UOA

Scientific

A student-run publication

October 2022
Volume 2 No.4

ISSN 2815-7893

GOING CUCKOO: PARASITES OF THE AVIAN WORLD

Cuckoo birds have evolved remarkable strategies to get other bird species to raise their young.

Editors' Note

Nau mai, haere mai! Welcome to Issue Four of *Scientific*'s Volume Two.

As we slowly approach summer and the days begin to get longer, we hope you are taking care of yourselves and are looking forward to the fantastic weather ahead of us!

In this issue, all articles were written by guest writers, marking a longstanding milestone for us as a publication. We want to thank all the guest writers who have written about their research and passion for science over the last two years.

From potential fraudulent practices in Alzheimer's research that opens the question about integrity in science, to one of the greatest scientific achievements of our time – the successful launch of the JW Space Telescope and its first five images – this issue is packed with thought-provoking ideas of the role of science in our world.

Katherine McLean discusses the recent bombshell investigation that unveiled the potential fabrication of results in a breakthrough in Alzheimer's research published in 2006. Sheeta Mo writes about how pandemics have shaped our past and future, and the role of science in dealing with outbreaks through history. You-Rong Wang reviews the first five images taken by the JW Space Telescope and discusses their implications. Ella Speers explores the remarkable evolution of parasite cuckoo species, and Danielle Lucas writes about how speed restrictions are saving endangered Bryde's Whales. Finally, Milly Darragh discusses why more investment into the research of endometriosis, a chronic illness that affects 10% of women, is badly needed.

This issue is our last for the year. As we reflect on the past two years, we are reminded of the countless people who have supported our endeavour and made this publication a reality. If interested, please visit the final article in this issue, written by our executive team, that describes a little bit about the history of this publication and what it stands for.

We dedicate this issue to our readers, writers, supporters, and everybody who has partaken in this publication in the last two years.

We will see you again in our summer edition in 2023!

Ngā mihi maioha,
UoA Scientific Executive Team, 2022

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Have We Got Alzheimer's All Wrong? Research Fraud Threatens Science

Katherine McLean

Image by Pawel Czerwinski from Unsplash.

Alzheimer's disease is a terrifying illness that slowly destroys sufferers' memory, personality, and sense of self. It is a progressive neurodegenerative disorder that causes brain atrophy (shrinkage) and neuron death [1]. Brain and bodily functions decline as the disease progresses, and average life expectancy post-diagnosis is only 3-10 years [2]. No true treatments exist, and we currently have no way to stop or reverse its progression – only slow it down.

In 2006, *Nature* published a breathtaking study that shaped the direction of Alzheimer's research for years to come. Sylvain Lesné was a neuroscientist on the rise at the time, working in the University of Minnesota, Twin Cities lab of the renowned researcher Karen Ashe. Lesné and his team reported the first definitive identification in brain tissue in Alzheimer's research of a substance shown to cause memory impairment – a long-awaited discovery that seemed to finally validate the influential yet contentious amyloid hypothesis of Alzheimer's disease [3].

The amyloid hypothesis identifies a type of protein named amyloid beta (Aβ) as one of the disease's primary drivers [4]. Imbalances in the production and 'clean-up' of these proteins lead to accumulated amyloid beta 'plaques' in the brains of Alzheimer's sufferers. The amyloid hypothesis postulates that these cytotoxic (toxic to cells) plaques are not simply a by-product of the disease, but the trigger behind the cascade of harmful changes visible in Alzheimer's patients' brains – the first domino in the deleterious chain, so to speak. Lesné's study identified a specific subtype Aβ protein – Aβ*56, or "amyloid beta star 56" – as causing memory loss in rats. Suddenly, amyloids were confirmed as an active agent of the disease. This smoking gun bolstered support for the amyloid hypothesis, validating proponents and spurring myriads of other Alzheimer's researchers to turn away from other theories and towards Aβ plaques.

However, in late July this year, just as researchers from around the globe were coincidentally sitting down for the 2022 Alzheimer's Association International Conference, the ordinarily staid field was shaken to its core. A bombshell investigation published in *Science* unveiled potential fabrications in both Lesné's original 2006 paper and his later works [5].

Whistleblower Matthew Schrag, a neuroscientist focused on Alzheimer's disease, first raised the alarm last year after finding what appeared to be edited and duplicated sections in the papers' images. He brought his concerns to *Science*, who decided to conduct their own 6-month investigation into this potential image doctoring. *Science* reached out to two independent image analysts to corroborate Schrag's findings – Jana Christopher, an image data integrity analyst, and Elizabeth Bik, a microbiologist and forensic image consultant whose identifications of manipulated imagery in scientific publications have resulted in 879 retractions, 116 expressions of concern, and 952 corrections (as of July 2022). Bik and Christopher agreed that many of the images flagged by Schrag appeared to have been tampered with and even identified further suspicious images in additional papers. In total, the investigation found over 20 "suspect" papers by Lesné, including more than 70 individual instances of image doctoring – ranging from selective enhancement to "copy and paste". In experiment after experiment, serious anomalies kept occurring. It appears Lesné deliberately

faked data to better fit his hypothesis. Without access to the raw data we cannot know for sure, but this seems to be a case of systemic, deliberate academic fraud.

This devastating news indicates that decades of research may have been misdirected and billions of dollars in research funding and pharmaceutical development allocated on false pretences. The amount of time and money that may have been wasted due to this fraud cannot be overstated. Other promising avenues of Alzheimer's research, such as the role of inflammation due to infection, have been consistently sidelined by funding and conferences in favour of the promise of Aβ proteins and plaques [5].

Funding allocated by the American National Institutes of Health (NIH) to Aβ has exponentially increased since 2006, largely due to Lesné's paper [5]. Approximately $1.6 billion of funds allocated to Alzheimer's research by the NIH last fiscal year was directed to projects mentioning "amyloid" in their title – around half of all Alzheimer's funding. How many of these projects were based on incorrect assumptions? How many were doomed to fail from the start? Lesné's 2006 paper has been cited over 2000 times since its publication, making it one of the most-cited in the field. *Nature* has now added an editor's note, stating that "the editors of *Nature* have been alerted to concerns regarding some of the figures in this paper" and warning readers to utilise data and results from the paper with "caution" [3], but countless pieces of work have already taken Lesné's spurious conclusions as fact.

Pharmaceutical companies have spent years developing drugs designed to attack Aβ plaques in the hopes of preventing and treating Alzheimer's disease. Clinical trials have frustratingly failed to provide clear-cut evidence of anti-amyloid therapies slowing cognitive decline [6], yet the promise of Lesné's papers has spurred research onwards despite repeated failures. Anti-amyloid drugs have even been successfully pushed through FDA approval processes despite dubious, even dangerous, results in trials, based largely on blind faith and desperation [7]. If it were not for this near-total dominance of the amyloid hypothesis, research in Alzheimer's prevention and treatment could be years ahead of where we are now.

The Big Picture

If scientific research worked as it should, this fraud should never have been able to go unnoticed. Our discipline is deeply flawed. I hope, however, that this can become a teachable moment. If we want to prevent incidents like this from reoccurring, then at least two core things must change: the attitudes of our institutions and organisations towards publishing and the unyielding pecking order of academia itself.

