

Oliver Pain: Bringing together functional and statistical genomics to enhance personalised medicine for neuropsychiatric disorders

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Dr Oliver Pain, Sir Henry Wellcome Postdoctoral Research Fellow at King's College London, is revolutionizing psychiatric genomics through groundbreaking work on polygenic scoring and precision medicine for mental health disorders. Based at the prestigious Maurice Wohl Clinical Neuroscience Institute since 2021, Pain specialises in statistical genetics, focusing on genome-wide association studies to uncover mechanisms underlying psychiatric and neurological conditions, including autism, antidepressant response, and motor neuron disease. His seminal contribution to the field is the development of GenoPred, a comprehensive open-source pipeline that implements leading polygenic scoring methodologies, making genetic risk prediction accessible to researchers worldwide. This Genomic Press Interview explores Pain's journey from molecular genetics to becoming a pioneer in translational psychiatric genomics, where he bridges statistical and functional genomics to transform mental healthcare. As a contributing author to the landmark 2025 Cell publication, which identified 697 genetic associations for major depression across diverse ancestries, and lead analyst for international antidepressant pharmacogenomics consortia, Pain's research directly addresses critical challenges in personalised psychiatry. His innovative tools for converting polygenic scores to absolute risk scales enable safer clinical interpretation. At the same time, his commitment to developing methods that work across diverse populations ensures genomic advances benefit all communities equitably. Through collaborations spanning academia and industry, including his strategic year at UCB Pharma developing polygenic scoring programmes for drug development, Pain exemplifies how cutting-edge genomic research can be translated into tangible improvements for individuals living with psychiatric conditions.

Part 1: Oliver Pain – Life and Career

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

I was born in Oxford, United Kingdom, and I currently reside in London, United Kingdom.

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 Oxford in a close family with three siblings. Although curious about the natural world from an early age, I underperformed at school until my A-levels, when I began to apply myself and earned a place at King's College London. I began studying biomedical science, thinking I might become a doctor, but an introduction to genetics altered my path. I switched to molecular genetics and developed a fascination with understanding DNA and its influence on biology.

A summer internship in pharmaceutical investment banking was another formative experience. It gave me a glimpse of the finance and



Figure 1. Oliver Pain, BSc, MSc, PhD, King's College London, United Kingdom. Photo: Mark Adams.

pharma world but also confirmed that my genuine interest lay in science – I missed the intellectual excitement of research.

The most profound turning point was the sudden close family bereavement during my undergraduate years. It was devastating and brought a period of intense reflection and anxiety, but also a deep interest in the mind and mental health. I became drawn to questions about consciousness, psychiatry, and human behaviour, and in my final year discovered psychiatric genetics. This field brought together my passion for genetics with my desire to improve mental health.

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

My primary research interest is psychiatric genomics – using genetic tools to understand psychiatric disorders and improve mental health care. The spark came in my later undergraduate years, through academic exposure and personal experience. Discovering genetics was transformative; I became fascinated by how genes influence complex traits and illnesses, and personal experiences deepened my curiosity about why people are the way they are.

To pursue this, I undertook a Master's degree in Genes, Environment, and Development at the Institute of Psychiatry, Psychology, and Neuroscience, King's College London. There, I was introduced to genome-wide association studies (GWAS) and statistical genomics. Learning how to scan the genome for variants linked to disorders like schizophrenia or depression was exciting. However, I quickly saw the challenge: GWAS





yields many signals, yet interpreting them biologically or clinically is far from straightforward. Bridging this gap between statistical findings and underlying biology became my focus in psychiatric genomics.

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

After my Master's in Psychiatric and Statistical Genetics at King's College London, I pursued a PhD jointly at Birkbeck and the London School of Hygiene & Tropical Medicine. There, I strengthened my skills in genome-wide association studies (GWAS), statistics, and epidemiology, gaining the confidence to run large-scale genetic analyses of complex traits.

I then joined Cardiff University for a one-year postdoc in a leading psychiatric genomics group. This was where I significantly expanded my computational skills, developing automated GWAS and post-GWAS pipelines to improve efficiency and reproducibility. I also mastered transcriptome-wide association studies (TWAS), which link genetic variants to changes in gene expression, illuminating possible mechanisms underlying psychiatric disorders.

