

GUIDE FOR THE REVIEW ARTICLE

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1. INTRODUCTION

The review article is one of the mandatory parts of your master's. In your review article, you will combine several research papers to investigate a specific question or hypothesis in the field of your master's specialisation. This topic may be related to, but not be the same as the subject of your research internship. After you have chosen a topic, this must be worked out in more detail on the basis of a number of original or review articles. It is important that you formulate, deal with and then solve a problem in your review.

1.1 THIS GUIDE

The purpose of this guide is to offer you an overview of the writing process, the expected structure of a review and the expectations regarding supervision. This will hopefully lead to a smooth and enjoyable review writing and solve some of the problems you might encounter when writing. Supervisors and students can decide to deviate from these guidelines, but should only do this with proper arguments and when both parties agree.

1.2 SHORT CRITERIA

In short, your review should:

1. Include at least 4000 and no more than 8000 words (excluding footnotes/endnotes, title page and references);
2. Deal with an original subject that is related to your specialisation;
3. Contain a title, summary, introduction, main body, conclusion and reference list;
4. Be supplemented by a rebuttal;
5. Showcase an independent and professional work attitude;
6. Be well written (spelling, grammar and structurally sound, arguments are clearly framed and readable);
7. Have a workload of 6 ECTS (168 hours, corresponding to approximately 4 weeks fulltime).
8. Be completed under responsibility of an approved Radboud University/Radboudumc examiner. Certain intermittent supervision tasks may be delegated to internal or external colleagues, but responsibility for course quality and grading remains with the examiner at all times.

1.3 EER LEARNING AIMS FOR WRITING A REVIEW ARTICLE

The purpose of writing the review article is learning to present scientific articles in an abridged form and in your own words. Moreover, you critically evaluate these articles and integrate them in a comprehensive story.

Writing a review article will help you to reach the following learning outcomes of your master's programme, as derived from the *Education and Examination Regulation*:

Review Article	Education and Examination Regulation <i>You will be:</i>
Introduction	Capable of formulating new questions and hypotheses in the biological/biomedical field, and familiar with the research methods and state-of-the-art techniques to solve them, taking into account available equipment and resources;
Body of the text	Capable of independently identifying, critically reading and comprehending relevant, up-to date international literature from different disciplines, of discriminating essential from nonessential information, and of integrating new information in their overall view on nature;
Body of the text Conclusion with perspectives	Capable of writing down the results of a research project in the form of a master thesis, in accordance with the standards of an academic article;
Rebuttal	Capable of defending their view and critically evaluating other views in a scientific discussion.

2. THE WRITING PROCESS

In this section, the writing process will be explained in some detail for each of the different phases of writing.

When you are writing your review, there are three moments of submission:

1. The first submission (via an email to your supervisor) consists of your outline that contains the main- and sub-questions of your literature research. You should also add the proposed deadlines for your first and final version;
2. The second (via an email to your supervisor) consists of the first, full version of your review;
3. The third (by uploading your review article to Osiris Case) consists of the revised version of your review, including a rebuttal in which you explain how you implemented/rejected the comments of your supervisor.

To support the writing process and three submissions, you will interact with your supervisor at least four times, either via mail or in person. It is advisable to agree on the next moment of interaction during the preceding one. The four moments are:

1. Agreeing on supervision and the broad subject;
2. Discussing the outline, main question, aims and sub-questions;
3. Discussing the first full version of the review;
4. Discussing your revised version, rebuttal and grade.

If you are an experienced writer already, you will probably not need the detailed instructions for each phase and reading the headers will suffice. If you feel that you still do not know how to start or if you are stuck in a certain phase, reading (parts of) the books that underlie this section may be helpful. These are:

- Karin Kniseley *A student handbook for writing in biology* (W.H.Freeman & Co Ltd);
- Joy de Jong *Handboek Academisch Schrijven* (Coutinho; in Dutch);
- Kate Turabian's *A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers* (University of Chicago Press);
- Piet Verschuren's *De probleemstelling voor een onderzoek* (Spectrum; in Dutch);
- Elizabeth Fisher's and Richard Thompson's *Enjoy Writing Your Science Thesis or Dissertation!* (Imperial College Press).

2.1 DETERMINING A SUBJECT

The first phase of writing a review is – naturally – choosing a suitable topic, in a broad sense. A good starting point are the courses you have followed and particularly liked. For example, *cancer-gene regulation*, *ecology of urban birds*, *flowering of arctic plants* and *neurogenesis in adults* are all suitable “rough” topics. Alternatively, you may select a topic related to your research internship. This has the bonus of you already being well versed in its literature. However, your review should not become a reiteration of your research report. Therefore, your review article should deal with another problem; please discuss your plans thoroughly with your supervisor. Other options are to consult web pages of

research departments of your interest as these may also state possible topics for your review, or asking researchers if they have questions that they would like to get answered. Obviously, there are many more ways to determine your subject; just remember that at the end of this phase you should have a topic that you find interesting.

