Write in Word, **Save in Markdown**, Publish in LaTeX

May take some pain out of scientific writing.

Katrin Leinweber

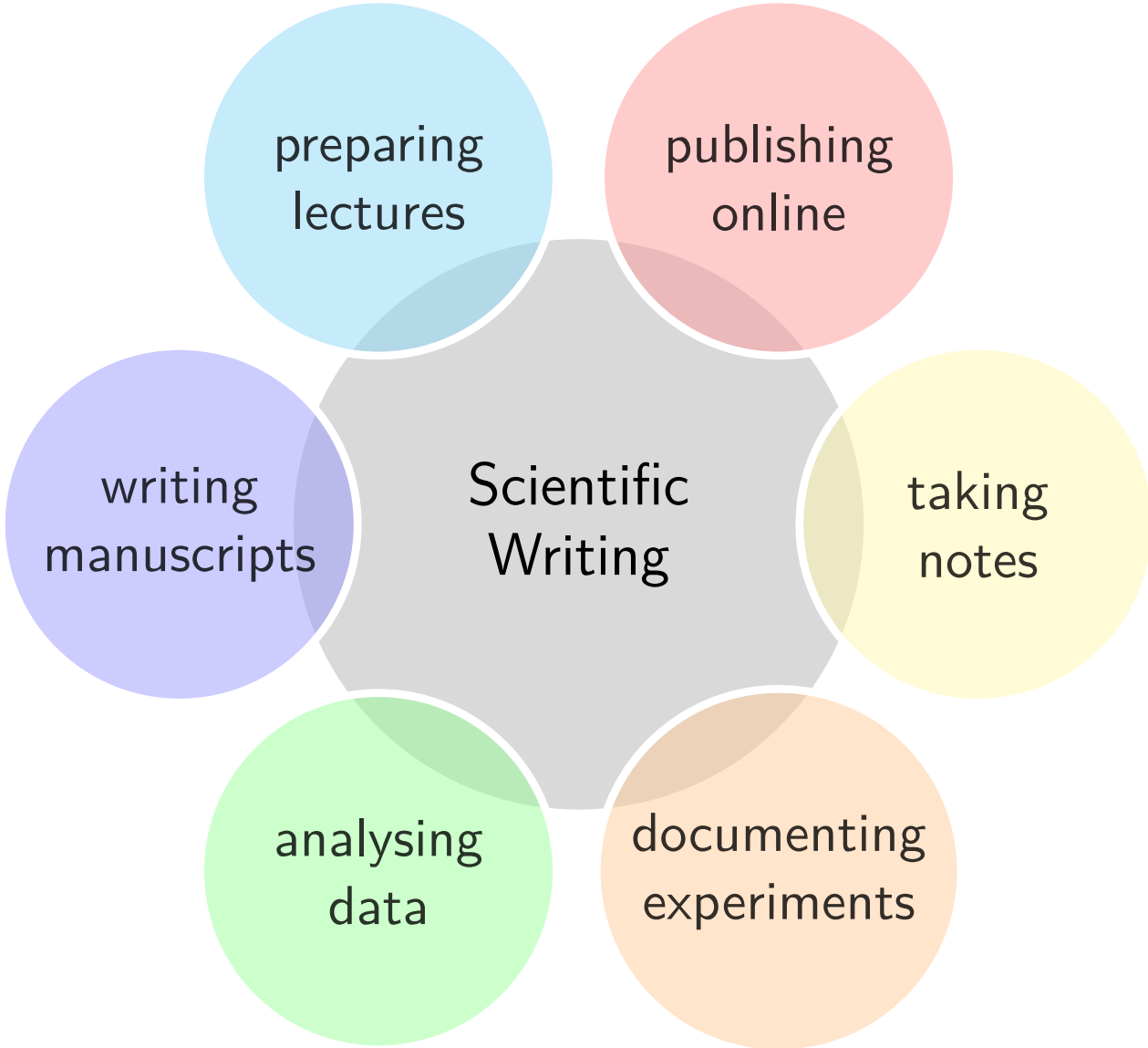
2015-Aug-31

Why not talk about a research project?