Firstly, we must acknowledge that the natural hierarchy of academic seniority has become toxic. Junior scientists cannot speak up or voice concerns about research by senior investigators without jeopardising their own careers. One of the main reasons that the 2006 paper remained significantly unquestioned for so long was the highly respected status of the laboratory head, Karen Ashe; Lesné's subsequent work also remained unquestioned due to the status that he gained for himself as Ashe's 'rising star' [5]. Only a few researchers even attempted to replicate any of Lesné's results, and, when those that did were unable to reidentify Aβ*56, they automatically assumed that they must be the ones who messed up – not Lesné. For 16 years, scientists were held back by their fear of being reprimanded for daring to question the leaders of their field. This toxic culture needs to change. We must be able to question the work of our seniors without jeopardising our reputations.

Secondly, the constant push to publish novel research needs to stop. Top-tier journals are consistently reluctant to publish identical replications or experiments with negative results, forcing researchers to avoid replicating prior studies or questioning standard, broadly-accepted hypotheses. In this case, research that doubted the amyloid hypothesis's strength has been consistently relegated to second-tier journals (at best). Researchers also cannot afford to spend valuable time on a project that might not end up being publishable, as a lack of regular publication will stall their career progression (the classic 'publish or perish' situation). Consequently, a vast majority of studies never get questioned after their initial publication. Questioning, replicating, and accepting negative results as positive outcomes may be 'good' science, but good science is not currently earning those coveted tenured professorships.

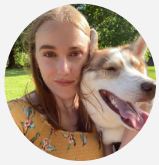
To avoid repeating the failures that led to this situation, we must hold science accountable. However (and that is a very big 'however'), we cannot undermine its efforts and provide ammunition to the opponents of science. Far too many scientists have been speaking out about *Science*'s investigation in ways that cause further harm. I have been watching in various online forums as science deniers enthusiastically latch onto experts' criticisms and use them to 'prove' that science is broken and scientists cannot be trusted. When talking about events like these, we must never present an incomplete picture for others to fill in. For example, instead of saying "that was bad science" and leaving space for deniers to expand your statement, be explicit and say "most science is good science, but that specific experiment was not." How you say things matters almost as much as what you say. Try to contextualise adverse facts by explaining, for example, that we became aware of this individual's academic dishonesty thanks to other scientists continuing to search for the truth, think critically, and work to do good science.

We must also be careful of where we comment. Social media has become increasingly integral to academic networking, and many scientists now have a professional online persona. However, the statements and criticisms shared in private with scientific peers are not always appropriate to be shared on social media. It is too easy for non-scientists to misinterpret valid, targeted criticisms of a scientific study as much broader statements on science as a whole. In public, we need to be seen to support each other as scientists – the overarching message the public needs to receive is that, in general, scientists have faith in science. It is like parenting – duke it out behind the scenes but present a unified front to the kids. While we must hold science accountable, we need to think about what we say and how and where we say it.

These events have emphasised how desperately science needs a dual culture shift: institutions and organisations need to stop forcing shallow novelty in research and allow researchers to question and replicate without fear of reprisal, and scientists need to stop prioritising seniority and work towards a more egalitarian discipline. Reducing the toxic "old boys" culture and making science more equal and open may also help alleviate public mistrust of science. In a time of increasing scepticism, events like these can be enormously damaging – they are precisely the sort of thing that erodes the public's trust in scientists and scientific research. To insulate science against future damaging dishonesty, we must turn this mess into a learning opportunity.

Acknowledgements

Acknowledgements to Alexander Swain, whose opinions helped shape this discussion.



Katherine McLean - BA (Hons), Biological Anthropology

Katherine is an Honours student in Biological Anthropology with focuses in palaeoanthropology and the evolution of cognition. She is currently working as a mentor and tutor for Anthropology Tuākana and is on the 2022 editorial team for UoA's Interesting Journal.

The Sword of Damocles — Virus, Bacteria & the History of Pandemics

Sheeta Mo

"In many ways, it is hard for modern people living in First World countries to conceive of a pandemic sweeping around the world and killing millions of people."

— Charles River Editors, The 1918 Spanish Flu Pandemic: The History and Legacy of the World's Deadliest Influenza Outbreak

Our generation believed that transmissive diseases were an old and outdated threat. We did not envision our future with a pandemic. Everything changed in 2019. With the Covid-19 outbreak, the terror of transmissive disease rose to the surface again. However, living in a pandemic is nothing new. Our history is tangled and twisted with viruses, bacteria, and pandemics. It is like the sword of Damocles, always hanging on top of human fate.

The Past

Black Death

Death cast its dark cloak over the globe in the 1340s. The disease was carried to Sicily by a ship from Crimea in 1347, where it quickly swept across mediaeval Europe [1]. The Black Death killed about 50 million people, at least a quarter of the world's population [2]. The disease was named after its terrible symptoms – black blotches on patients' skin. Other symptoms included fever, chill, diarrhoea, and vomiting [3]. Patients were asymptomatic and infectious during the incubation period of one to seven days. Infected individuals were described as "poisoner[s]... walking destroyer[s]... who might have ruined those that he would have hazarded his life to save." [3] Medical knowledge and public health measures were not developed at the time. It was widely accepted that diseases were a punishment for sin [4]. Thus, praying was a method of curing. People also believed that the Black Death was caused by breathing in "bad air." Doctors wore bird-like masks as they could fill the long beaks with herbs and perfume, hoping they would sanitise the air [5]. Treatments available included bloodletting, purging, and medicine that contained a large amount of opium (theriac) [6]. Without proper scientific knowledge, humanity had no chance of overcoming the nasty disease. Once infected, there was only one fate: to die. Dead bodies were left on the street since there were not enough people to bury them. People fled from cities, further spreading the Plague. It was a living hell.

In the present day, we know the Plague was caused by *Yersinia pestis* – the same bacteria which caused the Plague of Justinian in 541 that killed half of the world's population [2]. It was transmitted from the bites of infected fleas, skin contact, and inhalation [7]. Knowledge can be used for both good and evil. Microbiology offers insight into fighting diseases and facilitates the weaponisation of bacteria and viruses. With its high fatality and susceptibility, the Plague was used as a biological weapon several times. During the Second World War, *Y. pestis*-infested fleas were dropped by Japanese planes over Chinese cities. It killed more than 30,000 people in 1947 as the epidemic persisted for years after the attacks [8]. By the 1960s, the USSR and the US had active programs to weaponise *Y. pestis*. Models demonstrate that an "international release of 50 kg of aerosolized Y. pestis over a city of 5 million would ... cause 150,000 cases of pneumonic plague and 36,000 deaths." [1]

The ghost from the past had never left us. The Plague also caused several epidemics and the modern pandemic from the mid-19th to1930 that killed more than 12 million people. Currently, an average of 2,500 cases of Plague are reported per year [1]. The impact of the Plague decreased as our sanitation and modern disease control methods improved. Effective antibiotic treatment is also available to save lives.

