

iT Centre Learning

LaTeX: Kick-off!

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IT Learning Centre



PREREQUISITES

Time in the workshop is precious – it is an opportunity for you to interact with the workshop leader and other participants through questions and discussions and to share your experiences and concerns. To make the most of this time we sometimes ask you to carry out learning activities ahead of the workshop so that everyone comes into the class with the same basic knowledge. We keep this prior learning to a minimum and often make use of online videos.

Online videos provided through LinkedIn Learning can be accessed free of charge by University members anytime, anywhere, through a browser or app. Your course booking will tell you if any prior learning activity is required.

If you don't have an environment where you can do this learning, you can come along to one of our LinkedIn Learning sessions. These are a quiet space where you can work through videos or other workshop resources. If you arrive for a workshop without having done the prior learning, the workshop leader may suggest that you come back on another session.

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ABOUT THE WORKSHOP DESIGNER

Thomas Duffield spent several years as a freelance copywriter for various London based firms and has extensive experience preparing documents for publication using LaTeX. He prioritises getting students to the desired learning objective in the most efficient possible manner and strongly believes that the best way to learn is to build something.

Thomas is a bioinformatics researcher, working in a German hospital research laboratory for several years before returning to the UK to be a PhD researcher in epigenetic ageing at the University of Liverpool.

Version	Date	Author	Comments
1.0	01/11/2022	Thomas Duffield	Created.

ABOUT THIS WORKSHOP

The format for this workshop will be a bit uncommon. I will be travelling through the subjects as outlined, from basic to expert, for the next hour and a bit. We've arranged several templates, examples and workbooks for use with the computers in the workshop.

There are worksheets covering each section, as well as some templates ready for you to modify for your professional use. Attendees can choose to listen to the presentation, or go to the computers and start experimenting with the resources if you are already familiar with the topics currently being explained.

After every section we'll move everyone to the computers and get you going on some examples for a few minutes to drive home the learning objectives. If you want to rejoin the group of listeners, or swap to being at a PC, that's the time to do it (although there is nothing stopping you listening in from the computers).

I would ask that the people working on the computers do so in silence during the presentation and really fight the urge to ask questions, because we will do a quick Q&A at the end of each workbook section. After a couple of hours we will be done with the presentation and move onto customising your own personal template, and I'll be wandering around answering questions.

Lastly, I encourage you to make use of the most powerful tool humanity has: getting frustrated and googling things. The very first thing I will teach you at the start of the session is how to find answers to questions about LaTeX online. If I can leave you with one thing from this course, please let it be the knowledge and habit of answering your own LaTeX questions. A strange note to begin a workshop with, particularly from the person teaching it, but you should think of this as training wheels. The ultimate goal is to make LaTeX the most usable solution for you going forward so as to unlock the huge benefits provided by this incredible tool.

WHAT YOU WILL LEARN

- The general principles of LaTeX programming, editor behaviour and document creation.
- How to seek out and use resources on the internet to dramatically speed up your document production pipeline.
- Specific techniques enabling you to problem solve within LaTeX and optimise your workflow in a manner that removes unnecessary busywork and repetition.

WHAT YOU WILL NEED TO KNOW

- Basic knowledge of general computer use, such as copy/paste, menu navigation, etc.
- Basic understanding of referencing software such as EndNote, if you want to be able to get the best from the bibliography component of the course.
- Basic understanding of the general programming will be helpful to you, but you do not need to code.

COURSE COMPONENTS

WHAT YOU WILL NEED TO BRING

- You are free to bring your own laptop or you can use one of the provided computers.
- You can bring your own documents and assets to insert into the provided templates.
- You can use your own EndNote/Mendeley reference library and your own Overleaf account. We STRONGLY encourage you to have created a Overleaf account before the start of the session.

ACCESSING COURSE RESOURCES

At the beginning of the session you will be provided with a set of links to the course folder and the share links for the course worksheets and templates.

To access these templates after the event, follow the link provided and save a copy of the template to your own account. You are then free to edit and retain the template as discussed in the session.

WORKSHOP EXERCISES

There is a general worksheet template containing exercises of various difficulties. Other tasks will be outlined in the comments of the teaching templates.

