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Member Spotlight

Frances Separovic



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University of Melbourne

Frances Separovic is the Distinguished Professor Emeritus of Chemistry and Deputy Director of the Bio21 Institute at the University of Melbourne. She has held honorary appointments at Harvard University, Oxford University, UCSD, CNRS - Université Bordeaux, the University of Southampton, and the University of London. She also serves as the Foreign Secretary of the Australia Academy of Science, with an extensive track record of international leadership. Dr. Separovic leads a research program that has long integrated rapidly advancing solid-state NMR methods, some developed in her lab, with studies of membranes and membrane proteins. She has published over 250 papers. Among her many honors Dr Separovic is an Officer of the Order of Australia, a Fellow of the Biophysical Society, an ISMAR Fellow, an IUPAC Distinguished Woman of Chemistry, winner of the ANZMAG medal and the ASB Robertson Medal, and a member of the Australian Academy of Science. Read more about Dr. Separovic and access some of her previous interviews [here](#).

CS: Dr. Separovic, thanks for agreeing to chat! Since we have known each other a long time I hope it is OK if I take the liberty of calling you by your first name. I have to confess that I had no idea just how many times you have been interviewed till I started to prepare for this one! I'm going to try to avoid asking the same questions you have been asked previously, but do want to encourage our readers to check out some of your previous interviews at the link above.

Here's my first question. While you were born in Croatia, you grew up in a mining town in New South Wales, Australia: Broken Hill. I looked it up on a color-coded map and see that it is in an isolated part of NSW completely engulfed in the tan-colored part of the map (no green in sight), suggesting a desert climate. This calls to my mind songs by the great Aussie band Midnight Oil, "Blue Sky Mine" and "Poets and Slaves" that evoke a harsh mining town existence, even when listened to half a world away. Did Broken Hill seem like a tough place to you when you were growing up and were you aware of just how hard your folks (a miner and a house-cleaner) must have been working to lay the foundation for a better life for your family?

FS: Thank you Chuck – I am chuffed that you're aware of Broken Hill's links to musical royalty and, yes, the Silver City does feature in a number of musical videos, but 'Blue Sky Mine' refers to the Wittenoom asbestos mine in Western Australia. David Bowie's 'Let's Dance' video was shot in a pub in outback Australia, which is also reminiscent. Films that feature Broken Hill include *Wake in Fright* (1971), *Mad Max 2* (1981) and, of course, *The Adventures of Priscilla, Queen of the Desert* (1994). My family actually lived in the area where *Buckley's Chance* (2021) was filmed. I grew to love the desert but if it

rained, it was celebrated. Two people close to my family were killed in mining accidents in 1966. Whenever the mine sirens sounded you could hear them in the classroom, and you hoped it was not your dad. So, yes, my impression was that earning a living was very hard in this harsh environment.

CS: You did a radio interview where you mentioned that you read every single book in the Alma Primary School library. I love it! Never estimate the value of libraries! You also mentioned a family friend there in Broken Hill, "Aunty Myra," who intervened to make sure that you went to school when you reached the right age because your family were unable to speak English. Did she continue to be an important person in your life growing up?

FS: Aunty Myra was no relation but lived two houses away from us in the 1950s. She taught me to speak English (and read at the same time) using The Australian Women's Weekly. I did not realize at the time what a strong foundation this women's magazine gave me, but it did instill in me a desire to understand. Aunty Myra also went to parent-teacher night and encouraged me to learn. When I was elected to the Australian Academy of Science, I asked her daughter Adele to come to the induction, as Aunty Myra had died and I included her in my acknowledgements.

CS: You initially dropped out of the University of Sydney and went to work at CSIRO, working as a tech doing food-related studies. Around that same time you discovered you really liked physics and wanted to do research. You also gave birth to your son. This led to what I think is an amazing 18 years where you continued to work full-time at CSIRO while you completed undergraduate studies in math and physics at Macquarie University and PhD studies in physics at the University of New South Wales. I can't imagine the willpower it must have taken to reach the finish line of that long itinerary! Did you have good mentors to help you through those years? And, if you don't mind my asking, is your son a scientist?

