

EADC Resident and Research Fellow Section (RRFS) Exchange through internship programs

Name and location EADC hosting center Ace Alzheimer Center Barcelona

Link to center's website <https://www.fundacioace.com/en>

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Description of the center

Introduction

Ace Alzheimer Center is a recognized leader in cognitive care, renowned for its solid dedication to diagnostic precision, treatment efficacy, research innovation, training, and public awareness. Our sphere of expertise encompasses the entire spectrum of cognitive conditions, ranging from normal cognitive function to the complexities of mild cognitive impairment and dementia.

Our multidisciplinary team, comprising neurologists, geriatricians, neuropsychologists, social workers, and nursing professionals, collectively make the mission of Ace Alzheimer Center possible. We integrate clinical experience with the scientific rigor of basic, clinical and social research and we participate in multiple national and international research projects.

Ace Alzheimer Center is formed by 6 functional units: Daily Care Unit, Diagnostic Unit, Research Unit, Educational Unit, Neuromodulation Unit and Therapeutic Apheresis Unit.

Daily Care Unit

Established in 1991, the Alzheimer Educational Center (ACE) stands as the pioneer of Daily Care Centres in Spain. Initially conceived as a Day Hospital in October 1992, Ace underwent an evolution, culminating its transformation into a government-affiliated specialized therapeutic Day Center for individuals afflicted with dementia in October 1993. Actually, housed within the Daily Care Unit, these services encompass the Memory Workshops, the Day Hospital, and the Day Center. The Unit holds an approximate of 80 users in the Day Hospital, 168 in the Day Center and 63 in the Memory Workshops, per year each.

Diagnostic Unit

Established in 1995, it operates as an independent unit focused on neurodegenerative diseases, providing tailored care and comprehensive assistance for individuals affected by cognitive impairment, Alzheimer's, or other dementias. The unit offers a multidisciplinary approach with diagnostic services, ongoing monitoring, pharmacological and non-pharmacological treatments, personalized guidance, family-oriented support, training, and caregiver assistance. The unit receives more than 8.000 patients per year, of whom 2.000 are new patients.

Research Unit

Research serves as a foundational cornerstone within the realm of Ace Alzheimer Center Barcelona. In 2006, the establishment of the Research Unit formalized the centre's resolute dedication to addressing its scientific endeavours in a holistic manner.

Throughout the years, this unit's trajectory and output have solidified its standing as a notable influencer on both national and international fronts. Its impact is evidenced not only by the extensive volume of conducted clinical trials but also by its distinction as the possessor of Europe's largest collection of genetic samples for Alzheimer's research. At the heart of this unit lies a central mission: the advancement of dementia knowledge through a comprehensive and interdisciplinary lens. With this core objective, the unit is organized into five principal programs: Applied (clinical trials), Genomics, Clinical, Medical, and Social Psychology. The unit participates in 25 active clinical trials, with more than 350 patients included.

a. Genomics Research Program (Victoria Fernandez, Head of the Genomics program)

The GRACE Genomics Research Program has a collection of more than 20,000 DNA samples from individuals with Alzheimer's disease and other neurodegenerative diseases. Using this resource, we conduct genomic association studies of both common and rare variants to investigate the genetic basis of different clinical diagnoses, including Alzheimer's disease, frontotemporal dementia (FTD), dementia with Lewy bodies (DLB), and progressive supranuclear palsy (PSP).

In parallel, we conduct multi-omics studies integrating genetic information with other molecular layers, including plasma proteomics and pQTL analyses, as well as brain genomics projects aimed at investigating the relationship between genetic variation, neuropathology, and clinical presentation. Ultimately, our goal is to better understand the relationship between underlying brain pathologies and clinical diagnoses, and to identify shared and disease-specific genetic and molecular mechanisms across neurodegenerative diseases.

The program offers opportunities to work with genomic and multi-omic data, including GWAS, rare variant analyses, whole-genome sequencing (WGS), pQTLs, and the integration of genetic, molecular, and neuropathological data.

b. Molecular Biology and Biomarkers Research Program (Amanda Cano, Head of the Molecular Biology and Biomarkers Program)

The Molecular Biology and Biomarkers Research Program focuses on identifying and validating biomarkers capable of detecting Alzheimer's disease and other forms of dementia before the onset of overt clinical symptoms. We also investigate the molecular pathways involved in the development of these pathologies.

