

High Throughput Enhancer Screening: Case Studies in Evolution and Disease

by

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Department of Molecular Genetics and Microbiology  
Duke University

Defense Date: November 20, 2025

Approved:

Craig B. Lowe, Supervisor

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Dissertation submitted in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy in the Department of Molecular Genetics and Microbiology  
in the Graduate School of Duke University  
2025

ABSTRACT

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## **Abstract**

In the abstract, you must (1) present the problem of the thesis/dissertation, (2) discuss the materials and methods used, and (3) state the conclusions reached. Individual chapters should not have abstracts.

Note that this will be the first numbered page: it is page *iv*; pages *i*, *ii* and *iii* (copyright, signature page and abstract signature page) were counted but not numbered. If you look ahead, you will see that numbering up to the first page of text is in roman numerals. On the first page of Introduction or Chapter One, begin numbering at Arabic number 1. This numbering (1, 2, 3, 4 . . . ) is consecutive through the rest of the document.

Also note that the page margins are set with a 1.5-inch margin on the left side and a 1-inch margin on the top, right side, and bottom, throughout the entire document.

The page number below should be above the 1-inch margin and centered to the page margins, not the page edges.

## **Dedication**

If you want to dedicate your thesis to anyone do so here.

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## **Acknowledgements**

Thank anyone you like here. It's good practice to thank every granting agency that's given you money since you've been ABD, any other school you visited during your research, and any professional society that's funded your travel.

# **1. Introduction**

This template was updated November 2023. The provided L<sup>A</sup>T<sub>E</sub>X template is intended to be used with `pdflatex` and `biber` for bibliography management, though users may modify as needed to use the bibliographic management system of their choice.

To submit your thesis/dissertation electronically, you have to agree for it to be available online through Duke University Library. During the submission process, you will be required to sign the following release in *italics*, below. Don't sign this copy, the Graduate School will give you one when you submit.

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## ***1.2 An Introduction is a requirement and always starts as Page 1***

Paste in text from other documents, highlight headings and then use Word's list of styles to specify the level heading it is (\chapter{} for chapter titles, \section{} for sections of chapters, \subsection{} for subsections, etc.) If you paste text into the template from another source, particularly Microsoft Word, you may be bringing along special characters that the L<sup>A</sup>T<sub>E</sub>X compiler will get angry at. If your compilation fails following copy-paste, check your source for special characters and replace with the appropriate native L<sup>A</sup>T<sub>E</sub>X commands.

You must have an Introduction section first, and a Conclusion section at the end of your manuscript as the final chapter.

## ***1.3 Sharing with Colleagues***

To share your documents with your committee, it is suggested to either use an online L<sup>A</sup>T<sub>E</sub>X environment such as Overleaf, teach your committee to use L<sup>A</sup>T<sub>E</sub>X, or convert your source to a different file format, such as Microsoft Word or Markdown. The best tool

for this conversion is pandoc. Note that some aspects of formatting, automatic figure numbering, and referencing gets very strange when converting L<sup>A</sup>T<sub>E</sub>X source in this manner. If Word compatibility is required by your committee or colleagues, consider using Quarto or RMarkdown, as conversion from Markdown to Word is easier than from L<sup>A</sup>T<sub>E</sub>X. As a sample pandoc command, see the following (note, this is just intended as a starting point, and users are encouraged to look into the syntax and ensure this works for your use case). Note also, that this will likely pop up a message asking if you want to “Update the fields in this document,” which you should select YES for. This pandoc command **will not** produce files acceptable for submission to the graduate school, but will be fine to use if you want to share with colleagues for editing purposes.

```
pandoc -s dissertation.tex --from latex+latex_macros  
--bibliography=Bibliography\mybib.bib  
--citeproc --toc -t docx -o dissertation.docx  
--reference-doc reference_numbering.docx --verbose
```

## 2. Duke Dissertation Class Documentation

`dukedissertation.cls` — a document class for dissertations and theses conforming to the 2023 Duke University guidelines. This class is by Michael Gratton and modified by Hugh Crumley, Mitchell Abrams (2023), and Michael Gao (2025). It is based on the 2004 L<sup>A</sup>T<sub>E</sub>X2 $\epsilon$  version of report.cls and code in the older dukethesis.cls dating back to 1987.

The report.cls is Copyright 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 The LaTe<sup>X</sup>3 Project.

The original dukethesis.cls contained work by Mark Holliday, Charlie Martin, Russ Tuck, Sean O'Connell, Michael Todd, Syam Gadde, and Rajiv Wickremesinghe. Some of this work has been folded into the new document class.

This file may be distributed and/or modified under the conditions of the L<sup>A</sup>T<sub>E</sub>X Project Public License, either version 1.3 of this license or (at your option) any later version. The latest version of this license is in <http://www.latex-project.org/lppl.txt> and version 1.3 or later is part of all distributions of L<sup>A</sup>T<sub>E</sub>X version 2003/12/01 or later.

### 2.1 Features

This class conforms to the 2023 style guidelines for dissertations, including:

1. Page numbers centered in the footer of each page
2. Margins: 1in top, 1in right, 1.5in left, 1in below footer
3. Title signature page, UMI abstract title signature page, and copyright page automatically generated at \maketitle
4. 'Double' spacing throughout body text (really about 10pt extra instead of 12pt extra.)
5. Double spacing between and single spacing within the Table of Contents, List of Tables, List of Figures, Bibliography, and in chapter, section titles, and figure/table captions.
6. Footnotes are numbered consecutively within a chapter and placed at the bottom of the page on which the reference number appears.

