

Psychedelics

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INNOVATORS & IDEAS: RISING STAR

Katarina Leão: Links between the auditory and limbic systems, with a focus on the effects of unconventional novel treatment options, such as psychedelics and cannabis extract

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Katarina E. Leão, PhD, is an associate professor at the Brain Institute at the Federal University of Rio Grande do Norte, Natal, Brazil. She is vice-coordinator of the postgraduate program in neuroscience (2013–2017 and 2023 – current) and spent 2020 as a visiting professor at the Karolinska Institute/Uppsala University, Sweden. She is head of the Hearing and Neuronal activity lab researching neuronal mechanisms of noise-induced tinnitus and tinnitus-related anxiety. Dr. Leão recently joined the ongoing interview series by Genomic Press, discussing her professional endeavors and personal experiences.

The Genomic Press Interview Part 1: Katarina Leão – Life and career

Could you kindly offer a glimpse into your personal history, emphasizing the pivotal moments that first kindled your passion for science?

I grew up in a small steel factory town in Sweden, in a non-academic family. I worked as a nanny in South Carolina, USA, straight after high school to improve my English. In 1999 I started studying Pharmaceutical Bio-science at Gothenburg University, Sweden, convinced I wanted to work in the pharmaceutical industry. Having developed preclinical studies for my master project, I had an opportunity to do my final project abroad and by stitching together several travels grants I managed to make it to Australia. Here I aimed to visit my aunt and cousins living in Canberra, and thereby applied to the John Curtin School of Medical Research (JCSMR), at the Australian National University (ANU). The two main research lines at that institute were immunology and neuroscience, and knowing both were competitive, I opted for neuroscience. This was a strike of sheer luck as I ended up in a world renown neuroscience department, with particularly strength in whole-cell patch clamp electrophysiology being applied by almost every lab there. In this dynamic and very social research environment, I fell in love with neuroscience and specifically ion channels and action potentials. Here is also where I became friends with a group of Brazilians.

We would like to know more about your career trajectory, leading up to your most relevant position. What defining moments channeled you toward that responsibility?

I carried out my PhD in the lab of Professor Bruce Walmsley at JCSMR, ANU, Australia, studying membrane properties of brainstem neurons from deaf and sound stimulated mice. Returning to Sweden in 2007, I gave up on the pharmaceutical industry plan, but had bureaucratic issues for getting a postdoc stipend as a Swede. Finally, I ended up at Uppsala University, in a lab producing different transgenic mice lines for studying spinal cord circuits. This was a humbling experience as I knew close to nothing about genetic engineering and spinal cord physiology. However, the lab of Dr Klas Kullander was well funded and I convinced the PI that they needed



Figure 1. Katarina Leão, PhD, Universidade Federal do Rio Grande do Norte, Brazil.

to add electrophysiology as a core technique and was then entrusted to order equipment and assembled their first patch clamp rig. The lab developed more transgenic lines than they had time to test but one caught my attention, the *Chrna2-cre* mouse (now considered one of the most specific cre-lines in neuroscience). This led to collaborative work together with my then Brazilian husband, studying a particular hippocampal interneuron, and a publication in *Nature Neuroscience*. After years as a postdoc, I heard about the international neuroscience institute recently established in Natal, Brazil, and the chance of getting tenured positions. With some hard work this became reality in 2013. To have job stability as the industry usually provide, and being able to do basic research on my terms without paying for lab space, is a dream come true, actually more than I had dared to hope as a young female PhD student. Now I am proud to be one of four female PIs at the Brain institute, UFRN, Natal, and I enjoy living in a tropical, sunny climate.





Please share with us what initially piqued your interest in your favorite area of research or professional focus.

My fundamental research interest is neuronal excitability and how it is dynamically shaped by distinct voltage-gated ion channels regulated by genes and sensory experiences. Specifically, my last project as a PhD student has shaped my research interest, seeing how sound presented for just one hour, dramatically changed gradients of ion channels in circuits of sound localization. This showed me how plastic the brain is, where just increased activity for one hour triggered distinct c-Fos activity and reorganization of certain voltage-gated ion channels. As PI I returned to the auditory field, focusing on the challenging question of mechanisms behind perception of noise-induced tinnitus. Here, I carry with me my post-doc experiences of working with transgenic animals and hippocampal electrophysiology both in vitro and in vivo.

What kind of impact do you hope to achieve in your field through your focus on your specific research topics?

Specifically, I hope to contribute towards treatments of tinnitus and tinnitus-related anxiety. I study tinnitus without concurrent hearing loss, often occurring in younger individuals and causing a life-long negative impact on their quality of life due to increased stress and anxiety. I strive to increase the level of detail in this field by identifying variations in subtypes of neurons, specific ion channel perturbations, and alterations of genes in specific areas. As I have worked in several anatomical areas, with different cell types, I can often draw useful parallels from other fields, leading to new ways of thinking.

Could you tell us more about your current scholarly focal points within your chosen field of science?

My research focus is on the mechanisms of perception of noise-induced tinnitus in a mouse model. Here we implement genetic tools and investigating links between the auditory and limbic systems by studying the impact of loud noise on cortical neurons and also on hippocampal circuits. As noise-induced tinnitus is highly correlated to anxiety and stress, this is also something we investigate looking at genetics, electrophysiology and behavior, and also examining the effects of unconventional novel treatment options, such as psychedelics and cannabis extract.

What habits and values did you develop during your academic studies or subsequent postdoctoral experiences, that you uphold within your own research environment?

We have weekly journal clubs, taking turn presenting current topics, often using the journal club to collectively tackle methodologically complex papers. I speak mostly English in the lab to teach students the global scientific language. We collaborate and help each other, and celebrate publications with cake and sparkling wine, all according to my PhD experience.

