Francesca Malfatti, (University of California at San Diego, USA), IRPE Prize winner 2010 in marine ecology.

I am a postdoctoral fellow in the Azam laboratory at Scripps Institution of Oceanography (SIO). I am a marine microbial biogeochemist who studies the ecology of marine bacteria at the individual cell level. We, my advisor and I, are interested in understanding how the microscale activity (=life) of marine bacteria shapes large scale carbon cycle in the ocean. This is the reason why we are exploring at the microscale the bacterial life. Think that the whale watchers are using binoculars and ecosound devices to observe the whales whereas we as marine bacteria watcher are using powerful high-resolution and high-magnification tools such as microscopes, atomic force microscope and secondary ion mass spectroscopy probes.

Last year she received the IRPE Prize in marine ecology. The discovery of the association among primary producers (Cyanobacteria) and heterotrophic bacteria lead to the IRPE Prize (http://www.int-res.com/ecology-institute/irpe-prize/). This finding adds another level of complexity (marine bacteria can associate with each other) in the marine ecosystem that we need to face in order to correctly quantify the carbon fluxes in the environment.

What made you decide to leave Italy and why did you decide to stay in North America?

In December 1999, after finishing the Laurea (5 years, comparable to BA and Master Program) in Biological Science (in the field of Marine Biology) at the University of Trieste, I did not want to stop studying but I wanted to pursue a PhD. At my time, there were not any PhD offers in the Marine Biology field at the University of Trieste but there were exchange programs among different labs within the European Community (ERASMUS project). By interacting with one of my
teaching Professor Serena Fouda-Umani, who was the head of the Marine Biology Laboratory (LBM today part of the OGS-BIO) we decided that I would have been trained in her laboratory under the guidance of Dr. Bruno Cataletto in marine microbial ecology and I would then spend six months at the Station Biologique of Villefranche-sur-Mer (in France, part of the CNRS and affiliated with the University Paris 6) under the guidance of Dr. Fereidoun Rassoulzadegan and Dr. Maria Luiza Pedrotti. The only “problem” for me was that I had to switch field, from marine benthic ecology, the subject of my field and thesis work that I had been trained in the laboratory of Professor Giuliano Orel to the unexplored and unknown world of the marine microbial ecology. Professor Fouda-Umani and Dr. Cataletto have spent a lot of energy and time on me in training and in “molding me” as a scientist. The experience in France was beneficial for me, being exposed to a different reality in science has helped me in being more flexible and less stiff. At the end of the exchange period Professor Fouda-Umani has offered me a payed-position as a researcher assistant in the Marine Biology Laboratory. And in 2001 I was able to work for 6 months the Scripps Institution of Oceanography, now my home since 2002 in La Jolla California. This has been possible thank to a grant of the Italian Embassy in USA. At that time in Washington, Maria Livia Tosatto was in charge of promoting scientific exchange between Italy and USA and she had contacted Professor Fouda-Umani who had identified me as a “good bet” for that program. This is how my USA adventured as started. During those 6 months I have been working with my actual adivisor Dr. Farooq Azam, distinguished Professor at UCSD and we have established a positive and good interaction. He had offered me to join his lab after passing the TOEFL and the GRE. I did it and I became in 2002 a UCSD graduate student at the Scripps Insitution of Oceanography (I could not ask for more, I still have goose bumps when I think at the path that took me here). My advisor has been mentoring me from the very first second and I will always have to thank him for teaching me how to think and how to pose scientific questions that I can answer.

How would you define the interaction with the Italian professional community in North America? And with your colleagues in Italy?

I have mostly Italian friends in the medical and biological field and sometimes by eating out in some Italian restaurant I know the Italian working community. In the scientific field, I consider us, the New Immigrants, luckily enough we are different than Al Capone. We are exporting some joyful Italian style and some (hopefully) brain too,
beside pizza, ciao bella, gelato and panini (it happens to me all the time when the locals spot me as an Italian Madonna).

Fig.1

How does one find a balance between working abroad and contributing to your homecountry?

