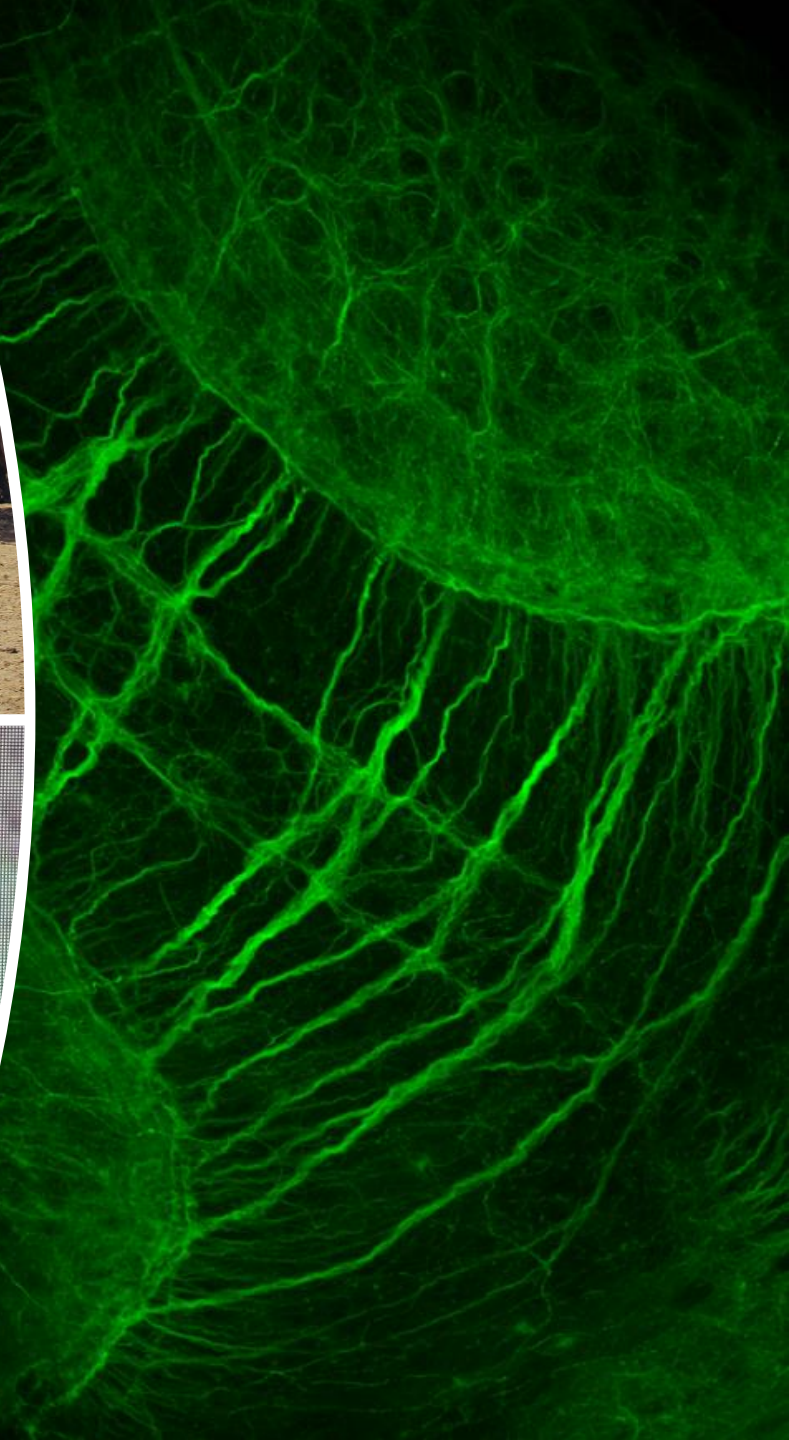




2026 LIDo Research Image Competition

These photos were the
previous entries winners in
the last competition.

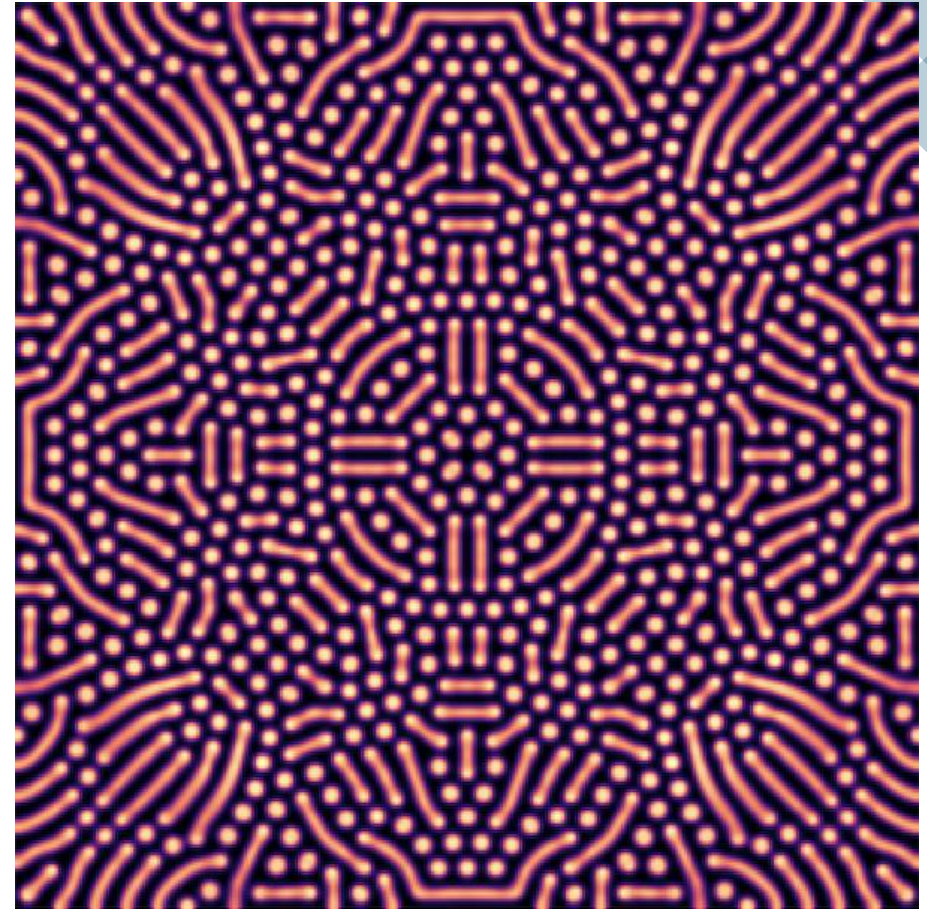


From Neural Activity to Self-Organising Geometry

What do low blood sugar, epilepsy, and psychedelic experiences have in common? Under the right conditions, they can produce remarkably similar geometric visual hallucinations. These patterns appear across diverse conditions, cultures, and across history, suggesting they arise from underlying properties of the brain itself.

