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UCL's Science Magazine

1st EDITION

She Shapes Science: Kathleen Lonsdale

From crystallography breakthroughs to challenging gender norms - a legacy of science, courage, and change.

Are we alone in Space?

From organic carbon on Martian rocks to surviving DNA fragments- how new experiments are reshaping the search for life on Mars.

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Editor's Letter

Welcome to the inaugural edition of our printed Science Magazine, from the laboratories, libraries, and minds of University College London. This publication embodies life at UCL and pertains to a simple premise: to chronicle the pursuit of understanding at its most consequential and most rigorous. This is a record of inquiry, a portrait of the process where observation gives way to insight.

In this issue, you will encounter the architecture of this pursuit. You will discover examination at every scale - from epigenetic traces written into our biology to the planetary-scale cognition of artificial systems; from the elegant engineering of a lifeline prosthetic to the fundamental question of life's cosmic solitude. These threads, diverse in discipline, are united by a shared rigour and a reach that defines the modern scientific endeavour.

We are honoured to frame this collection with the legacy of Dame Kathleen Lonsdale, a scholar whose own work in crystallography exemplified the precision and perseverance that remain our highest standards.

It is our hope that this magazine serves not only as a dispatch from the frontiers of research but as a testament to the intellectual ethos of UCL: precise, ambitious, and inherently forward-looking.

We invite you to read with a critical eye and an engaged mind.

Sincerely,

Ariella Morris
Editor-in-Chief
UCL Science Magazine
University College London

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“There is a single light of science, and to brighten it anywhere is to brighten it everywhere.”

-Isaac Asimov

ARTICLES

From bold questions about Artificial Intelligence to the hidden marks written in our genetics, science continually pushes the boundaries of how we understand ourselves, our planet, and the universe beyond. The Articles section brings together a diverse collection of writing by UCL students, spanning an eclectic range of themes. By placing technology beside biology, and planetary thought beside human experience, these pieces capture conversations that shape modern science, celebrating curiosity in both the lab and the wider world.

Digital Gaia: How AI is becoming the Earth's nervous system

Written by Ariella Morris

Humans have always wondered about why, how, and where we exist. This curiosity drives our ingenuity, yet the universe - and even our own planet - remains full of mysteries. Earth's intricate systems, evolved over millions of years to sustain life, cannot be fully explained or replicated by humankind. This self-regulating force of life is the essence of the Gaia Hypothesis.

What is the Gaia Hypothesis?

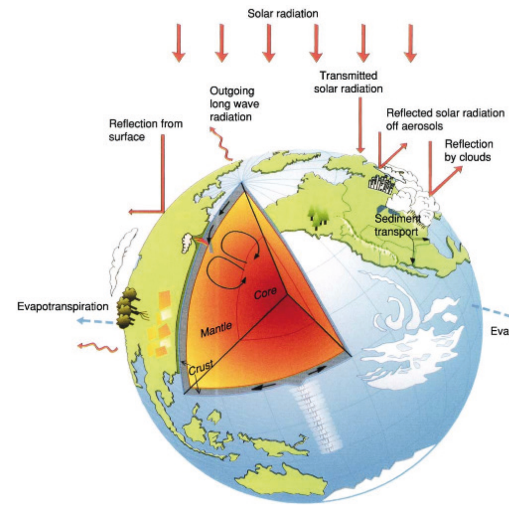
First introduced by Lovelock, "The Gaia Hypothesis" proposes that all living and nonliving components of the planet form a single, complex entity whose interactions sustain life (Selley, 2005). Many scholars believe the term should be interpreted metaphorically rather than verbatim; however, the system's approach can be seen as an extension of the operative Gaia Hypothesis, maintaining favourable conditions on Earth (Boston, 2008).

Now, with the rapid and largely uncontrollable advancement of digital technologies and artificial intelligence (AI), a parallel framework has emerged: a "Digital Gaia", acting as Earth's increasingly sophisticated nervous system. The digital augmentation reflects humanity's efforts to enhance its capabilities through technology such as artificial intelligence (AI), brain-computer interfaces (BCIs), and bioengineering (Curum AI, 2025). AI, in particular, is alarming because it is a regenerative body of code; however, when integrating this unnatural mastermind into planetary monitoring, it lacks the intrinsic and organic values of natural processes. Therefore, the question arises, does this digital web encircling Earth truly align with the innate Gaia Hypothesis?

How a Digital Gaia acts as a Superorganism

The concept of "superorganisms", predating Lovelock's 'Gaia Hypothesis', describes a group of synergistically-interacting organisms coordinating for collective benefit. Some scholars extend this concept to encapsulate technological systems at human scales. In these interpretations, a superorganism emerges when the sum of individual agents (human or artificial) begins to exhibit collective intelligence or self-organisation, transcending the capability of any single agent. Lovelock's original hypothesis framed Earth's self-regulation as a product of biological and geophysical feedback loops. Digital Gaia, however, implies more premeditated control, an arrangement that arises from human ingenuity in the form of earth monitoring. The Digital Gaia acts as an extension of the original Gaia Hypothesis, superseding the age-old system. This can be seen in the proliferation of global sensor networks, artificial intelligence, and Earth system models that collectively monitor, predict, and even regulate planetary processes - effectively creating a cybernetic layer of feedback (Collins, 2024).

If Gaia represents Earth's "body," then Digital Gaia acts as its synthetic "nervous system", facilitating rapid feedback and adaptive management. This Digital Gaia functions as a superorganism due to the exponential influence it can impose. Through an ethical lens, this may oppose the crux of The Gaia Hypothesis. Raising the question: can AI, a human-made creation, manage Earth's systems, detached from nature's intrinsic values and still align with Gaia's balance and autonomy? Or is this an overreach of mankind that risks disrupting nature's equilibrium?



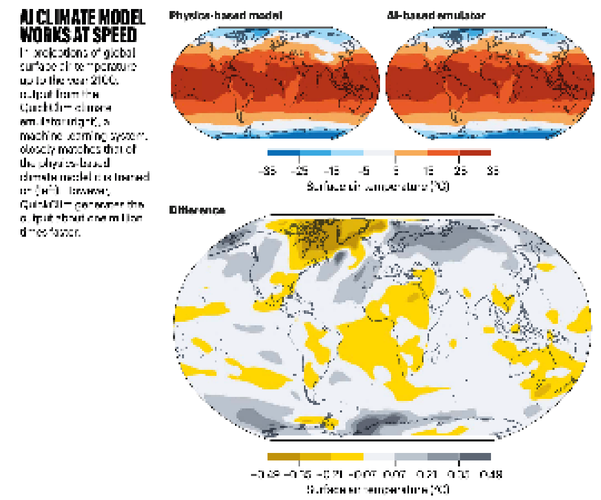
The cyclical processes on Earth demonstrate the biological and geophysical feedback loops as a part of Earth's self-regulation (Selley, 2005).