Using cutting-edge high-throughput proteomics, lipidomics, and metabolomics techniques, we conduct extensive analyses on our collection of plasma, saliva, and CSF samples—a repository that currently comprises over 4,000 paired specimens and more than 13,000 plasma samples. Furthermore, to gain deeper insight into the origins of the disease, we conduct studies using animal and cellular models, helping us unravel molecular questions that remain unsolved to this day.

Our research lines cover areas such as the analysis of extracellular vesicles, the detection of alpha-synuclein in CSF as a proxy for co-pathology, and the analysis of biomarkers and multi-omics data integrated with clinical patient characterization, MRI findings, genetic data, biochemical profiles, and more.

Ultimately, our goal is clear: to unravel the molecular origin of the disease to develop early diagnostic methods and monitoring tools that enable personalized treatments and allow us to track each individual's response to therapy.

c. Artificial Intelligence Research Program (Sergi Valero, Head of the Artificial Intelligence Program)

The Artificial Intelligence Research Program applies machine learning and natural language processing to multimodal clinical data to improve the early detection and longitudinal monitoring of cognitive impairment and Alzheimer's disease (AD). Our multidisciplinary team combines expertise in psychology, biomedical engineering, mathematics, and biomedicine to develop digital biomarkers and analytical tools for research and clinical practice.

A central research focus is the development and validation of speech-based digital biomarkers across the cognitive continuum, from subjective cognitive decline to dementia. The program has access to more than 6,900 speech recordings linked to clinical diagnoses and has developed computational pipelines that automatically extract over 1,400 acoustic, prosodic, morphosyntactic, lexical, and semantic features. We study these measures alongside cognitive assessments, neuroimaging, and biological markers to investigate their diagnostic and monitoring potential.

Our research includes participation in the international SpeechDx Consortium and the European COMFORTAGE project, alongside collaborations with PUNTO Health and Nutricia. Current projects address digital cognitive screening in community settings, personalized prevention of dementia, and clinical decision support combining speech biomarkers with digital cognitive measures through ScreenIA.

In parallel, we use large language models to extract and structure information from electronic health records, including medication data for research on polypharmacy and potentially inappropriate prescribing. The program also provides analytical and methodological support across ACE's research and clinical services, with opportunities to work on multimodal predictive modelling, automated speech analysis, and clinical applications of AI.

d. Clinical Research and Medical Psychology Program (Marta Marquié, Head of the Clinical Research Program)

The Clinical Research and Medical Psychology Program is dedicated to advancing the understanding of cognitive impairment and Alzheimer's disease (AD) through the

integrated study of clinical, cognitive, neuroimaging, and neuropathological data. Our multidisciplinary approach combines the study of well-characterized clinical cohorts with advanced imaging and biomarker research, providing a comprehensive framework to investigate disease mechanisms and identify novel markers for diagnosis and disease monitoring.

The program has access to an extensive portfolio of real-world clinical and cognitive datasets along with multimodal imaging data, including more than 10,000 Optical Coherence Tomography (OCT) examinations, 2,900 brain MRI scans, over 700 amyloid PET scans, and 7s tau PETs.

Our research is supported by a broad network of national and international collaborations with leading research consortia, academic institutions, healthcare organizations, and industry partners, including the Catalan Network for Early-Onset Dementias, HUB Alzheimer Center Barcelona, Amyloid Biomarker Study Group, CPAD Consortium, European DLB Consortium, InRAD, Lantheus, Roche, Lilly, and Araclon.

Our current research focuses on the clinical and neuropathological validation of CSF seeding assays for alfa-sinuclein in Lewy body diseases, the study of neuroimaging proxies of the glymphatic system in MRIs from the AD continuum, and the characterization of astrocyte activation using Deprenyl-PET in patients with early stages of AD.

Therapeutic Apheresis Unit (Yahveth Cantero-Fortiz MD, MSc, MHA, Head of the Therapeutic Apheresis Unit)

In 2021, the Ace Alzheimer Center Barcelona, in collaboration with Grifols, open the Alzheimer Management by Albumin Replacement (AMBAR) programme. This pioneering approach introduces an innovative treatment for individuals in the mild to moderate stages of Alzheimer's that has shown substantial promise in decelerating the advancement of the disease. The unit holds more than 75 patients per year.

