Every student has to conduct a research project supervised by one of our professors (the promoter) and prepare a thesis (the course unit ‘Master thesis Biology’) in order to obtain the degree of Master of Sciences in Biology. The Master Thesis Biology accounts for 30 ECTS, corresponding to 25% of ECTS of entire Master of Science in Biology programme.

In summary, the Master Thesis consists of the following phases:

1) Choosing a thesis subject
2) Preparation of a thesis proposal
3) Thesis work (e.g., laboratory and/or field work)
4) Preparation of the thesis manuscript
5) Thesis submission
6) Thesis defence
7) (Scientific presentation)

1. Choosing a thesis subject.

Thoughtful selection of a thesis subject is the first step in successfully completing a high-quality thesis and graduating from your Master programme. Students typically start looking around for a thesis subject in the first year of their Master programme. Depending on your interests or fascinations in biology, you have either one of these three options:

- If your interests lie close to any of the Department’s research themes, talk to the responsible principal investigator and express your interests in conducting a thesis in his/her research team.
- Similarly, if you are interested in conducting research related to any topic seen during a course unit, talk to the responsible course titular or teacher, regardless of whether he/she is a member of the Biology Department, of another department at the VUB, or a guest teacher. He/she may propose a thesis subject in his/her own research team, or if necessary, refer you to a more appropriate team at the VUB or another institute.
- Finally, if you are interested in conducting a thesis on a subject outside the Department’s expertise, contact the coordinator of your graduation option and discuss your ideas. The coordinator may refer you to a relevant research team outside the VUB (even outside Belgium), or advice you to take initiative and contact another research team yourself.

The thesis subject is defined in dialogue with the team’s principal investigator (a professor). Once settled on the subject, the principal investigator agrees on acting as your promoter, the official supervisor of your thesis. An additional co-promoter or (co-)supervisor, (typically a PhD student or a postdoctoral researcher) may be assigned. If you will conduct your research outside the VUB, one of the Department’s professors has to agree on acting as (co-)promoter of your thesis.

2. Preparation of the thesis proposal
2.1. Purpose
Before starting your thesis work, you have to describe your thesis in a document called a ‘thesis proposal’, which needs to be approved by the Biology Department’s Council. The purpose of this document is not to evaluate you (no marks are given for the proposal) but to guarantee the scientific level and feasibility of the proposed research. Writing guidelines for this thesis proposal are described below (p. 2).

The thesis proposal must be submitted to the Chairman of the exam committee of the 2nd Master year (through the secretariat of the Biology Department) before initiation of the thesis work (practical lab or fieldwork). Table 1 shows the deadlines of submission depending on the planned starting time of the thesis work. Your thesis proposal will be discussed during the first Biology Department Council meeting after the deadline of submission. The Council has to give its approval before the planned start of the thesis work.

Note: For students of the graduation option ‘Tropimundo’, the thesis proposal is an actual course unit (‘Thesis proposal’, 3 ECTs). You will be graded for the quality of this proposal, and passing this course unit is required to start your thesis research.

Table 1: submission deadlines for the thesis proposal.

<table>
<thead>
<tr>
<th>Deadline</th>
<th>Foreseen start of the thesis work</th>
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<tbody>
<tr>
<td>July 1st</td>
<td>July-August</td>
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<tr>
<td>September 1st</td>
<td>September</td>
</tr>
<tr>
<td>October 1st</td>
<td>October</td>
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</tbody>
</table>

2.2. Guidelines for preparing your thesis proposal
A thesis proposal typically covers 2-3 pages and contains the following sections:

1) General information
   • Name of the student
   • MSc graduation option
   • Provisional title for the thesis
   • Name of the promoter and, if relevant, co-promoter(s)
   • Three suggested readers with contact info and e-mail address
     Note: proposed readers are selected in agreement with your promoter and can be Professors or researchers with a PhD degree from the Biology department or, if relevant, from another VUB department (e.g. Bio-engineering) or even another Belgian institute (e.g. Université Libre de Bruxelles, Royal Institute of Natural History, National Botanical Garden,…).
   • Date of submission

2) Abstract
The abstract should contain approximately 250 words and summarise the proposal, including:
   • The scientific hypothesis and research objectives
   • Summary of the proposed methods
   • Relevance of the scientific question in relation to the general research domain

3) Cited literature list
   Provide a literature list, containing all relevant references, including author, year, title, journal, volume and pages.
Journal articles can be cited as follows:

Articles or chapters in books can be cited as follows:

4) Financials statement
All costs of your research are paid by the promoter or co-promoter (dependent on where the research is done). In case of additional expenses (train or plane tickets, cost of a lodge during fieldwork, ...), state explicitly who will pay. Without explicit statement, it is assumed that the lab will pay all expenses.

