

A cartoon illustration of a mouse wearing a white lab coat, a yellow tie, and a red bow tie. It has large pink ears and glasses. The mouse is sitting at a brown wooden desk, looking at a laptop screen. A blue chair is visible in the foreground.

# Write a Paper in

*Christelinda Laureijs*

R

Set up an  
R project



**Julia Riley**  
Assistant  
Professor



Track  
changes in  
your files



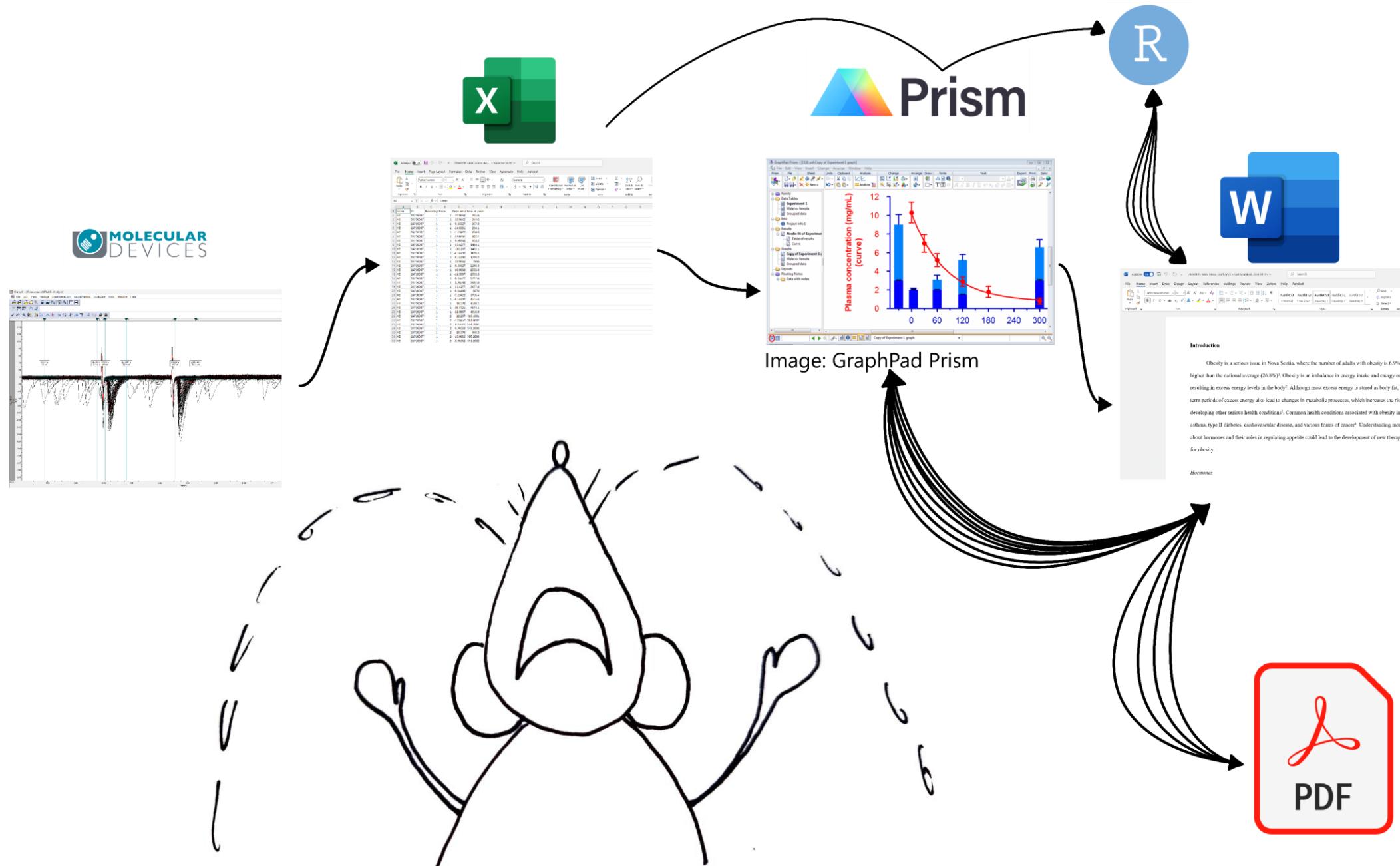
**Elizabeth Stregger**  
Data and Digital  
Services Librarian

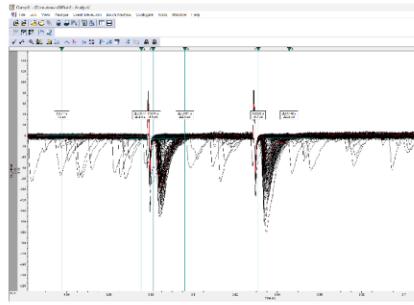
L<sup>A</sup>T<sub>E</sub>X

Write a  
paper in R



**Christelinda Laureijs**  
M.Sc. Candidate in  
Biology





- ✓ More efficient
- ✓ Fully reproducible
- ✓ NO MORE manual formatting!!
- ✓ Plaintext files – no proprietary software, small size
- ✓ Track with Git



Prism

R



Introduction

Obesity is a serious issue in New Zealand, where the number of adults with obesity is 6.8% higher than the national average (20.4%). Obesity is an imbalance in energy intake and energy output resulting in excess energy levels in the body.<sup>1</sup> Although excess energy is stored in body fat, long-term periods of excess energy also lead to changes in metabolic processes, which increases the risk of developing other serious health conditions<sup>2</sup>. Common health conditions associated with obesity include asthma, type 2 diabetes, cardiovascular disease, and various forms of cancer.<sup>3</sup> Understanding more about how excess energy is regulated appears could lead to the development of new therapies for obesity.



PDF

## **This workshop covers:**

- ✓ Figures + captions
- ✓ Inline statistics and tables
- ✓ Table of Contents, list of figures ...etc.
- ✓ Basic LaTeX customization
- ✓ Citation

## **This workshop does not cover:**

- Importing & cleaning data
- Statistical analysis
- Data visualization

**Workshop format: Lecture + question/help period**

1. Identify paper **sections** and build **outline** in R

*Knit to pdf!*

2. Insert **figures** and captions

*Knit to pdf!*

3. Run statistical **analyses**

*Knit to pdf!*

4. Insert statistical results as **tables** and **inline-text**

*Knit to pdf!*

5. Insert **citations**

*Knit to pdf!*

6. Advanced **figures**

*Knit to pdf!*

7. **Customize** font, page layout, margin, etc.

*Knit to pdf!*

# CASE STUDY

## **My honours thesis**

<https://github.com/christelinda-laureijs/honours-thesis>

The effect of insulin on excitatory synaptic  
transmission in the rat dorsomedial  
hypothalamus

by

Christelinda Laureijs

A thesis submitted to the  
Department of Biology  
Mount Allison University  
in partial fulfillment of the requirements for the  
Bachelor of Science degree with Honours  
in Biology

April 10, 2024

# Contents

## Numbering

Abstract	i
List of Figures	iv
List of Abbreviations	v
Introduction	I
Hormones . . . . .	I
Insulin . . . . .	2
The Dorsomedial Hypothalamus . . . . .	4
The Current Study . . . . .	6
Methods	7
Animals . . . . .	7
Brain Removal & Slice Preparation . . . . .	7
Recording . . . . .	8

## **Heading 1** →

## Methods

### *Heading 2* →

### *Animals*

I used young (28-44 days old) male and female Sprague-Dawley rats from Charles River Laboratories (Québec, Canada) for all treatment groups. The rats arrived when they were 22 days old, and they had a one-week acclimation period. The rats lived in groups of 4 with free access to standard rat chow and water. All cages had wood shavings for bedding, toys (wooden blocks and a plastic chew toy) for enrichment and Crawl Balls™ (Bio-Serv) for shelter. The animal rooms were maintained at 21°C and 50% ± 10% humidity, with a 12-hour light/dark cycle. The Animal Care Committee at Mount Allison University approved the project (Protocol #103088).

### *Heading 2* →

### *Brain Removal & Slice Preparation*

# Québec,

Advanced typography,  
e.g. contextual alternates

*Full justification with no rivers*

## Methods

### *Animals*

I used young (28-44 days old) male and female Sprague-Dawley rats from Charles River Laboratories (Québec, Canada) for all treatment groups. The rats arrived when they were 22 days old, and they had a one-week acclimation period. The rats lived in groups of 4 with free access to standard rat chow and water. All cages had wood shavings for bedding, toys (wooden blocks and a plastic chew toy) for enrichment and Crawl Balls<sup>TM</sup> (Bio-Serv) for shelter. The animal rooms were maintained at 21°C and 50% ± 10% humidity, with a 12-hour light/dark cycle. The Animal Care Committee at Mount Allison University approved the project (Protocol #103088).

### *Brain Removal & Slice Preparation*

Auto-updating p-values!

nsulin significantly de-

d ( $p < 0.001$ ; Figure 8).

Automated cross-referencing

the first five minutes of

# Auto-updating tables & results

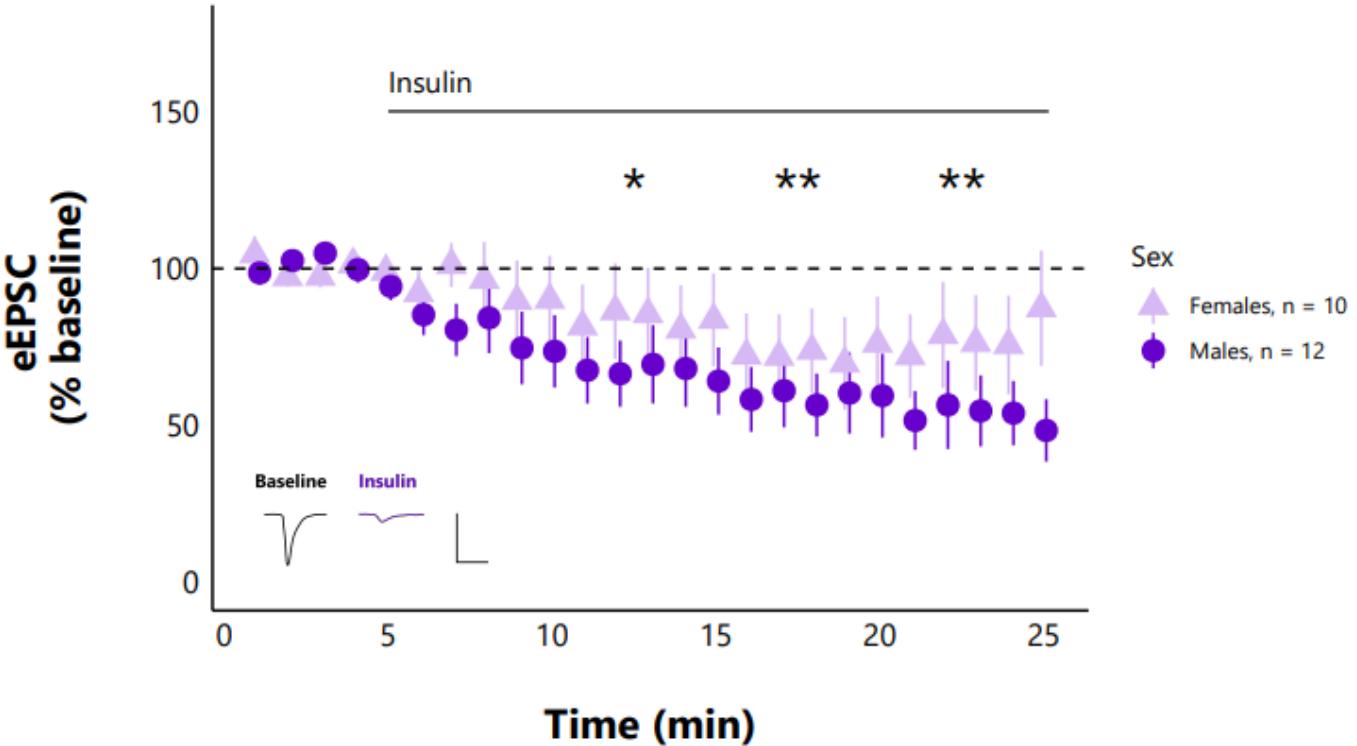
Table 1: A Wilcoxon signed-rank test shows that insulin significantly affects action potential amplitudes, thresholds, and half-widths. Insulin does not significantly affect the latency to fire, afterhyperpolarization amplitude, or the time of afterhyperpolarization.

