# Interview Dr. Nelson Lima

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Nelson Lima graduated in the Teaching of Biology and Geology and obtained his PhD in 1993 in Engineering Sciences (Biotechnology) at the University of Minho (Braga, Portugal), where he has been a full-time professor since 2004 and director of the Mycoteca of the University of Minho since 1996. He is a researcher at the Centre for Biological Engineering (CEB) and the Centre for Research in Child Studies (CIEC), being at CEB the coordinator of the research group in applied mycology. He chaired from 2013 to 2019 the European Organization of Culture Collections and has served on the board of the World Federation of Culture Collections, the Portuguese Society of Microbiology, and the governing staff of the Portuguese Society of Biotechnology. He is founder and managing partner, with other colleagues from UMinho, of the spin-off company Mycotec Lda. In Brazil he was also a visiting professor at the Federal University of Pernambuco (UFPE), Catholic University of Pernambuco (UNICAP), Federal University of Lavras (UFLA), University of La Frontera (UFRO, Chile) and University of Milan-Bicoca (Italy). He has also lectured in other universities such as UFAM, UFMA, CEUMA or in the PhD program in Biotechnology - Northeast Network of Biotechnology (RENORBIO). He has more than 400 publications, 550 papers in conferences and more than 60 master and doctoral orientations and is scientifically responsible for more than 20 post-doctoral studies. He is an evaluator of half a hundred international journals, as well as of

projects for research funding agencies, mainly in the European Commission, Italy, United Kingdom, Chile, Brazil and Belgium.

**1. It strikes us how you have, through your fruitful career as a teacher and researcher, dedicated yourself to such diverse areas of science. Child studies, teacher training, fungi, food, microorganisms, etc. You have a wide range of interests. How do you manage to be part of so many organizations, publish and participate in so many projects? Tell us a little about how you plan and achieve so many goals?**

Prof. Nelson: Well, this is a question I have been asking to myself, because in personal terms my curiosity has no limits and always makes me go after knowledge that helps me understand myself and the world around me. Then, I have never accepted divisions that have always seemed limiting or sometimes even disconnected from reality, such as the dichotomy between social and human sciences versus exact and natural sciences, or fundamental sciences versus applied sciences. My brain does not work like that, as knowledge is elaborated in our mind and is therefore ultimately always human knowledge. The laboratory experience, both in the numerous practical classes I have taught throughout my academic life and the experimental part I have developed for my research have created deep difficulties for me in fitting in with simple and abstract (and therefore not at all true) models, such as the experimental model, where chance, trial and error do not enter the configuration of these models. Pasteur's quadrants, proposed by D.E. Stokes, where fundamental knowledge and the relevance of its use come much closer to my way of being and acting as a researcher. Therefore, planning has to do with a strategy that starts from fundamental knowledge which is then colored by a palette of different degrees of relevance. If we look at it from this point of view, I am not after all as multifaceted as I might seem! and, finally, my team is the one who helps me most to achieve these same goals. These are my heroes.

**2. One of the most common complaints among Brazilian**

**researchers, pertinent incidentally, is the lack of resources to fund research. You have recently had approved a project of your leadership of 5 million euros for microbial research (https://alumni.uminho.pt/pt/news/Paginas/02/02/2020/Nelson Lima MIRRI.aspx). Tell us a little about this project and give us tips on how to seek funding for projects of this level and scope.**

Prof. Nelson: The lack of resources for research is, and always will be, scarce. Financial envelopes and priorities, which are defined at each moment by scientific and technological policies, mean that resources are finite and distributed inequitably. I think that this is a proposition that any researcher, being also an ordinary citizen, should accept as a starting point for the analysis and search for his sources of resources. In other words, a researcher, at every moment, has to know what the strategic alignments of the funding agencies or sources of funding are available. It is up to them to decide whether to play the game, whether or not to agree with a certain policy of priorities, proposal formats and forms of evaluation. If you go into the game and prepare a proposal, it is not enough to have an excellent hypothesis or research question, you have to know how to translate it into a proposal that is feasible in time and financially, you have to demonstrate that your project beyond scientific excellence (usually the most successful part) has project management tools that ensure the smooth running of the proposal and risk control with an elaborate mitigation plan and, finally, you have to demonstrate the aforementioned strategic alignments and the relevance and social impacts as a return on the public investment that you are requesting.