2.2 FINDING A SUPERVISOR AND ENROLLING

The second phase of writing a review is finding a suitable supervisor (which sometimes coincides with the first, determining the subject). The supervisor must be an approved examiner from Radboud University/Radboudumc and belong to a department that is associated to your specialisation (see “Departments for internships” in the study guide). An examiner may delegate intermittent supervision tasks to an internal or external colleague who is not an approved examiner (e.g. a PhD student or someone from another university), upon own proposal or upon request by the student, but in all cases, remains responsible for quality of the course and final grading. There are multiple ways to find a supervisor within the area of your interest. For example, you can contact the lecturer of a course that you found interesting or you can search on the FNWI webpages for interesting research groups and approach their group leader. If you find it hard to find and/or approach a supervisor, you can contact your study advisor for help and tips.

Once you have identified a suitable supervisor, you may ask about supervision possibilities via email, but it can sometimes be helpful to talk to them in person. Usually, you will have a (short) first discussion about your review plans and your supervisor might already give you a few papers to read, so you can start refining your topic.

When you have found an examiner, start a Case in Osiris (an application), and fill out all appropriate fields, e.g. the research department and your examiner. After submitting this application, you will be automatically registered for the course in Osiris. It will also enable you to upload your final thesis in a new Case in Osiris (‘case upload’).

2.3 NARROWING DOWN YOUR TOPIC

Narrowing down your topic to a workable one is a very important next step of review writing. In most cases, this phase will start with a period of “free reading” during which you read reviews or a recent experimental paper on your topic. While reading, take note of interesting points, questions that arise, and missing explanations, as these might be useful in refining your own topic. During the “free reading” period, it is important to keep track of literature, as this will be helpful later on. Refining your topic might go along the following lines:

After the first meeting with your supervisor, you may have decided to write a review about ‘human fertility’, but your supervisor said that this topic is too broad to be of sufficient depth for a review. You have read a few reviews about ‘human fertility’ and found that much more is written about ‘female human fertility’ than ‘male human fertility’. This indicates that ‘male human fertility’ might be more original and therefore you chose this temporary subject that still needs more refining. After reading a number of reviews on ‘male human fertility’, you discover that several factors influence ‘male human fertility’ and subsequently you choose one of these factors to write your review about, preferably one on which some experimental research articles have been published in the past few years. In this way,

the broad topic 'human fertility' might have been narrowed down to 'the influence of obesity on male human fertility', as this is much more manageable.

The refining process can take quite some time and it is a well-known pitfall for many students, so a deadline is advisable. Often this finalisation coincides with the finalisation of the central and sub-questions in the outline.

2.4 FORMULATING THE CENTRAL QUESTION AND SUB-QUESTIONS

Formulating your central question and sub-questions is arguably the most important part of the review writing process. A good set of questions should act as a point of focus to guide you during the rest of the writing process. The first and most important characteristic of your questions is their specificity. In first instance because you get a very clear idea what your review will be about, but later also to ensure the reader will understand it in one go.

Your central question must be formulated as precisely as possible and has to be supported ("surrounded") by the two following elements (also formulated as precisely as possible):

- Goal, which acts as an explanation of the importance of answering your main question;
- Specific research questions ("sub-questions"), which provide an explanation of how you are going to answer your main question.

Your goal must be explained first. Why is your review written in the way it is? For example, what is the point in writing a review when the main question is already answered in an existing review? The social relevance of your main question should also be explained in this part. It shows why you (and your reader) should care about your review article.

Secondly, the specific research questions help you to answer the main question. As such, it is important that these questions align with your main question. If this is not the case, to rewrite either the main or the sub-question, as a mismatch will likely derail your writing process at some point. The sub-questions might also be supported with hypotheses that can act as testable guides later on. When determining the sub-questions it is a good idea to already connect previously read literature to the different aims, so you can determine if a review or original research paper can really be used for your intended purpose (later on).

At the end of this phase, you will have a main question that is supported by goals and specific research questions. Your goal should be clear and the questions should be efficient and concrete too. Be aware that this is a key phase of the writing process; it is better to spend too much than too little time on it.

2.5 WRITING AN OUTLINE

Writing an outline will undoubtedly assist the writing process. In general, this outline serves a dual purpose:

1. It helps you structure your review and ensures that all needed sections (title, summary, etc.) are present;
2. It ensures that your sub-questions actually help in answering the main question.

