

# The MTS/EMT PhD Program

The MTS/EMT PhD Program is guided by the following **8 fundamental recommendations** shown in Table 1 (following the Salzburg II recommendations,<sup>1</sup> the LERU guidelines for PhD education,<sup>2</sup> good practice,<sup>3</sup> the standards of ORPHEUS<sup>4</sup> and Keller et al. 2018<sup>5</sup>)

**Table 1. Eight fundamental recommendations**

1 The main goal of a PhD is to conduct experimental research in a research-intensive and supportive environment. Research must be individual and original.
2 Each PhD student should be supervised by Tutor(s).
3 The PhD program should have flexible structures for personal and professional development. It should include the provision of at least 5 ECTS/Credits a year of dedicated training, mainly in basic concepts in biomedicine (basic, translational and clinical), transferable skills, as well as scientific conduct and research ethics.
4 PhD students should have a student program portfolio consisting on programs tailored to their needs.
5 Diversity and internationalization should be taken into account in the program, including, but not limited to, opportunities for travel or hiring various people from different countries.
6 Funding should be guaranteed for a 4 year PhD.
7 Opportunities for quality control of the PhD program and qualified assessment of the PhD project, such as peer review, should be guaranteed.
8 Inter-disciplinary and inter-sectorial offerings help PhD students to drive their own professional development, and give them the opportunity to try out ideas. It also allows them to look into a wide range of possible career opportunities.

## Interdisciplinary competencies as defined by the MTS/EMT PhD Program

The PhD students obtain **3 sets of interdisciplinary competencies** during their PhD training (Table 2):

- 1. Knowledge and scientific competencies:** research methods, information literacy, scientific writing, professional conduct, ethics and integrity, and awareness of interdisciplinary contexts.
- 2. Organization and management competencies:** project management, self-management, and teaching.
- 3. Leadership and personal competencies:** communication and leadership.

**Table 2. Interdisciplinary competency framework**

Interdisciplinary competency framework as defined by the PhD Program MTS/EMT.	
Competencies	Description
<b><i>Knowledge and scientific competencies</i></b>	
Research methods	<p><i>1. Posing the research question</i> Translational research (bench to controlled clinical setting to routine clinical practice and its use in the community) Levels: genome, cell, tissue, organ and apparatus, wellbeing, prevention, health care and care system, health service/profession, community, evidence based medicine.</p> <p><i>2. Study design</i> Basic research: experimental in vitro, ex vivo and in vivo studies. Cell and molecular biology, proteomic, and metabolomic and genomic approaches. Bench to bedside: experimental, intervention (drug, device, diagnostic test, behavior), non-experimental (cohort, case-control, cross-sectional) designs, causation, bias, confounding and interaction, sampling, qualitative researches Secondary studies: systematic reviews, health technology assessment</p> <p><i>3. Data collection methods and management</i> Use of raw and routine data, questionnaires, interviews, focus groups, online vs paper data collection forms (CRFs), phone applications Measurement (reliability, validity, scales and scores, diagnostic accuracy, health metrics)</p> <p><i>4. Data analysis</i></p>

	Descriptive and inferential statistics (e.g., t-test, ANOVA, multiple comparison tests, effect measures in general, random error, multivariable regression modeling, meta-analysis)
<b>Information literacy</b>	1. Electronic databases (e.g., MEDLINE, PubMed, EMBASE, Cochrane library) Search strategies Management of references (software) 2. Critical appraisal; selection of relevant information
<b>Scientific writing</b>	1. Grant proposal (selecting a “selling strategy”) 2. Manuscript for publication (following guidelines) 3. Study protocol (detailed methods, SOPs)
<b>Professional conduct, ethics, and integrity</b>	1. Consideration of autonomy and safety of study participants, informed consent, vulnerable populations 2. Seeking approval from ethics Committees 3. Responsibilities toward stakeholders, scientific community, and society (publication, authorship, plagiarism)
<b>Awareness of interdisciplinary context</b>	1. Philosophy and History of science 2. Knowledge of other subjects
<b>Organization and management competencies</b>	
<b>Project management</b>	1. Planning and structuring of research 2. Organization of infrastructure and logistics 3. Quality assurance
<b>Self-management</b>	1. Career planning (inside/outside of academia) 2. Systematic building of knowledge base 3. Personal qualities: enthusiasm, self-confidence, and self-reflection 4. Work–life balance, time management
<b>Teaching</b>	1. Knowledge transfer
<b>Leadership and personal competencies</b>	
<b>Communication skills</b>	1. Communication with team/assistants, peers, supervisors, stakeholders, students 2. Presentations to scientific and public audiences 3. Conflict and change management
<b>Leadership</b>	1. Development and formulation of own ideas 2. Ability to take risks 3. Accepting responsibility
Abbreviations: CRF, Conditional Random Field; SOP, Standard Operating Procedure.	