5) Optional: Policy or publication statement
Prior to starting your thesis work, you need to be aware of (and agree with) in-house policy rules and the publication culture of the research team where you will conduct your thesis work.

6) Signatures
Your thesis proposal should be approved and signed by both you and your promoter(s) before submission. This makes sure that you both agree on the objectives and the outline of your thesis.

2.3. Language
If you are enrolled in an English graduation option of the Master programme, the thesis proposal, like the eventual thesis manuscript, must be written in English. Be consistent in selecting either ‘English UK’ or ‘English US’ throughout both documents. Sentences should be short, concise and grammatically correct. Avoid slang, jargon, personal opinions, and importantly, plagiarism. A scientific text must be objective and factual. Latin expressions, and scientific species names must be written in italic (e.g., *Mytilus edulis*). The simple past or present could be used and the tense should differ among sections within the thesis report but do not change tense within a paragraph. The quality of the written language in the thesis is a criterion for evaluation.

2.4. IMPORTANT NOTE
Besides submitting your Thesis proposal to the Department’s secretariat, you must also submit a provisional thesis title and abstract to the secretariat of the Faculty of Sciences and Bio-engineering Sciences (Campus Etterbeek, Building F, Room 4F107b). **Deadline of submission is December 1st.**

3. Thesis work
During your thesis work, you become part of a research team, and this implies several responsibilities:
- Make effort to integrate well in the team’s daily functioning. This may include your participation to lab meetings, daily or weekly tasks etc.
- Regularly report the progress of your thesis work to your promoter.
- Meet any deadlines agreed on with your promoter or your supervisor regarding your thesis work and manuscript preparation.
Taking up these responsibilities is in your own interest, since it will make your thesis work a more pleasant experience and will affect your evaluation in a positive way (see Master thesis evaluation criteria).

In return, your promoter carries the responsibility to coach you in the most feasible way, provide you access to the necessary means and infrastructure, treat you as a valuable member of the team, and provide feedback regarding your thesis work, manuscript preparation and thesis defence.

4. Preparation of the thesis manuscript

Below are the instructions for writing your master thesis, which should consist of two main parts:
1) Scientific paper
2) Supplementary Information

4.1 Scientific paper

Except for citations, we largely follow the style of Scientific Reports, please refer to publications in that journal for examples of published papers (http://www.nature.com/srep/). The master thesis should be presented as the work of a single author (the student). The main text (not including Abstract, Methods, References and figure legends) should be no more than 4,500 words. The maximum Article title length is 20 words. The Abstract — which must be no more than 250 words long and contain no references — should serve both as a general introduction to the topic and as a brief, non-technical summary of the main results and their implications.

For the main body of the text, there are no explicit requirements for section organization. According to the students' preference, the text may be organized as best suits the research. As a guideline and in the majority of cases, however, we recommend that you structure your manuscript as follows:
- Introduction (without subheadings)
- Results (with subheadings)
- Discussion (with or without subheadings)
- Methods (with or without subheadings)

A specific order for the main body of the text is not compulsory and, in some cases, it may be appropriate to combine sections (Results and Discussion, for example). Footnotes should not be used. Articles should contain no more than 6 display items (figures and/or tables).

4.1.1. Front Cover

The front cover includes:
- Thesis title
- Name of the student
- Academic year
- Name of the Master programme and graduation option
- Name of promoter and co-promoter
- Optional: a relevant cover picture, VUB logo, Department logo, Laboratory logo

4.1.2. Figures
Students are responsible for obtaining permission to publish any figures or illustrations that are protected by copyright, including figures published elsewhere and pictures taken by professional photographers. Figures should be numbered separately with Arabic numerals in the order of occurrence in the text of the manuscript. When appropriate, graphs should include error bars. A description of the statistical treatment of error analysis (preferably standard deviation or standard error) should be included in the figure legend. If statistical tests involve hypotheses about means, means should be plotted in figures, not medians. Figure lettering should be in a clear typeface (for example, Helvetica); the same typeface in the same font size should be used for all figures in a paper. Use 'symbols' font for Greek letters. All display items should be on a white background, and should avoid excessive boxing, unnecessary color, spurious decorative effects (such as three-dimensional 'skyscraper' histograms) and highly pixelated computer drawings. The vertical axis of histograms should not be truncated to exaggerate small differences. Labelling must be of sufficient size and contrast to be readable. The thinnest lines in the final figure should be no smaller than one point wide.