Returning to King's College London, I took on a pivotal postdoc role launching GenoPred, a programme focused on polygenic prediction of common diseases and traits. I led projects exploring how polygenic scores could predict risk or treatment response and became lead analyst for an international consortium studying antidepressant pharmacogenomics. This leadership role deepened my understanding of how genetics might guide personalised treatment.

A key milestone was being awarded the Sir Henry Wellcome Postdoctoral Research Fellowship, enabling me to integrate functional and statistical genomics into my independent research. During the fellowship, I spent a year at UCB Pharma, helping develop their polygenic scoring programme to support drug development. This experience broadened my view of how research can translate into therapeutic innovation.

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?

Midway through my postdoctoral fellowship, I chose to spend a year in industry at UCB Pharma—a decision that initially felt risky. Stepping away from academia raised concerns about losing momentum and missing developments in my field, and some colleagues cautioned against it. In practice, it proved transformative. At UCB, I developed a polygenic scoring programme within a clinical development setting, applying my academic expertise to real-world challenges such as improving trial design and patient stratification. I gained first-hand insight into the drug development pipeline and saw how genetic tools could inform each stage, from discovery to clinical testing.

The experience broadened my professional network, sharpened my focus on translational impact, and gave me confidence that my work has value well beyond academia. What I once feared might be a misstep became an important stepping stone that strengthened both my research and its real-world relevance.

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

Over my academic and postdoctoral career, I have developed habits and values that I actively uphold in my research environment. Perseverance and self-discipline are central: I set clear goals and work steadily towards them, approaching research as both a passion and a profession. Collaboration and openness are equally important. Working with statisticians, biologists, clinicians, and industry partners has shown me how diverse expertise can elevate a project. Therefore, I aim to create a collegial atmosphere where ideas, data, and tools are shared openly, and junior colleagues feel supported in contributing.

I prioritise continuous learning and adaptability in a field that evolves rapidly. This means regularly updating my skills, staying current with new literature as it emerges to identify opportunities and ensure my work remains relevant, and encouraging my team to do the same. Rigour and integrity underpin all of this. Large, complex datasets require meticulous

documentation, version control, and transparent reporting—whether the results align with expectations or not. I also believe in writing clean, well-documented code so that analyses are reproducible and usable by others.

By combining hard work, openness, adaptability, and rigorous practice, I aim to foster an environment that supports both scientific excellence and professional growth.

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

My research focuses on psychiatric and functional genomics to translate large-scale genetic findings into biological and clinical insights. One strand is integrative genomics, which links genome-wide association study (GWAS) results for neuropsychiatric disorders to their underlying biology. While GWAS have identified thousands of variants for conditions such as depression and schizophrenia, the challenge is pinpointing which genes and pathways mediate risk. I use approaches such as transcriptome-wide association studies (TWAS) and the integration of eQTL, epigenetic, and other functional genomic data to prioritise genes and clarify their mechanisms.

A second focus is the development and application of polygenic scores (PGS) for personalised medicine. I lead the GenoPred programme, which evaluates and refines methods to construct more accurate, robust, and equitable PGS. This includes optimising algorithms, reference datasets, and performance across diverse ancestries. GenoPred also delivers open-source pipelines to make best-practice PGS computation widely accessible.

I continue to contribute to research on the genetics of antidepressant response, aiming to identify genetic predictors of treatment response through a meta-analysis of clinical trials and cohort data. Even modest improvements in prediction could guide medication selection and reduce the use of trial-and-error prescribing.

Overall, my goal is to bridge the gap between genomic discovery and application, supporting more precise and equitable mental health care.

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

I aim to make genetics a routine, helpful part of personalised medicine for psychiatric and neurological disorders, as well as other areas of medicine. In practice, this could mean using a patient's polygenic score to identify those at high risk earlier, or guiding treatment choices toward the medication most likely to be effective for them.

By bridging statistical and functional genomics, I aim to advance biological understanding of mental illness, identifying genes and pathways that mediate risk. Such findings could reveal new therapeutic targets. I aim to move beyond listing genetic associations, towards explaining the mechanisms underlying psychiatric conditions, ultimately leading to better treatments and prevention strategies.

Through my work on polygenic scores, I also strive to make genomic advances equitable. Current models often underperform in non-European ancestry groups due to historical underrepresentation in research. I am developing methods and advocating for more diverse data to ensure accurate predictions across populations, thereby reducing rather than reinforcing health disparities.