Smallpox

Day 1 *- You felt sick. You had a high fever, and the pain in your back was killing you. It appeared to be just the flu. You went to rest and hope the symptoms will be gone in a few days.*

Day 3 *- Red spots appear on your face and spread to your body quickly.*

Day 5 *- The spots become blisters filled with clear liquid, which later turn into pus. You know you had it – smallpox, a variola virus that killed millions of people. You had a 30% chance of dying. Even if you are lucky enough to survive, the deep, ugly scars over your entire body will follow you till your grave. [9]*

Smallpox is now a name that no longer triggers terror. The ancient disease that existed for over 3,000 years was

Illustration by the author

eradicated in 1980. This remarkable victory was built upon the first successful vaccine created by Edward Jenner. Thousands of years ago, before vaccines were invented, people in some regions of China, India, Egypt, and Ethiopia collected infected patients' pustules or crusts and put them into healthy people's skin or noses [10]. Inoculation often results in mild illness, but offers protection against severe forms of the disease. Jenner observed from the milkmaids that being infected by cowpox can protect against smallpox. After countless experiments and trials, in 1796, he created the first successful vaccine in human history. Promoting vaccines was not successful in the beginning. Opponents feared that recipients would grow cow-like features on their bodies after being vaccinated with cowpox [10]. The world slowly accepted vaccination in the 1800s as it proved to be effective in eliminating smallpox outbreaks.

In 1967, the World Health Organisation started an Intensified Smallpox Eradication Programme campaigning for mass vaccine coverage globally [11]. It led to triumph as smallpox was eradicated 13 years later, the only disease eradicated by vaccination. The Centre for Disease Control and Prevention, and the Russian State Centre for Research on Virology and Biotechnology keep the remaining virus samples for future studies [12].

The Present and Future

"Globally, as of 5:54pm CEST, 6 September 2022, there have been 603,164,436 confirmed cases of COVID-19, including 6,482,338 deaths, reported to WHO."
- World Health Organisation [13]

When the first case of Covid-19 was discovered in Wuhan, China in December 2019, the public thought it was an epidemic that would end quickly and quietly. This thought was a naive wish as the WHO declared the outbreak a global pandemic on 11 March 2020. Suddenly, medical jargon became everyday words: SARS-CoV-2, airborne transmission, quarantine, variants, R0, herd immunity. We ride through the emotional cycles, from fear to familiarity. Masks, sanitiser, social distance, and isolation became the new ordinary. We saw empty supermarket shelves, long lines of wait in testing and vaccination, and protests against lockdown and vaccine mandate. We cannot believe history is repeating. Right here, right now, in front of our eyes, except we are the actors, not the audiences. It is August 2022; Covid-19 continues to change our present and future while new threats like monkeypox emerge.

Our relationship with the environment increases the risk of pandemic occurrence. For instance, it was the historical congregation of humans and domestic animals in villages and cities that provided the opportunity for ancestral organisms to switch their hosts to humans and cause human smallpox, measles, and other diseases [2]. The risk of introducing infectious diseases from wildlife directly to human society increases exponentially as our ecological footprint grows. Global warming will also affect the distribution of infectious diseases and potentially increase the severity of animal-borne diseases [14]. Our growing population and urban lifestyle creates an ideal breeding ground for outbreaks. Spreading infectious diseases becomes faster and easier with modern transport systems. There are many unknown challenges ahead of us. Therefore, it is essential to revisit the past. By tracking past pandemic origins and analysing host-virus relationships, we can identify the causes of emerging diseases and predict potential risks [2]. We have the practices and technology accumulated from the past, such as quarantine and vaccines. It all contributes to better prediction, prevention, and control of infectious diseases.

We are currently walking in the mist. We have no idea what the future will be like and where the path will lead us. But we have a lamp in our hands that our ancestors did not hold. It is not bright enough to reveal the entire path but provides guidance. It allows us to light up the surroundings instead of wandering in the dark. The lamp is science. It is merely a tool, and its use depends on the user. We can choose the path of misinformation, speculating with suspension and rumours. Or we can choose to trust knowledge accumulated by years of observation, experience, and practice. Where we walk depends on us.

Sheeta Mo - BSc, Biomedical Science
Sheeta is a first year BSc student specialising in biomedical science. She is immensely interested in neuroscience and genetics and plans to do research in the future.

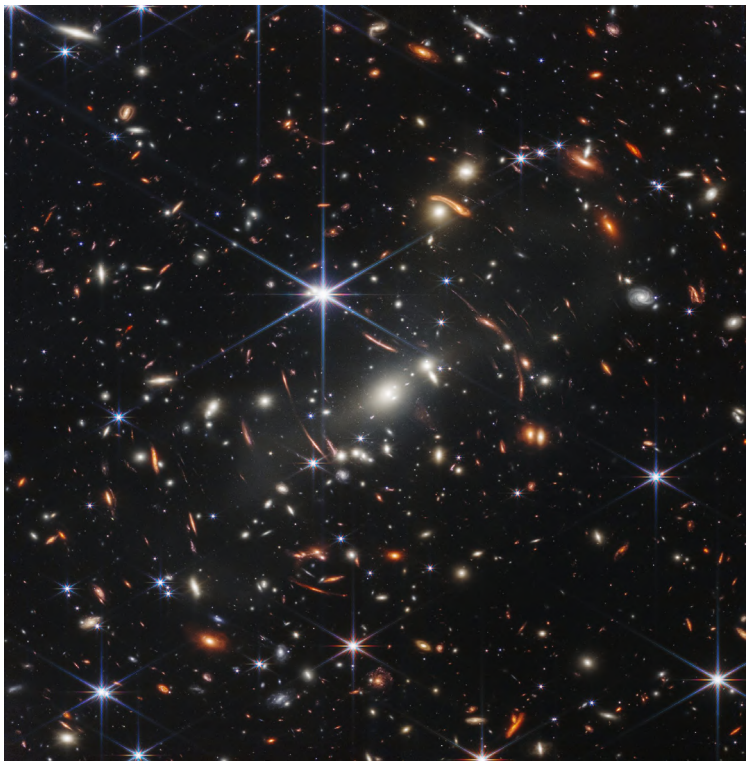
Random fact about her relating to the article: she was born in China during the SARS outbreak and turned 18 during the COVID-19 pandemic.

Conquest of Spaces — A Review of James Webb Space Telescope's First Five Images

You-Rong F. Wang

In mid-July 2022, a million miles from Earth, the James Webb Space Telescope (JWST) entered service. Five unique test images highlighting the telescope's various subsystems and capabilities were made available to the public in high-profile events from the governments of the USA and the European Union, garnering international coverage.

A month on, the scientific community has been hard at work incorporating the latest JWST results into a wide range of research inquiries. In this brief essay, we will look back at the first five images and discuss their importance and the scientific potential they entail.



Deepest image of the universe. Image by NASA from Flickr.

01. SMACS-0723 Deep Field (4 Billion Lightyears From Earth, and Far Beyond)

To the uninitiated, it may have been confusing why this image was used to open the JWST announcement; it looked like a star field any night sky photographer or artist can produce. This is until you realise that the image is an extremely zoomed-in patch of the night sky[1]: almost every spot[2] of light there is a distant galaxy, and this image looks far beyond our galaxy, across the history of our universe. Discovered by the Southern Massive Cluster Survey project a decade ago, SMACS-0723 is a cluster of galaxies 4 billion light years away from earth, and they show up in this image in white. Everything else with a more reddish-orange hue is a galaxy further away.

