



**UNIVERSITÀ
DI SIENA
1240**

**DIPARTIMENTO DI
MEDICINA MOLECOLARE
E DELLO SVILUPPO
— DMMS**

**Università degli Studi di Siena
Dottorato di Ricerca in Medicina Molecolare**

PhD Student Annual Report Form

Florence, 1st October 2025

To the Academic Board of the PhD Program in Molecular Medicine

Dr. Balzano Mariano

cycle XXXIX° tutor Prof. Marco Linari

Scientific activity carried out during the 2nd year of the PhD program, Academic Year **2024/2025**

In striated muscle, regulation of contraction is operated by both thin, actin containing and thick, myosin containing filaments. In the thin filament, Ca^{2+} induces structural changes of regulatory proteins that release the actin sites for binding the myosin motors. In the thick filament, a mechanosensing-based mechanism, not yet fully characterised, switches ON the myosin motors from the OFF state, in which they lie folded back on the surface of the thick filament. The role of the cytoskeletal protein titin in thick filament mechanosensing at physiological sarcomere length (SL) has been demonstrated in active frog muscle fibres in which the masking action of myosin motors was pharmacologically eliminated. Upon activation I-band titin stiffness increases by two orders of magnitude (Squarci et al. PNAS 120:e2219346120, 2023). Under this condition any mechanical perturbation applied at the sarcomere extremity is efficiently transmitted through the I-band titin to the A-band titin, enabling titin to switch ON motors.

The second year of my PhD course was spent to investigate the Ca^{2+} -dependence of the increase in I-band titin stiffness in skinned muscle fibres of rabbit. For this I tested if specific myosin motor inhibitors maintain the thick filament switched OFF at the European Synchrotron ESRF (Grenoble, France). X-ray patterns were acquired in relaxing (pCa 9.0) and activating (pCa 4.5) solutions from fibres of fast (psoas) and slow (soleus) muscles of rabbit. X-ray signals marking the OFF state of the thick filament (intensity of the first myosin layer line, intensity and fine structure of the third order myosin meridional reflection and spacing of the sixth order myosin meridional reflection) were analysed. Results show that at pCa 4.5 in fast fibres the motors are fully switched OFF in the presence of p-Nitroblebbistatin (PNB 50 μM), as at pCa 9.0 in control. In slow fibres Mavacamten (100 μM), in addition to PNB (40 μM), is necessary to fully switch OFF the motors.



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- Teaching activity

TOTAL ECTS credits earned for attendance of frontal teaching activities:18

1. Pisa, DAY 1, Tuesday, 8th April 2025 Room C1, Polo San Rossore, via Risorgimento, 19
ECTS: 3 ECTS
2. Pisa, DAY 2, Thursday, 10th April 2025 Room D1, Polo San Rossore, via Risorgimento, 19
ECTS: 3 ECTS
3. Firenze, Day 1, Friday, 11th April 2025 Aula ex biblioteca, Dipartimento Neurofarba, viale Pieraccini 6, primo piano ala est del Cubo (zona Careggi)
ECTS: 3 ECTS
4. Siena, Day 1, Tuesday, 10th June 2025 Aula 14, Polo Scientifico San Miniato, Via Aldo Moro,2, Siena
ECTS: 3 ECTS
5. Firenze, Day 2, Friday, 20th June 2025 Aula magna della ex Presidenza Facoltà di Medicina, Padiglione 6, Careggi, Largo Brambilla 3.
ECTS: 3 ECTS
6. Siena, Day 2, Tuesday, 10th October 2025 Aula 18, Polo Scientifico San Miniato, Via Aldo Moro,2, Siena
ECTS:3

- Seminars

- | | |
|---|--|
| 1. Date: 29 ottobre 2024:
Title: Mimiking the ventricular pressure-volume Relationship ex vivo with cardiac slices. h 16:00-17:00.
Organiser: info@bigmarker.com
InsideScientific
Form: online
ECTS: 0.5 | Organizzato da: AULA B Scienze Fisiologiche, UNIFI.
Speaker: Neil Kad, Professor of Molecular Biophysics, Director of Research and Director of Innovation, Division of Natural Sciences, University of Kent.
Form: in-person
ECTS:1 |
| 2. Date: 11/11/2024
Title: Exploring DNA repair to search for antibiotics and single molecule imaging to quantify the cardiac muscle". | 3. Date: 08/01/2025
Speaker: Sizun Jiang, PhD, Assistant Professor of Medicine, Harvard Medical School |