Technology enhancement using AI

A fundamental part of the Digital Gaia is climate modelling, just as a nervous system processes inputs and generates outputs, AI climate modelling involves the systematic interpretation of environmental data to simulate and predict targeted responses within the climate system. Traditional climate forecasts rely on supercomputers, but AI accelerates this process dramatically. According to climate scientist Vassili Kitsios, AI-powered climate models could be up to a million times faster than conventional ones (Kitsios et al., 2023).

Supercomputers already enhance climate prediction accuracy, offering earlier warnings of environmental changes and generating more accurate climate change predictions (Thomas, 2019). The first approach involves machine-learning tools called emulators - they curate similar results as traditional models without tedious mathematical calculations. The second uses AI to power the foundations of climate models, whilst the third is a hybrid of both. All three approaches all upgrade our eco-defence. However, these AI-driven models consume vast amounts of energy. Simulating a century's worth of climate modelling can require 10 megawatts, equivalent to a year's electricity use for an average US household (Wong, 2024). Additionally, data centres produce immense heat as waste energy, demanding significant water resources for cooling which leads to an ethical paradox to emerge: if AI aims to "save the planet", why does it do so at valuable environmental expenditure?

Despite these obstacles, AI's benefits are significant. It can optimise power usage, reduce costs, and enhance environmental protection (Dellosa et al., 2021). AI also plays a pivotal role in "climate finance," which facilitates investment direction for sustainable developments. The United Nations Framework Convention on Climate Change (UNFCCC, 2025) notes that logistical hurdles hinder climate finance implementation. AI could streamline this by identifying high-impact projects, efficiently allocating funds, and monitoring outcomes, bridging technology and sustainability to a new equilibrium while advancing renewable energy adoption.



AI Climate Model Works At Speed. Depicting global surface air projections up to the year 2100, 'QuickClim' (right) performed the output one million times faster than the physics-based model (left) it was trained on (Wong, 2024).

Criticisms and the Future of the Digital Gaia

Integrating the Digital Gaia into our world is promising, but there are potential setbacks we must acknowledge. The sheer energy demands of AI raise concerns, as data centres often rely on fossil fuels, exacerbating climate concerns. Water-intensive cooling systems also strain local supplies, forcing another ethical dilemma: we devote resources to AI-driven sustainability efforts while harming local environments. This leads some to believe humankind is evading its obligation in environmental stewardship.

Critics argue that the notion of "controlling the Gaia" is flawed. AI-driven interventions, guided by narrow objectives or commercial interests, might disrupt Earth's homeostatic balance rather than sustain it. Additionally, centralised AI control by corporations or governments raises concerns over data access and decision-making power, as to who determines which signals matter and how to respond. Nevertheless, advocates propose that implementing transparent governance, robust ethical frameworks, and fostering international cooperation can help alleviate these challenges. They propose that The Digital Gaia, rather than overriding natural feedback mechanisms, should enhance them, detecting disruptions before they escalate into bionic crises. It is an anthropogenic responsibility to remedy the disorder we have inflicted. Using AI, as our tool, to save the planet is warranted.

Looking ahead, the development of energy-efficient hardware and AI powered by renewable energy could be key to resolving Digital Gaia's inherent contradictions, transforming it into an authentically sustainable tool for planetary management. Hence, escaping ethical disagreements. Synergy between human ingenuity and integrity is essential. Open-source platforms have the potential to democratise environmental monitoring, fostering shared decision-making among nations, communities, and researchers. We have the possibility and the responsibility to use this technology to better our working world. In this sense, The Digital Gaia is more than a technological marvel; it is an opportunity to integrate human ethics with planetary-scale intelligence, fostering a new era of responsible environmental stewardship.

The Epigenetics of Stress: When Experience Gets Under the Skin

Written by Candice Savary

A look at how our experiences leave a biological imprint on our genes, possibly influencing how calmly (or chaotically) we deal with adversity.

Between Nature and Nurture

Wouldn't it be nice to actually take everyone's advice and just not stress? Indeed, we all know that one person who never seems to flinch, even when the world feels like the most stressful place imaginable. In answering why it is that some individuals seem naturally better equipped to manage stress than others, scientists have looked to examine the individual differences in stress responses.

When tasked with understanding why people differ, two main explanations usually surface: they were born that way (genes), or their environment shaped them that way (environment). As usual with psychological explanations, the nature vs nurture argument arises. There's also a field for this; Behavioural Genetics does an exceptional job of identifying how much of the differences between individuals on certain traits are due to their genes (heritability) or their environment.

However, this distinction could start to blur once we look at how genes are expressed across different contexts. Genes code for lots of things, eye colour, blood type, the cells in our lungs. Yet every cell contains the same DNA, and only certain genes are actively expressed in each. During development, signaling pathways switch genes on or off, guiding cells to form specific tissues, so no lung cells where photoreceptors should be. Pretty neat. As we shall see, this is not the only way gene expression may be regulated.

Epigenetics is the study of how environmental factors can influence the expression of our genes without changing the underlying DNA sequence. The term 'epigenetics' comes from the Greek word 'epi', which means over or above. This reflects how epigenetic changes act on top of or alongside our genetic code, regulating when and how genes are turned 'on' or 'off' (expressed or not expressed). Epigeneticists have reformed the views of nature and nurture by elegantly revealing the intertwining reality of nature influencing nurture through biology. This has alleviated the grips of a 'deterministic' genome but rather a dynamic epigenome, malleable by experience.

The epigenetics and psychology combo works particularly well once we understand that biology has a lot to do with how we act and feel. Neurotransmitters like serotonin and dopamine regulate mood and behaviour. Elevated cortisol can heighten anxiety and shape social interactions, while a more reactive amygdala drives stronger emotional responses and impulsivity. In essence, neuroscience helps us unpack behaviour through the brain's biological and chemical processes. If biology may underpin some types of behaviour…and of course genes underpin biology…and our environment can regulate gene expression, we could look at how our environment may shape the way our genes are expressed in our phenotype and how this affects behaviour.

Before I can continue, I'm obliged to highlight the illegal term in behavioural genetics: 'a gene for'. There is very very rarely (not really ever) ever a gene for a behavioural trait. It's usually more like; this gene makes you a bit more likely to have this tendency and if you inherit it along with this other gene, you're even more predisposed to that tendency and about thirty textbook pages and lots of gene associations later, this might explain why you freak out more than the next person when you have an essay due. Regrettably, this is much less compelling than presenting you with a stress gene, but hopefully this piece will allude to something interesting about predispositions to stress. So, while our biology may nudge us toward certain behaviours, it doesn't decide them but makes them more likely.

By examining how environmental factors regulate behaviour-related genes, we may gain insight into individual differences in stress responses. Here, I build a case for the role of epigenetics in explaining these differences.

