

Guide to Scientific Writing - Biochemistry

Preparation of laboratory protocols and scientific theses (Bachelor's thesis, Master's thesis, dissertation)

This guide provides orientation on scientific-writing practice for students and doctoral researchers in the Department of Biochemistry at Goethe University Frankfurt. However, **requirements in individual courses or instructions from supervisors take precedence.**

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1. General principles

Scientific writing is a fundamental skill in studies and research. Its aim is to communicate scientific knowledge clearly, precisely and concisely, following a logical and coherent line of argument. Experiments and results must be documented accurately so that the work can be understood by others and, where appropriate, reproduced.

All scientific work must comply with the **principles of good scientific practice**. Ideas, text, data, images, and other materials originating from other sources must be identified appropriately and cited. Scientific work must also document the methods and analyses relevant to the reported results in a transparent and traceable manner. Further guidance on good scientific practice is provided by [Goethe University](#).

It is advisable to become familiar with the **principles of scientific writing** before starting a thesis. The [Writing Center \(Schreibzentrum\)](#) of Goethe University offers free courses, workshops, writing groups and personalized writing consultations for students. Guides and textbooks on scientific writing can also provide additional support.

For a BSc or MSc thesis, the primary objective is not necessarily to obtain spectacular or immediately publishable results. Assessment also concerns the student's ability to work scientifically, analyze data appropriately, critically evaluate results and document the work clearly. **Unexpected, negative or inconclusive results are scientifically relevant** when they are interpreted rigorously.

2. Planning a thesis

Writing a thesis usually takes more time than expected. Allow sufficient time for data analysis, figures, writing, references and final formatting. It is often useful to start writing while experimental work is still in progress.

A typical workflow may include:

- Thorough literature search (search, read, and manage relevant literature)
- Organizing and analyzing your data.
- Preparing publication-quality figures and tables.
- Drafting the individual sections (see chapter 5). Starting with a straightforward section such as Materials and Methods can help initiate the writing process.
- Revising the wording, structure, and scientific argument.
- Checking formatting, citations and consistency.
- Obtaining feedback from the supervisor and proofreading by peers.
- Performing a final scientific, linguistic and formal check.

3. Language

BSc Biochemie: For laboratory protocols, follow the language requirements of the respective course (usually German). The Bachelor's thesis may be written in German or English. If the thesis is written in English, a German abstract is required.

MSc Biochemistry: Laboratory protocols must be written in English. The Master's thesis must be written in English. It may be written in German with the consent of the Chair of the Examination Board. If the Master's thesis is written in a language other than English, an English summary must be attached.

4. Length

Type of work	Typical length	Usually not more than
Bachelor's thesis	approx. 50 pages	60 pages
Master's thesis	approx. 70 pages	90 pages
Dissertation	approx. 150 pages	300 pages

5. Structure

The structure of reports and theses should be modeled after publications in a subject-specific academic journal and organized into the following sections:

- **Title page:** Title of the work, name, institutional affiliation, e-mail address, supervisor, and date (see p. 8 for an example title page for a thesis).
- **Form identifying reviewers**
- **Table of contents:** Include page numbers. Use automatic heading styles and an automatically generated table of contents where possible.
- **List of figures and tables**
- **List of abbreviations**
- **Summary / Abstract:** Briefly state the scientific context, aims, main methods, most important results and principal conclusions. References should not be included. Please note: Along with the title, the abstract is the most frequently read part of a thesis and therefore a crucial element in promoting your work.
- **Introduction:** Introduce the scientific topic and current state of research, supported by relevant literature, in a way that even people without a background in the subject can understand. The final part of the introduction should summarize what the study addresses and why the question is scientifically relevant.
- **Materials and Methods:** Describe experimental procedures and analyses in sufficient detail to be understood and, where appropriate, reproduced. For specialized equipment, report relevant identifying information such as manufacturer and model. For reagents or materials, report supplier, catalogue number and the country of the company's headquarters. Describe data processing, software, and statistical analyses transparently.
- **Results:** Present results in a logical sequence rather than merely following the chronology of laboratory work. Report the observations and quantitative analyses needed to address the research question. The data should be summarized in the form of graphs whenever possible (e.g., mean values, S.E.M., statistical comparisons). However, the data are not interpreted until the discussion section. Avoid repeating every value from figures or tables in the text. Unexpected or negative results must not be omitted merely because they do not support the hypothesis. Any exclusion of data must be scientifically justified and transparently documented.
- **Discussion:** Interpret the findings in relation to the research question and current literature. What was the answer to the questions posed at the beginning? Do the results meet expectations? If not, what might be the reason? Consider alternative interpretations and relevant conflicting evidence. Critically discuss limitations, methodological constraints and possible sources of error. Distinguish clearly between conclusions supported by the data and more speculative interpretations.
- **Conclusion and Outlook:** The discussion should end with a conclusion: Summarize the main scientific conclusions and the scientific contribution of this research. Where appropriate, identify meaningful questions or experiments for future work.
- **Acknowledgements:** Acknowledge relevant technical or intellectual assistance and funding sources.
- **References:** List all cited sources consistently according to the selected citation style (see chapter 9).
- **Appendices:** Use for supplementary material that is relevant but would interrupt the flow of the main text.