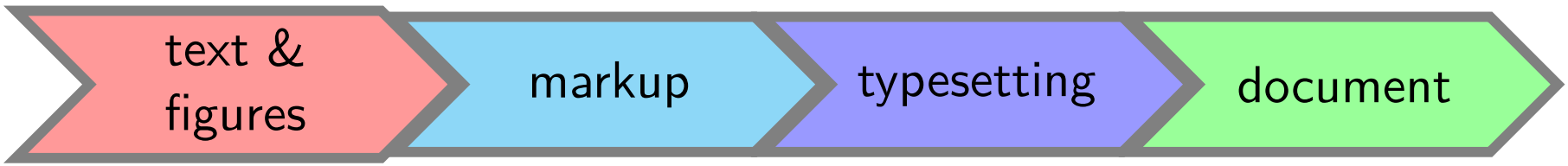
Support research and training programs that transcend traditional disciplines.[1]

[1] chembiol.uni.kn/statement.html

Markdown can help you with...



Background: Markup languages



- design philosophy[2]: separate content from presentation
- most modern document formats are markup
- word processors just typeset continuously

[2] en.wikipedia.org/wiki/Separation_of_presentation_and_content

Background: Markup languages

LaTeX (1985)	HTML (1992)	
`\textbf{bold}`	`<strong>bold</strong>`	**bold**
`\emph{Species name}`	`<i>Species name</i>`	*Species name*
`\section{Heading 1}`	`<h1>Heading 1</h1>`	**Heading 1**
`\subsection{Heading 2}`	`<h2>Heading 2</h2>`	Heading 2
`\sout{strike out}`	`<strike>out</strike>`	~~strike out~~

- a lot of formatting commands
- only really readable in typeset form (PDF, website)
- but machine-readable

What is Markdown? Minimalistic markup language!

`**bold**`	**bold**
`*Species name*`	*Species name*
`# Heading 1`	**Heading 1**
`## Heading 2`	Heading 2
`~~strike out~~`	~~strike out~~

- fast to type & easy to read
- defined in 2004 by John Gruber[3] & Aaron Swartz
- designed for web publishing => converts to HTML
- has links, images, lists, quotes, etc.

[3] daringfireball.net/projects/markdown

Science-related use-case examples for Markdown (MD)

Words of caution: try with finished doc, or small new one!

- up-front time investment to install tools & get used to MD
- accept hand-over of styling & templating to others
- return to `.docx` possible in any case

Íshestar via equitrekking.com

Use-case: digital lab journalling

```
##### Preparation
- [x] Glucose standards ("4/2/13", [150304a](https://
docs.google.com/spreadsheets/d/1zl4l1v1qddJ3-jqSSMlV34OX9wQ-
gmmEzDZJOwgDEdg/edit#gid=0) & [141015a](https://trello.com/c/
hO7txKOa/104-141015a-achmi-sugar-standard-curves) mix)
- [x] solution of 5% crystalline phenole (not Roti-Phenol) in MQ-
H<sub>2</sub>O
- [x] shaker(s) at room temperature
- [ ] Multipette with 5mL- & 10mL tips
- [ ] PMMA cuvettes

##### Procedure
- 2 1mL aliquots taken from Erli for non-concentrated measurements:
    - centrifuged down at 18k*g* for 3min => SN transferred into
    "oSN" sample & centrifuged again => V_oSN = 978.4µL
- 184.8mL cell suspension centrifuged down at 5k*g* & 20°C for 3min
    - slightly lower recovery of supernatant for concentration
    ("cSN") due to disturbances of pellet with 25mL pipettes =>
    V_cSN = 175mL
    - lyophilisation at [Spitellers'](https://trello.com/c/
    j7bmrNW2/135-spitellers-lyophilisator) at 0°C,

##### Conclusions

![](plots/Glu-and-Glu+F2-standards.png)

- **high salt complicates assay procedure due to overboiling &
degrades standard curve**
- **conc. supernatant only 2-5x**
```