This image reveals how such patterns emerge through mathematical modelling of neural activity in the visual cortex. The brain contains two neuron types: excitatory neurons (the accelerator) and inhibitory neurons (the brake). Information processing depends on the delicate balance between these populations. Using a reaction-diffusion model—the same mathematical framework explaining leopard spots or zebra stripes—we simulated this neural interplay. When excitatory and inhibitory populations interact at different rates and within a specific parametric "sweet spot," they spontaneously self-organise into intricate geometric structures.

The pattern shown here demonstrates a maze-like arrangement mirroring the geometric visuals reported during altered states of consciousness and neurological conditions. This work bridges mathematics, neuroscience, and phenomenology, revealing how the same principles governing pattern formation in nature may also underlie our most extraordinary visionary experiences. Geometric hallucinations thus allow us to witness not just the intricacies of neural functioning, but universal patterns of nature herself.



Floral medicine for bees

This buff-tailed bumblebee queen (*Bombus terrestris*) is feeding on strawberry tree nectar (*Arbutus unedo*), which contains unedone. Previous research has shown that unedone can reduce infections of *Crithidia bombi*, a parasite that may render bumblebee queens infertile or reduce their colony-founding success. While self-medication in insects is still debated, *A. unedo* is so popular among young bumblebee queens during its autumn flowering period that the whole tree appears to be buzzing with them.

My research focuses on nectar compounds like unedone that have the potential to support bee health and influence behaviour in beneficial ways, such as enhancing learning and foraging performance or reducing stress. Nectar therefore not only offers food for bees but may also act as a floral pharmacy - a source of medicines or even psychoactive drugs.

This bee is also performing buzz pollination, a specialised technique in which she grips the flower and vibrates her flight muscles to shake pollen loose, visible falling beneath her. Bumblebees are highly efficient and specialised buzz pollinators, making them vital for the production of many crops, including tomatoes, blueberries, potatoes, and aubergines.



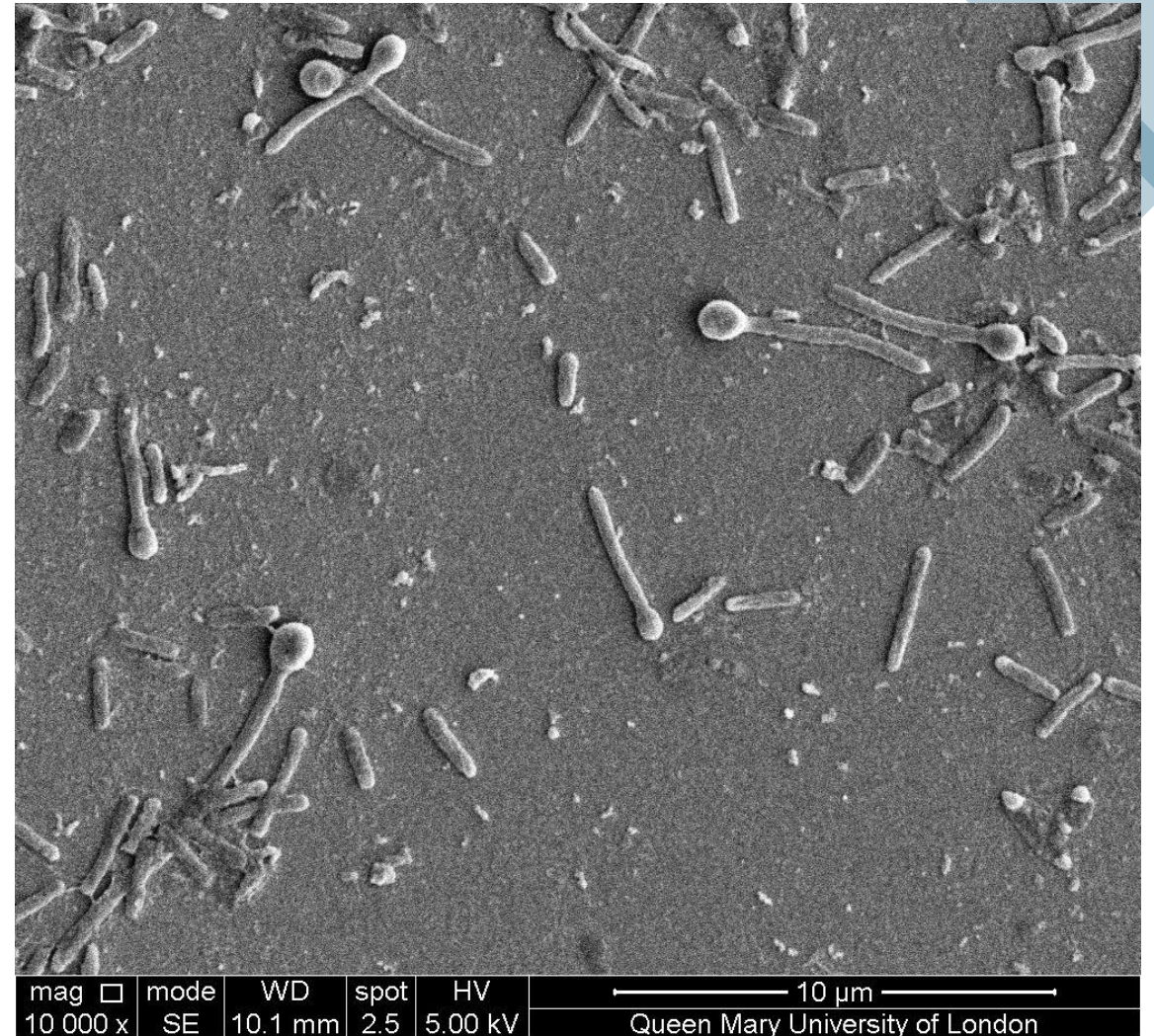
A synthetic microbial consortium for the valorisation of CO₂, captured using SEM imaging

The image shows a scanning electron microscopy image of an electrode surface from a microbial electrosynthesis (MES) co-culture of anaerobic bacteria *Clostridium ljungdahlii* and *Geobacter sulfurreducens*.

C. ljungdahlii is an acetogenic bacteria which naturally utilises the Wood-Ljungdahl pathway (WLP) to reduce CO₂ to acetate and ethanol, offering a plausible means of economically viable carbon capture. However, the WLP yields only one ATP per cycle, posing energetic limitations its use for large-scale applications. MES seeks to overcome this limitation by using an electrochemical cathode to provide a constant supply of electrons to drive the WLP.

In this project, we hope to increase the electron uptake flux of *C. ljungdahlii* in the culture by forming a conductive biofilm using electroactive *G. sulfurreducens*, which couples extracellular electron transfer to its respiration. Electron transfer from *G. sulfurreducens* to other species has been shown to occur both directly to some species using c-type cytochromes and conductive pili, and indirect via electron mediators.

