



# UNIVERSITÀ DEGLI STUDI DI PALERMO

## Characteristics



## Educational objectives

The 2nd cycle Degree Course in “Neuroscience” fits in the process of innovation and rationalisation of the educational offer of the University of Palermo, aiming at improving the knowledge, competitiveness and professional opportunities of 1st cycle graduates in Biology and Biotechnologies.

The new course is based upon the excellent and interdisciplinary competences existing in our University, the characteristics of the local and national biotechnological industry and the innovative thrusts of bio-economics.

The course trains experts in Neuroscience and Neurobiology, who can furtherly refine their competences through PhD courses and Master degrees.

Graduates of the Degree Course in Neuroscience may access to management positions in the research and development branches of private and public Hospitals, Pharmaceutical and Biotechnological Industry, companies and innovative Start-Up companies for the creation of new neurological and psychotropic drugs, new bioengineering technologies for the management, diagnosis and innovative care of central and peripheral nervous system diseases and of mental illness. They may access in management position of public and private companies dealing with biological Databases, Big Data and creation of software and apps for the management and early diagnosis of central and peripheral nervous system diseases.

The natural work position of graduates in “Neuroscience” is envisaged, therefore, in academic or industrial research, advanced diagnosis, patient’s management and analysis of clinical and biological data in the field of Neuroscience. Other professional opportunities may be found in the neuro-pharmaceutical and neuro-biotechnological industry, currently expanding, as well as in companies producing medical diagnostic, neuro-rehabilitation devices and neuro-prostheses.

The Course is designed in a way to provide adequate and balanced training in core subjects (48 credits) as well as in clinical fields, with respect, in particular, to the fields of Biochemistry, Anatomy and Physiology, with advanced study of the structural, morphological and functional aspects of the central and peripheral nervous system, including its cellular and molecular aspects; these teachings are preparatory to a correct framing of pathological processes, as well as of the relevant diagnostic-instrumental path and pharmacological therapy.

These educational contents are provided in the teachings of Neuropathology, Neuropharmacology and Advanced clinics and diagnostics.

The course also gives space to the study of Information Processing in Neuroscience, which is strategic for the modern computational approach to Neuroscience.

The educational programme consists of mandatory courses, (the attendance of which is certified by individual teachers), elective courses and laboratory practice.

To meet the needs of foreign students, working students, disabled students and students with small children, frontal teaching will be also available in distance learning (mixed mode). No student may attend more than two thirds of the educational programme in distance mode. The course will try to agree the timing of laboratory activities with each individual students, taking into account his/her personal needs, and the place of these activity will be defined through national and international agreements.

The Degree course in Neuroscience aims at training 2nd cycle graduates possessing:

- Sound basic cellular and molecular knowledge of Neuroscience, under an interdisciplinary point of view.
- Advanced scientific knowledge and ability to apply it, consistently with the regulations and deontological and bioethical issues, to various neuroscience areas and, namely: in the hospital, pharmaceutical and industrial sectors, (also veterinary), as well as in the field of scientific communication, patenting and defence of intellectual property, fund raising and management.

The course is fully taught in English, and the international character of the educational programme is enhanced by the collaboration with the University of Rzeszow, available to host 2nd year students who must carry out laboratory practice and possibly the final dissertation.

## Professional opportunities

Profile:

Manager in the research, development and diagnosis laboratories of public and private bodies.

Functions:

Upon passing the national qualification exam and enrolling in the professional register of Biologists, graduates may carry out

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the regulated profession of the biologist.

The Degree Course in Neuroscience trains experts in Neuroscience and Neurobiology, whose training shall be completed with postgraduate education.

Graduates of this Course, who complete their postgraduate training in PhD, Graduate School and Master courses, may access to all managerial professions (consistently with the admission calls of individual bodies) in the research and development branches of public and private Hospitals, in the pharmaceutical and biotechnological industry, in companies and innovative start-up companies aiming at the creation of new neurological drugs, as well as of new bioengineering technologies for the management, diagnostics and innovative care of the central and peripheral nervous system diseases.

Graduates in Neuroscience can autonomously carry out basic and applied research activities in the biochemical, molecular biological, genomic, biomedical, microbiological, and biotechnological fields with wide autonomy. Graduates of the class can also take on managerial roles with full responsibility for projects, premises, and staff.

Graduates in Neuroscience plan and manage experimental laboratory protocols in the fields of molecular and cellular biology, biochemistry and genetics of both animal and plant organisms.

In this context, they:

- design and produce cellular and animal models for understanding the molecular mechanisms underlying diseases.
- lead and coordinate professional and project activities in the sectors of industry, healthcare and public administration with respect, in particular, to biological, genetic molecular, immunochemical and microbiological analysis laboratories.
- draw up requests for financing from public and private institutions.
- summarize the results in scientific publications.
- can manage or contribute to the management of molecular and cellular biology laboratories.

