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INNOVATORS & IDEAS: RISING STAR

# Xuyu Qian: Understanding human brain development and diseases using human-based approaches



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**In this illuminating Genomic Press Interview, Dr. Xuyu Qian, a visionary neuroscientist whose groundbreaking spatial transcriptomics research promises to revolutionize our understanding of human brain development at unprecedented single-cell resolution, shares his remarkable path from an art-infused childhood in Nanjing to becoming a Forbes 30 Under 30 laureate and pioneering force in brain organoid technology. As the newly minted Assistant Professor at the University of Pennsylvania and Children's Hospital of Philadelphia, Dr. Qian has transformed our understanding of human cerebral cortex formation through his innovative fusion of spatial transcriptomics and organoid models. His landmark work, recently published in *Nature* (2025), leveraged state-of-the-art MERFISH technology to analyze over 18 million single cells, thereby redefining our understanding of the emergence of cortical layers and specialized brain regions during fetal development. This breakthrough builds upon his earlier revolutionary development of brain organoid protocols, now cited over 2,000 times and instrumental in shaping CDC guidelines for the prevention of Zika virus. Throughout this candid conversation, Dr. Qian reveals how the anime series Evangelion sparked his passion for biotechnology, explores his generous collaborative philosophy that has led to numerous discoveries, and articulates his commitment to human-centric approaches for decoding neurodevelopmental disorders. His distinctive combination of scientific excellence, creative vision, and infectious enthusiasm establishes him as one of neuroscience's most promising emerging leaders, destined to unravel the fundamental mysteries of human brain development and disease.**

**Figure 1.** Xuyu Qian, PhD, University of Pennsylvania Perelman School of Medicine, USA.

## Part 1: Xuyu Qian – Life and Career

**Where were you born and where do you live now?**

I was born in Nanjing, Jiangsu, China. I live in Boston, Massachusetts, USA, but I will be moving to Philadelphia.

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

I grew up in Nanjing, China, in a family that was more artistic than scientific—my dad is a high school art teacher, and my mom is a skilled artisan of brocade crafts. Both of them have always appreciated science, and that quiet enthusiasm rubbed off on me. In their eyes, studying science or engineering was the default path for boys with good school grades. For kids of my generation born in the early '90s China, being a scientist was hands down the most admirable dream job. If you had surveyed a classroom of first graders back then, 95% of us probably would have said we wanted to be scientists when we grew up. To the best of my knowledge, I am the only one from my class who has become a basic scientist. It is hard to pinpoint a single moment that ignited my passion: it was a natural process. I was always drawn to science shows like Beakman's World and later to documentaries on Discovery Channel and National Geographic. I feel lucky to have grown up during a time when those American shows were broadcast on Chinese television—that is no longer the case today.

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

My interest in the biological sciences was directly sparked in high school after watching the Japanese anime series *Evangelion*. As dramatic as it sounds, it was the most life-defining moment for me. Set in a post-apocalyptic world, the series centers on humanity's last hope: the "Eva" units-giant, humanoid beings created through advanced bioengineering. Unlike typical sci-fi mechas like Gundam, the Evas are not machines; they are fully living, cloned organisms. That concept completely transformed how I saw biology. It was the first time I realized that biology and

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biotechnology could reshape the world. Inspired by that vision, I chose biomedical engineering as my college major without considering future career paths or job market prospects. It was only after my first year in college that I realized I needed to pursue a PhD to make a difference in the biological sciences.

**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 attended Worcester Polytechnic Institute (WPI) in Massachusetts, one of the few U.S. universities that offered scholarships to international students. That opportunity enabled me to attend college in the U.S., and I am deeply grateful for it. I graduated in three years, from 2010 to 2013. I started volunteering in a research lab during my first summer. While labs at WPI did not always conduct the kind of cutting-edge science I would later immerse myself in; I quickly realized how much I enjoyed the research process. I spent about a year and a half in Dr. Qi Wen's lab, and I am very thankful for his mentorship. Although I did not produce any publications, the experience taught me how to think like a scientist and confirmed that this was the path I wanted to pursue. Fortunately, PhD applications in 2013 were not as publication-driven as they are today, and I was accepted into Johns Hopkins.

