

Marie Skłodowska-Curie Post-doc Positions at the Department of Physical Sciences, Earth and Environment of University of Siena¹:

“Expression of Interest” for hosting Marie Skłodowska-Curie Fellows

This template should be used by Professor/Doctor interested in hosting post-doctoral fellows within the Marie Skłodowska-Curie fellowship programme.

1. Short Description of the Project idea

At the present time, there is an increasing interest on a particular type of marine contamination: the one caused by marine litter. We can define our age, the Plastic Age because plastic debris are everywhere and represent an environmental problem. A lot of research is conducted in the last years on marine mammals to investigate the toxicological effects produced by plastics and microplastics on those animals. The results show that the damage is due to their presence in the organisms but also to other contaminants they carry inside the organism. They have the capability to attach on their surface different types of contaminants. Some of these, as organochlorines (OCs), polybrominated diphenyl ethers (PBDEs), bisphenol A (BPA) and phthalates are endocrine disrupting chemicals (EDCs) and immunosuppressors. Others, such as polycyclic aromatic hydrocarbons (PAHs), derived from both natural (e.g., oil spills, forest fires, natural petroleum seeps) and anthropogenic (e.g., combustion of fossil fuels, use of oil for cooking and heating, coal burning) sources, are carcinogenic, teratogenic and mutagenic compounds and some studies have shown that PAHs with four or more rings can induce dioxin-like activity and weak estrogenic responses. Moreover PAHs have attracted scientific interest due to their genotoxicity. But how is it possible to discriminate the negative effects in the organism of plastics and microplastics, including the products they are made of, and which are to be considered real contaminants, and of pollutants that bind to them or that are independently present in the environment? And it is possible to assess the susceptibility of an organism to a specific toxic in a mixture of many pollutants?

In this project, we propose the use of “Test Tube Cetaceans”, an “in vitro” method consisting in cetacean fibroblast cell cultures, obtained from skin biopsy of free-ranging animals and from skin tissue of stranded animals dead within 12 h, to explore the susceptibility to plastics and microplastics and mixture of different environmental contaminants in these marine mammals, taken as a model of study for their trophic position and because they are subject to large impacts from marine litter (for example sperm whale (*Physeter macrocephalus*) or fin whale (*Balaenoptera physalus*)).

The same studies will then be replicated in a similar model made on humans (Test Tube Humans) and any differences will allow us to assess whether there is a different risk to the same impacts.

The ultimate goal of the project will be to model the results obtained with the aid of statistics to make toxicological hazard predictions from plastics, derivatives of plastics and environmental contaminants.

Step of study:

- 1) Cetacean and human sampling
- 2) Fibroblast cell cultures
- 3) Cell exposure to different target: microplastics and contaminants.
- 4) Biomarker tests for genotoxicity, immunosuppression, carcinogenesis and generic stress.
- 5) Data elaboration and statistical models

Milestones

- 1) Fibroblast cell cultures of human and cetacean success
- 2) "In vitro" test with selected contaminants
- 3) Evaluation of toxicological risk for cetaceans and humans
- 4) Statistical models for long-term predictions

2. DEPARTMENT/LABORATORY (*Describe briefly the department/laboratory, where the researcher will be employed, including the research team expertise*)

Available lab facilities:

TEM/EDS lab (JEOL 2010)

TEM sample preparation lab (PIPS, Duo Mill for Ar⁺ ion milling)

SEM/EDS lab

Optical microscopy lab (polarized light, transmitted and reflected light, 3D KH 7700 Hirox),

X ray Powder Diffraction (XRPD) lab

Chemical lab.

3. Position, scientific requirements (es. n of publications), topic, discipline*:

We seek a candidate for an experimental **Post-doc Position**

*Please tick: (according to scientific subject areas, defined by MSCA):

Environment and Geosciences (ENV)

4. DESCRIPTION OF THE SUPERVISOR (max. 200 words)/Contact person: (name and e-mail address)

Prof. Letizia Marsili, Associate Professor in Ecology at the Department of Physical Sciences, Earth and Environment - University of Siena – Italy, ; E-mail: letizia.marsili@unisi.it

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Scientometric data: citations 1824; H-index 25 (Scopus, Feb. 2018)

• BIOSKETCH

Since 1988, I handle ecotoxicological and morphometric investigations on some species of Mediterranean cetaceans and in the marine mammals of the different world areas. My

predominant research field is the development of new methodological tools for the assessment of toxicological risk by means of non-destructive biomarkers in endangered vertebrate species and, in particular, in marine mammals. Since 1997 I am specialized in cetacean's fibroblast cell cultures to assess the interspecies and gender susceptibility of different cetaceans to different environmental contaminants. In particular, my activity in the field of ecotoxicology has allowed me to acquire competences on:

