

Curriculum

Münster Graduate School of Evolution (MGSE)

1. Introduction

Based on a scientific program that bridges the Faculties of Biology, Medicine, Geosciences, Mathematics, and Philosophy, the MGSE provides doctoral students with the necessary skills for acquiring and applying knowledge in a multidisciplinary world. The curriculum of the MGSE is tightly linked to its research questions, but also based on a strong theoretical and philosophical foundation for all participating students. The three-year teaching program takes the diversity of future careers into account and is tailored towards developing scientists who see interdisciplinary connections in the multifaceted aspects of evolutionary problems.

2. Curriculum overview

The entire doctoral studies are accompanied by the interdisciplinary “**studium integrale**”, which encompasses for example multidisciplinary lectures and courses and that is also open for members of other faculties in the WWU.

The three-year teaching program furthermore includes regular **meetings** in order to facilitate scientific and personal exchange.

The **education program** is structured into three periods, according to years one to three of the PhD-projects. During the first period doctoral students are trained in a cross-disciplinary manner, participating in courses within and outside their faculties and visiting labs of other disciplines, in order to facilitate the interdisciplinary approach of each student and to promote contacts between the labs. The second period is meant to increase the student’s scientific communication skills and includes for example topic group work and contributions to conferences. Owing to the large diversity of possible careers, the third period is divided into three main tracks (academia, industry, and society) and is shaped according to the students’ individual plans and inclinations.

The training program is complemented by **project-oriented training** in the respective research groups, where the doctoral students are fully integrated members.

An overview of the Qualification program of the MGSE is shown in Fig. 1.

3. “Studium integrale”

A key feature of the MGSE is the multidisciplinary “studium integrale” (Integrated studies) for all students of the school, which is also open for students and scientists from other faculties of WWU, further increasing the opportunities for interdisciplinary contacts for the MGSE students.

The “studium integrale” accompanies the entire doctoral studies and consists of

- the lecture series “Evolution across Fields”,
- the lecture series “The Growth of the Evolutionary Thought”,
- and the annual MGSE symposium,

The weekly **lecture series “Evolution across Fields”** in the summer semester is organized as a joint course of all MGSE PIs. In a period of three years, it spans all topics and fields included in MGSE. The lectures is based on the original research of the groups but aim at the broad spectrum of students from the diverse disciplines.

In the winter semester the weekly **lecture series “The Growth of the Evolutionary Thought”** provides an in-depth introduction to the history and philosophy of evolutionary thinking, the basics of the theory, and the philosophy of science. Doctoral students normally hear the lecture once during their graduate studies, preferably in their first or second year.

Doctoral students are involved in the preparation of the **annual MGSE Symposium**, which is a major event bringing together all doctoral students, PIs, and other scientists working in the MGSE research areas. Doctoral students present their projects and results in talks or posters, and invited speakers give public lectures. Furthermore, the general assembly of all members meeting may take place on the occasion of the symposium.

	1 st winter semester	1 st summer semester	2 nd winter semester	2 nd summer semester	3 rd winter semester	3 rd summer semester
<i>Studium integrale</i>	MGSE Symposium		MGSE Symposium		MGSE Symposium	
	lecture series The Growth of the Evolutionary Thought		lecture series The Growth of the Evolutionary Thought		lecture series The Growth of the Evolutionary Thought	
		lecture series Evolution across Fields		lecture series Evolution across Fields		lecture series Evolution across Fields
	fortnightly Peer group meetings & Evolution meetings					
<i>Three-phase education program</i>	Cross-disciplinary training lab rotation; courses, journal / book clubs, lectures, and workshops from the Master programmes outside the own department/faculty		Science-skills training topic group work, contribution to conferences, paper writing, research stay abroad		Tailored education academia track, industry track, society track soft skill and language courses, application workshops	
	Project-oriented training					

Figure 1: Qualification program of the MGSE.

4. Regular meetings

In order to facilitate the contacts and scientific exchange between doctoral students, the PhD-students of MGSE meet on a regular basis for discussion and socializing.

During the fortnightly **peer group meetings** all doctoral students from the different disciplines meet in the “Kavaliershäuschen” to discuss scientific, organizational, and personal matters. For example, one of the students can present an overview and the status quo of his / her PhD-project. Thereby, all students are well informed about each others projects and everyone gets the opportunity to discuss potential problems in an informal manner. Furthermore, the peer group meetings are meant to be an occasion for socializing and may also be combined with a BBQ or other social activities.

