



# Our 2024 Schmidt Science Fellows

## **Ajinkya Dahake**

Nominating institution: Cornell University

### **Summary:**

As a 2024 Schmidt Science Fellow, Ajinkya aims to unravel how the nose of mosquitoes distinguishes between humans and other animals or plants.

Both male and female mosquitoes are vegans for most of their life, primarily feeding on nectar, plant sap, and fruits. But the female mosquito seeks human blood as nourishment for her developing eggs. How then does she locate a human for a blood meal?

This research has the potential to develop novel strategies to curtail the spread of mosquito-borne diseases.

**Interdisciplinary Pivot:** Ecology to Neuroscience

## **Annemiek Waajen**

Nominating institution: Edinburgh University

### **Summary:**

The increasing temperatures in the Arctic, resulting from climate change, will lead to the thawing of currently frozen (permafrost) soils, soils that store large amounts of carbon. To what extent this will contribute to climate change, is not well understood due to research limitations.

As a 2024 Schmidt Science Fellow, Annemiek plans to build a holistic perspective on permafrost thawing, comparing single-site and single-method studies in a global, multi-omics meta-analysis.

This insight will help address this issue and support policymakers in limiting its impact.

**Interdisciplinary Pivot:** Microbiology to Bioinformatics

## **Ashwin Kumar Jainarayanan**

Nomination Institution: University of Oxford

### **Summary:**

As a 2024 Schmidt Science Fellow, Ashwin will investigate a common and aggressive brain cancer - glioblastoma multiforme (GBM), research that could lead to the development of novel targeted therapies.

During his PhD at Oxford, he specialized in immunology, focusing on characterizing particles released into the immunological synapse – a nano-scale gap between T-cells and antigen-presenting cells. Leveraging this expertise, he engineered cytotoxic T-cells to release synthetic extracellular particles that specifically target and kill cancer cells.

Ashwin aims to leverage these skills alongside cutting-edge neuroscience techniques in investigating treatment strategies for GBM particularly, by harnessing neurotransmitter activity in the tumour microenvironment.

**Interdisciplinary Pivot:** Immunology to Neuroscience

## **Bruna Martins Garcia**

Nominating Institute: Max Planck

### **Summary:**

It is estimated that 10 million people die per year due to cancer, of which 90% is caused by metastasis - the ability of cancer cells to disseminate to other organs.

As a 2024 Schmidt Science Fellow, Bruna plans to investigate the metabolic demands driving metastasis, giving new insights into targeted therapies for one of the main causes of death worldwide.

To date, it is not possible to predict when and which organs will turn into future sites of metastasis. Bruna's work aims to broaden our understanding of organ-specific metastasis prevention and may open new avenues to future targeted therapies.

**Interdisciplinary Pivot:** Molecular & Cell Biology to Cancer Biology

## **Carmen Amo Alonso**

Nominating Institute: California Institute of Technology

### **Summary:**

As a 2024 Schmidt Science Fellow, Carmen plans to create more reliable and data-efficient language technologies. This will expand accessibility to minority language speakers and combat the spread of misinformation.

She will use mathematical models to gain a better understanding of our cognitive capabilities for language processing combined with computational tools to unveil the fundamental differences between natural and artificial language processing.

By bridging the gap between machine and human intelligence, her goal is to create safer and more efficient language technologies and, ultimately, steer artificial intelligence towards creating more equitable societies.

**Interdisciplinary Pivot:** Applied Mathematics to Natural Language Processing

## Charles Emogor

Nominating Institute: University of Cambridge

### Summary:

As global protected areas increase from 123 million km<sup>2</sup> to 153 million km<sup>2</sup> by 2030, anti-poaching patrols will be pushed to the limit.

2024 Schmidt Science Fellow Charles Emogor plans to enhance the management of these important areas by using artificial intelligence to help crucial anti-poaching patrols identify and target poaching hotspots.

He will use a unique combination of data from a biodiversity hotspot, including self-reported poaching records from hunters, to predict poaching hotspots and determine optimal allocation of patrol efforts for poaching deterrence. The findings could be incorporated into ranger patrol toolkits to enhance anti-poaching patrols globally.

