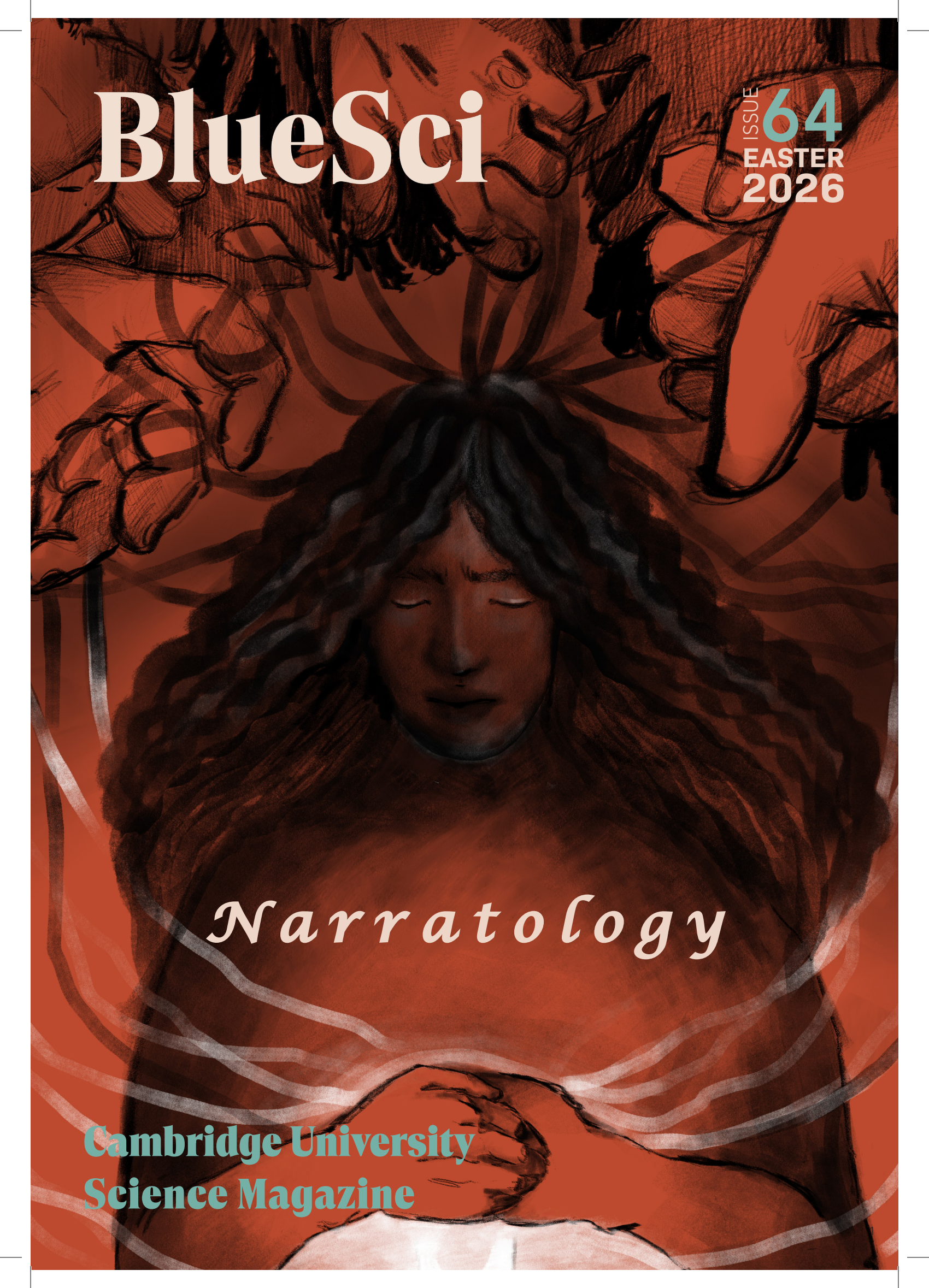




BlueSci

ISSUE **64**
EASTER
2026

Narratology

**Cambridge University
Science Magazine**



thenode.biologists.com



the community site for and by
developmental and stem cell biologists



 @the_node

 the-node.bsky.social

 showcase/the-node

Hosted by
Development

Contents



04 EDITORIAL

05 ON THE COVER

08 BREIF: ON DISCOVERY BY PROXY OF INVENTION
Rushikesh Dasoondi

10 BREIF: THE STORIES WE TELL
Courtney Kremler

11 INTERVIEW: DR FRANCIS WELLS

16 THE HAPPY ENDING PROBLEM
Flaminia Zane

18 RETHINKING ALZHEIMER'S DISEASE AFTER A CENTURY
Laura Jialing Li Yu

20 THE UNIVERSE AS A STORY WE KEEP REWRITING
Dily Duan Yi Ong

22 WHY MALARIA RESISTS A HAPPY ENDING
Niamh Bewick

25 REVIEW: NARRATING INEQUALITY THROUGH BIOLOGY
Hyunseo Noh

26 NOT ALL PLANT VIRUSES ARE VILLIANS
Adaobi Fiona Nwokeji

28 REVIEW: OF RUBBISH AND RIVER MAGIC IN MIKE EDWARDS' RIVER SKIN (2025)
Isabel Fernandez Mayor

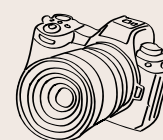
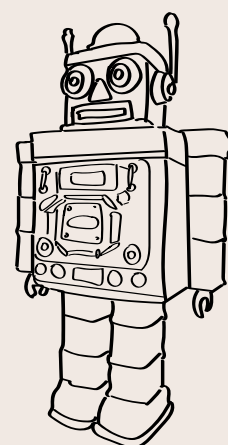
30 THE DILEMMA OF ATHROPOCENE AS A HISTORY
Pollyanna Chamberlain

32 KNOWING A PATIENT
Rehan Zuberi

34 FORMATION OF AN EXTINCTION NARRATIVE
Sara Hamaguchi

36 FOCUS: WHEN THE BEES RETURN
Ellen Sheridan

40 CRYPTIC CROSSWORD
Alexia Galsworthy





A Message From the Issue Editor:

Today's world is one that's seemingly characterised by chaos. Ecological, social, health, political, and cultural catastrophes abound, artificial intelligence compounds, the polycrisis has formed. But beneath the surface, mycelial networks are strengthening, and new narratives are beginning to sprout. It is to this newly renewed practice, the science of narrative, that our Issue turns this term.

Narratology - the science of narrative- is driving our authors' inquiries. Critically unpacking scientific discovery itself, Rushikesh Dasoondi describes a novel approach to biology that might help us re-construct the anthropocentric definition of life, and Courtney Kremler offers a compelling take on how patient narratives could help scientific research produce more holistic and ethical approaches to the distribution of inquiry capital.

Building on the art of science, Grace Heslin generously engages Dr Francis Wells, esteemed cardiothoracic surgeon at Papworth and honorary fellow at Clare Hall, in a conversation that follows his own artistic renditions of cardiothoracics, detailing his extensive career through his own interpretation of art as a medium for creative problem solving, calling for prospective surgeons to follow suit.

Flaminia Zane, Laura Jialing Li Yu, and Dily Duan Yi Ong continue through our theme of scientific discovery, with Flaminia discussing the erasure of 'failure' in contemporary scientific practice, Laura tracing how certain hypotheses get embedded as dominant models that obscure multiplicity from 'western' science, and Dily reflexively contemplating the narratives that complicate our idea of the 'universe'.

But narratives don't just produce competing scientific discoveries. They also dictate how humans construct their place on the world; the second part of our Issue explores narratives of extinction, indigenous livelihoods, and seeks to deconstruct the concept of an 'Anthropocene' epoch.

Niamh Bewick explores the entanglement of biology, power, and colonialism with malaria, while Hyunseo Noh draws parallels to how systemically embedded narratives are shaping reproductive health knowledge production that fails to make room for the stories of racialised women and other people with uteruses. Adaobi Fiona Nwokeji then unpacks plant viruses' reputation for agricultural ruin, detailing how viruses themselves must be rescued from the narrative of destruction and decay.

Isabel Fernandez Mayor translates the discussion through her review piece of Mike Edwards's *Riverskin* (2025), tracing the production of watery worlds in children's fiction as a means of fostering a more convivial relationship between anthropos and non-human kin as we face extinction threats together. Pollyanna Chamberlain extends this into a personal debacle with the Anthropocene as a history-lover, before Rehan Zuberi introduces a nuanced discussion about the role of artificial intelligence in transforming medical research, and Sara Hamaguchi challenges the long-embedded notions of competition that have coloured our understanding of evolution for centuries.

Closing out the Issue, Ellen Sheridan contributes a distinct and detailed look at the neuroscience of the decline in bee population, often attributed as one of the key 'signs' of anthropogenically accelerating climate change under the Anthropocene. Sheridan expertly cautions all of us to embrace a pluriverse of narratives for our future, claiming Irish folk tales as "a technology for directing attention toward what mattered

- Jay Chambers

Thank you to everyone involved in the production of this issue.

Issue Editor: Jay Chambers

Managing Editors: Daisy Gordon, Emma Powers, Jessica Tang

Subject Editors: Andrea Rogolino (Physical Sciences), Gabriel Trujillo (Biological Sciences)

Editors: Freddie McNay, Emily Naden

Art Editors: Grace Heslin

Authors: Rushikesh Dasoondi, Flaminia Zane, Courtney Kremler, Laura Jialing Li Yu, Dily Duan Yi Ong, Niamh Bewick, Sara Hamaguchi, Ellen Sheridan, Adaobi Fiona Nwokeji, Isabel Fernandez Mayor, Pollyanna Chamberlain, Hyunseo Noh, Rehan Zuberi

Artists: Grace Heslin, Barbara Neto-Bradley, Nina Valenbreder, Ashlyn Chew, Alexandra Kim, Jordan Inglis

Crossword Design: Alexia Galsworthy



ARTISTS OF THE ISSUE

Grace Heslin is a 5th year medical student at Corpus Christi College.

Jordan Inglis is a 3rd year materials science student at St John's.

Alexandra Kim is a first-year PhD student at TU Munich studying the biomechanics of airway cilia—the microscopic oars that row together to keep our lungs clear.

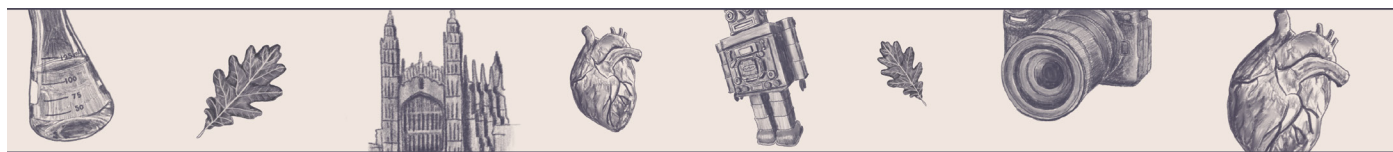
Barbara Neto-Bradley is a postdoctoral researcher in the Department of Plant Science

Ashlyn Chew is a fourth year materials scientist at Fitzwilliam College

Nina Valenbreder is rounding off her first year as a PhD student in the Transmissible Cancer Group. Her project focuses on investigating tumor-host immune interactions in mammalian transmissible cancers.

BlueSci

Cambridge University Science Magazine

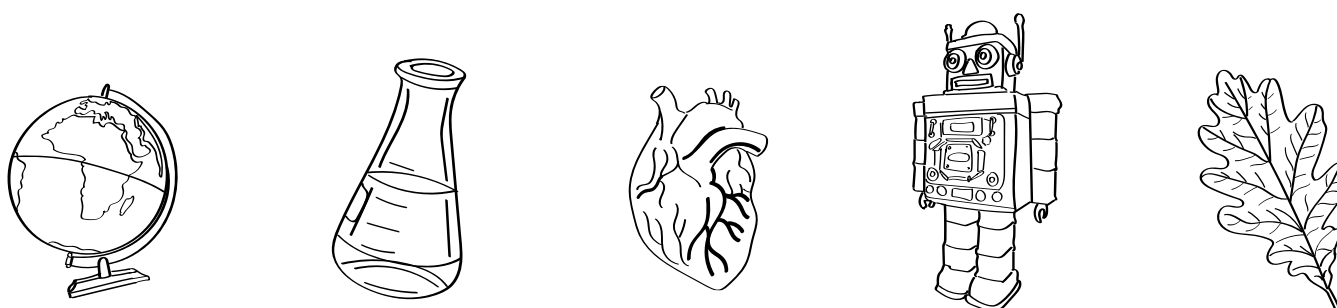


View previous issues at www.bluesci.co.uk



BlueSci was established in 2004 to provide a student forum for science communication. As the longest running science magazine in Cambridge, BlueSci publishes the best science writing from across the University each term. We combine high quality writing with stunning images to provide fascinating yet accessible science to everyone. But BlueSci does not stop there: at www.bluesci.co.uk, we have extra articles, regular news stories, podcasts and science films to inform and entertain between print issues. Produced entirely by members of the University, the diversity of expertise and talent combine to produce a unique science experience.

President: Kristen Burgess ————— president@bluesci.co.uk
Managing Editors: Daisy Gordon, Emma Powers, Jessica Tang ————— managing-editor@bluesci.co.uk
Secretary: David Lee ————— enquiries@bluesci.co.uk
Finance Officer: Emma Hinchcliffe ————— finance@bluesci.co.uk
Subject Editors: Andrea Rogolino, Gabriel Trujillo ————— subject-editor@bluesci.co.uk
Podcast Editors: Gabriel Trujillo Rodriguez de Ledesma, Emily Naden, Michael Taliotis ————— podcast@bluesci.co.uk
Webmaster: Clifford Sia ————— webmaster@bluesci.co.uk
Communications Officer: Courtney Kremler, Marcus McCarter ————— communications@bluesci.co.uk
Art Editors: Grace Heslin, Alex Neaverson ————— art-editor@bluesci.co.uk



DISCOVER THE BENEFITS OF FINE SCIENCE TOOLS



Customize
your own
Tool-Kit

Get
high-quality tools
for unique conditions

Benefit
from exclusive
FST Student-
Discounts

Since
1974



On discovery by proxy of invention

How can reversing the flow of scientific discovery alter our knowledge of the origin of life? Rushikesh Dasoondi describes how a new approach known as constructive biology is changing humanity's narratives of life.

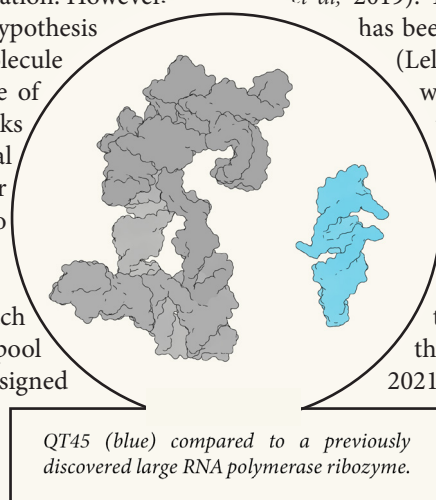
How might life on Earth have begun? If life exists beyond Earth, what might it look like? Some of humanity's greatest questions remain unanswerable, because the truth is fundamentally inaccessible. Conventional scientific discovery requires a 'bottom-up' approach, relying on the observation and analysis of natural phenomena - but how do you try to understand a system that you can neither observe nor detect? Where traditional ('bottom-up') science cannot be applied, researchers in the life sciences have increasingly been adopting a constructive ('top-down') approach. Unable to find the answers in nature, so-called 'constructive' biologists have begun to direct their efforts towards synthesising new biological systems in the laboratory. This field, known as constructive biology, has been enabling researchers to finally begin developing an understanding of some of the great mysteries of life that have captivated human minds for generations.

The origin of life has undoubtedly inspired some of the most compelling narratives, from ancient philosophy and religious texts to modern fantasy, speculative literature and science fiction. While no clear traces remain of the prebiotic systems from which the first, single-celled organisms likely emerged, scientists have long speculated that life may have begun as short ribonucleic acid (RNA) molecules, capable of self-replication. However, for decades, this so-called 'RNA world' hypothesis suffered from a major drawback: No RNA molecule had **ever** been discovered that was capable of self-synthesis. This recently changed thanks to a team based here at the MRC (Medical Research Council) Laboratory of Molecular Biology, Cambridge, led by Dr. Edoardo Gianni (Gianni *et al.*, 2026).

Gianni's team adopted a constructive approach to their research; starting from a random pool of short, synthetic RNA sequences, they designed a system to select for, or 'fish-out', RNA polymerase enzymes (ribozymes) that could perform templated synthesis of longer RNA molecules using short RNA building blocks. In doing so, they discovered the 'Quite-Tiny', QT45 ribozyme, the first ever RNA molecule found to be capable of self-synthesis. This synthetically engineered RNA molecule is by no means alive,¹ but its discovery represents a giant leap forward in origins-of-life research. It demonstrates the power of invention in complementing our understanding of the natural world, allowing us to access discoveries in areas that traditional ('bottom-up') science alone cannot reach.

The Ancient Greek 'Atomists' argued that there must be countless worlds like our own, while modern discussions of extraterrestrial life have often been shaped by tensions between the Drake equation and Fermi's paradox. As the discipline of constructive biology calls for deeper understanding of the fundamental systems supporting life on Earth, advances in this field are also contributing to our understanding of what life beyond Earth, if it exists, could look like. It is well established that all [known] life relies on a universal genetic alphabet, composed of four bases, or 'letters' (A, T, C and G). These letters are strung together by oxygen and phosphorus atoms to make up DNA or RNA, and a total of sixty-four combinations of these letters act to encode twenty (sometimes twenty-two) amino acids. However, it has been becoming increasingly clear that systems which diverge from these seemingly 'fundamental' laws could still support life.

For example, through the reconstruction of single-celled organisms' genomes, it has been proven that living cells can use as many as 27 amino acids (Robertson *et al.*, 2025) and could even use as few as 19 (Liu *et al.*, 2026). Moreover, it has also been demonstrated (*in vitro*) that DNA can be chemically modified to include an additional four bases (letters in the genetic alphabet), creating a genetic system with a total of eight letters (Hoshika *et al.*, 2019). Even the integral oxygen-phosphorus linker has been replaced with a nitrogen-phosphorus bond (Lelyveld *et al.*, 2023) and this modified DNA was synthesised using a genetically engineered polymerase enzyme. Interestingly, efficient synthesis was only possible when the reaction was supplemented with trivalent, rare earth metal cofactors, as opposed to natural DNA synthesis which requires divalent metal cofactors. Systems such as these enable the development of new technologies and therapeutics (Duffy *et al.*, 2020; Robertson *et al.*, 2021), but more importantly, they fundamentally challenge our understanding of what life requires and what it can support.



Looking ahead, constructive science could even allow us to better understand the metaphysical, as well as the molecular. The idea of constructing consciousness has been deeply rooted in the human psyche, from the golems of Hebrew folklore to Mary Shelley's *Frankenstein* and (of course) *The Matrix*. Now, such ideas have reached the forefront of scientific discussion. This year, US-based tech firm Eon Systems announced that they had leveraged recent advances in neuronal connectomics (Lappalainen *et al.*, 2024; Lin *et al.*, 2024; Wang-

¹QT45 copies itself too slowly to enable self-amplification (required, among other things, for true self-replication).



Chen *et al.*, 2024) to build a biologically accurate, virtually simulated fruit fly. According to the company, when ‘spawned’ into a virtual environment, the simulated fly began to exhibit behaviours such as grooming and drinking despite not having been programmed to do so (Eon Systems, 2026). This work was not peer reviewed, and is widely considered a hoax (Carboncopies Foundation, 2026). Nevertheless, experts in the connectomics field believe that future work could make such an achievement possible (Hayworth, 2026).

Today, LLMs and other machine-learning models have already complicated our understanding of consciousness by demonstrating that language and reasoning-like behaviour can be artificially reproduced. Moreover, the environmental impact of such technologies are beginning to raise some serious ethical concerns (Xiao *et al.*, 2025). Yet, these models fundamentally rely on input to generate responses. Although their responses are not explicitly programmed, the architectures that allow them to “learn” are meticulously engineered and grounded in mathematics. The genuine creation of a *biologically* grounded artificial intelligence in the future could open up an entirely new way of understanding consciousness and intelligence from the ‘top-down.’ However, whether the treacherous ethical landscape of such a field could be safely navigated is becoming an increasingly urgent question – albeit one that many modern narratives have already tried to answer.

