

## Gerardo Bosco, MD PhD



Residency in Diving and Hyperbaric Medicine

Residency in Nutritional Sciences (Clinical Nutrition/Internal medicine)

I started my diving and hyperbaric activity when I was a twenty-three year old medical student; my first scuba diving experience occurred looking for an ancient submerged city, as a student of Professor Data, who was a physiologist, cardiologist, and director for twenty years of the only residency in diving and hyperbaric medicine in Italy.

From that experience, my studies began in his laboratory of human physiology; he made me a participant of all the ongoing experiments. We isolated the carotid body in the rat and we injected contrast medium for evaluating post-dive pulmonary scintigraphy in man. Respiratory system and metabolism started to be my key points. Then my scientific interest focused on a portable machine for measuring oxygen consumption. Prof. Data asked me to measure all manners of standard human metabolisms, starting from the ordinary housewife, leading up to the basketball champion, during real athletic activity and also whilst diving.

Meanwhile, I was listening to stories about Jacques Mayol and Enzo Maiorca and the great scientific expeditions directed by Prof. Data in Peru, Indonesia, and Greece. I was immediately intrigued by the environmental physiology; I particularly liked the effects of the environment on man while exercising. In 1996, I participated in the training course at the European Space Agency (ESA) under the supervision of Franco Rossitto. Later, back to the University of Chieti with Rossitto and Data, I started a fascinating adventure, using a small hyperbaric chamber for asbestos incineration treatment, which was my first real experience with a hyperbaric chamber as Principal Investigator. In the beginning, the experimental protocol was extreme and we were working only at night when the lab and the building were empty. Later on, this experiment was certified as a patent and awarded a press communication during the American Physiology Society (APS) meeting in 1999.

My passion of technology applied to human physiology grew even more when I knew the scientific papers of different research groups in Milan, Buffalo, Philadelphia, and above all, Duke University. The physiology and the medicine of diving seemed to me as the easiest way to study the pathophysiology of the human body otherwise difficult to explore.

In 1997, my thesis for the medical school led me to begin a series of research projects with the Italian Navy Special force (ComSubIn). Specifically, my thesis consisted of the functional evaluation of combat divers. Indeed, while they performed trekking trials between 20 and 42 km for selections and training, we measured oxygen consumption and lactate accumulation.

From 1997 to 1999 we made an experimental campaign with high-altitude dives, where breath-hold divers and scuba-divers participated. In that project, we evaluated the different degrees of post-immersion platelet activation in an iced lake on Monte Bianco.

After a year of residency in underwater and hyperbaric medicine, I asked to carry out a job abroad, in one of the great labs aforementioned. Fortunately, in 1999 while I was reading the Bennett Elliott book, I came across the chapter 5 written by Lanphier and Camporesi. From that, I suggested to Prof. Data to visit the Department of Anesthesia in Syracuse (SUNY) to meet Prof. Camporesi, one of the respiratory physiologist students of Margaria, later involved in the "Atlantis Dives Series" at Duke University as anesthesiologist.

I spent several years at SUNY studying the Ischemia/Reperfusion model (my PhD thesis) and the human metabolism in extreme environments. At that time, I visited several prestigious labs in the US and met with the accomplished scientists of the diving and hyperbaric physiology.

Back in Italy, I started my medical profession at the hyperbaric Center of Salerno and I continued my work with Data and from 2003 to 2005 with Professor Mortola at McGill University and Chieti University. We carried out a series of experiments at the hyperbaric center of COMSUBIN studying the variation of circadian rhythms induced by hypoxia, focusing on the respiration/thermoregulation link. Then we studied breath-hold variations induced by circadian rhythms and hypoxia, also in a hypoxic environment. As a tutor of residency courses, I started a collaboration with the Italian Air Force to test the beneficial effects of pre-oxygenation in the hyperbaric environment.

This was an important moment of my life, which brought me back to the University to deepen my knowledge on human metabolism. In these years, I won a grant that allowed me to study again pre-oxygenation, this time in the open sea experiment (preoxy project).

A strong collaboration with Prof. Camporesi (US lab in Tampa) and Prof Vezzani (Aspati, Italian HBO patients association) evolved into a series of experiments to clarify HBO mechanisms of action in diving and hyperbaric medicine with different models.

In 2011, I obtained the position of Assistant Professor at the Physiology Institute at the University of Padova. I immediately started my collaboration with ATIP, the Hyperbaric Center of the city. My interests are to focus on clinical studies and on cells and animals model (*Drosophila* and rat), with two small hyperbaric chambers.

In these years, I was able to formally organize the laboratory of respiratory physiology and environmental medicine. The main topics of interest are: the safety of human performance in extreme environments and quality of care of the orthopaedic, vascular, and infective patients before and after surgery. In particular, I like exploring the hypoxia modulation in cells, in animals and humans and the hyperbaric oxygen therapy. Moreover, other areas of interest are respiratory mechanics and cardiovascular adaptations in diving, metabolic disorders and environmental stress

on exercise-induced oxygen toxicity, nice collaboration with the Open Lab at Y 40 swimming pool-Montegrotto Terme.

In 2013 I founded the school of “Hyperbaric School Padua” at the University of Padova which aims to educate future professional figures in Diving and Hyperbaric Medicine through two courses:

- A Level II master in Diving and Hyperbaric medicine
- High Course in Technical and health management in the hyperbaric chamber for technicians and nurses

Education, research, and clinic are three interdependent pieces for a valid and useful approach in the underwater and hyperbaric medicine.

My message is that research, education, and clinic, is the perfect triage for not only an academic progress in diving and hyperbaric medicine, but for a rigorous and scientific approach to bring more information for the safety of our divers and HBO patients as well. Lab and clinical aspects are focusing on osteonecrosis and HBO: in 2006 ECHM recognized AVFN as indication with a Level B, thanks our group work, and more information was obtained on OPG/RANKL modulation as per Cytokines production, clarifying the anti-inflammatory property of HBO.

From 2016 to 2018, I had the great honour to be elected as VP for UHMS.

In diving physiology, my recent research themes are focusing on oxygen toxicity during CCR and Nitrox diving, with different preconditioning model (oxygen, exercise and nutrition). Recently data were obtained on arterial blood gases in breath-hold divers during controlled immersions to 5 ATA. Currently I am an associate professor at the Department of Biomedical Sciences at the University of Padova.

This is my little story and the reason to be part of Diving and Hyperbaric Medicine family.