Educational and training program

ACE Alzheimer Center Barcelona is committed to educating healthcare professionals, caregivers, families, and society about Alzheimer's disease through a wide range of training initiatives. Its School Program helps children and adolescents understand the impact of dementia on family members and promotes awareness from an early age.

ACE also organizes the Barcelona-Pittsburgh Conference, a leading international meeting on dementia research and clinical neuroscience held every two years. The conference brings together renowned national and international experts and fosters collaboration among professionals involved in dementia care.

Another flagship initiative is the Global Research Summit, which gathers researchers and clinicians from around the world to discuss the latest advances in dementia research. The summit encourages scientific exchange and collaboration among leading experts in the field.

Since 2018, ACE has maintained an academic affiliation with the Universitat Internacional de Catalunya (UIC Barcelona). This partnership promotes specialized education, collaborative research, and healthcare innovation in Alzheimer's disease.

Neuromodulation Unit

The Neuromodulation Unit is at the forefront of pioneering interventions, offering innovative approaches to address cognitive disorders and elevate the quality of care for individuals and their families. It encompasses advanced techniques in cognitive care: Magnetic Transcranial Stimulation (TMS) and Direct Transcranial Stimulation (tDCS).

Internship program focused on residents and researchers' fellows

Optimal duration of the internship: 2 or 4 weeks

The Neurology Internship Programme offers a platform for individuals seeking a comprehensive immersion into the realm of cognitive care. By merging clinical involvement with research exploration, this program provides participants with an opportunity to cultivate an understanding of neurology's role in addressing cognitive disorders.

Components of the Programme

- **Clinical Engagement:** Interns will gain hands-on experience by shadowing our experts, acquiring insights into diagnostic methodologies, treatment modalities, and patient interaction.
- **Research Integration:** Interns will become integral contributors to our dynamic research initiatives, actively participating in national and international research undertakings.
- **Guided Mentorship:** Our team of neurologists, geriatricians, and other specialists will serve as mentors, providing personalized guidance to ensure the assimilation of knowledge, adherence to best practices, and the embodiment of Ace Alzheimer Center's holistic ethos.
- **Educational Enrichment:** Interns will have access to educational seminars, workshops, and academic discussions. These sessions cover a broad spectrum of topics, spanning diagnostics, treatment advancements, ethical considerations, and more.
- **Collaborative Environment:** Interns will engage in collaborative activities alongside a diverse cohort of professionals. This interaction cultivates interdisciplinary dialogue, fostering innovation and comprehensive cognitive care solutions.

Objectives of the Programme

General Objectives:

- Comprehend and acquire the knowledge and competencies essential for clinical and research practices in the comprehensive management of cognitive disorders and dementia.

Specific Objectives:

Develop proficiency and expertise in the following domains:

- Recognize prevalent cognitive disorders in the adult population.
- Master the accurate execution of neurological clinical histories and cognitive assessments.
- Understand diagnostic protocols and the significance of neuropsychological evaluations.
- Identify tools for early-stage diagnosis.
- Familiarize yourself with biomarkers employed in Alzheimer's disease diagnosis.
- Grasp the methodology behind determining the progression of cognitive pathology.
- Recognize the importance of a holistic diagnostic and treatment approach, orchestrated by a multidisciplinary team.
- Gain insight into therapeutic options and disease progression.
- Acquire knowledge of pharmacological and non-pharmacological strategies to manage symptoms associated with cognitive disorders.
- Comprehend the care model that seamlessly integrates clinical practice with research.
- Familiarize yourself with prominent research avenues and cultivate proficiency in both basic and clinical research methodologies.

- Engage actively in daily discourse, participating in the analysis of clinical cases handled within the Diagnostic Unit.

Neurology Internship Programme Schedule

2-WEEK PROGRAMME OPTION:

Week 1: Diagnostic Unit and Neuromodulation Unit

Welcome and Introduction to Ace AlzheimerCenter;

Clinical Department Tour and Introduction to Multidisciplinary Team;

Neurology

Clinical Observations: Patient Consultations and Evaluations;

Overview of Cognitive Disorders and Alzheimer's disease;

Neuropsychology

Neuropsychological Assessment Techniques and Cognitive Assessment Tools;

Clinical application of NBACE diagnostic battery;

Online use of Neuropsychological Assessment Tools,

Social work

Social work Assessment with families at Ace;