Of the questions discussed here, few will likely ever be *conclusively* answered. Nevertheless, the emerging field of constructive biology is closing the gap between humanity’s narratives about life and the truths behind them. Whilst grounded in traditional, analytical science, constructive biology reverses the usual flow of discovery. Instead of beginning from what nature reveals, experiments in this field are spurred by attempts to unmask its most deeply hidden secrets through synthesis. Ultimately, these efforts offer unique insights into what it means to be alive, serving as a testament to humanity’s enduring impulse not only to define what it can see, but to try and give shape to the unknown and the unknowable.

Rushikesh Dasoondi is a 2nd year PhD Student at the MRC Laboratory of Molecular Biology studying enzymatic syntheses of modified nucleic acids

Works cited

- Carboncopies Foundation (2026) ‘No, a Fruit Fly has not been uploaded’, Carboncopies Foundation.
- Duffy, K., Arangundy-Franklin, S. and Holliger, P. (2020) ‘Modified nucleic acids: replication, evolution, and next-generation therapeutics’, BMC Biology.
- Eon Systems (2026) ‘We’ve uploaded a fruit fly’, Eon Systems.
- Gianni, E. et al. (2026) ‘A small polymerase ribozyme that can synthesize itself and its complementary strand’, Science..
- Hayworth, K. (2026) ‘My statement regarding the misleading EON Systems “fly upload” video’,
- Hoshika, S. et al. (2019) ‘Hachimoji DNA and RNA: A genetic system with eight building blocks’, Science.
- Lappalainen, J.K. et al. (2024) ‘Connectome-constrained networks predict neural activity across the fly visual system’, Nature.
- Lelyveld, V.S., Fang, Z. and Szostak, J.W. (2023) ‘Trivalent rare earth metal cofactors confer rapid NP-DNA polymerase activity’, Science, 382(6669), pp. 423–429.
- Lin, A. et al. (2024) ‘Network statistics of the whole-brain connectome of *Drosophila*’, Nature.
- Liu, L. et al. (2026) ‘Toward life with a 19-amino acid alphabet through generative artificial intelligence design’, Science.
- Robertson, W.E., Funke, L.F.H., de la Torre, D., Fredens, J., Elliott, T.S., Spinck, M., Christova, Y., Cervettini, D., Böge, F.L., Liu, K.C., Buse, S.K., Maslen, S., Salmond, G.P.C. and Chin, J.W. (2021) ‘Sense codon reassignment enables viral resistance and encoded polymer synthesis’, Science.
- Robertson, W.E. et al. (2025) ‘*Escherichia coli* with a 57-codon genetic code’, Science.
- Wang-Chen, S. et al. (2024) ‘NeuroMechFly v2: simulating embodied sensorimotor control in adult *Drosophila*’, Nature Methods.
- Xiao, T., Nerini, F.F., Matthews, H.D., Tavoni, M. and You, F. (2025) ‘Environmental impact and net-zero pathways for sustainable artificial intelligence servers in the USA’, Nature Sustainability.

Image From: <https://mrcmb.ac.uk/news-events/articles/bridging-the-gap-from-chemistry-to-life-discovery-of-a-tiny-rna-that-can-copy-itself/>

The Stories We Tell

Written by Courtney Kremler

The narrative of scientific discovery changes depending on who's in the room. Having run a wide range of patient involvement events, I find it fascinating how we adapt our stories based on audience and context, and what we gain or lose in doing so.

I recently presented at a conference where I knew public collaborators, such as patients and their families, would be present. Afterwards, a colleague remarked that I'd really edited my story down. I had; I wanted a cohesive, easy narrative to follow. But who did that actually benefit? It wasn't a lie, exactly. More like a selective truth. And yet that selective truth reinforces a damaging myth: that science follows a linear path and always makes sense. Which it doesn't.

The most impactful sessions I've run have been smaller focus groups, where a more intimate context allowed for real depth of discussion. This covered things that were going well, like choosing models for our treatment prediction task, and things that weren't, like translating standard performance measures of such models into clinically meaningful outputs. This context allowed for patients' questions to flow without bias. It reminded me of how patients tell one version of their illness to their friends and a different, more honest one to their doctor. As a patient, the version you tell friends isn't dishonest, but it lacks the depth needed to actually problem-solve together. And why would you? They don't have the qualifications to problem-solve those issues. But as a scientist trying to communicate results with an audience that does have expertise, what version should be told?

The trouble is that clinical science rarely has the format, infrastructure, space, or resources to hold these more intimate sessions. These sessions require fewer patients to commit a larger amount of time than in a usual presentation context; they need to be present and focused during in-depth discussions about scientific research. The patients are seen as experts and so are asked by clinicians and researchers for advice and opinions based on their own experiences. My lab has been fortunate; many of our staff are also clinicians, which helps with recruitment. We also have a lab manager who can organise these meetings, which is no small feat, especially when participants have disabilities. We're always trying to

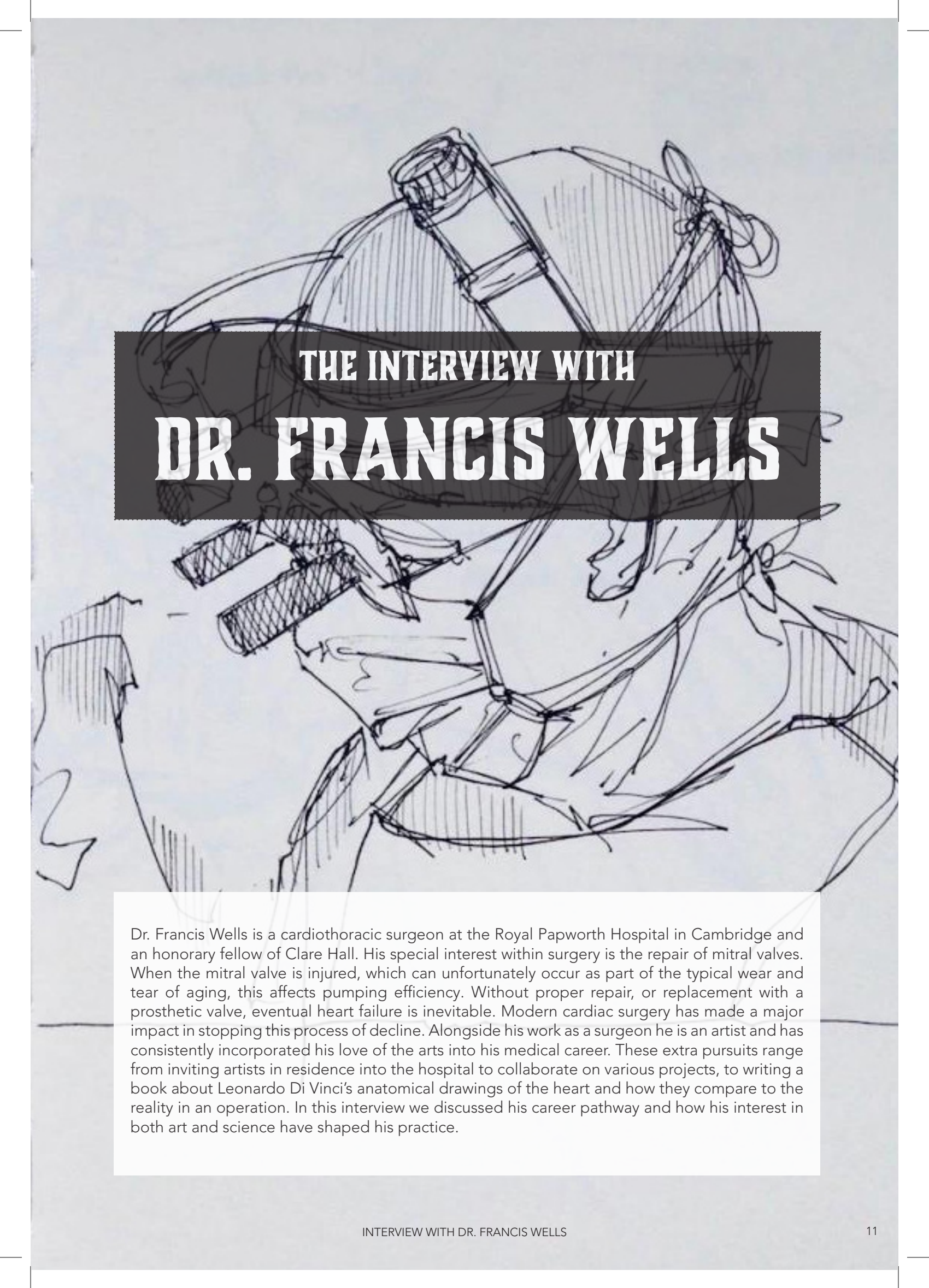
make people to feel welcome, whilst also ensuring that they do not feel like a burden.

So how do we make patients' contributions accessible to more labs? Patient and Public Involvement (PPI) grants help enormously for compensating patients' time, but they don't acknowledge the researcher who has to justify why this work is worthwhile. For example, this may be a PhD student pitching to a sceptical PI, or a postdoc with grant applications to submit. We need both the infrastructure and the cultural shift: a research community that isn't insular but genuinely integrated, with patients being involved in steering research directions.

As the saying goes: suffering shared is suffering halved, and excitement shared is excitement doubled. There's something unburdening about sharing the worries alongside the wins, telling more truthful narratives instead of the happiest or most fruitful ones. Despite sharing less than promising results about our initial model's performance, patients reacted with excitement at the progress made and questions answered. Having an answer is better than the uncertainty, and it allows new questions to be asked. Patients responded to these results with suggestions for future projects, potential improvements, and an acknowledgement of the hard work that had been done. Patients benefit enormously from being told the full picture, not just the polished one. And researchers benefit too - we've now taken on many of their suggestions.

Ultimately though, it comes back to funding and incentives. If prestige and publications generate money, and money generates more research, then the stories we tell will keep being shaped by what attracts both. Journals that question the levels of patient involvement with the same rigour as they question the methodology, and funders who call for projects

Courtney Kremler is a 3rd year PhD in Clinical Neuroscience studying the application of Machine



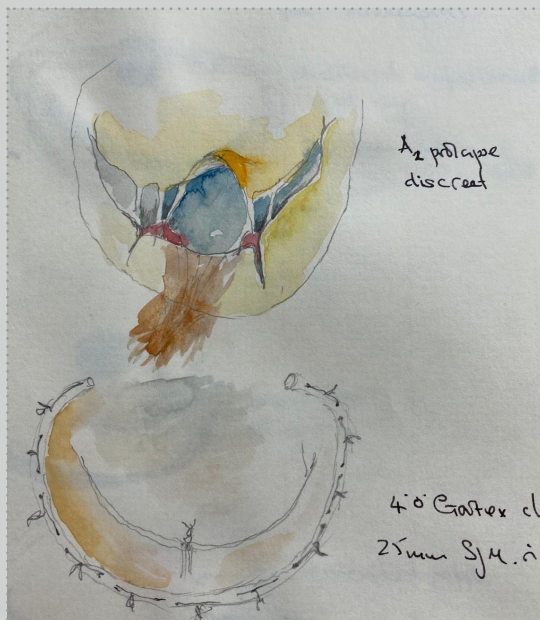
THE INTERVIEW WITH **DR. FRANCIS WELLS**

Dr. Francis Wells is a cardiothoracic surgeon at the Royal Papworth Hospital in Cambridge and an honorary fellow of Clare Hall. His special interest within surgery is the repair of mitral valves. When the mitral valve is injured, which can unfortunately occur as part of the typical wear and tear of aging, this affects pumping efficiency. Without proper repair, or replacement with a prosthetic valve, eventual heart failure is inevitable. Modern cardiac surgery has made a major impact in stopping this process of decline. Alongside his work as a surgeon he is an artist and has consistently incorporated his love of the arts into his medical career. These extra pursuits range from inviting artists in residence into the hospital to collaborate on various projects, to writing a book about Leonardo Di Vinci's anatomical drawings of the heart and how they compare to the reality in an operation. In this interview we discussed his career pathway and how his interest in both art and science have shaped his practice.

Grace: I've heard that you do sketches for the operations you've performed. Can you tell me more about how you capture those details and what you've learned through this process?

Wells: This is [a page from] my new book:

So these are the operations this week. The first case was for a



Mitral valve prolapse of the A2 segment

massive mitral prolapse, a chap with a severe ruptured cusp. I also draw up what I can remember as soon as the operation ends. That's what I do. And then you know, if I need to go back and think about it, as soon as I see the drawing, I can remember everything. The visual brings it all straight back to you, if that makes sense.

The act of drawing or painting, you have to put yourself in the place of what you're drawing. So, for example, when I'm doing those drawings, I'm redoing the operation in my head. I'm thinking, what did I do there? What did that look like? What's the relationship to that? And it does start to make you think in a different way. Yeah, I mean, the striking thing is that, for example, mitral valves repair. People look at the leaflets. The focus traditionally was on the valve leaflets themselves but the rest of the apparatus, the papillary muscles and the chordae tendineae, are just as important. If you have to draw that, then you've got to look at where they are. It does make you notice the whole picture. Otherwise you can't draw it if you've missed anything. So you're not looking to do a good drawing afterwards, you're looking to understand the operation. And as you're doing the drawing, you start thinking, maybe I could have done this or I could have done that.

Grace: I agree that when you're trying to understand anatomy or learn any new concept, drawing can be so helpful especially to identify the gaps in your own knowledge.

Wells: I found it very helpful in first year when we were doing anatomy when I was revising to just draw it myself because you just remember it so much better. I think I'll keep mine forever. It'll be like a textbook. I can look back. Because again, you know what I used to do was read Grey's Anatomy and shut the textbook and draw it, then check it. You will never forget it. And

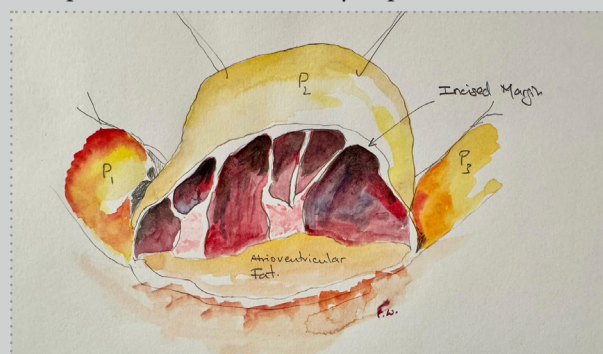
you can see which bits you get [wrong]. It'll be useful if I'm ever asked about the pterygopalatine fossa. Most of my colleagues have never heard of it. I had drawn it.

Grace: What made you pick cardiothoracics?

Wells: Well, there's the sort of 'Hollywood movie story', who could not possibly want to operate on the heart? And it's got to work at the end [of the operation]. I mean, people try to equate it to neurosurgery, but [in] neurosurgery, you can cause strokes, of course you can, you can kill a patient, but usually you don't. To do most of these complex cardiac operations, you've got to stop the heart. And the heart's got to work afterwards. And that is an absolute dividing line between success and failure.

The second thing is that it's such a beautiful thing to be able to do. You really are using anatomy and physiology every day. You're a bit like a conductor in an orchestra. You've got a perfusionist [and an] anesthetist assisting you, the scrub nurse with you, and then the heart itself. And you're trying to bring all of that together so it works perfectly for what you're trying to do. So it's multifactorial.

If you get it right, you transform their lives. You get someone who's sitting in a chair, blue, puffing away, you know, can't do anything anymore. I see them six weeks later completely changed and then off they go. Yeah, it's really amazing. I did a lot of thoracic too. I started [working in] cardiac and thoracic. So I did a lot of oesophagus, lung cancer, and that sort of thing, and that's a different mindset. I mean, when you're doing valve repairs, if you operate at the right time, the right way, everyone should survive and everyone should come out of the place. That's not necessarily the case when you're operating on lung cancer for example. The course can be very unpredictable.



Mural leaflet detachment

Grace: You mentioned how Leonardo's drawings gave you a new insight into trying to get more of a natural physiology back to valves. Can you tell me more?

Wells: Well, surgery first and then I'll talk about *The Heart of Leonardo*.

So even today, open heart surgery is quite a young specialty. It didn't really start properly until the 60s. There were stumbling efforts in the 50s. There were no replacement valves though. It was mainly congenital work, trying to correct PDAs, coarctation of the aorta, ASDs, things like that. And there wasn't any decent technology, patients were presenting very late. So there were one or two people around the world who, in the face of mitral valve problems, tried to reconstruct them because there were no replacements. It didn't work very well. And then valve replacements came along and then people started to get into

that. But then they rapidly realised that replacements had their problems as well.

So later on in the late 70s, early 80s, Carpentier in Paris, looked again at trying to work out ways of comprehensively repairing these valves. So, that started all of that off, and that's when I gave my very first major paper at the American Association meeting in Atlanta. Just before the end of this lecture, which was called "The French correction", I talked about my repair. I gave my talk, and that just turned me on to it. So, in the past techniques primarily turned the valve into a mono leaflet valve. You basically immobilise it as a single opening flap as opposed to a leaflet with sections. The mitral valve has to change its orifice circumference by 40% throughout the contraction cycle. It's basically a sphincter. If you immobilise it, it loses that ability, which is fine. But let's say I was operating on you and you want to climb Mount Everest or swim in the Atlantic. It certainly restricts your possibility of doing that.



Ventricular view of the papillary muscles and chordae tendineae of the mitral valve (left). En face left atrial view of a prosthetic mitral valve (right).

I started to think of new ways of trying to repair the valve. Leonardo didn't tell me how to do much. What he did do, first of all, [he] was the first to describe the structure in any relevant detail. And he kept going on about [how] everything in nature is as it is for a reason. Find the reason, you understand nature. So I was looking at the valve and trying to work out how the whole thing works and what the physiology was and how we could work with the valve to preserve its physiology, rather than just turn it into a one-way non-return valve. Because yes, it's a one-way non-return valve, but it also supports the ventricular function. If it does not have that sphincter dysfunction, then you lose that functionality. The heart is like a complex cone that twists as it contracts and the valve is a big part of that. So that's what I was looking at. That made me start to look at different ways of reconstructing chords, reconstructing leaflets, and all these sorts of things, which I started really doing in the early 90s, which was quite a bit before most others. I remember presenting in front of the surgeons in Paris and they laughed at me. Well, it did work and nobody was doing it. That's how it came about.

Leonardo writes beautifully, everyone looks at his pictures, but read his notes! He writes so concisely, so beautifully. It's a bit of mediaeval structure, but it doesn't matter. It's all in there. And I know physicists, I know architects, lots of people who've read his notes who just get a lot out of the words. There's a man called Murray Garrett, he was the head of Caltech for several years. He's an astrophysicist and maths professor. And reading through Leonardo's notes, he discovered how Leonardo in [his own] words described the mechanism of gravity 150 years before Newton. So, you know, take it seriously, because [it's] true, he was an absolute genius.

He was also a man of his time, so he made lots of mistakes. I mean, his initial description of the circulation of the blood is Galenic and not modern, so you have to read it with generalised knowledge, I read all his dissections, photographed them all, and that blew me away, because that's like being in the dissection room with him, because his drawings are absolutely precise.

Grace: I wanted to get to know a bit what your approach is for each patient. What do you do beforehand? What do you do after, to check if everything went well?

Wells: Well, beforehand, it starts with a referral letter, of course. Knowing you've got adequate information and you see the patient. I always show them their investigations. I show them their echo[cardiogram], I talk them through it. And I don't talk down to them. So I explain to them how the heart works. I explain what we're trying to do, rather than say you'll be okay, we'll do this now, and I find that's very helpful for them. It allows me to get to know them a bit better as well, which helps when you interact with them. Always examine them, of course. And be very careful about taking a full history, past medical history, analysis, family history, social history, all those, because it can all play into it. Yeah, full examination, and then almost get them to tell me what I'm gonna do to them. If they can do that, they understand it. Some engage better than others.

I always try to see them with a family member. And I always say to them, if you have any questions, call my secretary, get back to me. Don't hesitate to ask. And when they leave, I give them my phone number. Not many people do that. [...] This distance and separation between consultants and patients, you see it a lot, but it never pays off. It's all about communication. You know, if you communicate well with a patient, you won't get sued. Be honest and communicate. So that's the way I set it up. I make sure I see them before they go to sleep down in the theatre. I want to banter with them. When I finish the operation, I always call a relative or wife, and then see them that night when they're waking up and see them practically every day on the ward. And then see them six weeks [later].



Grace: Do you ever show them your drawings or use drawing to help illustrate some things?