Neuroscience graduates also organize scientific dissemination and technology transfer activities, and in particular:

- they are communicators, addressing the public to spread scientific culture and the perception of the importance of neuroscience in human activities.
- they are able to carry out promotion and development of scientific and technological innovation in the same areas.
- they participate in the promotion and development of technological and scientific innovation.

## SKILLS

To carry out their functions, 2nd cycle graduates in Neuroscience acquire:

- Knowledge of physiology, pharmacology and pathology with respect, in particular, to the nervous system and to the degenerative diseases of the central and peripheral nervous system.
- Knowledge of the main research methodologies used in the field of Neuroscience, at cell, organ and system level.

They will therefore possess the skills needed to carry out basic research and clinical experimentation activities, to use the latest generation of instruments for the study of the nervous system as a whole and of its cells, to coordinate a research group or a research laboratory. They will have acquired adequate skills to write and propose national and international research projects also in English, and the ability to relate to foreign institutions and agencies in the field of basic and applied research.

Professional opportunities:

Public and private research agencies, public and private hospitals.

## PROFILE:

Manager of the research and development branches in the pharmaceutical and diagnostic industry

Functions:

Graduates in Neuroscience may have managerial positions in the production of biotechnological drugs, in the quality control, development and application of diagnostic tests, in the production of engineered vectors and systems to produce drugs; in the screening of biotechnological drugs and products; in technical-scientific information, industrial marketing, data gathering for the preparation of health or patent regulations for the production of biotechnological products for Neuroscience, creation of biotechnological systems for pharmacological-toxicological studies in the field of neuroscience, biotechnological and chemical analyses and experiments, clinical monitoring of neurological drugs.

Skills:

The knowledge acquired during the course, about the drugs and pharmaceutical products used for the treatment of the diseases of central and peripheral nervous system, as well as the knowledge about the organisation and strategies of a biotechnological company, acquired through the internship at accredited companies, will enable graduates in Neuroscience to develop new molecules or new therapies - not necessarily of chemical nature - for the treatment of central and peripheral nervous system diseases.

Professional opportunities:

Chemical, pharmaceutical, Biotechnological companies, innovative Start-Up companies aiming at the production of new neurological drugs or for the treatment of the diseases of central and peripheral nervous system, including neurodegenerative diseases and the diseases stemming from enzyme accumulation and deficiencies.

Functions:

Graduates in Neuroscience in the field of research may participate, with their competences, to the production of personalised

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or standard neuro-prostheses for the treatment of neurological pathologies, to the screening of biotechnological products and drugs, to technical-scientific information, industrial marketing, data gathering for the preparation of health or patent regulations for the production of biotechnological products for Neuroscience, to the creation of technological systems for studies related to the Human-machine interface in the field of Neuroscience.

#### Skills

The knowledge acquired through tutored internships and workshops with companies and dissemination consortia for business creation will enable graduates in Neuroscience to actively participate in the creation and management of a technological company for the development of new bio-medical prototypes for the management of diseases of the central and peripheral nervous system (neuro-prostheses or medical devices).

#### Professional opportunities:

Private research agencies, companies and innovative start-up companies aiming at the production of prototypes and software for the treatment of central and peripheral nervous system diseases, neuro-prostheses and Human-machine interface devices.

#### PROFILE:

Manager in service centres, public and private agencies for the design and development of databases and new methodologies for the analysis of biological data.

#### Functions:

Graduates in Neuroscience may have a key role in public and private bodies in the design of biomedical research and in the development in the chemical, pharmaceutical and bio-engineering sectors through bio-bank analysis and biological data analysis.

#### Skills:

Students will acquire adequate computer skills, with enough space for the study of information processing in Neuroscience, Human-machine interfaces (HMI), including the Brain Computer Interface (BCI), key topics in the sector. Rehabilitation Engineering, of strategic importance for a modern computational approach to Neuroscience, will also be addressed. These skills will allow graduates in Neuroscience to participate in the development and construction of genomic, transcriptomic, proteomic and metabolomics databases, as well as in the development of new methods for querying and analysing biological databases and in the analysis of data extracted from biological databases.

#### Professional opportunities:

Public and private research and development bodies for bioinformatics applications, chemical, pharmaceutical, biotechnological industries, public and private service centres for biotechnologies applied to neuroscience, small businesses and start-ups dedicated to big data analysis and development of software and apps for the management of central and peripheral nervous system diseases.

#### Final examination features

The 2nd cycle degree in “Neuroscience” is awarded after passing a final examination, consisting of the presentation and discussion of a written Thesis in English prepared by the student, reporting the results of an original scientific or technological research activity. This Thesis has an educational value, completing the two-year course. The Thesis must contain original experiments and its preparation should be consistent with the number of credits awarded. The Thesis is usually prepared at a University Department. Alternatively, the Thesis work can also be carried out, with the agreement of the Board of the Professors of the Course, in research laboratories of public or private bodies outside the University. The discussion of the Thesis is public, a specific Board of Experts will be named. The Thesis is discussed in English. The Board in charge for the final examination formulates a final judgment taking into consideration the entire career of the student and, in particular, the coherence between educational and professional objectives, the cultural maturity, the presentation and elaboration skills.