The SEM image shown demonstrates co-existence of shorter *G. sulfurreducens* and the longer *C. ljungdahlii* on the electrode, however limited physical contacts between the species suggest that direct interspecies electron transfer may not be the dominant method of electron uptake by *C. ljungdahlii*.



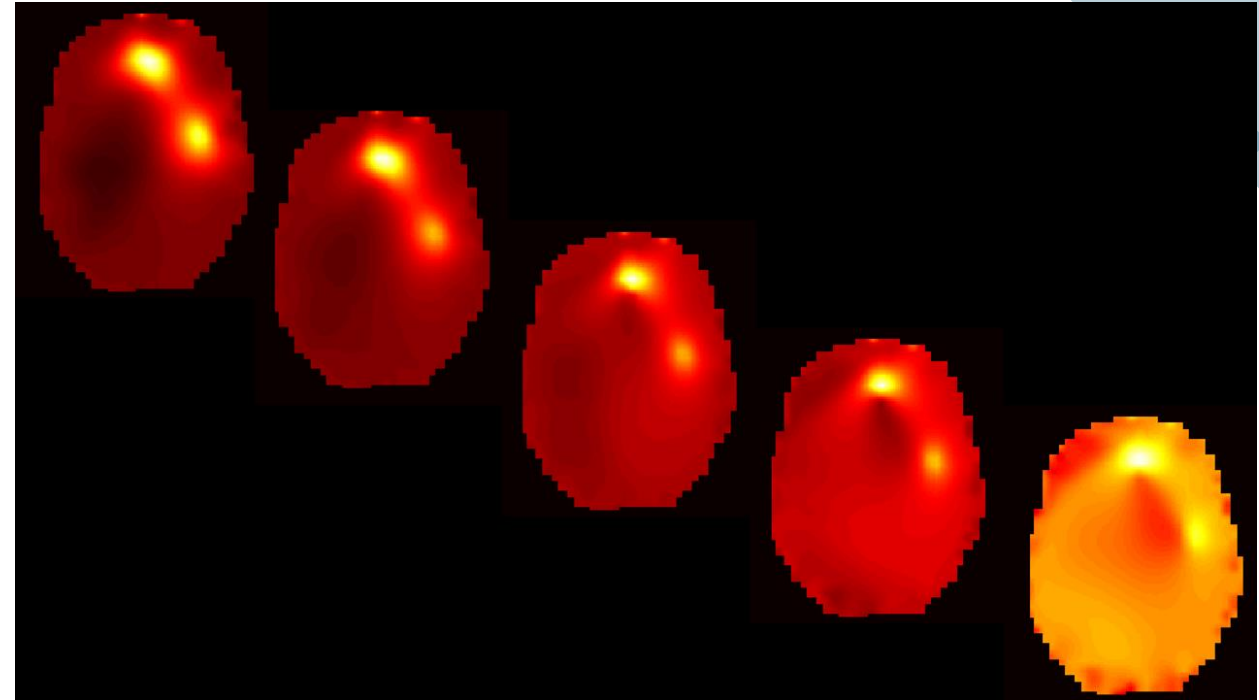
Light in the Noise

“In the midst of darkness, light persists”

– Mahatma Gandhi

Imagine trying to find hope in darkness. These brain images show exactly that. Electrical brain activity was simulated with two regions involved in emotional processing artificially activated. Moving from left to right, we progressively drown the signal in noise. The glowing spots show where the algorithm believes the brain is active.

The aim is to assess the robustness of the algorithm: at which levels of noise it breaks and is no longer able to recover the true signals. As noise increases, the algorithm struggles to separate truth from interference. Yet, even at the highest level of noise, the glows persist. The signals are still there; they just need to be found.



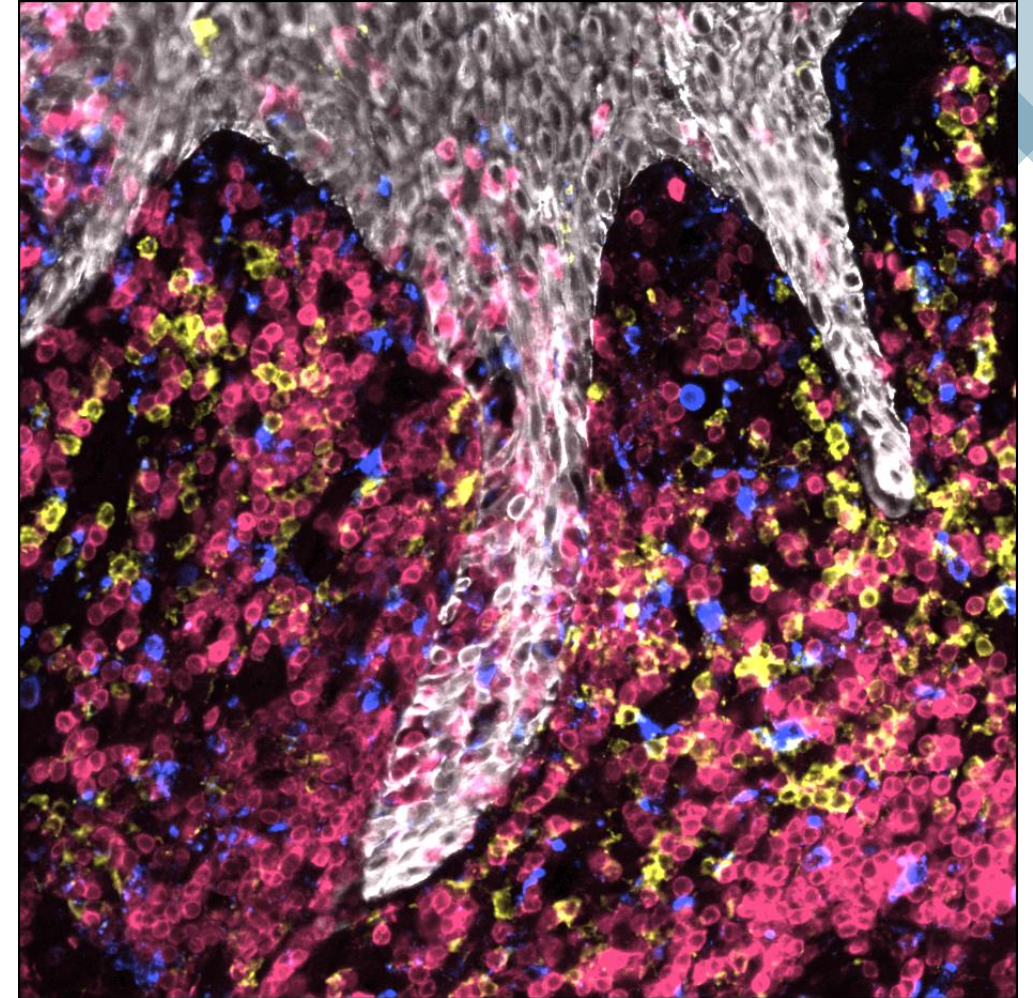
Immune Infiltration in the Gums

Abstract:

The gums are an important barrier, protecting us from the large number of microbes that inhabit the mouth. Gums are often rich in immune cells, which patrol the tissue, ensuring detection and response to threats before they cause harm. This image shows the outer barrier surface (epithelium) in grey, and immune cells (T cells in pink, B cells in yellow, and macrophages in blue).