Wells: Yeah, I bet sometimes they'd like to have it, yeah. [There was a famous artist] who was my patient once. So, after the operation, I sat down and [he] said: "Tell me what you did". So, instinctively I got some paper out and a pen and I was drawing

in front of him and suddenly thought: "Hang on, I'm drawing in front of a serious artist here". Then he said: "Can I keep that?" And then six weeks later he invited me for dinner with him and then took me down to the studio. [And I see,] there's my little drawing on the wall. It's a good way of communicating your ideas. If I was to stand there and tell you what I'd done in one of those complex operations, you wouldn't properly understand it. Show you a drawing, did that, did that, did that; it all comes together.

Grace: You've touched on how things have changed a lot in surgery and in medicine generally. Do you think that there's still room for creativity?

Wells: In surgery, definitely, yeah. A lot of surgery is being hijacked by the physicians now with cath lab-based stuff and gastroenterology and so forth. It doesn't stop you being innovative as a surgeon. Materials change. Ideas change, experience changes, outcomes change. So it's a little more difficult than it was, but no, there's still plenty of room. There is still not the perfect hip replacement. There's still not the perfect heart valve. There still isn't a functional artificial heart. There's lots of things like this which can and will change. And then approaches, surgical approaches, where you reach something, how you do something. It's always evolving. It's a theatre set that keeps changing. And you think to the point of, when are we going to reach the perfect solution? But I don't think you can, can you? Because patients change. And generally preventative medicine is getting so much bigger, we're pushing more in that direction.

Grace: Do you think that's a product of a general lack of funding for the arts nowadays?

Wells: Yeah, the arts are not so well funded anymore. There's still the originality out there. Marcus Woxneryd, who came from Scandinavia, we did a piece called 'the sonic body'. So we made this box. If you have a sensitive microphone, you can record heart sounds, breathing, or blood flow. We built organs in this black box and you could hear what they were doing. If you touch it, it turns to pathology, so the knee starts to creep, and it all starts. I suppose medicine is the study of humans, just as much as the arts is. It is humanity.

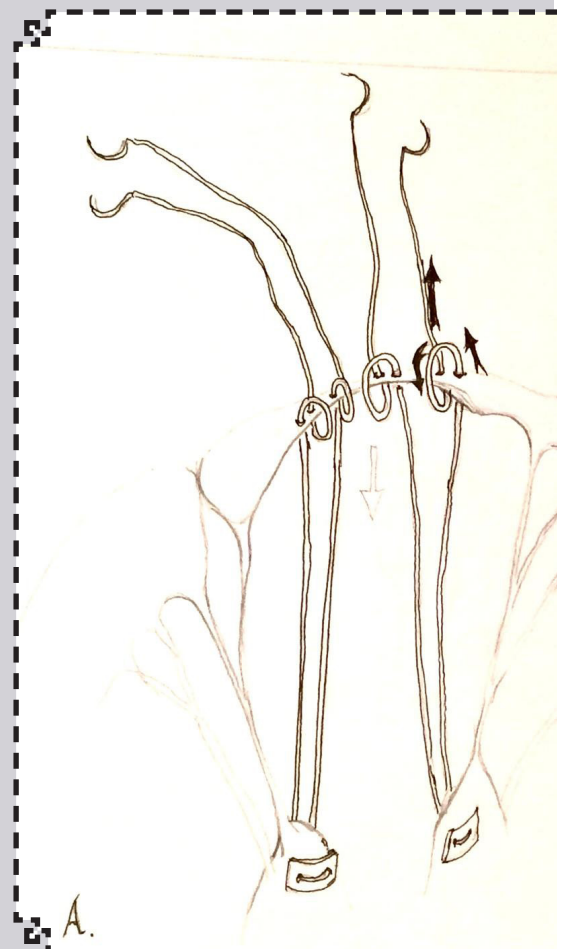
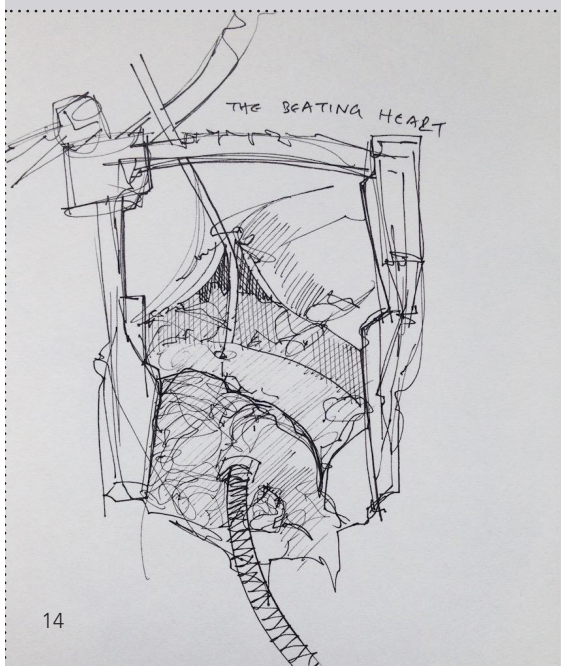
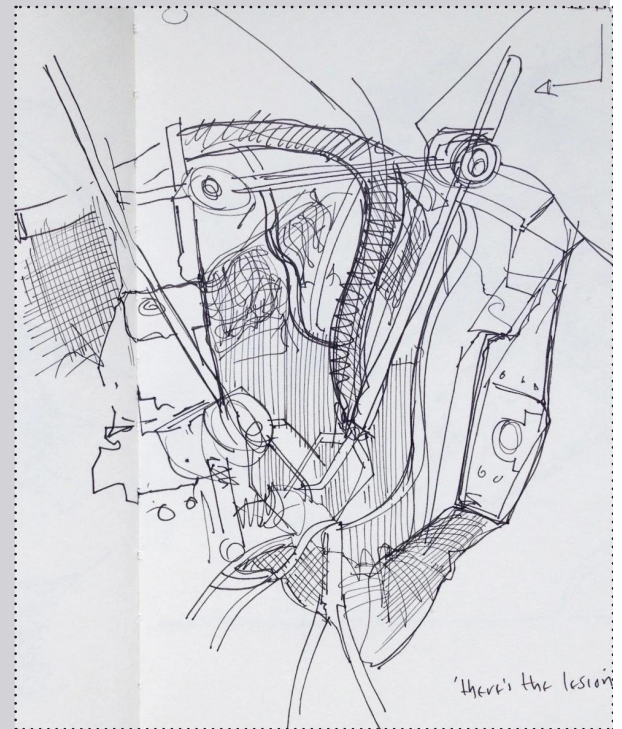
Grace: Yeah, it's really amazing to hear how you've managed to combine both. I hope there's still room for that. I do think lots of people are very receptive to it and it makes complete sense that art and science are combined like that. I think both can learn from each other, definitely.

Grace: Can you tell me about your favourite collaborations or things you've done over the years, that were essentially for this 'artists in residence' programme?

Wells: So we did all sorts of things. The first one was a guy called Jordan Baseman, a sculptor. And he came [here] on an Arts Council grant, spent the whole of a summer with me filming in theatre. I didn't know what he was doing, he just came along. And after this, he went away and after about six weeks, he dialed me up and said, "I'd like you to come down to my theatre, which is a big top floor warehouse in the east end of London, overlooking the river". I went along in the evening and then set up one end of the room with a black curtain all around the screen. He had made this movie, called "Under the Blood". He filmed lots of operations and he spliced lots of things together. So

it wasn't an operation from start to finish. With a lecture about the Blood of Christ underscoring it. He then sampled sounds from theatre, made a background track of a continuous noise, which is all these sounds in theatre, with voices coming in and out. I was quite shocked when I saw it, but actually [now] that's travelling the world, I think.

Jane Prophet, who is a professor of sculpture at Westminster College, came and she had the idea of making some silver hearts out of magnetic resonance scans. She's the one that filmed me drawing during an operation, which



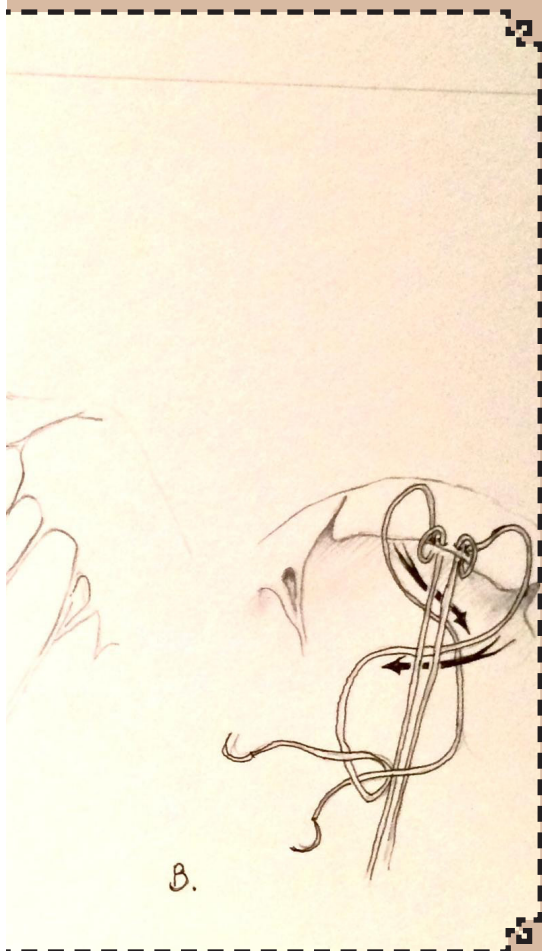
then got to the Royal Academy with David Hockney, who I worked with. That caused a bit of a stir. That was the very first installational video in the Royal Academy ever. That was quite fun. And that year, I shared the Hugh Casson Prize for drawing with Frank Auerbach and Paula Rego, the three of us.

I had another lady, Marilène Oliver, she'd done a family portrait of members of her family. She put them all through an MRI scanner, and then she made lifesize prints and she engraved every MRI section in bronze ink on glass. And then stacked them all up in 3D. She came and said, "Can I do something with you?" I said, "Yeah, what do you think we should do?" And we produced a version of Leonardo's great lady in 3D. She said to me: "I'm going to sell them". She asked me if I wanted to share the profits, and I said no. She ended up selling 15, at £15,000 [each]. One is in the Rijks Museum in New York. Yeah. So there was that and then, oh, several others. So lots of fun.

Grace: So, did the artist residencies last?

Wells: [No.] It was a shame, because the patients loved it. I ended up helping to choreograph modern dance with Siobhan Davies. I went down every Monday evening for three months. to sit with the dancers, which is a great experience. Most of them were ballet dancers who moved on to modern dance. We discuss the movement of the body and breathing and the heart and then they would go and work something out. It's all very well if you learn a poem, or learn a piece of music and then reproduce it. Dance, I can't get it. They just do it. And then [we would] go down the next week and they would do exactly what we'd done the week before. Proprioceptive learning.

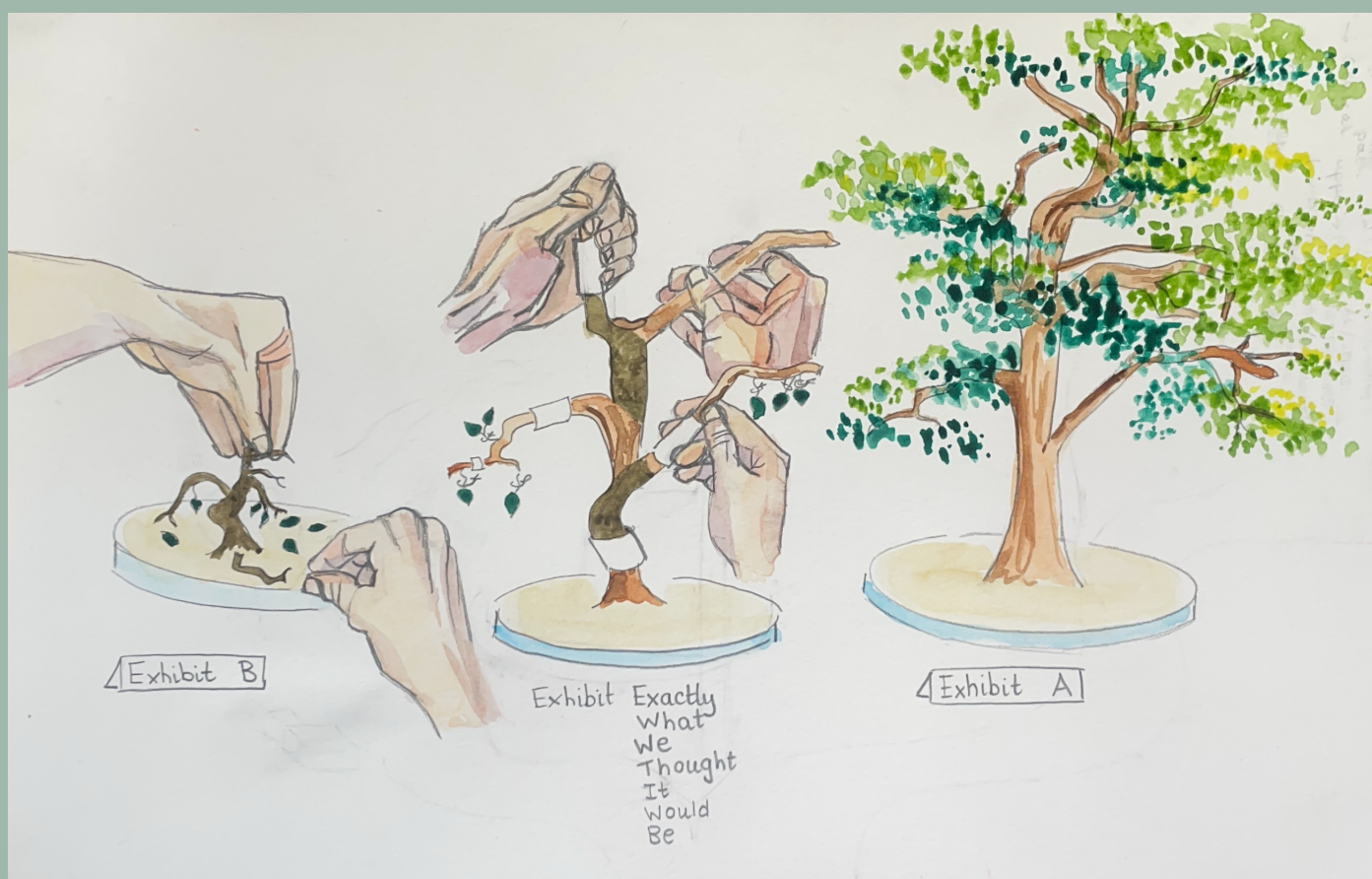
End of interview



*Interview conducted by Grace Heslin
All images courtesy of Dr. Wells*

The Happy Ending Problem: Where did Failure go in the Scientific Narrative?

Flaminia Zane discusses where failure falls in the scientific process, presenting a problem with ignoring and hiding failures in modern day scientific presentation, grant writing, and literature.



Artwork by Grace Heslin

Early in my research journey, I recall an informal conversation when a senior researcher explained to us, very naive students, how grant writing actually worked. They said, “The results you want to get, you’ve got them already. This way you are sure it will work out, and then you can push further with the money you get.” We laughed. It sounded like a well laid plan and a quite smart one, but it wasn’t until nearly ten years later that I understood these words.

If you have ever read or written a research grant application, towards the end of it you may have encountered a Gantt chart. It is a colour-coded table illustrating, at normally around a month’s resolution, the planned timeline for experiments, analysis, and where relevant, article writing. As beautiful and satisfying as it is to look at, it is often widely recognised as a work of fiction. Joining a project in the middle, I once asked the project leader about allocated time and deadlines for intermediate steps. They replied that it was just something they wrote for the grant, and not to look at it. It was a good point, as for some of the project tracks there was little resemblance to what was actually going on.

Research is an explorative quest. You enter a forest with only an idea of what may happen. All you can see at the very beginning is a narrow path, disappearing as the forest gets denser. As you move forward, you gather clues on where to go next: you initially thought straight ahead was the way, but there is a wall. You look at the clues and decide to go right. You loop back to the beginning and realise it was probably the other way all along. Then, when the moment comes to write up your results and submit your paper, you focus on the message you want to give. You find yourself reconstructing the narrative backwards, patching the hike into a linear family-friendly walk. You may also find yourself quietly sidelining those unresolved results, the loose threads that don’t quite fit the story you are now telling.

Storytelling in science is not inherently a problem. As humans, we have connected and learned through stories for tens of thousands of years. What becomes dangerous is forcing a not-quite-ready story into a neat narrative. Research publications often cover projects spanning the lifespan of a position or a grant, which is commonly two to four years. In life sciences, a

single experiment can last months. You may arrive towards the end of your contract, look at your work and find no narrative there. However, a narrative must be found. Publishing your research is essential to secure your next position or funding. In the “publish or perish” academic system, the number and quality of articles (where quality is often assessed by journal prestige or impact factor) is one of the main survival criteria.

Such a system creates enormous pressure to speed up research. Young researchers often manage multiple projects simultaneously, to ensure that at least one works. But what does it mean, for an experiment to work? A truly failed experiment is one compromised by a technical error: equipment failure, wrong calibration, broken reagents. A negative result (one that does not confirm the initial hypothesis) is something else entirely: it is actually science doing exactly what it is supposed to do. And yet, in a system where negative results are largely unpublishable and publishing is essential to keeping your position, the two have quietly become synonymous. If you don't have a happy ending, you may end up with a story not worth telling at all.

In this context, laboratories should provide space and freedom to discuss negative results. However, that's not true everywhere. I have heard stories of weekly lab meetings updates where students could only bring “what worked”. At times, this could mean nothing.

An environment that does not allow for failing can be particularly harsh on young researchers and young principal investigators, who may struggle to secure funding for more risky, or out-of-the-box projects. In a fast-paced lab where there is no time to reflect on failure, Alexander Fleming would probably have tossed away the contaminated Petri dish without a second glance and never noticed the strange growth pattern around the mould that would lead to the discovery of penicillin.

Fortunately, this problem is not going unnoticed. In April 2026, Nature published an editorial entitled “We need to talk about failure in science”, discussing how failure is often perceived as taboo in academia. While it argues that the need for research funded by taxpayers' money needs to return its investment to society through results, they recognise that failure is an inherent part of the process and time to learn and rebuild from it

has to be given. The same month, Imperial College London, in collaboration with Nature, organised a one-day conference dedicated to failure in science.

On the publishing side, different solutions are also starting to be explored and implemented. In 2023 the journal *eLife* introduced a new review framework: once a paper is accepted by the editor for peer review, it cannot be rejected and undergoes a transparent, collaborative peer review process. This protects authors against rejection based on novelty and results only, sometimes driven by reviewer or editorial requests that are unrealistic in terms of time. Another format, adopted by publishers such as Nature and Elsevier, is the “Registered Report”. Here, authors submit their study for peer review before the full data are collected. A pilot study is required at this stage. If accepted, the paper undergoes a second peer review after the full study is submitted. This framework aims to value the study rigour rather than the results only, and is particularly suitable for studies where data collection requires years. It is encouraging to see respected journals, often driving publication trends, acknowledging the issue and implementing changes.

An interesting analogy provided in the Nature editorial is the perception of failure in sport, where whole training sessions are dedicated to analysing failed actions and learning from them. This analogy highlights how a collective system reflects individual behaviour. Professional sportspeople are of course disappointed by failure, yet they are implicitly encouraged to use it as motivation to improve and try again. Science does not always offer the same. The pressure to produce publishable results creates a stressful environment where part of the cost is paid at the individual level: researchers find themselves needing to produce more, and produce faster. Yet most of the time spent in the lab is time spent failing, and it is often erroneously perceived as wasted time, when it is really an essential part of the process. This is something Dr Melanie Stefan, now Lecturer at the University of Edinburgh, captured in her Nature column published back in 2010, entitled ‘A CV of Failures’. Wouldn't it be a powerful group exercise to compile a record of all our research setbacks, to remind ourselves that we are not alone in facing failure, from inexplicable results to grants and paper rejections? More than ten years have passed since then, but this idea is still very much relevant.

Change in working culture often comes slowly, but the conversation appears ongoing at different levels, from researchers to the publishing industry. And so, where does this leave us at an individual level? A simple, and yet powerful action may be this: don't be too anxious to rush for an easy, immediate happy ending. We can take the time to reflect on and discuss failed experiments, rejected applications, abandoned hypotheses. We will find that everybody around us has very similar stories to share. Perhaps we can even laugh a little about them together: it will then feel almost natural to start again from there.

