

## INNOVATORS &amp; IDEAS: RISING STAR

## Munir Gunes Kutlu: Exploring the neural mechanisms of learning and social behaviors – A scientist's journey and perspective

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**Dr. Munir "Gunes" Kutlu, Assistant Professor at the Center for Substance Abuse Research (CSAR) and the Department of Neural Sciences at Temple University Lewis Katz School of Medicine, investigates the neural mechanisms underlying associative learning, mainly focusing on reward, fear, and social interaction. Drawing from his computational neuroscience training at Duke University and postdoctoral work at Temple and Vanderbilt Universities, Dr. Kutlu combines systems neuroscience, computational approaches, and behavioral analysis to understand how our brains process environmental associations and how these processes can become maladaptive in disease states. His laboratory, dedicated to "bridging the brain-behavior gap," fosters a collaborative environment that nurtures the next generation of neuroscientists while pursuing innovative neural circuit analysis approaches in reward and aversive learning contexts. In this Genomic Press interview, Dr. Kutlu shares his insights on these fascinating aspects of behavioral neuroscience and his laboratory's mission to advance our understanding of neural circuit function in health and disease.**

### Part 1: Munir Gunes Kutlu – Life and Career

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

I grew up with a natural curiosity about how things work, but my true passion for science was ignited during my undergraduate studies when I took my first neuroscience course. There, I was fascinated by the complexities of the brain and the potential to understand behaviors through neural mechanisms. Each step of my journey, from obtaining my Ph.D. through my postdoctoral training to starting my own lab, has been fueled by a desire to uncover how the brain drives behavior. I conducted my first research project on understanding learning mechanisms in humans. This experience showed me the power of combining behavioral analysis with computational modeling, shaping my future research path toward understanding the neural circuits underlying learning and memory.

**We would like to know more about your career trajectory leading up to your current role. What defining moments channeled you toward this opportunity?**

I grew up in Istanbul, Turkiye, where I received my bachelor's degree in psychology at Bilgi University. At Bilgi, I conducted a thesis project on the mathematical models of associative learning as an undergraduate. Following my interest in the theory, I did my Ph.D. at Duke University under my mentor, Dr. Nestor Schmajuk, studying the theory and computational models of learning and memory. The second pivotal moment in my career was my postdoctoral training under Dr. Erin Calipari at Vanderbilt University, where I was trained in in-vivo neural recording techniques, which allowed me to examine the neural circuits supporting the learning and



**Figure 1.** Munir Gunes Kutlu, PhD, Temple University Lewis Katz School of Medicine, USA.

memory mechanisms I previously studied at the theoretical and behavioral levels. As a result, in my lab at Temple University Lewis Katz School of Medicine, I study learning and memory as well as social behaviors in several different analytical levels, such as from theory to behavior and circuit biology.

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

My fascination with the brain's ability to encode information began during my undergraduate studies when I was introduced to associative learning models like the Rescorla-Wagner and Pearce-Hall models. Exploring how these models predict learning through associations between stimuli and responses sparked my curiosity about the neural mechanisms underlying these processes. I liked the idea that complex behaviors could be





understood through relatively simple mathematical frameworks, which led me to delve deeper into how the brain implements these computational principles. This early exposure to associative learning theories laid the foundation for my research, which focuses on understanding how the brain encodes, processes, and retains information, especially in the context of reward-based learning and social interactions. It was a defining moment that set the course for my future work in neuroscience.

**What impact do you hope to achieve in your field by focusing on specific research topics?**

The primary impact I hope to achieve in my field is to uncover how our brains perform fundamental calculations about our surroundings, particularly in making decisions about rewards and dangers. My research aims to decode the neural processes that enable us to assess our environment, predict outcomes, and make adaptive decisions. By focusing on associative learning and neural encoding mechanisms, I strive to understand how the brain transforms sensory inputs into meaningful predictions that guide behavior. Ultimately, my goal is to reveal how neural circuits integrate information to evaluate risks and rewards, shedding light on the underpinnings of decision-making processes. This research has the potential to inform our understanding of mental health conditions where these computations go awry, such as anxiety, addiction, and social dysfunction, paving the way for new therapeutic strategies.

**Please tell us more about your current scholarly focal points within your chosen field of science?**

My current scholarly focus centers on associative learning, specifically how memories are encoded and maintained in the brain and how these processes influence decision-making when interacting with our environments and others in social settings. Our primary focus is to discover where fundamental learning and memory computations such as novelty, prediction error, saliency, and attention are encoded in the brain. We have published a series of manuscripts examining the role of dopamine release in the striatum and its role in encoding prediction error and saliency during associative learning. Challenging the current dogma of dopaminergic information encoding, we found that dopamine release in the nucleus accumbens core signals perceived saliency, an associative learning term for how salient external stimuli are perceived independent of their physical saliency. Similarly, we identified valence-free information encoding properties of D1 and D2 medium spiny neurons in the nucleus accumbens. I continue this line of work in my lab and expand it to other neurotransmitter systems, such as acetylcholine and single-cell neural ensembles.