Preparation

- ☑ Glucose standards ("4/2/13", 150304a & 141015a_mix)
- ☑ solution of 5% crystalline phenole (not Roti-Phenol) in MQ-H_2O
- ☑ shaker(s) at room temperature
- ☐ Multipette with 5mL- & 10mL tips
- ☐ PMMA cuvettes

Procedure

- 2 1mL aliquots taken from Erli for non-concentrated measurements:
  - centrifuged down at 18k*g* for 3min => SN transferred into "oSN" sample centrifuged again => V_oSN = 978.4µL
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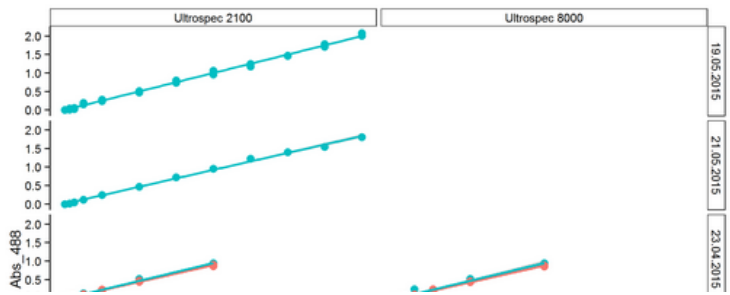
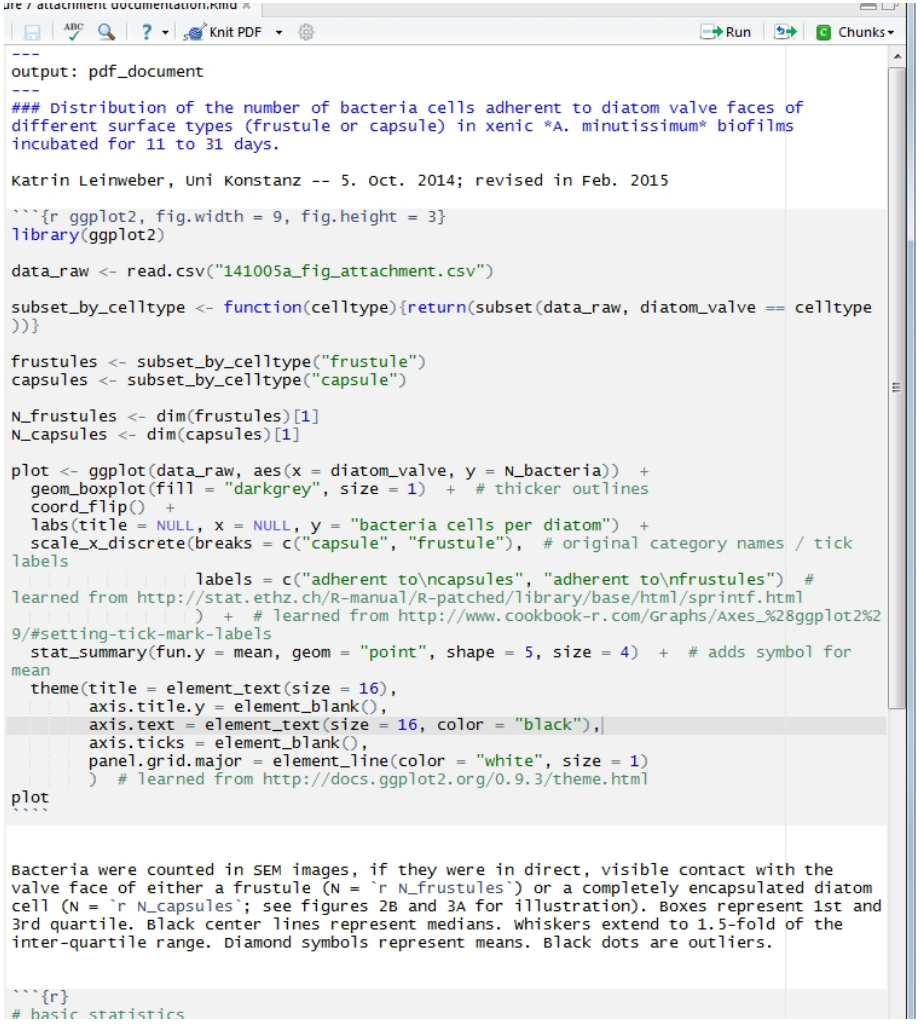
  - slightly lower recovery of supernatant for concentration ("cSN") due to disturbances of pellet with 25mL pipettes => V_cSN = 175mL
  - lyophilisation at Spitellers' at 0°C,