Flaminia Zane holds a PhD in life sciences from Sorbonne University, with a specialisation in bioinformatics and the biology of ageing. She now works in scientific mediation and training at the European Bioinformatics Institute (EMBL-EBI) in Cambridge.



Rethinking Alzheimer's disease after a century of plaques

Laura Jialing Li Yu explores why decades of Alzheimer's research may have been looking in the wrong place, revealing a disease far more complex than a single protein.

The Rise of the Amyloid Hypothesis

More than a century ago, in 1906, a German psychiatrist named Alois Alzheimer stood before a conference in Germany and described a peculiar disease. His patient, Auguste Deter, had lost her ability to hold a conversation, grew confused and suffered from severe memory failure. After her death, Alzheimer examined her brain under a microscope and observed two unusual features that would come to define the disease: strange deposits later named amyloid beta plaques, and twisted fibres inside neurones now known as neurofibrillary tau tangles.

For much of the 20th century, these features remained mysterious. Scientists did not know what the plaques were made of, nor whether they were the cause of disease or simply debris left behind by dying brain cells. It wasn't until the 1980s that researchers identified the main component of these plaques as a small protein fragment called amyloid beta and cloned the gene involved in its production. Over the following decade, scientists began uncovering how this protein was produced, how it accumulated in the brain, and how it might damage neurones. In the 1990s, genetic breakthroughs appeared to cement its central role. John Hardy and colleagues discovered mutations in genes linked to Alzheimer's disease (AD) including the amyloid precursor protein and presenilin genes, which increased production or accumulation of amyloid beta (Hardy and Selkoe, 2002).

This convergence gave rise to what became the dominant theory in the field: the amyloid hypothesis, marking the conceptual shift from descriptive to mechanistic view (Hardy and Allsop, 1991). The logic was compelling, amyloid beta accumulates, forms plaques, triggers a cascade of toxic events and ultimately kills neurones leading to dementia. Every known case of rare familial AD increased amyloid beta production or altered its processing, providing evidence that amyloid lay at the origin of disease. At a time when few alternative mechanistic explanations existed, amyloid offered a clear target. For over 30 years, this hypothesis has shaped research, drug development and billions in investment.

However, the story did not unfold as expected. Nearly all disease-modifying therapies developed for AD have targeted amyloid beta. By some estimates, over 90% of clinical trial strategies have focused on removing or reducing this protein (Cummings et al., 2021). But around 99% of these trials have failed to produce meaningful improvements in cognitive decline (Cummings et al., 2014). Even the drugs that have now been introduced, which slow cognitive decline such as lecanemab, only do so with moderate effects (Van Dyck et al., 2023). This, alongside questions around cost-effectiveness and clinical impact, is why such treatments have not been widely funded by the NHS in the UK.

Beyond Plaques: Tau, Glia and Neuroinflammation

Yet even as the amyloid hypothesis gained prominence, the second pathological hallmark of Alzheimer's disease—neurofibrillary

tangles composed of the protein tau—received considerably less attention. While Alzheimer first described these intracellular tangles in 1906, tau itself was only identified as their principal component decades later (Iqbal et al., 1974). Much of the genetic evidence emerging in the 1980s and 1990s pointed towards amyloid, with mutations causing familial Alzheimer's disease all affecting amyloid processing. By contrast, tau is also implicated in several other neurodegenerative disorders, creating uncertainty over whether it was a primary driver of Alzheimer's disease or a downstream consequence of amyloid pathology. As a result, amyloid became the principal focus of research and therapeutic development.

Current evidence suggests that amyloid beta may be necessary to initiate Alzheimer's disease but is unlikely to be sufficient on its own. Rather than directly causing cognitive decline, amyloid appears to create conditions that enable tau pathology, neuroinflammation and other cellular dysfunctions to emerge. Once tau begins to spread through interconnected brain regions, it correlates much more strongly with neuronal loss and cognitive impairment than amyloid burden itself (Edwards, 2019, Musiek and Holtzman, 2015). This may help explain why therapies that remove amyloid after symptoms have developed have produced only modest clinical benefits: by this stage, downstream pathological processes may already have become self-sustaining. Despite the growing recognition of tau's importance, there are currently no approved disease-modifying therapies targeting tau. Developing such therapies remains challenging because tau aggregates accumulate within neurones, making them inherently more difficult to access than extracellular amyloid plaques, and because the mechanisms underlying tau propagation are still not fully understood.

However, the AD framework should be expanded even further. For decades, AD research has been mostly neurone-centric, but more than half the brain is made of glia cells, thought to just be support cells but recently shown to be very important for many functions and pathways. For example, genetic studies revealed that the strongest risk factors for AD are genes expressed in microglia, the immune cell of the brain. They are responsible for clearing debris from the brain but in disease they can become overactive and trigger



chronic inflammation which may in turn be toxic to the brain. In this view, AD is also a neuroinflammatory disease as well as a neurodegenerative one.

Astrocytes are the other group of glia that serve as key regulators of central nervous system homeostasis. They maintain the extracellular environment by controlling ion balance, neurotransmitter uptake, and metabolic support to neurones. Beyond these physiological roles, astrocytes are deeply involved in a range of pathophysiological processes like neuroinflammation and oxidative stress where they were reported to adopt reactive phenotypes that influence disease progression (González-Reyes et al., 2017). Increasing evidence suggests that astrocytes actively respond to the two hallmark pathologies of amyloid beta plaques and tau aggregates (Preman et al., 2024, Saroja et al., 2022). Most recently, their role in the glymphatic system, a waste clearance system in the brain, has gained attention. This system maintains homeostasis by facilitating the removal of toxic metabolites and proteins (Dagum et al., 2026). In AD, this process can be impaired, leading to the accumulation of amyloid beta and tau and accelerating disease progression.

There is another less explored group of cells in the brain called oligodendrocytes which are further implicated. These cells produce myelin, the insulating layer that allows neurones to communicate efficiently. Emerging evidence suggests that disruptions in myelin and oligodendrocytes may occur early in disease progression, seen as white matter hyper intensities on MRI scans. It is thought that the myelin debris may also activate microglia and drive amyloid beta deposition (Depp et al., 2023). This is further supported by genetic data like *APOE4*, the strongest risk gene for AD is one involved in lipid and cholesterol transport (Jansen et al., 2015). Disruption in neuronal communication due to white matter lesions can also explain the long distance signalling breakdown across the brain.

The old strategy to remove amyloid now appears overly simplistic. The emerging consensus is that effective therapies will likely need to be combinatorial and delivered at the right stage of disease. Future treatments may involve reducing amyloid levels, halting tau propagation and modulating glia mediated neuroinflammation. This also requires precision medicine approaches as different patients may enter the disease through different biological routes with different pathologies playing greater roles. Rather than treating AD as a single disease, future therapies should combine biomarkers with molecular profiling to identify pathways driving disease and tailor treatment accordingly.

More broadly, these processes are deeply interconnected. Amyloid beta and tau (both misfolded proteins) interact with microglia, astrocytes, and oligodendrocytes, disrupting immune signalling, waste clearance, and white matter integrity across the brain. Genetic risk factors such as

APOE4 further influence these pathways through effects on lipid transport and glial function. Together, this suggests that Alzheimer's disease is not driven by a single pathway, but by a network of interacting molecular and cellular dysfunctions.

Alzheimer's Disease Beyond a Single Model

Even this expanded biological framework does not capture the full complexity of AD. A further challenge is that AD is a highly heterogenous disease. Speak to two individuals with the same diagnosis, and their experiences can differ greatly. Age of onset, rate of progression and symptom profiles vary. Understanding this heterogeneity is one of the greatest challenges in the field and one of the most important. Much of what we know about AD comes from studies conducted in populations of European ancestry. This lack of diversity has significant consequences, because genetic risk and disease biology differs across populations. The *APOE* gene illustrates this clearly. In individuals of European descent, carrying the *APOE4* variant is the strongest genetic risk factor for late-onset AD, increasing risk up to fifteen-fold. However, in African American populations, *APOE4* confers a much smaller increase in risk whereas it is much higher in East Asian populations (Farrer et al., 1997). Different genetic factors may play different weighted roles in different populations. If clinical trials are based primarily on European ancestry data, disease modifying effects may not be widely applicable.

In addition, even the tools used to diagnose AD and identify disease stage are not immune to bias. Blood-based biomarkers like plasma p-tau 217 show different baseline levels across populations, but standard reference ranges do not yet account for this variation. The same applies for imaging and cognitive tests, increasing risk of misdiagnosis in underrepresented groups. Efforts are underway to address these gaps. Large-scale initiatives are expanding genetic studies to include more diverse populations and organisations are pushing for great inclusion in clinical trials. However, progress remains slow, limited by funding, and other challenges.

Overall, the amyloid cascade hypothesis has a landmark moment in AD research. It provided a framework, a target and decades of scientific momentum. Today, AD is understood not as a single pathway but as a network of interacting processes - protein aggregation, immune response, cellular dysfunction and individual variation. The question is no longer simply what causes AD, but what drives it in each person and how we can treat it accordingly.

References: Cummings J, et al. (2021). *Alzheimers Dement Transl Res Clin Interv* 7:e12179; Cummings JL, et al. (2014). *Alzheimers Res Ther* 6:37; Dagum P, et al. (2026). *Nat Commun* 17:715; Depp C, et al. (2023). *Nature* 618:349–357; Edwards FA. (2019). *Trends Neurosci* 42:310–322; Farrer LA, et al. (1997). *JAMA* 278:1349–1356; González-Reyes RE, et al. (2017). *Front Mol Neurosci* 10:427; Hardy J, Allsop D. (1991). *Trends Pharmacol Sci* 12:383–388; Hardy J, Selkoe DJ. (2002). *Science* 297:353–356; Iqbal K, et al. (1974). *Brain Res* 77:337–343; Jansen WJ, et al. (2015). *JAMA* 313:1924–1938; Musiek ES, Holtzman DM. (2015). *Nat Neurosci* 18:800–806; Preman P, et al. (2024). *EMBO Mol Med* 16:3113; Saroja SR, et al. (2022). *Proc Natl Acad Sci USA* 119:e2108870119; Van Dyck CH, et al. (2023). *N Engl J Med* 388:9–21.

Laura is a PhD student in Clinical Neuroscience at St John's College, researching Alzheimer's disease. She is passionate about what goes wrong in the brain and how we can treat it.

Artwork by Isabel Valenbreder

The Universe as a Story We Keep Rewriting

From Ptolemy to Einstein, the story of our universe has changed dramatically. But how do modern telescopes and new statistical models aid (or complicate) the work of cosmologists like Dily Duan Yi Ong?

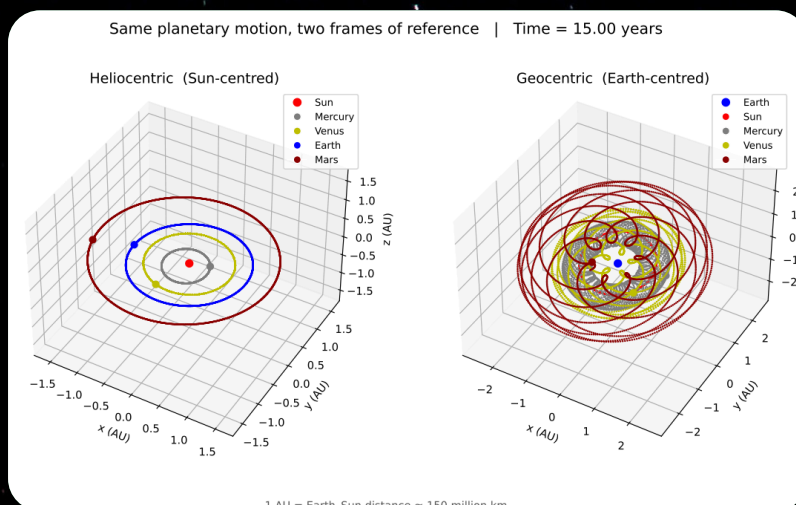


Cosmology is one of the oldest stories humans have ever told, and every time we look up at the night sky, we are looking into its past. Light takes time to travel, so every patch of sky presents a different chapter in the river of cosmic history. When we look at the Andromeda Galaxy, the nearest major galaxy to the Milky Way, we are reading a chapter of the Universe that is about 2.5 million years old because its light has taken roughly 2.5 million years to reach Earth. This article discusses how the narrative of the Universe has changed throughout human history: from ancient constellations traced with the naked eye, to Ptolemy's geocentric Universe in the 2nd century CE, to Copernican heliocentrism in the 16th century, and finally to modern cosmology shaped by observational data from space telescopes and interpreted through high-performance computational analysis.

Before the age of telescopic astronomy, people turned the night sky into stories, connecting stars into gods, animals, and objects. Many constellations used in modern astronomy came through ancient Greek astronomy, especially Ptolemy in the 2nd century

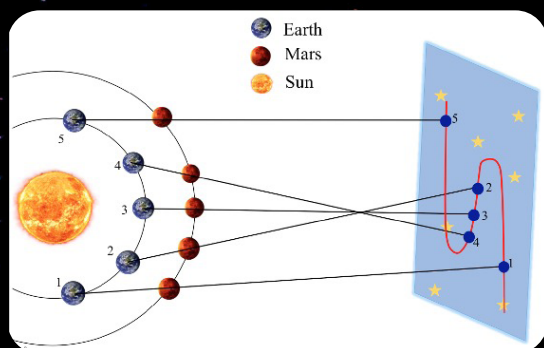
CE, though their roots reach further back into Babylonian and Mesopotamian skywatching. We now know that these stars are usually not physically connected but only appear close from Earth's point of view. Even today, constellations remain part of astronomy's language, helping us locate objects in the sky while preserving echoes of ancient cultural imagination.

The cosmic story changed dramatically with the rise of mathematical astronomy. For many centuries, especially after Ptolemy's *Almagest* in the 2nd century CE, the dominant astronomical model was geocentrism: a Universe with Earth at its centre and the Sun, Moon, planets, and stars moving around it. One of the puzzles this model had to explain was apparent retrograde motion: the way planets such as Mars sometimes seem to slow down, reverse direction against the background stars, trace a loop, and then move forward again. The geocentric model was far from primitive. It used a sophisticated system of circles upon circles, known as epicycles, to account for this strange wandering of the planets across the sky.



The same planetary motion (simulated over 15 years) viewed from two different frames of reference. The heliocentric (Sun-centred) view (left) illustrates the modern narrative of the Solar System, where Mercury, Venus, Earth, and Mars follow simple, elliptical orbits around the Sun. In contrast, the geocentric (Earth-centred) view (right) fixes Earth at the origin, resulting in complex, looping trajectories for the other planets. These overlapping loops visually demonstrate the apparent retrograde motion that early astronomers attempted to explain using epicycles. Distances are measured in Astronomical Units (AU), where 1 AU represents the Earth-Sun distance (approximately 150 million km). Figure adapted from the author's undergraduate research thesis.

In the 16th century, Nicolaus Copernicus rewrote the plot. His 1543 book *De revolutionibus orbium coelestium* proposed that Earth was not the centre of planetary motion. Instead, Earth and the other planets moved around the Sun. In this Sun-centred model, retrograde motion has a simple physical origin: Earth moves faster on an inner orbit and sometimes overtakes Mars. As our line of sight shifts, Mars appears to move backwards against the distant stars, even though Mars itself has not reversed direction. The loop is not a real loop in Mars's path around the Sun. It is an effect of perspective.



As Earth, on its inner orbit, overtakes the slower-moving Mars at successive positions 1–5, the line of sight from Earth to Mars shifts across the background stars and momentarily reverses. This projection creates the red looping path seen from Earth, which we observe as Mars's apparent retrograde motion. Figure adapted from the author's undergraduate research thesis.

The shift from geocentrism to heliocentrism was not only scientific. It was also cultural, philosophical, and religious. In the 17th century, Galileo Galilei's defence of heliocentrism brought him into conflict with the Catholic Church. He was warned in 1616 not to advocate the Copernican theory, and in 1633 he was condemned and placed under house arrest. Heliocentrism was not simply a new astronomical model. It challenged an inherited narrative about humanity's place in the cosmos.

But the story did not end with the Solar System. In the 20th century, Einstein's general relativity transformed cosmology again. The Universe was no longer a fixed stage on which stars and planets moved but a dynamical spacetime whose geometry could evolve. Gravity was no longer understood simply as a force between objects but as the geometry of spacetime itself. Soon after, observations of distant galaxies revealed that the Universe itself is expanding. By the late 20th century, supernova observations showed an even more surprising twist: this expansion is accelerating, pointing to the mysterious phenomenon we now call dark energy.

Modern telescopes extend this idea further. Space-based observatories and galaxy surveys do not simply produce beautiful images. They collect the evidence from which cosmologists reconstruct the history of the Universe. The cosmic microwave background tells us about the young Universe. Supernovae help us measure cosmic expansion. Galaxy surveys reveal how matter clusters across vast distances. Weak gravitational lensing shows

how invisible matter bends light. Each dataset is like a different narrator, telling the same cosmic story from a different point of view.

But narrators do not always agree. One of the central challenges in modern cosmology is that different datasets sometimes appear to prefer different values for the same cosmological quantities. These disagreements are known as tensions. They may be hints of new physics, but they may also arise from measurement uncertainties, hidden systematics, or assumptions in the way data are analysed. Like conflicting witnesses in a detective story, they make the plot more interesting but also more difficult to resolve.

The standard model of cosmology today is known as Λ CDM. It describes a Universe containing ordinary matter, cold dark matter, and dark energy in the form of a cosmological constant, represented by Λ . It is remarkably successful, but it may not be the final story. Cosmologists continue to ask whether dark energy is truly constant or whether it evolves with time. They ask whether the tensions between datasets are signs of new physics or signs that our measurements need revision. They ask which model of the Universe is not only possible, but most strongly supported by the data.

This question lies at the heart of my PhD research. I study eight alternative Universe models and rank how plausible they are using observed data from 13 different cosmological surveys. Each model represents a different possible cosmic narrative. Some may allow dark energy to behave differently. Some may change assumptions about the ingredients or geometry of the Universe. The task is not simply to find a model that can fit the data. A more complicated model, with more adjustable parameters, can often fit observations more easily, just as a longer story can explain away more plot twists. But flexibility comes at a cost. If the extra parameters do not substantially improve the explanation, they may be unnecessary additions rather than signs of new physics. The harder question is therefore not only which model fits the data but which model earns its complexity.

This is where statistical methods become the editors of the cosmic narrative. In science, a good model must be supported by observational evidence. It must explain the data without inventing unnecessary complications. New observations from telescopes can change the story but so can new ways of analysing those observations. The same sky can support different interpretations depending on the methods we use to compare models, combine datasets, and quantify uncertainty.

Cosmology is therefore not a finished book. It began with naked-eye stories written in the stars, evolved through geocentric and heliocentric models, and expanded into the modern story of the Big Bang and the accelerating Universe. Today, it is still being revised by telescopes, surveys, simulations, and statistics. Science's narratives are powerful because they can change according to new discoveries. Cosmology is the story of the Universe and also the story of how we keep learning to tell it better.

Dily Duan Yi Ong is a final-year PhD student in Physics, specialising in machine-learning-enhanced Bayesian inference in cosmology.

WHY MALARIA RESISTS A HAPPY ENDING:

eradication, empire and modern global health

Niamh Bewick explores why malaria withstands a tidy eradication story, tracing how colonial history and biological complexity still shape who leads the research and whose solutions count.

Infectious disease research often prioritises narratives of conquest: a pathogen is identified, a treatment is discovered, and science eradicates the pathogen. The eradication of Smallpox, for instance, is often told as one of science's biggest triumphs, where a deadly disease was identified, people were vaccinated against it, and it was ultimately removed from the world entirely. This narrative has a neat ending: the conquest over nature, an idea that has impacted how infectious disease research imagines progress and defines success. Yet, the majority of diseases do not follow this process. Despite decades of global initiatives, technological breakthroughs and investment, malaria has periodically resisted eradication. The neat narrative provides an oversimplified one, shielding the darker colonial and imperial influences that motivated malaria research and still shape funding to this day. As a single-celled parasite that infects both the liver and red blood cells, malaria presents biological challenges that are far more complex than the neat narrative of discovery, intervention and elimination suggests. Understanding this persistence requires looking not only at the biology of the parasite, but also at the colonial and imperial histories that motivated malaria research and continue to shape funding today.