Parameter	df	Statistic	p-value
Peak amplitude	15, 15	120	< 0.001
Threshold	15, 11	63	0.005
Latency to fire	15, 11	31	0.90
Half-width	15, 11	2	0.003
After-hyperpolarization amplitude	15, 11	35	0.90
After-hyperpolarization time	15, 11	17	0.17

Insulin significantly decreases action potential amplitude relative to baseline amplitudes ( $W(15, 15) = 120$ ,  $p = < 0.001$ ; Figure 7C). In four recordings, there were no amplitudes after insulin exposure, so additional action potential parameters could not be measured. Of the action potentials that did fire after insulin exposure, the threshold decreased significantly ( $W(15, 11) = 63$ ,  $p = 0.005$ ; Figure 7D). Action potential

# List of Figures

1	Insulin binding activates a series of molecular pathways. . . . .	3
2	The DMH interacts with many brain regions . . . . .	5
3	Whole-cell patch clamp electrophysiology uses two electrodes to manipulate and record from living neurons . . . . .	9
4	The current clamp steps protocol with labelled action potential properties . . . . .	12
5	A schematic of the evoked currents protocol. . . . .	13
6	I removed rat brains, recorded from DMH neurons, and compared recordings before and after insulin exposure . . . . .	15
7	Insulin changes action potential characteristics in DMH neurons . . . . .	17
8	Insulin significantly decreases evoked excitatory current amplitudes in DMH neurons . .	19
Short captions		



# Caption

Same figure: different caption than in the list of figures!

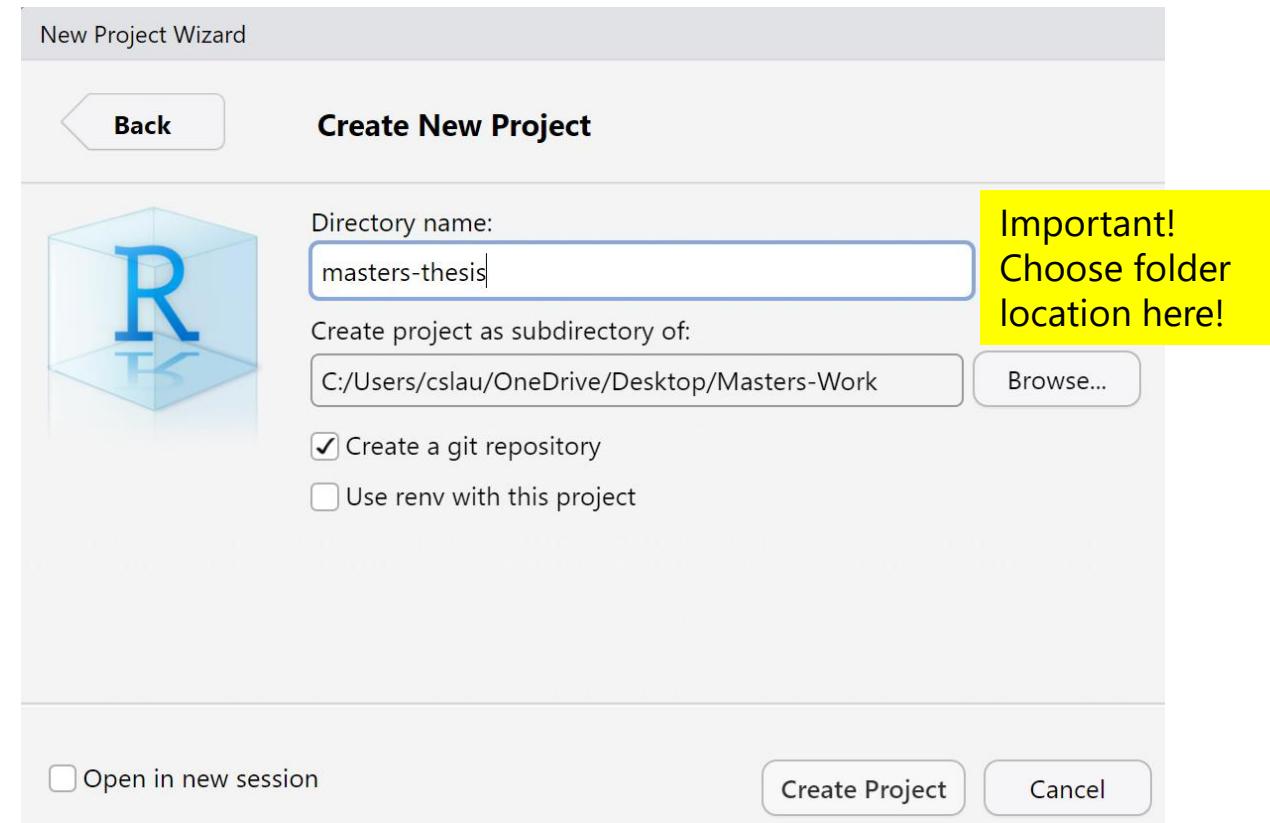
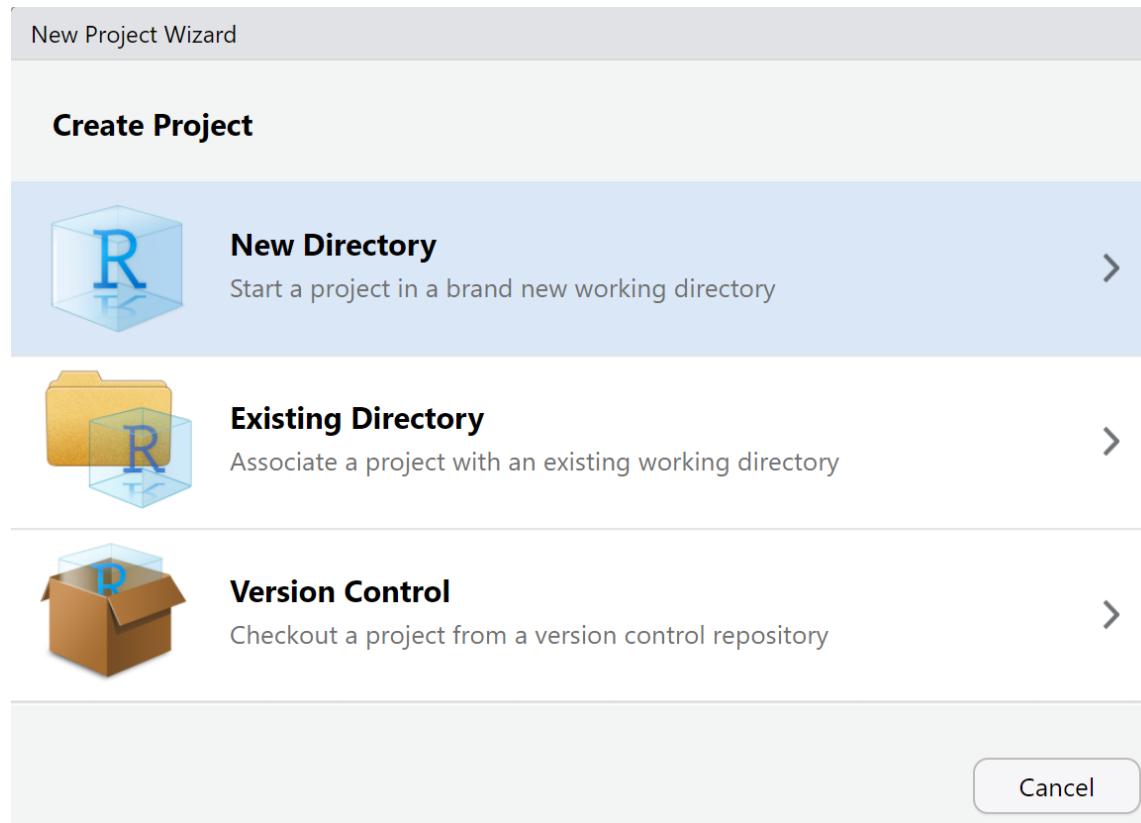
**Figure 8:** Insulin significantly decreases excitatory evoked post-synaptic current (eEPSC) amplitude over time in both sexes, with no significant differences between the sexes. I exposed DMH neurons to 500 nM of insulin from 5 minutes and onward. Each point represents the mean eEPSC amplitude ( $\pm$  the standard error) across all cells and  $n$  represents the number of unique cells. The asterisks indicate a statistically significant decrease in current amplitude relative to the baseline (t-test; \* =  $p < 0.05$ , \*\* =  $p < 0.01$ , \*\*\* =  $p < 0.001$ ). The representative traces consist of eEPSCs from one cell averaged over the baseline period (0 to 5 min) and last interval (20 to 25 min) of the recording, and the scale bar represents 50 pA/20 ms.