- **Declaration of independent work:** A thesis must include a [sworn statement](#) confirming that the work was written independently and without the use of any sources or resources other than those cited.
- **Declaration regarding use of generative AI:** You must include a declaration and the disclosure of AI-assisted tools (see chapter 10).

6. Formatting

Scientific journals specify their own formatting requirements in detail. In the Department of Biochemistry there is no standard formatting style, but this guide provides recommendations. **Ask your supervisor whether specific conventions apply.** Possible default settings are:

- Paper size: DIN A4.
- Margins: approximately 3 cm inner/outer and 2.5 cm top/bottom.
- Font: a clearly readable serif or sans-serif font.
- Font size: typically 11 or 12 pt.
- Line spacing: approximately 1.5.
- Paragraph alignment: justified text with hyphenation or left-aligned text.

Formatting styles (e.g., heading levels, paragraph spacing, figure and table styles) should be consistent throughout the document. When formatting, it is very helpful to use Word features that automate processes and thus significantly speed them up. You can find helpful videos on the most common features online, for example [here](#).

7. Text design

- Write clearly and concisely. Avoid unnecessarily long sentences, filler words, vague formulations and laboratory jargon.
- Avoid unnecessary abbreviations. Define non-standard abbreviations at first use and use them consistently thereafter. An alphabetical list of abbreviations is useful in longer works.
- Divide longer sections into logically organized subsections with informative headings, while avoiding excessive fragmentation.
- The text is mainly written in past tense. Established knowledge and generally valid statements are expressed in the present tense.
- Avoid subjective evaluations and replace them with statistical analyses whenever possible (e.g., instead of “larger,” use “significantly increased ($p = 0.041$)”). Do not describe a difference as statistically significant without appropriate analysis.
- Use a number of decimal places appropriate to the measurement precision and analytical method (example: Report 2.3 mg, not 2.3001 mg, if the measurement precision is 0.1 mg).
- Separate numerical values from units with a non-breaking space (e.g. 20 °C, 5 mM, 10 %).
- Use a decimal comma in German text and a decimal point in English text.
- Use correct superscripts and subscripts in chemical formulae and scientific notation.
- Italicize where required, e.g. scientific/Latin names of species.
- Use Greek symbols where appropriate (e.g. 'α' rather than spelling out 'alpha').

8. Tables, figures and images

Tables/figures/images should present information accurately and help readers understand the data.

- Choose the visualization/graph type according to the data structure and scientific question. Whenever appropriate, show individual data points rather than summary statistics alone. Box plots and violin plots can be more informative than bar charts because they show features of the distribution.
- Number tables and figures consistently and use automatic captions/cross-references where possible.
- Refer to every table and figure in the main text.
- Instead of sentences such as “Figure 1 shows...,” the text should include an explanatory statement regarding the data shown in the figure, followed by a reference to the figure: “(Fig. 1).”
- Place tables and figures close to their first relevant discussion in the text.
- Move very extensive tables to an appendix if they would substantially interrupt the main text.
- Table legends are normally placed above the table, figure legends below the figure.
- Make figures and tables as self-contained as possible. Figure legends should provide all information needed to understand what is shown, including relevant experimental conditions.
- Use consistent fonts, sizes, symbols and visual conventions across all figures and tables.
- Label axes completely, including quantities and units.
- For images in which physical dimensions are relevant, include a scale bar.
- State how data are summarized (e.g. mean $\pm$ SD), statistical tests used, and statistical significance ($p > 0.05$ n.s.; $p < 0.05$ *; $p < 0.01$ **; $p < 0.001$ ***). Clearly define sample sizes (n). Where relevant, distinguish between independent biological samples (biological replicates) and repeated measurements of the same sample (technical replicates).
- Image processing must not selectively alter, enhance, remove or obscure features of the original data. Any relevant image processing should be applied consistently and documented.

9. References

- Use **reference-management software** from the beginning of the project! This reduces manual work and helps maintain consistency. Goethe University supports [Zotero](#) (free, cross-platform) and [Citavi](#) (available to GU students). Always verify imported bibliographic metadata.
- Use one citation style consistently. The reference-management programs offer predefined output styles (based on guidelines of common journals) and also allow you to create your own custom styles.
- A journal-article reference typically contains: author(s), article title, journal, year, volume, page, and DOI (Digital Object Identifier). For sources available only online, include the URL and the date of access. Personal communications and other unpublished sources are not treated as ordinary published evidence.
- Reference lists may be ordered alphabetically by first author, chronologically or in the order in which references appear in the text. For multiple publications by the same author(s) in the same year, letter suffixes such as 2025a and 2025b may be used.
- In-text citations commonly use either an author-year system or numerical citations.
- All sources cited in the text must appear in the reference list, and all entries in the reference list should be cited in the text.

