



浙江大学爱丁堡大学联合学院  
**ZJU-UoE Institute**

## R Markdown - Why and How?

ADS 2, Lecture 12

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# The Reproducibility Crisis



This lecture is about . . .

. . . how to make your data analysis reproducible by using R markdown

# Learning Objectives

After this lecture, you should be able to ...

- Explain what a markdown language is
- Discuss reasons for using R markdown

# Outline

1 Basic definitions and reminders

2 What is Markdown?

3 Idea behind R Markdown

# Reproducibility vs Replicability

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*What differences do you see between replicability and reproducibility?  
What do they have in common? Can you imagine obstacles to achieving replicability or reproducibility?*

# Reproducible research

*Have you come across techniques or ideas that are designed to make research more reproducible?*



# Reproducible research

*Have you come across techniques or ideas that are designed to make research more reproducible?*



- Tidy data
- Publishing data
- Documenting code
- Publishing code
- Methods sections in publications
- Peer review (?)
- Preregistration
- Standards and protocols
- ...

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But first ...

What is Markup?

# Markup languages

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Example: html (hyper text markup language)

```
<dt>News</dt>
<dd>
<p>
<em>October 2019</em> - We welcome new MSc student <b>Aleksandra Slawinska</b> to the lab. Aleksandra is co-supervised by <b>Joanne Murray</b> and will be working on growth hormone signalling.
</p>
</dd>

<dd>
<p>
<em>September 2019</em> - <b>Mela</b> is speaking at the <b><a href="https://www.mariecuriealumni.eu/mcaas-events/failed-bored-conference">Failed and Bored</a></b> conference in Innsbruck this month.
</p>
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<p>
<em>September 2019</em> - Congratulations to <b>Carine, Giorgos, Jesus, Thomas,</b> and <b>Tom</b> for <b>submitting their MSc dissertations!</b>
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</dd>

<p>
<a href="http://stefanlab.net/news.html">Read all news</a>
</p>
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The screenshot shows a website header with "stefan lab" and navigation links for "Publications" and "Jobs". Below the header, there are two news items. The first news item is titled "October 2019 - We welcome new MSc student Aleksandra Slawinska to the lab. Aleksandra is co-supervised by Joanne Murray and will be working on growth hormone signalling.". The second news item is titled "September 2019 - Mela is speaking at the Failed and Bored conference in Innsbruck this month. Congratulations to Carine, Giorgos, Jesus, Thomas, and Tom for submitting their MSc dissertations!". At the bottom of the news section is a link "Read all news".

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Other examples?

# Markdown

Markdown is a “light-weight” markup language.

- simple syntax
- easy to read and write
- can be converted into markup (e.g. html)

```
11
12
13 # Markdown intro
14
15 Markdown is *awesome*, look at what it can
do, for instance:
16
17 - itemize
18 - itemize some more
19 - **formatting**
20 - [some_website.html](hyperlinks)
21
22
23
```

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# Main idea of R Markdown

Code and documentation in one document. This is done through a combination of formatting (using Markdown) and the inclusion of “code blocks”, which are both reported and executed in the final document

The screenshot shows the RStudio interface with two panes. The left pane displays the R Markdown file (R\_markdown.Rmd) with the following content:

```
23 # R Markdown intro
24
25 R markdown can do the same *typesetting* that Markdown
26 does.
27 - itemize
28 - itemize some more
29 - **formatting**
30 - [some_website.html](hyperlinks)
31
32
33 But: You can also include R code:
34
35 ``{r}
36 hist(rnorm(100),col="pink", main="Histogram")
37 ...
38
```

The right pane shows the rendered output of the R Markdown file, titled "R Markdown intro". It includes a bulleted list and a histogram. The histogram has the following approximate data:

Bin Range	Frequency
-3.0 to -2.5	1
-2.5 to -2.0	8
-2.0 to -1.5	0
-1.5 to -1.0	35
-1.0 to -0.5	32
-0.5 to 0.0	0
0.0 to 0.5	15
0.5 to 1.0	0
1.0 to 1.5	3
1.5 to 2.0	0
2.0 to 2.5	2
2.5 to 3.0	0
3.0 to 3.5	1
3.5 to 4.0	0

# Why use R Markdown?

You work in biomedical informatics. In what situations would it be useful to use R Markdown, and why?



# What questions do you have?

Now, you should be able to ...

- Explain what a markdown language is
- Discuss reasons for using R markdown

## Optional further reading

- Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. Nature News, 533(7604), 452. <https://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970>

# Image credits

- Example of html code and the resulting webpage (screenshot). My own work (2019), CC-BY-SA 3.0.
- Example of markdown code (screenshot). My own work (2019), CC-BY-SA 3.0.
- Example of R Markdown code and resulting file (screenshot). My own work (2019), CC-BY-SA 3.0
- Reproducibility crisis screenshot. From: Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. Nature News, 533(7604), 452. <https://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970>
- Three students working on computers. By Yuuki Guzman and Agoston Tyll (Okinawa Institute of Science and Technology), 2015.
- Two students working on an experiment together. By Yuuki Guzman (Okinawa Institute of Science and Technology), 2016.