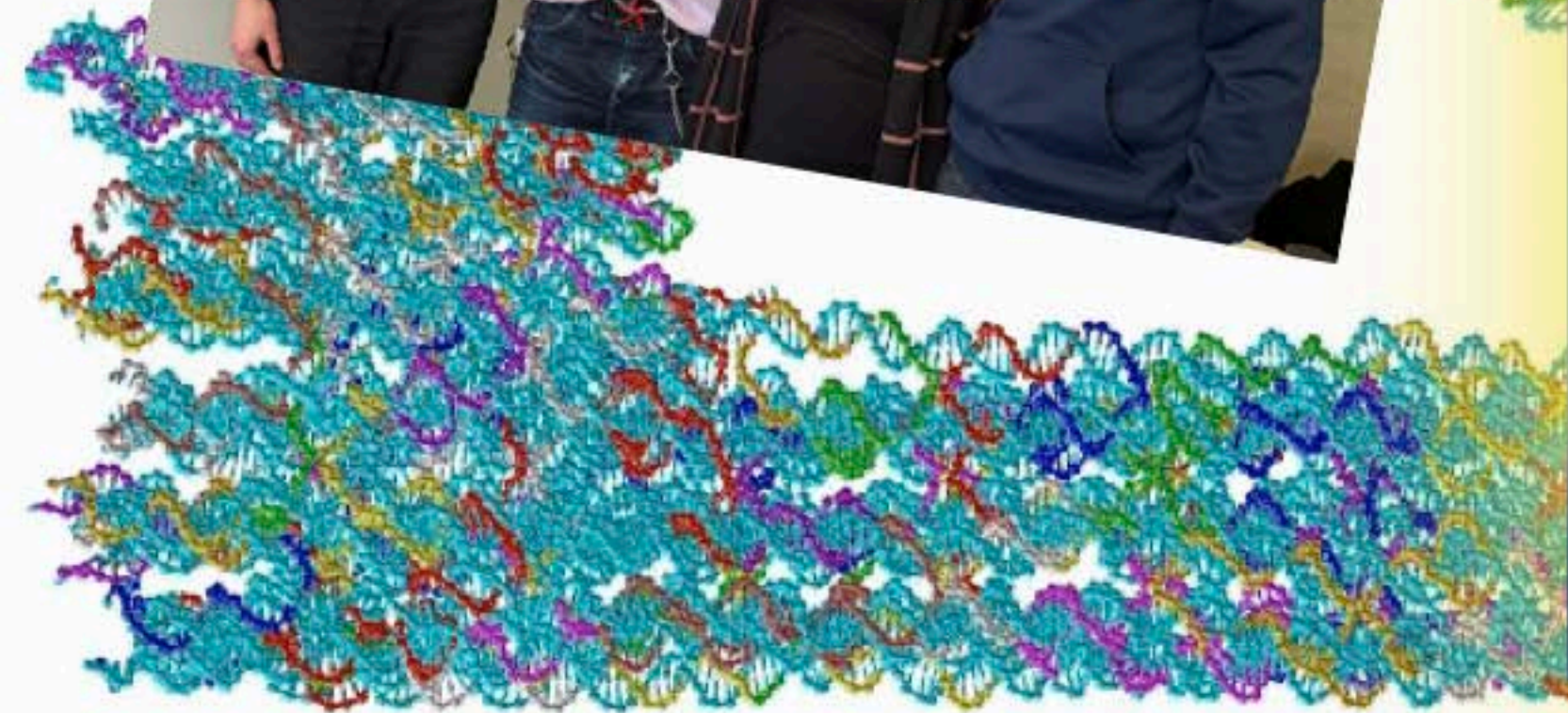
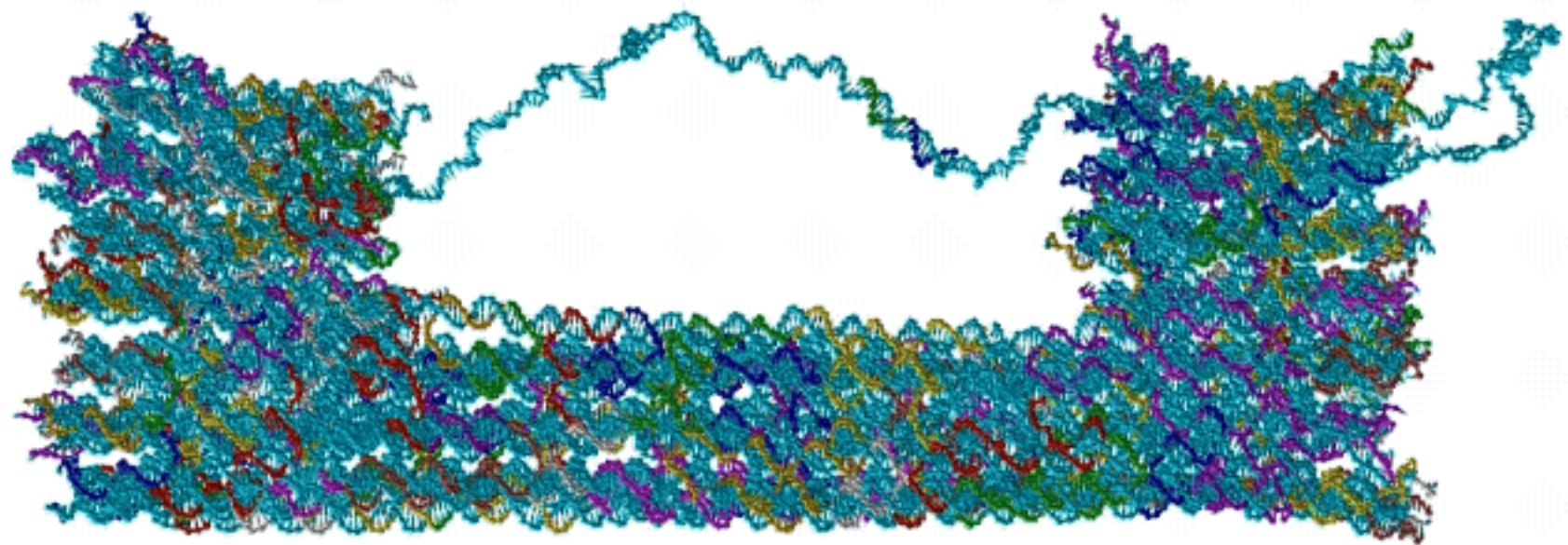


