Curious people

The articles here illustrate how diverse and inspiring curiosity can be, and how it stimulated these people to become professional scientists or engineers.

Dr Chiara Pazzagli

Curious researcher in biomedicine and drug discovery

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Age: 35 years
Novartis Institutes for BioMedical Research - NIBR
Translational Medicine
Novartis Campus WSJ-386.12.48.29
CH-4056 Basel Switzerland
Email: chiara.pz@gmail.com

Ten questions

1. What made you curious when you were young, and did you have any heroes who influenced you? For example, is there a person, place, event, or moment that influenced or changed your way of thinking?

With my family, we used to lie down in the garden watching falling stars during the warm summer nights in Tuscany, and I used to be stunned by the vastness of the sky and those sparkling stars. Also, one day - I was 12 back then - my dad came back from work, bringing with him petri dishes. My sister and I were allowed to put our hands in them, just for fun. The following morning, my dad brought the dishes back from the lab, where they incubated for two weeks. He let us watch what developed on the medium of the dishes – different bacteria and fungus. Everything that was on our dirty hand, invisible to the naked eye, was now displayed in colorful patterns. All those mysteries of the infinitive big, and the infinitive small, fascinated me. I think developed my interest in Nature back then.

My parents are my heroes. They are both passionate scientists, and my sister and I grew up in an environment surrounded by science. My parents exposed me to many interesting and knowledgeable people, as well as interesting places. They opened my mind to the world, and they taught me to explore every path with freedom, passion and curiosity.

2. When and why did you decide to choose science as a career, particularly what or who inspired you? Did you have any family connections to careers in science?

Even though I was surrounded by science, I was no good at maths, physics or chemistry at school. When I finished college I didn't want to study science at all, but rather become a journalist or a psychologist. I tried different faculties, which were all uninteresting to me. One day I attended by chance, with a friend, a biology lesson at the University, where a passionate Professor stated that 'a cell is the smallest entity capable of its own life, and you can think of it as the smallest, but infinitive, Universe'. At this exact moment I realized I was in the right place, ready and curious to learn more about Nature.

3. Where did you grow up, and what was your educational path?

I grew up in the beautiful city of Florence, in Italy. I carried out my university studies there too, becoming a scientist in 2011, with a thesis based on rare diseases. During my studies I went on a summer exchange to Washington DC, at the National Institute of Health, where I performed my first research as a scientist. I then moved to Germany for my PhD, where I defended my thesis in Molecular Medicine in 2014.

4. How has your career developed after university, and how was it funded?

During my final years at the University I realized I wanted to carry out research into Rare Diseases, being affected by one myself. I wanted to commit to a topic that was poorly explored, to contribute meaningfully to science, and to help patients. My journey to achieve my dream brought me to Germany, where my research, conferences and travel exchanges were mainly funded by the Excellence Programs SGBM and the DFG, the German Research foundation, or by other awards that I achieved. Finally, in 2015, I landed at Novartis in Basel, where I am collaborating with international teams and experts to develop new treatments for patients with rare diseases, or other unmet medical needs.

5. Have you had any break-though moments in your research? If so what were they, and how did they affect your development?

My initial experiments were a mess. Very few worked, and I had to spend several nights and weekends in the lab. Also, being far from home, and immersed in an entirely new cultural setting, making new friends, and providing good performance in my research, was not always easy. But I worked hard, and became more skilled with time. The support of my family and new friends kept my motivation high. I have learned a lot from all those stressful times, which turned into great positive changes. They've taught me a lot, and made me stronger. Finally, in 2017, I had my research published in an important journal, with one of my fluorescent cells on the cover page!

6. What do you regard as your most important discoveries and inventions, and why?

I think my most important discoveries were achieved by observing living cells under the microscope, recording them in time-lapse while they moved into a petri dish. I discovered that some cells prefer to adhere and move on special substrates, and they can even acquire the ability to walk and jump, one on top of the other if they are missing some anchoring proteins. (Pazzagli, C., *et al*., 2017. *Absence of the Integrin α3 Subunit Induces an Activated Phenotype in Human Keratinocytes.* J Invest Dermatol. 137(6):1387-1391. DOI: 10.1016/j.jid.2017.01.018. Epub 2017 Feb 3.)