A Tale of Adversity

Responding to our environment can mean lots of different things. On a behavioural level, it could mean altering our actions based on the stimuli we encounter, a process that generally serves us well; run when there's a lion, hunt when we are hungry, the whole song and dance. But our biology can too be moulded to better suit our environment; in accordance with the conditions we face. This is the reason for our survival most of the time until, a first caveat: problems arise when there's a mismatch between the environment we're biologically prepared for and the one we actually live in. Take a developing fetus: if a mother faces scarcity and malnutrition, her body, through chemical signalling, alerts the fetus to prepare for a harsh world. The fetus adapts, developing mechanisms to hold onto glucose, slowing metabolism and fine-tuning the hypothalamus to cling to every calorie. This is wonderfully useful if the child is indeed born into a world of scarcity, but terribly damaging if they instead enter one where food is abundant and calories are everywhere. In effect, responses that were once adaptive now increase the risk of obesity and metabolic disease.

This was the fate of many babies during the Dutch Winter Famine of 1944, one of the first clear examples of epigenetics in action. Pregnant mothers, deprived of food during pregnancy but not at the point of birth, gave birth to children who later showed higher expression of the insulin-like growth factor gene (IGF2) due to reduced DNA methylation (a type of epigenetic modification) (Heijmans et al., 2008). In adapting to hold on to every nutrient in anticipation of scarcity, these children became more susceptible to obesity and metabolic disease in a world where food was, in fact, plentiful. More to our interest, despite the mothers' genes being unchanged, their children carried the genetic signature of famine. It seems that even before birth, we can evaluate environmental cues and adjust gene expression accordingly, an evolutionary bet if you will, on the kind of world we expects to face.

The story of the Dutch Hunger Winter highlights two key insights: first, our experiences can directly shape gene regulation, meaning we role in shaping us into who we are. Epigenetics propose a biological foundation as to how our experiences translate into enduring changes in our biology and potentially, our tendencies to stress.

Stress and Epigenetics

Stress is especially interesting because it is a good example of a biological tactic, which used to be incredibly advantageous, is now less so as our environments have changed.

The stress response is designed for intermittent use, to help us run from the usual saber-tooth tiger or summon the strength to fight off an opponent, and this is really useful. Right but, tigers run-ins are a lot less usually these days as you may have noticed and physically running and/or fighting is lower on our lists of survival skills, instead we experience more prolonged stress. Unfortunately for us, when stress response is constantly activated for things that aren't running from a predator, it results in persistently elevated cortisol levels with widespread negative effects. Imagine your heart pounding and muscles tensing through your entire 9-to-5 as if in moments of real threat. Such chronic activation, grants results like stomach ulcers and increased vulnerability to disease - less useful. More central is chronic stress, particularly in environments of consistent adversity such as childhood maltreatment, which places an epigenetic burden on our cells. This may explain why some individuals develop a heightened sensitivity to stress, carrying a biological weight long after the threat is gone.

One of the most impactful studies in this field examined the effects of maternal care on infant development. In the rodent world, one of the most crucial maternal behaviors is licking and grooming (LG) -a caregiving behavior observed in rat mothers toward their pups. In Liu et al.'s (1997) study, the absence of this maternal care led to rats that were more fearful, displayed heightened stress responses to novelty, and engaged in fewer exploratory behaviors. These neglected rats coped with stress far less efficiently than their well-nurtured counterparts. More importantly this stress vulnerability persisted throughout their lives, hinting at a deeper more complex biological mechanism, one that epigenetics could explain.

Remarkably this experiment fluently uncovered parts of the epigenetic mechanisms that predispose these behaviors. The neglected rat group exhibited methylation of the Nr3c1 exon 1, a promoter for NGF1-A, a gene critical for driving the expression of glucocorticoid receptors (GRs) in the brain. GRs play a pivotal role in inhibiting the stress response by suppressing the release of CRH (corticotropin-releasing hormone) and ACTH (adrenocorticotropic hormone) through a negative feedback loop. However, the addition of methyl groups suppressed the expression of NGF1-A, effectively "closing" the DNA to transcription and making this DNA strand less accessible. As a result, these rats developed fewer glucocorticoid receptors, impairing their ability to regulate their stress response. To highlight the potential of epigenetic inheritance for the stress response regulation, even the next generation of non-neglected pups exhibited behavioral and genetic patterns similar to their neglected parents.

We now see the potential for the postnatal environment in directly shaping the genome

of a developing rat. Even more interesting, the case is thought to be the same in humans too. Rather obviously we cannot test in a lab the epigenetic consequences for stress induction however, research on adults who experienced severe childhood trauma has revealed strikingly similar correlations between glucocorticoid receptor methylation and heightened stress reactivity (McGowan et al., 2009). Underscored clearly is the intricate interplay between early life experiences and gene expression related to stress, creating an epigenetic signature that may persist across generations.

Since scientists do quite well detailing abstract behaviours with little molecules, one might wonder: how exactly does environmental stimuli translate into biochemical changes in our bodies that subsequently silence genes? The short answer is that we don't fully understand the mechanisms yet, although various candidate pathways exist that propose how environmental stimuli can be converted into biochemical cascades, much of the research remains correlational. We observe that certain experiences coincide with gene alterations and find mechanisms for those alterations, yet we cannot always map the complete molecular sequence that drives these changes from external straight to internal. Understanding these causal pathways through a biological lens remains a compelling focus within the field of preventative epigenetics.

Concluding Thoughts

Epigenetics has done a remarkable job of revealing how our experiences may mark us on a biological level. The once-clear line between nature and nurture has become a little more blurred. By understanding that behaviour can be influenced by a series of chemicals triggered by the environment, we recognise that our response may be shaped by our unique biological makeup, potentially influenced dually by the biology we inherited and life experiences. This perspective shifts us a little away from the notion of a genetically stable phenotype.

Of course, more formalities and disclaimers follow any discussion on epigenetics and behaviour. As fascinating as this field is, epigenetics is not to our disappointment, the grand explanation for individual differences. In reality most reported human epigenetic effects are small, unstable and correlational rather than causal. Epigenetics should not be viewed as the environment rewriting our genes, but rather as an interesting biological mechanism through which the environment may affect us, and as a quite convincing mechanistic explanation for this phenomenon. More importantly, just because somewhere along the road something got methylated, this does not mean you're destined to worry and stress as a victim of your genes. Instead, recent research demonstrated that your epigenome regarding behaviour may be dynamic not only in early experiences but throughout your lifespan.

In any case, epigenetics appears to make a compelling case for how our environment literally gets under our skin.

Helping Hand: A Lightweight, Lifelike Prosthetic

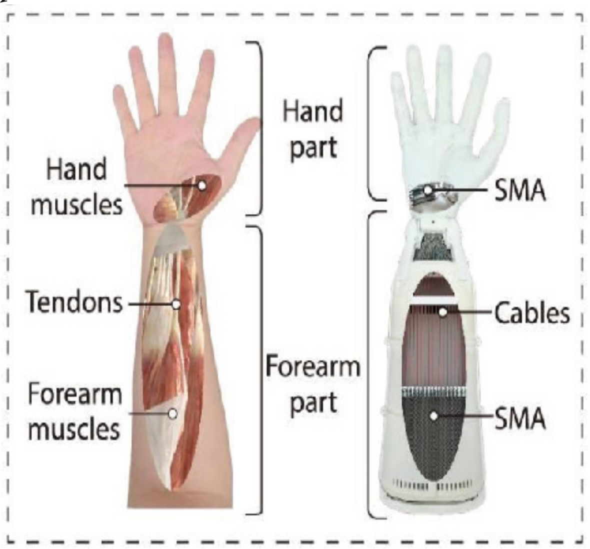
Written by Tanisha Mwendah

Around 1 in 3 robotic prosthetics are abandoned due to weight or limited movement (Biddiss and Chau, 2007). However, researchers Hao Yang, Zhe Tao and Jian Yang from the University of Science and Technology of China (USTC) aim to change that and provide better options to amputees. Their team has built an arm that is capable of a larger range of motion, while being as lightweight as a human hand. It can comb hair, pour a drink or even use a smartphone. A paper published in Nature in January this year has outlined their results with a 60-year-old amputee participant, proving highly successful (Yang et al., 2025).