You can see some orange arcs seemingly centred around the SMACS-0723 member galaxies. It sure feels odd that a galaxy has a structure like this, and they actually don't. In truth, they only appear to us as distorted filaments because the sheer mass of the foreground SMACS-0723 causes gravitational lensing. According to the theory of general

[1] There is a zoomable version on the Internet, showing how small this patch of sky really is, https://web.wwtassets.org/specials/2022/jwst-smacs/

[2] The ones with diffraction spikes are foreground stars situated within the milky way galaxy. They are distant and dim also, but nowhere near the distance of the galaxies in the photo.

relativity, heavy objects significantly warp the spacetime around them, even bending the light rays travelling past.

Such lensing effects are important to astronomers. Not only can they demonstrate the power of general relativity, but they also allow us sometimes to "zoom in" on much more distant objects otherwise too dim even for JWST to see. In this picture, the oldest galaxy is established[3] to be 13.1 billion years old — forming not long after the Big Bang was theorised to have taken place 13.8 billion years ago. We could see it because SMACS-0723's gravitational field helped us, increasing the distant galaxy's apparent luminosity by many orders of magnitude.

In another similar JWST image after this one, galaxies even farther away have been reported. The reddest one yet, GLASS-z13, clocks in at just 329.8 million years after the Big Bang. Due to the expansion of the universe, it has a present-day distance of 33 billion lightyears away from us. Such numbers provide long-awaited tests on our cosmological theories regarding the organisation of structures in the universe — when and how galaxies form out of the shimmering afterglow of the Big Bang, guided by dark matter or exotic physics we do not yet understand.

Lastly, when the Hubble Space Telescope photographed SMACS-0723, it took almost a week to gather enough light to make this image. JWST only took half a day, and reached a much higher image quality. I have prepared an interactive comparison web app you can play with at fwphys.com/jwsts-first-color-image/.

Image of Stephan's Quintet by NASA from Flickr.

02. Stephan's Quintet (290 Million Lightyears From Earth)

Named after its discoverer, French astronomer Édouard Stephan (1837 - 1923), the "Quintet" is four galaxies locked in a collision course, with the fifth one (NGC 7320) much closer to earth (40 million light years) and just photobombing. Out of the five images released, this is the one closest to my research area as it looks into the intricate matter of galaxy mergers, and provides many exciting prospects.

The timescale of a galactic collision is justifiably beyond human comprehension. Though every star and jet of gas in this picture is moving at an astonishingly high speed, over the span of thousands of human lifetimes, everything will look the same, frozen in a voyage across the vastness of space. Dynamically, we will not see the quintet reach its final act until billions of years in the future, when the galaxies are so thoroughly stirred up by each other, that they form a big elliptical galaxy, and their supermassive black holes eventually coalesce.

[3] Accompanying this image, the JWST team later also released optical spectra of a few of the galaxies in it. Redshift can be reliably measured using the emission peaks of hydrogen. This was a very difficult task before JWST.

While we won't be around to witness any of this, clever use of instrumentation aboard the JWST already provides us with much information about the fascinating array of processes that take place during a galactic merger.

The galaxies participating in the cosmic dance are referred to by astronomers as Hickson Compact Group 92 (HCG 92). Each of the four galaxies has a supermassive black hole in its centre, dominating the dynamics. Three of them are already so close to each other that long tidal tails, streams of stars and gas, can be seen ripped from their disks, interweaving with each other.

Thanks to JWST's ability to observe in infrared, piercing through the shrouds of galactic dust, astronomers are given an opportunity to see in unprecedented detail how galactic collisions stir up gas and trigger the birth of new stars. Then, using the integral field unit (IFU), which effectively takes a spectrum of every pixel at the same time, JWST was able to produce magnetic resonance images of galactic structures, not unlike the technique you see in modern medical imaging. This allows astronomers to access a rich array of information, including the individual distribution of certain chemical compounds.

In addition, one of the member galaxies of HCG 92 harbours an active galaxy nucleus, driven by a very energetic central black hole. It is estimated to weigh 24 million solar masses, and emit radiation at 40 billion times our sun's output power. JWST imaged the hot gas near the black hole and measured the velocity of bright outflows in a level of detail never seen before. This provides important insight into the properties of a supermassive black hole.

The imaging of NGC 7320 is not futile either. Thanks to its closer distance to earth, JWST was able to resolve its structure to an impressive extent, identifying individual stars, its bright core, and mapping the distribution of gas — star formation material. On the day of the image announcement, I remember seeing a tweet from a colleague in the US who works on galactic modelling. "It looks just like the simulations!" he commented.

Image of Cerina Nebula by NASA from Flickr.

03. Carina Nebula (8500 Lightyears From Earth)

One of the "tourist attractions" within our galaxy, the Carina Nebula is the largest nebula visible in the southern night sky. It is part of the open star cluster NGC 3324.

In the eye of JWST, the gaseous layers looked like the side of a mountain, and newly formed stars were sprinkled onto the rock like diamonds. Of course, the heights of the hills are measured in lightyears, and the stars are all still very far apart.

The properties of these new stars, their number, masses and chemical composition are all of the research interest in astronomy today. Furthermore, JWST will not only study how galactic gas clouds give rise to new stars, but how these stars shape the gas clouds in return, the back-reaction. The intricate structures lining the expansive cliffs of gas are not only a snapshot of its innate dynamics but also profoundly influenced by the radiation and stellar winds of newly birthed stars nested within such a galactic nursery.

Image of Southern Ring Nebula by NASA from Flickr.

04. Southern Ring Nebula (2000 Lightyears From Earth)

In a poetic dual to how the previous two pictures were about stellar births, this one is a stellar funeral.

The southern ring nebula, NGC 3132, is located in the constellation Vela. It is a planetary nebula[4], the result of a series of bursts when a dying star gradually loses grasp on its outer shells, retaining only its core to become a white dwarf, a stellar remnant.

The southern ring nebula has been extensively studied for decades, and the new imagery shows the nebula's central white dwarf in greater than ever detail. In addition, the binary nature of the system is confirmed, as another star closely bound to the white dwarf is also captured in this image. It's of interest how the two stars shaped the nebula's structure together.

Often described as a pool of light, its glow is driven by the remaining white dwarf's intense ultraviolet radiation and stellar winds. As the white dwarf cools and the gas continues to expand, this structure will eventually lose its shape and colours, mixing with other galactic materials to give rise to the next generation of stars.

As a surprise to astronomers, to the left edge of the nebula is another case of cosmic photobombing. JWST was able to identify a far-away galaxy that faces us perfectly edge-on. Such occurrences are rather rare in the night sky, and are a meaningful addition to our stash of galactic profiles.

[4] The name "planetary nebula" is a historical artefact as the early telescopes could only roughly resolve their shapes, mistaking them for planets in the solar system. We now know that they have nothing to do with planets. In particular, the southern ring nebula is about half a lightyear wide.