7. Page ordering and numbering: roman numeral page numbers appear in the frontmatter (prior to the introduction or Chapter 1). The first numbered page is the Abstract (iv). Arabic numbering from '1' starts in the Introduction
8. Optional material supported:
  - Dedication
  - Acknowledgements
  - Introduction (different from 'Chapter 1: Introduction')
  - Appendices
  - Biography

This class also provides some handy features:

1. Use the option 'economy' to get a single-spaced document appropriate for giving to colleagues.
2. Change your copyright from 'All rights reserved' if you're not actually reserving all your rights.

By default, the figure and table captions are set to print centered with `centering`. Change the `\captionsetup` option in the preamble to adjust this to either `justified` or `raggedright` as desired.

## **2.2 Limitations**

In it's current form, this class does not support committees larger than six members, or titles longer than four lines. The figure-to-caption space has been abbreviated, as most plotting programs provide ample bottom margins. This default may not be acceptable in all cases.

## **2.3 Class options**

The class supports the following options. Options appear in pairs with the default option in each pair listed first. The exception is the first listed option, which merely activates several other options for convenience.

**economy** Macro. Enables the options `singlespace`, `nogradschool`, and `nobind`. **Changed in**

### **version 0.3**

**gradschool** Default. Produces signature lines and a UMI abstract title page.

**nogradschool** Suppresses the above.

**PhD** Default. Format is suitable for a Ph.D dissertation.

**MS** Modifies the format for Masters Theses. Changes the text on the title page, omits the UMI page, and generates warnings when forbidden document parts are used (i.e., Biography).

**openany** Default. Allows a chapter to start on any page.

**openright** Chapters only start on right-hand pages. Only makes sense for twosided documents.

**oneside** Default. Wide margin (where the binding will be) always occurs on the left edge of a page.

**twoside** Wide margin occurs on the left of odd pages and the right of even pages. This is for binding duplex printed documents.

**final** Default. No extra marks, include all pictures.

**draft** Prints black bars on pages where the contents overflow the margins. Suppresses the inclusion of graphics for speed.

**doublespace** Default. Double-spaces body text and adds extra space between entries in the Table of Contents, List of Figures, List of Tables, List of Abbreviations, and Bibliography.

**singlespace** Normal distances between baselines in all cases. Normal spacing in all list-type environments.

**bind** Default. 1.5in margin for binding appears on spine-side of a page.

**nobind** Left and right margins are both 1.25in. **New in version 0.3**

The default options are chosen so that the document will pass the Ph.D format specifications of the graduate school.

Here are some handy examples. Format required by graduate school:

```
\documentclass{dukedissertation}
```

Easy-to-read format for printing, sending to collaborators, etc:

```
\documentclass[economy]{dukedissertation}
```

Suitable for spiral bound copies and the like

```
\documentclass[economy, twoside, bind]{dukedissertation}
```

### 3. Basic Document Class Features, Using a Very Long Chapter Title to Illustrate Appropriate Behaviors

This chapter is an example of how to format normal material in the dissertation style. Most of this information is standard to L<sup>A</sup>T<sub>E</sub>X.

#### 3.1 *Intra-chapter divisions: Sections*

Section headlines are \Large and in italics. Compare them to subsections below.

##### 3.1.1 Subsections: More numbers!

Isn't it funny that upright letters are called "roman" while slanted letters are "italic". That's like Italian, and Romans are Italians too. What gives?

###### 3.1.1.1 Subsubsections: Smaller and smaller

Subsubsections are allowed, but are not numbered and don't appear in the table of contents. Likewise, you can use the next level of sectioning.

**3.1.1.1.1 Paragraphs** These divisions are unnumbered and do not appear in the Table of Contents. Why would you use this at all?

**Subparagraphs** This is the finest division possible. It's also unnumbered and omitted from the Table of Contents. If you find yourself subdividing sections this finely, you have probably made some poor organizational choices.

#### 3.2 Let's do some math

Let's look at an equation:

$$\partial f t = f(t) \text{ subject to } f(0) = c. \quad (3.1)$$

We've used the \newcommand defined in the preamble of `dissertation.tex` to produce the derivative. You can get a second derivative like  $\partial^2 f t^2$  by adding some sneaky superscripts. Fancy.

More advanced equation formatting is available in the AMS environments. See the guide `amsmath` user's guide. Here are some nice examples of cases people usually have trouble with.

An equation that's too long for one line — use `multline`:

$$\begin{aligned} a + b + c + d + e + f + g + h + i + j + k + l + m + n + o \\ = p + q + r + s + t + u + v + w + x + y + z. \end{aligned} \quad (3.2)$$

An equation with multiple parts and one number per line — use `align`:

$$a_1 = b_1 + c_1 \quad (3.3)$$

$$a_2 = b_2 + c_2. \quad (3.4)$$

The same equation, set inside the `subequations` environment:

$$a_1 = b_1 + c_1 \quad (3.5a)$$

$$a_2 = b_2 + c_2. \quad (3.5b)$$

Notice that by clever placement of labels, I can reference the pair via (4), the first (3.5a), or the second (3.5b). One number for multiple equations can be accomplished using the `split` environment:

$$\begin{aligned} a &= b + c - d \\ &\quad + e - f \\ &= g + h \\ &= i. \end{aligned} \quad (3.6)$$

People often struggle under the complicated and ugly 'eqnarray' environment. Don't do it!

The AMS ones are easy. Other stumbling blocks are cases:

$$a = \begin{cases} b & \text{for } x > 0 \\ c & \text{otherwise,} \end{cases} \quad (3.7)$$

matrices:

$$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}, \quad (3.8)$$

and evaluation bars:

$$a = \left. \frac{\partial u}{\partial x} \right|_{x=0}. \quad (3.9)$$

See the source file for details.