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- Title: Spatial Omics to Interrogate Host-Disease Interactions
Organiser: Akoya Biosciences
Form: online
ECTS: 0.5
4. Date: 22/01/2025
Speaker: Arutha Kulasinghe, PhD.
Associate Professor, Frazer Institute,
University of Queensland
Title: Defining tumour heterogeneity,
one-cell-at-a-time
Organiser: Akoya Biosciences
Form: online
ECTS: 0.5
5. Date: 05/02/2025
Speaker: Marsha Rosner, PhD. Charles B.
Huggins Distinguished Service Professor
Ben May Department for Cancer
Research-University of Chicago
Title: Challenges and Opportunities for
Treatment of Metastatic Breast Cancer
Organiser: Inside Scientific – a
scientist.com company
Form: online
ECTS: 0.5
6. Date: 19/02/2025
Speaker: JoAnn V. Pinkerton, MD
Professor Obstetrics and Gynecology-The
University of Virginia
Title: Challenges and Opportunities for
Treatment of Metastatic Breast Cancer
Organiser: Inside Scientific – a
scientist.com company
Form (in-person/online): online
ECTS: 0.5
7. Date: 26/02/2025
Speaker: Teresa Milner, PhD-Professor
Neuroscience-Weill Cornell Medicine
Title: Hypertension and Hypothalamic
Changes in Menopause
- Organiser: Inside Scientific – a
scientist.com company
Form: online
ECTS: 0.5
8. Date: 10/03/2025
Speaker: Marc De Boissieu
Title: Introduction to the science at large
scale facilities: neutron, synchrotron and
XFEL sources
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
9. Date: 10/03/2025
Speaker: Claire Colin
Title: Refresher lecture on
crystallography. Real space (1/2)
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
10. Date: 11/03/2025
Speaker: David Attwood
Title: Introduction to Synchrotron
Radiation, coherence, and the evolution
to Free Electron Lasing
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
11. Date: 11/03/2025
Speaker: Andrew Harrison
Title: Introduction to interactions of X-
rays and neutrons with matter (1/2)
Organiser: ILL NEUTRONS FOR SOCIETY,
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Form: in-person
ECTS: 1
12. Date: 11/03/2025



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- Speaker: Andrew Harrison
Title: Introduction to interactions of X-rays and neutrons with matter (2/2)
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
- Speaker: Sakura Pascarelli
Title: Fundamentals of X-ray Absorption Fine Structure Spectroscopy
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
13. Date: 11/03/2025
Speaker: Heinz Graafsma
Title: Basics of X-ray detectors; How do they work and how are they characterised?
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
14. Date: 12/03/2025
Speaker: David Attwood
Title: X-ray optics and applications
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
15. Date: 12/03/2025
Speaker: Sakura Pascarelli
Title: XFELs and ultrafast applications
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
16. Date: 13/03/2025
Speaker: Sakura Pascarelli
Title: Introduction to X-ray Spectroscopies (XAS, XES, RXES)
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
17. Date: 13/03/2025
18. Date: 14/03/2025
Speaker: Andrew Wildes
Title: Neutrons: scattering and instrumentation (1/2)
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
19. Date: 14/03/2025
Speaker: Claire Colins
Title: Refresher lecture on crystallography. Reciprocal space (2/2)
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
20. Date: 14/03/2025
Speaker: Andrew Wildes
Title: Neutrons: scattering and instrumentation (2/2)
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
21. Date: 17/03/2025
Speaker: Alessandro Tengattini
Title: Introduction on Neutron and X-ray imaging
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1