Figures divided into parts should be labelled with a lower-case bold a, b, and so on, in the same type size as used elsewhere in the figure. Lettering in figures should be in lower-case type, with only the first letter of each label capitalized. Units should have a single space between the number and the unit, and follow SI nomenclature (for example, ms rather than msec) or the nomenclature common to a particular field. Thousands should be separated by commas (1,000). Unusual units or abbreviations should be spelled out in full or defined in the legend. Scale bars should be used rather than magnification factors, with the length of the bar defined on the bar itself rather than in the legend. In legends, please use visual cues rather than verbal explanations such as "open red triangles". Unnecessary figures should be avoided: data presented in small tables or histograms, for instance, can generally be stated briefly in the text instead.

4.1.3. Figure and Table legends
Legends begin with a brief title sentence for the whole figure and continue with a short description of what is shown in each panel in sequence and the symbols used; methodological details should be minimized as much as possible.

4.1.4. Methods
Where appropriate, we recommend that you limit the Methods section to 2,500 words. When more technical details are necessary, please use the Supplementary information section for that. You must ensure that the Methods section includes adequate experimental and characterization data necessary for others in the field to reproduce your work. Descriptions of standard protocols and experimental procedures should be given. Commercial suppliers of reagents or instrumentation should be identified only when the source is critical to the outcome of the experiments. Sources for kits should be identified. Students should describe the experimental protocol in detail, referring to amounts of reagents in parentheses, when possible (eg 1.03 g, 0.100 mmol). Standard abbreviations for reagents and solvents are encouraged. We advise to add an ethical statement and safety hazards posed by reagents (and measurements taken) whenever appropriate.

4.1.5. Statistics
The number of independent statistical units (n) should be clearly provided for each test. In case of a hierarchical nested design, the different levels should be clearly specified. Every article that contains statistical testing should state the name of the statistical test, the n value for each statistical analysis, the comparisons of interest, a justification for the use of that test, the alpha
level for all tests, whether the tests were one-tailed or two-tailed, and the actual P value for each test (not merely "significant" or "P < 0.05"). Assumptions of statistical tests should be discussed briefly. All P values should be accompanied by the value of the test statistic used to calculate the P-value. It should be clear what statistical test was used to generate every P value. Use of the word "significant" should always be accompanied by a P value; otherwise, use "substantial," "considerable," etc. P values do not provide information about how strong an effect is. A measure of effect size should therefore be provided when possible (e.g. standardized regression coefficients, a correlation coefficient, the coefficient of determination).

Data sets should be summarized with descriptive statistics, which should include the n value for each data set, a clearly labelled measure of center (such as the mean or the median), and a clearly labelled measure of variability (such as standard deviation or range). Ranges are more appropriate than standard deviations or standard errors for small data sets. Graphs should include clearly labelled error bars. You should state whether a number that follows the ± sign is a standard error (SE) or a standard deviation (SD).

You should justify the use of a particular test and explain whether the data conform to the assumptions of the tests. Three errors are particularly common:

- **Multiple comparisons:** When making multiple statistical comparisons on a single data set, you should explain how you adjusted the alpha level to avoid an inflated Type I error rate, or you should select statistical tests appropriate for multiple groups (such as ANOVA rather than a series of t-tests).

- **Normal distribution:** Many statistical tests require that the residuals are approximately normally distributed; when using these tests, you should explain how you tested the data for normality. If the data do not meet these assumptions, another error distribution may be appropriate (e.g. Poisson, Binomial) or a non-parametric alternative should be considered.

- **Small sample size:** When the sample size is small (less than about 10), you should use tests appropriate to small samples or justify their use of large-sample tests.

### 4.1.6. References

References should be limited to 60. In contrast to the format of Scientific Reports, references should be mentioned as the authors + year of publication. When there are more than two authors, the reference becomes ‘Author et al., year of publication’. Only papers that have been published or accepted by a named publication or recognized preprint server should be in the references.

All authors should be included in reference lists unless there are six or more, in which case only the first author should be given, followed by 'et al.'. Authors should be listed last name first, followed by a comma and initials (followed by full stops) of given names. Article titles should be in Roman text, only the first word of the title should have an initial capital and the title should be written exactly as it appears in the work cited, ending with a full stop. Book titles should be given in italics and all words in the title should have initial capitals. Journal names are italicized and abbreviated (with full stops) according to common usage. Volume numbers and the subsequent comma appear in bold. The full page range should be given, where appropriate.

**Published papers:**


**Books:**


Website:

4.1.7. Acknowledgements
Acknowledgements should be brief. Grant or contribution numbers may be acknowledged. Only people, institutions or organizations should be thanked, not animals or supernatural beings.