When starting to write an outline, use the main question and the sub-questions you formulated in the previous phase as a starting point. These questions should be addressed in the introduction and each sub-question will be addressed separately in the main body. Detail explicitly what you are going to answer where and how you are going to do this in a few key words or key sentences. Moreover, adding references to literature, short summaries of articles and reviews to each section will also greatly help in the actual writing.

As soon as you have finished your outline, look at it again critically. Is the order of the sections logical? Do the different sections actually contribute to answering your main question? If you find problems with the outline, change these straight away, as a sub-optimal outline will lead to frustration and more problems during the actual writing process later on.

At this point, it might also be a good idea to look at the literature you have already found. Are the sources you have of sufficient quality and do they help with answering parts of your outline? Moreover, are there actually enough sources to answer your questions or should you search better or in a different way? Once you have written a satisfactory outline, the actual writing process can start. Make sure that your supervisor agrees with the outline, as you might have to rewrite large parts of your review if you do not consult them. You should also add a planning to the outline, with deadlines for your first and final version. To ensure that you discuss your outline with your supervisor, you will have to send it to them by email. Once again, it is better to spend too much than too little time on this phase, as it will make writing your first draft much easier.

2.6 WRITING A FIRST DRAFT

Writing a first draft starts with the outline you have agreed upon with your supervisor. If written correctly, the outline should be your guide when answering the different sub-questions in the body of your review. It is not recommendable to first read “everything” and to write it down only afterwards. This leads to problems with citing other researcher’s work and you will miss cross-fertilisation between the literature and your review. Usually writing, reading, citing, rewriting, rereading and reformulating of sub-questions go hand in hand. Therefore, do not fear to play around with sections you have written already, it is perfectly normal to discard some parts at a later point.

A review is more than simply summarising literature about your subject. You should critically evaluate your sources. Are your sources equally important or applicable? What are their weaknesses? Do they contradict each other? And if they do, why is that so? Synthesising your findings is the best way to answer these and many more questions. In general, text may suffice, but a self-made illustration is usually much appreciated by the reader and at the same time will force you to be clear about your findings and rationale. After you have finished the main body of the review, write the introduction from your outline and write a conclusion to get a coherent text.

A pitfall in the writing of a review is the feeling that there is just too much to do and you have no idea where to start. The best way to tackle this problem is by simply writing (but always keep an eye on your outline), even when your output is not perfect yet. Moreover, if you set small goals during the writing process, you will notice that this overwhelming feeling will disappear rapidly. Another way to help you during this phase is teaming up with another student who is also writing a review or by making an appointment with the Radboud Writing Lab.

2.7 REVISING YOUR REVIEW

2.7.1 ON YOUR OWN

Once you have finished your first draft (title, summary, introduction, main body and conclusion), it is time to revise. First, check if your story is coherent and if you yourself can get through the text without any effort. If you have problems with your own text, a reader is bound to have many more, and revising the problematic parts is important. At this point it is also useful to make sure that the different sections of your review are easily discernible, *e.g.* by providing clear headings and subheadings.

After you have checked for the larger cohesion of your review, it is time to look more critically at the individual parts. Are your arguments sound and do they contribute to answering your question? Moreover, do the arguments flow logically or are steps missing? At this point, it is also a good idea to look at the structure of your paragraphs. Do they have an introduction, body and conclusion as well?

Naturally, other people will spot problems with your review more easily than you yourself can. Ask a friend or another student to look at your work critically. You can look at theirs in return and you will see that critically looking at a review of someone else will actually help you to critically evaluate yours, too. When this peer-review has taken place, consider and process the comments.

When revising, it may be useful to put the review aside for a short while, as parts that looked good one day, might actually be less clear the next. It is advisable to revise the entire review once more before submitting it to your supervisor for the first time. Of course, revision also includes checking grammar and spelling. Submitting the first full version of your review to your supervisor should be done by email.

2.7.2 WITH COMMENTS FROM YOUR SUPERVISOR

After your supervisor has commented on your review, it is time to revise again. In science, it is common practice for articles to undergo peer feedback before the final version is send in. The feedback is collected, and a rebuttal document is written in which the feedback is analysed and addressed. Revision therefore is an integral part of the writing process and does not consist of just accepting all comments and not think that much about the changes you implement; always make sure you critically evaluate the comments you get and understand why you got them. To support your thought process and enable your supervisor to understand the changes you made, you have to create a short text (“rebuttal”) where you discuss the most important comments of your supervisor and explain why you did or did not implement these. If another student also looked at your review, you may incorporate those comments as well. You need to add these rebuttal pages at the end of your review article.