*Insulin may bind to insulin-like growth factor 1 receptors on*



# Setup

# 0. Open an R Project (existing or start a new one)



## 0. Set up folders



masters-thesis.Rproj



README.md

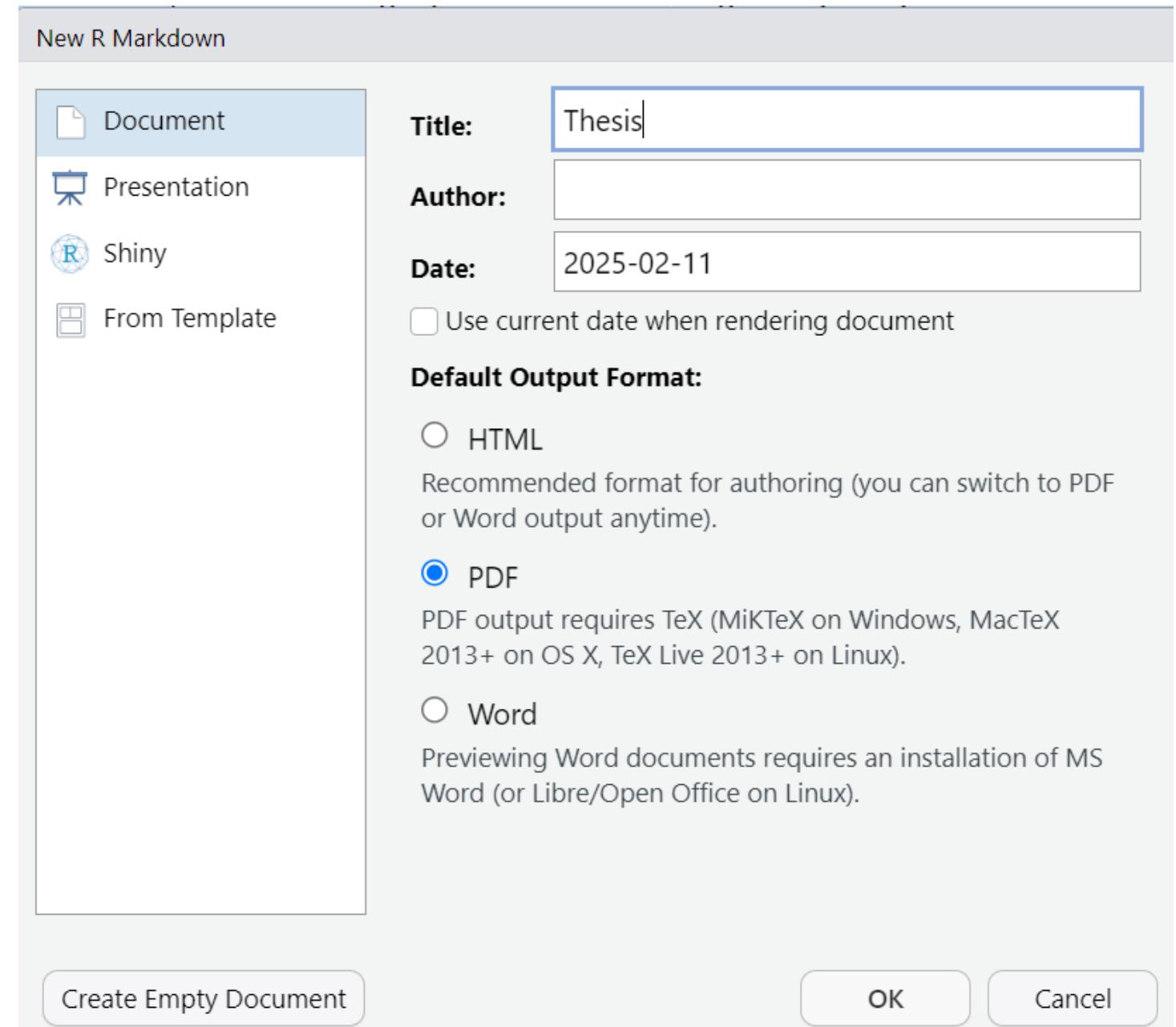


Thesis



Figures

1. File → New file  
→ RMarkdown



2a. PDF output

2b. "Save as" in the  
"Thesis" folder



### 3. **Knit** to PDF

Untitled

2025-02-11

#### R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed          dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Ugly, but it works!

#### Including Plots

You can also embed plots, for example:

4. Delete all filler content, fill with your headers

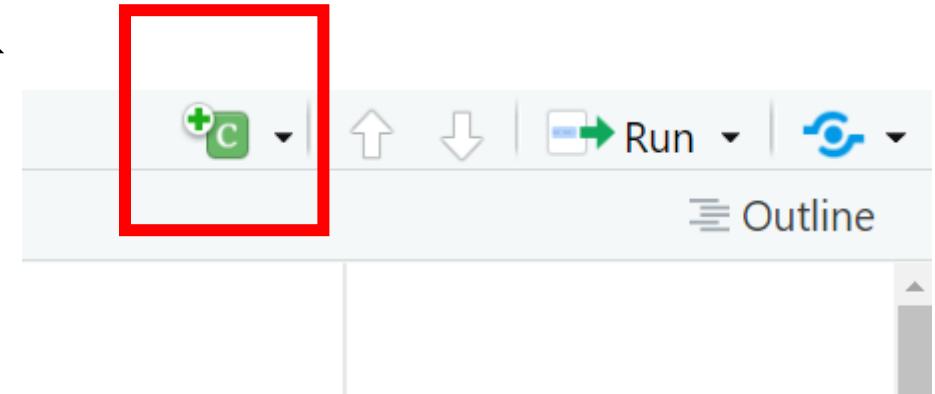
**#** = *Level 1*

**##** = *Level 2*

```
1 ---  
2 title: "Thesis"  
3 output: pdf_document  
4 ---  
5  
6 # Introduction  
7  
8 # Methods  
9  
10 ## Animals  
11  
12 ## Reagents  
13  
14 # Results  
15  
16 # Discussion  
17  
18
```

## 5a. Insert a new code chunk

Ctrl + Alt + I



5a. Name it (e.g. "setup")  
and add echo = FALSE  
to hide it

```
---
```

```
title: "Thesis"
```

```
output: pdf_document
```

```
---
```

```
```{r setup, echo = FALSE}
```

```
...
```

## 5c. Create a set-up chunk

```
```{r setup, echo = FALSE}
knitr::opts_chunk$set(
  dev = c("cairo_pdf"),
  dpi = 600,
  fig.align = "center",
  out.width = "100%",
  comment = NA,
  echo = FALSE,
  message = FALSE,
  warning = FALSE
)
```
```

Searchable text in figures (e.g. axis titles)

High-quality figure resolution

Set default width of the figures (% total page content width)

Remove ## in front of chunk output

Hide warnings and code chunks in output PDF

# Figures

## 6. Load libraries in a new chunk

```
library(ggplot2)  
library(dplyr)  
library(here)
```

In this tutorial, you  
will also need these:

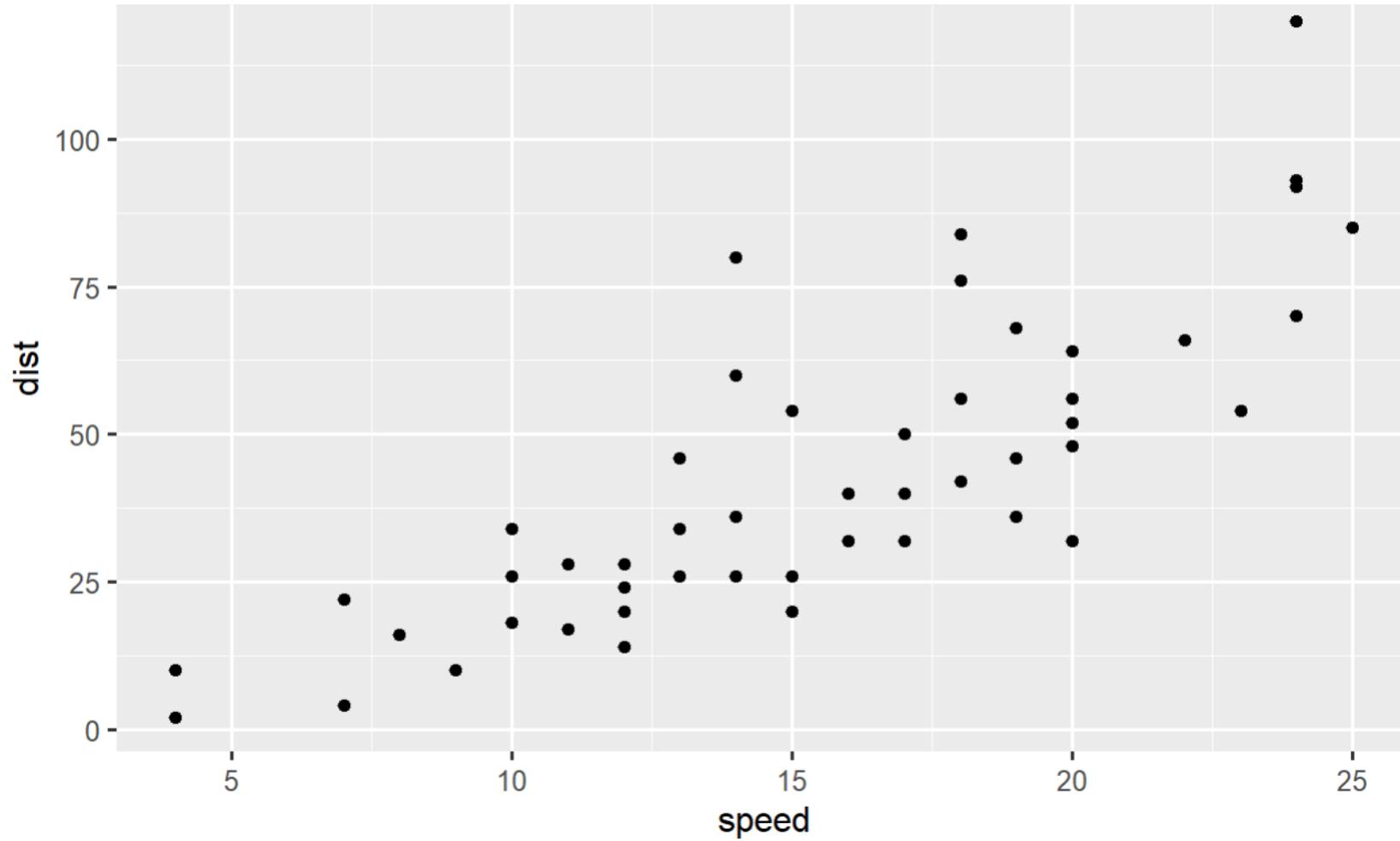


```
library(lazyWeave)  
library(broom)  
library(stringr)  
library(knitr)
```

## 7. Create a simple plot