(Modified from Salzburg II recommendations,<sup>1</sup> the LERU guidelines for PhD education,<sup>2</sup> good practice,<sup>3</sup> the standards of ORPHEUS<sup>4</sup> and Keller et al. 2018<sup>5</sup>)

The MTS/EMT competency framework (Table 2) outlines the competencies to be acquired by each student for completion of a biomedical sciences PhD and to be a qualified researcher. In addition to assessing existing and lacking skills and competencies, it guides students and supervisors regarding individual training needs. It helps to anticipate and adjust for the large variability in new students’ methodological and statistical skills. To ensure up-to-date information and meet evolving needs, this framework is continually reviewed and adapted.

All PhD students have to submit a **Learning Agreement** together with a **Research Proposal** of their PhD project after the admission at the MTS/EMT of the University of Torino. The Learning Agreement sets out the program of the studies and the traineeship to be followed. It includes the student plan for research activities ranging from 46 to 55 ECTS/Credits for year. It also includes student plan for educational non-research activities ranging from 5 to 14 ECTS/Credits for year. The four years ECTS equivalents for research activities range from 208 to 213 and for non-research activities range from 27 to 32 ECTS/Credits (*see below, Syllabus and Educational activities*). At end of PhD program, each student must acquire a total of 240 ECTS/Credits (60 ECTS/Credits for year).

The Coordinator/Steering Committee provides approval or feedback on the **Learning Agreement**. The yearly **Progress Reports** are evaluated by nominated ad hoc commissions, including a qualified visiting scientist, and are approved by the Doctorate board.

## MTS/EMT building blocks

The MTS/EMT consists of several building blocks (see Figure 1), chosen both to reflect the principles of doctoral education and to optimize students' professional development in view of the above reported 3 sets of competencies (Table 2).

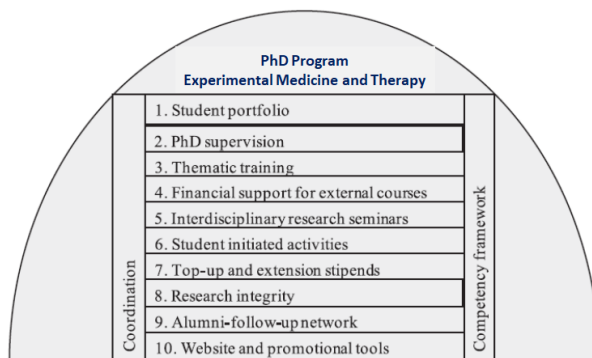


Figure 1. The MTS/EMT and its 10 building blocks (Modified from Keller et al. 2018<sup>5</sup>).

### 1. Student portfolio.

The individual PhD track is reported in the personal **student portfolio** comprising information on *course work* as well as the *PhD project's aims and results* and *timetable* (totaling 240 ECTS or Credits, 60 Credits for year [1 ECTS/Credit requires 25 hours of work], *see Syllabus*). Each portfolio also contains an overview of the student's plans regarding:

- a. attendance of workshops, seminars and courses (13-18 ECTS)
- b. attendance of national and international conferences (7-14 ECTS),
- c. teaching activities (0-2 ECTS)
- d. research and publications (208-213 ECTS).

