

# Brilliant Title

Joel H. Nitta<sup>1\*</sup>

<sup>1</sup>Bag End, Bagshot Row, Hobbiton

\*corresponding author

email: my@address.here

## Abstract

This is a `R markdown` template for a research paper.

`R Markdown` is ideal for research papers because we can avoid copy-and-paste errors and it frees us from formatting details. Using `R Markdown` in combination with `latex` (sparingly) and `pandoc` lets us generate formatted MS Word docs to submit to journals for the win!

**Keywords:** Reproducible, reproducible, reproducible

## Introduction

This template assumes you are already familiar with the basics of **R markdown**. A very important resource for all **R markdown** users is “R Markdown: The Definitive Guide” (<https://bookdown.org/yihui/rmarkdown/>).

Astute readers will notice I typed out authors and affiliations directly in the **R Markdown** document. It’s theoretically possible to take input to the **author** and **date** fields in the **yaml** header and format them with various **latex** packages, but almost never worth the effort. That is one part where your **Rmd** file is likely to vary slightly for different journals.

In example code blocks, things for the user to fill-in are indicated with **ALL CAPS**.

I like to add a (single) line break after every sentence within a paragraph. It doesn’t make a difference to the rendered output, but it makes it much easier to track changes to your **Rmd** file with **git**, since each sentence appears as its own line when you examine the **diff**.

## Methods

### Citations

You should provide a bibliography file including all references cited in your paper. The **.bib** format is often used, but **pandoc** can understand a wide variety of bibliography formats.

The citation format in **Rmd** is simple. When you want to add a parenthetical citation, just use **[@KEY]**, where **KEY** is the citation key for that reference in your **.bib** file. Multiple references can be included by separating keys with a semicolon. I am just citing my own papers here as an example (who doesn’t like to do that?) but I think you get the idea (Nitta *et al.*, 2011, 2017, 2018). For a more complete description of **Rmd** citation syntax, see this guide from RStudio: [https://rmarkdown.rstudio.com/authoring\\_bibliographies\\_and\\_citations.html](https://rmarkdown.rstudio.com/authoring_bibliographies_and_citations.html).

One of the major benefits of using **R markdown** is that we can use **CSL** (Citation Style Language, <https://citationstyles.org/>) templates to format citations for various journals. Just go to the Zotero Style Repository (<https://www.zotero.org/styles>), search for the **CSL** file for your journal, and download it. Here, we are using the “New Phytologist” journal format as an example. As of writing, there were over 9000 journals in the repository, so chances are good that most any journal you’re interested in submitting to will be there! And if not, there is also an open-source **CSL** editor available to customize citation styles (<https://editor.citationstyles.org/visualEditor/>).

### Data analysis

I would actually analyze my data in separate scripts then import the results here, but let’s just do it within this **Rmd** document here for simplicity.

We will analyze the height of Star Wars characters. Note that I set the **echo = FALSE** option globally in the very first **R** code chunk (**knitr::opts\_chunk\$set(echo = FALSE, warning = FALSE, message = FALSE)**) to prevent the code (or warnings generated by the code) from showing up in the rendered manuscript.

## Results

The mean height of human characters in the Star Wars universe is  $176.65 \text{ cm} \pm 12.54 \text{ cm}$ . In contrast, the height of droids is  $140 \text{ cm} \pm 52.01 \text{ cm}$ .

A useful `latex` package for formatting units according to SI is `SIunitx`. The basic syntax is `\SI{NUMBER}{\UNIT}`, e.g., `\SI{10}{\centi\meter}`, which gets rendered as 10 cm. This may seem like a lot of extra typing, but it can be very helpful when SI units get long and confusing. Right now it seems like `pandoc` only has partial support for `SIunitx`. Unfortunately subscripts, superscripts, and ranges don't work.

## Cross-referencing

It is very important in scientific papers to be able to reference figures and tables. One common error is for the numbering to get out of order as the paper is edited. `R markdown` can help with this by cross-referencing with code.

There are two options for cross-referencing.

- Option one: use the `bookdown` package. You must include the figure as a code chunk and provide a caption in the code chunk options with `fig.cap = "FIGURE CAPTION"` (I usually do this at the end of the MS). You can then reference the figure using the name of the code chunk like this `\@ref(fig:CODE-CHUNK-NAME)`. Note that code chunk names cannot use underscores, but can use hyphens. For example, let's check out this beautiful plot of Star Wars characters heights by species (Fig. 1). Now this will be numbered correctly, even if I add other figures and change the order the figures are referenced in the MS. **Drawback:** the reference numbers don't get rendered properly in `docx`. I am looking into a fix, and would love to hear any suggestions!
- Option two: use the `captioner` package as described here. This option is more flexible in that you basically set up your captions as `R` character vectors and access them with code chunks. Because of that, they will render properly in `pdf` and `docx`. Also, you don't actually have to include the figure output in the rendered document like you do with `bookdown`. However the `captioner` package is not under current development, and has some known issues with ordering, presumably because the captions are not linked as closely to the figures as with the `bookdown` method.