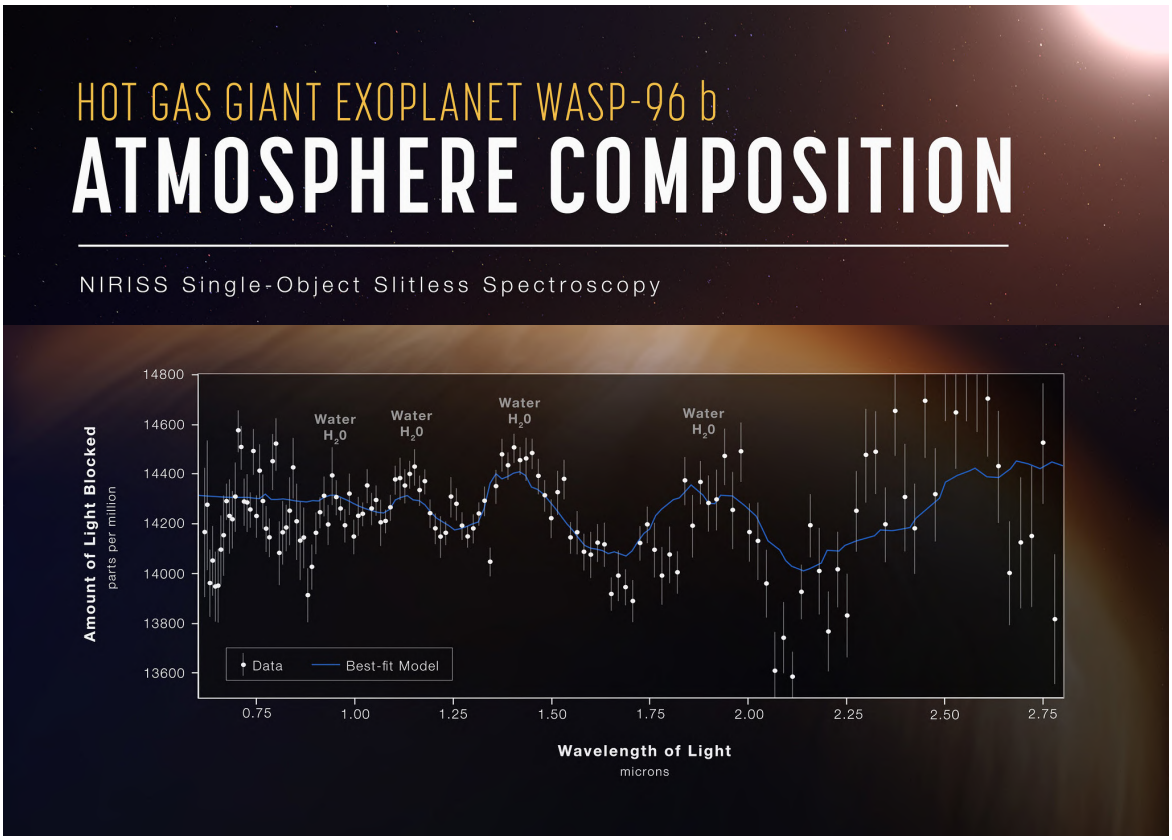


Figure 1: Hot Gas Giant Exoplanet WASP-96 b Atmosphere Composition. NASA's image retrived from Flickr.

Atmospheric Spectrum of WASP-96b (1150 Lightyears From Earth)

For many people browsing the image release on the NASA website, this one might have been the confusing outlier. "Where is the visual?" "What is this curve?"

In short, this image is the most detailed near-infrared transmission spectrum of an exoplanet atmosphere humanity has ever produced.

When the planet moves in front of its parent star, it partially blocks the starlight reaching us, and the planet's atmosphere's chemical makeup can be measured via transmission spectroscopy.

Discovered in 2013 in the Wide Angle Search for Planets project, WASP-96b itself is quite unlikely to harbour life. Categorised as a "hot Jupiter", it has a similar mass to saturn ♄ and encircles its sun-like parent star once every 3.4 Earth days, at a distance of only 11% Mercury's orbital radius. Such an extreme set of orbital characteristics means it is permanently tidally locked to its parent star, with the bright side reaching temperatures upwards of 1000 °C. However, this also provides an advantage to JWST with regards to technical demonstrations: it does not need to wait around for an observation window of WASP-96b, and measurements can be repeated rather quickly in a matter of days.

This JWST image also provided key insight into an ongoing debate. Owing to the planet's uniquely sharp sodium absorption lines, some prior literature argued that this planet is without clouds. However, using a range wider than previous instruments, JWST found unambiguous signatures of water, indications of haze, and evidence of clouds that were thought not to exist based on prior observations.

The spectroscopic range of JWST is particularly suited to look for atmospheric chemicals such as water, oxygen, methane, and carbon dioxide. Several dozen planetary targets, from giant planets to small Earth-like rocky planets, are scheduled for observations. The ability to quickly and reliably produce such atmospheric spectra will be an important tool to aid our future search for extraterrestrial life and habitable planets.

Closing Remarks

At midnight on 26 December 2021, I watched James Webb Space Telescope launch out from French Guiana live on TV. I set up a camera beforehand to record my reactions, wanting to give a little speech marking the moment. In reality, I found myself at a complete loss for words as the Ariane rocket lifted off, and I froze in reverential silence.

With its scale and duration, and of course the final cost of 10 billion USD, the JWST is an awe-inducing mega project, and I pay my utmost respect to the scientists and

engineers who worked on it. I remember reading about the James Webb Space Telescope, then "projected to launch in early 2006," when I was just a school pupil. Between then and the eventual successful deployment, it — we — despite a mixed bag of emotions and experiences over the intervening years (division, warfare, economic collapses, environmental disasters, disease outbreaks, and so on), we have persisted.

The telescope is both a witness and a fruit of a time not without problems here on the ground. Although it will probably not send back any quick answers from up in space, it will push the human race forward.

In one of author Cixin Liu's short stories, 朝闻道[5], an advanced civilisation placed monitors on planets with intelligent life, to raise alarms in case one world quickly developed technology powerful enough to destroy the universe. When the aliens eventually knocked on the door of humanity, people asked them when the alarm was raised:

"Was it when we first detonated nuclear weapons?"
"Was it when we started radio broadcasts?"
"Was it when we invented controlled flight?"

"No," the aliens said, bringing up a hologram of the Eastern African plains 370 thousand years ago, upon which a few shadows stood still in the landscape veiled in darkness.

"Here. A caveman looked at the night sky for too long, above our safety threshold. This is what triggered our alarm."

Humans are a curious bunch on our humble planet and much of our ability to shape our world roots in our collective pursuit of wonder. It is thus of my belief that the successful beginning of the JWST mission is a milestone in our history.

Our remote descendants will recount this year, these first results, with profound excitement and veneration: how the JWST first opened our eyes to so much of the cosmos so long hidden, how it inspired so many questions never asked before, and how it marked the beginning of our species' eventual conquest of spaces.

Notes on False Colour Images

There are perhaps two kinds of casual astronomy readers, with very few in between: those who assume the universe appears to the human eye like the "space photos" above, and those who categorically dismiss any such images, saying "they are all artificially synthesised anyway." Setting aside the problem of how little light the human eye can capture compared with specialised sensors, the colours themselves are a subtle subject.