Conclusions



editors with live preview: MarkdownPad, MacDown, etc.

Use-case: documenting data analysis



```
---
output: pdf_document
---
### Distribution of the number of bacteria cells adherent to diatom valve faces of
different surface types (frustule or capsule) in xenic *A. minutissimum* biofilms
incubated for 11 to 31 days.

Katrin Leinweber, Uni Konstanz -- 5. Oct. 2014; revised in Feb. 2015

```{r ggplot2, fig.width = 9, fig.height = 3}
library(ggplot2)

data_raw <- read.csv("141005a_fig_attachment.csv")

subset_by_celltype <- function(celltype){return(subset(data_raw, diatom_valve == celltype
))}

frustules <- subset_by_celltype("frustule")
capsules <- subset_by_celltype("capsule")

N_frustules <- dim(frustules)[1]
N_capsules <- dim(capsules)[1]

plot <- ggplot(data_raw, aes(x = diatom_valve, y = N_bacteria))  +
  geom_boxplot(fill = "darkgrey", size = 1)  +  # thicker outlines
  coord_flip()  +
  labs(title = NULL, x = NULL, y = "bacteria cells per diatom")  +
  scale_x_discrete(breaks = c("capsule", "frustule"),  # original category names / tick
labels
                   labels = c("adherent to\ncapsules", "adherent to\nfrustules")  #
learned from http://stat.ethz.ch/R-manual/R-patched/library/base/html/sprintf.html
                   )  +  # learned from http://www.cookbook-r.com/Graphs/Axes_%28ggplot2%2
9/#setting-tick-mark-labels
  stat_summary(fun.y = mean, geom = "point", shape = 5, size = 4)  +  # adds symbol for
mean
  theme(title = element_text(size = 16),
        axis.title.y = element_blank(),
        axis.text = element_text(size = 16, color = "black"),
        axis.ticks = element_blank(),
        panel.grid.major = element_line(color = "white", size = 1)
        )  # learned from http://docs.ggplot2.org/0.9.3/theme.html
plot
```


Bacteria were counted in SEM images, if they were in direct, visible contact with the
valve face of either a frustule (N = `r N_frustules`) or a completely encapsulated diatom
cell (N = `r N_capsules`; see figures 2B and 3A for illustration). Boxes represent 1st and
3rd quartile. Black center lines represent medians. Whiskers extend to 1.5-fold of the
inter-quartile range. Diamond symbols represent means. Black dots are outliers.

```{r}
# basic statistics
```

Distribution of the number of bacteria cells adherent to diatom valve faces of different surface types (frustule or capsule) in xenic *A. minutissimum* biofilms incubated for 11 to 31 days.

Katrin Leinweber, Uni Konstanz – 5. Oct. 2014; revised in Feb. 2015

```
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subset_by_celltype <- function(celltype){return(subset(data_raw, diatom_valve == celltype)

frustules <- subset_by_celltype("frustule")
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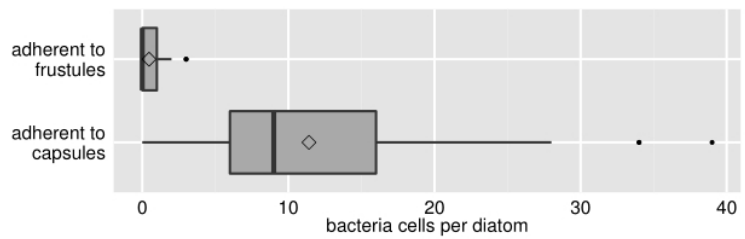
N_frustules <- dim(frustules)[1]
N_capsules <- dim(capsules)[1]