Our research focuses on how these immune cells interact within gingival tissue, particularly in relation to the peripheral nervous system. By using targeted staining techniques to label specific cell types, we can perform spatial analyses to determine whether certain cells localise near one another, and whether these patterns differ between healthy and diseased tissue.

Mapping these spatial relationships helps us identify potential cellular interactions. These findings can then be explored in greater depth using sequencing datasets and in vitro models, allowing us to better understand how neuro-immune communication may influence oral health and disease.



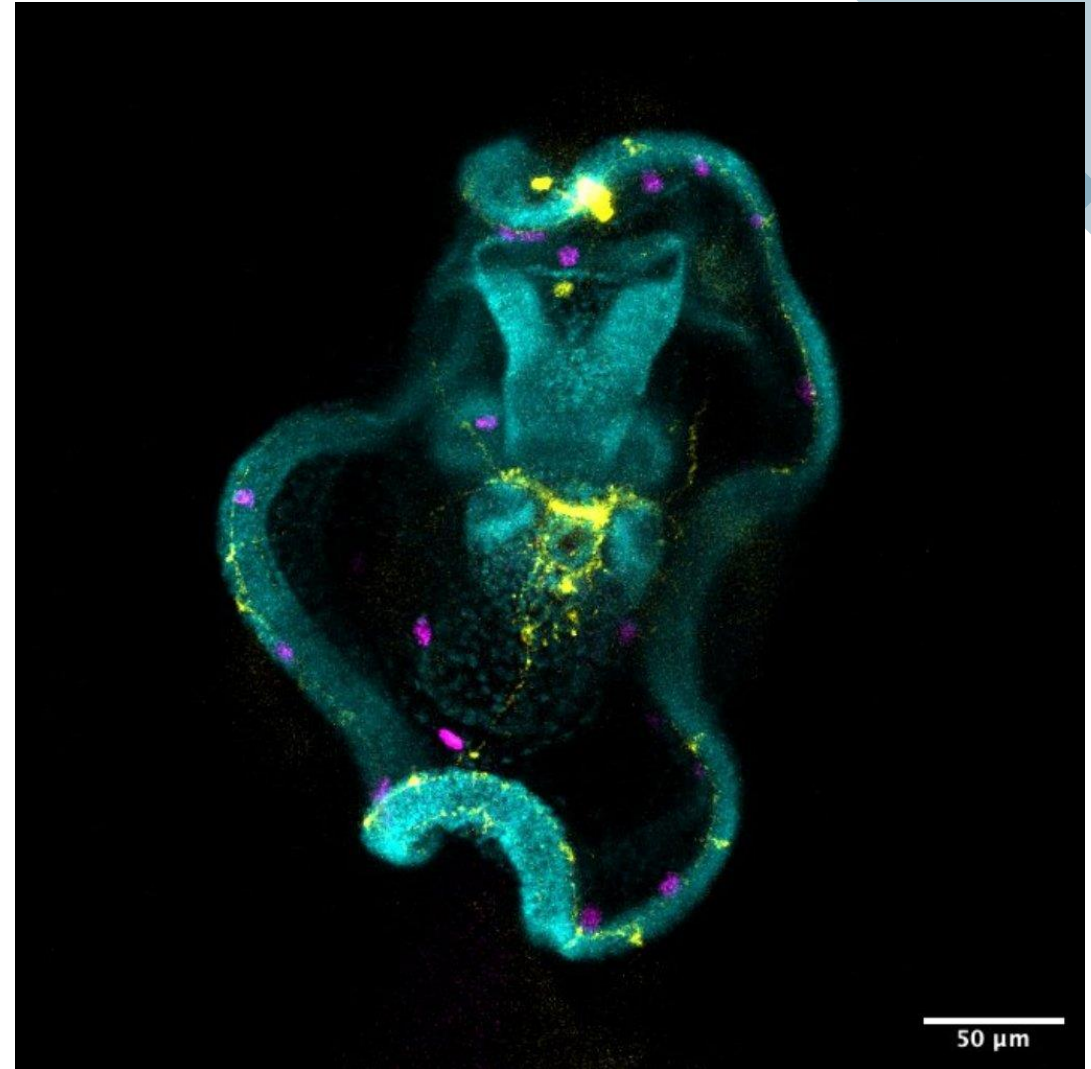
Grow with the Flow: Neurons and glia in the developing larval nervous system of a sea worm

Abstract:

View from above of a two-week-old larva of the marine annelid worm *Owenia fusiformis*, showing the structures of its developing nervous system. At the beginning of their life, *O. fusiformis* spend three weeks swimming and feeding in open water as microscopic, peculiarly shaped larvae (whole body stained cyan here) before sinking to the seabed to metamorphose into adult worms.

This larval development is studied for the insights it provides into the evolution of invertebrate nervous systems. The tiny larvae contain only about two dozen neurons (yellow), most clustered in a central organ that will develop into the adult's brain. In this image, the neurons are joined by another nervous system cell type: glia (magenta). Transcriptomic evidence from our lab suggested the presence of this previously unknown glial population. To confirm this, I combined three fluorescent staining methods with confocal microscopy, and this resulting image visualises the newly discovered glia lining the undulating edge of the larval mantle, closely associated with - but distinct from - neurons. In other animals, glia support and modulate neuronal circuits.

My project will explore the characteristics and functions of the glia in these minuscule larvae and what this teaches us about how nervous systems evolved and develop.



The health of one is the health of all

In the half-light between darkness and illumination, something small breathes. This image was taken close, in the intimate space where a researcher learns to look — not above the landscape, but within it, at the scale where life is most precarious and most interconnected.

Among Samburu pastoralist communities in Northern Kenya, the boundary between human health and animal health has never been a boundary at all. Herders have long understood what Western medicine is still learning to name: that the body of a cow, the soil of a riverbed, the bite of a tick too small to see, and the fever of a child are threads in a single fabric. When one pulls loose, the whole shifts.

The photograph asks the same question the research does: what do we miss when we refuse to look this closely?

Health is not individual. It is all.

