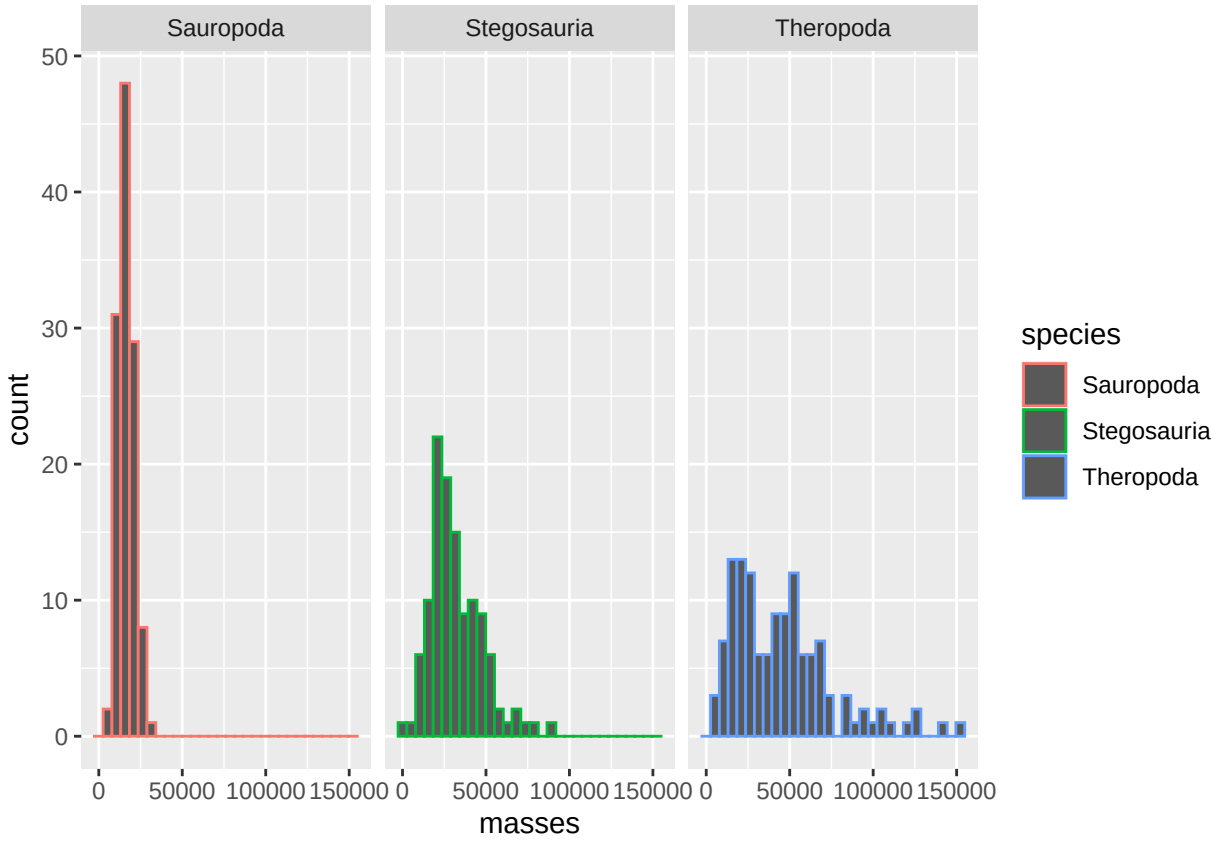
```
##  [61]  30231.694        NA  11293.886  72743.800  23675.484  64258.574
##  [67]  14931.085  16320.774        NA         NA         NA   7599.703
##  [73]        NA         NA        NA         NA  46920.035  70529.031
##  [79]   9482.759         NA  68340.494  44959.626         NA  48249.486
##  [85]  11730.174         NA  52295.177         NA         NA         NA
##  [91]  40358.292  38891.137  30878.439  19121.858         NA         NA
##  [97]   8695.594  19623.695        NA         NA  13411.390  33157.499
## [103]  10872.705  24554.930  16816.357  18421.449         NA  19645.723
## [109]  38206.241  53196.019  22346.109         NA  22685.103         NA
## [115]  13611.443  34685.790        NA  18654.525         NA 101482.428
## [121]  89149.257         NA  20816.953         NA  22228.705  59702.598
## [127]        NA  16318.730  22748.880         NA         NA         NA
## [133]        NA  25982.921  49818.253  13106.766         NA  32112.443
## [139]        NA  16984.463  10857.900  93973.020  52342.265  19148.216
## [145]        NA  13951.583        NA  15019.018  35933.327 140435.607
## [151]  20467.332  23869.639        NA         NA  15211.979  57098.945
## [157]  23588.700  27381.008  85932.513         NA   9329.554         NA
## [163]        NA  32005.502  16613.444   7904.857         NA  26352.263
## [169]  19876.772  15540.780  15490.764  13543.507         NA  36095.081
## [175]  42437.608         NA         NA  51637.913         NA  44120.181
## [181]   9533.805  59840.348        NA         NA         NA  44822.176
## [187]  14232.684  34751.496  11292.437         NA         NA         NA
## [193]  22002.082  19550.518  13221.303         NA         NA  68935.505
## [199]   9172.206  90096.476  25796.762  50594.426  61952.966  20128.772
## [205]        NA  13976.832  15481.074  12104.000  21789.436  54009.090
## [211]  13809.787   8070.433  21140.562  44097.848  16247.272  70065.996
## [217]  11168.265  22822.302  40885.088  17288.817  18390.960  50267.629
## [223]  70791.032  28464.276  41431.346         NA  14240.262         NA
## [229]        NA  52014.366  32865.058         NA  11903.929  17961.011
## [235]  14844.497  13077.396  76048.107  18843.875         NA  30737.511
## [241]  37983.026  18708.467  22636.970  29863.183  42799.606         NA
## [247]  43632.463 103600.943        NA         NA  10328.834  23659.805
## [253]  19126.024  17175.845  28017.230  54437.041         NA  20657.057
## [259]  13272.575         NA   8220.828         NA 108964.075         NA
## [265]   5845.741  26356.588         NA  59636.239  14854.811  45043.701
## [271]  47427.024         NA         NA  11804.979  27570.565  18173.976
## [277]        NA  22104.524  33908.940         NA         NA         NA
## [283]        NA  45862.941  23366.240  16165.694  10261.556         NA
## [289]  24026.928  33497.651        NA  15770.110  48190.121  33107.401
## [295]  20519.609  21387.730  15771.706  12630.582  28352.199  10399.711
## [301]  41162.369  16737.349  29576.590  28831.907  21618.872         NA
## [307]  26736.709  18660.400  10870.661  