When performing the worksheet tasks you will commonly have to break part of the document as a learning experience. Familiarise yourself with `ctrl-z`, `ctrl-y` and other methods for undoing the damage to the document after each task. If you ruin the document beyond repair, just re-download it from the available template.

FREE TO USE TEMPLATES

We will also provide you with already set-up documents with full commentary on how to use them. You can copy these documents to easily begin the process of making your very own LaTeX publications, or simply use them as a learning resource and a example of a simply set up, working document.

Welcome

```
\section{Welcome to LaTeX!}
```

In this tutorial we will show you how using LaTeX will provide you with a massive upgrade to the level of control you have over document creation.

This may be a `\textbf{bold}` claim, but we will provide all the `\cite{evidence}` you need, making it as simple as `\(1\)`, `\(\sqrt{4}\)`, `\(\frac{3}{1}\)`.

Additional Notes

Commands and Environments

Definition of a Command

A **command** is the basic *function* call of LaTeX. It always starts with a `\backslash`.

Definition of an Environment

An **environment** is a command pair that encapsulate a scope with specific rules of behaviour. Environments begin with `\begin {environment name}` and ends with `\end {environment name}`. Between these two commands, the environment is in effect.

Additional Notes

Arguments/Parameters

Definition of a Parameter

A **parameter** is how you pass behaviour into a command. Mandatory parameters are always defined within `{curly brackets}` while optional parameters are defined within `[square brackets]`. Multiple parameters of a type are separated with commas. The word **parameter** is commonly used interchangeably with **argument**, which is slightly incorrect.

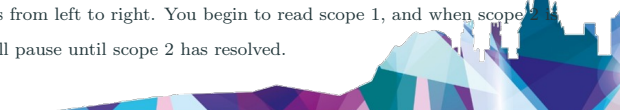
```
\command[optional parameter]{mandatory parameter}
```

Additional Notes

Scope

```
% A single scope:  
\scope1{<---- scope 1 ---->}  
  
% A nested scope:  
\scope1{<--\scope2{<-- scope 2 -->}-->}  
  
% ...and so on:  
\scope1{<--\scope2{<-- \scope3{<-- scope 3 -->} -->}-->}
```

You read scopes from left to right. You begin to read scope 1, and when scope 1
read scope 1 will pause until scope 2 has resolved.



Additional Notes

Scope

<pre>Commands can change \color{brown} something across \par the entire document \color{black} \par \emph{but brackets} limit scope.</pre>	<pre>Commands can change something across the entire document but brackets limit scope.</pre>
--	---



Additional Notes

Built-In Commands and Environments

```
% Example Commands  
  
% Create and title a section:  
\section{Section Title}  
  
% Use a special package:  
\usepackage{minted}  
  
% Add vertical space:  
\vspace{5pt}  
  
% Set font size to small:  
\small
```

```
% Example Environments  
  
\begin{frame}  
Frame contents!  
\end{frame}  
  
\begin{tabular}{ccc}  
Cell 1 & Cell 2 & Cell 3 \\ \\  
Cell 4 & Cell 5 & Cell 6 \\ \\  
\end{tabular}
```



Additional Notes

Orientation

General, comprehensive documentation:
<https://www.overleaf.com/learn>

Comprehensive cheatsheet for mathematical symbols:
https://en.wikipedia.org/wiki/List_of_mathematical_symbols_by_subject

Copy and paste document templates:
<https://www.overleaf.com/latex/templates>



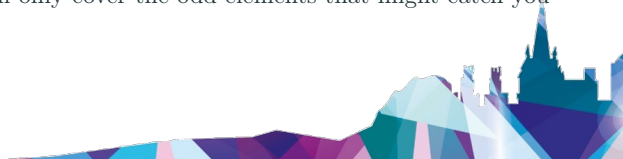
Additional Notes

Editors and Interpretation

Editors and Interpreters

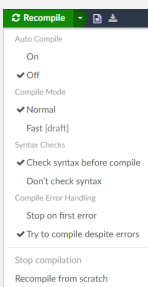
An **editor** is the interface in which you write LaTeX code and it will have some unique behaviours independent from the base functionality of the language itself. The language (and sometimes the compiler) provides rules of interpretation. Knowing the basic rules of how the editor you are using will interpret your code is critical.