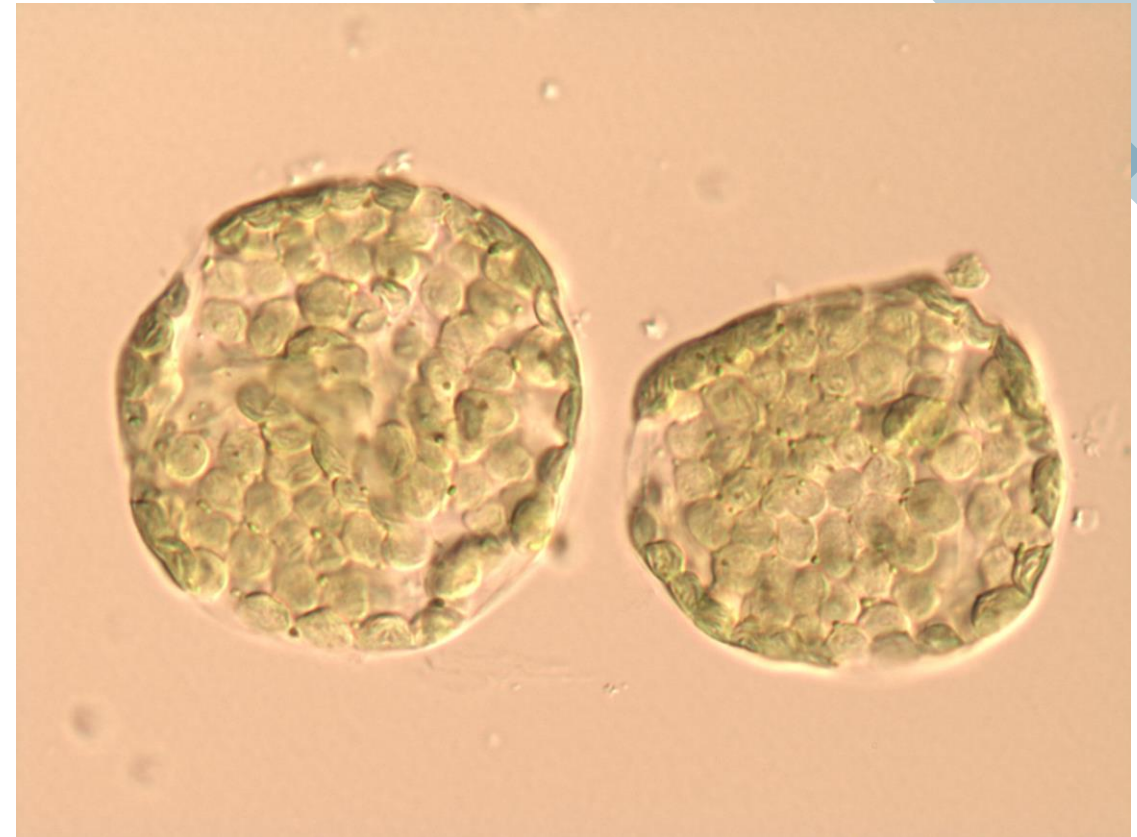


Mini Solar Panels of the Plant Cell

This microscopic view reveals plant cells filled with chloroplasts. These tiny structures allow plants to harness sunlight. Through photosynthesis, chloroplasts convert light energy into the sugars that sustain nearly all life on Earth.

My research explored how genes SGL2 (ARF2) and GLK1 control the development of these little "power stations". These genes are part of the regulatory network that controls how leaves turn green by promoting the formation of functional chloroplasts.

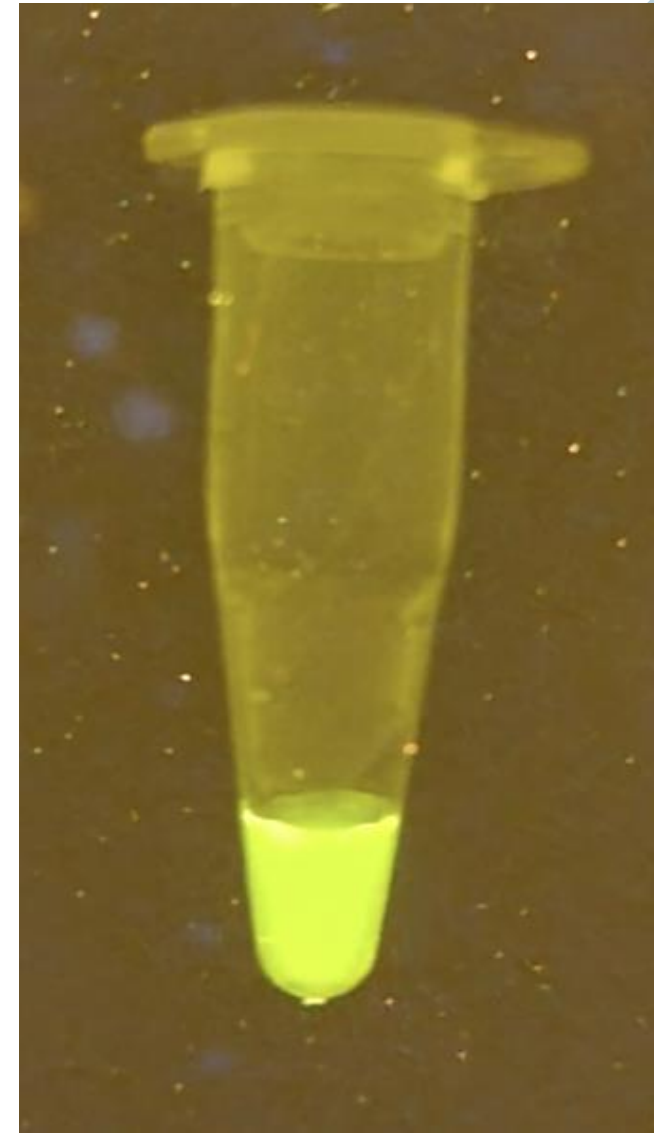
By studying plants carrying mutations in these genes, we can better understand how chloroplast development is genetically regulated. In the long term, this knowledge could help scientists develop greener, more efficient plants capable of capturing more energy from light and supporting improved plant growth.



In-Field Tuberculosis PCR Diagnosis in Non-Human Primates

My research focus is to create new tests for tuberculosis diagnosis in primates within zoos and sanctuaries, both here in the UK and abroad. One of these diagnostic tests, which I am currently developing and optimising is a specialised polymerase chain reaction (PCR) assay. The PCR assay detects the DNA from bacterial tuberculosis cells within clinical samples, such as blood, mouth swabs and faecal samples. The PCR assay has been specially designed, so that the primers (the PCR components that isolate the required DNA samples) will only bind to DNA from tuberculosis cells.

This image shows a positive PCR result during test development, using laboratory-grade tuberculosis DNA. My primers within the test have specially designed fluorescent probes attached, which means that when they bind to tuberculosis DNA only, they fluoresce under a blue light. Once fully developed, this assay will be able to be used by zoo and sanctuary veterinarians for primate tuberculosis diagnosis on-site, using a portable, miniaturised and cost-efficient laboratory. The aim is to provide more accurate diagnostics than those currently available and to eliminate the need for external laboratory testing, which is often not possible in more remote areas.