Early-Career Spotlight

Megan Engel - PI@CU



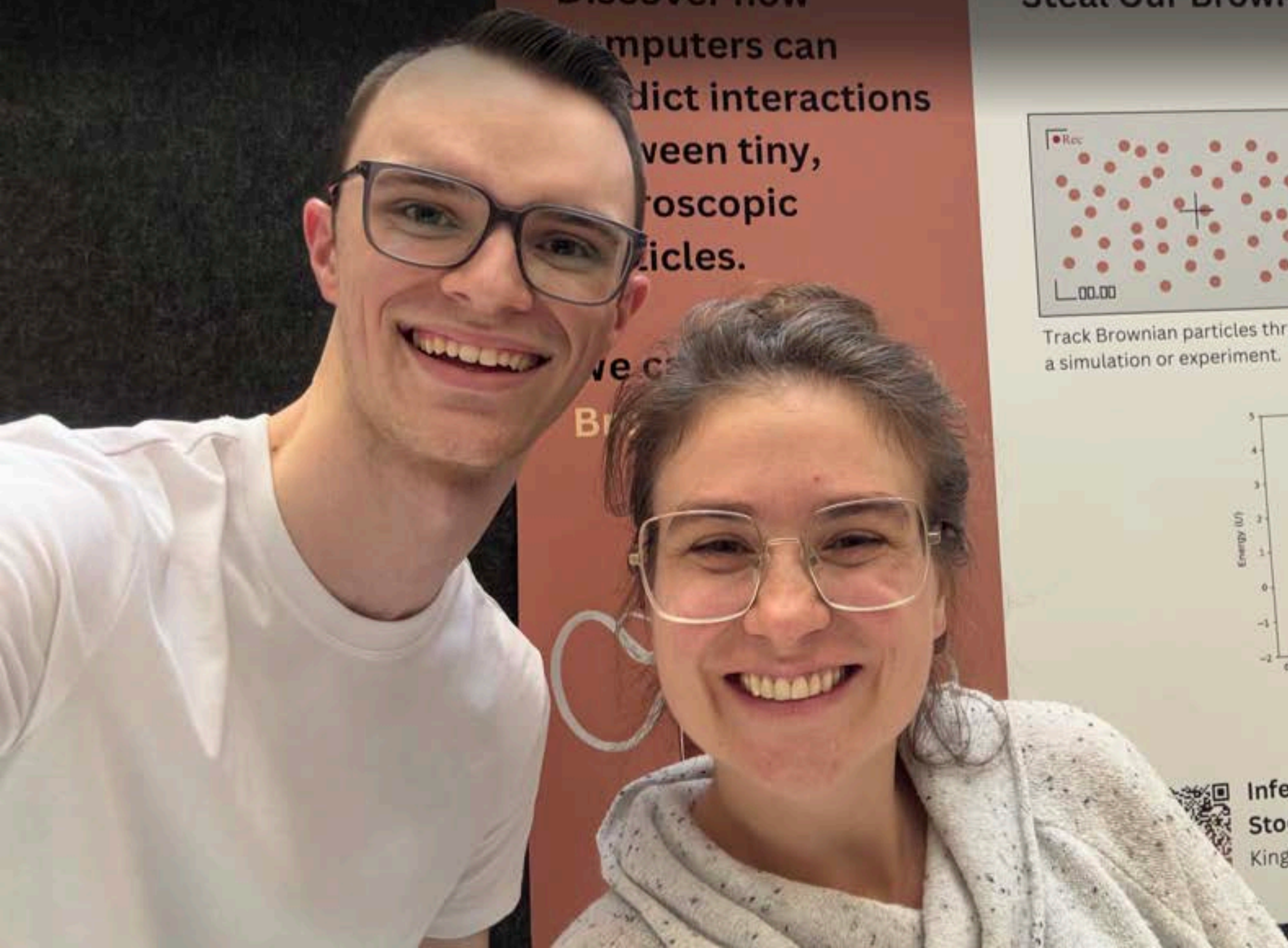


1. Why does your research matter?

I work at the intersection of non-equilibrium physics, machine learning and biology. My motivating questions constitute two sides of a coin: first, how has evolution optimized biological systems to thrive in their noisy, non-equilibrium environments? For example, the efficiency of cellular machines like ATP synthase rotors is close to 100%. The flip side of this question is: how can we harness the same principles in bio-nanotechnology? We see the enormous potential for synthetic and engineered biological systems to impact human society: from photonics to health care, from manufacturing to environmental monitoring. Unlocking the ability to rival the performance of naturally evolved systems – like ATP synthase – would exponentiate these impacts.