When we are talking about large-scale projects, we have all these elements already mentioned taken to the highest level of excellence and demand, as they involve many countries and, within them, various partners who contribute complementarities, synergies and where the whole is significantly greater than the simple sum of the parts. For great societal challenges we need great projects because no one individually, or a simple team or even a country will be able to solve them. Remember the loss of biological diversity, climate change, large human migrations and, more recently, the SARS-COV-2 pandemic, we can quickly

understand how important it is for researchers to be prepared to work in large international, multicultural, and multidisciplinary teams. This IS_MIRRI21 project, which I coordinate, on research into microbial resources and their applications involves 14 partners from 10 countries. Already this year I am involved in two other projects, but only as a partner, in which ISIDORe involves 21 million euros and has 152 partners and CanServ with 15 million euros and 19 partners. In these projects, the ambition is respectively to prepare and have solutions for future pandemics and to increase the 10-year survival of 3 out of 4 cancer patients.

**3. You have recently been awarded the title of Doctor Honoris Causa for "outstanding contribution to the biological resources of Brazil" by the Federal University of Pernambuco (UFPE) https://alumni.uminho.pt/pt/news/Paginas/Not%C3%ADcias%202015/Nelson-Lima.aspx) and more recently a new species of fungus was named after you (*Penicillium limae*) in your honor. You have often worked with Brazilian researchers, tell us a little about this partnership. Tell us about the advantages and disadvantages of doing research in Brazil and with Brazilians, and the results achieved.**

Prof. Nelson: Yes, it is true! Something that marked me immensely by the generosity of the whole collegiate of the Biosciences Center and the Mycology Department of UFPE. All the collaboration developed with this group has always been based on a great respect for the accumulated knowledge in mycology that at UPFE exists from the works of Prof. Chaves Batista and subsequent teams that have broadened and deepened his legacy. Beyond science, and it is always made by men and women, I found in several groups of UFPE, my "second home". As well as, later, at UFLA (Lavras), in the Agricultural Microbiology program and its collection CCMA, another irreplaceable shelter. I am grateful for the different acknowledgements, but much more grateful for the learning they share with me. This is the only way collaborations make sense. That is why, in Brazil, where I have passed through numerous university and research institutions, I always learn more than I teach. On the other hand, researching in Brazil is a constant challenge, where there are generations of talented

young people who want to break new ground. Brazilians are passionate about their work, sometimes, in my laboratory, it is the more emotional component that has to be worked on so that reason and resilience can also have space in the future researcher. The rest happens naturally. To have today former students' successful researchers, where I am a partner in their research projects funded by CNPq, or by FAPs, is an immense pride.... for a grassroots biologist, as I am, let me use the analogy of seeing the "seed germinating" and making its way. It is also seeing inter-generational replacement as natural and me being the first, and unconditional, admirer and facilitator of these new generations.

**4. Your work in relation to food mycology and the preservation of microbial resources in collections is recognized worldwide, which can be illustrated by your time as chair of the European Culture Collections Organization (ECCO) and your role in the implementation of MIRRI (www.mirri.org) as a European research infrastructure for microbial resources. Tell us a bit about recent advances in this vast field and what do you envision for the future in these areas. If one of our readers were interested in these areas, what would be the "hot" topics that you suggest for research in the coming decades?**

Prof. Nelson: Starting with microbial culture collections, they play a fundamental role for the basis of microbiological knowledge. It is not by chance that, right at the first steps of this new science, in parallel with the work of Pasteur, Kock and Lister, we found the emergence of collections, some of which have reached us, such as the CIP/Collection of the Pasteur Institute or the first service collection that we know of, founded by Frantisek Král around 1890 in Prague, which later ended up disappearing. However today we have centenary collections where, for example, we have the isolates of Bacterium coli commune studied by Theodor Escherich and referred to in his 1886 book and its first isolate is still deposited in the UK at the National Collection of Type Cultures (strain NCTC 86) under the current name of *Escherichia coli*. All this material is extremely relevant for its study and its potential biotechnological applications. For this reason, microbiological collections have gained increasing recognition as