**Interdisciplinary Pivot:** Biological Sciences to Math & Computer Science

## **Claire Zarakas**

Nominating Institution: University of Washington

### **Summary:**

The carbon dioxide removal (CDR) industry is rapidly evolving and essential for climate stabilization. However, including CDR in climate stabilization strategies can assume that different CDR methods are interchangeable.

Different methods affect different parts of the carbon cycle, with different timescales, stability, and uncertainty of carbon removal.

2024 Schmidt Science Fellow Claire Zarakas will explore these differences and how they could drive different climate outcomes depending on the CDR method applied. This will be tested using a hierarchy of climate models to develop physically robust approaches for comparing CDR methods.

**Interdisciplinary Pivot:** Atmospheric Sciences to Climate Systems



## **Claudia Fusco**

Nominating Institution: Max Planck

### **Summary:**

The destruction of natural habitats and the subsequent loss of biodiversity is a major global challenge. As a 2024 Schmidt Science Fellow, Claudia will use an evolutionary approach to help us better protect biodiversity.

She will study the cellular mechanisms that allow organisms to live together in a mutually beneficial manner, a biological phenomenon called symbiosis.

Questions that will be addressed will include: How do organisms from different species find each other? How do they adjust their molecular infrastructures to foster this interaction? And how can we protect them?

**Interdisciplinary Pivot:** Neuroscience to Evolutionary Biology

## Dengping Lyu

Nominating Institution: The University of Hong Kong

### **Summary:**

As a 2024 Schmidt Science Fellow, Dengping proposes to engineer intelligent materials by translating properties of living systems.

Communication and the ability to adapt and self-regulate: these are essential characteristics of living organisms but are very complicated and intelligent processes that do not exist in materials design and engineering.

She hopes to integrate tiny particles capable of harvesting energy and demonstrating group intelligence with other material platforms, such as polymer gels, to create intelligent materials. These materials could have uses in biomedicine, soft robotics, and electronics.

**Interdisciplinary Pivot:** Chemistry to Engineering

## **Elio Challita**

Nominating Institute: Georgia Institute of Technology

### **Summary:**

Elio's objective as a 2024 Schmidt Science Fellow is to develop an insect-inspired microrobot equipped with lab-on-chip sensors for environmental monitoring.

By emulating the exceptional abilities of insects, the novel "Lab-on-a-microrobot" will be capable of on-site fluid sampling, performing chemical analyses, and wirelessly transmitting results pertaining to threats related to water contaminations such as heavy metals, oil spills, and microplastics.

This technology could expedite emergency response and protect global ecosystems.

**Interdisciplinary Pivot:** Biophysics to Robotics

## **Erin Huiting**

Nominating Institution: University of California, San Francisco

### **Summary:**

As a 2024 Schmidt Science Fellow, Erin's work will focus on discovering plant innate immune receptors that impart multi-pathogen resistance in crops.

Plant immunity has been studied for over 30 years, uncovering critical insights into innate immune receptors that confer resistance to pathogenic bacteria, fungi, or viruses that cause severe disease in crops.

Erin's research will combine advancements in bioinformatics and genome engineering tools to discover new innate immune receptors in plants that are conserved across domains of life.

The results will serve as the basis to bioengineer multi-pathogen resistant crops for sustainable agriculture production and climate change mitigation.

**Interdisciplinary Pivot:** Biological Sciences to Earth Sciences

## Hayley Bounds

Nominating partner: University of California, Berkeley

### Summary:

Understanding how the brain represents information is essential to developing therapeutic treatments for brain damage and disorders.

Computational models of complex neural networks allow us to understand how different components are contributing to properties of the brain. An important emerging theory is that the geometry of relative activity within a neuronal population represents information. But many computational models lack key biological features limiting their utility and testability of this idea.

As a 2024 Schmidt Science Fellow, Hayley plans to build biologically-grounded, testable models to understand the contributions of different types of neurons to the population representation of information in the brain.

**Interdisciplinary Pivot:** Biological Sciences to Math & Computer Science

## **Jacob Beckham**

Nominating Institution: Rice University

### **Summary:**

As a 2024 Schmidt Science Fellow, Jacob will explore how the gut's microbiome influences our mental health in order to develop new bioelectronic therapeutics for anxiety.

Recent findings show the gut microbiome, the bacteria in your digestive tract, plays a surprisingly large role in mood disorders. However, we haven't yet identified the circuits and proteins that drive the effects of these bacteria on the brain.