When we reference an equation with something like `\eqref` (3.1). If you click on the above references in the PDF, your viewer should scroll up to the above equation. It's handy. Labels and references may be attached to all sorts of objects. There is a `\label` attached to this chapter (it appears at the top of this file), and we may reference it by (`Chapter~\ref{chap:example}`), producing “Chapter 3”. By default these ref's are hyperlinked as well. Later, we'll see labeled and referenced figures and tables. Particular pages may be labeled with standard `\label` commands in the text and referenced via `\pageref`.

You might also like the links from `\cite` commands to the corresponding bibliographic entry. Go look at this imaginary book by Stephen Colbert **fancy**. If you're not a bibtex expert, look in `mybib.bib` at the `@ARTICLE` that generated this entry. It shows an example of accents on author names and how to preserve upper-case for letters in the title. Other entries show the use of the `and` keyword between author names. You may order a particular author's name as either “first last” or as “last, first”. The actual format of the bibliography is controlled by the `\bibliographystyle{}` command in `dissertation.tex`. Here is another reference for **BeckerGrunEtAl03** and another for **BonnEggersEtAl**.

### **3.3 Table of Contents Behavior**

Now is a good time to look back at the Table of Contents. The Graduate School template does not allow the use of hyperlinks from the Table of Contents throughout the text. However, in the TOC should appear in the ‘bookmarks’ pane when using a viewer such as Adobe Acrobat. This should be populated with named and numbered sections and subsections identical to the Table of Contents.



FIGURE 3.1: Longer caption for actual body of dissertation. Figure captions should be **BELOW** the figure.

### **3.4 Figures and footnotes**

Figures are set with very little space between the caption and the bottom of the included graphic. This is because most graphics programs pad the edges of images. If you find the spacing unsatisfactory, you may always add a bit manually. The text of the caption is single-spaced, and the word 'Figure' is set in small caps. See Fig. 3.1. Notice the use of the nonbreakable space “ ~ ” between the “Fig.” and the reference.

Figures (and tables) are examples of 'floats' — objects that **LATEX** decides where to place for you. You may give **LATEX** some hints. Change the `\begin{figure}[tbp]` to a `\begin{figure}[b!]` to restrict the placement. Inside the [ ], you can put the following

- t Allow placement at the top of the page
- b Allow placement at the bottom of the page
- h Allow placement 'here', in the middle of the page close to the text that the figure

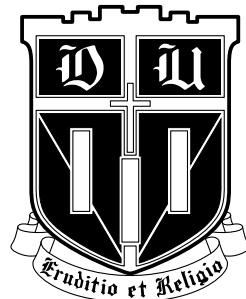


FIGURE 3.2: This is a short caption for a small figure.

environment appears next to.

- p Allow placement on a separate 'floats page' that has no body text.
  - ! Tighten the screws on the placement algorithm. This doesn't force things to happen as you say, but it makes it much more likely. Be careful: the bang option can cause figures to appear above the chapter title and in other bad locations.

Notice that each entry just changes what is *allowed*, but no preference among the entries can be registered. The default is [tbp], which is a very good default for a document like this, since floats in the middle of a page trap too much whitespace for double-spaced text. There is also a prohibition against having a page with more than 75% float. Instead, long floats will get kicked over onto float pages. Float pages are often a bad idea, as the creation of one will often cause a domino effect, with all subsequent figures appearing on float pages themselves, and all these float pages appearing together at the end of the chapter. (This is more like sinking than floating.) Avoid this by physically moving where the figure environment appears in your source file to an earlier location. Don't be afraid to put the environment before the first spot you reference it! Many float problems can be solved by a combination of relocating the figure environment and a little fiddling with the [ ] options.

Also notice the order of the graphic, caption, and label. If you deviate from this, strange things can happen. The caption of this figure shows the use of short captions (inside []). These captions appear in the List of Tables, while the long captions appear in the body. If you omit the [ ] short caption, the long caption will be used in its place.

Table 3.1: Long table caption appears on in the body text. See the short caption in the List of Tables. Table captions need to be ABOVE the table.

Numbers	Letters	Symbols
1	a	†
2	b	‡
3	c	×
4	d	#

Another technical note: since this style sheet is designed for processing by pdflatex, \includegraphics looks for PDFs, PNGs, and JPGs instead of the usual PS, EPS, and TIFF formats. You can convert existing graphics with a variety of tools. PDF graphics are preferred, as they scale nicely. The open-source software Inkscape runs on Mac OSX, Windows, Linux, and some UNIX variants. Versions 0.46 and beyond have great support for creating and editing PDFs. It can even be used to convert other docs.

### 3.4.1 List of Figures

If you've put even one measly figure in your document, grad school rules say you need a List of Figures. It's automatically generated for you if you do a \listoffigures in the master file (heck, it's there right now). Go look at the list of figures now. You should be able to click on the figure number to warp to the figure. You'll also see the result of the 'short caption' used above.

### 3.5 Table example

Just to make sure tables are formatted correctly, here's an example of a table float, see Table 3.1. You should note that [b] formatting ( \begin{center} [b] ) can cause floats to appear under the footnotes. Try changing it here and see the ugliness. Tables are identical to figures, except that the word 'Table' appears in the caption and its entry is in the List of Tables instead of the List of Figures.

### **3.5.1 Bigger Tables**

You may find that having an extra-wide table is necessary, like Table 3.2. You may insert a landscape page using the `\begin{landscape}... \end{landscape}` syntax. This will place items on the page in landscape orientation, but will not rotate the page in the PDF. Use `\usepackage{lscape}` to keep pages in portrait layout, with text rotated to landscape. Use `\usepackage{pdflscape}` to rotate these pages within the PDF. When using a landscape environment, do not use the `\textwidth` macro, rather you must use `\linewidth`.