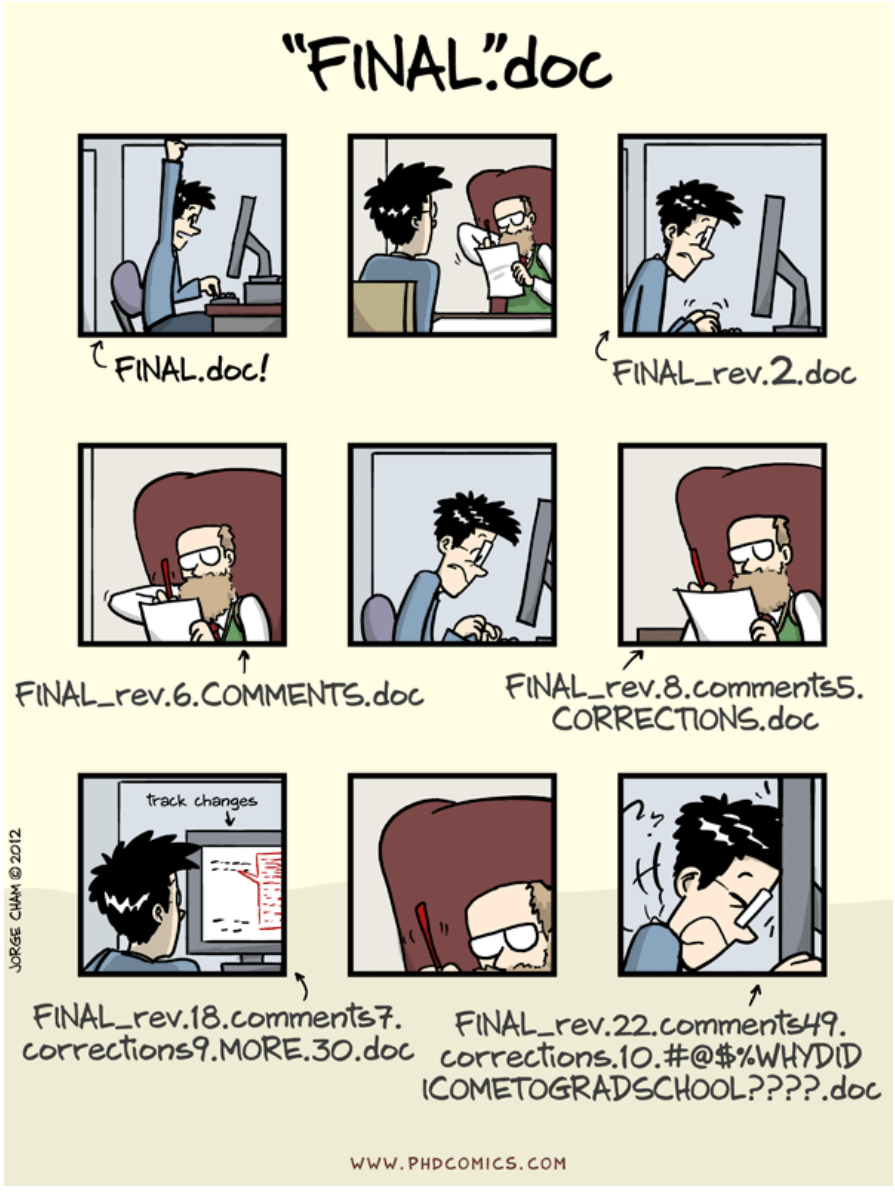
plot <- ggplot(data_raw, aes(x = diatom_valve, y = N_bacteria))  +
  geom_boxplot(fill = "darkgrey", size = 1)  +  # thicker outlines
  coord_flip()  +
  labs(title = NULL, x = NULL, y = "bacteria cells per diatom")  +
  scale_x_discrete(breaks = c("capsule", "frustule"),  # original category names / tick la
                   labels = c("adherent to\ncapsules", "adherent to\nfrustules")  # learne
                   )  +  # learned from http://www.cookbook-r.com/Graphs/Axes_%28ggplot2%2
  stat_summary(fun.y = mean, geom = "point", shape = 5, size = 4)  +  # adds symbol for me
  theme(title = element_text(size = 16),
        axis.title.y = element_blank(),