4.2. Supplementary Information
This section, which accompanies the manuscript, can be used to clarify anything you want. This can contain an extra introduction, extra figures, extra tables, ... Supplementary Information (text, tables and images) should be combined and supplied as a single file of maximum 20 pages, preferably in PDF format. Supplementary videos, spreadsheets or data files are not encouraged. Designate each item as Supplementary Introduction, Table, Figure, Methods, Discussion, as appropriate. Number Supplementary Tables and Figures as, for example, "Supplementary Table S1". This numbering should be separate from that used in tables and figures appearing in the main article. Supplementary Introduction, Methods or Discussion should not be numbered. Refer to each piece of supplementary material at the appropriate point(s) in the main article. Be sure to include the word "Supplementary" each time one is mentioned. Please do not refer to individual panels of supplementary figures.

Use the following examples as a guide (note: abbreviate "Figure" as "Fig." when in the middle of a sentence): "Table 1 provides a selected subset of the most active compounds. The entire list of 96 compounds can be found as Supplementary Table S1 online." "The biosynthetic pathway of L-ascorbic acid in animals involves intermediates of the D-glucuronic acid pathway (see Supplementary Fig. S2). Figure 2 shows..."

4.3. Important note
The fact that you have written your master thesis as a scientific paper manuscript, does not automatically allow you to also submit this manuscript to a journal for publication. The promoter of your thesis has the final word on when, how, and where data and results from your Master thesis will be published (or not). You are also not allowed to post your master thesis (or part of it, or research results) anywhere on internet or social media.
After the thesis, all samples and biological material will remain at the VUB. Deposition in another location is possible when approved by the promoter. Before leaving the VUB, it is the student's duty to hand over all data to the promoter.

5. Thesis submission
Your thesis will be evaluated by a panel consisting of the thesis promoter (in dialogue with co-promoter and supervisors) and two additional readers of the Biology Department (or, if relevant, of the Bio-engineering Department). Submission consists of the following two steps.

5.1. Originality check
First, before actually submitting your thesis to the Department’s secretariat (see 5.2.), you need to upload an electronic version of your thesis on the website www.turnitin.com, an online platform
that will screen your text for originality and detect potential signals of plagiarism (a process called ‘originality check’). Although as a student you won’t be able to see the results of the screen, your promoter can and will provide feedback regarding the originality check.

To submit your thesis to the originality check, proceed as follows.
1) Prepare a pdf document of your entire thesis text. Make sure that the document does not exceed 20 Mb. Give it a logical name, like ‘Yourname_thesis.pdf’
2) Use an internet browser to visit the page www.turnitin.com and follow the link ‘Create Account’ at the top left of the page.
3) Scroll down to ‘Create a New Account’ and choose ‘Student’ from the list.
4) Fill in the data form. Class ID should be ‘8053261’, Password is ‘Masterthesis’
5) Submit your thesis document by pressing the button ‘submit paper’ and uploading your document. Make sure to upload your document in the correct file (e.g., Master Thesis 1st session).
6) After successfully submitting your thesis, you will see a confirmation page. Print this page as a proof of your originality check and submit it to the Department’s secretariat along with your thesis (see 5.2).

5.2. Thesis submission
The thesis must be submitted to the Department’s Secretariat on the first day of the exam period in first or second session, prior to 4PM.
Before this deadline, you should submit the following to the Secretariat of the Biology Department (room 7F426):
- Four hard copies of your thesis. Two of those will be distributed by the secretariat to the two additional members of the reading panel; one copy will go to the Faculty’s secretariat.
- The electronic version (pdf) of your thesis. This can be done by email (secrdbio@vub.ac.be);
- A print of your Turnitin submission confirmation. This can be done by email (secrdbio@vub.ac.be);

6. Thesis defence

The thesis defence is a public event planned by the Department immediately after the exam period, during which you and your fellow students present your thesis research according to a predefined time schedule (i.e. similar to a scientific symposium). The defence consists of three parts:

1) A slideshow presentation in which you present your thesis work (max. 12 minutes)
2) Questions from the reading panel (max. 20 minutes)
3) Optional: questions from the audience

You should prepare your slideshow presentation in MS Powerpoint or Keynote. Your slideshow should:
- capture the essence of your thesis research
- be well-structured (e.g. including Introduction, Materials and methods, Results, Discussion, Conclusion and Acknowledgements)
- be clear and understandable to a broad audience
- be visually attractive but sober (without excessive decorations or special effects).
Practise your slideshow presentation in advance, and make sure that it respects the predefined maximum duration. Arrange one or more trial defence sessions with your promoter, supervisor, and other members of your research team. Try to anticipate questions from the reading panel and prepare clear and focused answers.

7. Scientific presentation

If you are enrolled in the graduation option ‘Human Ecology’, ‘Ecology and Biodiversity’, ‘Tropimundo’ or ‘Molecular and Cellular Life Sciences’, your thesis manuscript and your thesis defence will be additionally graded for the course unit ‘Scientific Presentation Skills and Career Planning’. Consequently, it is important to pay attention to the layout of your slideshow presentation but also to your attitude during the defence.