Current prosthetics can lead to discomfort that develops into health issues like arthritis (Pasquina et al., 2015). Most products can currently move in about 10 directions (degrees of freedom, or DOF). This is less than the human hand with 23 DOF, and the USTC device with an impressive 19 DOF (Yang et al., 2025). This technology has the potential to revolutionise prosthetics. Having access to fine motor skills can provide users with a new level of independence and confidence.

When it comes to electric prosthetics, there is a trade-off between the complexity of the device and its weight. Electric motors can be heavy, and users are much less likely to be open to integrating a device into their lifestyle if it is physically taxing. This prosthetic weighs only 370g while the average human hand weighs 400g (Yirka, 2023) - the secret to this is the use of shape-memory alloy (SMA) actuators.

The actuators work by using wires that can change shape in response to temperature (Cambridge Mechatronics, 2023). They can be as thin as a human hair, producing proportionally large movements. These properties make them ideal for mimicking muscles. Having a high power density of 1000W/kg means that SMA actuators can deliver a lot of energy in a small amount of time, suitable for quick movements.

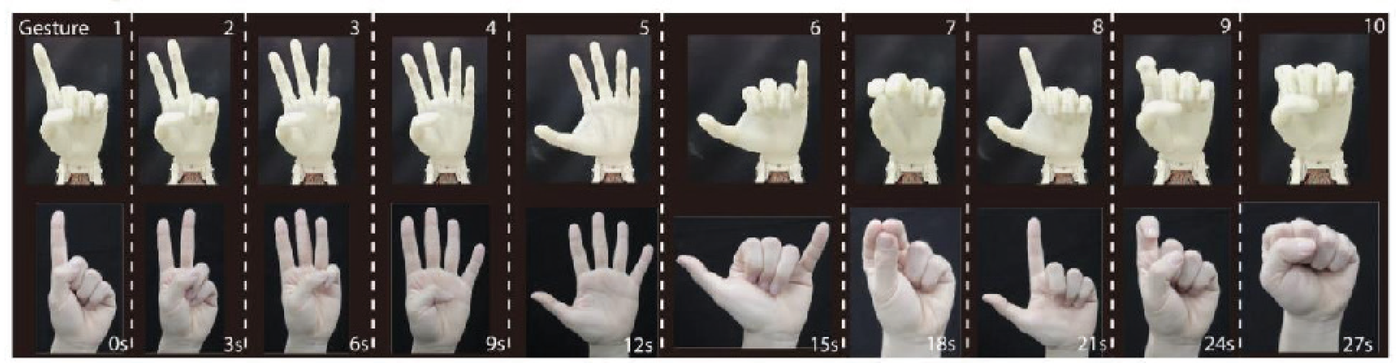


A diagram comparing the prosthetic produced at the Universiy of Science and Technology in China to the human hand. It shows the locartion of the actuators in the wrist and forearm.

Current prosthetics can lead to discomfort that develops into health issues like arthritis. The technology discussed in this article has the potential to revolutionise prosthetics. Having access to fine motor skills can provide users with a new level of independence and confidence.

The casing is soft silicone with the wires just underneath the surface. Their motions are controlled through heating/cooling, but the temperature never exceeds 27.2 °C. The test subject was able to use it confidently in less than a day. In addition, the arm also has an AI voice command operated by the iFLYTEK Large Language Model. This feature controls the prosthetic in more than 60 languages (Yang, 2025). It even works in noisy indoor environments of up to 70dB, which is about as loud as a washing machine (DecibelPro, 2021).

One drawback is that for very rapid movements, there is a time delay (Yang, 2025). Additionally, there is a lack of long-term data for this device, which makes its serviceability hard to predict for other users. With all these developments, SMA actuators could be key to solving issues with prosthetic limbs today. With more research and more development, hopefully, these prosthetic limbs can be fully integrated into healthcare globally.



Gestures produced by the prosthetic compared to a human hand, both showing numbers 1-10 in Chinese sign language.

Beyond Anthropocentrism: Rethinking Why We Save the Planet

Written by Sara Al-Muttalibi

The Human Lens: How We Perceive the Environment

When we talk about "saving the planet", what we often mean is "saving the planet for us." From reforestation to renewable energy initiatives, most sustainability efforts are driven by the desire to preserve a world that supports human life - our food systems, our urban development, and our comfort. This is an understandable instinct, yet it reveals a deeper truth about how we perceive the natural world - not as a living community to which we belong, but as a resource we control to our advantage.

Occasionally, even our most well-intentioned actions reinforce the same hierarchies that created ecological harm in the first place. Governments and corporations speak of sustainable development and 'green schemes,' yet rarely question the systems that lead to environmental exploitation. For example, corporations promote electric vehicles as a climate solution, while the lithium and cobalt required for their batteries are extracted under exploitative labour in developing countries. In doing so, the use of the word sustainability often masks the continuation of this system, where exploitation is rebranded as progress. These contradictions expose the fundamental issues with modern environmentalism, where we strive to protect the planet while viewing it through a human-centred perspective.