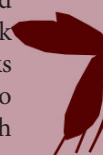
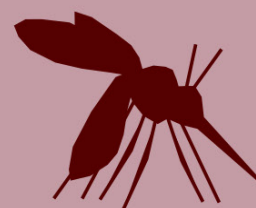
Empire, tropical medicine and the narrative of control

The history of malaria control is deeply tied to the history of empire and colonial powers. During the 19th and 20th century, malaria posed a major obstacle to European colonial expansion into parts of Africa and Asia, where deaths among soldiers and missionaries threatened imperial projects. Controlling malaria, therefore, was not solely of public health, but largely to facilitate colonial powers' expansion into Africa. It was a political and economic priority, tied to the governance and 'conquest' of tropical landscapes. In this context, tropical medicine developed, with colonial ambitions to enable tropical environments to be more 'manageable' and workable for colonial and imperial powers. Many narratives of these colonial and imperial ties to malaria research still shape funding to this day; the ideas of eradication, conquest and the search for more 'silver bullet' solutions have roots within malaria in this history and narrative of controlling these tropical environments.

Some regions of sub-Saharan Africa were referred to by Europeans as the "white man's grave", reflecting the major barrier malaria posed to colonial expansion into tropical regions. As a result, the driving force behind many early malaria control efforts was not simply humanitarian concern, but the strategic interests of European imperial powers. Controlling malaria became essential for enabling colonial administration, military movement, trade, and large-scale infrastructure projects. Perhaps the clearest example of this was the construction of the Panama Canal, where extensive mosquito control campaigns, drainage systems, and sanitation measures were introduced to protect workers from malaria. Ultimately disease control became a tool of economic and geopolitical power.

However, these interventions cannot be described as "public health" successes. The benefits of malaria control were distributed deeply unequally along racial lines. White "gold roll" workers were provided with screened housing, improved sanitation, and access to high-quality medical care. While Black "silver roll" workers were often housed in overcrowded barracks without basic preventative infrastructure such as mosquito screens. Medical treatment itself was similarly unequal, with Black patients frequently subjected to violent and dangerous procedures, including so-called "cold deadly" ice baths, that could themselves prove fatal. Although these campaigns advanced malaria research and tropical medicine, they primarily served imperial and economic interests rather than improving health equally across populations. The development of tropical medicine was therefore deeply intertwined with broader colonial ambitions to render landscapes, labour, and populations more governable through science and technology.

These colonial patterns of power are not confined to the past, but continue to shape malaria research and global health priorities today. Despite almost 90% of malaria cases occurring within





Artwork by Barbara Neto-Bradley

“Disease control is not always a linear story of discovery, intervention, and conquest, but one deeply entangled with biology, history, power, and the communities most affected.”

sub-Saharan Africa, the vast majority of malaria research funding and institutional power remains concentrated within Europe and North America. This creates a persistent imbalance in who is able to shape research agendas, define solutions, and determine what forms of knowledge are considered legitimate within global health. Debates surrounding the use of *Artemisia annua*, a medicinal herb from which the antimalarial compound artemisinin is derived, further highlight these tensions. While *Artemisia*-based treatments have been used locally for decades, and some researchers and clinicians argue they may offer affordable and accessible approaches to malaria treatment, their use remains highly contested within mainstream medicine and global health policy. Concerns surrounding dosage standardisation, efficacy, and the potential contribution to drug resistance have led organisations such as the World Health Organization to caution against the widespread use of non-pharmaceutical *Artemisia* treatments. Nevertheless, critics argue that the marginalisation of locally-grown treatments reflects broader inequalities within global health, where externally developed pharmaceutical interventions are often prioritised over community-led or locally controlled solutions.

These inequalities are also reflected in who is allowed to shape malaria research itself. Scientists working within malaria-endemic regions are often positioned as “field workers” for Western-led institutions rather than leaders in designing local interventions. Richard Mukabana, an insect biologist at the University of Nairobi, has criticised this imbalance, arguing that greater focus should be placed on implementing local vector control strategies, such as the use of *Bacillus thuringiensis israelensis* (BTi), a bacterium used to target mosquito larvae. His work around Lake Victoria also highlights the importance of community health initiatives in reducing endemic malaria transmission, challenging the continued emphasis on externally driven “silver bullet” solutions within global health.

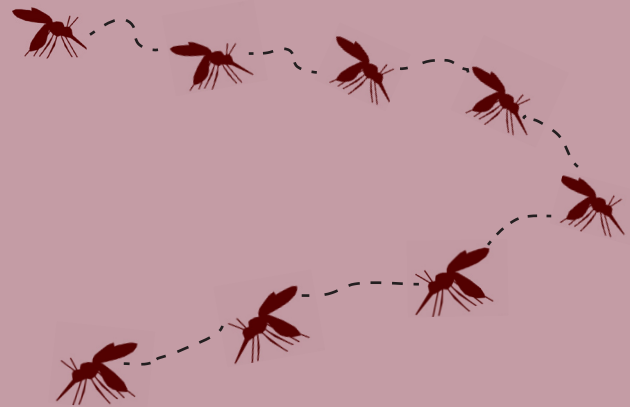
As a result, the narratives shaping malaria eradication continue to be shaped not only by the biology of the parasite itself, but by deeper questions of power and who is allowed to lead the fight against disease.

The Biological Perspective

The complex biology and lifecycle of the parasites that cause Malaria are also central to why eradication has proven so difficult. Unlike bacteria, which possess many distinct cellular features that can be selectively targeted by antibiotics, malaria parasites are complex eukaryotic organisms, just as human cells are themselves eukaryotic. As a result, the parasite shares many overlapping biological pathways and cellular processes with its human host, creating major challenges for drug development, as compounds capable of disrupting parasite function can also risk damaging host cells. Alongside this, malaria parasites exhibit extraordinary antigenic diversity, constantly altering the proteins expressed on their surface throughout infection. This ability to “switch” antigens allows the parasite to evade immune detection even after the immune system has begun to recognise it, contributing not only to persistent infection, but also limiting vaccine development and long-term vaccine efficacy. The parasite’s intracellular lifestyle further complicates immune clearance. By infecting red blood cells, which lack proteins on their surface that immune cells use to detect intracellular infection, the parasite is able to remain largely hidden from immune surveillance, only briefly exposing itself to immune

cells when infected blood cells rupture. In this sense, malaria repeatedly disrupts the idea of a straightforward “silver bullet” treatment, biologically resisting the kinds of simple endings that infectious disease narratives often seek.

Malaria therefore complicates the neat narrative of infectious disease eradication itself. The persistence of the parasite demonstrates that disease control is not always a linear story of discovery, intervention, and conquest, but one deeply entangled with biology, history, power, and the communities most affected.



Niamh Bewick is a MPhil student in molecular parasitology researching vaccine candidates in malaria.



NARRATING INEQUALITY



Art by Alexandra Kim

Hyunseo Noh reflects on the publication, “Physiological mechanisms mediating socio-environmental influences on pregnancy outcomes in Black people” and how narratives shape research questions in reproductive health and, importantly, the maternal lived experience.

A recent University of Cambridge study examined how systemic racism and socioeconomic stress may shape pregnancy biology, helping explain why Black women in the UK are significantly more likely to experience severe pregnancy complications (Amedor & Giussani, 2026). The science is striking: persistent socioenvironmental stressors may alter inflammation, oxidative stress and blood flow to the placenta — physiological processes essential for healthy pregnancy outcomes.

What stayed with me was the story that science tells, as much as the actual biology itself.

Scientific research is often framed as the discovery of objective mechanisms, detached from social context. Yet this paper reminds us that bodies do not exist outside the worlds they inhabit. Maternal health here is not presented as a physiological state, but as a record of lived experience; of chronic stress, inequality and systemic exclusion. In that sense, science is not simply describing the body; it is narrating how systemic racism becomes embodied.

As a doctoral scientist at the Autism Research Centre working on women’s health in neurodivergent populations, I found it difficult to read this work with emotional distance. Women’s health has long been treated as too complex, too variable or too difficult to prioritise. This research feels important not only because it offers a physiological framework for understanding maternal health disparities, but because it highlights that historically neglected questions deserve scientific attention.

If narratology asks whose stories are told, this paper offers an important answer: science must make room for stories that have too often been dismissed as merely social, subjective or peripheral. Some of the most important biological questions begin there.

Works cited

Amedor, G and Giussani, D A (2026) ‘Physiological mechanisms mediating socio-environmental influences on pregnancy outcomes in Black people.’ Review, *Trends in Endocrinology & Metabolism*. Available online: <https://doi.org/10.1016/j.tem.2026.03.003>

Hyunseo Noh is a doctoral scientist at the Autism Research Centre in the Department of Psychiatry, where her research focuses on the reproductive health of neurodivergent women. Hyun is a member of Clare College.

NOT ALL PLANT VIRUSES ARE VILLAINS



Art by Barbara Neto-Bradley

Historically, plant viruses have a bad reputation for causing destruction to crops and harvests. Adaobi Fiona Nwokeji explores how recent discoveries have changed this narrative, shedding light on how persistent viruses can make up an essential part of a plant's hologenome

Just like in humans, viruses also affect plants and for decades, the focus of plant virology has been on the impact of viruses as harmful pathogens. Pathogenic viruses have resulted in annual crop losses exceeding \$30 billion worldwide; stunting plant growth, destroying harvests, and sometimes triggering regional famine.

However, in some crop plants, RNA viruses have been quietly living for generations, passed from parent to offspring via infected seeds and cell division, they cause no visible disease (asymptomatic), and cannot spread between plants due to the absence of movement proteins. They are called “persistent viruses”.

How we learned to see viruses as enemies

Plant virology emerged in the late nineteenth century as a discipline of crisis response. Tobacco mosaic virus, the first virus identified, was discovered because it was destroying tobacco crops. The tools, funding structures, and research questions that followed were all shaped by the same logic: identify the pathogen, characterise the disease, develop resistance. For decades, this approach delivered enormous value. It also embedded an assumption so deep it became invisible: the interactions between a plant and its viruses are fundamentally antagonistic.

In this line, “healthy” meant “virus-free,” and healthy plants were not expected to harbour viral double-stranded RNA (dsRNA) (Azcona, 2020). If a plant showed no symptoms, there was no reason to look for a virus and less funding to do so. Persistent viruses, which are asymptomatic and cannot be transmitted mechanically or by insect vectors, were invisible to a discipline that only looked where damage had already occurred.

When researchers discovered dsRNA in visibly healthy plants, such as pepper, rice, and beans, they found that these viruses were non-pathogenic. Leading researchers began to question what their purpose might be. The result was a quiet split: researchers studying viral pathogenesis (how viruses cause diseases) and those studying viral mutualism (the mutualistic associations of viruses) began publishing in largely separate outlets, rarely engaging with each other's evidence. Two stories about the same biological kingdom, told in parallel, to different audiences.

A shocking revelation

The evidence that complicated the villain narrative came from beets. In 2008, researchers showed that beet plants inoculated with several acute viruses (pathogenic viruses that cause diseases) displayed improved tolerance to both drought and freezing. The infected plants accumulated higher levels of antioxidants and

osmoprotectants than the uninfected plants (Xu *et al.*, 2008; Mehetre *et al.*, 2021). The viruses did not simply fail to cause disease but appeared to be conferring a measurable survival advantage under stress. Similarly, Márquez and colleagues had previously demonstrated that a fungal endophyte (an asymptomatic fungus that lives inside plant tissues) could confer thermal tolerance to its plant host only when the fungus itself was infected with a virus in a three-way symbiosis. The implication was striking as some plant-virus interactions might only reveal their function under environmental pressure and remain invisible under controlled greenhouse conditions.

In pepper, persistent partitiviruses and endornaviruses have been found in some cultivars tested worldwide. They are transmitted vertically through seed and pollen and have likely been co-evolving with their hosts for thousands of years. To study the effects of one of these viruses, Bell Pepper endornavirus (BPEV; a prominent persistent virus), researchers created near-isogenic lines of bell peppers, genetically identical except for the presence or absence of BPEV. Interestingly, they found that BPEV-infected plants showed less severe symptoms and lower viral titres than their BPEV-free plants when infected with tobamoviruses (Escalante *et al.*, 2023). The persistent virus appeared to interfere with acute viruses.

A tale resists a clean reversal

“Asymptomatic”, a word used to describe these persistent infections, carries contradictory meanings depending on where and when used. In wild plant ecology, asymptomatic (symptomless) infection can suggest a stable relationship that has developed over time between the plant and the microbe. In plant pathology, however, the absence of symptoms does not always mean the plant is healthy. Some asymptomatic infections can still reduce crop yield by up to 45% even when

there are no visible signs of disease (Prendeville *et al.*, 2014; Roossinck, 2012; Nancarrow *et al.*, 2022). Use of the same phrase has failed to distinguish true neutrality from undetected harm or undetected benefit. Any claim about what persistent viruses are really doing rests on shaky definitions.

From eradication to harnessing

One emerging framework proposes treating persistent viruses as part of the plant’s hologenome, the collective genome of a host and its associated microorganisms. In some cultivars of pepper, the plant’s biological identity does not end at its own genome. It may include persistent partitiviruses or endornaviruses carried for generations, the microbial community in its rhizosphere, and the complex interactions between them.

If persistent viruses can modulate how a plant responds to acute infection or environmental stress, breeding programmes that accidentally eliminate them may be a useful tool. Conversely, breeding programmes may select for the absence of persistent viruses in cultivars where this absence provides a trade-off between host immunity or increased productivity. Whether a persistent virus helps or harms depends on the host’s genotype, the environmental pressures it faces, and the surrounding microbial community as their role in priming the host’s immunity is highly cultivar dependent.

Historically, plant virology has revolved around a single narrative: viruses attack and we defend. This narrative has been extraordinarily productive, driving the development of resistant cultivars, informing biosecurity policy, and preventing incalculable crop losses. However, the expanding research into persistent viruses makes it difficult to view this as a one-size-fits-all concept since some viruses persist without pathogenicity or cause infections that confer resilience. Still, many of these interactions are yet to be categorised as symbiosis, commensalism, or parasitism in model plant systems.

Adaobi Fiona Nwokeji is an early-career researcher pursuing graduate studies in Biological Sciences at the University of Cambridge, with interests in engineering plant and microbial systems for sustainable agricultural applications.

References

- Escalante, C., Khankhum, S. and Valverde, R.A., (2023). Biological and molecular interactions between bell pepper endornavirus and two tobamoviruses. *Frontiers in Virology*, 3, p.1267692.
- Mehetre, G.T., Leo, V.V., Singh, G., Sorokan, A., Maksimov, I., Yadav, M.K., Upadhyaya, K., Hashem, A., Alsaleh, A.N., Dawoud, T.M. and Almaary, K.S., (2021). Current developments and challenges in plant viral diagnostics: A systematic review. *Viruses*, 13(3), p.412.
- Nancarrow, N., Aftab, M., Hollaway, G., Rodoni, B. and Trębicki, P., (2022). Symptomless turnip yellows virus infection causes grain yield loss in lentil and field pea: A three-year field study in south-eastern Australia. *Frontiers in plant science*, 13, p.1049905.
- Prendeville, H.R., Tenhumberg, B. and Pilson, D., (2014). Effects of virus on plant fecundity and population dynamics. *New Phytologist*, 202(4), pp.1346-1356.
- Roossinck, M.J., (2012). Plant virus metagenomics: biodiversity and ecology. *Annual review of genetics*, 46(1), pp.359-369.
- Santín Azcona, J., (2020). Cryptic viruses in Black-grass: Investigating their role in plant stress tolerance (Doctoral dissertation, Newcastle University).
- Xu, P., Chen, F., Mannas, J.P., Feldman, T., Sumner, L.W. and Roossinck, M.J., (2008). Virus infection improves drought tolerance. *New Phytologist*, 180(4), pp.911-921.

Of Rubbish and River Magic in Mike Edwards's *Riverskin* (2025)

Isabel Fernandez Mayor explores how Mike Edwards's *Riverskin* uses fantasy and a half-river protagonist to make river pollution visible to young readers, arguing fiction can voice an ecological crisis that statistics alone cannot.

Artwork by Nina Valenbreder

According to the 2024 "State of Our Rivers Report" issued by The Rivers Trust, in England alone it can be observed that "none of [the country's] river stretches are in good or high overall health" while "85% of river stretches fall below good ecological standards" (2024, n.p.). But how can we mediate this shocking ecological truth for young readers and engender a feeling of appreciation for the waterscapes that sustain us all? For Astrida Neimanis, water crises centrally emerge from the interplay of material concerns of wet environments "with our idea of water" (2017, p. 20; emphasis original). Fantastic narratives can cater to exactly this aspect of ideas of (young) readers by expanding our imagination into magical waterscapes. In line with Zoe Jaques (2015), I see the potential of children's fantasy in how it "animates and gives a voice to a host of imaginary, impossible and real beings so that drawing boundaries between truth and fiction becomes sufficiently challenging as to question a rigidly hegemonic, humanist ontology" (p. 6). Fantasy for the young therefore allows the voice and concerns of rivers to come to light via narrative.

The recently published middle-grade novel (targeted at children aged approximately 9–12 years old) *Riverskin* (2025) by Mike Edwards treats riverine pollution as an everyday occurrence that functions as the backdrop of the narrative. In the story about the amphibious 'Riverskin' protagonist Tess, which is primarily concerned with questions of self-discovery, litter is explored as an all-encompassing feature. Her home in the so-called 'turns' of the River Tees – "twisting tunnels that worm updown inout the riverbank" (2025, p. 19) – is cluttered with all kinds of rubbish that Edwards expresses as "tatty rags", a discarded "matrus" (p. 41), an unwanted "sofur" and "cushuns" (p. 22), a "stone sink, dumped in river by dry-folk" (p. 13), "a rick-rackety stool where [Tess] keep[s] [her] tesco dresses and shawls [...] stitched up from reeds and rags" (p. 42), "spinnies: cages with wheels on them and dry-folk words like *Tesco* and *Asda*" (p. 42), and "kans, lotslots kans" (p. 42). The sheer abundance of those objects, which are rooted into the realist world via their reference to brand names and corporations familiar to British (child) readers, conveys an atmosphere laden with unwanted

objects that illustrate dry-folk's [human] disregard for river ecology. Hoarded into the turns by Tess's guardian, Aunt Peg, the *Riverskins*' living space becomes littered with the clutter collected from both land and water and thus epitomizes the fateful connection between the two spheres.

While this contamination is rather commiserated than actively fought by Tess, it becomes the backdrop against which Edwards's protagonist must come to terms with her existence as a being who is part-human and part-River – a *Riverskin*. As Aunt Lilly explains to Tess close towards the end of the novel, "We drowned but didn't die [...]. For years we lay as rocks. And the river, with all its moods and its magic, washed over us. It streamed through us. All that swims in it, all that grows in it, is born and dies in it, became part of us. [...]" (pp. 217-218). As a creature that is part-river, the omnipresent rubbish becomes even more heart-breaking to witness and expands the concern as far as Tess's embodiment. By granting (young) readers access to the watery world through the eyes of the protagonist, the impact that humans leave on the underwater world and even on the turns, which are liminally placed between the terrestrial sphere and the river, becomes visible. Dry-folk greed and carelessness are a recurring theme throughout Edwards's narrative as people dump their rubbish into the river, fish senselessly, or try drowning a kitten in the tumbling waters. Providing awareness of the detrimental disregard for our waterways through literature for the young might – in line with Neimanis and Jamie Linton – change the material-discursive processes of worlding into a more ethical mode that recognizes the vitality of water and might therefore "directly impact how we treat water" (Linton qtd. In Neimanis, 2017, p. 20).