        axis.text = element_text(size = 16, color = "black"),
        axis.ticks = element_blank(),
        panel.grid.major = element_line(color = "white", size = 1)
        )  # learned from http://docs.ggplot2.org/0.9.3/theme.html
plot
```



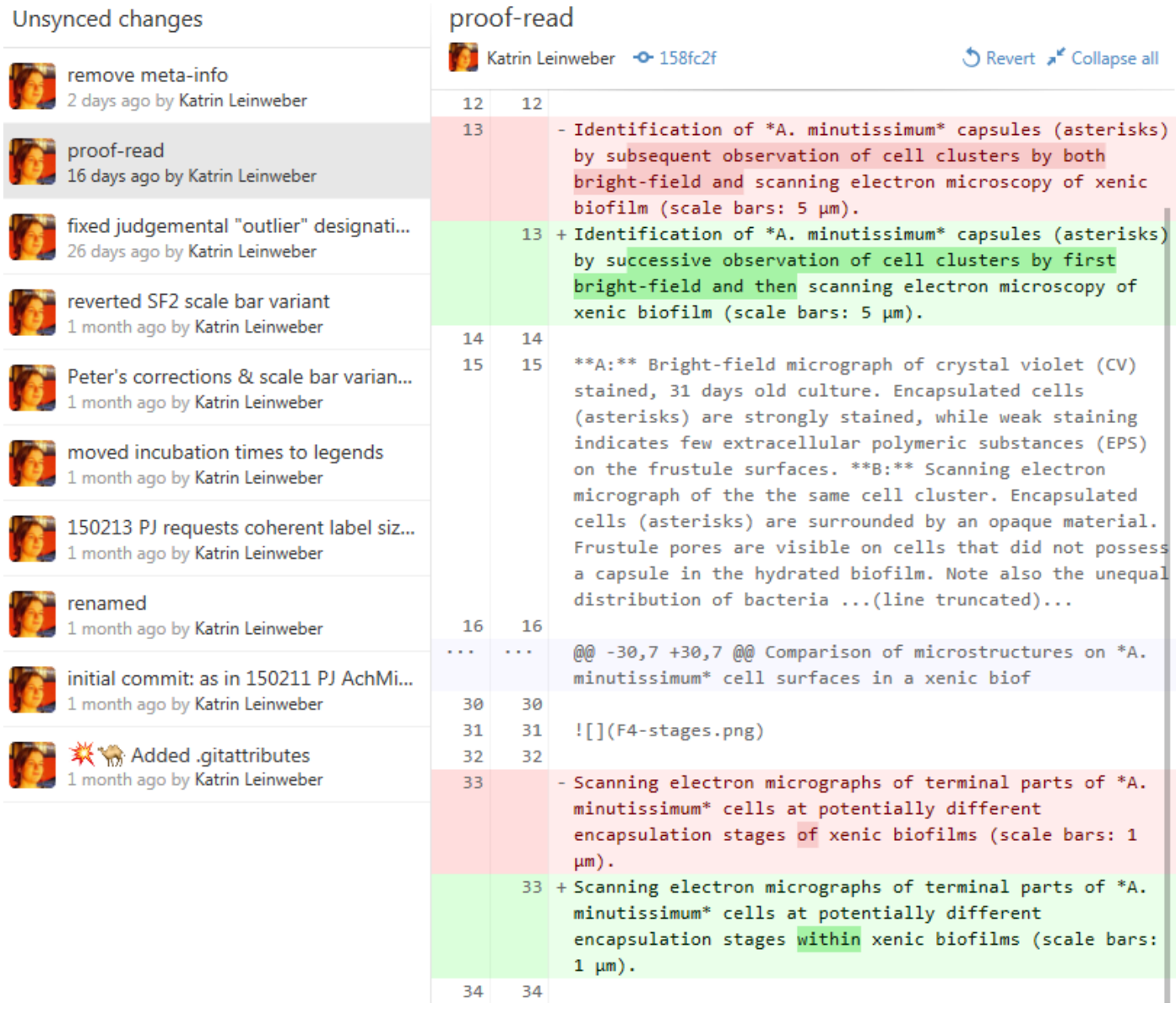
Bacteria were counted in SEM images, if they were in direct, visible contact with the valve face of either a frustule (N = 54) or a completely encapsulated diatom cell (N = 71; see main figures 2B and 3A for illustration). Boxes represent 1st and 3rd quartile. Black center lines represent medians. Whiskers extend to 1.5-fold of the inter-quartile range. Diamond symbols represent means. Black dots are outliers.

RMarkdown.RStudio.com
```