2.8 SUBMITTING THE REVIEW

At this point, you have finished your review and all you have to do is submit it for grading. Upload the final version of your review to a new Osiris Case. If you and your supervisor have reasons to keep your review confidential, please select the relevant option during submission. After grading, you discuss the grade with your supervisor and get final feedback.

2.9 GENERAL REMARKS FOR REVIEW WRITING

2.9.1 FINDING SOURCES

In the early phases of review writing, you will read reviews and maybe one or two experimental papers to get an overview on your topic. It is later on, when looking at specific aspects, whilst answering small questions, that you look at more original research papers. During this literature study, it is a good idea to work systematically and to keep track of your search system, *e.g.* which keywords you used so you can find the same type of articles again. The librarians of the Library of Science may be of further assistance. Apart from using web-based databases, it might be a good idea to check the bibliography of reference works (books) or to ask a knowledgeable person about possible sources of information. Lastly, when searching for sources, always make notes of what you found so you can reliably return to these sources. If your sources contain information on several topics, make distinct notes for each of these as well.

2.9.2 EVALUATING AND COMBINING SOURCES

Once you have found potential sources, it is time to determine which sources are useful and reliable and which sources are not. In general, all cited sources should be expert-curated, peer-reviewed, accessible and of the latest version. Further determination if a source is reliable may be less obvious and comes with experience. However, there are several tactics to approach this. A basic method is by checking whether it is published in a reputable journal or book (check its impact factor) and whether other researchers have cited it. Moreover, looking at internal consistency of your source is also a good way to judge its reliability. When synthesising different sources, always check if they are really comparable or just seem to be comparable. For transparency, always state the shortcomings of these comparisons too.

2.9.3 SUBMITTING YOUR REVIEW TO A PAPER

Some student review articles are of such high quality that a supervisor might propose to try to publish it. When this is the case, the supervisor should make this clear to you and explain that the comments you get on your final version are aimed to further improve the review for publication. It is still important that the second full version is graded, to prevent study delay.

3. STRUCTURE OF THE REVIEW

Each review must comprise of the following:

- Title page (including name of the author, student number, MSc specialisation, name of the supervisor, place and date);
- Brief summary;
- Introduction in which a main question, aims of the review and sub-questions are formulated;
- Body of the text, either as two separate or one integrated section consisting of:
 - An examination of the used articles;
 - A discussion with critical comments with respect to the articles that are used and conclusions concerning the main question and sub-questions as formulated in the introduction;
- A conclusion with perspectives;
- A reference list;
- A rebuttal in which you react directly to the most important comments of your supervisor (and peers).

Details about style (tenses of verbs, active/passive voicing, citing styles, etc.) should be discussed with your supervisor.

3.1 TITLE PAGE

This section is mainly meant for easy recognition of your review and should contain at least a title, your name and student number, MSc specialisation, the name of your supervisor, place and date. The title itself should cover the content, but also act as an invitation to start reading your review. An interesting title is therefore of great importance, but make sure that you do not oversell the contents of your review or make claims that are too bold.

3.2 SUMMARY

In the summary you should explain your review in the most concise way. Once again, this section is intended to draw your reader in and ensure that your review will be read. The summary must contain:

- Background of your review, *i.e.* why your topic is important;
- Main question of your review;
- Sub-questions that help you to answer your main question;
- Synthesis of the found literature;
- Conclusion that answers the main question and links back to the background/goal of your review.

The summary can also be backed up by several keywords that help your reader understand the content of your review even better. These keywords should not be present in the title already.

3.3 INTRODUCTION

The goal of the introduction is twofold: explaining the why and how of your review and, just to be sure, to entice your reader to keep on reading. The best way to do this is by starting with the background of your review topic and giving a broad overview, and especially the relevance of your topic. Your main question must logically follow on this section. To this end, your introduction should only be aimed at explaining relevant information.

Subsequently, the sub-questions should follow, as well as a bit of explanation how answering these questions actually helps to answer the main question. An explanation of how you found your literature (explaining your search terms, etc.) can also be a part of your introduction depending on your specialisation.

3.4 MAIN BODY

The first part of your main body is comparable to the results section of a research article, but instead of presenting your own data, you present the findings of other research articles in a concise manner. In this section it is important that you critically evaluate your different sources when comparing and combining them. It is useful to structure the examination of the articles in such a way that the information for each sub-question is grouped together. The use of graphs, conceptual figures and tables are a vital part in the main body of most reviews.

In the second part of your main body you start weighing the different findings from your sources to answer each sub-question. To do this, carefully reiterate the separate, small conclusions of the examination of the articles and combine them. Explain why certain conclusions carry more weight and why you answer your sub-questions with these particular conclusions.