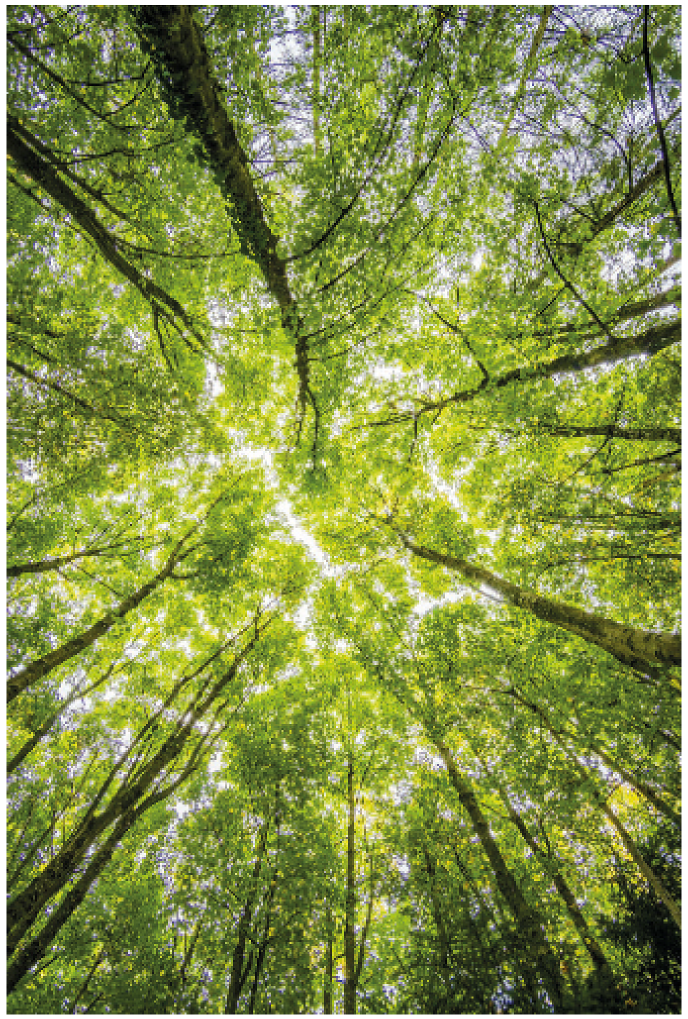
The philosophy of deep ecology challenges this lens by asking the question: What if the Earth's value lies not in its service to humanity, but in its existence itself? (Naess, 1973)

Shallow vs Deep Ecology- Two Ways of Seeing Nature

The fundamental question that environmentalists strive to answer is Why do we have any moral obligations concerning the natural environment? (Cochrane, 2006).

The straightforward response would be that if we do not constrain our actions towards nature, then humans will cease to exist. Yet this reasoning implies that nature matters only because it benefits us - a perspective that deep ecology rejects.

Deep ecologist Arne Naess argues that moral consideration as humans must extend beyond humanity to include the broader natural community. As Naess (1973) writes, "the well-being and flourishing of human and non-human life on Earth have value in themselves. These values are independent of the usefulness of the non-human world for human purposes." In other words, the natural world possesses intrinsic value, not merely instrumental value.



Environmentalism often values nature for its human benefits, but deep ecology challenges this view, asserting that Earth's worth is intrinsic, not based on its usefulness. True sustainability begins by recognising that nature deserves protection simply for existing, not for what it provides us.

By contrast, shallow ecology - the form of environmentalism most dominant in policy and media - remains anthropocentric. It seeks to protect the environment primarily to safeguard human welfare; to preserve clean air, fertile soil, and a stable climate for civilisation (Naess, 1973; Devall and Sessions, 1985). Deep ecology, meanwhile, calls for a more radical shift in perspective; one that recognises humanity as a single species within a vast ecological network. This "biospheric egalitarianism," as Naess described it, suggests that all forms of life have an equal right to exist and flourish, regardless of their usefulness to us. In other words, inherent worth is not dictated by human needs, and we have moral obligations to preserve the natural environment because it possesses its own intrinsic value that humans have no right to violate.

Anthropocentrism in modern environmentalism

Even as global awareness of environmental issues grows, most modern sustainability efforts remain rooted in human-centred thinking. Policies often justify conservation through the concept of ecosystem services - the benefits nature provides to people, such as carbon storage, food, and recreation (Millennium Ecosystem Assessment, 2005). In the past, this approach was arguably necessary. People were more likely to care about the environment if they could see how it directly benefited them. Appealing to self-interest made environmentalism easier to understand in a world driven by growth and consumption. But as awareness and education have improved, our motivations should begin to change.

Large-scale tree planting schemes, for example, are promoted as carbon offsets that serve climate targets (Holl and Brancalion, 2020). Yet, such projects usually measure success in terms of emissions absorbed, rather than biodiversity restored. We replant forests because they absorb carbon, not because they breathe. This framework merely provides political convenience. Governments can claim environmental progress through quantified targets, without having to deal with the deeper moral changes that true progress requires. In contrast, rewilding initiatives aim to revive natural processes for their own sake, recognising that ecosystems possess value beyond human utility (Perino et al. 2019).

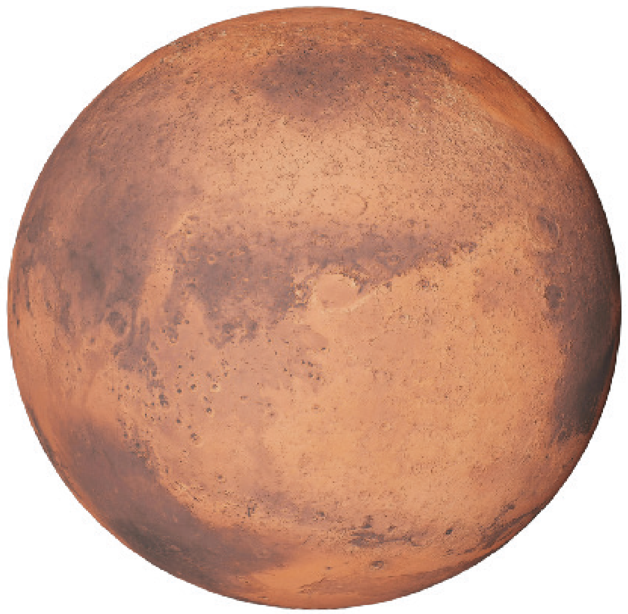
These cases reveal how anthropocentrism still shapes even our "green" ambitions - protecting nature primarily to sustain ourselves, rather than because it deserves to exist.

Ethical Reflection

At the heart of this debate lies a deeper moral question: who, or what, deserves moral consideration? Most environmental policies assume an anthropocentric worldview -that humans alone possess moral importance, and nature's value lies in how it serves us. Deep ecology proposes an ecocentric ethic, in which all living beings and ecosystems have equal moral standing (Naess, 1973).

This calls for a shift from management to coexistence: to see a forest not as a resource, but as a community of life with its own right to exist. Critics argue that such thinking is idealistic in a world facing poverty, development, and climate urgency. Yet perhaps the ultimate act of sustainability isn't saving the planet for us - it's learning to live as if we were never at the centre of it.

Are We Alone in Space?
Written by Sean Tsoi



From believing Earth was the centre of the universe over 400 years ago, to discovering our planet is just 1 of 100 billion - 1 trillion planets in the Milky Way Galaxy, our understanding of space has developed significantly. Though this vast number is true, we are still yet to find evidence of another life-inhabiting planet. This was until researchers at the Centro de Astrobiología (CAB) in Madrid, Spain, developed a strategy to detect traces of DNA on Martian rocks, potentially bringing the search for life much closer to home (Brennan, 2020).

Why Mars?

Given its Earth-like characteristics, Mars stands out as a prominent candidate for potential life in our solar system. It has a solid surface providing a landing space and has less extreme environmental conditions compared to other planets in our solar system, such as Jupiter and Saturn, that are gaseous and extremely hot (European Space Agency, n.d.). This opened the way to the 'Curiosity' rover project led by NASA, launched in 2011, aimed to remotely research the physical aspects of Mars.