At Hopkins, I joined Dr. Hongjun Song's lab for my third rotation. Within a month, I knew it was the right place for me. I am grateful that Hongjun and Guo-li took me in, even though I had no background in neuroscience or stem cell biology. Under their mentorship, I developed pioneering methods to generate human brain organoids from stem cells—a foundation that shaped the direction of my research.

I continued to pursue my interest in human brain development during my postdoc with Dr. Chris Walsh at Boston Children's Hospital. Chris gives postdocs a great deal of freedom to chart their course. I utilized spatial transcriptomics to analyze preserved human brain samples, thereby constructing a developmental atlas of the human cerebral cortex that was published in Nature (2025) (see Figure 2).

In the fall of 2024, I entered the job market for faculty positions. After numerous interviews, I am thrilled to receive my dream offer and launch my lab at the University of Pennsylvania and the Children's Hospital of Philadelphia. My lab will start this fall, and I could not be more excited for the next chapter.

**What is a decision or choice that seemed like a mistake at the time but ended up being valuable or transformative for your career or life?**

Looking back, I have been fortunate in my career. Concrete evidence or detailed reasoning did not drive many of the choices I made- often, they were based on gut instinct. At the time, that felt risky or naive. For example, choosing biomedical engineering as a college major or joining a neuroscience lab without a background in the field could have easily backfired. However, somehow, those intuitive decisions turned out to be exactly right. What initially felt uncertain at the moment ultimately proved to be transformative, and it has taught me to trust my instincts.

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

One of the core values I developed during my training is a strong commitment to collaboration. I genuinely enjoy working with others and believe in leaning on the expertise of collaborators rather than trying to learn and master everything myself, especially in a fast-moving field where techniques quickly become outdated. When I collaborate, I make it a priority to ensure that my collaborators receive full and fair credit for their contributions. I always ask early on what they hope to gain from the collaboration and work to align our goals. If I cannot offer enough benefit in return, I do not ask for significant effort.

This approach has been shaped by both of my mentors, Hongjun and Chris, who lead highly collaborative labs and are generous with credit and authorship. I learned from them that strong science comes from strong partnerships. Like them, I try to be generous with co-authorship—anyone who contributes to a project is included, regardless of the size and depth of their role. I do not believe in using credit as a carrot to motivate more work. Instead, I want people to feel that working with me is enjoyable and rewarding, so they will want to collaborate again or recommend others to do so.

**Figure 2.** Dr. Xuyu Qian in his current laboratory, standing beside a collection of external hard drives containing raw spatial transcriptomics data from his groundbreaking human brain development research. The drives, ranging from 5TB to 20TB in capacity, represent the massive scale of single-cell resolution data generated in his recent *Nature* (2025) study analyzing over 18 million cells to map human cerebral cortex development.

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

My research focuses on understanding how the human cerebral cortex develops and how this process goes awry in neurodevelopmental disorders. The cortex is the most evolutionarily advanced part of the brain and underlies many aspects of cognition, yet it is also particularly vulnerable to developmental disruption. Conventional animal and cell culture models often fail to capture the unique features of human cortical development, which has limited our understanding of human-specific diseases.

To address this, my research program integrates three key human-based strategies: brain organoid models, spatial omics technologies, and human genetics. In the short term, my lab will focus on uncovering the mechanisms that drive the specification of cortical area-specific neuronal subtypes. By combining advanced organoid models with spatial omics, we aim to decipher how cortical regions acquire their unique identities and why some are more susceptible to conditions such as malformations of cortical development and autism spectrum disorder. My long-term goal is to identify the developmental programs disrupted in these disorders and build a foundation for future therapeutic strategies.