Jacob's proposed experiments aim to create a better understanding of how bacteria reduce anxiety and how we can mimic their signaling to treat mental health disorders.

**Interdisciplinary Pivot:** Chemistry to Biological Sciences

## **Jeong Min (Jane) Park**

Nominating Institution: Massachusetts Institute of Technology

### **Summary:**

Jane's research will help find novel phases of matter and particles by combining materials design and sophisticated local scale measurements.

Theories predict the existence of fundamentally different particles known as non-abelian anyons, whose wave functions braid upon particle exchange. This braiding process can be used to encode and store information, potentially advancing quantum computing by addressing current challenges in qubit technology.

As a 2024 Schmidt Science Fellow, Jane's work will seek to directly detect phases that could host new particles by employing an instrument that can visualize sub-atomic scale phenomena.

**Interdisciplinary Pivot:** Condensed Matter Physics to Experimental Physics

## **Jessica Moore**

Nominating University: Yale University

### **Summary :**

Jessica will explore the impact of stress on the brain-body axis and offer a foundation for developing interventions to mitigate its effects.

As a 2024 Schmidt Science Fellow, she will investigate the mechanisms governing the development of the gliovascular unit, a critical interface responsible for maintaining the integrity of the blood-brain barrier, particularly under stress conditions.

By combining interdisciplinary approaches and collaborating with experts across neuroscience, immunology, and development, this will contribute to the understanding of the brain at multiple scales, addressing questions with important implications for human health.

**Interdisciplinary Pivot:** Biomedical Sciences to Neuroscience



## **Jia Le Lee**

Nominating Institution: Agency for Science, Technology and Research (A\*STAR))

### **Summary:**

As a 2024 Schmidt Science Fellow Jia will develop tools that can be used to advance research in improving cancer treatment.

Using a combination of imaging and computational methods, she will endeavor to expand the capabilities of current imaging tools to understand the complex changes in liver tissue during the liver cancer hepatocellular carcinoma (HCC).

This research will be important in enhancing our understanding of HCC biology and in identifying targets for the design of safer and more effective therapeutic strategies. The developed tool could be potentially applied to other research areas in the future.

**Interdisciplinary Pivot:** Immunology to Biological Imaging

## **Mansi Sood**

Nominating Institution: Carnegie Mellon University

### **Summary:**

As a 2024 Schmidt Science Fellow, Mansi will pivot to algorithm and incentive design for social networks, focusing on mitigating the spread of misinformation, improving algorithmic transparency, and fostering healthy discourse in online communities.

By transforming how people consume and share information, online social media has emerged as an instrument for shaping public opinion with a direct bearing on critical issues, including public health and safety.

Mansi is interested in studying how we can improve transparency in how content gets filtered and propagated in online information ecosystems and design interventions to ensure equitable access to information from diverse and reliable sources.

**Interdisciplinary Pivot:** Probability to Algorithms

## **Megan O'Driscoll**

Nominating Institution: University of Cambridge

### **Summary:**

The SARS-CoV-2 pandemic highlighted the vast unpreparedness of current global disease surveillance methods for detecting and responding to emerging biological threats.

Megan plans to develop open-source analytical platforms to support immunological surveillance efforts for future epidemic and pandemic preparedness.

As a 2024 Schmidt Science Fellow she will combine systems immunology and artificial intelligence methodologies to build integrative models of multiple immune components and their dynamic interactions that shape human immune system responses to infection and vaccination.

**Interdisciplinary Pivot:** Epidemiology to Immunology

## **Olivia Goldman**

Nominating Institution: The Rockefeller University

### **Summary:**

Millions of people currently suffer from long-COVID, and an underappreciated symptom of this condition is headache.

As a 2024 Schmidt Science Fellow, Olivia will develop a new model of headache in mice that will help us understand what causes headaches induced by viruses. She will use artificial intelligence to define how a mouse with a headache behaves, and use molecular biology to understand how viruses affect immune and sensory cells.

By providing new insights, the work could point the way to new therapeutics against long-COVID and headaches in general.

**Interdisciplinary Pivot:** Neuroscience to Neuroimmunology

## **Pailin Chiaranunt**

Nominating Institution: University of Toronto

### **Summary:**

Immune challenges, such as viral infections or allergic asthma, can impair breathing and cognition, as observed in conditions like post-COVID brain fog.