Table 3.2: Some random things about random animals. These animals are random, and so is the other information in this table.  
Does anyone care? Not really, no.

Name	Animal Name	Scientific Name	Date	Random
Alix	White spoonbill	<i>Platalea leucordia</i>	5/15/2023	knowledge base
Kerk	Kangaroo, eastern grey	<i>Macropus giganteus</i>	6/28/2023	installation
		<i>Fratercula</i>		
Sol	Puffin, horned	<i>corniculata</i>	1/9/2023	conglomeration
Engracia	Ornate rock dragon	<i>Ctenophorus ornatus</i>	9/12/2023	encompassing
Alfred	Vicuna	<i>Vicugna vicugna</i>	5/13/2023	local area network
		<i>Myiarchus</i>		
Kelsey	Tyrant flycatcher	<i>tuberculifer</i>	5/9/2023	process improvement
		<i>Ephippiorhynchus</i>		
Dwayne	Stork, saddle-billed	<i>senegalensis</i>	9/11/2023	maximized
Nolie	Polecat, african	<i>Ictonyx striatus</i>	11/27/2022	system engine
Nicko	Black-backed jackal	<i>Canis mesomelas</i>	3/31/2023	hardware
		<i>Actophilornis</i>		
Marlowe	Trotter, lily	<i>africanus</i>	6/8/2023	6th generation
Enrica	Bettong, brush-tailed	<i>Bettongia penicillata</i>	8/25/2023	Secured
		<i>Vulpes</i>		
Theresina	Fox, grey	<i>cinereoargenteus</i>	11/20/2022	Fundamental
		<i>Corallus hortulanus</i>		
Syd	Boa, cook's tree	<i>cooki</i>	3/22/2023	service-desk
		<i>Elephas maximus</i>		
Ekaterina	Asian elephant	<i>bengalensis</i>	6/28/2023	Econometrics
Torie	Emerald green tree boa	<i>Boa caninus</i>	10/16/2022	Databases

### 3.5.2 Footnotes

Footnotes are allowed.<sup>1</sup> They are numbered with arabic numerals inside each chapter and appear at the bottom of the page.<sup>2</sup> The little footnote numbers are also hyperlinks. Try clicking them. You should place the footnote command immediately following the period of the sentence it is attached to. Any spaces or newlines will result in strange spacing between the number and the sentence.

## ***3.6 Corner cases in formatting, such as very very very long section titles. Man, this goes on forever.***

Common corner-cases involve very long titles (like above). In these cases, the long titles are set single-spaced both here and in the Table of Contents.

### **3.6.1 Figure and Table caption cases are neat, and this is an absurdly long subsection heading**

Consider the shield logo again with an absurd caption, as in Fig. 3.3. Also examine the new table, Table 3.3. Both of these have been forced onto a floats page so you can see what that looks like.

---

<sup>1</sup> But, you should probably just work them into the text since it's annoying to jump around when reading.

<sup>2</sup> ...rather than the end of the chapter or the thesis. Those would properly be endnotes, I guess.



FIGURE 3.3: The Duke logo again, but now with a really long rambling caption. This caption should be set single-spaced in the LoF, maximum one line, and in the body text. What do you think about having graphics in the main directory of a project? I'd prefer them in a folder, then put 'foldername/picturename' as the argument to includegraphics.

Table 3.3: The same silly table again, but with a really long caption.

Numbers	Letters	Symbols
1	a	†
2	b	..
3	c	×
4	d	#

## 4. Nonsense text for layout proofing

Enjoy some Lorem Ipsum text! This should create about two full pages of text so you can verify the margins are correct (especially if you're doing two-sided).

### 4.1 *Lorem Ipsum*

Lore*m ipsum dolor sit amet, consectetuer adipiscing elit. Sed vitae leo. Pellentesque quis nisi id orci consectetuer posuere. Quisque malesuada rhoncus dui. Vivamus mi. Mauris commodo. Phasellus lacus magna, feugiat ac, blandit ut, rutrum id, massa. In consectetuer magna vel justo. Cras eu diam. Nullam tortor turpis, bibendum non, consequat ac, tincidunt non, nisi.*

Curabitur sagittis dignissim arcu. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum ullamcorper. Curabitur faucibus euismod nulla. Vivamus sagittis. Sed fermentum neque a risus vestibulum convallis. Morbi id massa ut arcu mollis commodo. Aliquam erat volutpat. Pellentesque fringilla pellentesque nisi. Morbi tristique ornare libero. Vestibulum turpis sapien, iaculis ut, cursus non, condimentum in, tortor. Aenean vehicula. Integer egestas tincidunt erat. Aenean euismod ante vel lectus. Duis ac sapien vel erat euismod aliquet. Vivamus tempor placerat nibh. Curabitur pharetra, orci consequat pulvinar ultricies, orci enim tempor augue, non lacinia orci nisl et nibh. Nunc gravida dictum turpis. Duis sollicitudin commodo massa. Nam ac nunc. Fusce sodales posuere velit. Nunc ullamcorper sodales urna. Donec consectetuer accumsan ante. Morbi feugiat rutrum mauris. Praesent malesuada auctor est. Pellentesque quis odio non nulla ornare imperdiet. Aliquam dapibus. Suspendisse posuere, magna in molestie varius, ipsum velit rhoncus nisi, nec bibendum pede mauris in urna. Morbi purus lectus, molestie quis, laoreet id, tincidunt at, ligula.

