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Computational Neuroscience for non experts

A primer in Computational Neuroscience

December 22, 2024

Springer Nature

*To Maura, my inspiration, and in memory of
Professors Grattarola and Tagliasco, my
mentors.*

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Declarations

Competing Interests The author has no conflicts of interest to declare that are relevant to the content of this book.

Ethics Approval The experimental recordings collected in the experimental lab directed by the Author, and included in a few figures of this book for illustrative purposes, were obtained in full compliance with the European Directive 2010/63/EU, the Belgian Royal Decree 29/5/2013, the Italian Decree 4/3/2014 n. 26, and upon explicit prior approval and formal authorisation by institutional Ethical Committees and national regulatory authorities.

Contents

Part I Part Title

1	Chapter Heading	3
1.1	Section Heading	3
1.2	Section Heading	3
1.2.1	Subsection Heading	4
1.3	Section Heading	6
1.3.1	Subsection Heading	7
	Appendix	10
	Problems	10
1.4	Styling of References	11
	References	11
A	Chapter Heading	13
A.1	Section Heading	13
A.1.1	Subsection Heading	13
	Glossary	15
	Solutions	17

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Chapter 1

Chapter Heading

Abstract Each chapter should be preceded by an abstract (no more than 200 words) that summarizes the content. The abstract will appear *online* at www.SpringerLink.com and be available with unrestricted access. This allows unregistered users to read the abstract as a teaser for the complete chapter.

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Please note that the first line of text that follows a heading is not indented, whereas the first lines of all subsequent paragraphs are.

Use the standard equation environment to typeset your equations, e.g.

$$a \times b = c, \quad (1.1)$$

however, for multiline equations we recommend to use the `eqnarray` environment¹.

$$|\nabla U_\alpha^\mu(y)| \leq \frac{1}{d-\alpha} \int \left| \nabla \frac{1}{|\xi-y|^{d-\alpha}} \right| d\mu(\xi) = \int \frac{1}{|\xi-y|^{d-\alpha+1}} d\mu(\xi) \quad (1.2)$$

$$= (d-\alpha+1) \int_{d(y)}^{\infty} \frac{\mu(B(y,r))}{r^{d-\alpha+2}} dr \leq (d-\alpha+1) \int_{d(y)}^{\infty} \frac{r^{d-\alpha}}{r^{d-\alpha+2}} dr \quad (1.3)$$

1.2.1 Subsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Further on please use the `LATEX` automatism for all your cross-references and citations as has already been described in Sect. 1.2.

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1.2.1.1 Subsubsection Heading

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Paragraph Heading

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1. Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - a. Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - b. Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
2. Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Subparagraph Heading

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- Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development, cf. Table 1.1.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.
 - Livelihood and survival mobility are oftentimes coutcomes of uneven socioeconomic development.

Fig. 1.1 If the width of the figure is less than 7.8 cm use the `sidecaption` command to flush the caption on the left side of the page. If the figure is positioned at the top of the page, align the sidecaption with the top of the figure – to achieve this you simply need to use the optional argument `[t]` with the `sidecaption` command

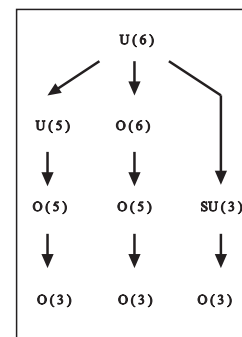


Fig. 1.2 Please write your figure caption here

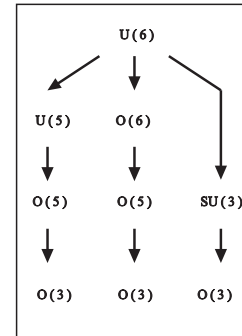


Table 1.1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA ^a	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

^a Table foot note (with superscript)

- Livelihood and survival mobility are oftentimes outcomes of uneven socioeconomic development.

Run-in Heading Boldface Version Use the \LaTeX automatism for all your cross-references and citations as has already been described in Sect. 1.2.

Run-in Heading Boldface and Italic Version Use the \LaTeX automatism for all your cross-references and citations as has already been described in Sect. 1.2.