To me, it is not redundant to always stress that astrophysical images are presented in "false colour" — so-called because the Red, Green, and Blue channels that make up an image are used to represent information measured originally in other frequencies (colours) of light.

The JWST, for example, owing to how far into the history of the universe it is designed to look and also to reduce extinction effects due to dust in our own galaxy, is an infrared instrument, detecting light with wavelength between 600 to 28000 nanometres. Compared with the human eye's preference, 380 to 700 nanometers, there isn't much of an overlap.

Well, our vision has evolved for a long time for the express goal to suit our habitat, some lush grasslands on a tiny planet, lit by an ordinary G-type "yellow-white" star. It can then be argued that the universe has no obligation to mind such innate limitations of ours, and the use of false colours is a smart compromise when researching the universe's structures and dynamics. Therefore, some conversion methods were employed by scientists to visualise the officially published JWST data, and you can even develop your own false colour schemes to visualise the same data differently!

In summary, we cannot see the universe like in the images with our own eyes, ever, but it does not make the visualisations we produce with our instruments and computers any less valuable and impressive.

You-Rong F. Wang - PhD, Physics

FW is a third-year doctoral candidate at Auckland Cosmology under the supervision of Prof. Richard Easther. While not an astronomer by trade, he resonates with modern astronomy's fundamental drive to find humanity's place, in space, and in time.

The author photo is him with a rocket launch photo he took in East Cape, published in the NZ Herald in June.

[5] The story title is hard to translate directly as it is taken from a Confucius quote, "Should one learn the universe's way in the morning, and die in the evening, there is no regret."

I am in the process of making an English version with the title "Morning. Truth." You can see the draft here, fwphys.com/zwd_ch1/

Going Cuckoo: Parasites of the Avian World

Ella Speers

Mother Nature is capable of remarkable phenomena across every biosphere, including vivid and emotive displays, colourations, diversity and interactions. However, a newly hatched fledgling pushing intact eggs out of its own nest is a sight to behold.

Cuckoo birds, *Cuclidae*, are parasites scorning the systematic operation of nature. Through years of evolution manifesting into cheating tactics, they have freed themselves from the cost of parental care by inflicting this on a host species instead. A cuckoo will lay an egg in a host species' nest when vacant to trick it into raising its young as part of its own brood, thus escaping the energetic expense of parental care.

However, nature is not that straightforward. The cuckoo's cheating tactics are mirrored by the host species' own evolutionary leaps in an attempt to rid itself of the parasitic cuckoo and the expense of raising its young. It is a cyclical process, a typical pattern in nature. Over periods of evolutionary time, the cuckoo will evolve an adaptation to trick the host, the host will develop a defence to block this, the cuckoo will create another adaptation, only to again be overcome by the host, and on the cycle goes. These rapid and intensive cycles of co-evolutions by parasite and host in response to selection pressure from the other are the epitome of an evolutionary arms race [1].

Cuckoo Trickery Versus Tuning

The cheating mechanisms that cuckoos use to inflict a host bird into raising its own young have earned them the title of obligate brood parasites. This parasitism has evolved independently three separate times within the cuckoo family [2].

The parasitic adaptations that a cuckoo uses to exploit its host are a form of either trickery or tuning.

Cuckoo trickery includes an exhaustive list of remarkable adaptations that have arisen to overcome host defences, such as host-egg mimicry and developing stronger egg shells that are resistant to damage by the host. Trickery ultimately aims to evade the hosts' defences and to trick the host into raising the cuckoo egg as one of their own [2].

In comparison, tuning strategies ensure that the cuckoo egg and subsequent chick development are suited to the host species' life history strategies to give it the best chance of survival [2]. A range of specific adaptations is required to ensure cuckoo development is conducive to the host's niche, such as its incubation and provisioning strategies, which have evolved to suit the host's life history, not the cuckoo's [2].

Cuckoo Trickery in Accessing Host Nests

The first example of trickery exhibited by a cuckoo is exhibited by its access to hosts' nests. A female may invest a significant amount of time observing a host bird from a concealed perch [2]. This will give the cuckoo insight into how the host behaves, including its usual feeding patterns and when the nest is not guarded.

Raising parasitic young is extremely expensive as it reduces the clutch size and success of the fledglings of the host's brood [3]. To reduce the chances of their nests being seen and therefore exploited, host species employ a range of strategies which may include nesting further from sites where cuckoos have been seen to cryptically perch [2], concealing their nests [4], secretive behaviour, or unpredictable laying; methods which make timing the parasitism difficult for the cuckoo. Perhaps the most elaborate method of avoiding cuckoos, hosts may alter their nest architecture by narrowing the entrance tubes into their nests, so the bigger cuckoos will struggle to enter [5].

Host Nest Defence

A host may attack an approaching cuckoo through mobbing [2]. A previous study by Welbergen and Davies [6], shows that hosts who mob approaching cuckoos more aggressively were less likely to become parasitized, giving hosts an incentive to attack intruders they recognize as cuckoos.

Cuckoos aim to remain as cryptic as possible, as other hosts in the area will increase their attendance at their nests and rates of egg rejection when cuckoos have been identified in their areas [7], hence cuckoos may be inclined to avoid species they remember as being strong mobbers to avoid injury risk and attracting predators or other brood parasites [8].

To overcome hosts' nest defences, cuckoos employ secretive behaviour and rapid laying [2]. They also benefit from plumage that resembles predatory hawk species [9], as predator resemblance allows cuckoos fitness benefits through attack avoidance by hosts [10]. Furthermore, to counter the ability of visual recognition that host species may possess, some cuckoo species have polymorphic

female plumage – the existence of two or more different colour morphs over different time periods. By employing this strategy and essentially changing their appearance, cuckoos become unidentifiable to hosts and can therefore exploit hosts' resources to raise their young.

Egg Trickery

While cuckoo trickery for access to host nests shows immense strategic evolution, cuckoo egg trickery is an even more complex and sophisticated mechanism. Host adaptations (egg rejection) select for parasite resistance (egg mimicry) in an intricate co-evolutionary arms race [11]. The similarity of eggs between the common cuckoo and those of hosts was first noted in the mid-18th century [12]. Research since this period has revealed that some species can recognize their own eggs. In a nest of eggs, a host's egg may serve as a reference for the egg type that is the correct one (its own), and hence provide a template for deducing which are foreign [13].

Species of birds with no history of cuckoo parasitism showed no rejection of foreign eggs, as demonstrated in Davies and Brooke's 1988 study [7]. In comparison, previous hosts of cuckoo parasitism did reject eggs that were unlike their own. Davies and Brooke here show that egg rejection by hosts evolves in response to cuckoo parasitism.

Conversely, but also contributing to the arms race of evolution, cuckoo egg mimicry evolves because of host egg rejection [2]. For example, reed warblers (*Acrocephalus scirpaceus*) reject eggs that differ from their own, so their cuckoo parasite produces a mimetic egg. Strengthening this concept but through the opposite mechanism, dunnocks (*Prunella modularis*) do not discriminate on different eggs; hence, their cuckoo host lays a non-mimetic egg in these nests.