13069.784  35308.681  17142.505
## [313]  19616.870   1550.370         NA  11509.202  16574.358  94984.150
## [319]   9446.285  56370.430         NA  47899.078  27521.456  24907.229
## [325]  12797.637  34456.895         NA  19137.794   9082.608         NA
## [331]  20392.214   7635.398  15449.599         NA  11482.576         NA
## [337]  21319.064  17062.973  24482.018  19394.529  61929.256         NA
## [343]  29113.203  53044.431  17891.216  21665.733  21611.857  13915.027
## [349]  21715.000         NA  10523.637  31777.548  45932.499  16393.743
## [355]        NA  21020.829   9497.817         NA  11884.052  13594.631
## [361]        NA  32610.060  50496.496  23176.533  20838.975  27426.143
## [367]  51655.501  52241.022  27527.983  40947.425  26691.614  23152.573
## [373]  43419.737  44236.593  60396.602  15875.999  70561.697  17370.994
## [379]  10330.435  34844.884        NA  43839.492         NA  10259.928
```

```
## [385]  24344.124         NA  23490.643  15151.289  40052.674  31011.453
## [391]         NA  36300.595  28716.671  21430.732         NA  27977.292
## [397]  13912.492         NA         NA  45387.391  21638.866  12782.316
## [403]         NA         NA         NA  74279.377  19250.194  19647.872
## [409]  39022.265         NA         NA   9445.114  33097.292         NA
## [415]  23694.389  15498.136  13487.847   7309.707  63156.403  40543.550
## [421]  19939.256         NA         NA  26883.979         NA  18099.432
## [427] 125939.133         NA         NA  14391.178         NA  62045.506
## [433]  60194.052  36753.957         NA         NA  32061.537         NA
## [439]  67466.670  17624.458  24171.682  25912.917  67098.902         NA
## [445]  17695.994  18900.226  13125.296  17292.224  42209.926  23422.297
## [451] 118937.988         NA  18162.444         NA  46816.660         NA
## [457]  53237.908  23121.375  25937.746         NA  47637.068         NA
## [463] 127540.554         NA  12310.802  24271.988  15500.675  16106.789
## [469]  15965.471  54296.492         NA         NA  14363.297 153749.934
## [475]  59143.016  18520.846   6227.675  13606.978         NA         NA
## [481]  49146.996 103896.484  38059.728  41076.716         NA  30013.153
## [487]  41805.513  20113.277  24071.440         NA         NA   8488.143
## [493]  24344.639         NA         NA  44921.367  26262.993  16880.232
## [499]  14441.998         NA
```

```
library(dplyr)
```

```
dino_table %>%
  rowwise() %>%
  mutate(masses = get_mass_from_length_by_name(lengths, species)) %>%
  filter(!is.na(masses)) %>%
  ggplot() +
  geom_histogram(mapping = aes(x = masses, color = species)) +
  facet_wrap(~species)
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```




```
library(ggplot2)
```

```
# ????
dino_names <- c("Sauropoda", "Stegosauria", "Theropoda")
a_values <- c(214.44, 10.95, 0.73, 25.37)
b_values <- c(1.46, 2.64, 3.63, 2.49)
dino_masses <- vector(mode = "numeric", length = length(dino_names))
for (i in 1:length(dino_names)){
  dino_masses[i] <- a[i] * length[i]^b[i]
}
```

```
## Error in eval(expr, envir, enclos): object 'a' not found
```

```
dino_masses
```

```
## [1] 0 0 0
```