

Reproducible papers in the life sciences using R

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Introduction

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- However, R is rarely used in the life sciences as a default method to create papers
- Why?

Reasons

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- “R is just for Stats”
- “There is a learning curve”
- **“I can’t create figures for publication”**

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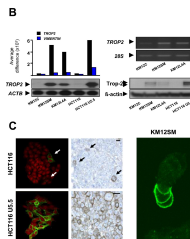
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- Papers in the life sciences usually require figures where the following are combined:
 - Images from cells/tissues
 - Figures that summarize data
 - Figures that present statistical analyses (with “p-values”)

The Problem

Figure 1: A typical figure



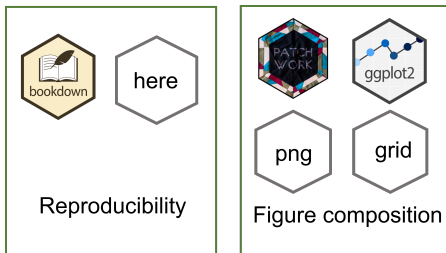
Guerra et al. *Neoplasia*
2021

- Can figures like this be created using 'RMarkdown'?

The Solution

- Yes, we can create figures like this using R!

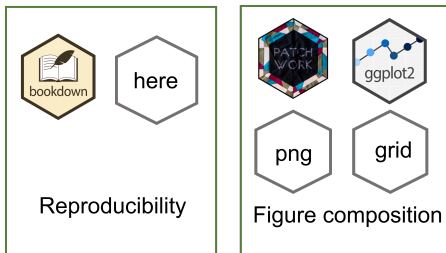
Figure 2: The packages



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- Yes, we can create figures like this using R!
- We will need to use a combination of packages to achieve this

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 - Each section of the paper: (Materials and Methods, Results, etc.) is in a separate `Rmd` file
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- **here** allows to easily call scripts within the document (we will look at this later)

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 - Want to create a composite figure of images/data analysis

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 - Have written your paper sections (Methods, Results, etc) each section is in a Rmd file
 - Have some images
 - Have some data that needs to be analyzed
 - Want to create a composite figure of images/data analysis
 - **For the sake of time, I will focus on the image composition/data analysis part**

Project Organization

- How to organize the files:

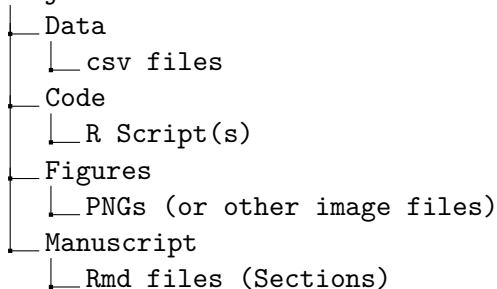
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 - Reading the images is achieved by `grid` and `png`
 - `ggplot2` creates the plot of our analysis
 - `patchwork` allows us to assemble everything

A Handy Script: Images

- How do we read a PNG image?

```
cells<-rasterGrob(readPNG(here("figures",  
                              "cells.png"),  
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- We use [here](#) to call the PNG file located in the “figures” directory.

A Handy Script: Data Analysis

```
# for regression

formula<-y~x

# create a plot of the data and the regression
a1<-ggplot(data=data,
           aes(x=weight,y=body_fat,fill=Group,color=Group))
  +
  geom_point(show.legend=FALSE,shape=21,colour='black',size=5,
            alpha=0.7)+
  geom_smooth(method="lm",formula=formula, se=T)+
  stat_poly_eq(use_label(c("R2","p.value")),
              formula = formula, size = 3)
```

- Try **ggpmisc**

A Handy Script: Layout

- Provide a layout for the figure <https://patchwork.data-imaginist.com/articles/guides/layout.html>

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```
layout<-"  
AAAABBBB  
AAAABBBB  
AAAABBBB  
AAAABBBB  
CCCCDDDD  
CCCCDDDD  
CCCCEEEE  
CCCCEEEE  
"
```

A Handy Script: Assemble!

- Use `wrap_elements` and `patchwork`

```
image_a<-wrap_elements(  
  panel=cells  
) +  
  wrap_elements(  
    panel=molecule  
  ) +  
  wrap_elements(  
    panel=jellyfish  
  ) +  
  ylab("jellyfish") +  
  a1 +  
  a2 +  
  plot_layout(design=layout)
```

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- We can use R to create reproducible papers and complex figures
- There **is** a learning curve, but once you learn you won't go back to W**d!

Acknowledgments

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