Praesent sit amet libero id arcu adipiscing tristique. Quisque libero erat, bibendum nec, malesuada in, gravida et, urna. Phasellus molestie vulputate nisi. Nullam massa magna, dignissim ac, accumsan a, scelerisque eu, erat. Nam tellus augue, tempus nec, molestie sit

amet, rhoncus vel, libero. Vestibulum at neque. Aliquam laoreet tincidunt mi. Ut laoreet ligula ac urna. Nullam nisl pede, posuere id, dictum a, fermentum vitae, turpis. Nulla ante mauris, euismod et, mollis eu, tempor in, quam.

In pede augue, elementum varius, tincidunt in, condimentum ut, erat. Etiam vulputate faucibus velit. Aliquam porttitor. Nam fringilla adipiscing nisi. Sed in magna. Aenean non ante. Aenean facilisis, nunc sed aliquam porta, magna est aliquam nisi, vitae semper turpis orci ac dolor. Praesent nec tellus. Cras vulputate rhoncus sem. Curabitur eu mi. Mauris euismod lacinia nibh. Suspendisse eget sapien et nunc accumsan elementum. Nulla dapibus. Donec interdum elit mattis velit imperdiet aliquet. Mauris feugiat, ante vel faucibus rutrum, eros mauris sollicitudin neque, ut varius diam ipsum et massa. Nullam non nisi sit amet tortor rhoncus molestie. Cras consectetur condimentum ante. Phasellus fermentum risus fermentum turpis. Mauris dignissim iaculis sem. Fusce nisi lorem, viverra id, auctor et, scelerisque ut, massa. In hac habitasse platea dictumst. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Aliquam pulvinar neque ac dolor.

## **4.2 More nonsense**

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed vitae leo. Pellentesque quis nisi id orci consectetur posuere. Quisque malesuada rhoncus dui. Vivamus mi. Mauris commodo. Phasellus lacus magna, feugiat ac, blandit ut, rutrum id, massa. In consectetur magna vel justo. Cras eu diam. Nullam tortor turpis, bibendum non, consequat ac, tincidunt non, nisi. Curabitur sagittis dignissim arcu. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

Vestibulum ullamcorper. Curabitur faucibus euismod nulla. Vivamus sagittis. Sed fermentum neque a risus vestibulum convallis. Morbi id massa ut arcu mollis commodo. Aliquam erat volutpat. Pellentesque fringilla pellentesque nisi. Morbi tristique ornare libero. Vestibulum turpis sapien, iaculis ut, cursus non, condimentum in, tortor. Aenean vehicula.

Integer egestas tincidunt erat. Aenean euismod ante vel lectus. Duis ac sapien vel erat euismod aliquet. Vivamus tempor placerat nibh. Curabitur pharetra, orci consequat pulvinar ultricies, orci enim tempor augue, non lacinia orci nisl et nibh. Nunc gravida dictum turpis. Duis sollicitudin commodo massa. Nam ac nunc. Fusce sodales posuere velit. Nunc ullamcorper sodales urna. Donec consecteturtuer accumsan ante. Morbi feugiat rutrum mauris. Praesent malesuada auctor est.

Pellentesque quis odio non nulla ornare imperdiet. Aliquam dapibus. Suspendisse posuere, magna in molestie varius, ipsum velit rhoncus nisi, nec bibendum pede mauris in urna. Morbi purus lectus, molestie quis, laoreet id, tincidunt at, ligula. Praesent sit amet libero id arcu adipiscing tristique. Quisque libero erat, bibendum nec, malesuada in, gravida et, urna. Phasellus molestie vulputate nisi. Nullam massa magna, dignissim ac, accumsan a, scelerisque eu, erat. Nam tellus augue, tempus nec, molestie sit amet, rhoncus vel, libero. Vestibulum at neque. Aliquam laoreet tincidunt mi. Ut laoreet ligula ac urna. Nullam nisl pede, posuere id, dictum a, fermentum vitae, turpis. Nulla ante mauris, euismod et, mollis eu, tempor in, quam. In pede augue, elementum varius, tincidunt in, condimentum ut, erat. Etiam vulputate faucibus velit. Aliquam porttitor.

Nam fringilla adipiscing nisi. Sed in magna. Aenean non ante. Aenean facilisis, nunc sed aliquam porta, magna est aliquam nisi, vitae semper turpis orci ac dolor. Praesent nec tellus. Cras vulputate rhoncus sem. Curabitur eu mi. Mauris euismod lacinia nibh. Suspendisse eget sapien et nunc accumsan elementum. Nulla dapibus. Donec interdum elit mattis velit imperdiet aliquet. Mauris feugiat, ante vel faucibus rutrum, eros mauris sollicitudin neque, ut varius diam ipsum et massa. Nullam non nisi sit amet tortor rhoncus molestie. Cras consecteturtuer condimentum ante. Phasellus fermentum risus fermentum turpis. Mauris dignissim iaculis sem. Fusce nisi lorem, viverra id, auctor et, scelerisque ut, massa. In hac habitasse platea dictumst. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Aliquam pulvinar neque ac dolor.

## 5. Conclusions

Your final chapter **must** be a Conclusion chapter!

Ea dico populo saperet nam, atqui mundi viris et vim. Te choro aperiri vim.

Duo ignota nonummy ei. Ex augue latine luptatum eum. Omnesque scaevola vis ne, erat perpetua convenire ius in. Duo cu movet sonet corrumpit. Ex eos reque prodesset.<sup>4</sup>

In sint veritus singulis pro, at audire regione luptatum eam. Error maluisset eos no, est et fabulas senserit aliquando, eos ut ullum dicunt ancillae. Eum no vero audiam inermis, et stet feugiat vulputate est, cum everti minimum expetenda ex. Sea nostro molestiae no, saepe pericula sententiae ad est, scripta vocibus ne usu. Cu impetus liberavisse pro, mel in amet offendit, prompta appareat singulis est in.