Further information can be found on the website of the [University Library](#).

10. Use of generative AI

Generative AI tools may support parts of the scientific workflow, provided that they do not replace the student's own work relevant to assessment and that their use is disclosed and documented. The author remains fully responsible for the accuracy and scientific integrity of all submitted content.

- Follow the [Goethe University guidance on generative AI in teaching and assessment](#) and instructions issued by your supervisor.
 - Do not use an AI tool in a way that replaces the independent intellectual contribution required for the assessed work.
 - Do not enter confidential, unpublished, personal or otherwise protected research data into external AI systems unless this is explicitly permitted and compliant with data-protection and confidentiality.
 - It remains the student's responsibility to verify the relevance and accuracy of any material. AI-generated content can contain factual errors and misleading interpretations. In particular, if the AI cites secondary sources, these must be carefully checked, as AI tools may generate non-existent or incorrect bibliographic references. Therefore, thoroughly check AI-assisted text, images, and analyses and verify scientific statements and references against reliable original sources.
1. **Citing AI-generated content in the text:** Content (e.g., text, images, data) that was created using an AI tool must be identified as such. In the text (instead of citing the author when citing academic papers) the **prompt** (user input), the AI tool name and the date of generation must be referenced (e.g. „How do I cite correctly...”, ChatGPT, 18.9.2026).
 2. **AI Resource Directory:** All relevant AI uses must be documented in a list of AI resources, listing **prompt, name, version and URL of the AI tool, provider, and date the content was generated**. For text, image and multimedia generation tools, the prompt is treated as the title. For very long prompts, you can specify just the beginning. The resource directory can either provide a separate citation for each prompt (Example: “*How should one cite correctly when using generative AI?*”, ChatGPT 3.5, OpenAI, 18 May 2025, [chat.openai.com/chat](#)”) or group all associated prompts together under the individual AI tools, for example:
 - **“ChatGPT version 3.5, OpenAI: [openai.com/chat](#).**
 - “What is geology?”, output from 23 March 2023.
 - Assistance with structuring the text.
 - **DeepL Translate, DeepL SE: [https://www.deepl.com/translator](#)**
 - Translation of text passages.”
 3. **Documentation Table:** A documentation table in the appendix should list, for each instance in which an AI tool was used, in separate columns the AI name, type of deployment, relevant sections of the thesis where it was used, and comments on the type of use.
 4. **Declaration of Originality:** Include a signed declaration of originality on the last page of the report: “*I am aware that the use of machine-generated text does not guarantee the quality of the content or the text itself. I therefore declare that I have used generative AI tools solely as aids and that my own intellectual and creative contribution predominates in the present work. Furthermore, I declare that I have appropriately identified all passages written with the assistance of AI-based tools and indicated the AI tool used. I declare that I have not used any AI writing tools whose use was explicitly prohibited in writing by the examiner.*

Place, date: _____ Signature: _____”

11. Research data documentation

Good scientific practice requires research data to be documented reliably.

- Preserve all relevant raw/primary data.
- Relevant primary data must not be discarded simply because they conflict with expectations or hypotheses.
- Document experimental procedures, data-processing steps, analysis workflows, and exclusion criteria. Retain the information needed to understand how figures and statistical results were generated from the underlying data, e.g. analysis files, scripts/code, metadata, instrument settings and version information.
- Provide relevant research data and associated documentation to the supervisor.

12. Checklist before submitting a thesis

Before submitting your thesis, allow sufficient time for the final review. Check the final PDF or a printed copy, as errors are easily missed on screen. Ask another person to proofread the document where possible. If your supervisor agrees to review a draft, allow enough time for feedback and revision.

Final checklist

- Spelling, grammar and punctuation checked.
- Scientific terminology and abbreviations used consistently.
- Formatting consistent throughout.
- Table of contents and page numbers correct.
- Figures and tables numbered and labelled correctly.
- All figure/table cross-references correct.
- Axes, units, legends, sample sizes and statistical information complete.
- Citations in the text and reference list cross-checked.
- All quoted, paraphrased or adapted material is clearly identified and appropriately referenced.
- AI-assisted tools disclosed and documented.
- Required declaration of independent work included.
- Relevant raw data, analysis files and documentation organized and archived.

FACULTY OF BIOCHEMISTRY, CHEMISTRY AND PHARMACY

GOETHE UNIVERSITY FRANKFURT AM MAIN, GERMANY



[Title of the thesis]

Bachelor's thesis

submitted in partial fulfilment of the requirements for the degree of
Bachelor of Science in Biochemistry (B.Sc.)

or

Master's thesis

submitted in partial fulfilment of the requirements for the degree of
Master of Science in Biochemistry (M.Sc.)

or

Dissertation

submitted in partial fulfilment of the requirements for the degree of
Doctor of Natural Sciences (Dr. rer. nat.)

submitted by

[First name] [Last name]

from [Place of birth]

Frankfurt am Main, [Month] [Year]