irreplaceable collections of resources and information. At the European level, the MIRRI research infrastructure results from the valorization of these resources for the future of life sciences, health, food and agriculture, and the environment. In this perspective, the role of food mycology is also a focus of great importance, since food degradation by these microorganisms does not allow many foods to reach their recipients, which poses serious food safety problems in parallel with the growing demand caused by the continuous increase of the world human population. This will certainly be a hot area which is how to ensure food for all, eradicating hunger, without further degrading/destroying the still existing natural habitats. Much will have to be researched to find innovative solutions, and micro-organisms will certainly play a central role in such research.

**5. Your career has also shown your interest in education, from early childhood to teacher training. What are the challenges for this area that you see from your privileged view of the world? Also tell us a little about these challenges for Portugal and Brazil in your perception?**

Prof. Nelson: As a university teacher trained in the teaching of biology and geology, I have always been interested in science didactics and the various disciplines of psychopedagogy. For, first and foremost, teaching at university is very important, but so is educating and teaching in kindergartens and primary schools. The quality of these educational processes are the foundations for the citizens of tomorrow that every society wants to have. Hence my dedication to the educational and teaching processes in infancy and childhood. Didactics is a challenge in this field, but for me, it only makes sense if the person who teaches has a solid background in the content they teach. In other words, the educator is the first to need training, to consolidate and analyze his teaching-learning proposals and, from a true reflection of meta-analysis and gain of self-confidence about his self-training process, be able to successfully integrate in the classroom context what he intends and how he intends to teach. In my perception of teacher training and didactics for the teaching of science and microbiology, I think that the starting point will always

be excellence in training and mastery of the contents that will later be transposed into multiple didactic strategies. For this to happen, the teaching process will have to change immensely, placing the student at the center of the learning process through new methods and the use of new digital, information and communication tools and the teacher as a mentor or guide of these processes. The teacher, besides having to be deeply valued socially, should have time to prepare and innovate their classes (or their educational projects) and for their own training throughout their professional life.

**6. Another aspect of your career that draws attention, is your high scientific productivity, with many high-level publications, communications at conferences and as an evaluator and member of editorial boards of several international journals. Give some tips to our readers regarding academic production, which can help beginning researchers who want to achieve this quality scientific productivity.**

Prof. Nelson: To this question I feel like telling the reader, or the young researcher, that there are no tips. Scientific productivity for me has never been my focus or my starting point. I always set out to research to solve questions. I was never concerned with the scientific paper. So at the beginning of my academic life, and even after I got my PhD, I am not very productive. Later, with the accumulation of experience, of the teams I was involved in and that I built, the results started to make sense and then they were published. Even today, nothing is published without rigorous discussion and scrutiny by me. Integrity in science and rigor in the scientific data obtained are for me inalienable points. Perhaps the coherence and consistency in the theoretical corpus used throughout my academic career allowed me to accumulate knowledge that ended up in this "high" scientific productivity. Above all, I did research because I believed in the questions and the methods used, even when everything around me seemed to be a desert and, at the end of the day, the fall off the cliff was evident. Believing in what we are doing and having a cohesive team as a support network I think is the "tip".

**7. Looking at your curriculum you have worked with researchers not only from Brazil, but from various parts of the world. Tell us a little about the difficulties and advantages of these partnerships and, once again, tell our readers about the ways to participate in this type of international collaboration.**

Prof. Nelson: I have always seen science as global and scientific knowledge as democratic. Maybe today this statement is even mild because societies, and the ordinary citizen, have already understood that our common home is also global, and that knowledge is very accessible on our mobile phone or tablet. But when I started my academic career, in the mid-80s of the last century, this was not the perception. Partnerships are made strategically and with partners that, over the years, we will jointly evolve in the projects and research we collectively carry out. They are my peers par excellence. Sometimes partnerships exist in a more opportunistic way, based on the circumstance of the moment and the joint will to solve a problem. We know the importance of both approaches, but I give much more priority to the first and to the complementarities in skills and capabilities (technologies) that each one offers. That is why I have had partnerships for many years, both in Brazil and at European and international level. Those who know me know that I call these partners "my contemporaries", but it is with them that I allow myself to dream, implement and progress with our research. For that, trust, credibility, rigor, diplomacy, including a great sensitivity to multiculturalism and inclusion, and complementarities in knowledge and technologies associated to the mastery of the English language will be some strong points for the success of these international collaborations. Perhaps what I have just mentioned can be, in part, syncopated with the concept of what a "scientific community" is in a given area of knowledge.

