

**Activation and regulation of *E. coli*  
DNA Polymerase V studied at the  
single-molecule level**

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university of  
 groningen

# **Activation and regulation of *E. coli* DNA Polymerase V studied at the single-molecule level**

**PhD thesis**

to obtain the degree of PhD at the  
University of Groningen  
on the authority of the  
Rector Magnificus Prof. E. Sterken  
and in accordance with  
the decision by the College of Deans.

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by

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*Science is a wonderful thing  
if one does not have to earn one's living at it.*

Albert Einstein



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# SUMMARY

Write your summary here.



# SAMENVATTING

Write the Dutch Summary here.



# RESUMO



# PREFACE

Preface goes here. This chapter is optional.

*Albert Einstein*  
*Groningen, January 2016*





# 1

## INTRODUCTION

**Albert EINSTEIN**

*Nature and nature's laws lay hid in the night;  
God said 'Let Newton be!' and all was light.*

Alexander Pope

*It did not last: the devil shouting 'Ho.  
Let Einstein be!' restore the status quo.*

Sir John Collings Squire

---

Parts of this chapter have been published in *Annalen der Physik* **324**, 289 (1906) [?].

## ABSTRACT

*Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.*

This document is intended to be both an example of the TU Delft dissertation template for  $\text{\LaTeX}$ , as well as a short introduction to its use. It is not intended to be a general introduction to  $\text{\LaTeX}$  itself,<sup>1</sup> and we will assume the reader to be familiar with the basics of creating and compiling documents.

Instructions on how to use this template under Windows and Linux, and which  $\text{\LaTeX}$  packages are required, can be found in `README.txt`.

## 1.1. DOCUMENT STRUCTURE

SINCE a dissertation is a substantial document, it is convenient to break it up into smaller pieces. In this template we therefore give every chapter its own file. The chapters (and appendices) are gathered together in `dissertation.tex`, which is the master file describing the overall structure of the document. `dissertation.tex` starts with the line

```
\documentclass{dissertation}
```

which loads the dissertation template. The template is based on the  $\text{\LaTeX}$  book document class and stored in `dissertation.cls`. The document class accepts several comma-separated options. By default, hyperlinks are shown in cyan, which is convenient when reading the dissertation on a computer, but can be expensive when printing. They can be turned black with the `print` option. This will also turn the headers dark gray instead of cyan. Moreover, it will add a 3 mm bleed around the page including crop marks. This will help the printer with the thumb indices, since they run right up to the page borders. Finally, the `nativefonts` option can be used to override the automatic font selection (see below).

A dissertation is a big document, which makes it easy to miss warnings about the layout in the  $\text{\LaTeX}$  output. In order to locate problem areas, add the `draft` option to the `\documentclass` line. This will display a vertical bar in the margins next to the paragraphs that require attention.

The contents of the dissertation are included between the `\begin{document}` and `\end{document}` commands, and split into three parts by

1. `\frontmatter`, which uses Roman numerals for the page numbers and is used for the title page and the table of contents;
2. `\mainmatter`, which uses Arabic numerals for the page numbers and is the style for the chapters;
3. `\appendix`, which uses letters for the chapter numbers, starting with 'A'.

The title page is defined in `title.tex` in the `title` folder and included verbatim with `\include{title/title}`,<sup>2</sup> (see below). Additionally, it is possible to include a preface, containing, for example, the acknowledgements. An example can be found in `preface.tex`. The table of contents is generated automatically with the `\tableofcontents` command.

<sup>1</sup>We recommend <http://en.wikibooks.org/wiki/LaTeX> as a reference and a starting point for new users.

<sup>2</sup>Note that it is not necessary to specify the file extension.

Chapters are included after `\mainmatter` and appendices after `\appendix`. For example, `\include{chapter-1/chapter-1}` includes `chapter-1.tex`, which contains this introduction.