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|---|--|
| <p>22. Date:17/03/2025
Speaker: Martin Muller
Title: Small angle scattering
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> | <p>Speaker: Allison BALLANDRASCOLAS
Title: Electron microscopy for structural
biology
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> |
| <p>23. Date:17/03/2025
Speaker: Victoria GARCIA SAKAI
Title: Neutron Spectroscopy as a Tool to
Understand Dynamics in Soft Matter
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> | <p>28. Date:18/03/2025
Speaker: Peter MÜLLERBUSCHBAUM
Title: GISAXS/ GISANS for polymers and
soft matter
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> |
| <p>24. Date:17/03/2025
Speaker: Elke DE ZITTER
Title: Protein crystallography
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> | <p>29. Date:19/03/2025
Speaker: Giorgio SCHIRÒ
Title: Structural dynamics by time
resolved X-ray solution scattering
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> |
| <p>25. Date:18/03/2025
Speaker: Monika Spano
Title: Crystallization of biological
macromolecules
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> | <p>30. Date:19/03/2025
Speaker: Serena DE BEER
Title: X-ray spectroscopy
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> |
| <p>26. Date:18/03/2025
Speaker: Yuri GERELLI
Title: X-ray and neutron reflectometry in
biophysics
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1</p> | <p>31. Date:19/03/2025
Speaker: Frank GABEL
Title: Biological small angle neutron
scattering
Organiser: ILL NEUTRONS FOR SOCIETY,
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Form: in-person
ECTS: 1</p> |
| <p>27. Date:18/03/2025</p> | <p>32. Date:24/03/2025</p> |



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- Speaker: Anders MADSEN
Title: Coherent X-rays for colloidal matter
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
33. Date:24/03/2025
Speaker: Thomas BAREND
Title: Serial (femtosecond)
crystallography
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
34. Date:24/03/2025
Speaker: Sean LANGRIDGE
Title: Science at neutron spallation
sources: exploiting accelerator-based
facilities
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
35. Date:27/03/2025
Speaker: Matthew BLAKELEY
Title: Neutron macromolecular
crystallography
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
36. Date:27/03/2025
Speaker: Claude SAUTER
Title: Introduction to current trends and
challenges of molecular and structural
biology
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
37. Date:28/03/2025
Speaker: Peter CLOETENS
Title: Full-field Coherent Imaging
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
38. Date:28/03/2025
Speaker: Peter CLOETENS and Markus
APPEL
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Title: Neutron spin-echo and Neutron
backscattering
Form: in-person
ECTS: 1
39. Date: 08/04/2025
Speaker: Martin BLACKLEDGE
Title: Nuclear Magnetic Resonance
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
40. Date:10/04/2025
Speaker: Giuseppe Zaccai
Title: Protein Dynamics by Neutron
Scattering and Dynamics of
Macromolecules
Organiser: ILL NEUTRONS FOR SOCIETY,
GRENOBLE
Form: in-person
ECTS: 1
41. Date: 09/04/2025
Speaker: Linus PITHAN
Title: Machine and deep learning to Date
analysis
Organiser: ILL NEUTRONS FOR SOCIETY,
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Form: in-person in-person



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- ECTS: 1
42. Date:09/04/2025
Speaker: Vincent FAVRE-NICOLIN
Title: Data science: from big & open Data to cloud computing
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
43. Date:09/04/2025
Speaker: Chris JACOBSEN
Title: Coherent diffraction imaging and ptychography for soft condensed matter and biology
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
44. Date:09/04/2025
Speaker: Dominique BOURGEOIS
Title: Super-resolution microscopy: a revolution in biological imaging
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
45. Date:10/04/2025
Speaker: Martin WEIK
Title: Radiation damage in protein crystallography
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
46. Date:10/04/2025
Speaker: Giuliana TROMBA
Title: Biomedical imaging with Synchrotron Radiation
- Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
47. Date:11/04/2025
Speaker: Frank GABEL
Title: Biomolecular deuteration for neutron scattering
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
48. Date:11/04/2025
Speaker: Jürgen ALLGAIER
Title: Deuteration for soft matter and chemistry
Organiser: ILL NEUTRONS FOR SOCIETY, GRENOBLE
Form: in-person
ECTS: 1
49. Date 25/09/2025
Speaker: Andrey Tsaturyan
Title: Bridging cryo_EM with X-ray diffraction in striated muscle through direct modelling
Organiser: Università di Firenze
Form: in-person:
ECTS:1
50. Date 29/09/2025
Speaker: Andrey Tsaturyan
Title: Mechanisms of tension propagation across plasma membrane
Organiser: Università di Firenze
Form: in-person
ECTS:1