Cuckoo Chicks Favour Their Own Survival

Some cuckoo species will eject the host's eggs or kill the host's young to enhance their own survival success [14]. While having an egg size that closely matches the size of the host's eggs, these cuckoos, known as ejectors, parasitize hosts that are smaller than themselves to allow a newly hatched cuckoo to push the unhatched host eggs out of the nest [14]. Ejector cuckoos have, therefore, evolved a smaller egg for their body size to facilitate this phenomenon. Darwin [15] suggested the small egg size was advantageous in both deceiving foster parents into thinking it was their own egg, and hatching within a shorter period to promote the pushing of other unhatched eggs out of the nest.

Chick Trickery

It has been a great mystery to zoologists as to why hosts of cuckoo parasitism exhibit discrimination against eggs unlike their own, yet some will accept a cuckoo chick upon hatching [2]. In species where the cuckoo is a non-ejector and is raised alongside the host's brood, this is especially hard to understand, since a cuckoo chick tends to be larger and have a different gape flange colour when compared to the host's fledglings. These two cues of size and colour are precisely what is employed in egg discrimination [7], so it is difficult to understand why these cues cannot be used to differentiate between chicks too. A theory for the acceptance of chicks, proposed by Davies and Brooke [7], is that eggs look the same during the incubation period. In contrast, chicks change dramatically in appearance from day to day. Identifying a foreign chick may pose a challenge in a clutch of constantly changing chicks.

In hosts that do reject foreign young, co-evolutionary theory accurately predicts that cuckoo parasites have evolved a visual mimicry of the host's chicks' nestling down, skin colour and gape flanges [2] that are employed to prevent cuckoo chicks from being rejected.

Cuckoo Tuning to Host Life Histories

Tuning of a cuckoo egg and the subsequent chick is a recent proposal that requires more research. Current findings suggest that tuning first begins with host choice, explicitly finding a host that has a suitable size, diet, and nest type for a cuckoo chick. For ejector cuckoo chicks, the nest cannot be too deep to prevent the successful ejection of the host eggs [16]. Parasitic cuckoos are likely to need cognitive ability to allow them to remember the spatial and temporal availability of suitable host nests [17], hence females of the Molothrus species exhibit a larger hippocampus region than males [18].

A suite of adaptations ensures cuckoos hatch before the host's eggs so that ejectors can expel them from the nest. For non-ejectors, hatching first allows a head-start in development, and hence a greater chance of out-competing host chicks [2].

In cuckoo chicks, tuning requires a further suite of adaptations that differ from the egg's. These will vary, depending on whether a chick is an ejector.

In ejectors, the cuckoo is raised alone and receives all the food its host parent brings to the nest. It therefore simply needs to ensure the host brings enough food, although the

usual host-specific fledgling strategies of begging for more food cannot be employed, as there are no host chicks to learn these off [2]. To compensate for this, a cuckoo chick will employ extravagant begging signals to increase host provisioning, such as rapid begging [19] and wing patches to stimulate extra gapes in the nest [20].

Non-ejector cuckoo chicks can use the other chicks to solicit food, so they tolerate the host's chicks. However, they then have to compete for this on delivery [2]. Through tuning strategies, a cuckoo in a nest of host fledglings will take the most food by stretching higher, begging most intensively, and manipulating the hosts into favouring it over their own young [21].

Cuckoo brood parasitism is an extraordinary phenomenon that has fascinated zoologists for centuries. Trickery, the refined art of cheating, involves adaptations evolved to counter host defences, leading to remarkable co-evolutionary arms races in both parasite and host to overcome the other.

Tuning may allow hosts to escape parasitism through evolutionary changes in their life-history strategies as cuckoos learn them. However, these are likely to occur on significant temporal scales, and immediate behavioural defences may suffice.

Obligate brood parasitism yields an interaction between two species that is a wonder of the animal kingdom.

Ella Speers - BSc, Marine Science, Biological Sciences

Ella is a third-year student majoring in Marine Science and Biological Science. She is extremely passionate about counteractive measures against climate change, and marine ecology. Her area of interest is in restoration and conservation of marine habitats. She cannot wait to make a difference in fragile ecosystems.

Voluntary Speed restriction in Tīkapa Moana; saving endangered Bryde's Whales

Danielle Lucas

Bryde's whale in the Hauraki Gulf. Photo by the author.

Sixteen Bryde's whales are alive today that would have otherwise succumbed to vessel strike in Tīkapa Moana had the Hauraki Gulf Transit Protocol not been introduced in September 2014. Many individuals are stunned to learn that we have some incredible marine species including Cetaceans such as Brydes whales (*Balaenoptera brydei*) and common dolphins (*Delphinus delphis*) in our very own backyard, Tīkapa Moana (Hauraki Gulf), Tāmaki Makaurau.

Currently Bryde's whales, pronounced 'broo-des' are endangered, classified as Nationally Critical with only an estimated 135 left in the Tīkapa Moana population. Bryde's whales are a year-round resident in the gulf as part of only a handful of global whale populations not to partake in migrations.

Unfortunately, it was discovered that ship-strike by vessels ≥70 m were killing on average 2.4 whales per annum in Tīkapa Moana, and between 1996 and 2014, 44 Bryde's whales died in the Hauraki Gulf [1]. "85% of whale deaths in the gulf were definitely or most likely the result of injuries sustained during a collision" [1]. In a small, isolated population of only 135 individuals, this rate of mortality is unsustainable and would likely contribute to a collapse of the population if protocols were not put in place to interfere. Lethal ship strike is a relatively new example of human-wildlife conflict and is especially threatening to large cetaceans. Bryde's whales typically spend more than 80% of their time in the top 10 metres of the ocean [1]. This makes them incredibly susceptible to strikes as the average draft (height of the part of the ship which is underwater) of a vessel is about 8.4m. A vessel sailing at 15 knots (around 28 kmh^{-1}) has an approximately 80% chance of killing a whale when they collide, whereas at 8.6kt (~16kph^{-1}) this was reduced to 20% [4]. When a vessel is travelling at a speed above 10kt (~18.5kph^{-1}), the potential risk of ship strike is measurably increased.

The Hauraki Gulf embayment has an area of around 4000km^2. It is the gateway into Aotearoa's largest port, Ports of Auckland, and there are three major shipping channels: Colville channel, Jellicoe channel, and Craddock channel, whereby vessels will enter the gulf en route to the port (Fig. 1) [2].