You will also probably want to write out your plot separately too so it can be submitted along with the manuscript. The `ggsave` function of `ggplot2` is handy for this as you can specify various output formats and dimensions easily. This means (hopefully) your plot will be publication-ready straight from code! (yes post-editing is sometimes unavoidable but we can dream).

## References

By default, references will end up at the very end of the MS (a `latex` quirk). This can be over-ridden by using the code `<div id="refs"></div>` wherever you want the references to show up (yes `Rmd` understands `html` in addition to `latex` and `R` and `markdown`!).

Nitta JH, Amer S, Davis CC. **2018**. *Microsorium*  $\times$  *tohieaense* (Polypodiaceae), a new hybrid fern from French Polynesia, with implications for the taxonomy of *Microsorium*. *Systematic Botany* **43**:

397–413.

Nitta JH, Ebihara A, Ito M. **2011**. Reticulate evolution in the *Crepidomanes minutum* species complex (Hymenophyllaceae). *American Journal of Botany* **98**: 1782–1800.

Nitta JH, Meyer J-Y, Taputuarai R, Davis CC. **2017**. Life cycle matters: DNA barcoding reveals contrasting community structure between fern sporophytes and gametophytes. *Ecological Monographs* **87**: 278–296.

## Figures

Often figures aren't actually included in the `doc` or `docx` submitted to the journal, but you can just manually trim them from those files, since they are nice to have your pdf and `bookdown` needs them for cross-referencing to work.

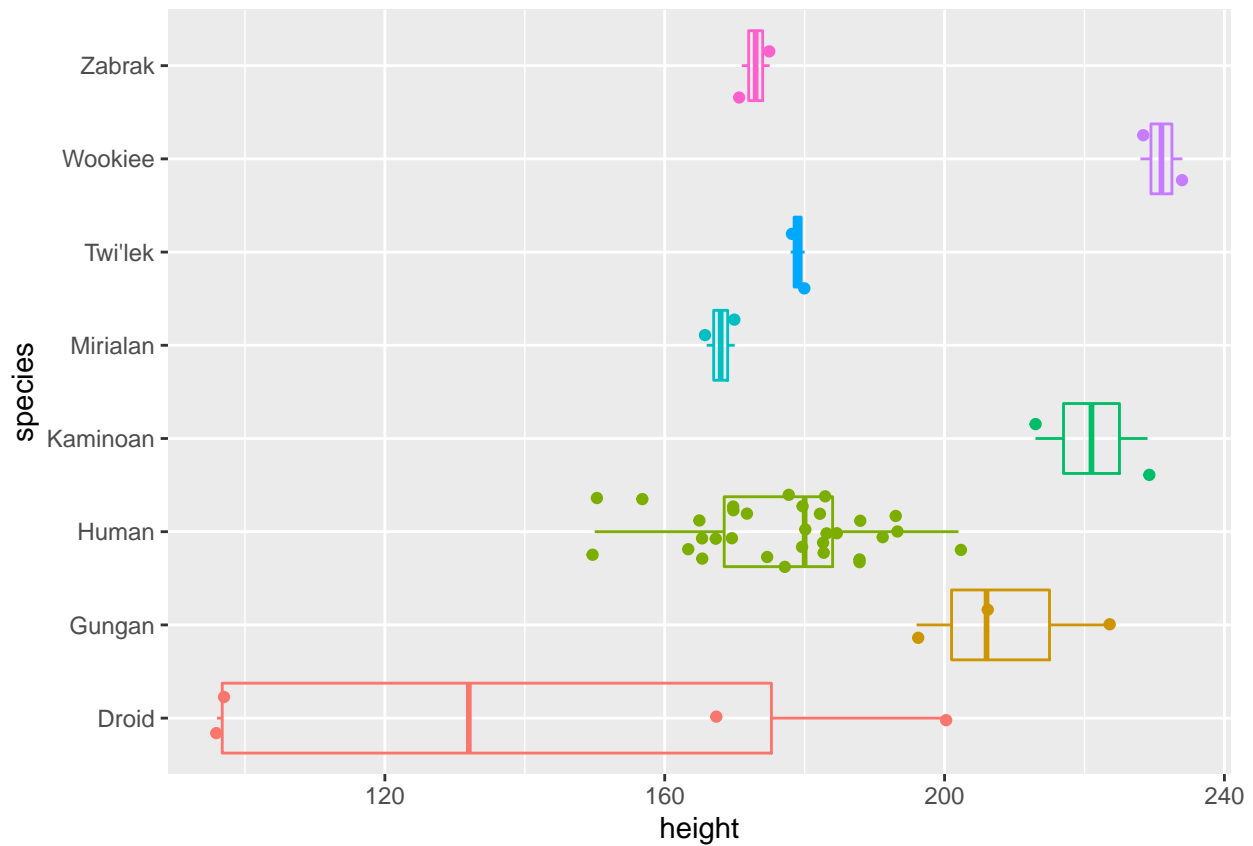


Figure 1: Heights of Star Wars characters by species