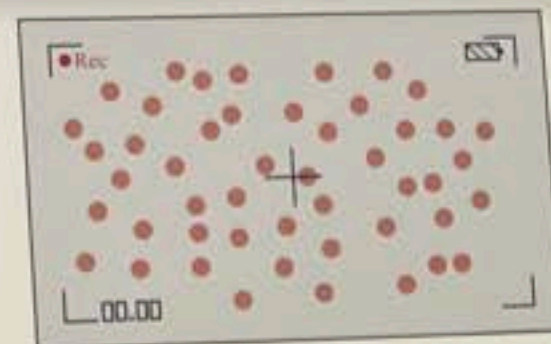
2. What got you into science?

My dad is a high school science teacher, and some of my earliest memories are participating in experiments he set up for my sister and I – from building bar charts to track the color of candies to exploring General Relativity using a bowl covered with cling wrap, a cantaloupe, and an ‘orbiting’ grape. Throughout my schooling, I fell in love with pretty much every domain of human knowledge and inquiry, but my dad’s infectious love of science and my great respect for him tipped the scales in favor of a scientific path.



Discover how computers can predict interactions between tiny, microscopic particles.

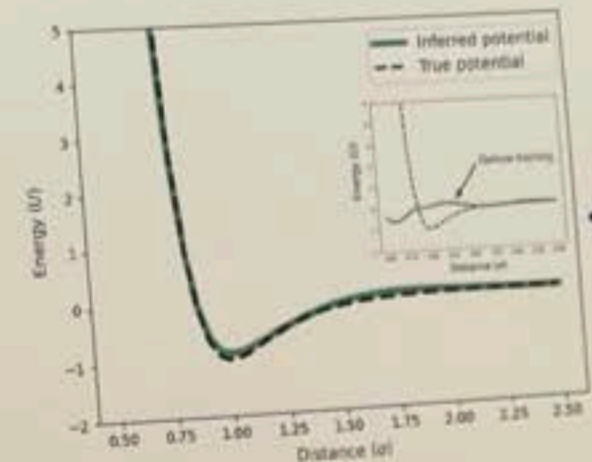
Steal Our Brownie Recipe...We Won't Mind



Track Brownian particles throughout a simulation or experiment.