Don't worry! This is so basic and obvious you barely need to be taught it. I'll only cover the odd elements that might catch you out.



Additional Notes

Compile

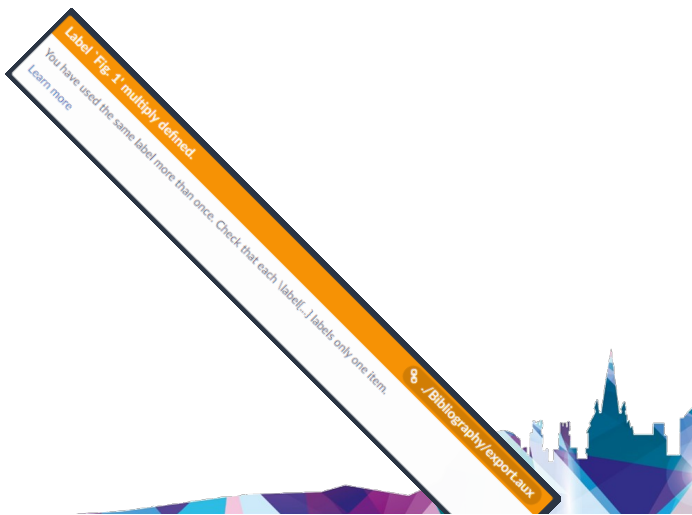


Typically ignore everything and just hit compile.



Additional Notes

Errors and Warnings



Additional Notes

Errors and Warnings



Additional Notes

Orientation

General technique for solving errors:

1. Undo until you isolate the action that prevents compile.
2. Fiddle with it.
3. Ask yourself if you need this behaviour.
4. Copy paste a working example of this code from the internet and compare to your code. Adapt this if it works.
5. Copy paste the error code into a search engine and look for a stack overflow answer on the subject.
6. Use a general search to find solutions to your problem.

Additional Notes

Orientation

General problem resolution skills:

- Use typical error searching format for search engine posts: `<language> <subject> <behaviour> <condition>`. e.g. latex figure wont center in beamer.
- Ask on a dedicated help website such as stackoverflow.com (make sure to include a well formatted minimum working example of your problem in the post).
- Don't be afraid to simply use a component from a free template.
- Learn to rapidly discard solutions that are taking too long.

Additional Notes

The Golden Rule

The Golden Rule

Almost every possible problem you could encounter in LaTeX has been encountered and solved by many people before you. It is incredibly unlikely that your issue is unique or without published solution. Almost every use-case will have hundreds of online examples.

If something is causing problems, seems too complex or is simply un-intuitive, delete it and replace it with an existing template.

Additional Notes

Workshop Files

- We have created several templates specifically for use in this course.
- They contain commented and uncommented versions of most key .tex files.
- The commented files contain in-file explanations and references, as well as workshop tasks to help train you in LaTeX use.
- The uncommented files are for ease of reading, clarity of design and for your personal use.
- These templates are licensed under creative commons, so customise them, make them your own and take a copy with you when you leave.

Additional Notes

Document Classes: Basic

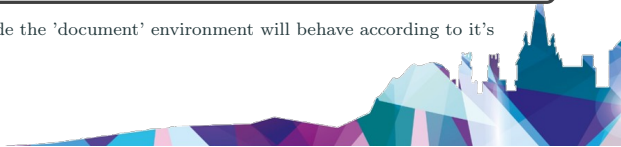
```
%\documentclass[12pt, letterpaper]{article}

%\begin{document}

\section{Section Title}
It was in the winter of 1861 that I ...

%\end{document}
```

Everything inside the 'document' environment will behave according to it's document class.



Additional Notes

Document Classes: Presentations

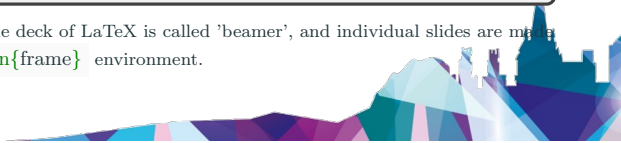
```
%\documentclass{beamer}

%\begin{document}

\begin{frame}{Frame Title}
It was in the winter of 1861 that I ...
\end{frame}

%\end{document}
```

The general slide deck of LaTeX is called 'beamer', and individual slides are made with the `\begin{frame}` environment.