**What impact do you hope to achieve in your field by focusing on specific research topics?**
I want to contribute to driving a paradigm shift in the field, moving from a reliance on animal models to directly studying the human brain. This is especially critical for the cerebral cortex, the most uniquely human part of the brain and the key to what makes us so special. My approach combines two complementary systems: direct analysis of human brain specimens and brain organoid models. Human tissue provides the ground truth, offering real data that allows us to build accurate models and form meaningful hypotheses. Organoids, on the other hand, provide a living, manipulable system in which we can test those hypotheses experimentally. While organoids are not the real brain, benchmarking them against human tissue helps us define what they can or cannot replicate and how we might engineer improved models.

By integrating these platforms, I aim to identify cellular and molecular disruptions that are directly relevant to human disease. One of my core interests is neuronal subtype specification. This is a key point of vulnerability in brain development, where the disruption of even a single gene can dramatically alter the identity and function of neurons, leading to the profound consequences we see in many neurodevelopmental disorders. Through this work, I aim to advance both our mechanistic understanding and our ability to develop targeted therapeutic strategies.

**What do you most enjoy in your capacity as an academic or research rising star?**
What I enjoy most is the freedom to ask questions that genuinely excite me and the sense of possibility that comes with building a new research direction. As I prepare to launch my lab, it is gratifying to define the kind of science I want to pursue and the questions I want to tackle. It is also significant to connect with others in the scientific community, whether it is learning from senior scientists, exchanging ideas with peers, or encouraging the next generation of researchers. That sense of shared passion and intellectual growth across career stages is one of the most fulfilling parts of academic life. For me, the journey from an initial question to a new insight into the human brain is what makes this work so energizing.

**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 you feel strongly devoted to?**
One cause I feel strongly about is open access to scientific research. The current publishing model in many prominent journals is deeply flawed. Authors often pay high fees to publish, readers or institutions must pay to access the content, and peer reviewers, who are essential to maintaining quality, are not compensated at all. Meanwhile, the profit margins for major publishers exceed those of companies like Google or Amazon. I fully understand that it costs money to run a high-quality journal: editorial staff, infrastructure, and production are all essential. However, the scale of the profits makes it clear that these fees go far beyond simply "keeping the lights on." Moving toward more equitable and open publishing models is essential for making science more impactful.

**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?**
As I mentioned earlier, my passion for biology was first sparked by *Evangelion*, so it is no surprise that I am a huge fan of Japanese anime. I also play many video games. I want to proudly highlight these hobbies because they are often seen as "unhealthy" or unproductive, but I would argue that such a perception is misguided. They energize me and often spark creativity. Anime and games tell incredibly inspiring stories, often with complex and thoughtful narratives that provide motivation and perspective. I have also known many other rising scientists who share these same passions.

To stay balanced, I also work out regularly. I am a history enthusiast and love watching YouTube channels on world history while exercising or doing chores. I do not read many books—I am a slow reader and tend to retain visual information more vividly.

I also create science-themed videos on Bilibili, a leading video-sharing platform in China, where I have built a channel of over 370,000 subscribers. I use this platform to make science accessible and exciting, especially for younger audiences, through videos that explain topics ranging from neuroscience breakthroughs to the science behind science fiction.

## Part 2: Xuyu Qian – Selected questions from the Proust Questionnaire[1]

**What is your most marked characteristic?**
My most marked characteristic is focus. I am very clear about my objectives and work with strong intent toward achieving them. Throughout my career, I have set ambitious but realistic goals at each stage and have consistently met them within the planned timeframe. When working on a project or manuscript, I plan the process carefully from the outset. I often sketch a draft version of the figures, complete with panel layouts and the types of analyses I expect, almost like a movie director's storyboard. That focus helps guide the direction, but I am not rigid. I am quick to adapt when data take an unexpected turn, and I am always ready to act when an unanticipated opportunity arises. Focus, for me, is not just about sticking to a plan but about staying attuned to the bigger picture while navigating the unexpected.