Through the rover's 13 years of data collection, it collected over 3,279 gigabytes of data, equivalent to more than 1,000 high-definition movies (Holloway et al., 2024). Amongst the data, the most important was the discovery of large amounts of organic carbon on Martian rocks, estimated to date back almost 3,500 million years. Seeing as carbon could survive the radiation on Mars over a prolonged period of time, questions surrounding the presence of other biological molecules on Mars arose, and if more complex compounds exist such as DNA, leading to the investigation by the CAB.

Scientists suspect Mars was once habitable, but radiation and oxidants erase biological traces. New tests exposing DNA on stones to simulated Martian radiation show that full sequences degrade, yet fragments can survive long enough for taxonomic identification, aiding the search for past life.

The Investigation

Organic carbon is a chemically stable and persistent molecule that enables it to survive and be easily extracted from Martian rocks. On the other hand, DNA is a much more complex compound, making it fragile and susceptible to degradation by the environment, leaving scientists curious if DNA even has the potential to survive Mars's radiation.

To explore this, researchers first collected sedimentary Earth rocks with similar total organic carbon content and physical aspects to the Martian rocks found. The rocks were then sealed in a vacuum-tight container and placed in an irradiation facility pool, surrounded by large sources of radioactive Cobalt-60 for 20 days. These specific conditions simulate up to 136 million years of gamma radiation that the rocks would have been exposed to if left on Mars.

Following the 20 days, the rocks were extracted from the radioactive conditions to be examined, and what was found was astonishing. While simpler biological molecules such as lipids and amino acids were quickly degraded, 1.48–8.45% of DNA sequences survived in fragments, leaving sufficient material for taxonomic identification and resequencing (Maria-Paz Zorzano et al., 2025).

What does this mean moving forward?

This discovery by CAB, that DNA fragments can survive years of radioactive exposure, advances our understanding and potential to detect life on Mars and other planets with similar conditions.

DNA is considered the molecule of life, as it carries the genetic information that shapes the development, growth and overall being of all living organisms. It is a hereditary material, meaning that it is passed down during reproduction to offspring. This essentially makes DNA a book that can be sequenced and analysed to explain the identity of its corresponding organism.

Therefore, by being able to detect DNA on Mars, we can learn all about what living organisms may have once lived on Mars, and compare their DNA to DNA of living organisms on Earth in order to determine similarities and potential relationships amongst species, leading to the discovery of the first extraterrestrial species (Nature Education, 2014).

This paves the way for future missions with the intent to uncover and characterise extraterrestrial life, bringing us one step closer to answering the question, are we alone in space?

SHE SHAPES SCIENCE

The influence of women in STEM continues to shape how science is imagined and shared. The She Shapes Science section spotlights the first article written that celebrates emblematic women in STEM and the ideas forged. Through this, the stories of perseverence and curiosity that helped shape the modern world are explored.

Crystals & Courage: The Legacy of Dame Kathleen Lonsdale

Written by Ariella Morris

Kathleen Lonsdale shattered the glass ceiling by becoming one of the first women to be elected to the Royal Society in 1945, and the first female professor at UCL. For centuries, women had been excluded from this prestigious body of scientists, making her achievement all the more groundbreaking. Lonsdale's inspirational story depicts how innovative science and social courage can redefine both chemistry and women's roles in academia.

Born in Ireland in 1903, and moving to London by 1908, the Lonsdale family had troubles [1]. She studied at Ilford County High School for Girls, but later transferred to the boys' school to study science and mathematics, subjects unavailable to girls at the time. An example of how institutional biases restricted women's scientific potential [1]. Despite these setbacks, Lonsdale received the highest grade in physics that any student at a London University ever had. She graduated in 1922 with a Bachelor of Science (BSc) from Bedford College for Women and later graduated in 1924 with a Master of Science in physics from the University College London [2].

Only seven years after receiving her Master's Degree, Lonsdale used X-ray diffraction to prove the structure of benzene. She later studied at the University of Leeds under Professor Christopher Ingold, who suggested she research the crystal structures of hexamethylbenzene and hexachlorobenzene. She was able to show that the molecules had a planar, hexagonal structure, which settled the enduring dispute about the structure of benzene [3].

This advanced crystallography for organic compounds laid the groundwork for modern materials and medicinal chemistry [4]. Today, this underpins drug design, as many pharmaceuticals are built on aromatic scaffolds. Continually, Lonsdale pioneered methods for solving the structures of increasingly complex organic molecules. These methods became essential for biochemistry, being used to determine the structure of vitamins, hormones and proteins. In medicinal chemistry, structural knowledge is key to understanding how molecules interact with biological targets, for example, enzymes and receptors [5].

In 1945, she was among the first two women elected as Fellows of the Royal Society, in spite of facing institutional barriers [6]. At the time, workplace bias meant that laboratories and research institutions often lacked facilities for women. Furthermore, women were expected to take up assistant roles rather than lead research, prohibiting women from making significant contributions.

In 1946, Lonsdale returned to UCL. She was appointed Professor of Chemistry and head of the Department of Crystallography. Lonsdale was the first woman to be made a professor at UCL [7]. Breaking barriers for Women in Science. She actively campaigned for equal opportunities in academia whilst balancing family responsibilities and challenging gender norms. Her story is often cited in discussions of female representation and equity in science, showcasing how talent can flourish once barriers are lifted.