Additional Notes

Chapters and Sections

```
\chapter{Chapter Title}
\section{Section Title}
Some body text.
\subsection{Subsection Title}
More body text.
\subsubsection{And so on...}
Extra body text.
```



Additional Notes

Contents and Numbering

<pre>\tableofcontents \section{Introduction} \subsection{Small Tangent} \subsubsection{Big Tangent} \section{Methods}</pre>	<pre>Contents 1 Introduction 1.1 Small Tangent 1.1.1 Big Tangent 2 Methods 1 Introduction 1.1 Small Tangent 1.1.1 Big Tangent 2 Methods</pre>
---	--



Additional Notes

Position and Whitespace

<pre>LaTeX ignores newlines and whitespace.</pre>	<pre>LaTeX ignores newlines and whitespace.</pre>
---	---

Exception: One or more blank lines in the editor are recognised as a new paragraph.



Additional Notes

Document Setup: Preamble

<p>Set up your packages and custom functions at the beginning of the document, before you begin the body.</p>	<pre>% Set up packages: \usepackage{multicol} \usepackage{tikz} \usepackage{natbib} % Set up custom commands: \newcommand{ \bf}[1]{\textbf{#1}} }</pre>
---	--



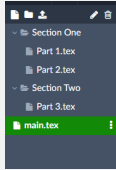
Additional Notes

Document Setup: Large Projects

Additional Notes

```
\section{One}
\include{Section One/Part 1}
\include{Section One/Part 2}

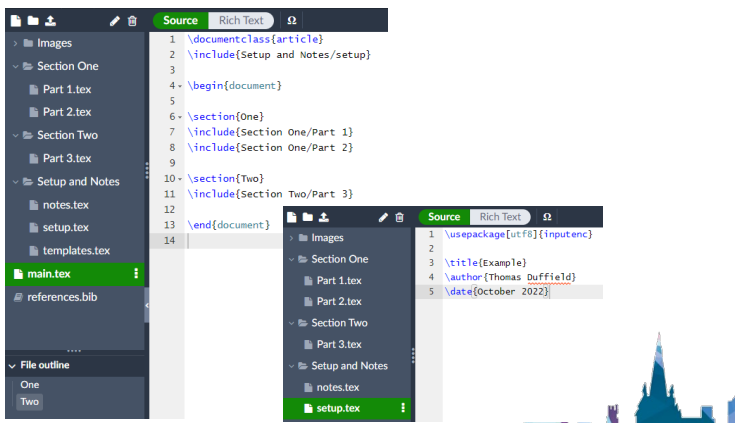
\section{Two}
\include{Section Two/Part 3}
```





Document Setup: Large Projects

Additional Notes



```
1 \documentclass{article}
2 \include{Setup and Notes/setup}
3
4 \begin{document}
5
6 \section{One}
7 \include{Section One/Part 1}
8 \include{Section One/Part 2}
9
10 \section{Two}
11 \include{Section Two/Part 3}
12
13 \end{document}
14
```

```
1 \usepackage[utf8]{inputenc}
2
3 \title{Example}
4 \author{Thomas Duffield}
5 \date{October 2022}
```



Workshop Break

Additional Notes

Questions?



Formatting

The best way of formatting LaTeX quickly is to look for examples, find template code and then adapt it to your needs.

Technique: Find a list of commands such as:
https://en.wikibooks.org/wiki/LaTeX/Command_Glossary
and use ctrl-f to quickly search the list for your use case.

Technique: Search google images for the general search term you are looking for, find one that looks good to you and see if it has code. For example: 'beautiful latex table academic professional'.



Additional Notes

Formatting

`\textbf{This is bold.}`

This is bold.

`\emph{This is emphasised.}`

This is emphasised.

`\underline{This is underlined.}`

This is underlined.



Additional Notes

Formatting

```
Hello.  
\newline  
This  
is  
\par a new paragraph.  
\begin{center}  
I'm centered.  
\end{center}  
\begin{flushright}  
Rightside!  
\end{flushright}
```

Hello.
This is
a new paragraph.
I'm centered.
Rightside!