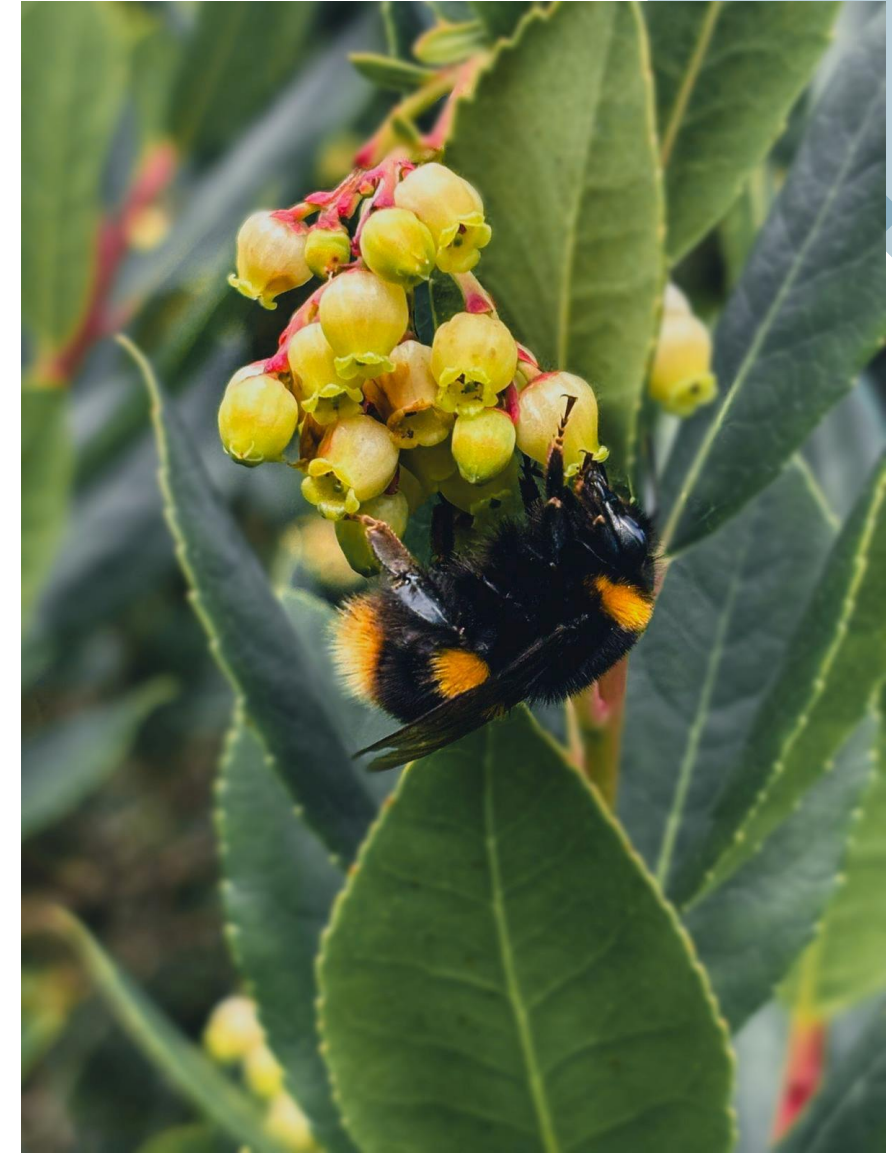


A sip of nectar... Oops, medicine?

Pollinators face ongoing threats that contribute to their decline, such as habitat loss and pathogens like *Crithidia bombi*, a parasite that can affect colony health. My research explores the "nature's pharmacy," investigating how chemical compounds found in nectar and pollen act as natural medicine for bees. I aim to explore if bees can detect and strategically consume medicinal "cocktails" to control infection, such as shifting their foraging to prioritize plants with chemicals that inhibit parasites. This suggests a complex behavioral feedback loop where the bee's health could influence its floral choices, and vice versa.

Arbutus unedo, the plant shown in the picture, is a fascinating example, as its nectar contains compounds that can inhibit *C. bombi*. In the picture, while we think we are just observing a bee on a flower, we might actually be witnessing a strategic foraging intervention against a microscopic parasite mediated by the plant's chemistry.

This photo represents the intersection of ecology and pharmacology, where a simple foraging trip may be a dose of medicine that improves pollinator health. By understanding these interactions between the bee, the plant, and the parasite, we can better design landscapes that support pollinator health and resilience.