At Genomic Press, we prioritize fostering research endeavors based solely on their inherent merit, uninfluenced by geography or the researchers' personal or demographic traits. Are there particular cultural facets within the scientific community that you think warrant transformative scrutiny, or is there a cause within science that deeply stirs your passions?

This is a topic I have interest in and have given talks about. For example, I believe women need to be mentored into leading positions in science, and locally women need to support other women in science in a more outspoken manner. The recognition of maternity leave in the CV is a small but crucial step towards accounting for lost years in science when applying for competing positions with men. Cultural diversity in science needs to be urgently increased, at grass root levels, with direct incentives. Removing or decreasing publishing fees for a larger group of developing countries is also fundamental for equal opportunities.

What do you most enjoy in your capacity as someone deeply engaged in academic and research activities?

I enjoy seeing the transformation of students into researchers, see them overcoming struggles, and gaining academic success. I am particularly happy when I can help students towards international travel grants where

they can partake in neuroscience courses and conferences, networking by making new friends, and at the same time see the world. I had the luck of travelling considerably during my academic trajectory and now I try to pay it forward. More so, I enjoy it when projects reach the point of becoming manuscripts with complex figures. It gives me closure and a sense of organization in the otherwise often complex and surprising world of basic research.

Outside professional confines, how do you prefer to allocate your leisure moments, or conversely, in what manner would you envision spending these moments given a choice?

I love spending time with my kids and friends, having everyone's kids around playing in the pool, while enjoying heartfelt conversations. I also love to travel to/with my boyfriend and going out to small street-side bars and listen to music.

The Genomic Press Interview Part 2: Katarina Leão – Selected questions from the Proust Questionnaire¹

What is your idea of perfect happiness?

Having a loving family and lots of friends, living in a comfortable home, having a secure and interesting job in science and living in a democracy that cares for its citizens and the environment.

What is your greatest fear?

Brazilian bureaucracy! No, that was a joke. I actually respect it, and it has taught me patience and provided me with a greater understanding of this large country that I live in and love.

Which living person do you most admire?

My parents. My dad is a rare mix of water purity expert, dyslexic, diving instructor, sonar inventor, car mechanic, yoga instructor, hunter and carpenter. I kind of grew up with MacGyver as my dad, and a mum with green thumbs making the house and garden full of exotic plants, and always with time to bake breads and cakes, despite having 3 kids, as my dad was kept busy by his activities.

What is your greatest extravagance?

I am a bit fearless and constantly push my comfort zone, not always voluntarily so, but usually things work out in the end. I think growing up in a safe and stable home in a small town gave me core resilience, and traveling while young made me brave.

What are you most proud of?

My kids.

What is your greatest regret?

I have few regrets as I believe all experiences teach us something useful. Perhaps I regret not going to the electrophysiology course at Stradbroke Island, Australia, as a PhD student. I think it would have liked it a lot, but then I thought it was too late to go as a second year PhD student. Little did I know then that science is a constant learning.

¹In the late nineteenth century various questionnaires were a popular diversion designed to discover new things about old friends. What is now known as the 35-question Proust Questionnaire became famous after Marcel Proust's answers to these questions were found and published posthumously. Proust answered the questions twice, at ages 14 and 20. Multiple other historical and contemporary figures have answered the Proust Questionnaire, such as Oscar Wilde, Karl Marx, Arthur Conan Doyle, Stéphane Mallarmé, Paul Cézanne, Martin Boucher, Hugh Jackman, David Bowie, and Zendaya. The Proust Questionnaire is often used to interview celebrities: the idea is that by answering these questions an individual will reveal his or her true nature. We have condensed the Proust Questionnaire by reducing the number of questions and slightly rewording some. These curated questions provide insights into the individual's inner world, ranging from notions of happiness and fear to aspirations and inspirations.

**What is the quality you most admire in people?**

Kindness and open-mindedness.

What do you consider the most overrated virtue?

If you had high grades in school as a kid. Paradoxically, it is often those who achieve moderate grades, rather than stellar ones, who reach the zenith of their professional journeys.

What is your favorite occupation?

Scientist and teacher.

Where would you most like to live?

By the ocean in a not too big city.

What is your most treasured possession?

Not sure I have one, but perhaps speakers and headphones of good quality. I love music and I need good quality sound.

When and where were you happiest? And why were so happy then?

I guess I am happy now. Life is a journey full of adventures, but to feel loved and secure, with a permanent university position, makes me very happy.

What is your most marked characteristic?

Organized.

Among your talents, which one do you think gives you a competitive edge?

I would say the combination of a mixed scientific background, enjoying reading papers, having good collaborations and that I am organized.

What is a personality/characteristic trait you wish you had?

Charisma as a public speaker.

What do you consider your greatest achievement?

Publishing our research with cutting edge techniques in high impact journals while planning and waiting for our current institute being built. In the first 8 years (that was supposed to be 4 years) we were in a suboptimal rented institute with limited research space; we even had to use bathroom space to fit equipment. Luckily, the spirit of all researchers was high and students worked hard, doing shifts to use equipment and sharing desk space. I am very proud of being part of the Brain institute of today and to be based in the building that we designed according to the highest of international standards.

What do you most value in your friends?

Sincere conversations and our wine-night gatherings.

Who are your favorite writers?

Salman Rushdie, William Gibson, Douglas Adams, Becky Chambers to mention a few.

Who are your heroes of fiction?

Lisbeth Salander in the Millennium trilogy books is a great fictional hero.

Who are your heroes in real life?

Dr Kerstin Schmidt, leading our institute, Greta Thunberg for being so prominent in the worldwide movement on ways of decreasing global warming.

What aphorism or motto best encapsulates your life philosophy?

"Show me, don't tell me." This applies to me as a supervisor as well as to my students.

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