Use-case: preventing this...



...by plain text version control with Git



30min intro at konscience.de/git

Use-case: easier collaboration on manuscripts

 Paper Now: github.com/PeerJ/paper-now

- Git-based template & generator for article websites
- no submission options (yet)

 Authorea.com

- academic text editor with citations, formulas, figures, commenting, etc.
- 1-click-formatting & journal submission

Use-case: offline Scientific Markdown[4]

```
In contrast, axenic \achmi cells did not form biofilms, so that even careful
rinsing left much fewer cells attached to the disks and thus available for SEM
analysis.
This observation is in agreement with studies that utilised other growth
substrates to compare biofilm formation by axenic and xenic diatom cultures.
By measuring chl concentrations, the possibility that axenic cells might
simply be less proliferate was excluded [@windler_biofilm_2015].
Xenic \achmi cultures on the other hand have also been found to develop
biofilms on glass beads as well as in plastic multi-well plates [
@lubarsky_stabilisation_2010; @windler_biofilm_2015].
Our results demonstrate, that xenic biofilms of \achmi can also be grown on
Thermanox disks, enabling direct preparation for electron microscopy of native
biofilm samples.

### Identification of \achmi capsule microstructures

![**Identification of \achmi capsules (asterisks) by successive observation of
cell clusters by first bright-field and then scanning electron microscopy of
xenic biofilm (scale bars: 5 µm).**
**A:** Bright-field micrograph of CV stained, 31 days old culture.
Encapsulated cells (asterisks) are strongly stained, while weak staining
indicates few extracellular polymeric substances (EPS) on the frustule
surfaces.
**B:** Scanning electron micrograph of the same cell cluster.
Encapsulated cells (asterisks) are surrounded by an opaque material.
Frustule pores are visible on cells that did not possess a capsule in the
hydrated biofilm.
Note also the unequal distribution of bacteria cells on capsules versus non-
encapsulated frustules. \label{CLEM}](capsule-microstructure-figures/CLEM.png)

In order to correlate the hydrated \achmi capsules visible in light microscopy
to their dehydrated appearance in SEM, areas were marked by scratches on the
CV stained disks and cells of interest were identified by BFM.
Subsequently, the same areas and cells were found again in the SEM (Fig.
\ref{CLEM}).
The same technique was successfully applied to axenic cultures, despite the
lower prevalence of adherent cells (Suppl. Fig. \ref{CLEM-ax},\ p.\
\pageref{CLEM-ax}).
```


after removal from the medium. Staining with the dye CV and subsequent bright-field microscopy showed that large portions of the diatom cells were surrounded by capsules.

In contrast, axenic *A. minutissimum* cells did not form biofilms, so that even careful rinsing left much fewer cells attached to the disks and thus available for SEM analysis. This observation is in agreement with studies that utilised other growth substrates to compare biofilm formation by axenic and xenic diatom cultures. By measuring chl concentrations, the possibility that axenic cells might simply be less proliferate was excluded [Windler et al., 2015]. Xenic *A. minutissimum* cultures on the other hand have also been found to develop biofilms on glass beads as well as in plastic multi-well plates [Lubarsky et al., 2010; Windler et al., 2015]. Our results demonstrate, that xenic biofilms of *A. minutissimum* can also be grown on Thermanox disks, enabling direct preparation for electron microscopy of native biofilm samples.