```
cars %>%  
  ggplot(aes(x = speed, y = dist)) +  
  geom_point()
```

# 7b. Marvel at its beauty



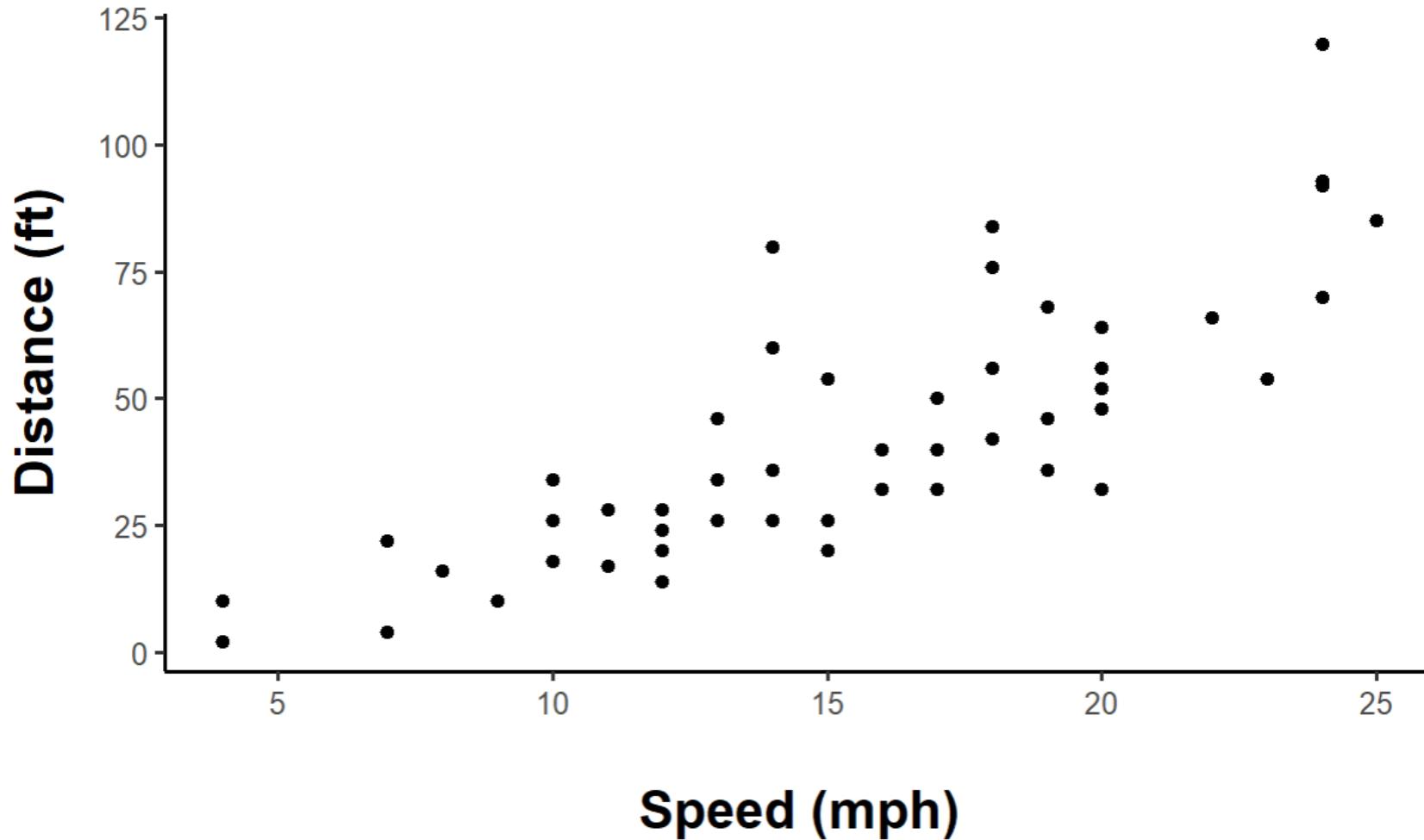
# 8. Make plot look better

```
cars %>%  
  ggplot(aes(x = speed, y = dist)) +  
  geom_point() +  
  labs(x = "Speed (mph)", y = "Distance (ft)") +  
  theme_classic() +  
  theme(text = element_text(color = "black"),  
        axis.title = element_text(size = 15, face = "bold"),  
        axis.title.x = element_text(margin = margin(t = 20)),  
        axis.title.y = element_text(margin = margin(r = 10)),  
        plot.margin = margin(20, 20, 20, 20))
```

Axis titles  
No grid

Better  
margins

## 8. Better!



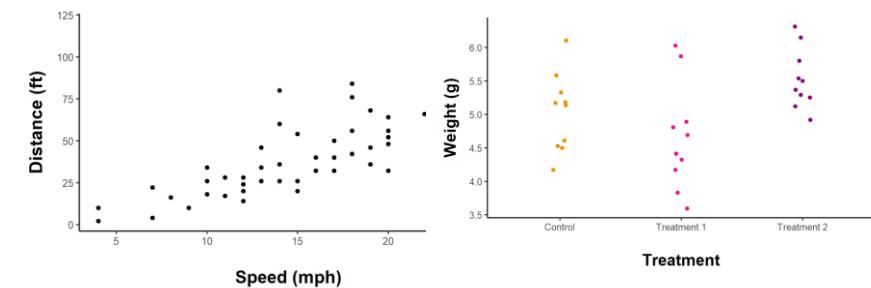
# 8b. Set default theme for all ggplots

Use `theme_set()` in a chunk near the top of the document

```
theme_set(theme_classic() +  
  theme(text = element_text(color = "black"),  
        axis.title = element_text(size = 15, face = "bold"),  
        axis.title.x = element_text(margin = margin(t = 20)),  
        axis.title.y = element_text(margin = margin(r = 10)),  
        plot.margin = margin(20, 20, 20, 20)))
```

Reduces repetitive theme code in all plots

```
cars %>%  
  ggplot(aes(x = speed, y = dist)) +  
  geom_point() +  
  labs(x = "Speed (mph)", y = "Distance (ft)")
```



## 9. Add caption (**fig.cap**) and short caption (**fig.scap**)

```
```{r cars-plot, fig.cap = "Faster cars take a longer distance to stop.", fig.scap = "Stopping distance of cars"}
```



## 10. Add a **\tableofcontents** and **\listoffigures**

**\tableofcontents**

**\listoffigures**

**# Introduction**

# 11. Knit to PDF!

Do NOT worry about formatting, fonts or spacing yet!

## Contents

<b>Introduction</b>	<b>1</b>
<b>Methods</b>	<b>1</b>
Animals . . . . .	1
Reagents . . . . .	1
<b>Results</b>	<b>1</b>
<b>Discussion</b>	<b>1</b>

## List of Figures

fig.scap

1	Stopping distance of cars . . . . .	2
---	-------------------------------------	---

## 12. Cross-reference image with `\ref{}`

```
```{r cars-plot, fig.cap = "Faster cars take a longer distance to stop.  
\label{cars-plot}", fig.scap = "Stopping distance of cars"}
```

Must put `\label{}` INSIDE the fig.cap quotations! No spaces!

faster cars took longer distances to stop (Figure `\ref{cars-plot}`).

faster cars took longer distances to stop (Figure 1).

Clickable!

# 13. (Optional) change other parameters in the chunk options

```
```{r cars-plot}
#| fig.cap = "Faster cars take a longer distance to stop. \\label{cars-plot}",
#| fig.scap = "Stopping distance of cars"
#| out.width = "75%"
```

Use #| to extend chunk options into a new line

\textit{} = italics

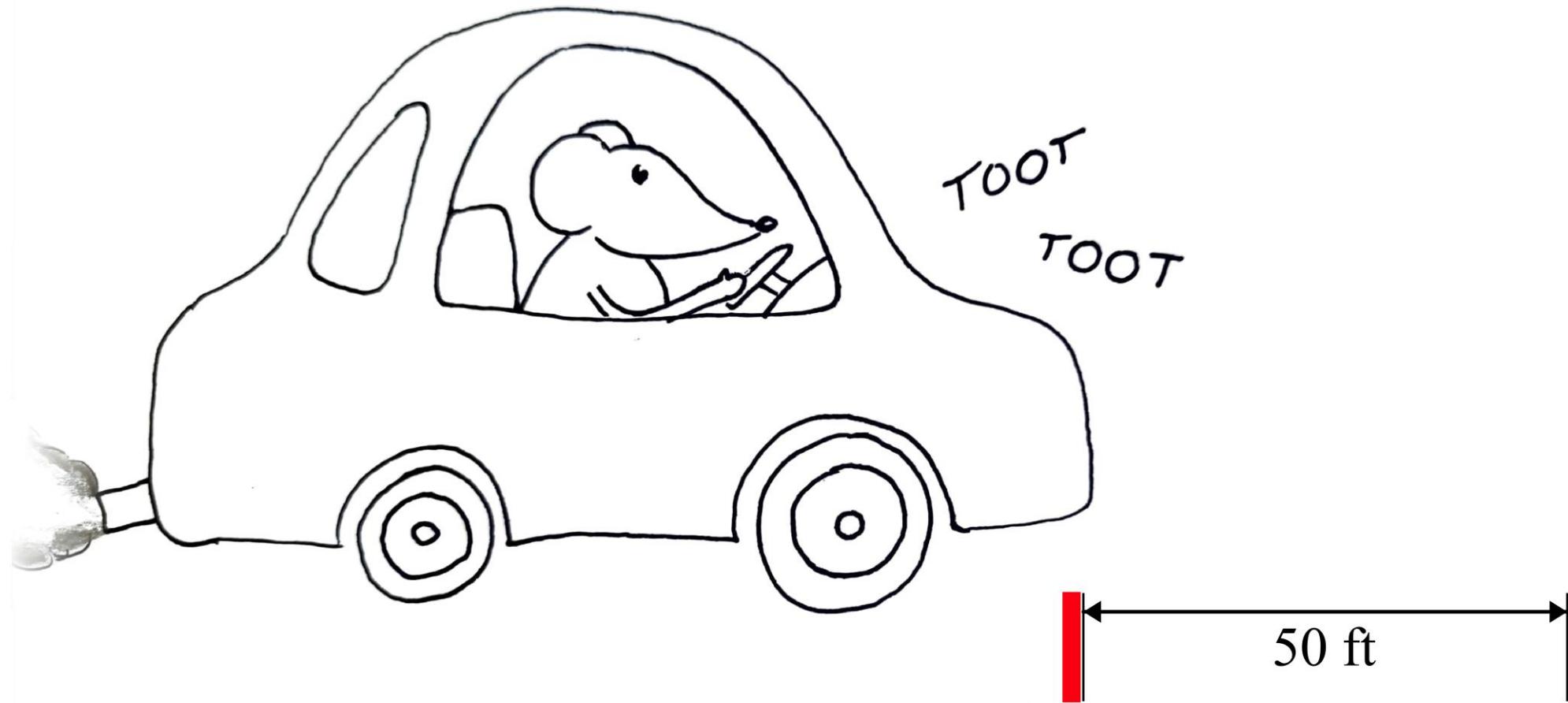
Use \ to cancel special characters like " or '

```
fig.cap = "Faster cars take a \textit{longer} distance to \"stop\".
```

Figure 1: Faster cars take a *longer* distance to "stop".