Run-in Heading Displayed Version

Use the \LaTeX automatism for all your cross-references and citations as has already been described in Sect. 1.2.

1.3 Section Heading

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- Type 1 That addresses central themes pertaining to migration, health, and disease. In Sect. 1.1, Wilson discusses the role of human migration in infectious disease distributions and patterns.
- Type 2 That addresses central themes pertaining to migration, health, and disease. In Sect. 1.2.1, Wilson discusses the role of human migration in infectious disease distributions and patterns.

1.3.1 Subsection Heading

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If you want to emphasize complete paragraphs of texts we recommend to use the newly defined Springer class option and environment `svgraybox`. This will produce a 15 percent screened box ‘behind’ your text.

1.3.1.1 Subsubsection Heading

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Theorem 1.1 *Theorem text goes here.*

Definition 1.1 Definition text goes here.

Proof. Proof text goes here.

□

Paragraph Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the \LaTeX automatism for all your cross-references and citations as has already been described in Sect. 1.2.

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Theorem 1.2 *Theorem text goes here.*

Definition 1.2 Definition text goes here.

Proof. Proof text goes here. □

Trailer Head

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```
\begin{trailer}{Trailer Head}
...
\end{trailer}
```

? Questions

If you want to emphasize complete paragraphs of texts in an `Questions` we recommend to use

```
\begin{questype}{Questions}
...
\end{questype}
```

> Important

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```
\begin{important}{Important}
...
\end{important}
```

! Attention

If you want to emphasize complete paragraphs of texts in an `Attention` we recommend to use

```
\begin{warning}{Attention}  
...  
\end{warning}
```

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```
\begin{programcode}{Program Code}  
\begin{verbatim}...\end{verbatim}  
\end{programcode}
```

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\begin{tips}{Tips}  
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\end{tips}
```

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...  
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```

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\end{backgroundinformation}
```

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```

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Appendix

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$$a \times b = c \tag{1.4}$$

Problems

1.1 A given problem or Exercise is described here. The problem is described here. The problem is described here.

1.2 Problem Heading

- (a) The first part of the problem is described here.
- (b) The second part of the problem is described here.

1.4 Styling of References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.³ If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

1. all works by the author alone, ordered chronologically by year of publication
2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

The *styling* of references⁴ depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1, 2, 3, 4, 5] and [6, 7, 8, 9, 10].
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⁴ Always use the standard abbreviation of a journal's name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

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Appendix A

Chapter Heading

All's well that ends well

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A.1 Section Heading

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A.1.1 Subsection Heading

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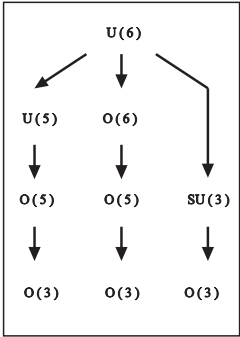
For multiline equations we recommend to use the `eqnarray` environment.

$$\begin{array}{l} \mathbf{a} \times \mathbf{b} = \mathbf{c} \\ \mathbf{a} \times \mathbf{b} = \mathbf{c} \end{array} \quad (\text{A.1})$$

A.1.1.1 Subsubsection Heading

Instead of simply listing headings of different levels we recommend to let every heading be followed by at least a short passage of text. Furtheron please use the \LaTeX automatism for all your cross-references and citations as has already been described in Sect. A.1.1.

Fig. A.1 Please write your figure caption here



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Table A.1 Please write your table caption here

Classes	Subclass	Length	Action Mechanism
Translation	mRNA ^a	22 (19–25)	Translation repression, mRNA cleavage
Translation	mRNA cleavage	21	mRNA cleavage
Translation	mRNA	21–22	mRNA cleavage
Translation	mRNA	24–26	Histone and DNA Modification

^a Table foot note (with superscript)

Glossary

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Solutions

Problems of Chapter 1

1.1 The solution is revealed here.

1.2 Problem Heading

(a) The solution of first part is revealed here.

(b) The solution of second part is revealed here.