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Organization

# Exploring the epigenetics of resilience

To do good science, we need to include diverse perspectives, work across disciplines and think outside the box while reminding ourselves that our goal as scientists is to serve humanity. I am sharing my story to encourage others to trust their gut feelings and to have the courage to see what everyone sees, but think what no one has thought.

I am a genetics researcher focusing on Circassian and Chechen ethnic populations, with an emphasis on building community trust. I conducted my PhD research as a Fulbright student at the University of Iowa in the United States. My passion for science was what motivated me to study to become a scientist, even after being married and having four children. Today, I am a full professor of molecular cell biology at Hashemite University in Jordan.

My hands-on experience working with different populations led me to pursue a project, along with Catherine Panter-Brick from Yale University, assessing a psychosocial intervention for stress alleviation in Syrian refugee and Jordanian children implemented by the international non-government organization (INGO) Mercy Corps. We aimed to assess biomarkers associated with stress (such as the hormone cortisol), immunological markers of stress and certain stress-associated genes (such as *MOAO*), along with DNA methylation patterns. This study involved working as part of a cross-disciplinary team spanning genetics, mental health and public health. As such, while working on this project, I was introduced to mental health research, including the study of stress, trauma and resilience<sup>1-7</sup>. The level of reading and learning required to gain expertise in this new field felt to me like I was doing another PhD. However, the really great thing was that, because I was coming into this field naive, I had a license to ask questions that made the seasoned scientists review their own assumptions. This, to me, is why interdisciplinarity is important: there needs to be diversity to allow different perspectives that not only enrich the research but also allow innovation and creativity, leading to better science.

As I was reflecting on the different aspects of this research project, I had an

inspiration. I am half-Syrian myself, and I have met many survivors of trauma and war, including relatives who lived through years of oppression under the Syrian regime. The question of how trauma affects subsequent generations has always interested me. Combining my expertise in genetics with my community connections, I had at my fingertips an opportunity to test the concept of inheritance of epigenetic markers across generations, which is still a contested issue and is of personal interest to me.

I knew that there was a massacre in the Syrian city of Hama in 1980. Hundreds of thousands were killed or imprisoned or forced to flee, including my own relatives, who had slept in our house in Amman. I wanted to know if pregnant mothers exposed to trauma in the 1980 massacre had an epigenetic signature that could be transmitted to their daughters and granddaughters. By virtue of being from this community and being aware of the history, I was able to recruit a suitable cohort to explore this question. Leveraging the strengths of interdisciplinary research, I established collaborations with Catherine Panter-Brick as a mental health expert to assess behavioral change, and Connie Mulligan and Alexandra Binder to assist with the epigenetic analysis, as we do not have the facilities to conduct epigenetic analysis in Jordan. We are currently analyzing the data, and we hope to be able to share results soon.

One important thing that I insisted upon for this project is that the analyses not only explore how people were negatively impacted by trauma, but also how they survived and thrived; I wanted to look at the positive side as well. How was resilience fostered, and was there an epigenetic pattern that correlated with resilience? At first, this positive lens was met with resistance. Many were against it because they were afraid that someone would use our research

to celebrate trauma with claims that it improves resilience. As a scientist, I think we need to be objective and study all aspects. If there is a concern about how our research will be perceived or used, then we need to be careful in how we present the results and interpret the data, but we should not stop doing the science altogether.

Now, fast forward to a few years later, and a paper<sup>8</sup> proposing a model for an epigenetic role in psychological resilience has been published, speaking precisely to what I had suggested, and what was met with opposition by some of my colleagues years before. This, to me, was a testament to the value of believing in my gut feeling and not taking no for an answer. After all, isn't that how most cutting-edge science happens?

This fresh perspective of taking a positive view to help humanity is much needed in today's world, which has been rocked by the COVID-19 pandemic. I am hopeful that our work on epigenetics and resilience will have an impact in the future on understanding mechanisms of human development and disease to enable better prevention and therapeutic interventions. □

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## Competing interests

The author declares no competing interests.