7. Can you think of anything that could have done better, and do you have any regrets?

Actually, I don't have major regrets. Working in the field of rare diseases, which I really like, is very stimulating to me. But I also find it very challenging, as the topic is poorly explored, and there are not many knowledgeable scientists that can support you. They are also rare! Thus, such research leaves a lot of space for creativity and imagination. But it can also bring you to a halt, and a bit of isolation. I would have liked to discuss my research with a broader team of scientists, and brainstorm how we could apply the discoveries to patients.

8. What other stories do you have about your curious life, including any entrepreneurial and commercial activities, and your other interests?

I recently met some surgeons in Austria, to align the medical procedures needed for a clinical trial. During my visit to the hospital, I was very surprised to meet them in the autopsy room, and even more surprised when I was asked to hold a leg from a cadaver to help the surgery! Even if this meeting was very successful, and relevant for the trial, I have to say it was quite an unusual experience, which I am not looking forward to repeat.

9. List six key publications (not necessarily yours), and explain why you have chosen them.

a) Saiki, R.K. *et al*. 1988. *Primer-directed enzymatic amplification of DNA with a thermostable DNA polymerase.* Science 239 (4839),487-491. The PCR (polymerase chain reaction) is a very special technique that allows you to make an enormous number of copies DNA extracted from the organism's cells. PCR is one of the 'Eureka' discoveries, as it is very simple, and is used for so many things, such as paternity testing, screening for genetic disorders, criminal investigations, or to identify cancers and pathogens.

b) Herb, B.R. 2014. *Epigenetics as an answer to Darwin's 'special difficulty'.* Front Genet. 5, 321. DOI: 10.3389/fgene.2014.00321. Organisms with the same genome can respond differently to their environment, and develop different phenotypes. This phenomenon is called epigenetic, and allows organisms to respond successfully to evolution and survival hurdles. The authors describe what happens to honey bee's larvae during their development. All larvae are genetically the same. However if a larva is fed with the royal jelly it turns into a queen, able to reproduce. If not, the larvae become sterile workers. So food is able to interfere with the differential development of reproductive organs!

c) Abbott, B.P. *et al*. 2017. (LIGO Scientific Collaboration and Virgo Collaboration). GW170817: *Observation of Gravitational Waves from a Binary Neutron Star Inspiral.* Phys. Rev. Lett. 119, 161101 – 16. This publication is an example of international teamwork, and a massive effort from scientists from all over the world. For the first time in history, after many years of difficult research and experimental limitations, they could detect gravitational waves originating in the space from two merging stars.

d) Wilmut, I. 2013. *A tribute to Keith Campbell: the birth of the first clone of an adult vertebrate, 'Dolly' the sheep.* Cell Reprogram. 5,339-43. DOI: 10.1089/cell.2013.ed01. Epub 2013 Sep 10. Dolly was the first sheep cloned from her mother. Cloning is the process by which an exact, identical copy of the original can be made in vitro. In fact, Dolly the sheep was the identical sister of her own mother, and Dolly doesn't have a father! She was born from the process of nuclear transfer, and represents a breakthrough for many scientists.

e) Mascalchi, M. *et al*. 2017. *Circulating tumor cells and microemboli can differentiate malignant and benign pulmonary lesions.* J Cancer. 8(12):2223-2230. DOI: 10.7150/jca.18418. eCollection 2017. A liquid biopsy is the sampling and analysis of blood. This technique is mainly used as a diagnostic and monitoring tool for diseases such as cancer, with the added benefit of being largely non-invasive. This procedure can thus be performed more frequently, to monitor relapse or the efficiency of cancer treatments over time.

10. What advice would you give a curious young mind? Imagine your ten year old self, if you started again! Is there a big unanswered question today?

Science is very exciting, and offers a wide and interdisciplinary area to work in. It has many unexplored topics to be investigated, many innovative technologies to use and implement. There's space for everyone. However, I think it's important to acknowledge that sometimes there's a lot of competition and poor collaboration between scientists. Don't let them obstacle your curiosity, or push you away from your dreams and scientific interests. Take your risks and follow your path with integrity and by seeking for collaboration.

Dr Darwin's Curiosity Shop

Curiosity inspires, discovert reveals

Why is this shrimp red?

Email your answer to info@theyoungdarwinian.com and we will put them on the blog page