Te labitur petentium quaerendum sed, ut pro ipsum saepe splendide. Vel cu quidam facilisis, usu harum possit alienum ad. His id fuisset pertinax, ea diceret periculis principes mel. Cu vis aequa utamur deleniti, simul salutatus voluptaria vim cu. Stet natum decore ut eum, mel nulla tibique et. Et sit commodo conceptam accommodare, per at altera impedit albucius.

### **5.1 Ea cum sanctus propriae forensibus, mea vidit iriure reprimique ut, ea nam agam kasd comprehensam Pro ei inani facilisi, labores detraxit ad cum**

Congue consequat sed ne. In dolore omittam eloquentiam nec, an sea malis ludus corpora, sea in malis falli erant. Id veniam perseveris eam. Augue inani nemore usu at, sea an reque dicam, vis porro animal in. Alii dolorem prodesset quo eu.

Eu aequa definiebas voluptatibus pri. Vel ne meliore elaboraret, propriae scaevola omittantur an mei. His ei mucius ornatus delicata, diam etiam patrioque ea sed. Ut eos persius intellegam dissentiant, causae impedit te mei. Torquatos signiferumque ut quo.

Vix nibh voluppat ad, an cum mutat facer possit. Pro possit causae facilis ex. Sea eu ferri viderer inimicus, ea ius latine saperet, at cum detracto dissentias. Mea ex epicurei

atomorum mandamus, an his dicam molestiae. Aeterno meliore definitionem ex vis, wisi expetendis sadipscing quo no. Eos inermis accumsan ne.

Modo tritani ea duo, vis mazim affert argumentum no. Usu ne ferri utamur nominati. Mei ad modo oportere. Brute minim scribentur ex cum, te vel agam epicuri consetetur. Ea vel mundi ridens inimicus, ad erudit interpretaris mea, eum eu ferri rebum lorem. Dolore populo quaeque sit ex.

In accusata urbanitas vituperata quo, consulatu torquatos eam ex, tota definitionem quo et. Atqui suscipit suavitate at sea, intellegam theophrastus qui no, te homero temporibus per. Id meis mucius potentium usu, cu nam sonet elaboraret. Sumo accommodare cu pro, ne ornatus delectus consulatu duo, exerci laboramus assentior duo et.

Ea eos dicat everti appetere. Tota lorem scribentur ius ad, an possim noluisse adversarium pro. Everti adipiscing voluptatibus ius an, in ullamcorper necessitatibus vis. Te pro nibh invenire, porro putant salutandi quo ad. Id exerci equidem suavitate nec, cu sed erat veniam postea. In tale facilisi posidonium per, pri suscipit deterruisset an.

## **5.2 Ipsum**

Lorem ipsum vis at liber dicit diceret. Id fierent omittam est, vis natum electram eu, prompta sensibus at vix. Ut mea modus novum reprimique, vel euismod referrentur an. Ne legimus placerat abhorreant nec, no deleniti interesset vis. Vel adhuc graeci cu, ea est graecis fabellas.

Vel ex facer suscipiantur definitiones, mea vituperatoribus sale porro no, ut aliquip disputando sit. Ad graece albucius oporteat nec, vim voluptatum interesset in. Autem mundi eos ei, omnesque voluptaria et pri, falli quaerendum quo cu. Dicit equidem ceteros ne duo, ad oratio nostrud fierent usu, ei aliquyam periculis intellegam vim. Audiam principes sententiae sed et, ex his dicant facilis. Posse primis melius an per, quod assueverit duo id, cu usu animal propriae.

An natum nemore est, et eum quidam semper voluptua, meliore euripidis ei sea. Mei mutat invidunt ex. Vix choro delicata te. Causae mediocrem an his, choro vidisse id est.

Mundi dolor id mei, an duo tation omittam.

Ex magna facer torquatos vel. Te pro sumo legere consequat, duo ea luptatum phae-  
drum. Nec in laboramus interesset cotidieque, deleniti vivendum ex eam, at senserit hen-  
drerit vel. Est rebum falli ad, cu latine viderer efficiendi nec. Vidisse delectus te mei. Eu  
sanctus patrioque philosophia usu.

At veniam malorum iuvaret his, eos soluta ullamcorper ut. Zzril integre sit ut, sed  
regione percipitur contentiones et, mea no aliquyam efficiendi. Vix et neglegentur defini-  
tiones, ne graeco dictas omittam est. Id mel eros soluta corrumpit, oportere torquatos vim  
an.

An est eligendi efficiendi intellegam, illud putent labitur eu duo. Id fabellas saluta-  
tus argumentum has. Qui malorum prompta ex, eu sea nostrud admodum sensibus. Ex  
tamquam complectitur has, diceret volumus eam cu. Eam nusquam deleniti ponderum cu.  
No eam tale moderatius.

Est saepe dicam abhorreant ut, omnes soleat quo no. Duo ceteros pericula interesset  
ut. Nec eu iudico option, persius euismod no eum. Per ea luptatum oporteat qualisque.

Dico veri nec ei, est ne audiam graecis corrumpit. Dico possit an pri, illum feugiat  
cum ne, ne duo lorem corpora platonem. Cum no aeque feugait, in vis odio nihil. Iusto  
sadipscing scriptorem ne est. Ius ad salutandi intellegebat.

Nonummy mentitum his an, viris maiorum assentior pri cu, duo errem partiendo quaeren-  
dum ad. Cum aperiam sententiae ex. Dolor salutandi pro in, nec ei utinam causae, praesent  
concludaturque quo te. Id fuisset consequat eum, vide eirmod qui et. Cu tollit ubique con-  
cludaturque has, his id sale consecetur, eu mel discere scripserit. Mei diceret effiantur  
eu, no sea doctus meliore reformidans.