Genetics is only part of the picture, but it is now a measurable and analysable component that can inform care. My goal is to ensure it is applied thoughtfully and inclusively, improving outcomes and quality of life for people affected by mental health conditions.

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

What I most enjoy about being an academic is the freedom to explore ideas. It often feels like I am getting paid to work with my favourite tools—whether large genomic datasets or new methods. Formulating a question, devising a way to answer it, and having the flexibility to follow interesting leads is a privilege.

Collaboration is another highlight. I regularly work with intelligent, curious people— from local colleagues to international partners— and these exchanges often spark new insights. Discussing problems and



Figure 2. Oliver Pain barbecuing in the English countryside during his wife's birthday celebration in summer 2025. The day was spent with close friends, enjoying food and sunshine (photograph by Jared Maina).

brainstorming solutions is energising and one of the most rewarding parts of the job.

Finally, there is the sense of purpose. Knowing that my research could contribute to improved healthcare is deeply motivating. Even if progress is incremental, each project contributes to a larger effort that could ultimately benefit patients. The combination of freedom, discovery, collaboration, and meaningful impact makes this career both stimulating and fulfilling.

At Genomic Press, we prioritise fostering research endeavours 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 cultural aspect I strongly believe in is the need for greater diversity and inclusivity in genomic research. Most large genetic studies have focused on populations of European descent, resulting in polygenic scores and risk estimates that are often less accurate for underrepresented groups. This is not just a fairness issue – it limits the clinical utility of our work. I am committed to helping broaden participation in genetic research, whether by designing studies in diverse settings, sharing resources with groups in low- and middle-income countries, or improving methods to account for population differences. Achieving equity in genomic medicine requires systemic changes, from funding priorities to journal policies.

I also care deeply about open science and collaboration over competition. Science should be a truth-seeking enterprise, but pressures from prestige and funding can work against this ideal. I advocate for sharing data, tools, and methods openly – as I do with GenoPred – and for mentoring others to value generosity and integrity in research. When many people can scrutinise and build on each other's work, we accelerate discovery and reduce bias.

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 work, I enjoy activities that help me unwind while engaging different parts of my mind.

One of my favourite activities is rock climbing, both outdoors and indoors. It is physically challenging and demands a problem-solving approach entirely different from research. On the wall, there is no space for work worries. Climbing is also very social.

Music is another passion. I play guitar most days. It serves as a creative outlet that complements my analytical work, and I sometimes unwind in the evenings by playing or jamming with friends.

I also love cooking, particularly barbecuing for friends and family. Preparing and sharing food is both satisfying and grounding, and it is another way to bring people together.

Beyond hobbies, I value quality time with my wife, family, and close friends. I also cherish time in nature, whether hiking in the countryside or tending to my plants.

Part 2: Oliver Pain – Selected questions from the Proust Questionnaire¹

What is your most marked characteristic?

I am naturally serious and tend to think more than I speak, with a strong drive to ensure things are done properly.

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. 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.

**Among your talents, which give you a competitive edge?**

I am good at connecting disparate ideas, which often leads to novel approaches.

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

I would reduce my tendency toward anxiety. It has eased with age and confidence, but less of it would make life more peaceful.

What is your current state of mind?

Focused and driven. I am making the most of this stage of life, before personal responsibilities grow, to make progress on my work.

What is your idea of perfect happiness?

A world with true equality and compassion, balanced with meaningful work, loved ones nearby, and surrounded by natural beauty.

When and where were you happiest?

Now is one of my happiest times – newly married, doing work I love, surrounded by family and friends in good health.

What is your greatest fear?

Dying young, before raising a family, realising my potential, or continuing to contribute through my work.

What are you most proud of?

Being seen as kind and reliable matters most to me. Professionally, I'm proud of contributing to science while maintaining those values.

What do you consider your greatest achievement?

Development of the GenoPred pipeline – collaborative work that is now used by others.

What or who is your greatest passion?

Genetics is my greatest intellectual passion. Rock climbing and music are the activities in which I lose myself the most.

What is your favourite activity?

Climbing, playing guitar, and cooking for friends and family, especially a relaxed barbecue outdoors.

What quality do you most admire in people?

Kindness – genuine, compassionate kindness – along with respectfulness and creativity.

What trait do you most dislike in people?

Selfishness, which often underlies other negative behaviours.

Lácar, Navarre, Spain.

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