When writing the main body you can choose between two structures. You can either structure it by topic, where you first write the section containing the summarised articles and its discussion before going to the next. Or you can structure it as such that you first summarise all articles and subsequently discuss them.

3.5 CONCLUSION

Once you have answered all the sub-questions properly, you can end with a conclusion in which you answer the main question of your review. In this conclusion you should explicitly state what your review has answered, what its implications and future perspectives are.

3.6 REFERENCE LIST

Correct referencing to your sources is of vital importance in proper scientific writing. Whatever style you choose, you should keep referencing consistent throughout your entire review. Make sure that a reference list is also present at the end of your review.

3.7 REBUTTAL

In your rebuttal, you critically evaluate the most important comments from your supervisor (and peers). Structure this document with sections for each chosen comment wherein you first cite the comment itself and subsequently explain why you did/did not implement it and how you did this. The rebuttal pages need to be added at the end of your review.

These points might help you create an effective rebuttal:

1. Begin the rebuttal by a small paragraph thanking the reviewers for their time and effort, mentioning that their feedback will help improve your writing.
2. Provide a point-by-point response. Number the responses made by the reviewers and respond to them sequentially. If multiple comments were formulated together, try to split them so you can address them individually.
3. Address the points raised by the reviewer in a clear and concise manner. If you do not agree with one of the points raised or are not able to address a comment, explain your reasoning behind it.
4. If a reviewer misunderstood something, clarify your thoughts politely.
5. The overall tone used in your rebuttal should be polite and respectful.
6. If you want more information or inspiration for your rebuttal, you could have a look at these two articles: <https://peerj.com/benefits/academic-rebuttal-letters/> or <https://www.journals.uchicago.edu/doi/10.1086/688886>

4. SUPERVISION

In this section you will read about the supervision during your review writing process. Be aware of the fact that different supervisors have different styles of supervising; you may want to get a clear understanding of this at the start. This section should mostly be seen as a general guideline.

4.1 THE ROLE OF THE STUDENT

When writing a review you are responsible for your own work. This means that you initiate the appointments with your supervisor and come prepared to these appointments. You need to work individually and stick to the deadlines you set. Do not be afraid to make an appointment if you have questions or are stuck, as your supervisor is usually more than willing to help you.

It is of critical importance that you communicate clearly with your supervisor, especially if you need to finish your review in a short time period in which grading also has to take place. Remember that your supervisor may well be busy and not be able to grade or have an appointment with you on short notice.

Finally, it is advised to share a link to the Review Article documentation in the study guide with your supervisor, to make sure you are working with the same set of expectations.

4.2 THE ROLE OF THE SUPERVISOR

When writing a review, you can expect your supervisor to advise you during your writing process, to help you if you have become stuck and to critically evaluate and provide feedback on your outline and first version. To do this, your supervisor will have at least four appointments with you, either via email or in person (see also section 2): (I) to agree on supervision and the broad subject, (II) to discuss the main question, sub-questions and outline, (III) to discuss the comments on the first version, and (IV) to discuss your grade.

4.3 TIME PATH AND APPOINTMENTS

One possibility is to write your proposal during a four-week full-time period. Please note that you need to make clear appointments with your supervisor so you will not experience any delay. An alternative possibility, for example when you are following other courses in parallel, would be to modify this timeframe in which you will spread the 6EC workload over 6-8 weeks. Please discuss the possibility for a modified timeframe with your supervisor. It is expected that you and your supervisor set deadlines for the outline, first full version and final version. This deadline setting will also ensure that your supervisor has allocated time for providing feedback and grading. If you deviate from your deadlines tell your supervisor in a timely fashion. It might also be a good idea to make the next appointment with your supervisor when you are already at an appointment.

4.4 GRADING

Your supervisor will use an online evaluation form (PDF example available in the study guide) to grade your review. As you will notice, the weight of the different categories is not specified further, and there is the possibility to add (or omit) a category, when deciding on a specific form or style of the review

together with your supervisor. It is advisable to discuss grading at an early point in your writing process so you will not be surprised later on. A good moment to do this is when you are discussing your outline.

4.5 RESIT

In case of a failing grade, you and/or your supervisor should always inform the course coordinator, who will ensure proper handling of the procedures, which includes a second opinion on the grades. If the failing grade is final, you may choose to resit the course with a revised version. You can base the revision on the feedback you received previously on your text and on the feedback belonging to the grading; no additional feedback will be provided by your supervisor. If the revised version is also found failing, you will have to choose a new topic and may change to another supervisor for a next resit.