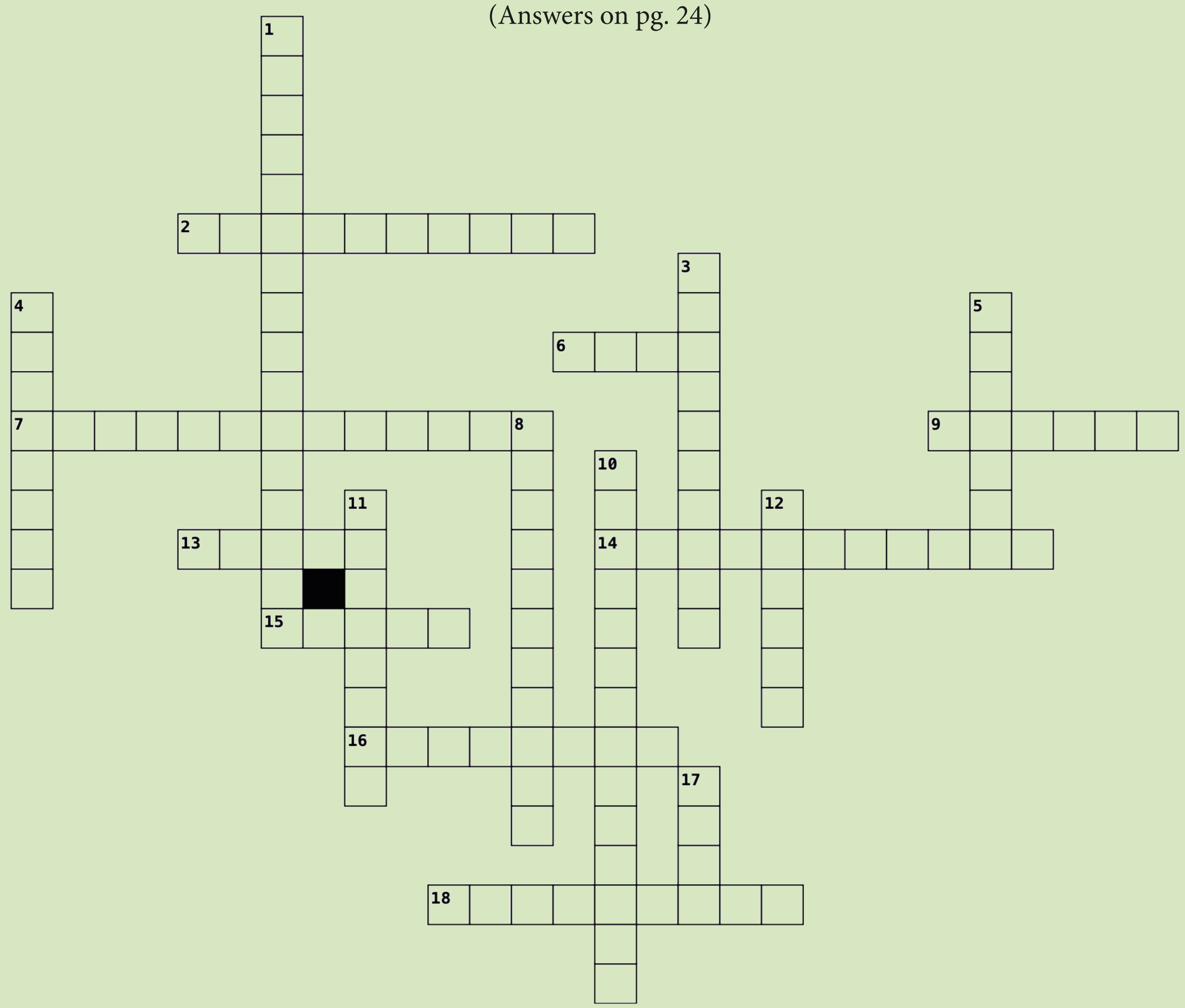
Kathleen Lonsdale's impact is now firmly woven into institutional memory - the very building in my department (Earth Science) bears her name. Her legacy serves as a powerful reminder that future scientists are not bound by imposed limitations but can transcend them. Lonsdale's career continues to inspire generations of researchers, symbolising both scientific excellence and social progress.

WONDER

"Play is the highest form of research"
-Albert Einstein

Across The Sciences

(Answers on pg. 24)



Across

2. Artificial limb, like the lightweight hand powered by shape-memory alloys
6. Hypothesis proposing Earth functions as a self-regulating superorganism
7. A collective entity, like Digital Gaia, exhibiting coordinated intelligence
9. The prenatal environment provided by a _____ influences fetal epigenetics
13. The USTC prosthetic can be controlled by AI ____ command
14. Study of how experiences alter gene expression without changing DNA
15. A simulation, like an AI climate _____
16. Hormone elevated by chronic stress, with widespread bodily effects
18. Type of value that deep ecology argues nature possesses in itself

Down

1. Human-centred worldview, nature primarily for its utility
3. The evolutionary purpose of the stress response and the goal of a good prosthetic
4. Pioneering crystallographer and first female professor at UCL
5. Type of prosthetic that is often abandoned due to weight
8. Epigenetic process that can silence stress-related genes
10. An increased likelihood, influenced by both genes and epigenetics
11. A loop essential to stress hormone regulation, planetary systems in the Gaia hypothesis, and AI climate modelling
12. What epigenetic changes make, Lonsdale's career, and a planet's environmental damage all leave behind
17. Planet where DNA fragments may survive radiation, hinting at past life

CREATIVE

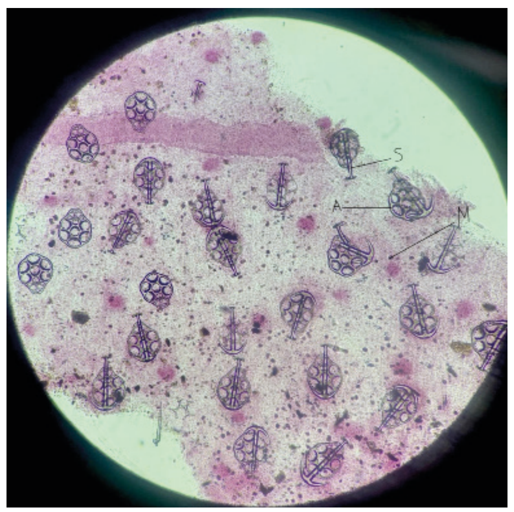
From the mesmerising patterns found in nature to the artistic beauty of microscopic organisms, science has always inspired creativity. We're therefore delighted to launch UCL Science Magazine's Creative section, a brand-new space dedicated to exploring science through photography, artwork, and creative writing by UCL students.

Into the Wilderness

A series of beautiful wildlife photographs taken by Olivia Binfield, an MSci Zoology student at UCl.

A close-up shot of a Nicobar pigeon's wing. Bird feathers are pennaceous, meaning they consist of a solid central stalk called a rachis and branching vanes or blades. These vanes are made of interlocking barbules of keratin, the same material as human fingernails.

Seahorse, such as this Hippocampus whitei, are framed for their unusual reproductive strategy. Males are the ones who give birth and become pregnant, protecting their young in specialisaed brood pouches.

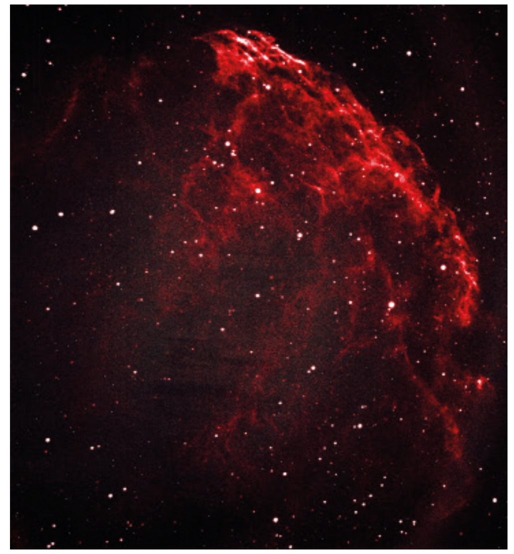


The skin of a sea cucumber is surprisingly beautiful. Ossicles, tiny, calcified plates, are a diagnostic feature of the echinoderm phyla. They serve as structural support for their buccal tube feet.