FS: At the time I did not realize that I had mentors, but I was encouraged to better myself, and the primary motivation was a better life for my son. Education led to promotion, which led to a pay rise, and I dreamed of one day being able to earn the average wage. But the more I learnt, the more I enjoyed learning – a vicious circle, culminating in a PhD for the joy of it. By that time, I appreciated the mentorship of people like Bruce Cornell and Jack Middlehurst at CSIRO, who encouraged me to do research and reach my potential. My son thought he was a scientist at four – he used to help me manually tune the NMR probes – but wanted to be a policeman. He ended up being an AV tech for several years, but in his last job drove a forklift during COVID19 lockdown and was designated an essential worker, unlike his mother.

CS: I recall first meeting you in the early 1990s (was it at a Biophysical Society, BPS, meeting?) and being intrigued by your work with Bruce Cornell and Ross Smith on oriented sample solid-state NMR of gramicidin and other proteins in lipid bilayers. I also thought you were a really nice person. I now realize that this work from that era was based out of CSIRO. Was your CSIRO research formally linked to your PhD research?

FS: I recall thinking you were a nice guy, too! Remember I lent you some melittin for your 1995 bicelle paper? My first BPS meeting was San Francisco in 1986, and I had to pay my own way as it was not related to my work at CSIRO. So rather than take holidays, I tended to save up for my annual pilgrimage to BPS. As I had started doing NMR at CSIRO, I decided to do a more theoretically based PhD project, on an irreducible tensor representation for NMR, some of which was applied to the structure analysis of peptides oriented in phospholipid bilayers.

CS: I remain grateful for that melittin sample! After you completed your postdoctoral studies at the US NIH with Klaus Gawrisch you completed your long service to CSIRO and became the first female Associate Professor in chemistry at the University of Melbourne, where you later made your way all the way up to the top of the ladder. From your other interviews I understand that you sometimes faced appalling misogyny earlier in your career along with a host of microaggressions. We know this remains by no means unusual for women pursuing careers in STEM. You have a long and decorated track record of advocating for the advancement of woman in science. I am curious how you view the current scientific culture there in Australia from an equity perspective? Do you think the societal stress of COVID19 and other factors have recently taken a toll on progress? Or are you more hopeful now than ever?

FS: Actually, I am more hopeful than ever, but we need to remain vigilant. Once upon a time I was focused on gender equity and, as I have seen it improve, now pay more attention to inclusion and embracing diversity in other forms. I am concerned about how polarized we tend to be in our opinions and the lack of respect towards those with whom we disagree. COVID19 has placed additional stress on those with carer roles and

we need to show our appreciation and value for the work they do. I am also concerned that despite embracing diversity, what often seems to matter is where you publish more than the quality of the work.

CS: On multiple occasions you have cited statistics showing that while the scientific training pipeline is sometimes now fairly well gender-balanced (depending on field of science), that there is typically a large drop in the percentage of women who then go on to pursue faculty careers. Can you suggest a couple of actions or policies that research universities can implement that might help address this attrition?

FS: Many of the issues are societal but to put it simply: appoint women. As the work force diversifies, so will the culture, and for too long it has been a monoculture at research-intensive universities. As head of department I saw how a mixed group enriched and informed the table, and we need at least 30% women at the table. Academia needs to bring in measures to ensure that it happens. I am so tired of committees that are unable to distinguish between candidates and then choosing the one that is most like themselves.

CS: You are a long-time expert in solid state NMR as applied to membranes, membrane proteins, and membrane-interacting proteins such as amyloid-beta. This is a technical area that, once upon a time, I used to follow closely. Nevertheless, even from a casual observer's perspective it seems like solid-state NMR has really taken off as a tool for biological problem-solving in recent years. I know that one of your dreams is to use these methods, including dynamic nuclear polarization, to conduct NMR of antimicrobial peptides (AMPs) doing their thing in the membranes of living bacteria. How's that project coming along? Any recent developments you are especially excited about?

FS: I am especially excited about the possibility of being able to study AMPs in-cell. These peptides often have very different conformations in different environments and I'd like to study them in action. DNP is usually done at low temperature but I'd like to see it develop further at ambient temperatures, where the molecules are more mobile. I know it won't be me doing it but am pleased to have helped others make it happen. Like most researchers, I cry poor, but it's always been hard to fund what I want to do, so instead have made suggestions for those with more resources to pursue.

CS: Can I also ask about what the latest is with studies of membrane-active antimicrobial polypeptides? What's the latest on their clinical use?

