How-To-R: A tutorial series on coding, and data analysis for Biologists

Part 1

OKR

2025-06-04

Created for training members of Lab 6 at UM MMB.
Loosely adapted from "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R" by Robert Knell.

(0.0) How to follow this tutorial

```
#things in grey boxes are command inputs, you should try passing the commands as you go
```

```
#Things precedded by "##" are command outputs, compare your output with ones here
```

(1.0) Navigating RStudio

(1.1) Fresh start with Consoles

Open RStudio. You should notice *three* sections in the interface.
1. **Console**, by default this takes up most of the left side
2. **Environment**, top-right side. this will get populated with *objects* as we work
3. **Viewer**, bottom-right side. several tabs, but importantly plots will appear here

The **Console** is where we input *commands*, which R will interpret, and then provide an output. the ">" symbol shows that the console is ready to receive instruction. Let's try simple mathematics in the console.

Type the expression below in the console, and press **ENTER** for R to process it

```
2+2
```

```
## [1] 4
```

the "[1]" at the beginning of the output is the **index**. it is saying that your output (i.e. 4), is the value at first position (i.e. [1]). Later on, we will generate output with a series of values, the brackets will help us visually track positions.

We can combine operators in a single command

```
(3*4)/6
```

```
## [1] 2
```

(1.2) Making Objects

Often we will do a series of transformations on values, it is helpful to **store** output in an **object**, which we can **recall** later

Let's make an **object** called *my_calculation* to store an output. Remember, objects are located in the top-right **Environment** window, it should still be empty since we have not asked R to store anything. The symbol to assign a value to an object is "<-". For example, below we will assign the calculation on the right side of "<-" to the object named on the left side of "<-".

```
first_calc <- (10*30)/(20-5)
```

notice that there's no output in the console this time! But now look at the **Environment** window, you should see your new object, and a preview of its value. We can **call** the value in the console using the name

```
first_calc
```

```
## [1] 20
```

Let's make a second object, and add them together

```
second_calc <- 3^3
first_calc + second_calc
```

```
## [1] 47
```

We can store this result in an object of course!

```
third_calc <- first_calc + second_calc
third_calc
```

```
## [1] 47
```

Each object created takes up memory from R and your machine (visual hint as a coloured disc on the Environments panel), using too much slows down potential processes going forward. You can check the object list using *ls()*. If you no longer need objects you can remove them with the *rm()* function

```
ls()
```

```
## [1] "first_calc"  "second_calc" "third_calc"
```

```
rm(third_calc)
ls()
```

```
## [1] "first_calc"  "second_calc"
```

trying to call *third_calc* should now return an error.

Exercises 1: Calculations and Objects

Use R to solve the following prompts (Solutions are at the end of this document if you wish to check!):
1. 4 x 6
2. 7ˆ2
3. Subtract 5 from 38 and then multiply the result by 3
4. Add 3.3 to 16 and then raise the answer to the power of 1.2 plus 1.2345
5. Add 3.3 to 16, raise the answer to the power to 1.2 and then add 1.2345
6. Divide 12 by 2.5 and then divide the answer by 3
7. Divide 2.5 by 3 and subtract the answer from 12
8. Create an object called "X1" which is the sum of 34 and 54.
Then create a second object called "X2" which is the product of 12 and 6.
Multiply X1 and X2 together and store the result as "X3".
Subtract 1 from X3 and calculate the 4th root (hint: a square root can be expressed as raising to the power of $\frac{1}{2}$)

Solutions to Exercises 1: Calculations and Objects

1. 24
2. 49
3. 99
4. 1347.998
5. 36.12191
6. 1.6
7. 11.16667
8. 8.921475

END of tutorial 1