## 1.2. TITLE PAGE

THE title pages are defined in `title/title.tex`, which you will have to modify according to your needs. Note that these pages are subject to the requirements of the *promotieregeling* and cannot be changed at will. Apart from the names and dates, most of the Dutch text is dictated literally.

Since the thesis title and name of the author appear several times throughout the document (on the title page, but also in, e.g., the preface and cv), special commands are provided so they only have to be specified once. The title (and optional subtitle) can be specified with

```
\title[Optional subtitle]{Title}
```

The name of the author is specified with

```
\author{First name}{Last name}
```

Note that the first and last name are separate arguments, since they may be printed in different font shapes. The `\title` and `\author` commands also ensure that the title and author appear in the metadata of the final PDF.

See `title/title.tex` for detailed documentation on the comment and layout of the title pages. Logos of institutes that have contributed financially to the dissertation may be included on reverse side of the title page. A few example logos can be found in the `title/logos` folder.

## 1.3. CHAPTERS

EACH chapter has its own file. For example, the  $\LaTeX$  source of this chapter can be found in `chapter-1.tex`. A chapter starts with the command

```
\chapter{Chapter title}
```

This starts a new page, prints the chapter number and title and adds a link in the table of contents. If the title is very long, it may be desirable to use a shorter version in the page headers and the table of contents. This can be achieved by specifying the short title in brackets:

```
\chapter[Short title]{Very long title with many words which could  
not possibly fit on one line}
```

Unnumbered chapters, such as the preface, can be created with `\chapter*{Chapter title}`. Such a chapter will not show up in the table of contents or in the page header. To create a table of contents entry anyway, add

```
\addcontentsline{toc}{chapter}{Chapter title}
```

after the `\chapter` command. To print the chapter title in the page header, add

```
\setheader{Chapter title}
```

If (parts of) the chapter have already been published elsewhere, it is customary to add a reference. This can be done with the special unnumbered footnote command `\blfootnote`. For example,

```
\blfootnote{Parts of this chapter have been published in Annalen  
der Physik \textbf{324}, 289 (1906) \cite {Einstein1906}.}
```

generates the footnote at the beginning of this chapter. Because this footnote is unnumbered, the `hyperref` package may throw a warning, which safely be ignored.

If multiple people have contributed significantly to this chapter, they can be listed with the `\authors` command. This can be followed by a quotation using `\epigraph` as shown above. Finally, it is customary for a dissertation to include an abstract for every chapter (except perhaps the introduction). This can be accomplished with the `abstract` environment. The abstract should be followed by `\newpage` to start the chapter text on a new page.

In a dissertation, each chapter has its own list of references. These can be generated with the special command `\references{dissertation}` from `dissertation.bib` at the end of the chapter. Note that this means that you need to run a command like `bibtex chapter-1/chapter-1` for each chapter. The bibliography style is specified in `dissertation.bst`, which is a modified version of `apsrev4-1.bst` (from REVTeX) designed to also display the titles of referenced articles. The template will automatically generate clickable hyperlinks if a URL or DOI (digital object identifier) is present for the reference. Although it is possible to manage the bibliography by hand, we recommend using EndNote (available from Blackboard) or JabRef (available from <http://jabref.sourceforge.net/>).

Chapters are subdivided into sections, subsections, subsubsections, and, optionally, paragraphs and subparagraphs. All can have a title, but only sections and subsections are numbered. As with chapters, the numbering can be turned off by using `\section*{...}` instead of `\section{...}`, and similarly for the subsection.