Subjects 1 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
21031 - BIOCHEMISTRY AND PHYSIOLOGY - INTEGRATED COURSE	11	1	V			
- <i>BIOCHEMISTRY</i> <i>Emanuele(PA)</i>	6	1			BIO/10	B
- <i>PHYSIOLOGY</i> <i>Giglia(PA)</i>	5	1			BIO/09	B
21032 - CELL BIOLOGY AND ANATOMY - INTEGRATED COURSE	12	1	V			
- <i>HUMAN ANATOMY</i> <i>Szychlinska(PA)</i>	6	1			BIO/16	B
- <i>CELL BIOLOGY</i>	6	1			BIO/13	B
22014 - INFORMATION PROCESSING SYSTEMS IN NEUROSCIENCE	6	2	V		ING-INF/05	C

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Subjects 1 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
21877 - NEUROANATOMY, NERVOUS ORGANOGENESIS, NEUROPHYSIOLOGY - INTEGRATED COURSE	10	2	V			
- NEUROANATOMY AND NERVOUS ORGANOGENESIS Di Felice(PO)	5	2			BIO/16	B
- NEUROPHYSIOLOGY Sardo(PO)	5	2			BIO/09	B
21878 - NEUROPATHOLOGY AND NEUROLOGY - INTEGRATED COURSE	9	2	V			
- NEUROLOGY Monastero(PA)	3	2			MED/26	C
- NEUROPATHOLOGY Dielì(PO)	6	2			MED/04	B
Other language skills	6					F
	<b>54</b>					

Subjects 2 ° year	CFU	Sem.	Val.	Att.	SSD	TAF
21027 - CLINICAL NEUROPSYCHIATRY AND REHABILITATION TECHNIQUES - INTEGRATED COURSE	9	1	V			
- CLINICAL PSYCHOLOGY Maniaci(RD)	3	1			M-PSI/08	C
- NEURO-PSYCHIATRIC AND REHABILITATION TECHNIQUES La Cascia(PA)	3	1			MED/48	C
- PSYCHIATRY Quattrone(PA)	3	1			MED/25	C
22713 - MEDICAL ADVANCED DIAGNOSTICS IN NEUROSCIENCE - INTEGRATED COURSE	7	1	V			
- APPLIED MEDICAL TECHNICAL SCIENCE Lo Re(PA)	3	1			MED/50	C
- NEURORADIOLOGY Gagliardo(RD)	4	1			MED/37	C
22012 - NEUROPHARMACOLOGY Cannizzaro(PO)	5	1	V		BIO/14	B
21876 - PSYCOBIOLOGY AND CLINICAL BIOCHEMISTRY - INTEGRATED COURSE	8	1	V			
- CLINICAL BIOCHEMISTRY Bivona(PA)	5	1			BIO/12	B
- PSYCHOBIOLOGY Oliveri(PO)	3	1			M-PSI/02	C
21013 - INTERNSHIP AND ORIENTATION TRAINING	14	1	G	✓		F
20658 - FINAL THESIS	12	2	G			E
Other training activities	3					F
Subjects of student's choice	8					D
	<b>66</b>					

## OPTIONAL SUBJECTS

Other language skills	CFU	Sem.	Val.	Att.	SSD	TAF
22711 - ENGLISH LANGUAGE LEVEL C1	6	1	G			F
22712 - ITALIAN LANGUAGE LEVEL A2	6	1	G			F
Other training activities	CFU	Sem.	Val.	Att.	SSD	TAF
22710 - ITALIAN LANGUAGE LEVEL A1	3	1	G			F
22709 - OTHER EDUCATIONAL ACTIVITIES	3	1	G			F

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## **PROPAEDEUTICAL TEACHINGS**

21876 - PSYCOBIOLOGY AND CLINICAL BIOCHEMISTRY - INTEGRATED COURSE

21031 - BIOCHEMISTRY AND PHYSIOLOGY - INTEGRATED COURSE

21877 - NEUROANATOMY, NERVOUS ORGANOGENESIS, NEUROPHYSIOLOGY - INTEGRATED COURSE

21031 - BIOCHEMISTRY AND PHYSIOLOGY - INTEGRATED COURSE

21032 - CELL BIOLOGY AND ANATOMY - INTEGRATED COURSE

22713 - MEDICAL ADVANCED DIAGNOSTICS IN NEUROSCIENCE - INTEGRATED COURSE

21877 - NEUROANATOMY, NERVOUS ORGANOGENESIS, NEUROPHYSIOLOGY - INTEGRATED COURSE

21032 - CELL BIOLOGY AND ANATOMY - INTEGRATED COURSE