I am also particularly interested in understanding how neural circuits, including those in the striatum, adapt to experiences of social competition and how these adaptations influence behavior and decision-making. Additionally, I am exploring the role of drugs of abuse in altering these processes. Stimulants such as cocaine and nicotine can profoundly affect how memories are formed and how social decisions are made, often leading to maladaptive behaviors that impair social functioning. By examining how these substances disrupt neural plasticity and reward systems, my research aims to uncover the mechanisms that underlie addiction and its impact on social cognition. I study how social hierarchies are established through behavioral paradigms and how environmental and pharmacological factors can modify them. By combining these behavioral tools with advanced neurotechnologies, such as fiber photometry for real-time monitoring of neurotransmitter release, I aim to gain a deeper understanding of how associative natural and drug-induced changes influence learning and memory processes in brain function. This research has broad implications for understanding addiction, competition, and the neural basis of social behavior.

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

During my academic studies and postdoctoral experiences, I developed a solid commitment to rigorously analyzing data from various perspec-

tives and analytical levels before reaching conclusions. This approach ensures that our findings are both reliable and robust while fostering a deeper understanding of the questions we seek to answer. In my research environment, we challenge ourselves not to accept current dogmas about the brain and behavior at face value. Instead, we critically evaluate these prevailing ideas through the lens of our data, questioning assumptions and exploring alternative interpretations. This mindset encourages innovation and helps us uncover insights that may disrupt conventional thinking. By integrating rigorous analysis with a willingness to challenge established norms, we strive to contribute to a more nuanced and accurate understanding of the brain and its relationship to behavior.

**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 warrant transformative scrutiny, or is there a cause within science that deeply stirs your passions?**

Free thinking is the cornerstone of all scientific progress. The ability to question, challenge the status quo, and push boundaries drives innovation and leads to breakthroughs. However, for science to truly thrive, we must ensure that free thinking is not confined to a select group but is accessible to individuals across borders, cultural identities, and socioeconomic boundaries. Transformative scrutiny within the scientific community is needed to dismantle barriers that limit participation. There are untapped perspectives and ideas in regions and communities that need access to resources or opportunities to engage in scientific discourse. By creating an environment where merit and curiosity are the driving forces, we empower individuals to contribute their unique insights and creativity. This diversity of thought enriches the scientific process and ensures that the progress we achieve benefits all of humanity, not just a privileged few.

**What do you most enjoy in your capacity as an academic or research rising star?**

What I most enjoy in my role as an academic and researcher is the freedom to be creative, to think deeply, and to ask meaningful questions. The academic environment provides a unique space where curiosity is celebrated, allowing us to explore novel ideas, challenge established perspectives, and pursue questions that inspire innovative approaches. That said, this freedom is not without its challenges. Funding concerns can sometimes hinder the extent to which bold, exploratory science can be pursued. The need to align research with funding priorities or to secure resources often imposes certain constraints on creative exploration. However, these challenges also inspire resilience and ingenuity, driving me to find innovative ways to balance creativity with practicality. Even within these limitations, the ability to ask questions and seek answers remains one of the most rewarding aspects of my work, fueling my passion for discovery and progress.

**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?**

Outside of my professional life, I enjoy engaging in physical activities that challenge both my body and mind, such as rock climbing, as shown in [Figure 2](#). It is a rewarding way to stay active and healthy while pushing myself to overcome obstacles. I am also a big fan of Turkish soccer, and as a proud supporter of Galatasaray, I love following their games and cheering them on. Above all, the most fulfilling way I spend my time is with my kids and family. Whether it is playing, exploring, or simply relaxing together, these moments bring me the greatest joy and help keep me grounded. My family is my biggest source of happiness and inspiration, and they make every day meaningful.



**Figure 2.** Gunes Kutlu scaling rock faces in Utah’s dramatic landscape. Beyond the laboratory, he finds both challenge and clarity in climbing – a pursuit that demands the same focus and determination he brings to his neuroscience research.

**Part 2: Munir Gunes Kutlu – Selected questions from the Proust Questionnaire<sup>1</sup>**

**What is your idea of perfect happiness?**  
Knowing my kids are happy and healthy.

<sup>1</sup>In 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. In 2003 Proust’s handwritten answers were auctioned off for \$130,000. Multiple other historical and contemporary figures have answered the Proust Questionnaire, including among others Karl Marx, Oscar Wilde, Arthur Conan Doyle, Fernando Pessoa, Stéphane Mallarmé, Paul Cézanne, Vladimir Nabokov, Kazuo Ishiguro, Catherine Deneuve, Sophia Loren, Gina Lollobrigida, Gloria Steinem, Pelé, Valentino, Yoko Ono, Elton John, Martin Scorsese, Pedro Almodóvar, Richard Branson, Jimmy Carter, David Chang, Spike Lee, Hugh Jackman, 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 your greatest fear?**

My greatest fear is facing a situation where, no matter what I do, I cannot prevent a negative outcome for my loved ones.