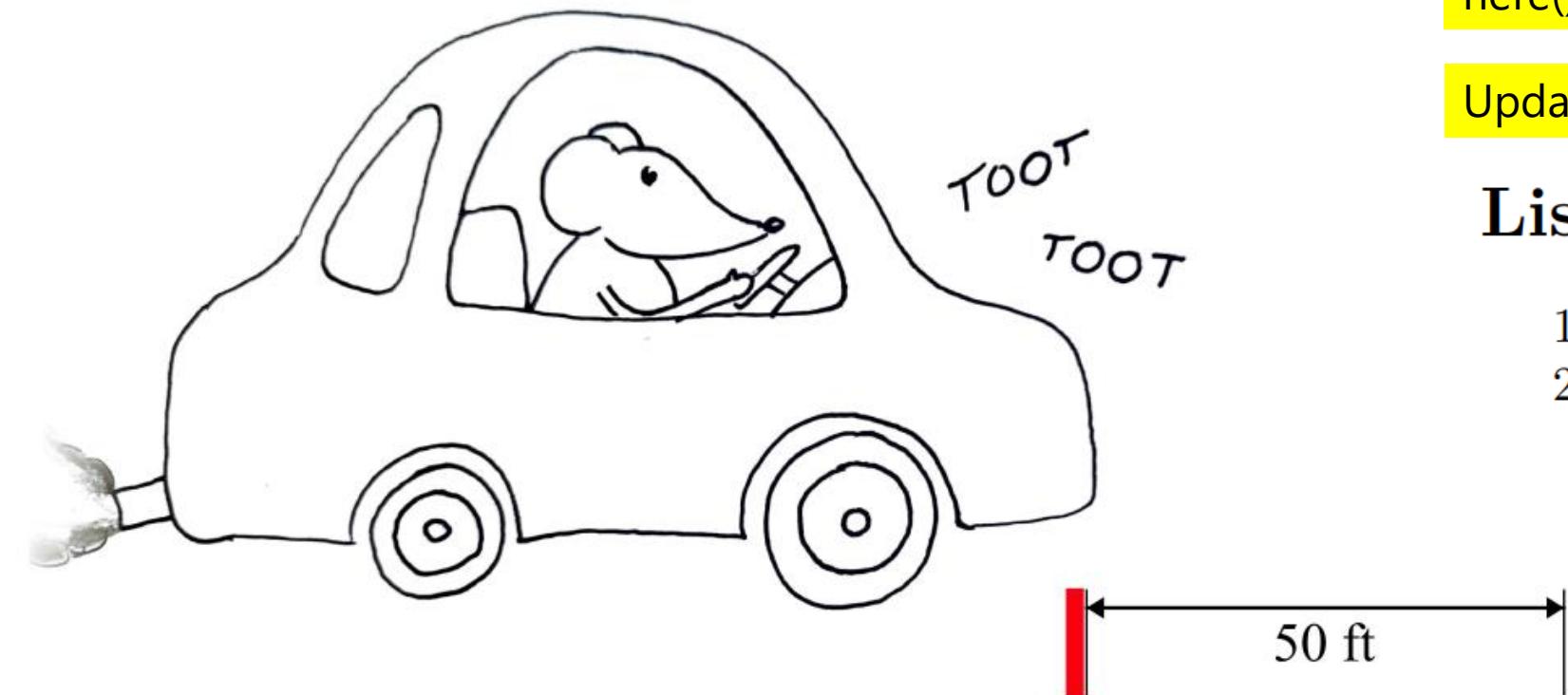
# Methods schematic

\* Not to scale



# 14. Insert images with **knitr::include\_graphics()**

```
knitr::include_graphics(here("Figures/Rat-car-schematic.png"))
```



here() selects file in the "Figures" folder

Updated figures numbers

## List of Figures

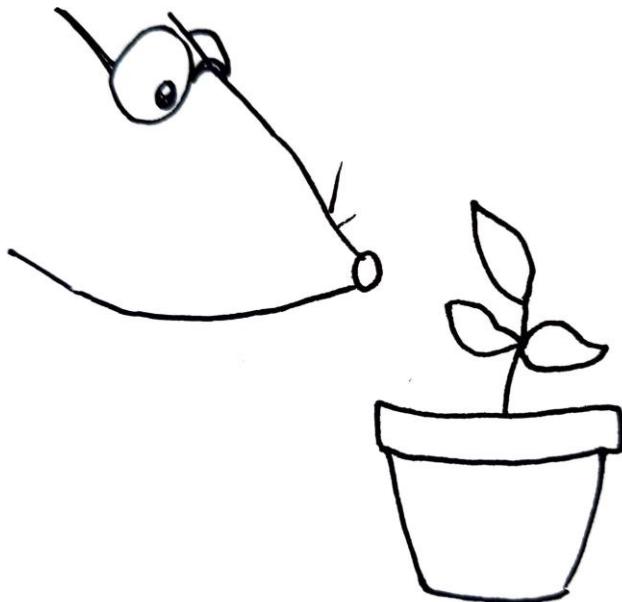
- |   |                                     |
|---|-------------------------------------|
| 1 | Methods schematic . . . . .         |
| 2 | Stopping distance of cars . . . . . |

Figure 1: Rats stopped at the red marker, and we measured the stopping distance.

# Statistics

# Analyzing Plant Growth

```
plant_data <- PlantGrowth
```



**Control**  
Water



**Treatment 1**  
Water + Herbicide



**Treatment 2**  
Water + Fertilizer

# 0. Explore data with **str()** and **nrow()**

```
plant_data <- PlantGrowth  
  
str(plant_data)  
````
```

```
'data.frame': 30 obs. of 2 variables:  
 $ weight: num 4.17 5.58 5.18 6.11 4.5 4.61 5.17 4.53 5.33 5.14 ...  
 $ group : Factor w/ 3 levels "ctrl","trt1",...: 1 1 1 1 1 1 1 1 1 1 ...
```

```
nrow(plant_data)  
````
```

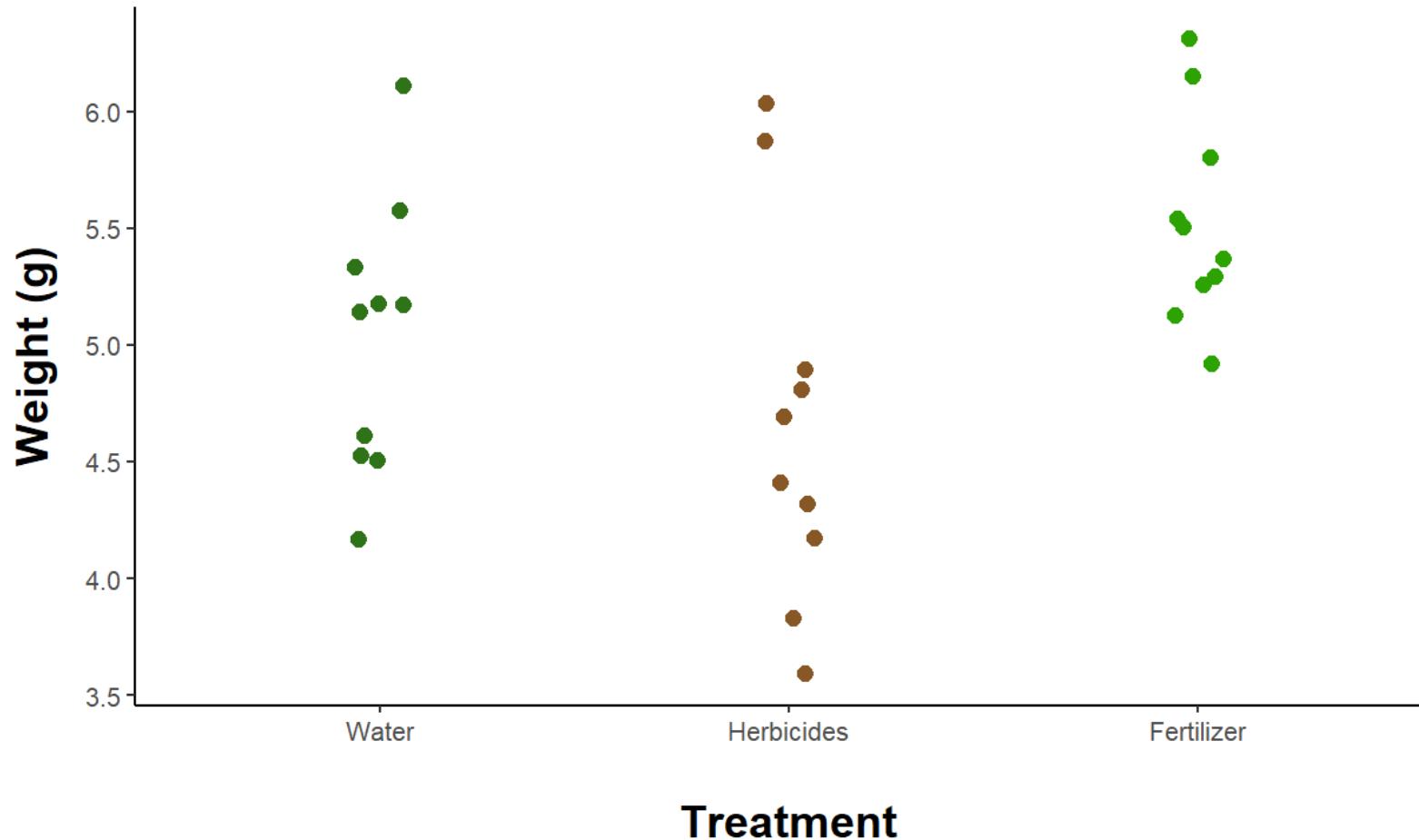
```
[1] 30
```

```
= 30 plants
```

Use chunk option **include = FALSE** to  
hide these printouts in your paper

# 1. Plot data

```
plant_data %>%  
  ggplot(aes(x = group, y = weight, color = group)) +  
  scale_color_manual(values = c("#2f7318", "#875826", "#2ca303")) +  
  scale_x_discrete(labels = c("Water", "Herbicides", "Fertilizer")) +  
  labs(x = "Treatment", y = "Weight (g)") +  
  guides(color = "none") +  
  geom_jitter(width = 0.07, size = 2.2)
```



# 2. Choose analysis

One-way Anova

*Assess effect of treatment on growth*

### 3. Test assumptions

```
plant_data_aov <- aov(weight ~ group, data = plant_data)
shapiro.test(resid(plant_data_aov))
```