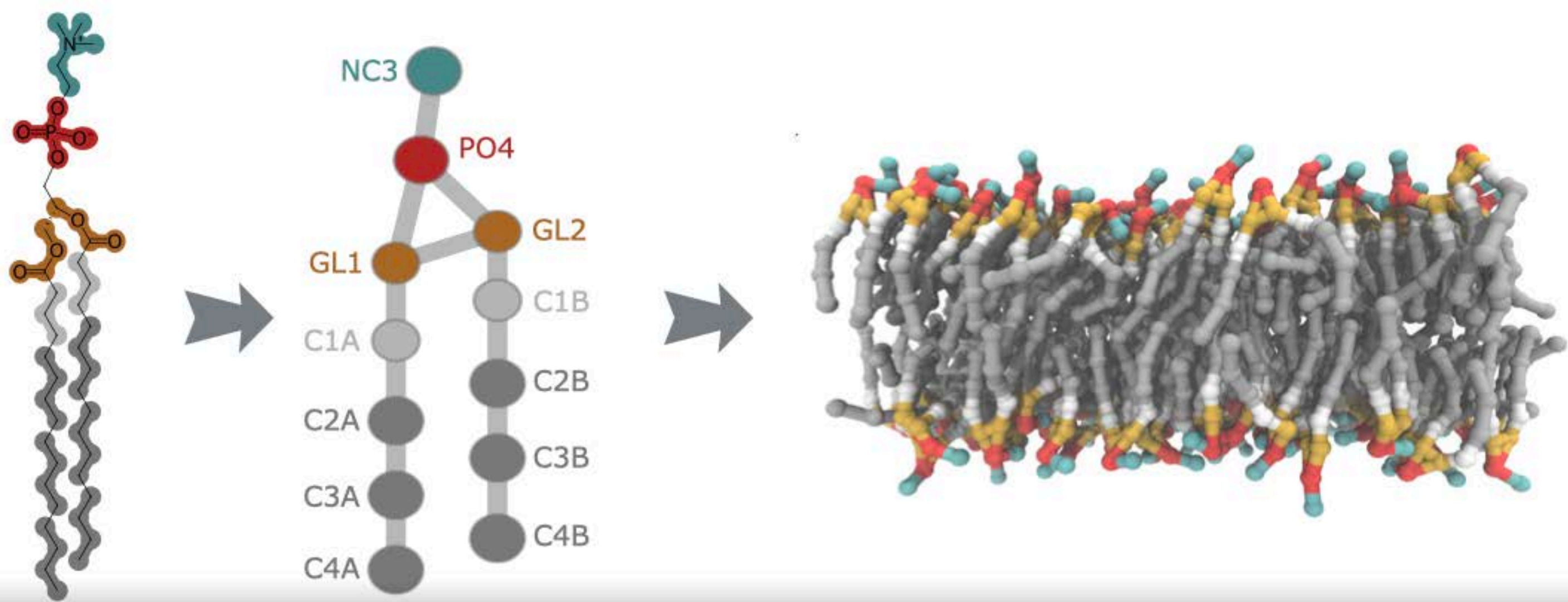
Train a Graph Neural Network using our physics-based approach.



Evaluate the GNN on a two-particle system to get your interaction potential.

Inferring Interaction Potentials from Stochastic Particle Trajectories
King et al, 2025, *Physical Review Research*