The peer group meetings are organized and attended by the MGSE Coordinator, who also assists the students in organisational matters and administrative tasks.

The **evolution meetings** may be organized on initiative of the doctoral students, who can invite PIs, ETT fellows, and guest speakers to present aspects of their work. The Evolution Meeting is a place for open and collegial discussion between doctoral students and guests in a friendly and informal atmosphere.

5. Three-phase education program

A modern doctoral program and research training should recognize the diversity of future careers. Since career plans differ greatly among the doctoral candidates, the curriculum is tailored to individual students, especially towards the end of the doctoral phase. The curriculum is therefore structured into three periods, according to years one to three of the doctoral studies (see Fig. 1).

5.1 First phase: Cross-disciplinary Training

The first period aims at cross-disciplinary training. Students have the opportunity to participate in a selection of courses within the MGSE research areas. These may be courses specifically designed for the MGSE as well as courses from the established master programs, both within and outside of the own faculty.

For example, the lecture series “The Growth of the Evolutionary Thought” is accompanied by a **seminar**, thus constituting a course for Master and PhD students from the faculties of biology, medicine, geosciences, and philosophy. While MGSE graduate students are obligated to hear the lecture series at least once, they may voluntarily participate in the seminar (5 credit points for both together). Other examples are the **advanced module** “Evolutionary Medicine” and weekly **journal/book clubs** organized, e.g., by the MGSE Junior Group Leader Francesco Catania.

During the first year of their studies, doctoral candidates should spend a minimum of two weeks and a maximum of six weeks in at least one lab of another discipline, which may or may not be part of the MGSE (**lab rotation**). The lab should however have strong affiliations with one of the involved groups. The lab rotation strengthens the interdisciplinary approach of the student and should facilitate the ability to learn new methods or perspectives on the studied subjects. In addition, the lab rotation exposes the doctoral candidates to new research environments and may facilitate collaborations between labs.

5.2 Second phase: Science-skills Training

The second period is aimed at scientific communication skills and may, for example, include a **contribution to a conference** or the **publication of a first paper**. Many of the doctoral students may also include a **research stay abroad**, which is planned / co-organized together with a PI's institution.

The students may establish interdisciplinary **topic groups**, e.g. to deal with a specific methodological problem, to facilitate a specific synthesis, or to prepare a scientific event. Topic groups are supported by postdocs, PIs, or ETT fellows, independently chosen by the students. These temporarily existing working groups may be developed autonomously, together with the PIs, or at the suggestion of ETT fellows or MGSE guests. Topic Groups help to achieve one of the main goals of the school, to develop a culture of interdisciplinary discourse between the students, PIs, and ETT fellows. The scientific output of the Topic Groups should bear the potential to be published in scientific journals (e.g. review journals of the 'Trends' or 'Current Opinion' series). It is expected that the doctoral students integrate themselves into at least one Topic group in this phase.

5.3 Third phase: Tailored Education

The third period focuses on qualifications that is tailored to the individual students' career plans and is based on the student's own initiative. There are three main tracks within period three:

- 1) Doctoral students aiming at a career in academia (**academia track**) are supported in their endeavour to facilitate academic networking, contribute to further conferences, and publish papers. Furthermore, they can develop their teaching and leadership skills by mentoring and teaching graduate students, for example in the research groups of their supervisors or by conducting workshops in the WWU Graduate Centre. The students of this track are also trained in proposal writing by integrating them into appropriate application processes.
- 2) In contrast, a second option is provided for students who aim at an industrial or business career (**industry track**). These students are encouraged to apply for industry internships and participate in business management courses, for example in cooperation with the Career service of the WWU. Moreover, alumni and business representatives may be invited for presentations or a job fair.
- 3) The third option (**society track**) applies to students who neither aim at academia nor industry. This is the most diverse group, which contains e.g. prospective journalists, publicists, museum and zoo staff, employees in the field of clinical research or education, scientific writers, or administration officers in university and science management. Training for this group is based on internships and courses in the respective institutions. Students are encouraged to contact local non-university partners, e.g. the "LWL-Museum für Naturkunde Münster" (Museum for Natural History), in order to be involved in exhibitions and events on evolution-related topics, which also promotes public outreach. Students aiming at a career in the area of education are enabled to develop their teaching and leadership skills by mentoring and teaching graduate students, as described for the academia track.