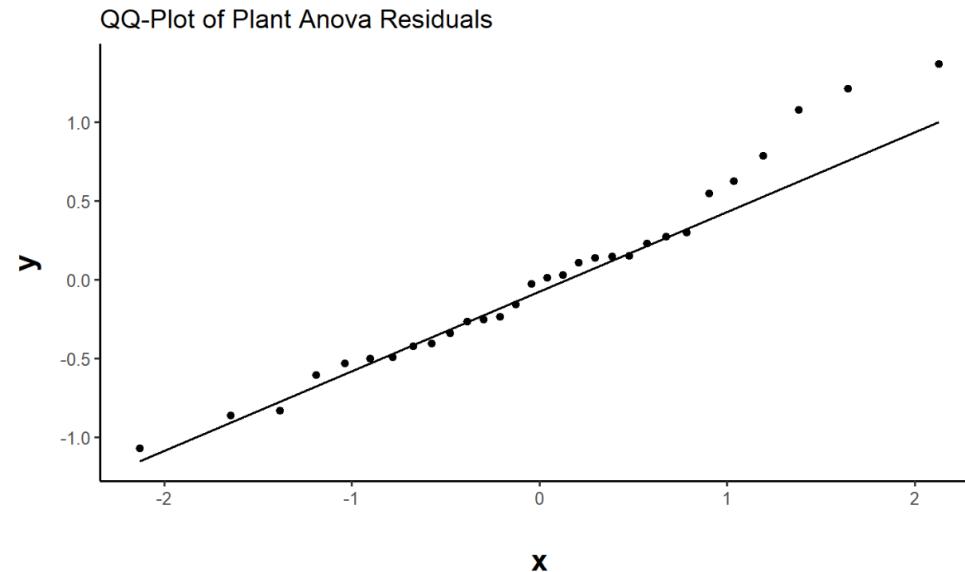
Normality of residuals

```
ggplot(plant_data_aov, aes(sample = resid(plant_data_aov))) +
  stat_qq() +
  stat_qq_line() +
  labs(title = "QQ-Plot of Plant Anova Residuals")
```

Shapiro-Wilk normality test

```
data: resid(plant_data_aov)
W = 0.96607, p-value = 0.4379
```

Data are normal!



## 4. Interpret results

```
plant_aov_summary <- summary(plant_data_aov)  
plant_aov_summary
```

|                | Df | Sum Sq | Mean Sq | F value | Pr(>F)   |                                 |
|----------------|----|--------|---------|---------|----------|---------------------------------|
| group          | 2  | 3.766  | 1.8832  | 4.846   | 0.0159 * | Treatment affects plant growth! |
| Residuals      | 27 | 10.492 | 0.3886  |         |          |                                 |
| ---            |    |        |         |         |          |                                 |
| Signif. codes: | 0  | ***    | 0.001   | **      | 0.01 *   | 0.05 .                          |
|                |    |        |         |         |          | 0.1 ' ' 1                       |

## 5. Report results

```
nrow(plant_data)
```

```
...
```

```
[1] 30
```

Backticks (above tab key) make a “mini chunk”

We weighed `r nrow(plant\_data)` plants.

We weighed 30 plants.

# 6. Extract p-values

```
View(plant_aov_summary)
```

| Name              | Type                                 | Value                                  |
|-------------------|--------------------------------------|--|
| plant_aov_summary | list [1] (S3: summary.aov, listof)   | List of length 1                       |
| [[1]]             | list [2 x 5] (S3: anova, data.frame) | A data.frame with 2 rows and 5 columns |
| Df                | double [2]                           | 2 27                                   |
| Sum Sq            | double [2]                           | 3.77 10.49                             |
| Mean Sq           | double [2]                           | 1.883 0.389                            |
| F value           | double [2]                           | 4.85 NA                                |
| Pr(>F)            | double [2]                           | 0.0159 NA                              |



Click on green arrow next to p-value

```
> View(plant_aov_summary)  
> plant_aov_summary[[1]][["Pr(>F)"]]
```

# 6. Extract p-values

```
> View(plant_aov_summary)
> plant_aov_summary[[1]][["Pr(>F)"]]
[1] 0.01590996      NA
```

```
> plant_aov_summary[[1]][["Pr(>F)"]][[1]]
[1] 0.01590996
```

Use **[[1]]** to select the first p-value, which is associated with *treatment*

```
> library(lazyWeave)
> pvalString(plant_aov_summary[[1]][["Pr(>F)"]][[1]])
[1] "0.016"
```

**pvalString()** requires library(lazyWeave)

Make publication-style p-values, like  
 $p < 0.001$

Plant growth is affected by chemical exposure

```
(p = `r pvalString(plant_aov_summary[[1]][["Pr(>F)"]][[1]])`)
```

Plant growth is affected by chemical exposure ( $p = 0.016$ )

# 7. Make publication-quality ANOVA table

```
Df Sum Sq Mean Sq F value Pr(>F)
group      2  3.766  1.8832   4.846 0.0159 *
Residuals  27 10.492  0.3886
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

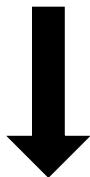


Table 1: Plant growth varies significantly with treatments.  
ANOVA summary table for a model examining the effect of treatment on plant mass.

| Term      | df | Sum of Squares | Mean Squares | F-statistic | p-value |
|-----------|----|----------------|--------------|-------------|---------|
| Group     | 2  | 3.77           | 1.88         | 4.85        | 0.016   |
| Residuals | 27 | 10.49          | 0.39         | NA          | NA      |

# 7a. Make dataframe

```
plant_data_aov %>%  
  tidy()  
...
```



A tibble: 2 × 6

| term      | df    | sumsq    | meansq    | statistic | p.value    |
|-----------|-------|----------|-----------|-----------|------------|
|           | <dbl> | <dbl>    | <dbl>     | <dbl>     | <dbl>      |
| group     | 2     | 3.76634  | 1.8831700 | 4.846088  | 0.01590996 |
| Residuals | 27    | 10.49209 | 0.3885959 | NA        | NA         |

**tidy()** requires library(broom)

tidy() produces a dataframe instead of a printout

# 7b. Round values & rename columns

```
plant_data_aov %>%  
  tidy() %>%  
  mutate(  
    across(sumsq:statistic, round, 2),  
    p.value = pvalString(p.value),  
    term = str_to_title(term)  
  ) %>%  
  rename(  
    Term = term,  
    'Sum of Squares' = sumsq,  
    'Mean Squares' = meansq,  
    'F-statistic' = statistic,  
    'p-value' = p.value  
  )
```

Round values

Capitalize names. **str\_to\_title()** requires library(stringr)

Make pretty column titles

| Term      | df | Sum of Squares | Mean Squares | F-statistic | p-value |
|-----------|----|----------------|--------------|-------------|---------|
| Group     | 2  | 3.77           | 1.88         | 4.85        | 0.016   |
| Residuals | 27 | 10.49          | 0.39         | NA          | NA      |

## 7c. Use kable()

```
rename<-
  Term = term,
  'Sum of Squares' = sumsq,
  'Mean Squares' = meansq,
  'F-statistic' = statistic,
  'p-value' = p.value
) %>
kable(
  booktabs = TRUE,
  linesep = '',
  caption = "Plant growth varies significantly with treatments.  
ANOVA summary table for a model examining the effect of  
treatment on plant mass."
) %>
kableExtra::column_spec(1, width = "1.5in")
```

**kable()** requires library(knitr)

Uses the booktabs style (horizontal lines around header row and bottom last row)

Don't put a space every 5 rows

Make first column wider

## 7c. Use kable()

Table 1: Plant growth varies significantly with treatments.  
ANOVA summary table for a model examining the effect of treatment on plant mass.

| Term      | df | Sum of Squares | Mean Squares | F-statistic | p-value |
|-----------|----|----------------|--------------|-------------|---------|
| Group     | 2  | 3.77           | 1.88         | 4.85        | 0.016   |
| Residuals | 27 | 10.49          | 0.39         | NA          | NA      |

## 7c. Use kable()

Table 1: Plant growth varies significantly with treatments.  
ANOVA summary table for a model examining the effect of treatment on plant mass.

| Term      | df | Sum of Squares | Mean Squares | F-statistic | p-value |
|-----------|----|----------------|--------------|-------------|---------|
| Group     | 2  | 3.77           | 1.88         | 4.85        | 0.016   |
| Residuals | 27 | 10.49          | 0.39         | NA          | NA      |

# Customization

# 8. Customize PDF

Thesis

Spacing?

Fonts?

Page margins?

## Contents

|                     |   |
|---------------------|---|
| <b>Introduction</b> | 1 |
| <b>Methods</b>      | 1 |
| Animals . . . . .   | 1 |
| Reagents . . . . .  | 1 |
| <b>Results</b>      | 1 |
| <b>Discussion</b>   | 3 |

## List of Figures

|   |   |
|---|---|
| 1     Methods schematic . . . . .         | 2 |
| 2     Stopping distance of cars . . . . . | 2 |

## Introduction

Text here...

## Methods

### Animals

### Reagents

## Results

We found that faster cars took longer distances to stop (Figure 2).

# 8. Improve spacing

Thesis

```
---
```

```
title: "Thesis"
output: pdf_document
fontsize: 12pt
geometry:
- margin = 1in
linestretch: 1.5
---
```

## Contents

|                    |   |
|--------------------|---|
| Introduction       | 1 |
| Methods            | 2 |
| Animals . . . . .  | 2 |
| Reagents . . . . . | 2 |
| Results            | 2 |
| Discussion         | 4 |

## List of Figures

|   |                                     |   |
|---|-------------------------------------|---|
| 1 | Methods schematic . . . . .         | 2 |
| 2 | Stopping distance of cars . . . . . | 3 |

## Introduction

Text here...

# 8. Prepare for printing

```
---
```

```
title: "Thesis"
output: pdf_document
fontsize: 12pt
geometry:
- margin = 1in
- bindingoffset = 10mm
linestretch: 1.5
classoption: twoside
indent: true
---
```

Exaggerated binding offset!

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## Methods

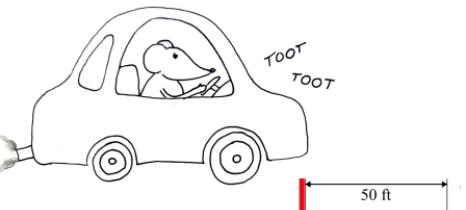


Figure 1: Rats stopped at the red marker, and we measured the stopping distance.

## Animals

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis

fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## Reagents

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## Results

### Cars Data

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim

# 8. Modify preamble

Create a new **.tex** file  
and save it

I used the Templates folder



masters-thesis.Rproj



README.md



Thesis



Figures



Templates