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ECTS credits earned for this activity: 48

• **Soft Skills**

1. Date: 14/10/2024 h 14:30-16:30
21/10/2024 h 14:30-16:30
28/10/2024 h 14:30-16:30
Speaker: dott.ssa Jessica Thonn
Title: Formazione per dottorandi 2024: La comunicazione scientifica
Organiser: CLA UNIFI
ECTS: 1
2. Date: 22/01/2025 dalle ore 9:15 alle 17:00
Speaker: Dott.ssa Chiara Bisori
Title: CORSO DI FORMAZIONE PARTE PRATICA SULL'UTILIZZO DI RATTI NELLA SPERIMENTAZIONE ANIMALE
Organiser: Università degli Studi di Firenze
Form: Presso la sede di: CESAL – Dipartimento di Neurofarba – Università degli Studi di Firenze
ECTS: 1.5
3. Date: 20/02/2025
Speaker: Annalisa Michetti, Daniele Pasquinucci, Alessandro Giordani
Title: Lezione 1- La nuova Commissione europea: priorità e obiettivi strategici
Organiser: Lezioni d'Europa 2025-FormezPA
Form: online
ECTS: 0.37
4. Date: 27/02/2025
Speaker: Anna Claudia Abis, Maurizio Sabatini, Francesco Leone
Title: Lezione 2 - Al servizio del cittadino europeo: l'UE e la modernizzazione della Pubblica amministrazione
5. Date: 13 marzo 2025
Speaker: Paola Riavelli
Title: Aprirsi al nuovo, senza timore. La strategia dell'UE per l'intelligenza artificiale
Organiser: Lezioni d'Europa, Euope direct Siena
Form: online
ECTS: 0.37
6. Date: 20 marzo 2025
Speaker: Elisabetta Lucertini
Title: Siamo ciò che mangiamo". La politica agricola comune: che cos'è e a cosa serve
Organiser: Lezioni d'Europa, Euope direct Siena
Form: online
ECTS: 0.37
7. Date: 27 marzo 2025
Speaker: Franco Cafarelli
Title: L'Unione europea e la "resilienza idrica"
Organiser: Lezioni d'Europa, Euope direct Siena
Form: online
ECTS: 0.37
8. Date: 03 aprile 2025
Speaker: Paola Riavelli
Title: L'Unione europea e la sua difesa: lo stato dell'arte, gli obiettivi



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- Organiser: Lezioni d'Europa, Euope direct
Siena
Form: online
ECTS: 0.37
9. Date: 10 aprile 2025
Speaker: Matteo Marcaccio
Title: I nostri vicini. L'Unione europea, il Mediterraneo e le ex repubbliche sovietiche
Organiser: Lezioni d'Europa, Euope direct
Siena
Form: online
ECTS: 0.37
10. Date: 25 marzo, 1, 8, 15 aprile 2025 / 11:00-13:00
Speaker: Prof. Franco Bagnoli
Title: MODELLIZZAZIONE AD AGENTI NETLOGO
Organiser: UNIVERSITA' DI FIRENZE
Form: online
ECTS: 1.5
11. Date: 19/05/2025
Title: Corso APRE-UNIFI =Le opportunità di finanziamento nel settore Salute:CL1 Mission Cancer, European Partnership
Organiser: UNIFI e APRE
Form (in-person/online): online
ECTS: 0.5
12. Date: 21/05/2025
Speaker: Benedetta Calonaci
Title: OPEN SCIENCE, OPEN ACCESS, OPEN EDUCATION
Organiser: UNIFI
Form (in-person/online): online
ECTS: 0.5
13. Date: 23/05/2025
Title: Rischi naturali: conoscere, prevenire, difendersi
Organiser: UNIFI
Form (in-person/online): online
ECTS: 0.5

ECTS credits earned for this activity: 8.1

- Conference participation:

1. Conference: PhD-Day Pisa
Date and place: **10/02/2025, ore 11:00 Pisa (Italy)**
Session: **Poster session**
Title: Passive and active mechanical properties of titin studied in fast skinned muscle fibres of rabbit upon inhibition of myosin motors.
M. Balzano, C. Squarci, M. Caremani, P. Bianco, M. Reconditi, A.I. Horváth, A. Málnási-Csizmadia, V. Lombardi, G. Piazzesi, M. Linari.
ECTS: 1
2. Conference: Hercules European school - EUROPEAN SYNCHROTRON RADIATION FACILITY (ESRF)
Date and place: **19/03/2025 GRENOBLE (France)**
Session: **Poster session**
Title: Passive and active mechanical properties of titin studied in fast skinned muscle fibres of rabbit upon inhibition of myosin motors.
M. Balzano, C. Squarci, M. Caremani, P. Bianco, M. Reconditi, A.I. Horváth, A.



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Málnási-Csizmadia, V. Lombardi, G. Piazzesi, M. Linari.

ECTS: 1

3. Conference: Hercules European school - ALBA Synchrotron-Barcellona, Spain
Date and place: **04/04/2025, ore 11:00 / ALBA Synchrotron, Barcellona (Spain)**
Session: **Poster session**

Title: Passive and active mechanical properties of titin studied in fast skinned muscle fibres of rabbit upon inhibition of myosin motors.

M. Balzano, C. Squarci, M. Caremani, P. Bianco, M. Reconditi, A.I. Horváth, A.

Málnási-Csizmadia, V. Lombardi, G. Piazzesi, M. Linari.

Date and place: **04/04/2025 ore 12:20 / ALBA Synchrotron, Barcellona (Spain)**

Session: **Oral session**

Title: Passive and active mechanical properties of titin studied in fast skinned muscle fibres of rabbit upon inhibition of myosin motors.

M. Balzano, C. Squarci, M. Caremani, P. Bianco, M. Reconditi, A.I. Horváth, A.

Málnási-Csizmadia, V. Lombardi, G. Piazzesi, M. Linari.

ECTS: 1

ECTS credits earned for this activity: 3

- Any stays in other Italian or foreign laboratories

1. March 2-9, 2025 (visit LS-3489)

European Synchrotron (ESRF) (Grenoble, France)

71 avenue des Martyrs, 38000

Grenoble, France (<http://www.esrf.fr>).

2. March 9, 2025 to April 13, 2025:
Hercules European School (<https://hercules-school.eu/>).

European Synchrotron (ESRF)

71 avenue des Martyrs, 38000

Grenoble, France (<http://www.esrf.fr>).

Institut Laue-Langevin (Grenoble, France)

71 avenue des Martyrs, 38000

Grenoble, France (<https://www.ill.eu/>).

ALBA Synchrotron

Carrer de la Llum, 2, 26, 08290 Cerdanyola del Vallès, Barcelona, Spagna

Dipartimento di Medicina Molecolare e dello Sviluppo

Via A. Moro, 2 – 53100 Siena (Italia)

Tel. +39 0577/235466/235780/233104/233105 – <http://www.unisi.it>

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Barcelona, Spain (<https://www.cells.es/en>).

3. October 5-14, 2025 (visit LS-3466)

European Synchrotron (ESRF) (Grenoble, France)

71 avenue des Martyrs, 38000

Grenoble, France (<http://www.esrf.fr>).

Summary Table of ECTS Credits – First Year

Teaching	Seminars Webinars	Soft Skills	Congress	PhD Day/Graduation Day	TOTAL I YEAR
12 ECTS	6 ECTS	5 ECTS	1 ECTS	2 ECTS	26 ECTS + Research 35 ECTS = 61 ECTS

Summary Table of ECTS Credits – Second Year (leave blank if referring to the first year)

Teaching	Seminars Webinars	Soft Skills	Congress	PhD Day PhD Day/Graduation Day	TOTAL II YEAR
18 ECTS	48 ECTS	8.1 ECTS	2 ECTS	1 ECTS	77.1 ECTS + Research 35 ECTS = 112.1 ECTS