Interestingly, the only way the harmful impact of dry-folk is ever redressed as something negative is when Tess confronts her monstrous Unkle Darkwater, the driving force that caused Tess to flee the turns in search for help by her unknown Aunt Lilly. Rendering monstrous all the traits that dominate the detrimental human behavior, Darkwater asserts:

What do I want? I want this river. And all that's in it. All its flow, all its force. Every fish that swims in it, ev'ry dry-folk that walks by it – or dares dips their feet in it. Aye, them especially. I want dry-folk to know this ain't their river. It's mine. I want em to fear it. Them that have tried to stem this river, dammed it up, dirtied it. If they dare come near, I want them to know that they'll be dragged under. I want em to sit on riverbed like the junk they chuck in here. I want to do what I please. Tek who I please. Feed on what I please. (pp. 141-142; emphases original)

Here, the menacing being highlights the monstrosity of seeking to wield sole power over the river, which humans continuously intend. Simultaneously, however, Darkwater himself encompasses that very same tyrannic trait from an aqueous perspective and it thus is no less monstrous. Recognizing his harmful insistence on retribution and abuse of power, Tess must actively fight Darkwater to protect the river and all that live in and near it. As such, the protagonist models the stewardship (which could in itself be criticized as an anthropocentric notion) that comes with the extraordinarily powerful impact that humans can exercise. What goes hand in hand with this exemplification of behavior is a tendency prevalent in children's literature to employ monstrosity as, how Marleena Mustola and Sanna Karkulehto (2020) find, "the mechanism that aims to reject otherness by 'taming the supposed out of control' [...] is an oft-used theme in children's literature" (p. 125). Children might be enabled to identify the misuse of power based on Darkwater and the benevolent Riverskin's triumph over him and to transfer them onto real-life situations. Neither dominion nor retribution for the ecological harm exerted on the riverscapes are affirmed. As Jeffrey Jerome Cohen (1996) argues, "[b]ecause of its ontological liminality, the monster notoriously appears at times of crisis as a third term that problematizes the clash of extremes – as that which questions binary thinking and introduces a crisis" (p. 6). While responsibility is clearly assigned to humanity for littering the waterscape that is inhabited by Tess and other riverine beings, the narrative also points out how retribution is not the accurate answer. Therefore, the narrative seeks a median for the discussion and begins by enchanting nature with the help of the magical River Tees and the benevolent Riverskin.

Riverskin thus provides an entry point for young readers into a vibrant riverine world that seems animate and worth protecting, and at the same time the novel depicts this environment as fundamentally impacted by human carelessness that manifests in the omnipresent rubbish in the narrative. What Edwards's fiction centrally achieves is a shift of attention toward underwater domains as of yet vastly unacknowledged. While literature for young readers does not possess the same inherent magic that River Tees does in the story, pointing at the ways in which humans affect and harm the riverscape might at least raise an awareness of the effects that careless behavior can have on the water itself and its (fantastical) inhabitants. To refer back to Neimanis and Linton's idea of the importance of water imaginaries, I maintain that narrative plays a vital role in the endeavor to protect waterscapes. As Ursula Le Guin once stated, "Fantasy is true, of course, it isn't factual, but it's true. Children know that. Adults know it too [...]. They know that its truth challenges, even, threatens, all that is false" (1974 [2019], p. 5). Riverskin follows suit. What the narrative highlights is humanity's undeniable connection to the watery realm. It is on us to explain to young readers that this relationship must be one of mutual care, and can only be accomplished on equal footing.

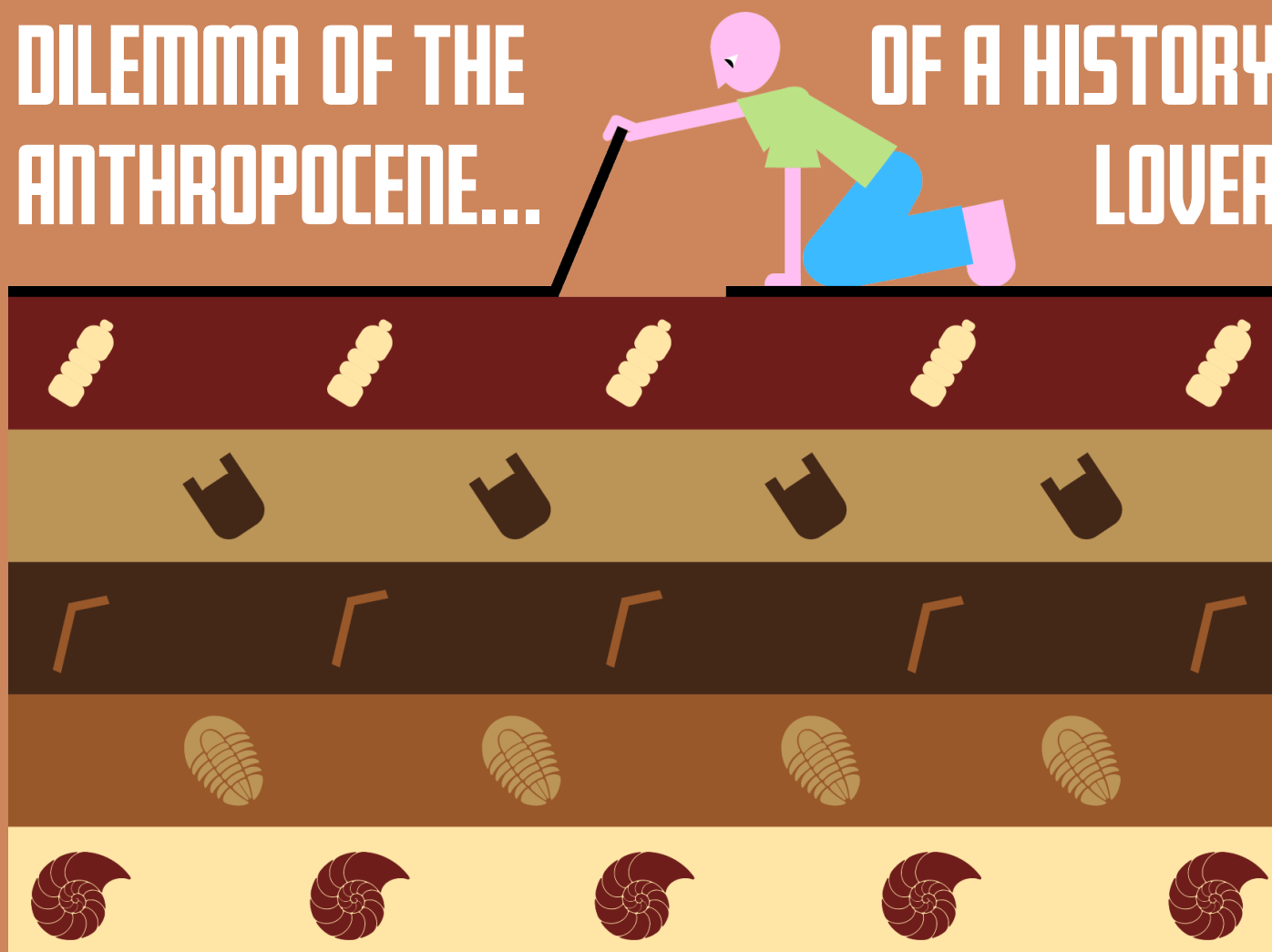
References

- Cohen, J. J. (1996). Monster culture (Seven theses). In J. J. Cohen (Ed.), *Monster theory: Reading culture* (pp. 3-25). University of Minnesota Press, Minnesota.
- Edwards, M. (2025). *Riverskin*. Walker Books, London.
- Jaques, Z. (2015). *Children's literature and the posthuman: Animals, environment, cyborg*. Routledge, London.
- Le Guin, U. K. (1974/2019). Why are Americans afraid of dragons? <https://worlding808.wordpress.com/wp-content/uploads/2019/05/leguin-1974-why-are-americans-afraid-of-dragons.pdf>.
- Mustola, M., & Karkulehto, S. (2020). Wild things squeezed in the closet: Monsters of children's literature as nonhuman others. In S. Karkulehto, A.-K. Koistinen, & E. Varis (Eds.), *Reconfiguring human, nonhuman and posthuman in literature and culture*, pp. 125-142. Routledge, London.
- Neimanis, A. (2017). *Bodies of water: Posthumanist feminist phenomenology*. Bloomsbury, London.
- The Rivers Trust. (2024). State of our rivers report. Available at: <https://theriverst>

Isabel Fernández Mayor is an MPhil student in Education (Critical Approaches to Children's Literature) at the University of Cambridge. In her MPhil Dissertation, she examined child-water relationships in post-2018 children's Fantastika.

EMBEDDED IN NATURE: THE DILEMMA OF THE ANTHROPOCENE...

...FROM THE PERSPECTIVE OF A HISTORY LOVER



Pollyanna Chamberlain questions the Anthropocene, arguing it flattens humanity and hides empire's role in environmental change, when we are in truth embedded within nature, not separate from it.

While explaining her dissertation, my friend from the Department of Pathology recently introduced me to the concept of the One Health approach to disease. I wasn't familiar with the name, yet I understood the principle as I had come across similar concepts in my historical studies over the years at Cambridge. Historian Timothy J. LeCain (2017) has traced the transmission of disease in the past via the movement of pathogens, which he calls 'fellow travellers', which accompany humans on their voyages across the world. He argues that humans are expressions of our environments as opposed to individuals confronting an external world of climate and disease (ibid.). We are a part of

our environment, not divorced from it. Humans interact with and rely on our ecosystems as well as making our own impact within them.

This compelling and perhaps even Romantic idea of humans as embedded in nature speaks to the proposed geological age of the Anthropocene: the debated (and controversial) moment in time when human activity became a dominant influence on our environment (Butler, 2021). It places the human at the very centre of environmental change, just as history as a discipline places the human at the centre of social, economic

and political change. The term serves to hold us accountable for environmental damage (at least that which succeeds deep time), but we miss an important point: that we are our environment. We are not mere agents impacting a world external to us, we have a symbiotic relationship with it – we are, in fact, on the inside of our world. But this is where the problem can lie for the historian in his academic cloister, untouched by the natural world. Even when we acknowledge environmental change we focus on how it affects our human, often artificial world.

I first came across the term Anthropocene when I was tasked with writing an essay on how we perceive historical time. In that essay, time became intensely political. The Renaissance and the so-called Dark Ages came under scrutiny as man-made constructions of time that only considered the activity and experiences of elite white European men (Bullen, 2007; Nelson, 2007). Supposedly, the Anthropocene denoted human activity as a whole, in an almost man-vs-nature type of conflict. However, cracks begin to form when we look a little closer at the concept of the Anthropocene, and we discover that it shrouds the same weaknesses of periodised terms like the Renaissance in the appeal of a singular big idea.

The Anthropocene accuses humanity of damaging the planet, but it fails to acknowledge that not all humans have contributed to such damage in equal measure, if at all. By framing ecological change around a generalised 'humanity', the term zooms out and ironically decentres the marginalised groups most affected by it. Alfred Crosby's so-called 'Columbian Exchange' is a good place to start when rethinking the Anthropocene. As European states claimed hegemony over the 'New World', the land, plants, animals and native human populations experienced a radical environmental shift – including those in Europe (Crosby, 1972). Flora and fauna, and disease travelled between the two continents, globalising the natural environment and altering landscapes for good. But this was not the doing of all humans, and rather the result of aggressive imperial motives by the European state. The most devastating example of this was the transmission of smallpox to indigenous populations. Historians such as William McNeill have even argued that this viral disease facilitated European domination of the 'New World'. Here, one of the many shortcomings of the Anthropocene become clear: it fails to account for the imperial roots of environmental change.

Yet these criticisms of the Anthropocene as a periodised category still remain bound by assumptions of human omnipotence. By constructing a 'Columbian Exchange' around human agency, we divorce humanity from its natural habitat, seeing us only as agents of change rather than victims of change. Prioritising imperial motives can inadvertently flatter imperial logic, understanding empire as a man-made machine capable of controlling and harnessing the power of nature to a colonial end. Such understandings of human activity externalise us our environments. We sometimes forget how insignificant we are on a grander scale of time. It is estimated that *Homo sapiens* have roamed the Earth for 300,000 years of the 4.5 billion years that our planet has existed. That is not to say that anthropogenic climate is not a serious and valid concern – if anything, it highlights its severity. Our minute occupation of the Earth should inspire a humility that makes us realise that we truly are embedded within our environment; we do not and can never transcend it.

The Anthropocene is thus a dilemma as a history-lover, a human-lover and a nature-lover. It has all the makings of a great political term that holds us accountable and integrates us into our surroundings. But it somehow falls short. I undoubtedly advocate a convergence between socio-historical studies and the natural sciences, but I am not confident that the Anthropocene is the way forward. It fails to account for geological accuracy while also failing to capture the breadth and nuance of human experience across time and space. I have often internally critiqued my scientist friends for understanding humans as a mere collective, yet now I criticise my historian friends for being too anthropocentric. There is a tension between the two disciplines that the Anthropocene struggles to resolve, but it certainly opens up the floor for a fruitful discussion about the world, its history and our place within it. Perhaps approaches such as the One Health model can help us: they propose a mode of thinking as opposed to trying to tenuously establish something more tangible. And anyhow, it served as a touchstone between myself (a historian of science and medicine) and an undergraduate pathology student – maybe there is scope for One Health and other concepts to one day amalgamate the geologist and the economic historian.

References

- LeCain, T. (2017) *The Matter of History: How Things Create the Past*, Cambridge University Press, Cambridge, pp. 1-22.
- Butler, D. R. (2021) 'The Anthropocene: A Special Issue', *Annals of the American Association of Geographers* 111, pp. 633–637.
- Bullen, J. B. (2007) *The Myth of the Renaissance in Nineteenth-Century Writing*, Oxford University Press, Oxford.
- Nelson, J. L. (2007) 'The Dark Ages', *History Workshop Journal*, 63, pp. 191–201.
- Crosby, A. (1972) *The Columbian Exchange: Biological and Cultural Consequences of 1492*, Greenwood Press, Connecticut.



Pollyanna Chamberlain is a recent STEM convert, having transitioned into the History and Philosophy Science Department for her MSci from the History Faculty. Her main research interests include the history of disability, the history of sex and sexuality, and gender history. In addition, she has always found the intersection between history, the arts, religion, and the sciences deeply fascinating, as shown in this article.

Hearing the Patient's Story: How Multimodal AI Could Support Narrative Medicine in Cancer Care

Rehan Zuberi discusses the role of multimodal AI in medical diagnosis and what it means for the future of patient care.

A scan can show where a tumour is. A genome can show which mutations are there. A blood test can show that something in the body has shifted. A diagnosis can give the illness a name. None of these, on their own, tells you much about the person sitting in the clinic.

Medicine has always needed stories. When a doctor asks when the pain started, what changed, what came before, what finally made someone book the appointment, they are building a timeline. They are trying to work out how scattered details fit together. Dr Rita Charon, one of the central figures in narrative medicine, argued in a 2001 paper that good medicine requires "narrative competence": the ability to recognise, interpret, and respond to the stories patients bring with them.

That sounds quite far from current artificial intelligence. Most stories about AI in medicine are about scale: more data, more images, more variables, bigger models, better predictions. And that story is mostly true, as modern AI can find patterns in data that would be hard, or impossible, to see by eye. It can compare thousands of images, read through long medical records, and pick up statistical signals across many patients at once. But what does this do to the individual patient?

A bad version of medical AI collapses the patient into a single output: one label, one risk score, one confident answer. It takes age, sex, smoking status, blood markers, tumour grade, and returns a verdict, as if the case were closed. The person disappears behind the number. A better version could do something quite different: rather than flattening the case into one figure, it could hold several kinds of evidence side by side, show where they agree and where they don't, and leave room for the doctor to interpret. In other words, the better system adds texture and acknowledges uncertainty, instead of hiding it.

This is where multimodal AI comes in: a step closer to assembling a patient's story, though not the whole answer to it. A multimodal model learns from several kinds of information at the same time. In medicine, that can mean images, clinical notes, blood results, genomic data, treatment history, wearable data, or records collected across years. A 2022 review in *Nature Medicine* by Acosta and colleagues describes multimodal biomedical AI as a way of using the growing range of health data now available: from imaging and electronic health records to genomics and remote monitoring. The point is simple: a patient is not well represented by a single test, and, as the later parts of this piece

argue, even multiple tests are not enough unless the system is built carefully.

Cancer makes this especially obvious. Cancer shows up in tissue. It shows up in DNA. It shows up in symptoms. It shows up in how someone responds to treatment. It shows up in recurrence. It shows up over time. A pathology slide might show how abnormal the tissue looks. A genomic test might show copy number changes, mutations, or other signs of instability. A clinical note might record weight loss, trouble swallowing, fatigue, pain, anxiety. Follow-up data might tell you whether the disease stayed quiet or came back.

Each of these gives you a partial view. A multimodal cancer model tries to connect them. Chen and colleagues showed one version of this in a 2022 *Cancer Cell* paper combining pathology whole-slide images with molecular profile data across 14 cancer types to predict patient survival. That is, estimating how long patients were likely to live, and stratifying them into higher- and lower-risk groups, while also picking out the tissue and molecular features that drove those predictions. The basic finding is that different kinds of biological evidence become more useful when they are read together rather than separately.

This is, in a way, close to how medicine already works. A doctor rarely makes sense of a case from one measurement, whether they are diagnosing the disease or estimating its likely course. For diagnosis, they connect clues: whether the scan fits the symptoms, whether the biopsy fits the blood results. For prognosis, they weigh tumour size, grade, and spread to judge how aggressive the disease is likely to be and what the realistic outlook is. In both tasks they ask whether today's finding makes sense given what happened six months ago. The Chen model mirrors the prognostic side of this work, combining tissue and molecular evidence to estimate outlook, although, unlike the doctor, it does so without the conversation in the room.

Time matters a lot here. The same scan can mean very different things depending on when it appeared. A small shadow that hasn't changed in ten years can be reassuring. The same shadow appearing over the course of a month is not. A biopsy that looks low-risk today might matter more if older samples show a slow but steady pattern of change. This is one place AI could help. It can reconstruct the patient's trajectory. It can compare old and new records. It can bring pathology, genomics, blood tests, notes, and follow-up together in one place. It can flag details that

are easy to miss when information is scattered across different systems, which, in most hospitals, it usually is.

None of this removes the need for the doctor. It gives the doctor a better memory. It gives the consultation more context. And it gives the doctor more time to focus on the person in front of them, rather than spending that time digging through fragmented records.

This connects to the more recent idea of generalist medical AI. In a 2023 Nature paper, Moor and colleagues argued that future medical AI systems might handle many tasks and data types at once, using little or no task-specific labelled data. Read carefully, that points toward systems that could help across the messy parts of care: summarising, comparing, connecting, flagging, explaining.

That matters because illness is messy. Patients live through appointments, scans, waiting rooms, uncertainty, side effects, fears of relapse, shifting symptoms, and decisions that have to be made without full information. AI should be judged on whether it helps with that reality, not just on whether it scores well on a single accuracy benchmark. This can, in fact, be measured, but just not with one number. Beyond overall accuracy, models can be evaluated on calibration (whether a stated 70% risk really corresponds to 70% of such patients), on subgroup performance (whether accuracy holds across age, sex, and ethnicity rather than only on average), and on robustness to missing or delayed data.

Some efforts now go further toward clinical reality: prospective and "silent" trials test whether a model's outputs actually change decisions and outcomes, and frameworks like the CONSORT-AI and DECIDE-AI reporting standards push evaluation toward real workflows rather than retrospective leaderboards. The point is that "does it help" is quantifiable, but only if we choose metrics that reflect patient care.

Medical AI can make weak data look clean. It can make biased records look objective. It can make a wrong story look mathematical. And that is a serious risk when dealing with health.

Obermeyer and colleagues showed this in a 2019 Science paper on a widely used healthcare algorithm. The algorithm used healthcare cost as a proxy for medical need. Because less money was being spent on Black patients with the same level of illness, the system systematically underestimated how sick they were. If a patient was dismissed, recorded poorly, diagnosed late, or treated less aggressively, the data carries that history forward. The model then repeats this error in future predictions, often with more confidence than the original record deserved. The lesson goes beyond that one algorithm. It shows how AI inherits the healthcare system's failures.