```
output:  
  pdf_document:  
    latex_engine: xelatex  
  includes:  
    in_header: "../Templates/sample-preamble.tex"
```

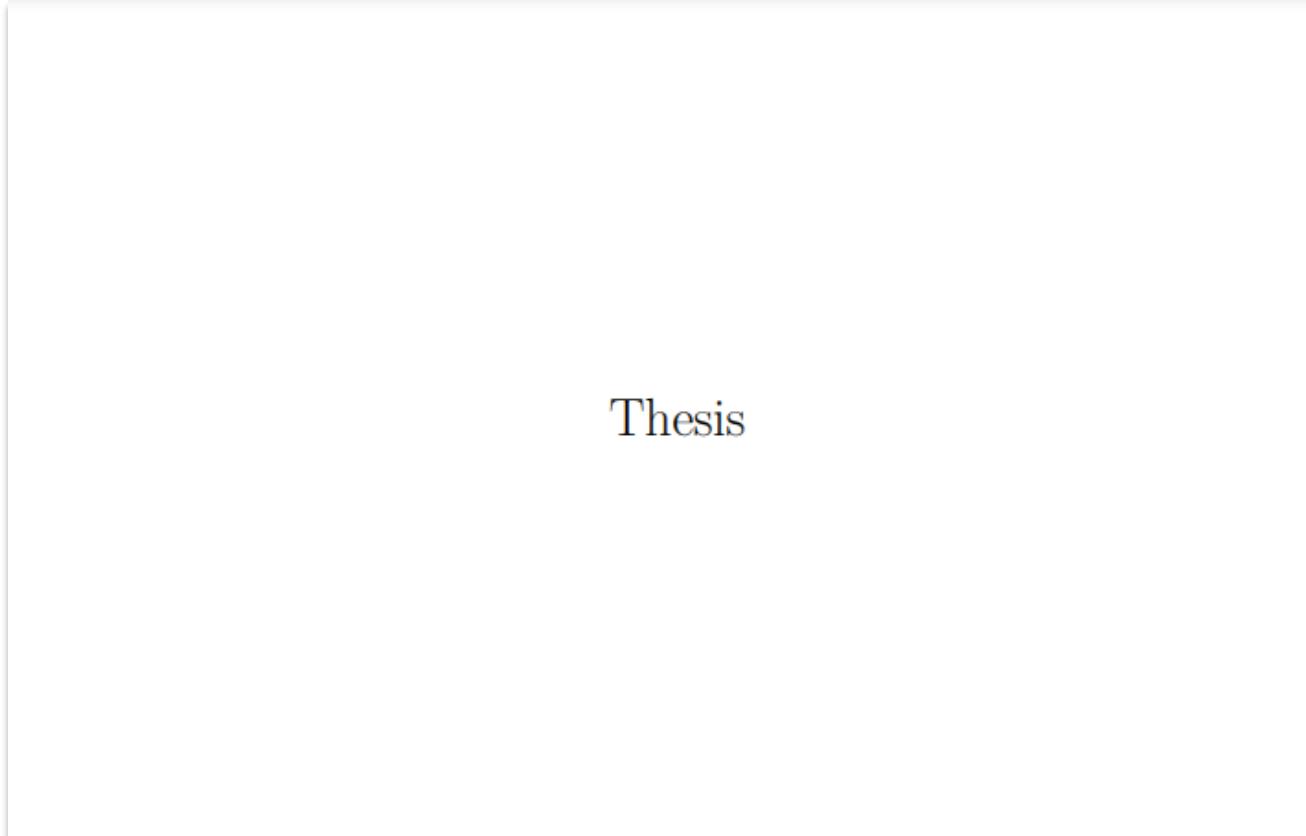
**..**/**/** = go up one folder. Reference point is the location of Thesis.Rmd, which is in **Thesis/** folder

## 8. Modify preamble

```
\pagenumbering{gobble} % Hide page number on title page
```

```
\usepackage{titling}
```

```
\pretitle{\linespread{1}\begin{center}\vspace{2cm}\Huge}
```



The image shows a large, empty white rectangular box with a thin black border, occupying the right half of the slide. This box represents the title page where the title 'Thesis' is centered.

Thesis

# 8. Modify preamble

```
\usepackage[skip=20pt plus1pt, indent=0pt]{parskip}
```

Change paragraph spacing

```
\usepackage[nottoc]{tocbibind}
```

Include list of figures in TOC

```
\usepackage{sectsty}
```

```
\newcommand{\BIG}{\fontsize{36}{43}\selectfont}
```

Make a new font size

```
\makeatletter
```

```
\renewcommand\section{\@startsection {section}{1}{\z@}%  
{-7ex \@plus -1ex \@minus -.2ex}%  
{7ex \@plus .2ex} %
```

Increase padding around  
headers and make  
headings larger

```
{\newpage\vspace*{-0.2in}\normalfont\BIG\SS@sectfont}}
```

```
\renewcommand\subsection{\@startsection{subsection}{2}{\z@}%  
{-3.5ex \@plus -1ex \@minus -.2ex}%  
{3.5ex \@plus .2ex} %
```

Make heading 1 start on  
a new page

```
\makeatother
```

## Introduction

### Heading 2

Lorem ipsum dolor sit amet, consectetur  
Nullam nec mi et neque pharetra solli-  
ullamcorper, felis non sodales commo-  
lectus placerat pede. Vivamus nunc nu-  
porttitor. Praesent in sapien. Lorem i-  
Duis fringilla tristique neque. Sed inter-  
rutm augue a leo. Morbi sed elit sit  
blandit mauris. Praesent lectus tellus,  
lacinia lorem sit amet ipsum. Nunc qu-

## Introduction

### *Heading 2*

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem.  
Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec  
ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh  
lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut  
porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit.  
Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam  
rutm augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit  
blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris  
lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

# Fonts

## 8. Custom font

title: thesis

output:

```
pdf_document:  
  latex_engine: xelatex  
  includes:  
    in_header: "../Templates/sample-preamble.tex"  
fontsize: 12pt  
geometry:  
  margin = 1in
```

EB Garamond

abcdefghijklmnoprstuvwxyz 0123456789

Must specify **XeLaTeX** engine in your YAML or it will NOT work!

# 8. Custom font

```
\setmainfont{EBGaramond}[\  
    Path=../Templates/,  
    Extension=.otf,  
    UprightFont=*12-Regular,  
    ItalicFont=*12-Italic,  
    RawFeature=+calt,  
]
```

Put .otf or .ttf files in **Templates/**

EBGaramond12-Regular.otf  
EBGaramond12-Italic.otf

Québec,

Advanced typography,  
e.g. contextual alternates

# Introduction

## *Heading 2*

  Lorem ipsum dolor sit amet, consectetur  
  Nullam nec mi et neque pharetra sollicit  
  ullamcorper, felis non sodales commodo  
  lectus placerat pede. Vivamus nunc nunc  
  porttitor. Praesent in sapien. Lorem ipsu  
  Duis fringilla tristique neque. Sed interdu  
  rutm augue a leo. Morbi sed elit sit a  
  blandit mauris. Praesent lectus tellus, alic  
  lacinia lorem sit amet ipsum. Nunc quis u

# Introduction

## *Heading 2*

  Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

## *Heading 3*

## *Heading 3*

# Google Fonts

<https://fonts.googleapis.com/>

Download a font

Place **.otf** or **.ttf** file in  
Templates/ folder

The sidebar on the left contains several filter sections:

- Cute** (selected), **Playful**, **Fancy** (selected), **Stiff**, **Show 12 more**
- Appearance**: **Valentines**, **Marker**, **Techno**, **Distressed**, **WACKY**, **Wood type**, **Blobby**, **Monospaced**, **Show 10 more**
- Calligraphy**: **All** (selected), **Handwritten** (selected), **Formal**, **Informal**
- Serif**: **All**, **Transitional**, **Slab**, **Old Style**, **Modern**, **Humanist**, **Show 3 more**
- Sans Serif**: **All**, **Humanist**, **Geometric**, **Neo Grotesque**

The main search results page shows the following content:

- Google Fonts** search bar, **Filters** button, **Feeling — Fancy**, **Calligraphy — Handwritten**, **Clear all**
- Readability**: How type influences readability (with icon)
- Material design guidelines**: Styling text (with icon)
- Optimize font loading**: Achieve faster page load times (with icon)
- Google Fonts API**: Get started with web fonts
- Lavishly Yours**: 1 style | Robert Leuschke. Preview: *Everyone has the right to freedom of thought, conscience and religion; this right incl*
- Mrs Saint Delafield**: 1 style | Sudtipos. Preview: *Everyone has the right to freedom of thought, conscience and religion; this right includes fre*
- Mr De Haviland**: 1 style | Sudtipos. Preview: *Everyone has the right to freedom of thought, conscience and religion; this right includes freedom to*
- Ms Madi**: 1 style | Robert Leuschke. Preview: *Everyone has the right to freedom of thought, conscience and religion; this right*

# Google Fonts

```
\setmainfont{Birthstone}[  
    Path=../Templates/,  
    Extension=.ttf,  
    UprightFont=*-Regular,  
    ItalicFont=*-Regular  
]
```

## *Introduction*

### *Heading 2*

*Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.*

### *Heading 3*

# Title Page

1 -

2 title: The effect of insulin on excitatory  
synaptic transmission in the rat dorsomedial  
3 hypothalamus

Put title in YAML

The effect of insulin on excitatory synaptic  
transmission in the rat dorsomedial  
hypothalamus

by

Christelinda Laureijs

A thesis submitted to the  
Department of Biology  
Mount Allison University  
in partial fulfillment of the requirements for the  
Bachelor of Science degree with Honours  
in Biology

April 10, 2024