FS: With the increase in the number of antibiotic resistant, there is renewed interest in AMPs. Although several AMPs have been clinically investigated, very few have been approved by FDA as antimicrobials since gramicidin and polymyxin B (as constituents of Neosporin®) in 1955, colistin (polymyxin E) in 1962 and daptomycin in 2003. The combination of AMPs with conventional antibiotics or other compounds, however, may result in an improved antimicrobial effect in clinical trials.

CS: You now are deputy director of the Bio21 Institute at the University of Melbourne. Can you tell us a little bit about this Institute?

FS: The Bio21 Institute of Molecular Science and Biotechnology, or Bio21 Institute, is based at the University of Melbourne and is a molecular science and biotechnology research institute. It is home to almost 800 scientists, equipped with modern instrumentation platforms, working together to improve human health and the environment through multidisciplinary research and dynamic interactions with industry. It includes a business incubator and industry centre and ~100 scientists from CSL Limited, an Australian-based global biotechnology company work at Bio21, which also add value to working at Bio21.

CS: You are very devoted to serving the scientific community, with one example (among many!) being your leadership of the Biophysical Society (now as past-president following a year as president, a previous stint as secretary, and as a member of Council). You also have served in a series of leadership positions at the University of Melbourne. Do you have any advice for early or mid-career scientists about determining when the time is ripe to take on serious service responsibilities and how to determine which opportunities to serve are worthwhile?

FS: I'm still trying to learn to say no but find it difficult because I find you learn so much by doing something different. Although others will disagree, I think it's important to start early: it not only increases your visibility but shows that you are keen – choose the level and time commitment that suits you and something that you value. Yes, there were some committees I chose not to rejoin and others that I enjoyed, e.g. I loved

scholarships and seeing the immediate difference they made to our students, but I always tried to fulfill my obligations.

CS: You have been involved in organizing over 45 scientific conferences in your career. This included planning editions of the long-running Lorne Proteins Conference series held on Victoria's "Surf Coast," west of Melbourne, which I have had the privilege of attending. The Protein Society is very proud to have an annual speaker exchange program between our Annual Symposium and the Lorne meeting. Lorne is a magical place and it is an outstanding conference series. I think every protein scientist in the world should consider making a pilgrimage to attend an edition of this meeting! Obviously, holding this conference in Lorne may be one of the factors behind the success of this conference. Any thoughts on other factors?

FS: Once upon a time there was only one woman on the organizing committee and then she invited me who then invited ... This made us very conscious of diversity and we pushed for it not only in the participants but also in the topics covered. It kept us on our toes and led to an even more stimulating environment.

CS: I have noted that the Lorne Conference and other events in Australia are now sometimes prefaced by disclaimers that they are being held on land that was historically was held by the native Australian aborigines. I am curious when this practice became common and what sort of related discussion there has been about this in broader society?

FS: I'm not sure but I do recall the first time I organized an international meeting many years ago and we decided to have an indigenous welcome and ceremony. I was a bit nervous at first thinking that the overseas visitors would not appreciate it. We all found it very moving and decided to do it again and now it's part of most opening ceremonies. Only Traditional Owners or Custodians of the land on which the event takes place can deliver a Welcome to Country. In parliament it was first started in 2008. An Acknowledgement of Country is usually delivered as part of the welcome at meetings and events and shows respect by upholding Aboriginal and Torres Strait Islander cultural protocols.

CS: I noted with interest that you really like the song "Bulls on Parade" by Rage Against the Machine. That's a pretty intense song. And then there is also your stated dream to drive a road train across the Nullarbor Plain in arid south Australia. And you mentioned that parts of the Mad Max (Road Warrior) movie series were filmed near Broken Hill. If the Mad Max writers are looking for a premise on which to base their next movie, I think I may have an idea...

FS: Agreed - we could take the premise of a road train, equipped with outmoded NMR instruments, searching the Nullarbor for water in a post-apocalyptic world. The NMR magnets are equipped with surface coils and achieve resonance when they sense below ground water. The soundtrack will feature 'Killing in the Name', which I replaced with 'Bulls on Parade' for the radio interview as it was considered a bit risqué. I'll do a cameo role as a petite Tina Turner and you can accompany me on ukulele.

CS: Ha! Finally, would you rather be a lipid or a membrane protein?

FS: I see myself more as a chorus member rather than a star, so I'd choose to be phospholipid so the membrane protein can work better with me around.

CS: Thanks so much Frances for taking the time for us! We are truly honored.

FS: Thanks Chuck, see you around.