**Among your talents, which one(s) give(s) you a competitive edge?**
One talent that gives me a competitive edge is trusting my intuition and making decisions quickly. I do not waste time hesitating or overanalyzing, which helps me avoid missing opportunities. Especially in science, timing matters, whether it is jumping on a new idea, starting a collaboration, or pursuing a surprising result. I am fortunate that I rarely regret the decisions I make in research. Sometimes, I can almost close my eyes and see the following steps unfold. I am not sure if that qualifies as foresight, but I like to think it is a kind of instinct that guides me in the right direction.

**If you could change one thing about yourself, what would it be?**
If I could change one thing about myself, I would want to be more thoughtful in my communication with others. I consider myself a kind person—I never intentionally hurt others who treat me fairly. However, in conversation, I can sometimes unintentionally say things that come across as hurtful or offend someone's feelings. I have been working on better understanding how my words might be interpreted from another person's perspective and how to express myself more clearly and sensitively. I have grown a lot in this area over the years—I was much more awkward in college and early grad school—but I think this is something many of us spend a lifetime trying to improve.

**What is your current state of mind?**
Right now, my mind is juggling a thousand things as I prepare to set up my lab: budgeting, submitting grants, ordering equipment, hiring staff, and managing paperwork. Everything is new, and each task comes with

[1]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.

its learning curve. It has made me realize what a privilege it was as a PhD student and postdoc to be able to focus entirely on science. I am excited about this next chapter, but I also look forward to the day when my lab is running smoothly, and I can return my full focus to discovery and experimentation, the part I love most.

**What is your idea of perfect happiness?**
My idea of perfect happiness is the conviction that I am not just one of many human beings who have lived but a truly unique being: a singularity. I want to know that I am special in a way that everyone can recognize and that there is something I can achieve that sets me apart.

**When and where were you happiest? And why were so happy then?**
I feel happy now because I am making steady progress toward achieving my goals. There is satisfaction in the momentum, in seeing things move forward. However, at this stage, I am still one of many junior scientists working hard to establish myself. My happiest moment will come when I truly accomplish something one-of-a-kind.

**What is your greatest fear?**
My greatest fear is death. Human life is far too short to unravel the universe's mysteries. There is so much to discover, but not enough time to see it all. We need to advance life science to a point where each year of progress is enough to extend human life by at least one more year. We do not have to achieve immortality overnight—but if we can stay ahead of the clock, we can keep going. That is not asking too much.

**What is your greatest regret?**
I have been fortunate not to have any deep or essential regrets. If anything, my regrets are lighthearted ones—like not buying Bitcoin in 2013.

**What are you most proud of?**
I am most proud of my research achievements and the tangible impact they have had in the field. From developing early brain organoid models to mapping human cortical development, I have contributed tools and insights that others have found valuable. My cortical organoid method was among the earliest in its domain- and the paper has now been cited over 2,000 times. Many labs have adopted the protocol, and it is gratifying to meet researchers at conferences who tell me they are getting great results with my protocols.

Using organoids, we were also among the first to provide experimental evidence for the causal link between the Zika virus and congenital brain malformations. The CDC referenced our study to support biological plausibility in their declaration that Zika causes congenital disabilities, and it informed public health guidelines advising pregnant women to avoid affected regions. Although the impact was indirect, knowing that my research helped prevent Zika-related harm—and may even have saved lives—is something I take immense pride in.

**What do you consider your greatest achievement?**
My most outstanding achievement is earning the opportunity to open my own lab at the University of Pennsylvania. For years, this has been my dream. It represents both a personal milestone and the beginning of a new chapter that I am incredibly excited about.

**What or who is your greatest passion?**
My greatest passion is scientific discovery—uncovering how the human brain works. Outside of science, I have also had a lifelong passion for anime.