## 1.4. \SECTION{...}

### 1.4.1. \SUBSECTION{...}

```
\SUBSUBSECTION{...}
```

```
\paragraph{...} Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod  
tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud  
exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor  
in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur  
sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est  
laborum.
```

## 1

## 1.5. FONTS AND COLORS

THE fonts used by this template depend on which version of  $\LaTeX$  you use. Regular  $\LaTeX$ , *i.e.*, if you compile your document with `latex`, `pslatex` or `pdflatex`, will use Utopia for text, Fourier for math and Latin Modern for sans-serif and monospaced text. However, if you want to adhere to the TU Delft house style, you will need to use  $\XeLaTeX$ , as it supports TrueType and OpenType fonts. Compiling with `xelatex` will use Bookman Old Style for titles, Tahoma for text, Courier New for monospace and Cambria for math. If you want to use  $\XeLaTeX$ , but do not want to use the TU Delft house style fonts, you can add the `nativefonts` option to the document class.

This template supports the use of drop caps, a large colored initial at the beginning of a chapter or section, via the `\dropcap` command:

```
\dropcap{L}{orem} ipsum...
```

The first argument is the capital that will be printed on two lines (in the title color), and the second argument is the rest of the word. Depending on the font, the latter may be printed in small caps.

The corporate colors of the TU Delft are cyan, black and white, available, respectively, via `\color{tudelft-cyan}`, `\color{tudelft-black}` (which differs slightly from the default black) and `\color{tudelft-white}`. Apart from these three, the house style defines the basic colors

- `tudelft-sea-green`,
- `tudelft-green`,
- `tudelft-dark-blue`,
- `tudelft-purple`,
- `tudelft-turquoise` and
- `tudelft-sky-blue`,

as well as the accent colors

- `tudelft-lavender`,
- `tudelft-orange`,
- `tudelft-warm-purple`,
- `tudelft-fuchsia`,
- `tudelft-bright-green` and
- `tudelft-yellow`.

Colors were deactivated in my version of this tex file. Refer to the original package if interested.

# 2

## REGULATION OF MUTAGENIC DNA POLYMERASE V IN SPACE AND TIME

Andrew Robinson, John P. McDonald, Victor E. A. Caldas, Meghna Patel, Elizabeth A. Wood, Christiaan M. Punter, Harshad Ghodke, Michael M. Cox, Roger Woodgate, Myron F. Goodman, Antoine M. van Oijen.

---

Regulation of Mutagenic DNA Polymerase V Activation in Space and Time. **PLOS Genetics**, 2015, 324,289 [? ].

## 2

**ABSTRACT**

*Write here the Abstract*



---

Here starts your content.



# 3

## CONCLUSION

This is a concluding chapter explaining the scientific and technical implications for society of the research findings in considerable detail.



# EPILOGUE

This is an optional epilogue.



# ACKNOWLEDGEMENTS

This is an optional chapter containing acknowledgements.





# CURRICULUM VITÆ

## Albert EINSTEIN

14-03-1879      Born in Ulm, Germany.

### EDUCATION

1892–1896      Grammar School  
Luitpold Gymnasium, München (1892–1895)  
Aarau, Switzerland (1895–1896)

1896–1900      Undergraduate in Mathematics & Physics  
Eidgenössische Polytechnische Schule Zürich

1905              PhD. Physics  
Eidgenössische Polytechnische Schule Zürich  
*Thesis:*            Eine neue Bestimmung der Moleküldimensionen  
*Promotor:*       Prof. dr. A. Kleiner

### AWARDS

1922              Nobel Prize in Physics

1925              Copley Medal

1929              Max Planck Medal

1999              Time magazine's person of the century



# LIST OF PUBLICATIONS

4. **A. Einstein**, *Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?*, Annalen der Physik **18**, 639 (1906).
3. **A. Einstein**, *Zur Elektrodynamik bewegter Körper*, Annalen der Physik **17**, 891 (1905).
2. **A. Einstein**, *Über die von der molekularkinetischen Theorie der Wärme geforderte Bewegung von in ruhenden Flüssigkeiten suspendierten Teilchen*, Annalen der Physik **17**, 549 (1905).
1. **A. Einstein**, *Über einen die Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspunkt*, Annalen der Physik **17**, 132 (1905).