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THE L'ORÉAL-UNESCO PRIZE AWARDED TO THE USE OF PARTICLES IN MEDICINE

Interview with Nicoletta Protti, post doc researcher at the INFN division in Pavia, selected among the five winners of the XIII edition of the "L'Oréal Italia for Women and Science" award

The award is part of the international L'Oréal-UNESCO "For Women in Science" project, dedicated to the promotion of scientific vocations in women. In the Italian edition, every year the award selects five researchers under 35 years of age and their projects, selected from hundreds of submissions.
Nicoletta Protti's project, "Preliminary feasibility studies of X-ray treatment for Alzheimer's disease based on neutron bombardment of neurotoxic amyloid aggregates", falls within the scope of a broader programme of verification of innovative therapies for Alzheimer's disease and is part of the activities that INFN has been supporting for some time now in the biomedical field.

How did your passion for the application of physics to medical therapy arise?

It is largely due to chance and was initially love at first sight. In my second year of the degree course in physics, I had the opportunity to attend a lecture on hadrontherapy - the medical therapy that uses proton and ion beams - organised in Mortara, the town where I was born, by CNAO, the National Center for Oncology Hadrontherapy in Pavia. It was a lecture for general practitioners to which my mother had been invited. I merely accompanied her. A fortuitous encounter, therefore, and very enlightening. I was going through a phase in my studies that forced me to concentrate mainly on the fundamentals of physics, quite abstract issues and, at least at first sight, far from everyday life. The discovery of this concrete application of particle physics to a field of great usefulness for people was a true revelation. Also the second step took place a little by chance, when I met Saverio Altieri, the professor at Pavia dealing with BNCT (Boron Neutron Capture Therapy), a valuable application of particles to medical therapy: I graduated and I obtained my PhD with his group and was then able to continue with experiences also abroad.

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What is the main objective of this innovative research?

It is believed that Alzheimer's is associated with the presence in the brain of the patient of an accumulation of extracellular plaques, composed mainly of a toxic protein, the amyloid beta peptide, which in healthy subjects has the function of promoting cell growth. Today, unfortunately, there are no effective therapies to arrest the course of the disease, although some strategies have been proposed to limit its progression, slowing the process of formation or, when possible, disintegrating the amyloid beta-aggregates in the brain. The research has precisely the objective of evaluating the effectiveness of a radiation therapy technique for Alzheimer's disease, based on irradiation of the amyloid beta plaques with high ionization density radiation. In my research, this radiation is alpha particles and lithium ions produced by neutron capture reactions (a particular nuclear reaction), which is induced by bombarding some specific chemical elements, in particular isotope 10 of boron and isotope 157 of gadolinium, with neutron beams. From the physical point of view and that of their action on biological tissues, the particles produced in this manner share many of the properties of radiation normally used in hadron therapy. To produce them, I use a low-energy source of neutrons made available to me by the University of Pavia at the LENA, Laboratory of Applied Nuclear Energy, research reactor of the University, with which INFN has for many years had an intense and fruitful cooperation in various fields.

In your opinion, which element in particular convinced the jury of the award to put your project in the list of the five winners, selecting it from hundreds of submissions?

Honestly, I think the key to winning was madness. And not only mine, but also that of the Mario Negri Institute in Milan which bravely believed in the idea of this research, which is quite daring. Of course when one speaks of research, even madness is based on concrete results. In particular, the literature provides several clinical cases of tracheobronchial amyloidosis (TBA) that have been effectively treated with conventional radiation therapy, in order to reduce or even reverse the accumulation of amyloid protein aggregates in patients' lungs. The chemical structure of the proteins involved in the TBA is very similar to that of the senile plaques of amyloid beta found in Alzheimer's patients.
Then, my personal courage is due to the support I have always received from my family and friends, among the latter, my colleagues at work with whom I have always been able to freely discuss, who have supported and believed in me.
Now I am very determined, but I will nevertheless approach the research with great caution. I know that from 2015 these studies can begin and I hope they will soon provide positive results. Even if today I cannot be certain of the outcome, the mere idea of having the opportunity to conduct research that, if successful, will provide a significant contribution to the treatment of Alzheimer's is in itself challenging and a great motivator.

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What would you recommend to a young person about to embark on a research career?

Never give up. In addition to luck you need passion, but also this, without the necessary determination, is not sufficient. Even if I am at the beginning of my career, like everyone I have come up against a number of obstacles. Among them, there are extenuating waiting periods without immediate feedback, during which one often does not know in which direction one is heading. This is the moment where you have to be strongest and not give up. Research is also made of this: many days when it's like getting blood out of a stone. You must not give up.

The "L'Oréal Italia for Women and Science" project aims to support the scientific careers of women. Do you think that being a woman can affect your career? How do you see yourself in 10 years from now?

I cannot say to have encountered difficulties due to the fact of being a woman and I do not expect, honestly, to encounter any in the future. I do not believe that this aspect in particular can be more of an influence than others. My ambition is to pursue a passion for research together with my private life and, up to now, I am satisfied on both counts. Then, in ten years' time, I would be happy to still be here doing research and being of help to others, with the same enthusiasm.