Scheda di Programma

Per l'attivazione nell'ambito del Corso di Dottorato di ricerca in **SCIENZE CHIMICHE**
del seguente Programma di ricerca, a valere sulle risorse di cui al DM n. 351/2022, relativamente alla seguente Misura:

☐ **M4C1- Inv. 3.4** "*Didattica e competenze universitarie avanzate*" → **Dottorati dedicati alle transizioni digitali e ambientali.**

☒ **M4C1- Inv. 4.1** *"Estensione del numero di dottorati di ricerca e dottorati innovativi per la pubblica amministrazione e il patrimonio culturale".* In particolare:

☒ **Dottorati PNRR**

☐ **Dottorati per la Pubblica Amministrazione**
(selezionare l'area/le aree CUN di riferimento del programma tra quelle di seguito indicate)

- ☐ Area 09 – Ingegneria industriale e dell'informazione
- ☐ Area 11 – Scienze storiche, filosofiche, pedagogiche e psicologiche
- ☐ Area 12 – Scienze giuridiche
- ☐ Area 13 – Scienze economiche e statistiche
- ☐ Area 14 – Scienze politiche e sociali

☐ **Dottorati per il patrimonio culturale**
(selezionare l'area/le aree disciplinare/i e la tematica del programma tra quelle di seguito indicate)

- ☐ Area 01 – Scienze matematiche e informatiche **Tematica** – Informatica, patrimonio e beni culturali
- ☐ Area 02 – Scienze Fisiche **Tematica** – Fisica applicata al patrimonio culturale e ai beni culturali
- ☐ Area 03 – Scienze chimiche **Tematica** – Chimica, ambiente, patrimonio e beni culturali
- ☐ Area 04 Scienze della Terra **Tematica** – Georisorse minerarie per l'ambiente, il patrimonio e i beni culturali
- ☐ Area 05 Scienze Biologiche **Tematica** - Ecologia, patrimonio e beni culturali
- ☐ Area 08 – Ingegneria civile e Architettura **Tematiche** 1) Architettura, ambiente antropizzato, patrimonio e beni culturali 2) Architettura e paesaggio 3) storia dell'architettura; 4) Restauro; 5) Pianificazione e progettazione dell'ambiente antropizzato; 6) Design e progettazione tecnologica dell'architettura
- ☐ Area 10 Scienze dell'antichità, filologico-letterarie e storico -artistiche **Tematiche** 1) Archeologia; 2) Storia dell'arte; 3) Media, patrimonio e beni culturali
- ☐ Area 11 – Scienze storiche, filosofiche, pedagogiche, psicologiche **Tematiche** 1) Biblioteconoma; 2) Archivistica; 3) Storia del patrimonio e dei beni culturali 4) Paleografia; 5) Estetica; 6) Didattica dell'arte; 7) pedagogia dell'Arte
- ☐ Area 12 - Scienze giuridiche **Tematica** Diritto del patrimonio culturale
- ☐ Area 13 - Scienze Economiche e statistiche **Tematiche** 1) Economia della cultura e dell'arte 2) Economia e gestione delle imprese artistiche e culturali; 3) Statistica e Data Analytics per i beni culturali
- ☐ Area 14 Scienze Politiche e sociali **Tematiche** 1) Sociologia dei beni culturali 2) sociologia dell'ambiente e del territorio

❖ **Titolo del Programma di ricerca**: **NOVEL STRATEGIES IN THE PHARMACEUTICAL/NUTRACEUTICAL FIELD FOR THE TREATMENT OF NEURODEGENERATIVE DISEASES**

❖ **Descrizione** (MAX 5000 CARATTERI SPAZI ESCLUSI)**:**

Over the past several years, pharmaceutical/nutraceutical compounds have attracted considerable interest due to their potential safety, nutritional but also therapeutic effects. These products could have a role in a plethora of biological processes, including antioxidant defenses, cell proliferation, gene expression, and safeguarding of