Additional Notes

Formatting

<pre>Regular. \vspace{10pt} \par \tiny Tiny! \large Large! \par \vspace{10pt} \normalsize \color{brown} \texttt{Typewriter Font}</pre>	<p>Regular.</p> <p>Tiny! Large!</p> <p>Typewriter Font</p>
--	--

Additional Notes

Images


<pre>\begin{center} \includegraphics [scale=0.5, angle=45] {images/image4.png} \end{center}</pre>	
---	--

Additional Notes

<pre>\includegraphics [width=3cm, height=1cm] {images/image4.png}</pre>	
---	---

Note: Be careful about using images and branding from templates. The University of Oxford branding above, for example, is protected and has rules about how you can use it.

Images

<pre>\begin{figure}[h] \includegraphics [width=0.5\textwidth, inner] {images/image4.png} \caption{Caption} \label{Fig. 1} \end{figure}</pre>	 <p>Figure 1: Caption</p>
--	--

Additional Notes

The optional parameter tells the figure where to locate itself relative to the environment. 'h' tells the figure to place itself at it's location in the code. 't' tells the figure to place itself at the top of the page, 'b' at the bottom, and so on. Read the LaTeX documentation for more.

Lists

```
\begin{enumerate}
\item Lists are easy.
\item Not a Haiku.
\item Okay.
\end{enumerate}
```

1. Lists are easy.
2. Not a Haiku.
3. Okay.

```
\begin{itemize}
\item Bulletpoint.
\end{itemize}
```

- Bulletpoint.
- Bulletpoint.
- Bulletpoint.

Additional Notes

Lists

```
\begin{description}
\item [Item A] Description A.
\item [Item B] Description B.
\item [Item C] Description C.
\end{description}
```

Item A Description A.

Item B Description B.

Item C Description C.

Additional Notes

Tables

```
\begin{center}
\begin{tabular}{c c c}
cell & cell & cell \\
cell & cell & cell \\
cell & cell & cell
\end{tabular}
\end{center}
```

cell	cell	cell
cell	cell	cell
cell	cell	cell

Additional Notes

Tables

```
\begin{table}[htbp]
\caption{Basic Table}
\label{tab:2}
\begin{center}
\begin{tabular}{|c|c|} \hline
ColA & ColB \\ \hline
A & B \\
C & D \\
E & F \\
Dinosaur & Pudding \\ \hline
\end{tabular}
\end{center}
\end{table}
```

Table 1: Basic Table

ColA	ColB
A	B
C	D
E	F
<i>Dinosaur</i>	Pudding

Additional Notes

Packages

Definition of a Package

A **package** is a pre-written library of code that handles a particular task well. Packages save you the need to personally write large amounts of high quality code and instead use the work of the package author. Packages must be loaded with `\usepackage{somepackage}` whereupon the functionality of that package can be directly called with commands, for example: `\somepackagecommand{somevar}`.

Note: Package documentation (also known as 'man/manual' pages) informs the user which commands and behaviours the package provides.

Additional Notes

Packages

```
1 Hello, LaTeX, could we please talk about \end{}? and
   some other things
```

```
Hello, LaTeX, could we please talk about \end{}? and some other
things
```

```
1 Hello, LaTeX, could we please talk about \end{}?
```

Additional Notes

Math Mode

Math Mode

To add non-alphanumeric characters and mathematical formatting to LaTeX, simply begin a **math mode**. Math mode allows you to create symbols by unique identifiers.

<pre>\begin{equation} S(\omega) \frac{\alpha g^2}{\omega^5} e^{\{-0.74 \bigl \frac{\omega}{U_\omega} 9.5\}} \bigg\}^{-4} \end{equation}</pre>	$S(\omega) \frac{\alpha g^2}{\omega^5} e^{[-0.74 \{ \frac{\omega U_\omega 19.5}{g} \}^{-4}]} \quad (1)$
---	---

Additional Notes

Math Mode

<pre>\(...\) \$...\$</pre>	Inline math modes.
----------------------------	--------------------

<pre>\begin{displaymath}... \begin{equation}...</pre>	Display math modes.
---	---------------------