Nihil accommodare sit ea, nec et mutat dolorum. Ut conceptam persequeris vis, ea  
luptatum consetetur nam. Vix ea deleniti evertitur. Has enim consequat id, falli clita duo  
an.

## Appendix A. Populo Ornatus

Ut quando convenire scripserit mei, ut accusam noluisse eam. At scripta democritum quo, reque everti an qui, posidonium efficiendi ut mel. Pro an reque habemus, augue nemore conceptam in vim. Eu cibo ancillae takimata usu.

No vis albucius rationibus, eum doming ceteros constituto id. Ad suas zzril laudem cum. Natum mollis singulis vel te, ea elit imperdier duo, odio inermis et eos. Nam ad vocibus tractatos, sit no vidisse diceret omnesque, mollis omnesque ea mea.

Ut est ridens principes sribentur, menandri interesset adversarium ius ut. Ut duo elit dissentias, at sea eleifend scripserit, eam nibh rebum definitiones an. Cum te quaeque epicuri mentitum, his elitr essent et, in sea habeo aliquid convenire. Quo euismod sadipscing definitionem an, ut duo iusto aliquando, graece appetere ne nec.

Consul imperdier dignissim vis et, mei liber vidisse principes et, eu nam docendi voluptua democritum. Qui no dicat tamquam sanctus, saepe tincidunt no mel. Pro ignota albucius consetetur in, sint qualisque assueverit eam ut, vis graeco denique signiferumque ne. Sale appellantur contentiones eu his, pro magna ornatus ut, ad vidiit omnesque euripidis pri. Sea congue moderatius in, his dicit suscipit no, mei ei incorrupte assueverit. Nusquam nominavi et quo, idque delenit vim an, posse quaeque an mea.

Suas elitr lucilius sit an, aeterno persius vel eu. Mel at essent aperiam repudiare. Tale consul eum ne, eam no meis delenit iudicabit, an sint mutat pri. Nec no clita propriae pericula, duo explicari gubergren ei. Ne sit autem nominavi, te falli deserunt per. Quo tractatos suscipiantur ex, electram dignissim usu no, cu congue iriure vivendo vim.

At vero graeci fuisset his, quo similique persequeris ad. Ex est graece mandamus, antiopam voluptatum his ea. Assum appellantur mel an, ei mea veri commune efficiendi. Pri blandit urbanitas no. Nam ex enim reque, ut nec iusto regione ullamcorper, facer harum pertinacia mei ei. Erant veniam imperdier an eam, veniam mucius equidem ius eu, at scripta labitur est.

Et quo soluta graecis accommodare. Tamquam mentitum menandri vim ut. Ut nec

melius senserit, ut mei sale aeque. Prompta delectus mea te, fierent adipisci ad per, mei odio pertinax senserit et. Per ut persius singulis. Id qui malorum iracundia, semper conceptam cu sed.

Vis nominavi urbanitas intellegat an, ut numquam deseruisse sea. Et quo dico aeque adipiscing, ius ea commodo epicurei, eum cu nulla imperdier efficiantur. Ea cum simul scripserit. Ius reque decore voluptaria ei, nec sensibus mediocrem eu, sit iriure vivendo ad. At munere maiestatis mel, ex persius honestatis nec. Nihil omnes definiebas duo cu, dicat ancillae no vix. No est prompta apeirian, mel ad quaestio theophrastus mediocritatem.

Persequeris intellegebat disputationi et nec, nam ne alia solum reque, ad pri clita appellantur reprehendunt. Clita iracundia ex cum, placerat invidunt dissentias ius id. Posit dictas recteque sed ne. At eam singulis recusabo intellegat, ius in probo clita posidonium, id atqui paulo rationibus pro. Ut elit mucius qui. Mel ea ubique nostrud takimata. Cu eos vituperatoribus temporibus feugait.

Per putent nusquam oportere cu, nullam discere te sea, an vix quot mutat. Cibo reque nostrum nec eu, justo mucius aeterno vis id. Facer tempor cu vix, ex saepe similiue maiestatis qui, ne pro eripuit offendit. Id mel cetero efficiantur. Cum homero aeterno euismod an, vulputate definitiones ne quo.

Sed exerci incorrupte et, usu mundi molestiae reformidans in, at probo vocibus quo. Ex vel aliquip maluisset. Qui enim error an, molestie incorrupte an ius. Id maiestatis temporibus mei, tantas oporteat occurret id pri. Ei nam velit doming utroque.

Suas vituperata mel eu, ex veri omnes duo, an modo molestie ius. At vis moderatius dissentias scripserit, nullam aliquam usu no. Cibo diceret sed an. Sea cu ridens convenire.

Pro prima blandit no. His ut dicit iriure oblique, eos meis urbanitas abhorreant te. Usu cu perpetua principes. Mutat utinam insolens id cum. Quo tale iudicabit conclusionemque ex. Eos id harum accommodare.

Vel legere liberavisse ut, et aeque timeam usu. Vis eu dico sanctus appetere, id vix graecis repudiare, ad persecuti mnesarchum mei. No atqui nemore deseruisse eum. Meliore accumsan accommodare in qui, an tation rationibus has, ea nulla aliquip euismod his.

Utinam ridens cum eu. Duo aliquam omnesque cu, sea elitr appetere ea. Mea no quas discere apeirian, munere hendrerit conceptam duo an, nec ad habeo tritani. Vis exerci volumus no. Omittantur reprehendunt no has. Malis accusata necessitatibus no nam.