**8. Tell us a little about your studies at the Mycotheca of the University of Minho and at the Centre for Biological Engineering. If any of our young readers were interested in doing a Master's or PhD at these centers, what would be the pathways? What do you suggest about the themes that should stand out in the upcoming years?**

Prof. Nelson: The Mycoto Library of the University of Minho (MUM) has as its mission to be a resource

center for the preservation of fungal diversity and its information, and to create solutions for sustainable development and the well-being of mankind. This collection is certified in the ISO 9001 system and has an assumed quality policy that emerges from the vision defined for the organization: a world where fungal diversity is preserved and available for all. It is based on stimulating the motivation and involvement of all interested parties in the processes relating to quality, with a view to internalizing a culture of excellence applied to all products and services. In this process, continuous assessment is seen as an element of continuous improvement that enables the degree of achievement of MUM's mission to be increased. In this sense, MUM provides services to its user communities and develops state-of-the-art research for the preservation, identification/classification, and supply of fungal diversity. It thus brings together classical knowledge with the most advanced identification/classification techniques. The description of new fungal species for science is a good result of this research strategy. These research lines are not exhausted within the applied mycology group, as we research environmental, food and clinical problems, as well as in the CEB, which is a research center evaluated as excellent in which there is a multitude of research lines ranging from the most fundamental to the most applied in the various engineering sciences and biotechnologies. Naturally, within the microbial diversity, the topics of microbiomes associated with new culturomic techniques are currently paths of great repercussion, since they open innovative solutions in terms of environmental remediation and ecosystem recovery, unprecedented agricultural productivity (e.g., biofertilizers and biopesticides), or even, to a personalized medicine.

**9. Complementing the previous question, if one of these Brazilian students wanted to be your Masters or PhD student, what characteristics do you think that are fundamental? What skills would you suggest they develop?**

Prof. Nelson: I would start by agreeing that more than a solid scientific knowledge in a certain area of knowledge, skills, or "soft-skills", are today of extreme

importance to integrate a research team. I would start with integrity, not only of character, but also in relation to the results obtained in the research, good capacity to work in a team, good interpersonal communication skills, including good understanding of the English language, autonomous capacity, including problem solving, and a well-developed critical sense. Creativity and a solid planning background and, finally, having high motivation to execute your postgraduate project. These are the skills I would suggest to be worked on.

**10. Finally, we are going through a moment of deep cuts in the funding of scientific research in Brazil, in addition to the employment crisis in many Brazilian universities, send us a message of encouragement to teaching and research for Brazilian students, researchers and teachers.**

Prof. Nelson: The economic and employment crises are cyclical and, in one way or another, will impact in all countries the funds released for research and, certainly, compromising scientific employment. The most important thing is to know whether the scientific and technological systems in each country have reached such a maturity that, even in a crisis phase, they are sustained and, even in a counter-cycle, they are strengthened. It is often in these phases, when everything seems stagnant, or even collapsing, that institutions and research groups seek more creative solutions to overcome external difficulties. For example, areas and groups that used to live in real silos, often with a high degree of redundancy and waste of resources, come together in a virtuous way to the point of creating networks of complementarities and collaborations making a more cost-effective management of resources and with great gains in the mobility of their researchers. The focus on mobility, complementarities, management of resources and installed capacities, the opening of laboratories to other teams and the search for sources of funding closer to the local, regional or international social, economic and business fabric will lead to research management and funding models with greater potential for return and social impact. Crises are moments for discomfort and to abandon chronic silos and ankyloses and rethink new strategies in an

open and innovative way, and certainly more enriching and resilient in the near future. Leaving the comfort zone and taking advantage of crises to make qualitative leaps is a challenge for all of us who do science. An opportunity to do differently and with innovation using the best-equipped human capital for these desiderata.