mitochondrial integrity.
In this context, **the aim of this project** is the development of biodegradable polymeric nanoparticles for the nose-to-brain targeting of molecules with potential cerebrotonic and neurotrophic activity to be used in the treatment of neurodegenerative diseases, such as Alzheimer's. These systems are aimed at improving the therapeutic performance of molecules already present in the market alone, or in association with natural molecules, in order to obtain a synergic action exclusively to the target organ. The natural products that will be employed in this project could arise from extraction processes that are part of sustainable development. Climate change, global warming, and the realistic threat of a lack of resources in the future for a rapidly growing world population have contributed to the push for process greenness and sustainability. Some key aspects of sustainable development are: 1) the reduction or even total elimination of wastes; 2) the use of renewable biological resources from land and sea to produce multiple product streams to be used as food, materials and energy through a biorefinery concept. In order to be fully utilized, the bioactive compounds contained in those matrices should be selectively extracted, minimizing the co-extraction of unwanted materials while looking for high extraction efficiency. To achieve these requirements, advanced environmentally clean extraction techniques using “green” solvents are needed.
Alzheimer's disease is a chronic and progressive neurodegenerative disease caused by the degeneration and death of nerve cells in the brain areas related to memory and other higher cognitive functions. The therapy currently in use in the treatment of this pathology involves the administration of symptomatic drugs. In June 2021 Aducanumab® was approved by the American FDA, a monoclonal antibody, which acts only in the early stages of the disease, eliminating accumulations of β-amyloid. It is a very expensive drug, with serious side effects, and even if it were approved in Italy, spending on the public health system would be unsustainable.
Intranasal administration of drugs could represent an effective and non-invasive approach for the delivery of drugs to the brain, following the pathways of the olfactory and trigeminal nerve, which represent the only access route from the external environment to the brain. However, a series of physiological factors (muco-ciliary clearance, presence of enzymes) reduce the cerebral bioavailability of the active ingredients administered through this route.
Innovative drug delivery systems, such as polymeric nanoparticles, can allow the resolution of these problems. They possess mucoadhesive properties, increasing the residence time of the active ingredient at the site of application. They are able to alter the permeability of the nasal epithelium, facilitating the translocation of the active ingredients from the nasal cavity to the brain. In addition, the use of biocompatible and biodegradable polymers guarantees their safety of use and clinical applicability.
The proposed program is part of the mission M6C2.2 TRAINING, SCIENTIFIC RESEARCH AND TECHNOLOGICAL TRANSFER - Investment 2.1: Enhancement and strengthening of the biomedical research of the NHS. Intervention iii) funding for research programs on highly disabling diseases and of **Mission 2**: GREEN REVOLUTION AND ECOIOGICAL TRANSITION and, in particular Component 1: C1. Sustainable agriculture and circular economy. This Component 1 aims to pursue a dual path towards full environmental sustainability: on the one hand, improving waste management and the circular economy, by developing a smart and sustainable agricultural / food supply chain, reducing the environmental impact.
The proposed research has as impactful the promotion of social inclusion. Due to the progressive aging of the population, Alzheimer's dementia represents a pathology in continuous increase and of great interest for socio-health systems, being a highly disabling disease, with great impact on families and assistance services. Innovative strategies that allow the restore cognitive and sensory abilities, or the progression of the disease, will be of valid aid in ameliorate the quality of life fostering the insertion into society.
PhD student will carry out his research at the structures of the University of Messina also in collaboration with other research groups of the same university or foreign universities, in which he will acquire skills of biology and applied physics.
The research will include the extraction and the identification of natural products that show the best therapeutic properties and the preformulative study of nanoparticles realized in order to select the formulations with the best physico-chemical and technological properties. Biological studies will then be carried out in vitro, on cell cultures and ex vivo on bovine nasal mucosa, in order to evaluate the efficacy and nasal permeation capacity of the optimized formulations.
The dissemination activity will include participation in national and international conferences where the results obtained will be exhibited in the form of posters or oral communications and publication in open access journals of international importance.

- **PERIODO IN IMPRESA – CENTRI DI RICERCA – P.A.:**

Il Programma di ricerca sarà svolto in collaborazione con il seguente soggetto:

Ragione sociale: Chromaleont s.r.l.
Sede legale: c/o Dip. CHIBIOFARAM, Viale Annunziata 98168 Messina
Rappresentante legale: Dr. Fabrizio Nicosia

L'ente sopra citato ospiterà il dottorando beneficiario della borsa finanziata sulle risorse del DM 351/2022 per n. 6 **(min 6 max 12)** nel corso del dottorato.

- **PERIODO ALL'ESTERO:**

Il Programma di ricerca prevede un periodo all'estero di n. 6 mesi **(min 6 max 18)** presso la seguente istituzione:
UNIVERSITA' DI SANTIAGO DE COMPOSTELA (SPAGNA) ;
INSTITUTE OF FOOD SCIENCE RESEARCH (CIAL, CSIC-UAM), Calle Nicolás Cabrera 9, 28049 – Madrid (SPAGNA).

Si dichiara inoltre che il presente programma è conforme al principio "di non arrecare un danno significativo" (DHSH) ai sensi dell'art. 17 del regolamento (UE) 2020/852 in coerenza con gli orientamenti tecnici predisposti dalla Commissione Europea (Comunicazione della Commissione Europea 2021/C58/01) e garantisce il rispetto dei principi orizzontali del PNRR (contributo all'obiettivo climatico e digitale c.d. tagging, il principio della parità di genere e l'obbligo di protezione e valorizzazione dei giovani).