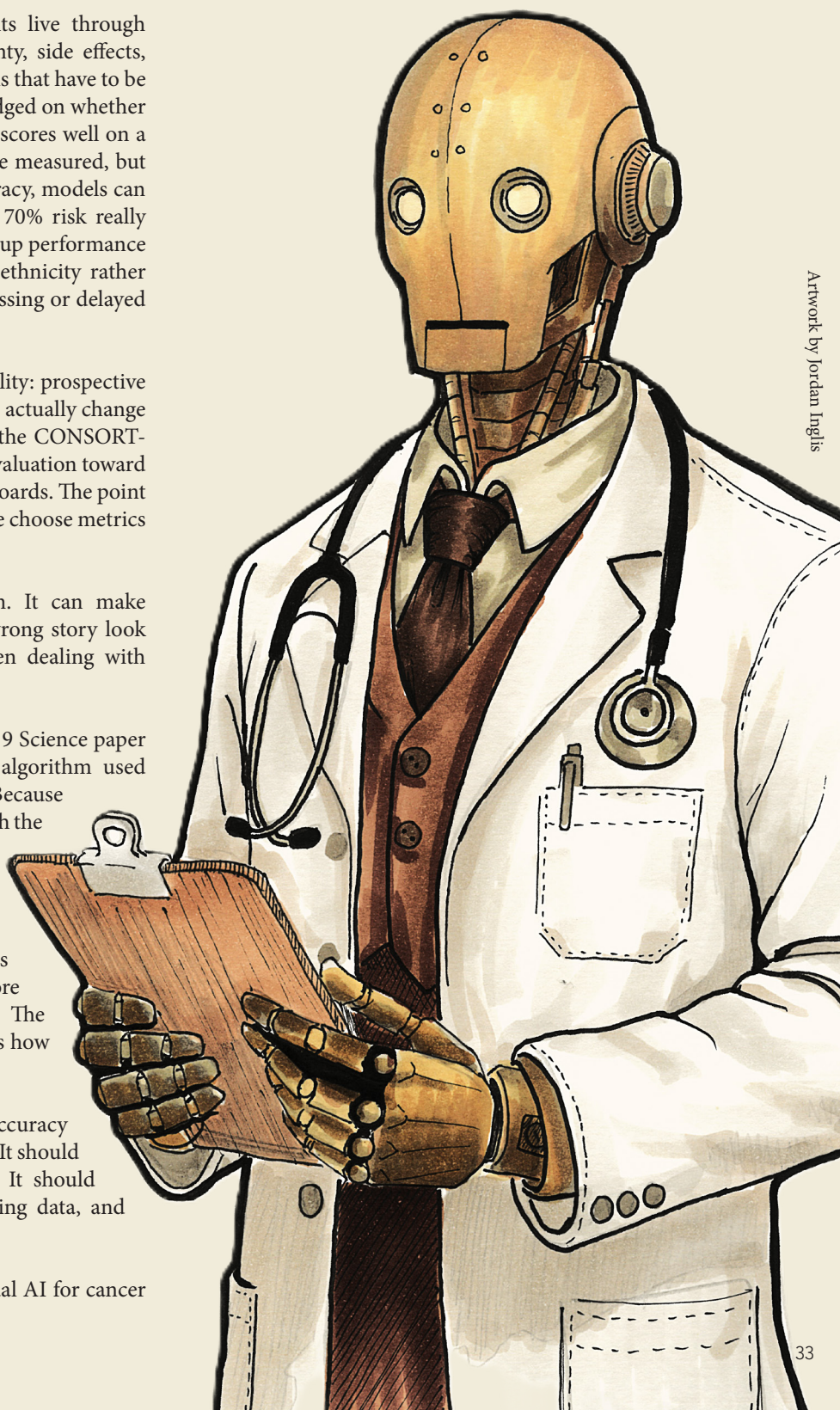
Medical AI should not just be chasing higher accuracy on average. It should be tested on who it misses. It should be checked for whose stories it cannot hear. It should be built with attention to time, context, missing data, and unequal access to care.

My own view, shaped by working on multimodal AI for cancer

detection, is cautiously optimistic. The best systems will prepare the clinical conversation rather than replace it. They will help doctors see what changed, what was missed, what fits, what doesn't. They will help medicine treat the patient as a person with a trajectory, rather than as a datapoint with a label.

We can therefore, when looking at the trajectory of technological advancements, ask whether AI in medicine will help doctors hear the story of their patient more clearly than before, rather than drown them in data.

Rehan Zuberi is a Medical Sciences PhD student at Hughes Hall and the Cancer Research UK Cambridge Institute, developing multimodal AI for early cancer detection, with interests in computational biology and digital pathology.



Artwork by Jordan Inglis

FORMATION AND TRANSFORMATION OF HOMININ EXTINCTION NARRATIVES

Sara Hamaguchi challenges the idea that human evolution is simply survival of the “fittest,” revealing a far more complex story of extinction and survival.

Neanderthal extinction - what does this phrase bring to our mind? Since the first discovery of its specimen in Neander Valley (Germany) in 1856, the Victorian perception of Neanderthals being brutes and unintelligent became dominant (Sweet, 2025). The time period overlaps with so-called ‘scientific racism’, when European scientists attempted to explain human diversity within a linear hierarchy, justifying colonial expansion, and tried to ‘improve’ races by selective breeding (or ‘eugenics’) - here, Neanderthal specimens were seen almost as an inferior race (Madison, 2021; National Human Genome Research Institute, 2022). The 19th and 20th centuries scholars, such as palaeontologist Marcellin Boule, analysed and described the fossils in a merciless way that is not based on scientific data, believing that Neanderthal extinction as an inevitable result of evolution, or due to their inferiority in adaptation compared to modern humans (Ibid).

This perception perhaps still has a lasting influence on how they are shown in popular scientific and fictional literature or movies. One major extinction narrative in such media is the ‘encounter-and-replacement’ model, which suggests Neanderthals were inferior indigenes in Eurasia being replaced by modern humans (Sweet, 2025). When it comes to other hominin species than Neanderthals or modern humans, there is almost no creative work depicting extinction (only one to the knowledge of the author), perhaps because they are not considered ‘human’ enough (Hackett and Dennell, 2003), but presumably, the brutish image of Neanderthals influenced public narratives of other extinct species. However, even so, our understanding of early hominin species - both in both a public and academic and lay sense - has been updated. The extinction narrative maintained by the media, which is perhaps internalised by many individuals today, is more or less different from the Victorian one, and new discoveries keep renewing it. This article aims to cover some aspects of such transformed narratives in hominin species, including Neanderthals, *H. erectus*, *H. heidelbergensis*, and *H. floresiensis* (see Figure 1).

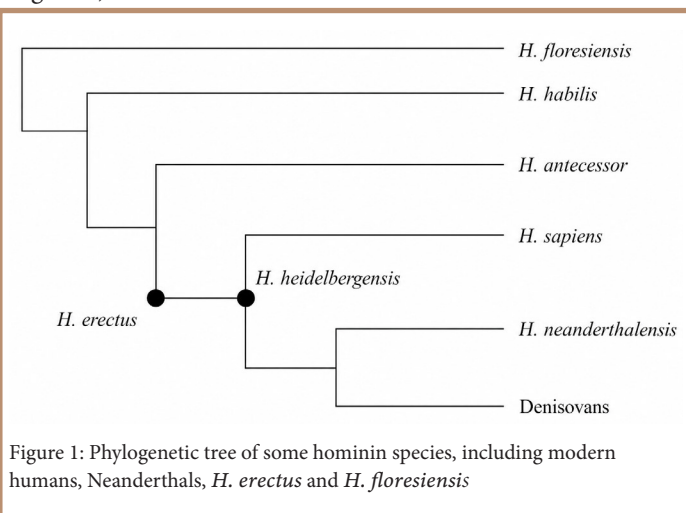


Figure 1: Phylogenetic tree of some hominin species, including modern humans, Neanderthals, *H. erectus* and *H. floresiensis*

Neanderthals: complex behaviours and extinction narratives

As opposed to what was once suggested by scholars in the last centuries, more recent findings suggest Neanderthals and modern humans share commonalities in cognition and behaviour. Firstly, it is largely accepted today that Neanderthals had bigger, or at least similar, sized brains compared to modern humans (e.g. Ponce de León et al., 2016). A larger brain is usually associated with higher cognitive capacity and more complex behaviours, and many studies support the increasing trend in encephalisation in the genus *Homo*. Comparing Neanderthals and *H. sapiens*, some argued that different brain morphology rather than the total size was responsible for inferior cognition in Neanderthals, such as linguistic and symbolic abilities (e.g. Kochiyama et al., 2018). However, Schoenemann et al. (2026) showed that the degree of brain morphological variability between Neanderthals and *H. sapiens* inferred from endocrania is as small as the variation between modern US and Chinese populations. This means, if we consider modern human populations are not cognitively different from each other, then we cannot assume that *H. sapiens* and Neanderthals were cognitively different in an ‘evolutionarily meaningful way’. Although this is not a consensus, it is apparent that the past narrative of Neanderthals simply being unintelligent has been challenged by developments.

Then, what are other explanations for Neanderthal extinction? Multiple possible causes have been suggested, such as climate change, interbreeding, competition, demography, and so on (Vaesen et al. 2021). For instance, the climate change model is supported by Staubwasser et al. (2018), who found the association between regional population decline and the two periods of severe coldness accompanied by aridity, decline in woodland and increase in steppe biomes in c. 44,000-40,000 years ago East-Central Europe. They suggest that Neanderthals may have had a less flexible diet than modern humans that could have exploited resources more effectively and managed to adapt and expand into steppic Europe, and the variable climate in this period increased vulnerability of Neanderthals, leading to repeated depopulation (Ibid). No single explanation has been agreed upon, and their extinction was likely multifactorial - rather than a single narrative.

Extinction narrative: Homo erectus

H. erectus was spread across Africa and Western/East Asia, lived between c. 1.89 million and 110,000 years ago, and is the earliest known species with body proportions comparable to modern humans. One possible explanation is that increasing aridification, and their failure to adapt to the environment, may have led to extinction (Australian National University, 2018). *H. erectus* used Acheulean technology (bifacial stone tools; see Figure 2), and Shipton et al. (2018) found populations in the Arabian Peninsula in Lower Palaeolithic had the least-effort strategies for resource acquisition and tool transportation, and they lacked transitional

features in technology. However, even if the Arabian region may have been abandoned by the Middle Palaeolithic (300,000-50,000 years ago), human bones from the Ngandong site in central Java imply the species persisted by 300,000-100,000 years ago (Widianto and Sofwan Noerwidi, 2023). Hence, the extinction narrative cannot be singular or causal, particularly when a species spreads across different regions.

Technology and cognition: another approach to evolution and extinction

So far, the focus of discussion has been on the multiplicity of explanations why hominin species went extinct. However, how about the species that lived in the same period or environment and still survived? What does the survival of our own species tell about the extinction narrative of other hominin species? We have already come out of a simple assumption that our species has been better than others like Neanderthals in terms of cognition or competition and thus replaced them - but still, the fact is that *H. sapiens* is the only survival species today. How can we understand this phenomenon in a more nuanced way?

Scholars such as Migliano and Vinicius (2022) propose that cumulative culture, or the transmission and accumulation of cultural traits across generations through social transmission (Derex, 2026), is responsible for the survival of *H. sapiens*. Cultural adaptations (e.g. through tool use) can occur faster than genetic changes, and cumulative culture allows individuals to develop from existing cultural practices, rather than invent from zero through a trial-and-error process - hence, cumulative culture can be an effective mean of adaptation to various environments (Demps and Richerson, 2023). Various evidence suggests that cumulative culture was unique to Neanderthals and *H. sapiens* and was not present in earlier hominin species like *H. erectus* - for example, Paige and Perreault (2024) suggests that cumulative culture only started 600,000 years before, based on their analysis of stone tool technology complexity.

Despite the importance of cultural adaptation, culture did not evolve on its own - biological evolution, such as brain size, cognition, and hand anatomy, evolved together. Gene-culture coevolutionary theory (GCC) proposes genes and cultures coevolved in a feedback loop, where cultural practices create and modify human's own niche and influence what genes to be selected, while genes affect what cultural practices individuals absorb (Brown and Lala, 2024; Gintis, 2011). Based on this approach, particularly larger brains and high cognitive abilities in Neanderthals and *H. sapiens* can be explained by their niche, created by their foraging practices, that favoured genes for effective transmission of cumulative culture (Migliano and Vinicius, 2022). For example, Morgan et al. (2015) examined the efficacy of five knowledge transmission mechanisms for Oldowan technology transmission, and verbal teaching was shown to be the most effective compared to non-language strategies like imitation. Although Oldowan was primarily used by *H. habilis* around 2.6-1.7 million years ago (Pain, 2022), the result suggests stone tool technology may have been a selective pressure for language evolution - and in fact, the so-called language gene, FOXP2, is present in Neanderthals (Krause et al. 2007).

Given that Neanderthals probably had high cognitive abilities and similar brain size/anatomy as discussed earlier, why did they become extinct while modern humans did not? One possible reason is the level of collective intelligence was lower in Neanderthals due to the reduced population connectivity and hence social transmission, which is suggested by a high frequency of inbreeding in Neanderthal genomes (Migliano and



Figure 2: Acheulean stone tools from the Saffaqah dyke

Vinicius, 2022). Population size or distribution can be influenced by various factors, including environment and predation. This case study shows that extinction narrative can be reconstructed through comparison with a successful counterpart, and relatively comprehensive theories like GCC can provide a more nuanced explanation.

All the examples discussed here shows there is no single explanation for the extinction of a species, and extinction is likely to be multifactorial. Past attempts to construct a single narrative for extinct hominin species resulted in brutal and erroneous perceptions, which have been challenged by a growing body of evidence. Narratives are a powerful means of explaining and telling a story of species' history and extinction. To fulfill its potential, efforts need to be made for empirical and theoretical recognition of diverse factors responsible for extinction, and for synthesising them to reflect the complexity of the event to a narrative - rather than simplification and unification.

References: Australian National University. (2018). ScienceDaily; Brown GR, Lala KN. (2024). Sense and Nonsense, pp. 169–198; Demps K, Richerson P. (2023). Human Success; Derex M. (2026). Open Encyclopedia of Cognitive Science; Gagan MK, et al. (2025). Commun Earth Environ 6(1); Gintis H. (2011). Philos Trans R Soc B 366:878–888; Gunz P, et al. (2012). J Hum Evol 62:300–313; Kochiyama T, et al. (2018). Sci Rep 8(1); Krause J, et al. (2007). Curr Biol 17:1908–1912; Madison P. (2021). Evol Anthropol 30(6); Migliano AB, Vinicius L. (2022). Philos Trans R Soc B 377(1843); National Human Genome Research Institute. (2022). Eugenics and Scientific Racism; Paige J, Perreault C. (2024). Proc Natl Acad Sci USA 121:e2319175121; Pain R. (2022). Mind Lang; Ponce de León MS, et al. (2016). Curr Biol 26:R665–R666; Ponce de León MS, et al. (2008). Proc Natl Acad Sci USA 105:13764–13768; Püschel HP, et al. (2021). Nat Ecol Evol; Schoenemann PT, et al. (2026). Proc Natl Acad Sci USA 123:e2426638123; Shipton C, et al. (2018). PLOS ONE 13:e0200497; Smithsonian Institution. (2010). Human Origins Program; Smithsonian National Museum of Natural History. (2010). Human Origins Program; Staubwasser M, et al. (2018). Proc Natl Acad Sci USA 115:9116–9121; Sweet T. (2025). Configurations 33:231–253; Vaesen K, Dusseldorp GL, Brandt MJ. (2021). Sci Rep 11(1); Widianto H, Sofwan Noerwidi. (2023). L'Anthropologie 127:103167.

Sara Hamaguchi is a 1st year undergraduate in Archaeology, who is passionate about biological anthropology, particularly evolutionary medicine, human evolution in Palaeolithic, and primatology.

WHEN THE BEES RETURN:

Irish Mythology and the neuroscience of why we are losing the bees

In this Focus piece, Ellen Sheridan investigates how Irish myth once made bees kin, why stories are what make attention stick, and what was lost when that memory faded.



Artwork by Grace Heslin



In earlier Ireland, when someone in the family died, you went to the beehive. You knocked softly on the wood and you told them. You told the bees. Not because they would grieve, but because they were part of the household. It wasn't a courtesy - they had to be informed; or they would leave (Dúchas, n.d.). An "old superstition", one may say. But it is more than that - it is a record of a people for whom the living world was not a backdrop. It was kin.

Now, we are living in an age some scientists and writers describe as the "Anthropocene"; a time when human activity has become a dominant force reshaping Earth's living systems, for better or for worse (Crutzen, 2002; Steffen et al., 2007). Across the island of Ireland, almost one third of bee species now face extinction (All Ireland Pollinator Plan, 2021), with bumblebee populations showing a 3.5% year-on-year decline since 2012 (FitzPatrick and Judge, 2025). A bill to protect the native Irish dark honeybee, *Apis mellifera mellifera*, from displacement by imported strains has also progressed through the Oireachtas (Native Irish Honey Bee Society, 2026). This matters in ways that reach directly into human life. Bees are keystone pollinators in many ecosystems, their influence disproportionately large relative to their abundance. Almost 90% of flowering plant species depend on animal pollination, with bees among the most important pollinators (Ollerton et al., 2011). Many of the hedgerow wildflowers that structure the Irish landscape depend on insect pollination, and the food chains they sustain reach upwards through insects, birds, and mammals. Remove the bees and, in a very literal sense, the world begins to fall apart around us. Pollinators affect around a third of global crop production, especially fruits, nuts, seeds, and many vegetables; their decline would not remove all food, but it would make diets poorer, ecosystems thinner, and agriculture more fragile (Klein et al., 2007). Conservation science now offers habitat restoration, wildflower corridors and pesticide reform, all necessary actions. But something less measurable may also be crucial for pollinators' thriving: whether people notice bees at all.

The Law and the Hive

Before any modern conservation framework existed, and preceding the so-called Anthropocene epoch, Irish society was already attuned to the relative importance of bees to their survival and enshrined that relationship across legal, folk and oral traditions. The Bechbretha, an early medieval Brehon law tract dating to roughly the seventh century, was devoted entirely to bees (Charles-Edwards and Kelly, 1983). It is among the few legal documents of the ancient Irish world to take insects seriously as subjects deserving of legal protections. A person who discovered a wild swarm could claim it, but owed a portion of the honey to their lord or church. Bees and their produce were understood as communal resources. Different species carried different legal values. The foraging range of a hive was understood to create obligations to neighbours whose flowers the bees visited; those neighbours were owed a share of the harvest. These were not incidental provisions. They reflect a culture paying sustained, structured attention to insect life and assigning it moral weight, albeit in relation to their own utility of those insects.

Two saints extend this picture considerably. St. Modomnoc of Ossory, who had travelled to Wales to study under St. David, tended the monastery's bees with such dedication that when he tried to sail home to Ireland, the swarm followed his boat

three times across the water. St. David, recognising when he was beaten and eventually blessed the bees and sent them back to Ireland with Modomnoc.

Modomnoc is thus credited, in legend, with bringing the practice of beekeeping to Ireland, though bees themselves had long been wild neighbours in the Irish landscape. What the legend gives him is not the bee, but the relationship of tending it (Rhygyfarch, c. 1090). His counterpart is St. Gobnait of Ballyvourney, the 6th-century patron saint of beekeepers, who released her swarm against those attempting to seize a widow's land, driving off the intruders (Dúchas, n.d.). The bees here are not a weapon of last resort; they are moral agents, extensions of saintly justice. At her shrine in Cork, a traditional straw skep still sits beside her statue, the coiled straw hive of an older Ireland, now largely replaced by wooden frames.

This tradition was carried and sustained by the seanchaí, the Irish keeper of community oral knowledge, a respected figure at the centre of céilí gatherings and fireside storytelling, preserving genealogy, local history, and folk narrative across generations. Rural folklore transmitted through this tradition depicts bees as chaste, wise creatures who could detect dishonesty, who "abhorred liars" (Dúchas, n.d.). Whether or not one takes these stories literally - I would personally advise against testing the "liars theory" with an active hive - they clearly performed a major cultural function: they made bees matter.

What Stories do to the Brain

We have only recently begun to describe, in neuroscience terms, what those stories were doing all along. The underlying machinery is well established. Stories pull on emotion, and emotional arousal can recruit amygdala-linked memory systems, modulating hippocampal-dependent encoding and consolidation (McGaugh, 2004; Paré and Headley, 2023). In other words, stories that move us are more likely to be stored robustly than information untethered from emotional attachment. Similarly, narratives appear to give memory a structure. Rather than storing events as isolated fragments, the hippocampus helps bind separate moments into a coherent story, making them easier to retrieve later (Cohn-Sheehy et al., 2021). A child who hears about Gobnait's bees defending a widow's land is not learning a fact about pollinators. They are having an experience in which bees are bound to emotion, to moral stakes, to a named place and a recognisable injustice. The amygdala and hippocampus work in concert - the amygdala flagging the experience as emotionally significant, which in turn strengthens hippocampal encoding into long-term episodic memory, the kind tied to specific places, people and emotions, and the kind we are most likely to carry with us. Across listeners, emotionally engaging narrative moments produce synchronised neural responses, a mechanism for shared encoding that extends beyond the individual (Song et al., 2021). When a story grips us, it grips us together, and it grips us for longer. That experience will persist in ways an extinction statistic simply will not.