- **INNOVATIVE TECHNIQUES FOR ECOTOXICOLOGICAL INVESTIGATIONS ON MEDITERRANEAN CETACEANS:** Evaluation of the "toxicological stress syndrome" in Mediterranean populations of cetaceans (through the use of innovative non-lethal methods applied to skin biopsy; study of gene expression (real-time PCR) and protein expression (western blotting, immunofluorescence). Development of innovative techniques for the "diagnosis" of interactions between xenobiotic contamination and morbillivirus infections.
- **BIOMARKERS IN THE EVALUATION OF TOXICOLOGICAL RISK OF INDUSTRIALISED AREAS:** implementation of applicative protocols for the use of biomarkers in the evaluation of ecotoxicological risk in oil extraction areas. Experimental investigations, using laboratory organisms, (crustaceans and fish) and field bioindicators, (crustaceans, fish, reptiles, birds and small mammals) to develop and validate an integrated strategy (biomarkers and residue levels) of biomonitoring of terrestrial, freshwater and marine ecosystems related to onshore and offshore hydrocarbons extraction activities.
- **NON DESTRUCTIVE BIOMARKERS:** Development and validation of non invasive investigation techniques (non-destructive-biomarkers) for the study and the identification of species or populations "at risk". Use of skin biopsies in marine mammals (cetaceans and pinnipeds) for the evaluation of contaminants levels (organochlorines, IPA, heavy metals) and biomarkers responses. Use of skin biopsy in free ranging species of cetaceans or marine reptiles (*Caretta caretta*) and fresh biological material (for example liver) in stranded cetaceans or marine reptiles (*Caretta caretta*) dead from max 12h, and in pelagic fishes (*Thunnus thynnus thynnus* and *Xiphias gladius*) for cell cultures to assess the interspecies and gender susceptibility of different species to different environmental contaminants.
- **STATISTICAL MODELS:** development of statistical models for the evaluation of toxicological hazard of organochlorines and polycyclic aromatic hydrocarbons in different species, including humans.

5. Previous Related Projects / Research Experience

Pertinent projects funded over the last years:

In 2014 she received the national scientific qualification as an Associate Professor in Ecology. By Decree of 2 March 2007 of the Ministry of Environment and Protection of Land and Sea, she is appointed member of the Director Board of the Tuscan Archipelago National Park (PNAT). Since 2009 she is the representative of PNAT and Siena University for the technical-scientific committee of "Osservatorio Toscano dei Cetacei", now "Consulta della Biodiversità" of Tuscany region and she is one of the managers of Cetaceans and sea turtles Stranding Network. She has been member of the Scientific Committee of the International Whaling Commission (IWC) as Italian delegate since 2003. In 2017 she was nominated member of the scientific committee of Maremma Regional Park and she is member of the Stranding Work Table of Ministry of Environment. To date is author and co-author of 350 scientific papers of which 150 are published in national and international journals. According to CITATION DATABASES 2018 of ISI WEB OF SCIENCE these papers were cited 1724 times in International Publications with Impact Factor. She has been relator and co-relator of approximately 80 students since 1989. She is referee of international journals as *Marine Ecology Progress Series*, *Environmental Science and Technology*, *Environmental Pollution*, *Marine Pollution Bulletin*, *Chemosphere e Science of the Total Environment*. She is member of several national (SITE, SIBM, Tethys) and international (SETAC, ECS, EEIU) scientific associations. On the 7th March 2015 She has been awarded with the international prize "La Mimosa d'Oro" by Associazione Donne Ambientaliste on the 25th Edition with the following statement "... for the scientific commitment, enthusiastic dedication and for the outstanding skills aimed at ensuring the biodiversity protection in the Mediterranean Sea and to the health protection of all the people that are living on its coasts". Letizia Marsili is involved in an intense communication activity on ecotoxicological topics of the effects of contaminants on the Mediterranean fauna. She has been also taken part of several local (50News Versilia, RTV38, Siena TV, Canale 3 Toscana, Radio Siena) and national (WIP Radio, Il Caffè - Rai 1, Linea Blu - Rai 1) radio and television shows about contamination of Mediterranean Sea. On the same topic she released interviews on several national and local magazines and newspapers. She was selected in 2018 from "Donna Moderna" magazine between the top 100 women in Italy for the "Donne come Noi" book. She was also been one of the performers of some documentaries such as "Il Re del Mare" by Osservatorio Toscano dei Cetacei, realized by Artescienza s.a.s. and Laboratorio Probabile bellamy in 2010; "The secret world of Pain" (episode 11 of 15) realized by BBC Horizon in 2010-2011; "I Cetacei" in the APP of *Museo dell'Accademia dei Fisiocritici* of Siena in 2015.

6. SPECIFIC REQUIREMENTS/PREFERENCES *(Describe the specific requirements/preferences for the MSC fellow if necessary for the development/implementation of the project eg. required language, degree field, research experience, etc.)*

*Please consider that the preparation of a Marie Skłodowska-Curie proposal requires some time.

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