For doctoral students of all three tracks the MGSE provides necessary skills for interdisciplinary work in science management and communication in close cooperation with the WWU Graduate

Centre, which offers a wide selection of soft skill and language courses. In the last phase of the doctoral studies, the students are supported by the Coordinator, a special consulting unit within the WWU Graduate Centre, and the WWU Career service regarding job applications or proposal writing. Beyond the career guidance and support the PhD-students receive, they are required to take the initiative and organize their third-year training program according to their own wishes and plans, thus increasing their independence.

6. Project-oriented Training

During the entire doctoral studies the students are fully integrated members of the research groups of their supervisors and take part in all scientific and social group activities. The doctoral students profit from the excellent research environment and the international network provided by the participating PIs and their groups. While being fully integrated into the network of the research labs and MGSE structure, doctoral students are able to exert autonomy and develop their leadership and administration abilities.

7. Credit point system

We use a clear and transparent credit point (CP) system to ensure that the doctoral students can easily oversee the activities that are required to graduate within the MGSE.

Through their participation in the **core courses** the students should earn at least **6 CP**. They are required to participate in each of the elements at least once.

Core courses		min.	max.
– Lecture series <i>Evolution across Fields</i>	1 CP per semester	1 CP	3 CP
– Lecture series <i>The Growth of the Evolutionary Thought</i>	1 CP per semester	1 CP	1 CP
– Participation in (and organization of) the annual MGSE symposium	2 CP per year	2 CP	6 CP
– Student Meetings	1 CP per year	2 CP	3 CP

At least **9 CP** should be earned within the **three-phase education program** by accomplishing freely chosen activities from the respective education program.

Three-phase education programme		min.	max.
(1) Cross-disciplinary training			
– Courses from Master programs (4 weeks advanced modules)	5 CP each	3 CP	5 CP
– Lab rotation (2 weeks)	3 CP each		9 CP

– Journal & book clubs (1 SWS)	1 CP each		3 CP
– Workshops (2 days; in a field of relevance to the MGSE)	1 CP each		3 CP

(2) Science-skills training

– Topic group work (1 SWS)	1 CP each	3 CP	3 CP
– Contribution to conference	1 CP each		3 CP
– Paper publishing	2 CP each		6 CP
– Research stay abroad (4 weeks)	5 CP each		5 CP

(3) Tailored education

– Internship (4 weeks)	5 CP each	3 CP	5 CP
– Soft skill and language courses	0.5 – 2 CP each		6 CP
– Mentoring bachelor/master students (research module, bachelor thesis, master thesis)	0.5 – 2 CP each		6 CP

In some of the faculties involved in the MGSE, teaching is required for graduation, e.g., in the Faculty of Biology 5 hours per week during one semester (=approximately 70 hours in total) of teaching in BSc- or MSc-courses (no research modules) have to be accomplished. To complete the MGSE doctoral program, doctoral students should earn at least **3 CP** for the engagement in **teaching activities** at some point during their doctoral studies. The amount of CP assigned should be designated and certified by the person supervising the teaching activity (e.g., course provider). For the MGSE (not necessarily for the Faculty of Biology) the following Teaching activities qualify for example:

Teaching activities		min.	max.
– Participation in the supervision of a 4-weeks-course, supervision of a weekly seminar during one semester or comparable involvement in basic or undergraduate teaching	1 - 5 CP each	3 CP	5 CP
– Holding a lecture in a course	0.5 CP each		3 CP
– Organizing a 2-day workshop for students	2 CP each		6 CP

To graduate within the MGSE, doctoral students are requested to earn at least **18 CP**:

- at least **6 CP** within the core courses,
- at least **9 CP** within three-phase education program,
- at least **3 CP** for teaching activities.

It is possible to balance the CP across the three years and to shift activities from one phase to another, to allow a flexible PhD project structure. In case of doubt the MGSE Speaker and the MGSE

Coordinator decide which activities qualify for the acquisition of CP and how many CP will be assigned. Calculations are based on the total workload required to successfully complete a course with 1 CP corresponding to 30 h workload.

The MGSE Coordinator lists the acquired CP of each graduate student in a database, which is also be accessible for the respective student. By supervising the students' achievements, the MGSE Coordinator makes sure that each candidate fulfils all necessary requirements to graduate within the MGSE. If necessary, the MGSE Coordinator offers advice and help in finding adequate opportunities to achieve the CP, as well as in organisational and administrative matters related to the doctoral thesis.

The intensive supervision provided by the dissertation committee and the MGSE Coordinator is outbalanced by the explicit encouragement of independence. Doctoral students are enabled to work on their research projects self-dependently and to shape the teaching program according to their own affinities and intentions, especially during the third year of the thesis.