<p>Sentence</p> <pre>\(\sqrt{x^2+\beta}\)</pre> <p>inline.</p>	Sentence $\sqrt{x^2+\beta}$ inline.
--	-------------------------------------

Additional Notes

Multilingual

```
\usepackage[russian,greek,main=UKenglish]{babel}
\babelfont{rm}[Language=Default]{FreeSerif}
```

<p>Tea Meme.</p> <pre>\foreignlanguage{russian}{.} \foreignlanguage{greek}{ί ά}</pre>	<p>Tea Meme.</p> <p>водка мем.</p> <p>Μου λείπει η Ελλάδα</p>
---	---

Additional Notes

Questions?



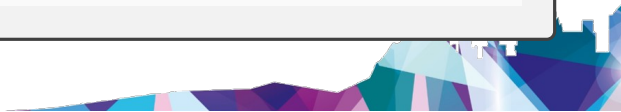
What is TikZ?

The **TikZ** package is typically used for diagram creation. While TikZ is not a built-in, it is almost universally used and can be considered to be a standard feature of LaTeX. TikZ is used by adding `\usepackage{tikz}` to the preamble and then creating the diagram within the `\begin{tikzpicture}` environment.

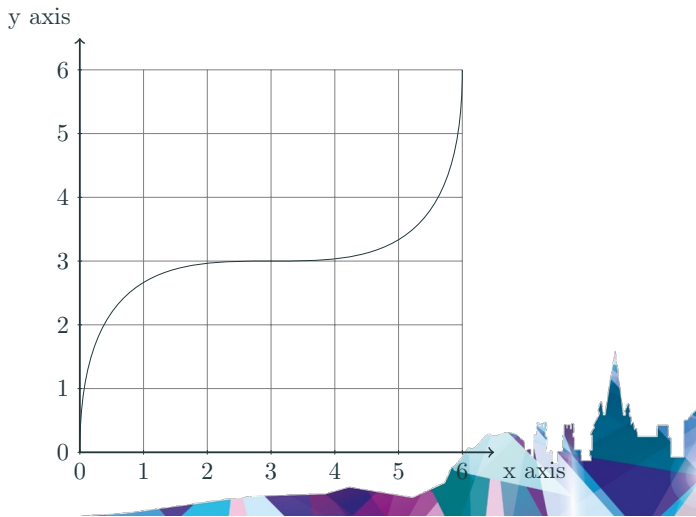
```
\begin{tikzpicture}
\draw[step=1cm,gray,very thin] (0,0) grid (6,6);
\end{tikzpicture}
```



```
\begin{tikzpicture}
\draw[step=1cm,gray,very thin] (0,0) grid (6,6);
\draw (0,0) .. controls (0,6) and (6,0) .. (6,6);
\draw[thick,->] (0,0) -- (6.5,0) node[anchor=north west] {x axis};
\draw[thick,->] (0,0) -- (0,6.5) node[anchor=south east] {y axis};
\foreach \x in {0,1,2,3,4,5,6}
  \draw (\x cm,1pt) -- (\x cm,-1pt) node[anchor=north] {$\x$};
\foreach \y in {0,1,2,3,4,5,6}
  \draw (1pt,\y cm) -- (-1pt,\y cm) node[anchor=west] {$\y$};
\end{tikzpicture}
```



Diagrams and TikZ



Additional Notes

History and Checkpoints

Checkpoint Two
Saved by You
16th Oct 2022, 6:53 pm

Checkpoint One
Saved by You
16th Oct 2022, 6:52 pm

Checkpoints are save points in the history.

Additional Notes

Sharing and Multiuser

Review Share Submit History

Recompile

Sharing is caring.

Additional Notes

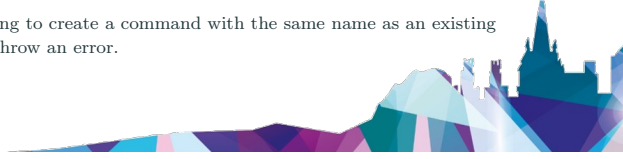
Custom Commands

Custom Commands

While you can easily rely on packages and built in functionality, LaTeX provides you with the option to create custom **commands**. New commands are defined with the command `\newcommand`.

```
\newcommand{\commandname}[1]{\commandbehaviour{#1}}
```

Note: Attempting to create a command with the same name as an existing command will throw an error.