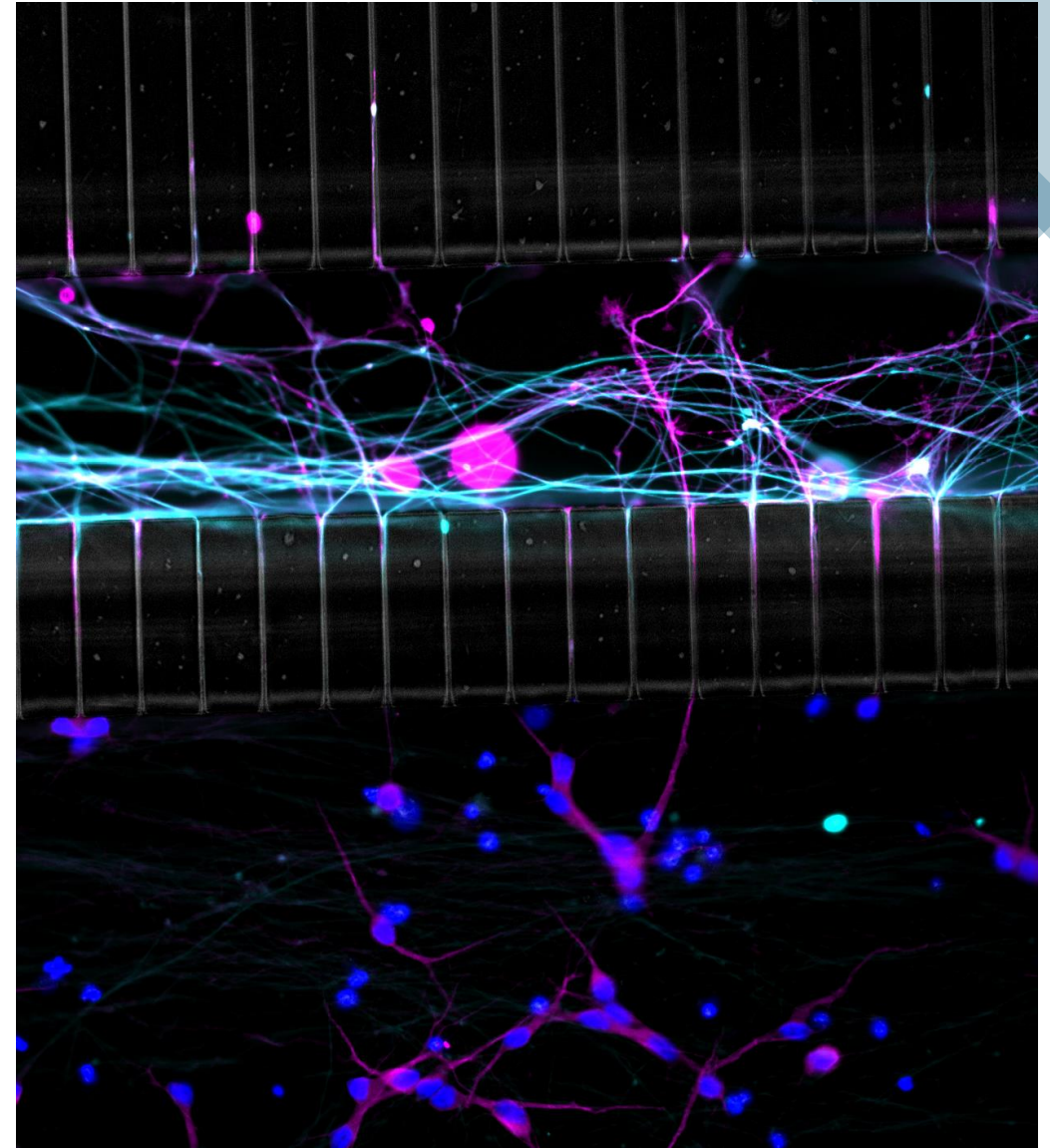


Bioengineered Brain Bridges

This image captures the intersection of **bioengineering**, **neurobiology**, and **bioinformatics** within a human "brain-on-a-chip." Using a precision-fabricated **three-chamber microfluidic device**, we have reconstructed the spatial complexity of the nervous system. The bottom chamber houses whole hiPSC-derived neurons (Blue: DAPI, Magenta: MAP2, Cyan: NFH), while the top chamber (not shown) directs axonal growth downwards. They meet in the centre: the **synaptic compartment**.

In neurodegenerative research, the synapse is often the first site of degeneration. By isolating these connections, we can observe organelle dynamics by tracking their movement in real-time via live-cell imaging. Furthermore, this compartmentalization allows for specialised multi-omics analyses. Our bioinformatics pipelines decode the resulting data to identify molecular signatures of disease that are often lost in traditional 2D cell cultures.

By integrating electrophysiology and advanced measurements into these chips, we can create high-fidelity human models that significantly reduce reliance on animal testing. This interdisciplinary approach provides a clearer, more ethical window into the mechanisms of human neurological health.



FFT expression in an *Arabidopsis thaliana* flower

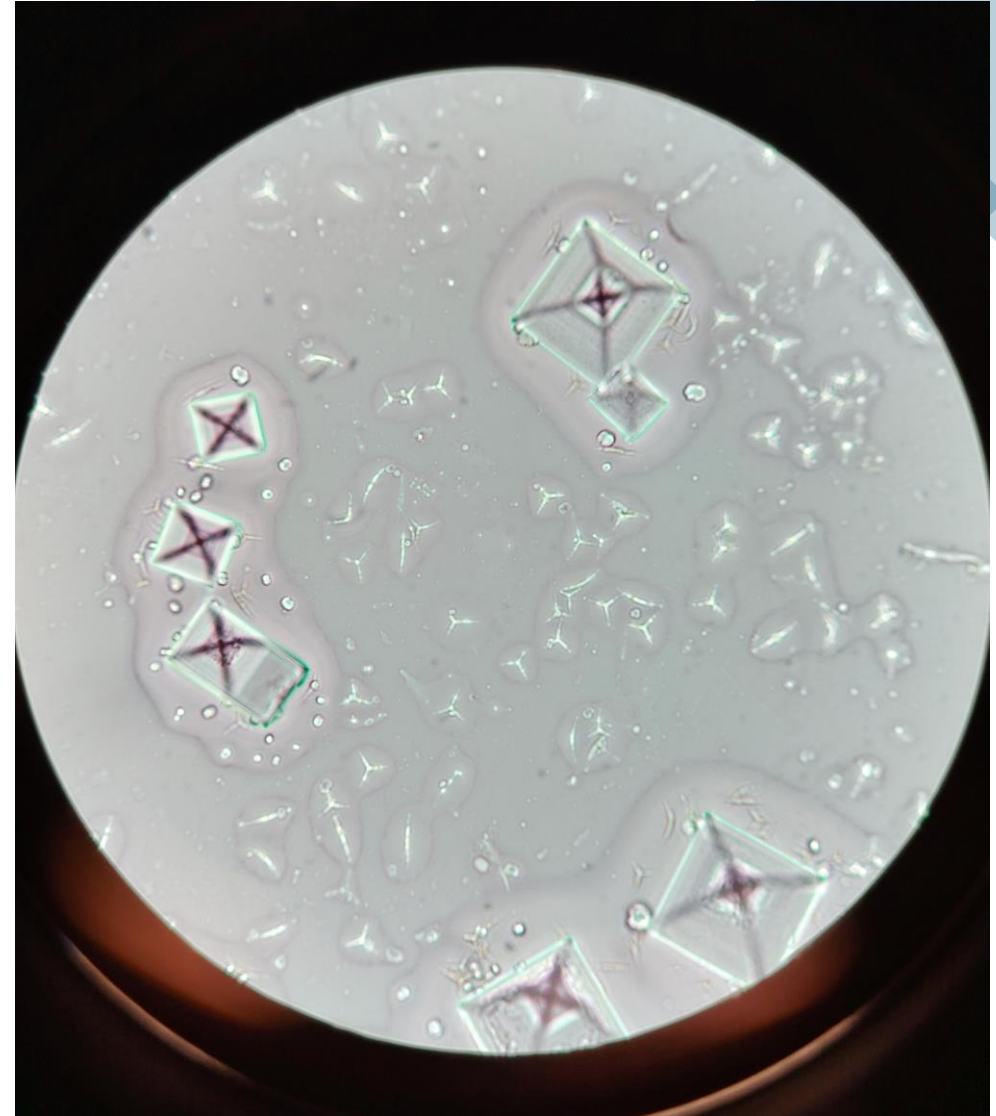
The base of a mature *Arabidopsis thaliana* (thale cress) flower, stained to show the presence of the FFT membrane transporter in blue, in nectary cells, and in guard cells (circular pairs of cells throughout the flower). Captured with a light microscope at 100X magnification. Uncovering the function of FFT in nectaries and guard cells is one of the objectives of my PhD project.



Starbound in Salt

Diatoms are photosynthetic unicellular algae that reside within intricate glasshouses – frustules – made of silica that they sequester from the surroundings. Among all algae, diatoms are exceptionally successful and widespread, inhabiting all sorts of marine and freshwater environments. As crucial primary producers, diatoms convert atmospheric carbon dioxide into organic carbon and oxygen, sustaining marine food webs.