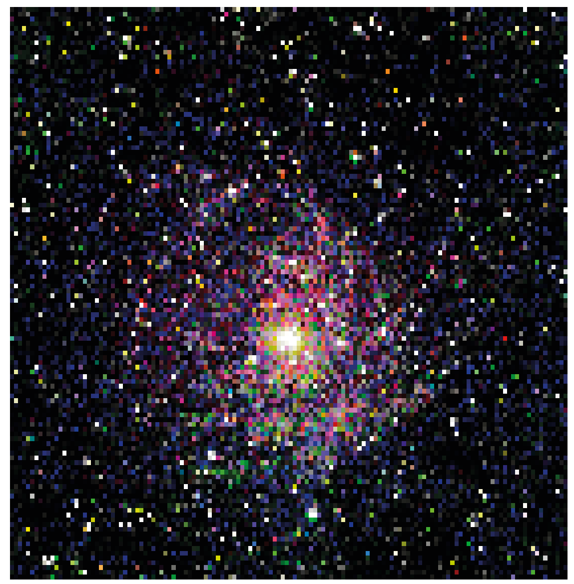
The Night Sky Through UCL Telescopes

Featuring stunning photographs taken by Astrophysics students at UCL. These breath-taking images, taken using robotic telescopes at UCL Observatory, reveal the hidden beauty of our universe- reminding us that science isn't just about discovery, but also about awe and inspiration.

Jellyfish Nebula: by Harry Taylor, BSc Astrophysics. A supernova remnant in the constellation of Gemini, formed from the explosion of a star thousands of years ago, creating shock waves by interacting with surrounding gas clouds. The red colour implies an abundance of hydrogen, which glows as it absorbs light and then re-emits as the electrons move down in energy levels. Photo taken as part of a module in Practical Astrophysics, through the robotic telescopes (Celestron 14" Schmidt-Cassegrain) at UCL Observatory in Mill Hill.



Crescent Nebula: by Shourya Shrivastava, MSci Astrophysics. A bubble-like nebula in the constellation of Cygnus, created by the powerful winds of a massive star- Wolf Rayet 136. These winds interact with the previously ejected material from the star, resulting in a complex and intriguing shape. The purple-red glow comes from ionised hydrogen and oxygen gases, energised by the shockwaves within the nebula. Photo taken as part of a module in Practical Astrophysics, through the robotic telescopes (Celestron 14" Schmidt-Cassegrain) at UCL Observatory in Mill Hill.

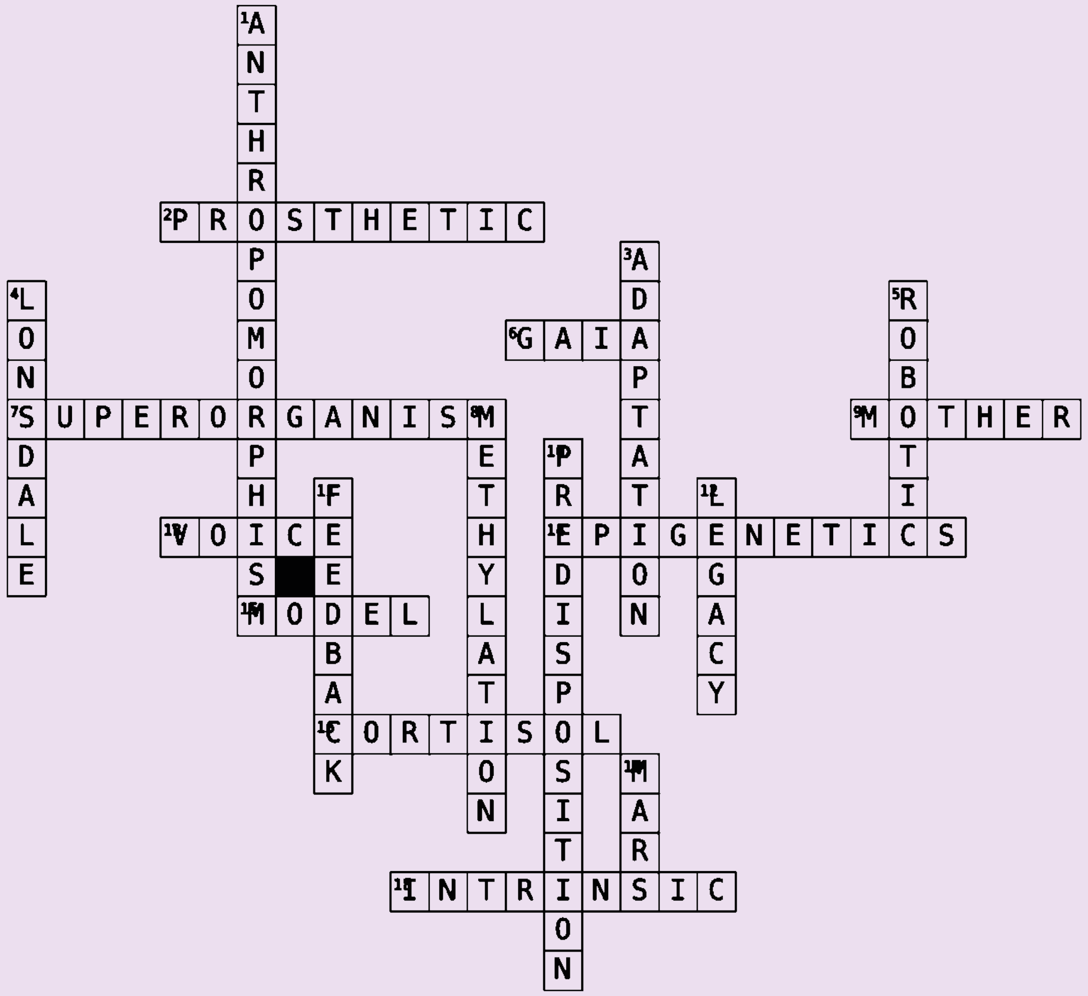


Caldwell 5: by Kirill Batrakov, BSc Astrophysics. A spiral galaxy about 10 million light-years away in the constellation Camelopardalis. It lies behind dense dust clouds in the Milky Way, making it particularly difficult to observe. The faint purple comes from ionised Hydrogen, showing star-forming regions, and the yellow centre shows a population of older stars. Photo taken as part of a module in Practical Astrophysics, through the robotic telescopes (Celestron 14" Schmidt-Cassegrain) at UCL Observatory in Mill Hill.

Messier 106: by Lorna Findlay, MSci Astrophysics. A spiral galaxy about 22 million light years away, with an active core powered by a supermassive black hole, and jets of gas. The bright center and arms are active star forming regions filled with dust, stars and gas. Photo taken as part of a module in Practical Astrophysics, through the robotic telescopes (Celestron 14" Schmidt-Cassegrain) at UCL Observatory in Mill Hill.

Across The Sciences

Answers



Dear Reader,

Thank you for taking the time to read the very first print edition of the UCL Science Magazine. This publication represents a collective effort driven by curiosity, creativity, and a shared passion for science, and we are incredibly grateful for the support that has made this inaugural issue possible.

We hope that this magazine continues to grow as a platform that informs, challenges, and inspires students to engage more deeply with science- both within and beyond the academics. With hopefully many more editions to come, our aim is to amplify student voices, celebrate interdisciplinary thinking, and cultivate a community united by curiosity and innovation.

We hope you enjoyed reading this issue as much as we enjoyed creating it.

With gratitude,
The UCL Science Magazine Team
Sara Al-Muttalibi
Editorial Director

UCL SCI MAG

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