As a 2024 Schmidt Science Fellow Pailin will use a combination of computational methods, chemogenetics, and respiratory disease models, to explore this lung-brain pathway. This could improve how we understand and treat neurological and psychiatric illnesses by incorporating the immune system as a critical regulator of the brain.

The work could lead to new therapeutic avenues for post-infection neurological syndromes, as well as neuropsychiatric and autoimmune diseases.

**Interdisciplinary Pivot:** Immunology to Neuroscience

## **Peter Serles**

Nominating Institution: University of Toronto

### **Summary:**

As a 2024 Schmidt Science Fellow, Peter will engineer high quality clusters of brain tissue that will allow us to better model diseases and test treatments.

Stem cells offer a major research opportunity as they can be grown into brain tissue, but current designs grow to a few millimeters in size before the cells in the middle begin to die. Using nano-3D printing, Peter plans to develop a supporting 3D micro-environment which mimics the human brain to help neural tissue mature and grow into a complex structure.

This would create a unique platform to study brain disease, damage, and treatment methods with high speed and low costs.

**Interdisciplinary Pivot:** Mechanical engineering to Biological Sciences

## **Rishyashring (Rishee) Iyer**

Nominating Institute: University of Illinois, Urbana-Champaign

### **Summary:**

Rishee hopes to deepen our understanding of mechanical cues in the neurovascular environments, which could inform the progression of neuromuscular and neurodegenerative disorders.

His research will study the role of mechanical cues in the neuro-vascular coupling in the sensory pathways within the mouse brain, concentrating on the vibrissa (or whiskers), which are critical to how mice perceive the world.

This could create a holistic electro-mechanical model of sensation and accurately describe how the sensory organs, neurons, and blood flow work cohesively within this process.

**Interdisciplinary Pivot:** Biological engineering to Biophysics

## **Rogan Grant**

Nominating Institution: Northwestern University

### **Summary:**

Rogan plans to identify pharmacologically actionable targets that can reduce neuroinflammation to delay or prevent the development of dementia.

Recent discoveries using high-content, unbiased techniques in biology have found that adaptive immune cells, called T cells, can enter the brain and potentially attack it as we age or develop dementia. It is currently unclear why this occurs, but, as part of his 2024 Schmidt Science Fellowship, Rogan's research aims to identify the molecular and cellular mechanisms necessary to drive this dysfunction.

Ultimately he aims to target these mechanisms to prevent neurodegeneration from occurring and potentially reverse cognitive decline in ageing and dementia.

**Interdisciplinary Pivot:** Systems Biology to Molecular and Cell Biology



## **Roman Barth**

Nominating Institution: Delft University of Technology

### **Summary:**

Roman will use powerful deep learning-based algorithms to design new candidates for a promising, but difficult to identify, class of drugs.

Proteins have varied tasks to fulfil within cells. To function appropriately, proteins need to adopt the correct three-dimensional structure. Misfolding of proteins is involved in up to 50% of human diseases during disease progression.

Pharmacological chaperones are a promising class of drugs to treat the progression of these diseases, but they are difficult to identify. As a 2024 Schmidt Science Fellow, Roman will employ powerful deep learning-based protein structure prediction algorithms to design pharmacological chaperones from scratch.

**Interdisciplinary Pivot:** Biological Sciences to Math & Computer Science

## **Sarah Cai**

Nominating Institution: The Rockefeller University

### **Summary:**

As a 2024 Schmidt Science Fellow, Sarah aims to study information transfer in DNA replication via state-of-the-art optical tweezers technology.

A single human genome can give rise to hundreds of cell types and tissues. This gene expression is specified by unique instructions written on the proteins that package DNA into chromosomes.

It is unknown how these instructions are specifically passed to daughter chromosomes during DNA replication. Understanding this mechanism could provide a blueprint for the development of novel therapeutics targeting cancer and regenerative medicine.

**Interdisciplinary Pivot:** Structural Biology to Biophysics

## **Satish Kumar**

Nominating Institution: University of California, Santa Barbara

### **Summary:**

As a 2024 Schmidt Science Fellow, Satish aims to study plants as "bioindicators" to detect and mitigate global pollution.

By studying how certain plant species respond to pollutants, he aims to establish a correlation between their presence and pollution levels, and establish how their spectral properties change in response to pollution.