I have been travelling a lot for research and I have partecipated to many international projects such as the environmental impact assessment of the MOSE project in Venice (sponsored by Thetis, Cristina Nasci, Italian PI) and NSF supported grant studying the mucilage of the Northern Adriatic Sea (Farooq Azam PI). During these events I have been interacting and collaborating with Italian, Croatian and Slovenian scientist.

When I visit Trieste and the close-by Slovenia and Croazia I have been invited to give some lecture at the local research institutions (OGS-BIO, University of Trieste, NBI-Marine Biology Station Piran, Rudjer Boskovic Station in Rovinj). In the past year, due to the fact that my life partner is a Science-Professor at the Scuole Medie I have guided two laboratory activities for two 1. Middle School classes. The first topic was the Cell and the second was that I asked the student via my partner to build a Winograsky column in order to have the perception that microbial life is everywhere and structure every ecosystem (Figure 1).

What advise would you give to a young investigator making his/her first steps here?

I am still living in a state of cultural shock, I miss Trieste and I miss the feeling of “knowing things”. Here everyday is an adventure at many different levels. What I have been appreciating lately are the expressions: “Good for her/him” and “Take it easy” so different from
the Italian culture. To conclude being flexible is rather essential in order to live well here!

**Current research and achievements**

In 2009, my advisor and I have published a paper on the discovery of association among marine bacteria in the pelagic ocean. Associations among bacteria are well known in the medical world (pathogenic biofilm in the lung of immunosuppressed patients, or on urinary catheters; human gut microbiome) as well in the soil microbiology (mycorrhizae association) and in the marine sediments (Archaeaum and methanoxidizing bacterium) but were not known in a liquid (not solid) environment. This discovery needs to be placed in big picture that is the biogeochemical cycle of carbon in the ocean (and in the sea, lake too). Primary producers (algae and Cyanobacteria) are fixing CO2 and creating biomass (more cells and organic matter; think at the tree in a forest that are getting taller and making leaves) heterotrophic bacteria are living at the expenses of the primary production. Heterotrophic bacteria are dictating the fate of the fixed carbon; they are utilizing it (making biomass, more bacterial cells and respiring it, creation of CO2 that equilibrates with the atmospheric CO2). Heterotrophic bacteria are the remineralizer the organic matter in the sea; by degrading it they are releasing nutrients for the primary producers. Their role is comparable to the fungi, protists, little rodents and soil bacteria in the leaves litter during the autumn in a forest; leaves do not accumulate but are used as a food-source and nutrients are then available to the trees. The strength and the nature of the coupling between primary producers and heterotrophic bacteria is the element that controls the carbon flux in the ecosystem. Now a days the measurements for assessing the activity of heterotrophic bacteria are still being made in the bulk part; that means we are integrating the activity in a 1 liter of seawater of $10^9$ heterotrophic bacteria cell, that maybe are doing different things and that are phylogenetically diverse. Consequently our understanding of the microbial world is still limited since we cannot measure (but now we are starting, it is a new revolution!) individual cell activity and thus we cannot better prognosticate the ecosystem response to climate change and human perturbation.
Here below follows the quotation of the IRPE Prize.

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Quotation of the Jury (Chairman: Victor Smetacek, Bremerhaven, Germany):

Francesca Malfatti has made innovative and important contributions to the emerging field of microscale biogeochemistry of the surface ocean. As a beginning graduate student Francesca became convinced that to understand how microbes regulate the global ocean carbon cycle we must know their activities and interactions at nanometer to micrometer scales. Painstakingly applying Atomic Force Microscopy to marine pelagic systems she discovered novel and abundant associations of bacteria with other bacteria and with Synechococcus and Prochlorococcus as well as microbial networks that had gone undetected despite decades of research in marine microbiology. These findings should significantly advance our understanding of the ecophysiology, adaptive biology and biogeochemical function of pelagic marine microbes. The jury found her most worthy of the IRPE Prize in marine ecology 2010.