Additional Notes

Custom Commands

```
% Create a command called hatstand:
\newcommand{\hatstand}

% Declare it will take a single parameter:
\newcommand{\hatstand}[1]

% Declare the command behaviour and where to insert parameters:
\newcommand{\hatstand}[1]{\emph{#1}}

% Example of use:
\hatstand{This is the output!}
```

This is the output!



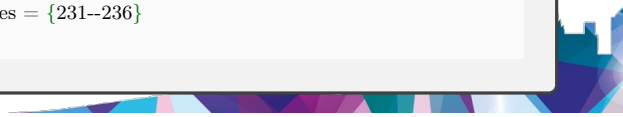
Additional Notes

.bib Format

.bib

The **.bib** format is a plain text file type used by all major LaTeX bibliography packages and reference managers.

```
@article{duffield3005,
  author = {Thomas Duffield},
  title = {Epigenetic Reprogramming},
  journaltitle = {Nature},
  year = {3005},
  volume = {50},
  number = {20},
  pages = {231--236}
}
```



Additional Notes

General Bibliography

<code>\usepackage{natbib}</code>	Install the package, not necessary for standalone bibtex.
<code>\bibliographystyle{unsrtnat}</code>	Identify the bibliography style.
<code>\cite{duffield3005}.</code>	Insert a citation to the text.
<code>\bibliography{bibfile}</code>	This will insert the bibliography.

Additional Notes

General Bibliography

```
\usepackage{natbib}
\bibliographystyle{unsrtnat}

\begin{document}

This is a citation \cite{duffield3005},
and here are some more \cite{citeA, CiteB}.

\bibliography{sample}

\end{document}
```

Check out the templates for other bibliography styles!

Additional Notes

Workshop Break

Questions?

Additional Notes



FURTHER INFORMATION

GETTING EXTRA HELP

The IT Learning Centre offers bookable clinics where you can get pre- or post-course advice. Contact us using courses@it.ox.ac.uk.

STUDY VIDEOS FROM LINKEDIN LEARNING

On our website, you will find our collection of self-service courses and resources. This includes providing LinkedIn Learning video-based courses free to all members of the University. Visit skills.it.ox.ac.uk/linkedin-learning and sign in with your Single Sign-On (SSO) credentials. Some courses recommend pre- and/or post-course activities to support your learning. You can watch the online videos anywhere, anytime, and even download them onto a tablet or smartphone for offline viewing.

ABOUT THE IT LEARNING PORTFOLIO ONLINE

Many of the resources used in the IT Learning Centre courses and workshops are made available as Open Educational Resources (OER) via our Portfolio website at skills.it.ox.ac.uk/it-learning-portfolio. Find the pre-course activity for this course in the IT Learning Portfolio: visit skills.it.ox.ac.uk/it-learning-portfolio and search for “LaTeX activity”.

ABOUT THE IT LEARNING CENTRE

The IT Learning Centre delivers over 100 IT-related teacher-led courses, which are provided in our teaching rooms and online, and we give you access to thousands of on-line self-service courses through LinkedIn Learning. Our team of teachers have backgrounds in academia, research, business and education and are supported by other experts from around the University and beyond. Our courses are open to all members of the University at a small charge. Where resources allow, we can deliver private courses to departments and colleges, which can be more cost-effective than signing up individually. We can also customize courses to suit your needs. Our fully equipped suite of seven teaching and training rooms are usually available for hire for your own events and courses. For more information, contact us at courses@it.ox.ac.uk.

ABOUT IT CUSTOMER SERVICES

The IT Learning Centre is part of the Customer Services Group. The group provides the main user support services for the department, assisting all staff and students within the University as well as retired staff and other users of University IT services. It supports all the services offered by IT Services plus general IT support queries from any user, working in collaboration with local IT support units. The Customer Services Group also offers a data back-up service; an online shop; and a computer maintenance scheme. Customer Services is further responsible for desktop computing services – for staff and in public/shared areas – throughout UAS and the Bodleian Libraries.