# Data visualization in R

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# The IJC Bioinformatics Unit

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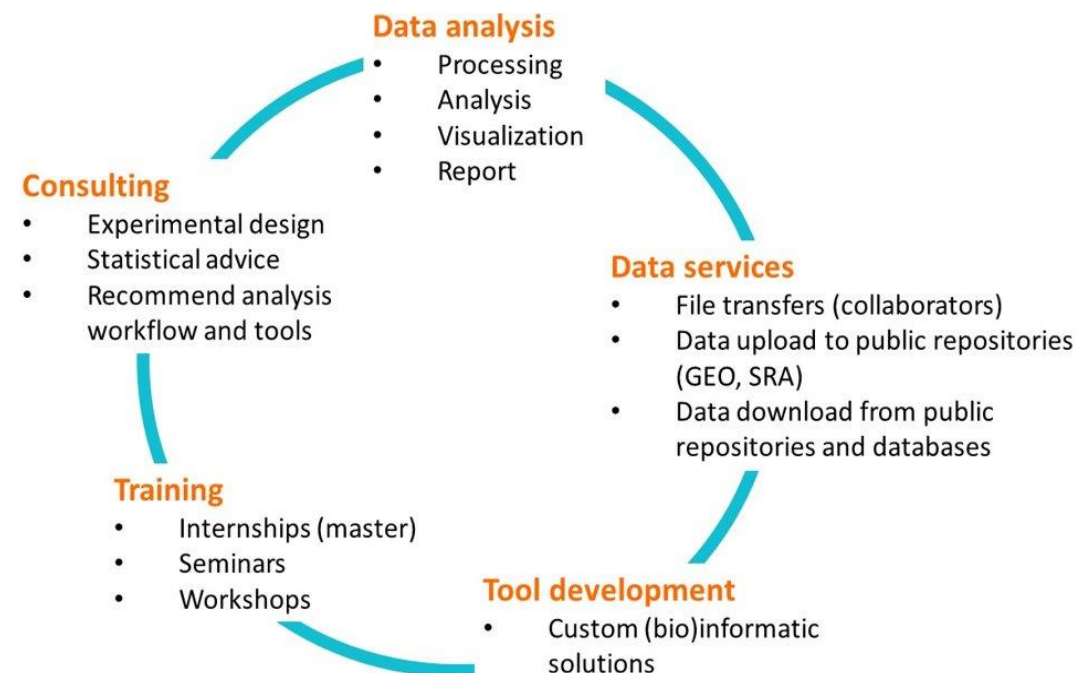Emilio Lario
Software Engineer

Marta Meroño
Bioinformatician

Paula Vela
Bioinformatician
(Student)

**Consulting**
- Experimental design
- Statistical advice
- Recommend analysis workflow and tools

**Data analysis**
- Processing
- Analysis
- Visualization
- Report

**Data services**
- File transfers (collaborators)
- Data upload to public repositories (GEO, SRA)
- Data download from public repositories and databases

**Tool development**
- Custom (bio)informatic solutions

**Training**
- Internships (master)
- Seminars
- Workshops

Office: 1st floor;  phone: 4300
https://ijcbit.eu
https://www.carrerasresearch.org/en/bioinformatics-unit

# Materials

Course book:

[R for Data Science, 2nd edition (Wickham, Cetinkaya-Rundel and Grolemund, 2023)](R for Data Science, 2nd edition (Wickham, Cetinkaya-Rundel and Grolemund, 2023))

BIT course webpage:

[https://ijcbit.github.io/Workshops/](https://ijcbit.github.io/Workshops/)

# Data visualization in R

packages:

- {graphics} for basic graphic

- {lattice}, for high level data visualizations for multivariate data

- {ggplot2} coherent system for data visualizations based on 'the grammar of graphics'

- {ggpubr} publication-ready pots based on ggplot2

- {ComplexHeatmap}, {pheatmap} for specialized graphic such as heatmaps

- {gviz} vizualization of genomic data

# The Tidyverse

Tidy verse = collection of approx. 25 packages for manipulation, visualization, transformation of "tidy data" (incl ggplot2)

Tidy data (and data frames aka 'tibbles'):
= each value is placed in its own "cell",
    each variable in its own column,
    and each observation in its own row.

```
table1
#> # A tibble: 6 × 4
#>   country      year  cases population
#>   <chr>       <dbl>  <dbl>      <dbl>
#> 1 Afghanistan  1999    745   19987071
#> 2 Afghanistan  2000   2666   20595360
#> 3 Brazil       1999  37737  172006362
#> 4 Brazil       2000  80488  174504898
#> 5 China        1999 212258 1272915272
#> 6 China        2000 213766 1280428583
```

```
table2
#> # A tibble: 12 × 4
#>   country      year type           count
#>   <chr>       <dbl> <chr>          <dbl>
#> 1 Afghanistan  1999 cases            745
#> 2 Afghanistan  1999 population  19987071
#> 3 Afghanistan  2000 cases           2666
#> 4 Afghanistan  2000 population  20595360
#> 5 Brazil       1999 cases          37737
#> 6 Brazil       1999 population 172006362
#> # i 6 more rows
```

```
table3
#> # A tibble: 6 × 3
#>   country      year rate
#>   <chr>       <dbl> <chr>
#> 1 Afghanistan  1999 745/19987071
#> 2 Afghanistan  2000 2666/20595360
#> 3 Brazil       1999 37737/172006362
#> 4 Brazil       2000 80488/174504898
#> 5 China        1999 212258/1272915272
#> 6 China        2000 213766/1280428583
```

# Base R and the tidyverse

**BaseR**

- better for software development

- better for running quick simulations

- generally faster performance

- more appealing to users with previous programming experience

Use if:

- Most of your work involves software or package development, advanced statistical procedures, or computationally expensive operations

- You're used to other languages that have more in common with Base-R

- Most of your collaborators and online network use it too

**Tidyverse**

- ease of use, functions have the same structure and easier names, enables reading functions as instructions

- quick and easy data manipulation

- grouping datasets with many variable for summary statistics with dplyr

- over 25 packages in the tidyverse, each requiring its own updates to stay current
  -> adds overhead, difficult to reproduce, limits submission to code repros as R cran or bioconductor

Use if:

- Most of your work involves data cleaning, visualization, and common statistics

- You're newer to R and find it easier to read and understand than base-R

- Most of your collaborators and online network use it too

# The Grammar of Graphics

- Variables are mapped to visual properties (aesthetics) : aes()

- Values of the aesthetic are assigned to each unique level (or values) of the variable = "scaling"

- Data is represented as = geom_*()

- Data might be transformed (rescaled) as part of the representation

# Practical session

R for Data Science, 2nd edition (Wickham)

- Chapter 1
  - Building up a plot: ggplot(), mappings = aes(), representations = geoms_*()
  - Visualizing distributions of variables and relationships between variable for exploratory analysis

- Chapter 9
  - Adding layers
  - Mapping aesthetics to groups (general vs specific)
  - Aesthetics mapping vs geom_* attributes
  - Grouping by facets

- Chapter 11
  - Labels
  - Guides (legends)
  - Scales
  - Coordinate systems
  - Themes

# Further resources

Tutorials:

- [Datanovia](#)

Inspirations with code examples:

- [R gallery](#)

GGplot2 extensions:
- [https://exts.ggplot2.tidyverse.org/gallery/](https://exts.ggplot2.tidyverse.org/gallery/)

# Questions?

# Thank you!