*The ECTS for each year must respect the maximum established in the Syllabus.*

The student portfolio is individualized and tailored to the students' needs of statistical and other methodological skills as well as competencies specifically required for the proposed PhD studies (see also Interdisciplinary competencies as defined by the MTS/EMT). Throughout the PhD program, the portfolio not only provides structure and orientation, but also may be used as a tool to assess student and research progress. Based on its content, each student is required to write an *annual self-assessment for discussion* (see *Educational activities*) with her/his PhD Tutor/Committee and for submission to the Doctorate Board of the MTS/EMT. At end of the PhD program the PhD student reports its research in a **cumulative dissertation (Thesis)** based on submitted or published paper(s). Publications should be peer-reviewed and preferably in high ranking journal/top ranking category.

### 2. PhD supervision.

In line with University of Torino rules, each PhD student is supervised by specifically chosen PhD Tutor(s).

Tutor(s) meets the PhD student at least once monthly to discuss the student's self-assessment.

During the annual **MTS/EMT Progress Report** (usually in September) the MTS/EMT Board meets representative PhD students to discuss about problems in the supervision of a PhD student and promote the quality of supervisory skills.

### 3. Thematic training.

A wide range of professional development courses is provided (see *Educational activities*).

The educational activities offered to the PhD student aim helping student to be a **qualified researcher**. Because the wide range of knowledge and skills of students entering the PhD program, training is available from basic to advanced levels. The **core content of MTS/EMT** training includes all biomedical sciences specialties employing comparable methodological approaches. Specifically, the main purpose of the PhD Program in

**MTS/EMT** is to provide the proper cultural, technological and operative upgrading to young students graduated in biomedical disciplines (e.g. Medicine and Surgery, Pharmacy, Pharmaceutical Chemistry and Technology, Biotechnologies, Dentistry, Biological Sciences) necessary for their formation as researchers qualified in the following fields:

- Molecular Pathology
- Experimental and Clinical Oncology
- Pathophysiology and Physiology of the Cardiovascular System
- Metabolic Pathophysiology
- Pathophysiology of the Odontostomatological System
- Experimental Pharmacology and Therapy

To achieve the given targets and to characterize and suitably integrate the scientific research activity promoted by the PhD program, the strategy adopted is to support:

- topics of common interest for all the involved scientific areas;
- knowledge and practice of advanced and complex technologies;
- individual and group addressing to the prominent topics of the scientific area in which the PhD School teachers and tutors work, and to the relative professional perspectives.

Therefore, the **MTS/EMT** and the other educational infrastructures selected by the Steering Committee (see *Educational activities*) offer biomedical-specific courses, as for example:

1. "Proposal Writing in Biomedical Sciences",
2. "Good Scientific Conduct and Relevant Ethical Issues in Sciences",
3. "Academic Writing in Biomedical Sciences",
4. "Essentials in Biomedical Research Methodology",
5. "Peer reviewing and journal editing for researchers in Biomedical sciences",
6. "How to prepare a job application inside or outside of academia."
7. "Statistic for Biomedical Sciences",
8. "Conflict and change management",
9. "Pathophysiology mechanisms of acute and chronic diseases"

The latter includes inflammation and progression of disease processes; oxidative stress and inflammation; normal and pathological cell signals involved in cell function, proliferation and death; experimental models of protection against multiphasic disease processes promoted by inflammation, infections, toxic and degenerative adverse reactions, altered hormonal responses (tumors, atherosclerosis, myocardial damage, diabetes, Parkinson's and Alzheimer's diseases); "molecular signaling" pharmacology and therapy directed to the treatment of solid and hemolymphopoietic tumors, cardiovascular and metabolic diseases, degenerative diseases (in connection with pharmaceutical industries).

The Steering Committee proposes each year the sequence of courses.

For all the courses, *Learning Objectives* are defined which reflect the competencies framework of MTS/EMT. At the end of each course, students have to take an examination (mandatory) to evaluate if PhD students reached the Learning Objectives and, hence, acquired the necessary competencies and Credits.