```
\begin{centering}
\begin{spacing}{1}
\Large
by
\LARGE
Christelinda Laureijs

\end{spacing}
\end{centering}

\large
\vspace*{\fill}

\begin{centering}
\begin{spacing}{1}
A thesis submitted to the \\
Department of Biology \\
Mount Allison University \\
in partial fulfillment of the requirements for the \\
Bachelor of Science degree with Honours \\
in Biology

```

by  
Christelinda Laureijs

A thesis submitted to the  
Department of Biology  
Mount Allison University  
in partial fulfillment of the requirements for the  
Bachelor of Science degree with Honours  
in Biology

April 10, 2024

# Decorative symbols

Requires adforn package

Add this code to the preamble:

\usepackage{adforn}

\adforn{20} \*COLOPHON\* \adforn{48}

\normalsize

This thesis was typeset in R Markdown and the te

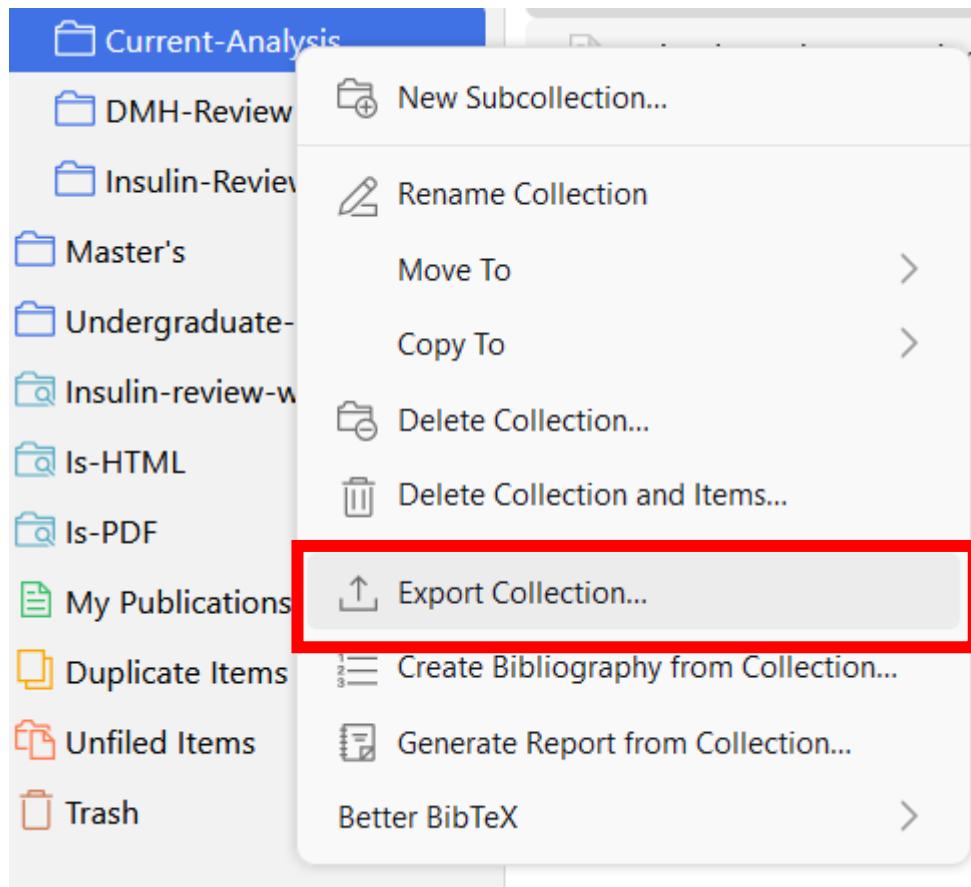
~~~ *COLOPHON* ~~~

This thesis was typeset in R Markdown and the text

produce this document are available at <https://github>

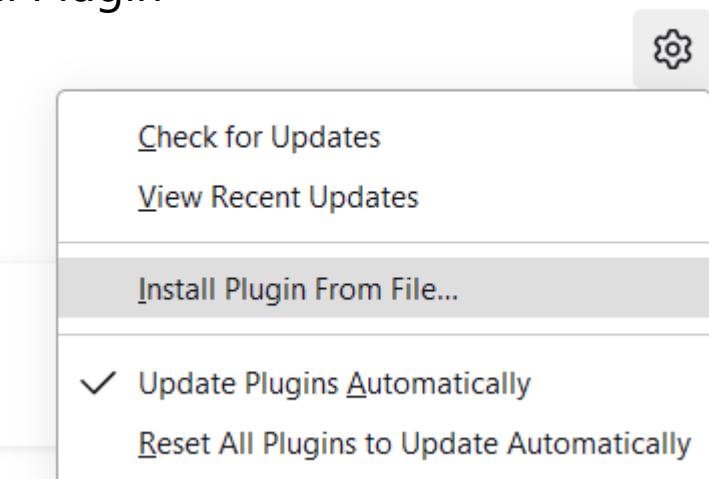
# Citations

# Citations in Zotero



Automatically-updating .bib file in Zotero

- Use the better BibTeX plugin (<https://retorque.re/zotero-better-bibtex/installation/>)
- Tools -> Plugins -> Install Plugin from File
- Choose the **.xpi** file you downloaded



# Set BetterBibTeX citation keys

Zotero Settings

- General
- Sync
- Export
- Cite
- Advanced

Better BibTeX

---

**Citation keys**

Citation key formula  
auth.lower + year

---

Force citation key to plain text

Enable citation key search

Automatically pin citation key after 

**Better BibTeX**

Edit -> Preferences ->  
Better BibTeX

auth.lower + year

wang2024

# Set BetterBibTeX citation keys

The screenshot shows a library application interface with a list of citations. The columns are 'Title', 'Creator', and 'Date'. The entries are:

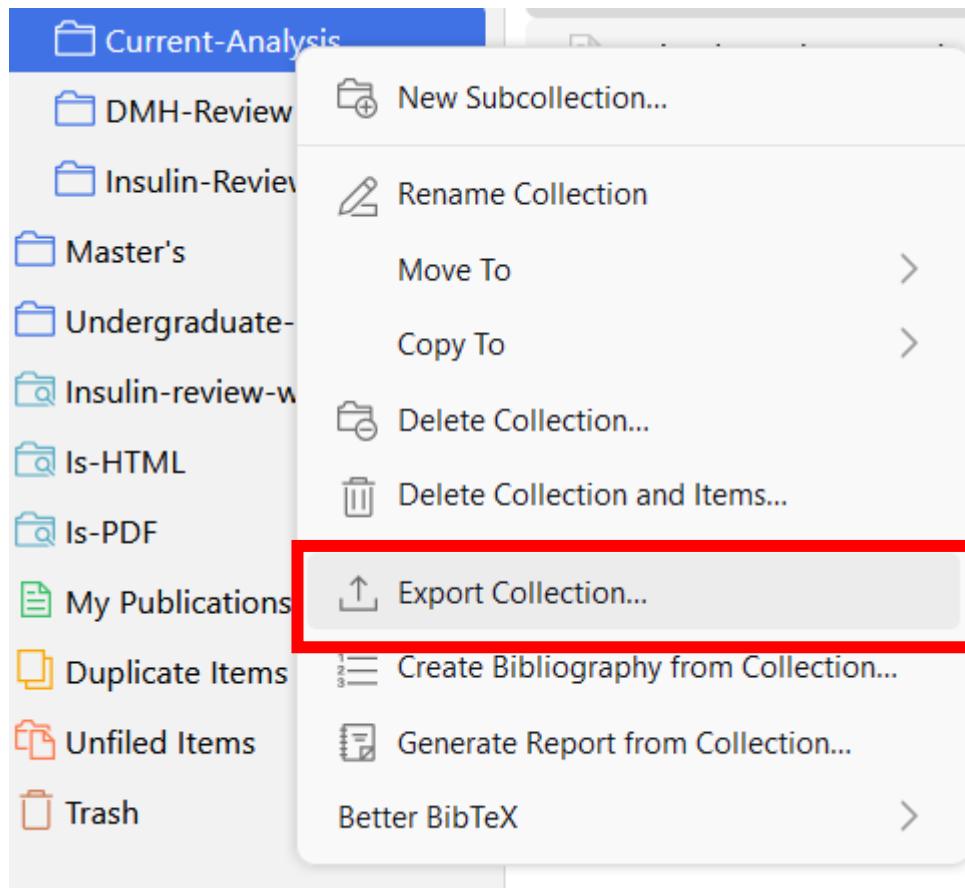
| Title                                                                                             | Creator               | Date       |
|---------------------------------------------------------------------------------------------------|-----------------------|------------|
| Automatic detection of spontaneous synaptic responses in central neurons                          | Ankri et al.          | 1994-04-01 |
| A simple exploratory algorithm for the accurate and fast detection of spontaneous synaptic events | Kudoh and Taguchi     | 2002-09-01 |
| A Deconvolution-Based Method with High Sensitivity and Temporal Resolution                        | Pernía-Andrade et al. | 2012-10-03 |
| Detecting unitary synaptic events with machine learning                                           | Wang et al.           | 2024-02-06 |

A context menu is open over the last entry ('Detecting unitary synaptic events with machine learning'). The menu items are:

- Open PDF in New Tab
- Open PDF in New Window
- View Online
- Show File
- Create Note from Annotations
- Find Full Text
- Add to Collection
- Remove Items from Collection...
- Move Items to Trash...
- Merge Items...
- Export Items...
- Create Bibliography from Items...
- Generate Report from Items...
- Better BibTeX
  - Change BibTeX key...
  - Pin BibTeX key
  - Pin BibTeX key from InspireHEP
  - Unpin BibTeX key
  - Refresh BibTeX key
  - copy BibLaTeX to clipboard
  - copy BibTeX to clipboard

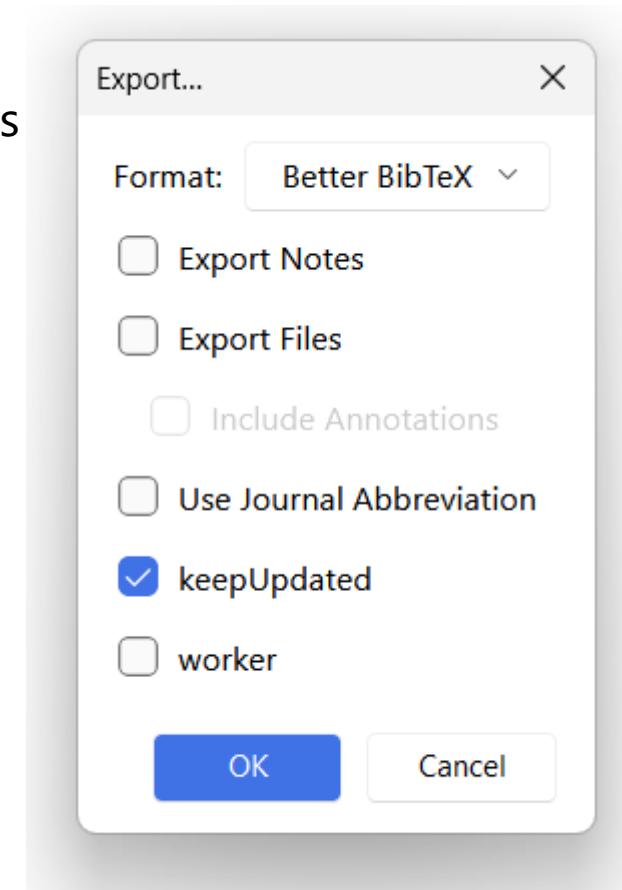
Select all entries, right-click -> Better BibTeX -> Refresh BibTeX key

# Citations in Zotero



Save in the same folder as the thesis

Check **keepUpdated**



# Citations in Zotero

```
1 pdf_document:  
2     latex_engine: xelatex  
3     includes:  
4         in_header: "../Templates/sample-prea  
5 bibliography: "sample-bib.bib"  
6 fontsize: 12pt  
7 geometry:  
8     margin = 1in
```

Here is a citation [[@ankri1994](#)]

Here is a citation (Ankri et al. 1994)

Here are multiple citations [[@ankri1994](#); [@wang2024](#)]

# References

Will automatically appear at the bottom of your document.  
Last line of your Thesis.Rmd should be **# References**

Ankri, N., P. Legendre, D. S. Faber, and H. Korn. 1994. “Automatic Detection of Spontaneous Synaptic Responses in Central Neurons.” *Journal of Neuroscience Methods* 52 (1): 87–100. [https://doi.org/10.1016/0165-0270\(94\)90060-4](https://doi.org/10.1016/0165-0270(94)90060-4).

What you'll look like when you finish your awesome paper!