Identification of *A. minutissimum* capsule microstructures

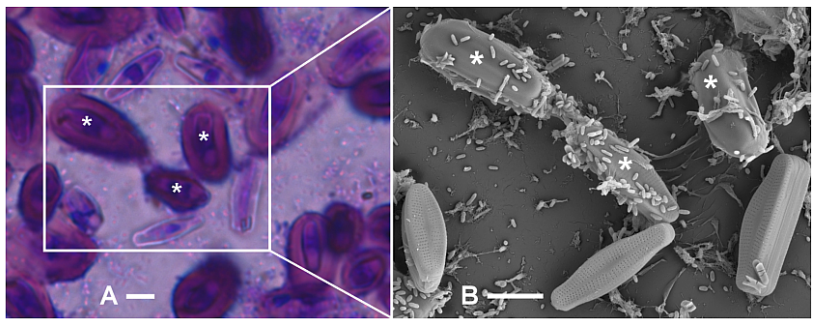


Figure 4.8: **Identification of *A. minutissimum* capsules (asterisks) by successive observation of cell clusters by first bright-field and then scanning electron microscopy of xenic biofilm (scale bars: 5 µm). A:** Bright-field micrograph of CV

toolset for bridging Markdown to LaTeX (and anything else)

[4] github.com/JensErat/scientific-markdown

Write in Word? Save in Markdown! Publish in LaTeX!

- Writage.com adds Markdown support in Word
- messy plain text, renamed image files & lost figure captions

Capsules of the diatom *Achnanthidium minutissimum* arise from fibrillar precursors and foster attachment of bacteria

Abstract

Please note: This is an experimental Paper Now version of this PeerJ article based on this source repository. No guarantees are given for the correctness or completeness of this experimental version.

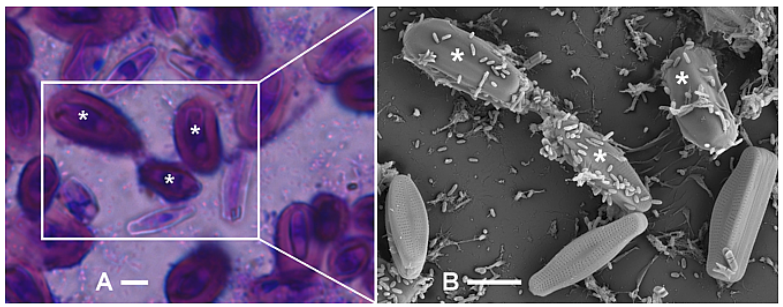


Figure 1: Crystal violet (CV) stained capsules (grey ovals) in xenic *A. minutissimum* biofilm (scale bar: 20 µm).

```
Capsules of the diatom *Achnanthidium minutissimum* arise
from fibrillar precursors and foster attachment of bacteria
============================================================
============================================================

Abstract
--------

**Please note: This is an experimental** [**Paper
Now**](https://github.com/PeerJ/paper-now) **version of**
[**this PeerJ
article**](https://peerj.com/articles/858/) **based on**
[**this source
repository**](
https://github.com/katrinleinweber/paper-now/)**. No
guarantees are given for the correctness or completeness
of this
experimental version.**

![](./media/image1.png)

Figure 1: Crystal violet (CV) stained capsules (grey
ovals) in xenic *A.
minutissimum* biofilm (scale bar: 20 µm).
```

Write in Word,
Save in Markdown,
Publish in LaTeX

~~Write in Word,~~

Use Markdown wherever possible,

Convert to whatever is necessary.

Thanks for your attention! Questions?

katrin.leinweber@uni-konstanz.de

notes, links & slides on konscience.de/md

Acknowledgements

- retreat organisers
- github.com/JensErat/scientific-markdown

Funding

Actual lab work and thesis writing happened as well ;-)