#### **4. Financial support for course participation.**

PhD students have the possibility to go to other universities and research institutes. Financial support to attend external (including online) courses and meetings that complement their PhD education are also available; specifically, each student receives as budget for research 10% annual PhD cost per year (starting from the II year) as financial support to participate at courses not offered at the University of Torino. To be eligible, courses and meetings must be approved by the Tutor, be linked to the student's portfolio, and cover competencies essential to the student's PhD studies. ECTS credits are recognized for each of these documented activities (see Syllabus).

## **5. Interdisciplinary research seminars.**

MTS/EMT promotes and encourages interdisciplinary research seminars to foster networking and stimulate the exchange of diverse scientific perspectives and approaches. MTS/EMT believes the interdisciplinary research seminars contribute to a creative and productive research environment. In this regard, MTS/EMT seeks information to be published on its website and to inform PhD students about interesting interdisciplinary seminars and meetings held at the University of Torino and worldwide. In addition to their direct educational value, these meetings and seminars promote professional communication skills among peers and allows students to share experiences and to network.

## **6. Student initiated activities.**

MTS/EMT encourages and supports *bottom-up initiatives*, also called student-initiated activities. Indeed, *“the ability to drive initiatives is part of a doctoral candidate’s process of becoming an independent researcher”*. These initiatives must be discussed with Tutor(s). To foster these educational moments, the annual *MTS/EMT Progress Report* and *Former PhD student meeting* are organized with the active support of students, which closely collaborate with Tutors to improve the internationality of these meetings. This encourages the participants to initiate activities autonomously, build transferable skills, and develop independent management skills.

## **7. Top-up and extension stipends.**

To allow PhD students the opportunity to deepen their research experience, extension of stipends is available. Salary integration (+50%) is available for “financed scholarship PhD students” to go aboard for research purpose. Top-up additional grants and financial support for unplanned and newly created projects during the PhD course are possible under the rules of the University of Torino.

## **8. Research integrity.**

Given the MTS/EMT program’s interdisciplinary approach, best scientific conduct practices across all the participating disciplines are soon provided. Students are made aware of the University of Torino’s Code for Good Practice in Research. “Good Scientific Conduct and Relevant Ethical Issues in Sciences”, course is offered by the PhD school.

## **9. Alumni follow-up network.**

Former PhD student networks help PhD students and the MTS/EMT with career orientation information and feedback regarding the program’s quality. Regular meetings and contacts with former PhD students may expand the MTS/EMT network and may facilitate continuous assessment of its career development support.

## **10. Website and other promotional tools.**

An interactive website is implemented by MTS/EMT (<https://dott-mts.campusnet.unito.it/do/home.pl>) for PhD profile-raising/job placement, networking, and dissemination purposes. Offering a group identity in an interdisciplinary framework, the Website includes links to the University and social media, where current events are regularly posted. In addition, MTS/EMT activities include welcome events for all new PhD students during their first year, a Doctoral day (D-day), and annual MTS/EMT Progress Report updates *via* faculty meetings, contacts with Former students all of which raise MTS/EMT awareness among PhD members and their supervisors. Links and dates are also available in a e-learning platform (Moodle) where student feedbacks are also collected after activities *via* a short questionnaire, and observations are constantly integrated for quality control and improvement by Steering Committee.

## **References**

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3. Bogle D. Good Practice Elements in Doctoral Training. Brussels, Belgium: LERU; 2014.
4. ORPHEUS/AMSE/WFME Task Force. Standards for PhD Education in Biomedicine and Health Sciences in Europe. Aarhus, Denmark: ORPHEUS; 2012.
5. Keller F, Dhaini S, Briel M, Henrichs S, Höchsmann C, Kalbermatten D, Künzli N, Mollet A, Puelacher C, Schmidt-Trucksäss A, von Niederhäusern B, De Geest S. How to Conceptualize and Implement a PhD Program in Health Sciences-The Basel Approach. *J Med Educ Curric Dev.* 2018 Apr 24;5:1-8.