**What is your favorite occupation (or activity)?**
Rewatching *Evangelion* and analyzing it frame-by-frame.

**What is your greatest extravagance?**
Traveling to Midgard and Asgard ... in the video game God of War.

**What is your most treasured possession?**
Cards from former lab members and trainees.

**Where would you most like to live?**
Italy—perhaps in the Tuscany countryside. The weather is beautiful, the food is incredible, the people are friendly, and the landscape is rich in history and culture.

**What is the quality you most admire in people?**
Resilience. I am inspired by those who can face setbacks, uncertainty, or failure and still keep moving forward with purpose.

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

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

**What do you most value in your friends?**
What I value most in my friends is their ability not to take offense easily. I appreciate people who understand that honesty and bluntness are not the same as bad intentions. I speak very directly, and I'm grateful for friends who know it comes from sincerity, not criticism. That kind of mutual trust makes for strong, lasting friendships.

**Which living person do you most admire?**
Anno Hideaki, the director of *Evangelion* (see Figure 3). He is a true genius and a legend in the creative industry. I admire how he poured himself into his creation, often at a significant personal cost. Now, having earned worldwide acclaim and creative and financial independence, he is free to follow his teenage dreams without worrying about audience expectations, critics, or investors. That kind of authenticity—staying true to one's vision—is incredibly inspiring to me.

**Who are your heroes in real life?**
My real-life heroes are my mentors, Chris and Hongjun as well as many other leaders in science whom I deeply admire. They have not only made extraordinary contributions to the field, but they have also done so with generosity, integrity, and kindness.

**If you could have dinner with any historical figure, who would it be and why?**
Alexander the Great. At the dinner, I would tell him the food is poisoned. If he survived because of it and goes on to conquer the rest of the world, I would find a strange satisfaction in knowing that my action altered the course of history forever.

**Who are your favorite writers?**
I am a Lord of the Rings nerd, so J.R.R. Tolkien is my favorite writer. I love how his story draws a clear line between good and evil without the political ambiguity or moral grayness that often dominates modern narratives. However, within that clarity, Tolkien still creates incredible depth, complexity, and resonance with the real world.

More contemporarily, I admire Hanada Jukki, one of the most prolific anime screenwriters in recent years. His work captures emotions that are deeply resonant yet difficult to articulate- those unspoken feelings that many writers shy away from. Nevertheless, he brings them to light with remarkable subtlety and honesty.

**Who are your heroes of fiction?**
As someone who watches a lot of anime, I find new fictional heroes to admire almost every season. But the greatest, of course, has to be Ikari Shinji, the protagonist of *Evangelion*. He is often misunderstood and criticized for his fear and hesitation, but that is precisely what makes him so compelling. Beneath the surface, Shinji is a profoundly human character—flawed, vulnerable, and constantly struggling with self-worth and purpose. His growth comes full circle in the 2021 series finale movie *Evangelion 3.0 + 1.0*, where he learns to take responsibility, make decisions, and face their consequences. That transformation felt profoundly earned, and it is why he remains my greatest fictional hero.


**Figure 3.** Sitting at Ube-Shinkawa Station, Ube, Japan. This unassuming station served as the real-world backdrop for Evangelion 3.0 + 1.0's final scene, a place where fiction and reality converge. As the series came full circle in this quiet setting, I found myself at my own threshold: visiting this endpoint of one story just as I embarked on a new chapter felt like a moment of perfect synchronicity.

**What aphorism or motto best encapsulates your life philosophy?**
"Anywhere can be paradise as long as you have the will to live" – from *Evangelion.*

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**Xuyu Qian**[1]
[1] *University of Pennsylvania Perelman School of Medicine and Children's Hospital of Philadelphia, Philadelphia, Pennsylvania 19104, USA*
✉ *e-mail: qianxuyu@gmail.com*