



Stazione
Zoologica
Anton Dohrn
Napoli

Drug discovery from marine microalgae

EU-H2020-MSCA-ITN MarPipe Project (2016 - 2020)

The Open University Ph.D. Course - XIX Cycle (2017 - 2020)

Stazione Zoologica Anton Dohrn

Marine Biotechnology Department

Naples, Italy

Doctor of Philosophy

School of Life, Health and Chemical Sciences

Kevin Andrés Martínez Andrade (M.Sc.)

Director of studies: Dr. Adrianna Ianora

Stazione Zoologica Anton Dohrn

Internal supervisors:

Dr. Giovanna Romano

Dr. Chiara Lauritano

External supervisor:

Prof. Marcel Jaspars

University of Aberdeen

Stazione Zoologica Anton Dohrn

July 2020

Abstract

Marine microalgae are eukaryotic unicellular protists that contribute up to 40% of global primary productivity. They have been shown to possess a broad range of biological activities, including antiproliferative (cancer cells), antimicrobial, antibiofilm and antiseizure activities that make them excellent candidates as new ocean medicines. They are also excellent sources of nutraceuticals and food supplements, can be easily cultivated in photo-bioreactors to obtain huge biomass and represent a renewable and poorly explored resource for human health benefits.

The general objective of this PhD project was to investigate eight marine microalgae strains (i.e. *Amphidinium carterae* FE102, *Leptocylindrus danicus* FE354, *Chaetoceros pseudocurvisetus* FE331, *Dunaliella tertiolecta* FE200, *Asterionellopsis glacialis* FE355, *Asterionellopsis glacialis* A4, *Skeletonema costatum* FE85, and *Odontella sinensis* B2) to identify secondary metabolites with anticancer, antimicrobial and antibiofilm properties which can become potential drug candidates. Different culturing conditions can lead to changes in biological activity so I also explored the potential of using this phenomenon during my thesis.

Of all the species tested, five displayed interesting biological activities and three of them were chemically studied in order to identify the source of the observed activity. From the bioassay-guided fractionation approach applied on *A. carterae* (Chapter 2), I isolated and identified a new marine polyketide with anticancer activity: amphidinol 22 (Chapter 3). From the extracts of *L. danicus*, I detected two different metabolites with potent antibiofilm activity (Chapter 4). Furthermore, the source of the antibacterial activity observed in *C. pseudocurvisetus* was unveiled (Chapter 4). The biological activity of the other species was assessed to identify those with potentially interesting bioactivity (Chapter 5).

There are still very few studies on bioactive metabolites from marine microalgae and this project allowed me to further exploit this niche and also to travel to other research institutions in order to complete such a multidisciplinary work.