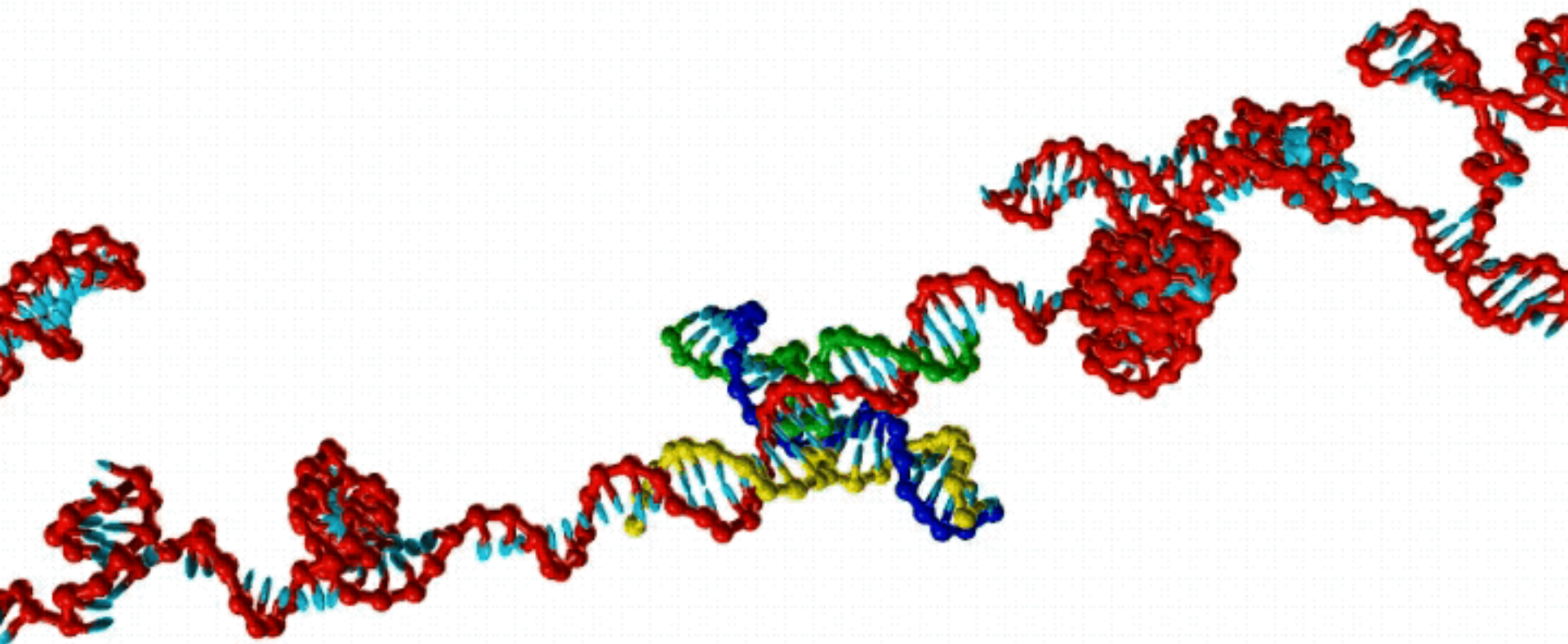


3. How did you end up where you are?

I felt that physics was most concerned with foundational questions: the ones you reach at the very limits of curiosity. To end up where I am today, I followed a circuitous and meandering path: I did my Bachelor's degree in Astrophysics, then became interested in experimental Biophysics in my Master's. Initially, I wanted to study quantum biology in my PhD, but for various reasons my project didn't work out, and I switched to computational biophysics. My postdoctoral fellowship was explicitly meant for interdisciplinary research, and enabled me to pivot into machine learning. Today, I am constantly being drawn to new interdisciplinary questions and learning skills in new fields.

4. What's one thing you wish someone had told you before starting out?

I wish someone had urged me to find a sense of intrinsic self-worth rather than worry about external standards and expectations. If you want to change the world, the existing standards and expectations must be dismantled. We cannot measure ourselves by them.