**Which living person do you most admire?**

I do not have a single person I admire the most, but rather a multitude of individuals across different fields who inspire me deeply. In science, I greatly admire those who challenge established dogmas and push the boundaries of conventional thinking, driving innovation and progress. In sports, I respect athletes who demonstrate exceptional talent, resilience, and dedication to their craft. These individuals inspire me in different ways, reminding me of the power of perseverance and boldness in achieving meaningful change.

**What is your greatest extravagance?**

My greatest extravagance is traveling. I deeply value the experiences and memories that come from exploring new places, immersing myself in different cultures, and broadening my perspective on the world. It is an indulgence that enriches both my personal and professional life.

**What are you most proud of?**

I am most proud of my family. Reflecting on my journey, I see we have come a long way from very modest beginnings, grappling with financial



challenges and an uncertain future. To have built a stable life and career that enables me to support and provide for my family is a profoundly cherished achievement. Their love and presence are my most significant source of pride and fulfillment.

**What is your greatest regret?**

There are certainly moments in my life where I could have made more informed decisions, but I strive to live without dwelling on past actions. Instead, I focus on learning from those experiences and moving forward with a mindset of growth and self-improvement.

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

Grit.

**What is the trait you most dislike in people?**

The trait I most dislike in people is a lack of ambition or a sense of purpose—when someone has no goal or pursuit to strive for.

**What do you consider the most overrated virtue?**

In my opinion, blind obedience or unquestioning compliance is the most overrated virtue. While discipline and respect for authority have their place, progress is driven by curiosity, critical thinking, and the courage to challenge established norms. With questioning and reevaluating, true growth and innovation become more accessible.

**What is your favorite occupation (or activity)?**

Watching soccer or “futbol” as we call it in Turkish.

**Where would you most like to live?**

Somewhere on the coast of the Mediterranean Sea.

**What is your most treasured possession?**

As a physical object, my most treasured possession is a Galatasaray jersey signed by the entire team. Beyond the jersey, however, my most cherished “possessions” are the memories and experiences I have shared with my family, which bring joy and meaning to my life daily.

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

Right now, I am happiest. Having my kids around me and spending time with them fills my life with joy and meaning. I know that in 10–20 years, I will look back on these days with fondness and nostalgia, cherishing the moments we share now. Knowing how precious and fleeting it is is a fantastic time in life that I sincerely appreciate.

**What is your current state of mind?**

My current state of mind is focused and determined. I am fully dedicated to building my lab and fostering its growth. This phase is exciting and challenging, filled with opportunities to lay the foundation for meaningful research and to create a collaborative environment that supports discovery and innovation.

**What is your most marked characteristic?**

My most marked characteristic is my determination—when I focus on a problem, I do not let it go until I have found a solution. This persistence drives me to dig deeper, explore every angle, and keep pushing forward, no matter how challenging the task may be.

**Among your talents, which one(s) give(s) you a competitive edge?**

Among my talents, my grit and determination give me a competitive edge. Once I set my sights on a goal, I am relentless in my pursuit, overcoming obstacles and staying focused until I achieve it. This resilience allows me to navigate challenges and maintain momentum, even in the face of adversity.

**What do you consider your greatest achievement?**

In my career, my greatest achievement is establishing my lab at a top research institution, where I can contribute to advancing science and mentoring the next generation of researchers. In my personal life, my greatest achievement is undoubtedly my family—they are my source of joy, support, and inspiration, and nothing brings me greater fulfillment than being with them.

**If you could change one thing about yourself, what would it be?**

If I could change one thing about myself, it would be to worry less about imagined problems. Sometimes, I overthink situations that may never happen. I want to focus more on the present and tackle challenges as they come. This is something I am actively working on to improve.

**What do you most value in your friends?**

Loyalty.

**Who are your favorite writers?**

During my teenage years, Amin Maalouf was my favorite author. I read all of his books and was captivated by his ability to seamlessly weave history with fiction. These days, I lean more toward non-fiction. While I do not have a single favorite author, I enjoy reading works by Niall Ferguson, Malcolm Gladwell, and Yuval Noah Harari, all of whom offer fascinating insights into history, society, and human behavior.

**Who are your heroes of fiction?**

I do not believe in heroes, especially fictional ones.

**Who are your heroes in real life?**

While I am skeptical of the hero concept, I resonate deeply with Albert Camus and his worldview.

**What aphorism or motto best encapsulates your life philosophy?**

“The struggle itself towards the heights is enough to fill a man’s heart. One must imagine Sisyphus happy.” — Albert Camus, *The Myth of Sisyphus and Other Essays*.

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Munir Gunes Kutlu<sup>1</sup>

<sup>1</sup>Center for Substance Abuse Research, Department of Neural Sciences, Temple University Lewis Katz School of Medicine, Philadelphia, Pennsylvania 19140, USA  
✉ e-mail: [gunes.kutlu@temple.edu](mailto:gunes.kutlu@temple.edu)

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