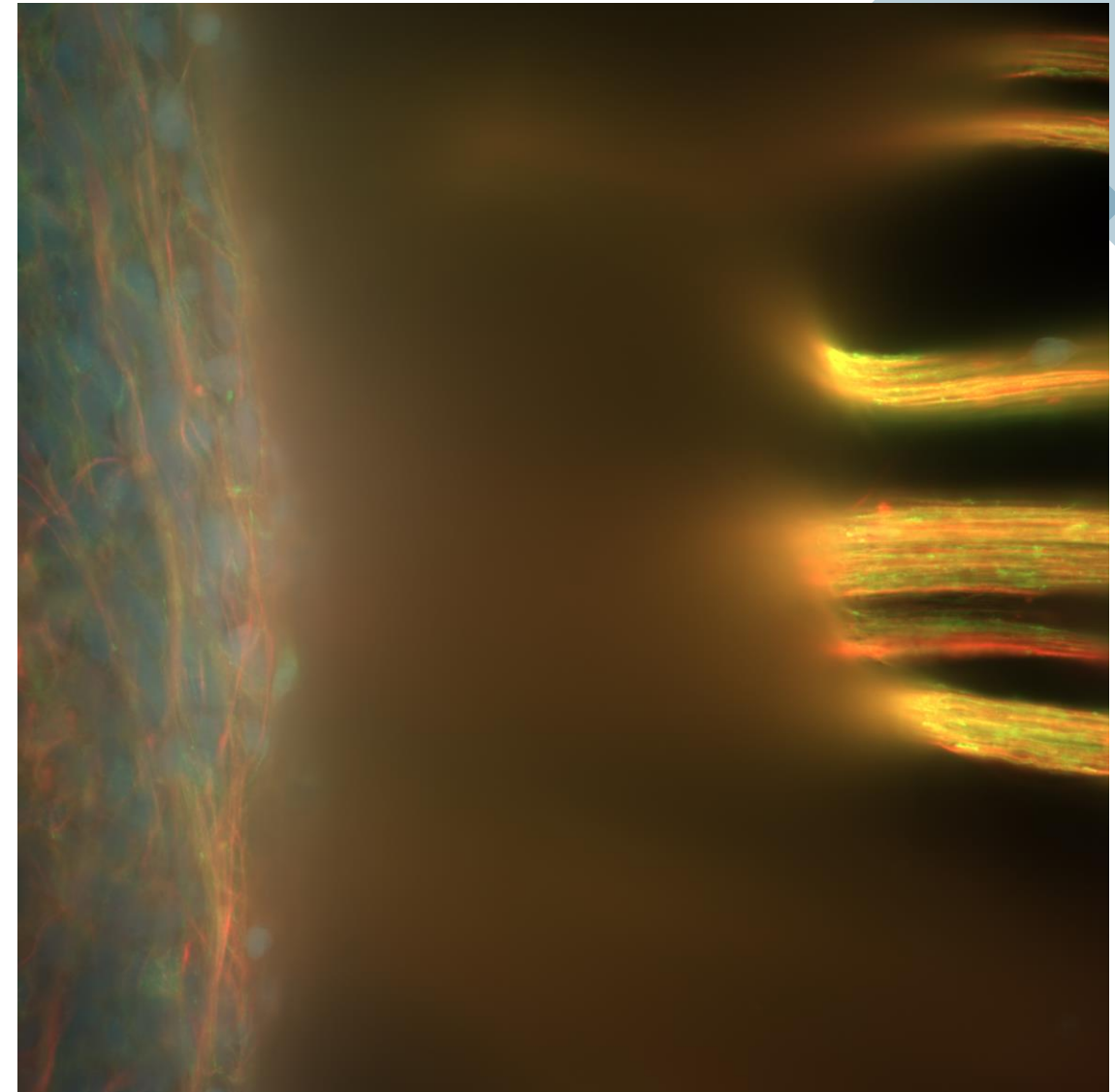
In this microscope image, a culture of *Phaeodactylum tricornutum* nestles among large 'pyramids' of salt crystals precipitated from the medium, which speaks to their resilience in thriving in a hyper-saline environment. Shapeshifters by nature, these cells can adopt different morphological forms: most appear as triradiate (3-pointed star), while a few fusiform cells (2-pointed) can also be seen.



Axonal Flare

This is an image of motor neurons derived from induced pluripotent stem cells (iPSCs), stained to visualise the endoplasmic reticulum (ER) and cytoskeleton in axons. They have been differentiated and seeded onto a specialised platform that helps the axons grow straight along narrow grooves and allows me to research length-based differences in the axonal ER.

As the aggregate of cell bodies (left) extend axons along these grooves, they dip out of focus (centre) before returning to the same focal plane (right), giving a hazy view between the aggregate and the axons. To me, this gave the impression of a solar flare, with the aggregate being the solar surface and the axons radiating out of it. My partner on the other hand said she saw an Aurora Borealis over a stormy sea (easier to see if you turn it counter-clockwise!).



Life after autotomy – starfish with two regenerating arms post-autotomy

Autotomy is a complex behaviour defined as the voluntary loss of a body part in response to predation, to reduce injury, as a response to inter/intraspecific conflict or to facilitate sexual reproduction. Starfish are a model organism capable of autotomy, where the anatomy and morphology of the breakage plane (the area where the controlled phenomenon of limb loss occurs) has been investigated in detail.

However, only recently have molecular insights into the neural mechanisms of autotomy in starfish been obtained with the discovery of a neuropeptide, ArSK/CCK1, that acts as an autotomy-promoting factor in *A. rubens*.

Our work aimed to identify putative autotomy-regulating motor neurons by investigating the expression of ArSK/CCK1 in the region of the autotomy plane in the common starfish.



Measuring the Motion of a Crocodile Ankle

Understanding how animals move begins with understanding how their joints function. This image shows a preserved crocodile hind foot prepared for biomechanical testing. Reflective markers attached to the bones allow motion-capture cameras to track how the ankle moves as the joint is gently manipulated through flexion and extension. By analysing the angles between segments of the limb, researchers can calculate the ankle's range of motion and investigate the (passive) mechanical limits of the ankle joint.

Studying these limits helps scientists understand how joint structure influences movement in living animals and also provides insights into the movement of extinct relatives such as dinosaurs. By combining experimental manipulation with motion-capture analysis, this research explores how the anatomy of archosaur joints constrains and enables motion.



A glimpse of the microverse

This super-resolution image captures the interaction between *Staphylococcus aureus* cells and nisin, an antimicrobial peptide, conjugated to a Cy3.5 dye. The bacteria themselves are not labelled; all visible signal comes from individual nisin-Cy3.5 molecules interacting with surface of the cells.

The image was acquired on the ONI Nanoimager, using dSTORM imaging technique that enables nanoscale resolution. This kind of imaging can help us better understand the microbe-drug interaction and offer insights into the drug mechanism of action.