Caregiver support group observation

Neuromodulation Unit

Neuromodulation techniques for neurodegenerative disease overview;

Ace Neuromodulation approach and treatment observations;

Week 2: Daily Care, Therapeutic Apheresis Unit, Research Experience

Ace Day Hospital and Day Center visit and experience; Ace therapeutic apheresis center visit and treatment observation; Introduction to Research at Ace Alzheimer Center; Clinical Trials screenings and follow-up at Ace; Laboratory visit, biomarkers and other CSF-blood tests;

Pharmacy visit, clinical trials drugs preparations and controls

4-WEEK PROGRAMME OPTION:

Week 1: Diagnostic Unit – Neurology

Welcome and Introduction to Ace Alzheimer Center; Clinical Department Tour and Introduction to Multidisciplinary Team; Clinical Observations: Patient Consultations and Evaluations; Overview of Cognitive Disorders and Alzheimer's disease; Diagnostic Techniques in Cognitive Assessment Tools; Pharmacological and Non-Pharmacological Interventions; Case Discussions: Treatment Planning and Patient-Centric Approach

Week 2: Diagnostic and Neuromodulation Unit - Neuropsychology Neuropsychological Assessment Techniques and Cognitive Assessment Tools; Clinical application of NBACE diagnostic battery; Online use of Neuropsychological Assessment Tools, Addressing Challenging Cases in Cognitive Care; Neuromodulation techniques for neurodegenerative disease overview; Ace Neuromodulation approach and treatment observations; Case Discussions: Neuropsychological diagnose

Week 3: Daily Care and Therapeutic Apheresis Unit - Social work Assessment with families at Ace; Caregiver support group observation;

Ace Day Hospital and Day Center visit and experience; Therapeutic Apheresis in neurodegenerative disease overview; Ace therapeutic apheresis center visit and treatment observation; Case Discussions: Social approach

Week 4: Research Experience and Engagement

Introduction to Research at Ace Alzheimer Center; Clinical Trials screenings and follow-up at Ace;

Laboratory biomarkers tests and Pharmacy drugs preparations;

Ace Basic research center visit;

Current research projects at Ace overview;
Addressing Challenging in Cognitive decline Clinical Trials designs.

Programme Daily Activities

- 8:00 AM - 9:00 AM: Clinical Grand Rounds and Case Presentations
Analyse diagnostic approaches, treatment strategies, and holistic patient care plans with a multidisciplinary team of Neurologists, Neuropsychologists and Social workers
 - 9:00 AM - 3:00 PM: Clinical Consultations and Evaluations
Under the guidance of professionals, actively observation and interaction will be encouraged with patients at consultations. The aim is to gain insights into the diagnostic, treatment discussions, and an integral care approach.
 - 4:00 PM - 5:30 PM (Every Thursday): Clinical Session, Journal Club
Every Thursday, this session offers a space to get theoretical knowledge and actual debates in the dementia field from internationals or internal experts.
- 2:00 PM – 3:30 PM (Every Wednesday): Clinical Trial Sessions

To conclude

The Ace Alzheimer Center Barcelona can offer a comprehensive approach to diagnosing and treating patients with dementia and cognitive impairments, encompassing not only a medical perspective but also a social point of view. Additionally, can offer participation in various clinical research projects, encompassing commercial drug trials, non-invasive neuromodulation or plasmapheresis treatment, genetics and biomarker research activities. We believe that the residents and fellows we may receive will benefit from this experience.

Resident and Research Fellow Evaluation

Participation in Case Presentations

As part of the evaluation of the Neurology Internship Programme at Ace Alzheimer Center, interns will have to present a Case of interest at the daily Case Presentation meeting. These presentations are useful to evaluate the critical thinking, organization, time management and expression of the presenter, as a critical component of the neurology-learning journey. The Fellow's case presentation will have the support of the mentor neurologists, enabling interns to comprehensively assess, diagnose, and strategize treatments for cases encountered within the Diagnosis Unit.

Participation in Daily Activities

The evaluation process will likely consider how well each intern demonstrates these qualities in their day-to-day interactions and tasks. The goal is to ensure that interns not only gain clinical knowledge but also develop the professional skills and attitudes necessary for a successful career in neurology. This topic will be taken in consideration: initiative and attitude toward work, judgment in decision-making, reliability, ability to learn, participation and compromise.