There is also an evolutionary dimension worth noting, though it remains a hypothesis rather than settled science. Storytelling may be a cognitive adaptation rather than the cultural luxury it's sometimes perceived as. Traditions transmit survival-relevant knowledge across generations in a form the brain is especially good at encoding and sharing (Boyd, 2009). In this vein, the seanchaí was not just entertainment nor were the stories just

myths or curiosities - they silently taught people to pay attention to the world around them, and to what that world, and they themselves, depended on to survive.

What Was Forgotten

The erosion of storytelling and the deep-rooted respect of bees began long before the Irish Famine. For centuries under British colonial rule, Irish land ownership, education, religion, language and cultural life were placed under sustained pressure through law, dispossession, and social control (Foster, 1988). A people who had encoded their knowledge of the land in language and story found both under deliberate assault. Then, between 1845 and 1852, over a million people died of starvation while British colonial policy continued to export food from a starving country, and millions more were forced to emigrate (Kinealy, 2006; Ó Gráda, 1999). The cultural infrastructure that had transmitted ecological knowledge for centuries did not survive.

The relationship between Irish Catholicism and folk practice adds its own complexity. It was the Catholic Church that preserved Gobnait and Modomnoc, saints whose legends absorbed pre-Christian bee mythology within a Christian framework. Early Irish Christianity was famously syncretic, bending to accommodate Celtic tradition rather than erasing it. But the institutional Church of the 19th and 20th centuries moved in a different direction. The devotional revolution of the mid-1800s standardised Catholic practice along Roman lines and grew increasingly hostile toward folk custom, to seasonal ritual, to practices like telling the bees that carried too strong a scent of the pagan past. The stories were not only lost, in some cases they were actively discouraged.

Post-independence Ireland added its own chapter. When Ireland joined the European Economic Community in 1973, the Common Agricultural Policy brought subsidies that incentivised agricultural intensification: larger fields, hedgerow removal, conversion of permanent wildflower pasture to silage, sharply increasing pesticide and fertiliser use. These were not policies imposed on an unwilling country; they were largely embraced, and their consequences for pollinator habitat were severe. It is in this period that the sharpest declines in bee populations occurred. Even the native Irish honeybee, *Apis mellifera mellifera*, adapted over millennia to Ireland's wet climate and short foraging seasons, has since faced severe pressure from imported strains and disease. Its active conservation today is a small symbol of something larger.

The Return

My father has, for the past few years, been leaving large patches of his lawn unmown through May. He is not alone in this endeavour. The All-Ireland Pollinator Plan's No Mow May campaign has been encouraging people across Ireland to do the same, stepping back and watching what arrives (All-Ireland Pollinator Plan, 2023). It was when he told me why that I began to look more carefully at what Irish folk tradition had always quietly known. A white butterfly crossing your path carries the soul of someone recently gone (Lady Wilde, 1888). Bees must be told when someone dies or they will leave. These are not separate superstitions. They are the same instinct: that the natural world is present and that we owe it our attention. The bees, as it turned out, had a great deal to say.

When someone notices, perhaps for the first time, a buff-tailed bumblebee working a dandelion, something shifts in their relationship to the living world. Whether or not they know the Modomnoc legend or have ever heard the word seanchaí, they are performing the same fundamental act the old stories once trained: paying attention to bees. If storytelling is a cognitive technology, and if Irish narratives spent centuries encoding bees as morally and socially significant, as neighbours, as agents, as creatures that noticed you back, then perhaps what is returning now is something that was never entirely gone. Not instinct exactly. Something more like cultural memory, quietly persisting, waiting to be recalled.

If that is true, it has practical implications. The same mechanism that made Gobnait's legend stick, an emotional narrative binding a creature to memory, is available to anyone who wants to ensure bees matter to the people who have stopped noticing them. You do not need a saint, you need a story that lands.

Telling the Bees

There is something worth recovering in what those traditions carried. The Bechbretha authors must have watched bees carefully enough to codify their foraging distances and assign them legal value. Gobnait's legend asks us to see bees as agents with something at stake. Modomnoc could not bring himself to leave without them. And telling the bees assumed they were household members who deserved to be informed. The old custom did not only ask people to notice bees. It asked them to speak to them, to include them in the news of the household, to treat the living world as something that could be addressed.

These are practices of attention in its deepest form: not observation from outside, but participation from within. Neuroscience tells us that stories which move us are remembered longest - emotional arousal strengthens how deeply an experience is encoded into memory (McGaugh, 2004). This is precisely what mythology, law, and oral tradition did: they made bees emotionally significant, morally weighted, impossible to ignore. What we attend to, we remember (Chun and Turk-Browne, 2007) - and those who feel emotionally connected to the natural world are significantly more motivated to protect it (Soga and Gaston, 2016). The stories were the mechanism for that remembering, encoding bees into moral stakes, into named places and recognisable injustice, in precisely the form the brain retains best (Cohn-Sheehy et al., 2021). They did not ask people to care about bees. They made caring part of the culture. What these stories understood, and what years of suppression tried to sever, is that people are not apart from their land. The Bechbretha framed bees as neighbours with standing - owed protection, and recognised as having obligations of their own. Gobnait and Modomnoc assumed a community that extended beyond the human, a household whose walls reached into the hedgerow, the field, the flowering hillside. To lose those stories was not only to lose a tradition. It was to lose a way of being in the world. Perhaps that is what the knock understood. You walked to the hive not to perform a ritual but because the bees were part of your life and you were part of theirs. Ireland and its land are not separate things. They never were.

For now, the bees are still here. But the data is unambiguous: a 3.5% annual decline, more than half of Ireland's most common bumblebee species heading downward, one third of all bee species facing extinction (FitzPatrick & Judge, 2025; All-Ireland



Pollinator Plan, 2021). The cultural infrastructure that once made them impossible to ignore has been largely dismantled.

Understanding the mechanism does not, on its own, reverse this. What it does is clarify the nature of one part of the loss. The stories were not incidental folklore. They were a technology for directing attention toward what mattered, encoding ecological relationships in a form the brain is especially good at retaining. When the stories faded, one way of noticing faded with them. The old stories were not waiting to be replaced by science. They were waiting to be understood by it.

References

- All-Ireland Pollinator Plan (2021) All-Ireland Pollinator Plan 2021–2025
- All-Ireland Pollinator Plan (2023) No Mow May
- Boyd, B. (2009) *On the Origin of Stories: Evolution, Cognition, and Fiction*. Cambridge, MA: Harvard University Press.
- Charles-Edwards, T. and Kelly, F. (1983) *Bechbretha: An Old Irish Law Tract on Bee Keeping*. Dublin: Dublin Institute for Advanced Studies.
- Crutzen, P.J. (2002) 'Geology of mankind', *Nature*.
- Chun, M.M. and Turk-Browne, N.B. (2007) 'Interactions between attention and memory', *Current Opinion in Neurobiology*, 17(2), pp. 177–184.
- Cohn-Sheehy, B.I., Delarazan, A.I., Reagh, Z.M., Crivelli-Decker, J.E., Kim, K., Barnett, A.J., Zacks, J.M. and Ranganath, C. (2021) 'The hippocampus constructs narrative memories across distant events', *Current Biology*.
- Dúchas: The Schools' Collection (n.d.) St Gobnait's Beehive
- FitzPatrick, Ú. and Judge, M. (2025) *All-Ireland Bumblebee Monitoring Scheme Annual Report 2012–2024*. Waterford: National Biodiversity Data Centre.
- Kinealy, C. (2006) *This great calamity: the Irish Famine, 1845–52* / Christine Kinealy. Gill Books.
- Klein, A.M. et al. (2007) 'Importance of pollinators in changing landscapes for world crops', *Proceedings of the Royal Society B*, 274(1608), pp. 303–313.
- Lady Wilde (1888) *Ancient Legends, Mystic Charms, and Superstitions of Ireland*. London: Ward and Downey.
- McGaugh, J.L. (2004) 'The amygdala modulates the consolidation of memories of emotionally arousing experiences', *Annual Review of Neuroscience*.
- Native Irish Honey Bee Society (2026) Submission and Additional Information to the Joint Committee on Agriculture and Food.
- Ó Gráda, C. (2001) *Black '47 and beyond: the great Irish famine in history, economy, and memory* / Cormac Ó Gráda. Princeton, N.J. ; Princeton University Press.
- Ollerton, J., Winfree, R. and Tarrant, S. (2011) 'How many flowering plants are pollinated by animals?', *Oikos*.
- Paré, D. and Headley, D.B. (2023) 'The amygdala mediates the facilitating influence of emotions on memory through multiple interacting mechanisms', *Neurobiology of Stress*.
- Rhygyfarch (c.1090) *Life of St David*, translated by Wade-Evans, A.W. (1923). London: SPCK.
- Soga, M. and Gaston, K.J. (2016) 'Extinction of experience: the loss of human–nature interactions', *Frontiers in Ecology and the Environment*.
- Song, H., Finn, E.S. and Rosenberg, M.D. (2021) 'Neural signatures of attentional engagement during narratives and its consequences for event memory', *Proceedings of the National Academy of Sciences*.
- Steffen, W., Crutzen, J., and McNeill, J. R. (2007). *The Anthropocene: are humans now overwhelming the great forces of Nature?*. *Ambio*.



Ellen Marie Sheridan is a PhD student in Clinical Neurosciences at Lucy Cavendish College.

CRYPTIC CROSSWORD

Created by Alexia Galsworthy

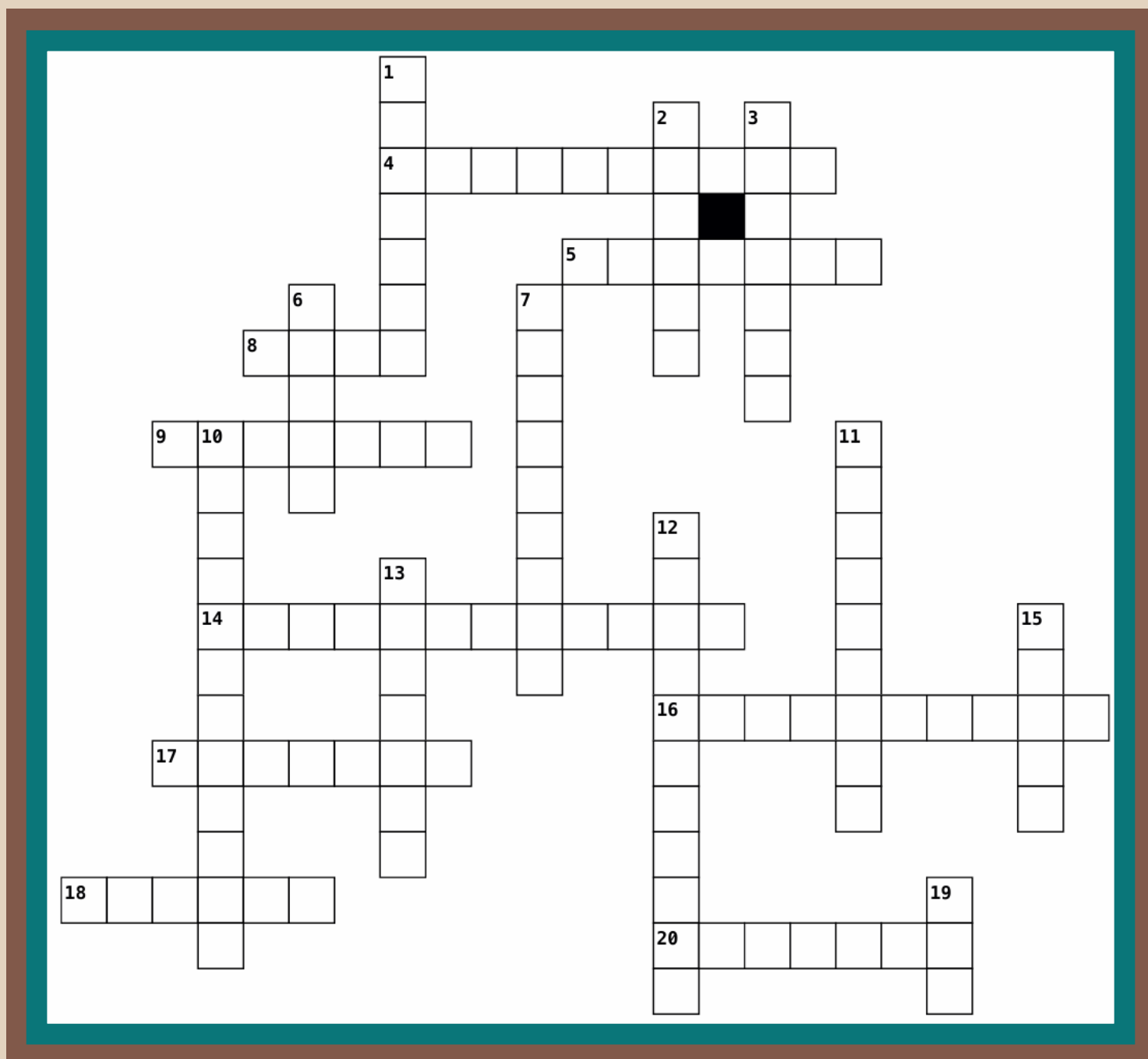
ACROSS

4. Content dozen drunkenly end all life on earth. (10)
5. Penicillin finder reporting chest infection symptom. (7)
8. Couples start lionhearted feast for Frankenstein's miracle! (4)
9. Aid sees lapse in medical condition. (7)
14. There's more beneath the surface as AI loses 99 but not nothing, sounds like they should keep the cameras rolling?! (12)
16. Dizzying haze miles are about more than just plaques? (10)
17. Operatic solo commences in poor French causing temperatures to soar. (7)
18. Blueprint discovered by mythically small man brings him extra energy. (6)
20. Target is against the broken generation. (7)

DOWN

1. I've been buzzing, knocking off the final pollination and picking up the first honey?!(7)
2. Tension for the small couple as their night begins with disturbed rest. (6)
3. Flee back home to clone in human lineage. (7)
6. I've stuffed initial R-Rated stream. (5)
7. The release of a first edition with rising art on the front is passed down through generations. (9)
10. Chronic stress begins with insides on fire! (12)
11. Asking why after a record ends is our goal in science. (9)
12. It's essential to finance Swiss cheese over the radio. (11)
13. We're all derived from the chaos of a capital carnival cut short by spirits. (7)
15. Intrinsic acyclovir usability captures pathogen. (5)
19. Life is lead by dreamers n' artists. (3)

Solve the cryptic crossword puzzle! Answers may be found throughout the articles...



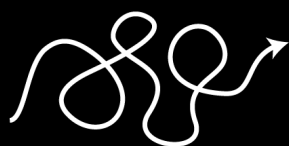
Find the answers on page 43!

Science is a story – join the communities that tell it

Every experiment has a backstory. Every figure, failure and breakthrough is shaped by people, choices and chance. If narratology is about how stories are told and why they matter, then science is rich with narratives waiting to be uncovered.

The Company of Biologists hosts three community sites – the Node, preLights and FocalPlane – that help share the stories behind scientific work and career paths. Together, they offer spaces where researchers don't just report results, but reflect on process, perspective and the human experience of doing science.

No such thing as a
standard career path



The Node: stories behind papers and career path

On the Node, scientists tell the stories that rarely make it into publications. 'Behind the paper' posts explore how projects really unfolded – from unexpected signals breaking through experimental noise to ideas that only worked after months (or years) of incubation. Alongside these are candid career stories, where researchers reflect on resilience, non-linear paths and the realities of academic life.

preLights: tracing ideas as they emerge

preLights captures science in motion. Through 'spotLights' and 'preprints by preLighters', early-career researchers highlight new preprints while placing them in a broader narrative: where an idea came from, why it matters now, and what questions it opens next. These pieces turn cutting-edge research into accessible stories, often enriched by direct interactions with preprint authors.



In conversation with



Kristine Willis
Founder
Woodley Park Institute
USA

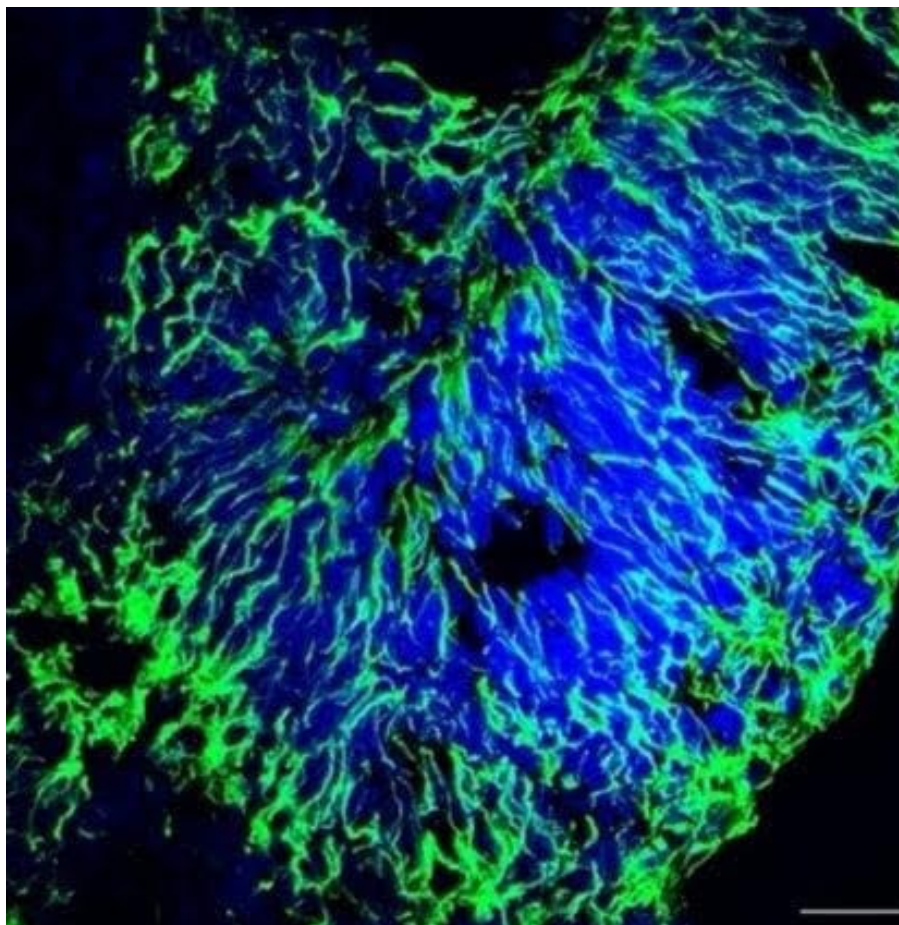
Analysing and predicting
breakthroughs in biomedical research

Hosted by

Jonathan Townson, Postdoctoral researcher, University of Oslo, Norway

FocalPlane: images with context and voice

At FocalPlane, the focus is on imaging though with plenty of room for storytelling. 'Featured images' invite contributors to unpack the scientific, technical and personal stories behind a single striking image. 'Imaging Spotlights' take readers deeper, combining visuals with narrative to explain how methods, biological questions and creative problem-solving intersect. The result is not just beautiful data, but visual stories that communicate how discoveries are made.



Why these stories matter

Across all three sites, contributors learn to communicate science as more than facts and figures. Writing for these communities helps researchers develop narrative skills – crafting compelling arcs, introducing characters (human and molecular alike), and situating discoveries within wider contexts. At the same time, readers gain a more textured understanding of how science actually happens.

If you're interested in how stories shape knowledge, or you want to tell the story behind your own work, careers or images, our community sites invite you to join the conversation.



CROSSWORDS ANSWERS

ACROSS: (4) Extinction, (5) Fleming, (8) Live, (9) Disease, (14) Anthropocene, (16) Alzheimers, (17) Malaria, (18) Genome, (20) Antigen

DOWN: (1) Beehive, (2) Stress, (3) Hominin, (6) River, (7) Tradition, (10) Inflammation, (11) Discovery, (12) Fundamental, (13) Origins, (15) Virus, (19) DNA



LOOKING FOR

Artists and Authors

JOIN THE BLUESCI CREATIVE TEAM

FEATURE ARTICLES FOR THE MAGAZINE CAN BE ON ANY SCIENTIFIC TOPIC AND SHOULD BE AIMED AT A WIDE AUDIENCE.

WE ALSO RUN SHORTER NEWS, REVIEWS AND, WEIRD AND WONDERFUL ARTICLES.

ARTWORK CAN BE OF ANY STYLE/MEDIUM, SO LONG AS YOU ARE ABLE TO SCAN IN THE FINAL PIECE!



Listen now on all major digital platforms!

anchor.fm/bluesci-podcast