He will use advanced computer vision algorithms to monitor these spectral changes using aerial and satellite imagery. This approach has the potential to revolutionize pollution monitoring, providing a cost-effective and efficient solution.

**Interdisciplinary Pivot:** Engineering to Earth Sciences

## **Sijie Ji**

Nominating Institution: Nanyang Technological University

### **Summary:**

Sijie's 2024 Schmidt Science Fellowship proposal explores the Internet of Materials, aiming to build a world where humans, objects, and the natural environment, are all sensors, coexisting and communicating with each other wirelessly.

The principle behind the concept is everything has its own responsiveness to various materials and perceives visible or invisible vibrations.

The work will utilize these different vibration levels and design communication protocols, enabling communication through the same vibrating frequency or relay materials.

**Interdisciplinary Pivot:** Math & Computer Science to Engineering

## **Soon Wei Daniel (Daniel) Lim**

Nominating Institution: Harvard University

### **Summary:**

As a 2024 Schmidt Science Fellow, Daniel's work seeks to expand access to affordable, general purpose diagnostic imaging in under-served and remote communities.

Ultrasound is a safe, affordable, and commonly used medical imaging tool. However, it has limitations due to poor spatial resolution and inconsistent results across different operators.

Daniel will explore using a new class of miniaturized acoustic sources, called acoustic frequency combs, to distinguish tissue types and pathologies more accurately.

If successful, this approach could lead to more precise diagnoses for a broader range of diseases, of particular benefit in remote or economically disadvantaged areas, where more costly imaging technologies are less accessible.

**Interdisciplinary Pivot:** Physics & Astronomy to Biological Sciences

## **Sophie Belman**

Nominating Institution: University of Cambridge

### **Summary:**

Through her 2024 Schmidt Science Fellowship, Sophie aims to understand the combined impact of air quality, meteorology, and population mobility on bacterial respiratory diseases.

The work will integrate multiple data types into spatial models to identify the factors driving respiratory disease and predict pathogen dynamics in a changing climate. This approach will aim to account for air quality, weather patterns, and population demographics that may influence disease patterns.

These models could project disease risk and help optimize the use of vaccines and antimicrobial drugs.

**Interdisciplinary Pivot:** Biological Sciences to Earth Sciences

## **Takumi Matsuzawa**

Nominating Institute: University of Chicago

### **Summary:**

As a 2024 Schmidt Science Fellow, Takumi aims to better understand self-regulation mechanisms within cells.

Without their self-regulating properties, proteins inside cells can clump together, potentially leading to severe conditions like ALS and Alzheimer's disease. Inside cells, droplets of biomolecules form and dissolve, regulating vital processes from gene transcription to energy consumption. But this mechanism is not well understood.

Takumi's research aims to mimic these biomolecular droplets in a simpler system and reproduce their self-regulating behavior. If successful, the work could help address issues caused by protein clumping and aid drug delivery.

**Interdisciplinary Pivot:** Condensed Matter Physics to Biophysics

## **Tomi Baikie**

Nominating Institution: University of Cambridge

### **Summary:**

As a 2024 Schmidt Science Fellow, Tomi will pioneer new understanding of how the body works through non-contact electrical measurements.

Our skin has electric potential variations, but their origins are not known, primarily because they are very difficult to measure over long timescales.

By translating techniques from semiconductor physics, Tomi aims to measure these electrical maps without even touching the skin. The work has direct implications for understanding human physiology.

**Interdisciplinary Pivot:** Physics & Astronomy to Biomedical Sciences



## Wonjun Yim

Nominating Institute: University of California, San Diego

### Summary:

As a 2024 Schmidt Science Fellow, Wonjun plans to develop novel nanosensors for early-stage cancer diagnostics in a clinical setting.

Early-stage cancer diagnostics pose significant challenges due to the short half-life of biomarkers, sample dilution, and the small size of tumors.

Nanosensors capable of detecting target biomarkers with high sensitivity and selectivity hold great promise. This work aims to integrate nanotechnology with medical devices to enable 3D biomedical chemical imaging.

The nanosensor-enabled early-stage cancer diagnostics has the potential to make a positive impact on healthcare.

**Interdisciplinary Pivot:** Materials Science to Cancer Diagnostics