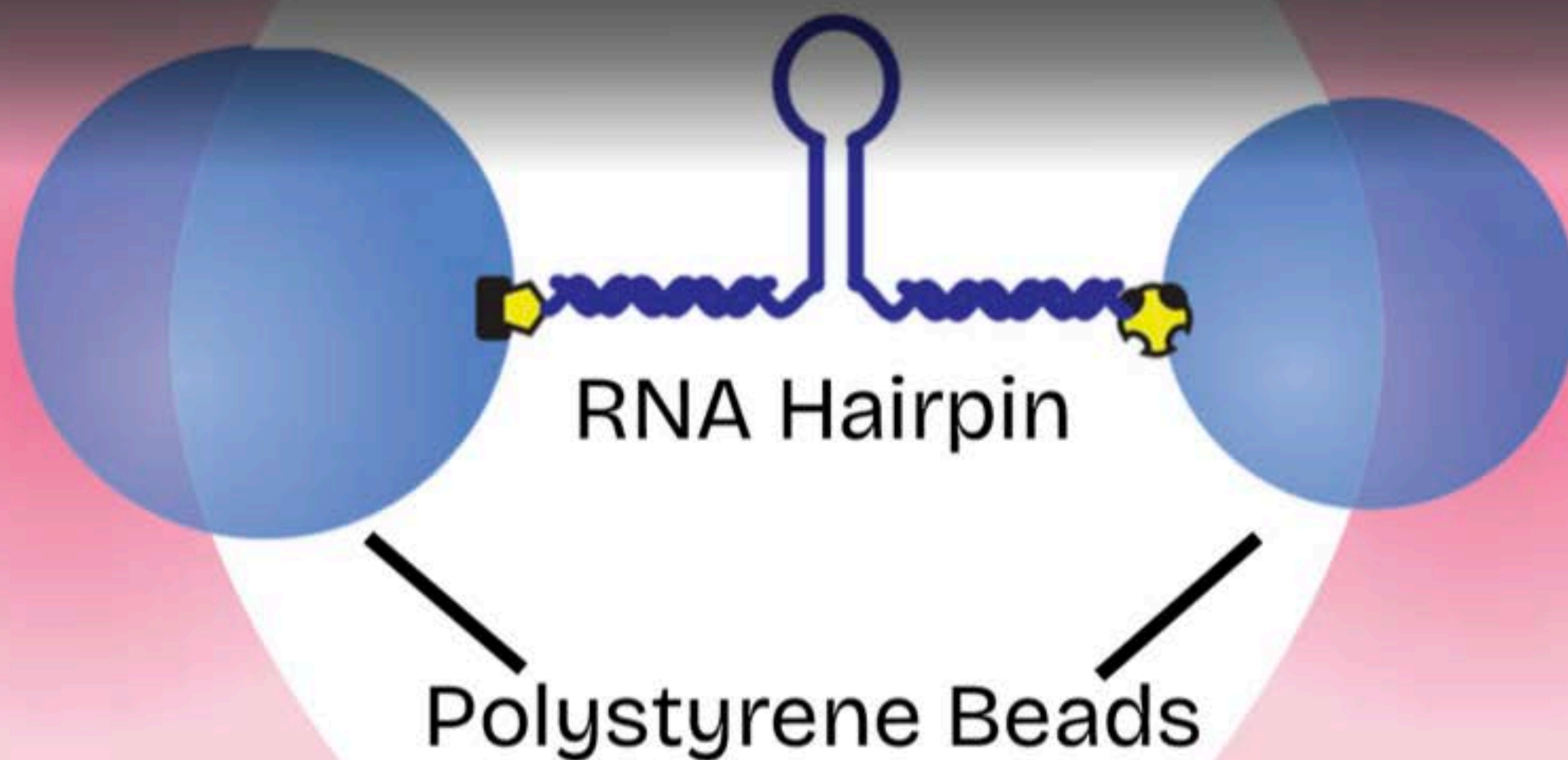
5. Has your career followed a straight path or took unexpected turns?

I would characterize my career path as Brownian motion biased by an external potential. If I hadn't gotten funding to pursue graduate studies at Oxford, I may not have done a PhD at all. If I hadn't graduated at the right time to apply for the then-new interdisciplinary Schmidt Science Fellowship after graduating, I may have left academia, as I was disillusioned with the traditional academic path. Finding a faculty job is the most stochastic process of all: where I am now is largely a fortunate accident of which University happened to be looking for someone with my profile at the time I was searching for a position. I've also had three career breaks and counting, taking 12 months' maternity leave for each of my children.



6. What's something in your work that you're really excited about?


My collaborators and I are working on a software that integrates the philosophy behind how large machine learning models are trained into building better models of DNA/RNA, lipids, and proteins. We're at the stage where we're seeing results with nucleic acid and lipid models, which is extremely exciting, and we are eager to dive next into the protein space. I'm also working with an experimental collaborator to develop potentially the first (!) scalable model of peptide nucleic acids, which have shown great promise for therapeutic and nanotechnological applications.





7. Is there a mentor that really inspired you to pursue an academic career?

I would not have considered graduate school had I not had an undergraduate supervisor suggest that I apply for a Masters scholarship (which I never dreamed I could get, but did end up getting!). My PhD supervisors were extremely supportive, helping me to finish my degree before giving birth to my first child (I defended while 8+ months pregnant), which gave me confidence to continue the academic route. There has also been a noticeable gap in mentorship, though, as I had very few interactions with senior women – in particular, there was no model for how to balance family and career (I was instead repeatedly told not to have children until after achieving tenure).



8. Now that you're mentoring others, what's something you try to pass on?

First and foremost, I treat others as human beings possessing an innate dignity that doesn't depend on GPA, number of papers, h-index, etc. It is important to decouple self-worth from extrinsic measures of success: not only is this necessary for flourishing, but it also leads to much better science! Freedom from external metrics and the "paper mill" enables scientists to pursue truly risky, meticulous, paradigm-shifting research. I also encourage young women to reflect on their long-term plans, and if building a family is part of them, it can be pursued early on. The narrative that you can't do good science while raising a family is simply false.