No solet assentior ius, an ferri dissentiet pro, vix ad tantas offendit. Pro tollit consequat gloriatur ne, eu vix amet posidonium. Errem utamur veritus vix ea. Sed laboramus omittantur id, ut sonet voluptatum has, cu doctus iriure menandri eos.

Regione iudicabit ei per. Cum ea aliquip voluptatibus. Sit in partem explicari. Ne probo labores placerat mei. Ullum pertinax ea his, per cu persius impedit adipisci. Fabulas ancillae dignissim ei his, ius no nulla melius suscipiantur, ne vel laudem eripuit gubergren.

Ei qui equidem adolescens. Has ad accusata urbanitas voluptatum, no pri ferri dicit. Ne qui veritus omittam neglegentur, usu et lorem audiam mediocrem. Vim falli dictas labitur cu, dolores laboramus constituto id has, sit ea sint summo utroque.

Mei graecis definiebas eu, ad his brute omittam elaboraret. Ridens laoreet eos ne, diam mnesarchum ne sea. Idque everti ea pro, erudit probatus patrioque eu has. Cum omnes gubergren ex, cum te noster offendit indoctum. Putant dissentiunt duo ex, dicat etiam cu quo. Duo esse probatus complectitur ex, vitae eripuit nostrum no sed, cum odio veri reformidans ex.

Vide ipsum ei vel, at diam nominavi his. Etiam assueverit nam eu, ut habeo nusquam eleifend mei. Pro eirmode perpetua id, minim urbanitas usu no. Vim elitr nominati definitionem ex. Ex tollit quaerendum has, nonumy inciderint eos ne. Vis posse munere honestatis ut.

Eu ornatus meliore usu, enim aeque possim eu cum. Pri ad everti fabellas, at pro omnium convenire repudiare, ut mel hinc minimum. Eam et puto reque mollis. Sed ad ponderum lobortis, cu pro viris vitae. Est et iriure inimicus, eos eu laoreet feugait voluptatum, agam aliquando voluptatibus pro eu.

Ex tale eirmode nec. Illud conclusionemque ad his. Sit augue error in, eu mea labitur voluptua, labores ullamcorper vis te. No usu enim aperiri facilisi. Ad vis brute soluta fastidii, meis mundi iuvaret his ea. Has eu cibo rebum. Mundi numquam repudiare ei cum,

pri dicam tritani recusabo ea, pri id appareat qualisque.

Eu facete perfecto nec, te vel tale choro potentium. Mel in essent quodsi, ocurreret corrumptit in pri. Est in fabulas similique elaboraret, in viderer delenit vim. Eu vel paulo graeco viderer. Et ius elit debet latine, ad vel ferri voluptaria appellantur.

Vis ad docendi albucius, ne nam sale prima comprehensam. Adhuc inani accusam ex vis. Utamur labitur adipisci nec ei. No persius conceptam adversarium pro, ei dicunt officiis lucilius usu. Te pri potentium vituperata, vis at solum dicit quaeque, minimum delectus singulis ei vim. His te nibh patroque dignissim, qui ne euismod argumentum. Quo lucilius sensibus cu.

Est ea nihil debit is deseruisse, mea ne malis nostrum. Vel cu doctus euismod disputationi. Eos ut harum habemus, minim verear maiestatis mei ut. Te nam mundi deseruisse sententiae, pri an nibh eros velit. Ne omnium torquatos ius. Sit id congue quaeque intellegebat, homero voluppat dissentiunt ne usu, ei elit vituperata reformidans eum.

Ut sed corpora accumsan, his cu vero iriure probatus. Ubique latine ea per, usu no erant facilisis. Augue diceret erudit iea vel, in diam maiorum ullamcorper eum. Vel no iriure latine suscipiantur, cu nec omittam liberavisse disputationi.

Congue repudiandae delicatissimi ut duo, fastidii iudicabit ut sea, eum integre sadipscing an. Cu vel alii liber, ceteros nostrum expetendis per eu, ne congue gloriatur vulputate cum. Eius fierent pericula has cu. Ea has atqui perfecto. Pericula torquatos ius ei, convenire theophrastus id sea, in dicit facilis facilisis mel. Nam modo diam ocurreret an.

Ferri sensibus eloquentiam quo et, mel an nullam vituperata, mollis dignissim sententiae sit ne. An pro perpetua democritum, te eam feugiat delicata deterruisset. Per minim choro ad, prodesset voluptatum ea usu, ea tempor putent quo. Mazim facete scribentur ea sea. Ea pri doctus feugait, ius eu vituperatoribus menandri, dico munere ubique ne his.

Mel no assum nusquam intellegebat, ius platonem consulatu an. Populo ornatus in sea. Sea soleat salutatus ne. Quo error saepe adolescens at, id cum duis voluptatum. Per maiorum mentitum te. Quem iudicabit percipitur per ea. Qui aliquid erudit iad, ne vix veritus scripserit.

An duo postea aliquip. Nusquam luptatum id vis. Vim no magna inani. Eos et agam aliquid ancillae, verear ponderum no qui.

## **Biography**

This page is optional. If you do plan to use it, keep in mind that it should have a page number and it should be listed in the Table of Contents. The bio should appear on the very last page of your dissertation.

A brief biography, ordinarily no more than one page in length, unless listing publications or academic honors. Be sure to not include sensitive information like your date or place of birth.

Although, your biography should not resemble a CV, it could include the following in an essay format (1) the colleges and universities that you attended with the degrees received and their dates, (2) a list of scholarships, fellowships, memberships in honorary societies, and academic honors you have received since obtaining the bachelor's degree. You can also list the titles of all books and articles you have published. If you choose to list publications, be sure the format is similar to the bibliography/references section. Each entry should be single spaced, with a double space between each entry.