In September 2013, Ports of Auckland introduced the Hauraki Gulf Transit Protocol for commercial shipping. This

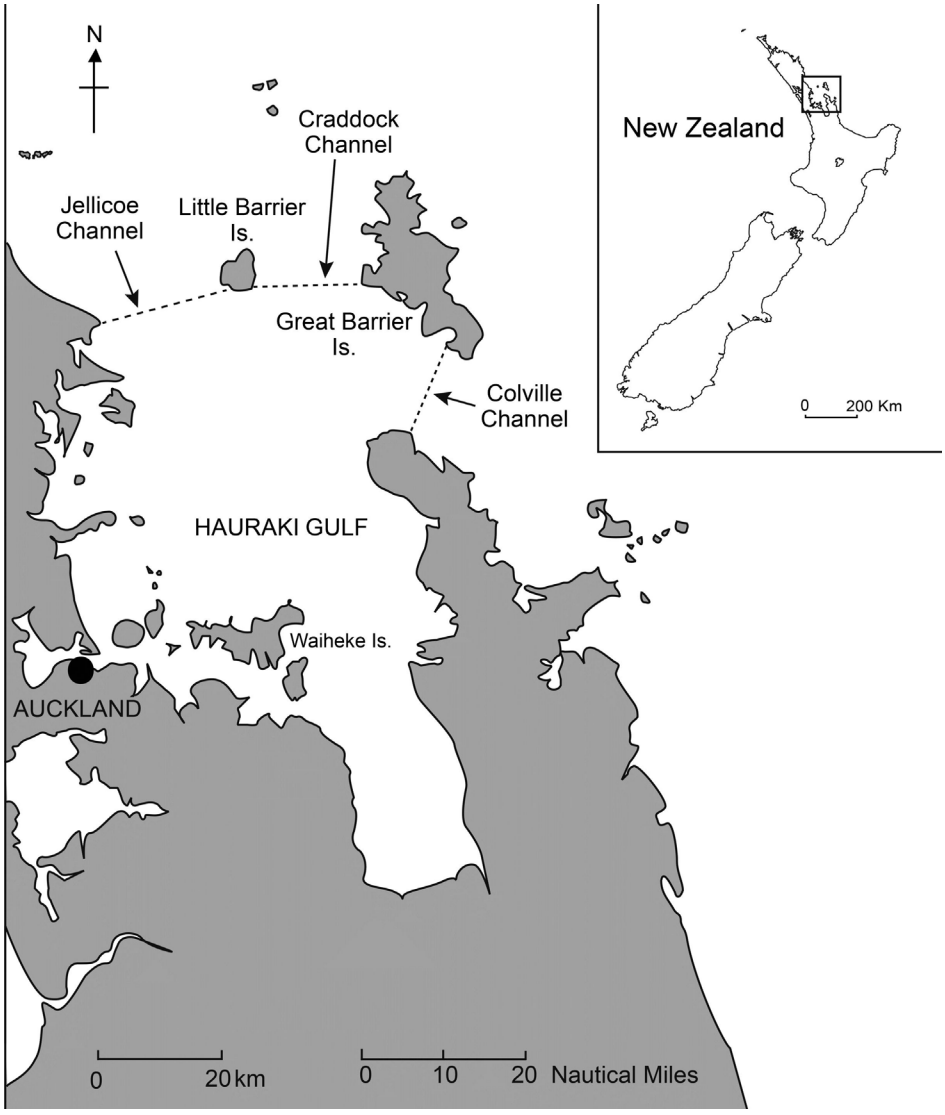


Figure 1: Map and location of the study site, the Hauraki Gulf. The Ports of Auckland is located within Auckland city, shown by the black dot. Dotted lines indicate where the voluntary Transit Prorocal comes into effect

is a voluntary protocol in which vessels slow down to 10kt as they travel throughout the gulf. Mandatory measures require the lengthy formation of laws and regulations and enforcement, which takes time, money and resources [2]. In an interview with Dr Rochelle Constantine, a researcher at the Institute of Marine Science, University of Auckland, and a crucial member of the research team whose work contributed to the implementation of this protocol, Dr Constantine states that in regard to this voluntary speed reduction, "I'm really proud that every day the ships and their crew go slow. Even though many of them have no idea why, it's just the new normal."

Bryde's whale population distribution in Tīkapa Moana was mapped from October 2014 to September 2016. The shipping traffic was also monitored in the gulf from October 2014 to September 2016, using Automatic Identification System (AIS) shipping data which provides information about a vessel according to a unique Maritime Mobile Service Identity (MMSI) number (Fig. 2).

The median speed of ≥70 m long vessels transiting through Tīkapa Moana was 10 kt in 2014–2015 (range = 1–27 kt; IQ = 9–12.4 kt), and 10.2 kt in 2015–2016 (range = 1–26.9 kt; IQ = 9–11.7 kt); these speeds represent a 25% decrease from the 13.2 kt reported from July 2012 – June 2013 prior to the implementation of the Transit Protocol [1] (Fig 3).

At lower travel speeds through the gulf, the risk of death via direct strike or hydrodynamic forces that pull the whale toward the ship are considerably reduced [3]. The voluntary Hauraki Gulf Transit Protocol recommendation to reduce speeds to ~10 kts directly resulted in a ~25% decrease in ship speeds, thereby nearly halving the threat of lethal ship strike to Bryde's whales within two years of implementation [1]. Since the Protocol was introduced in 2013, there has not been a single report of a Bryde's whale death in Tīkapa

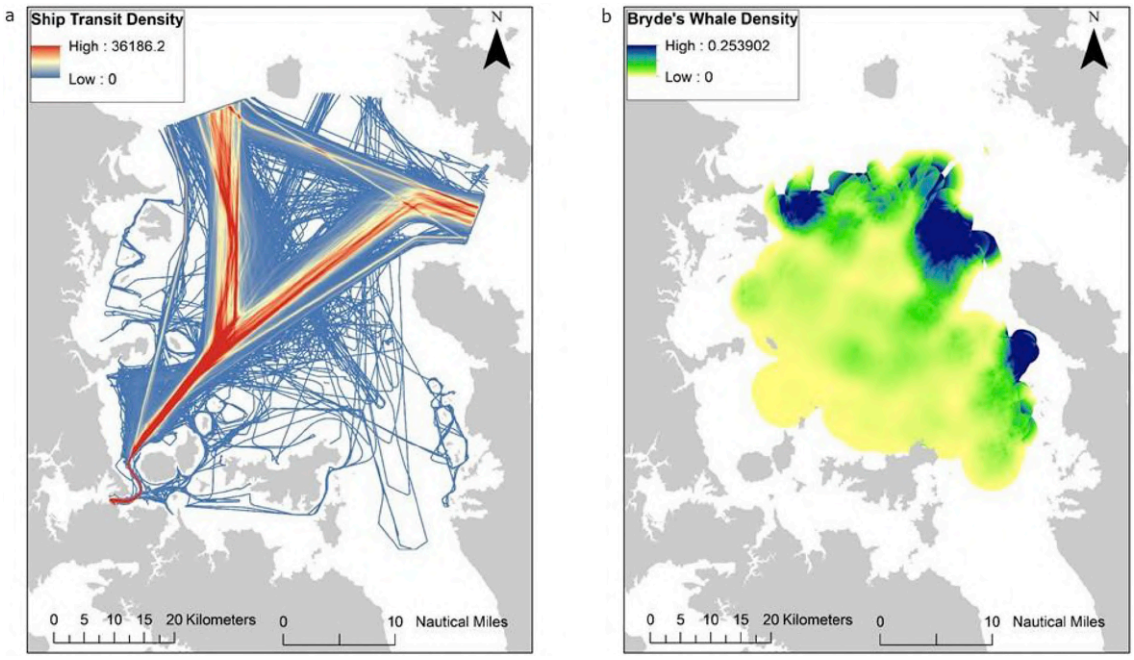


Figure 2: a) Density of ship transits per 100m^2 grid cell with a search radius of 100 m. b) Sighting per unit effort (SPUE) of Bryde's whales in the Hauraki Gulf, October 2014 - September 2016. The values represent the chances of seeing a whale within a 1,500 m radius.

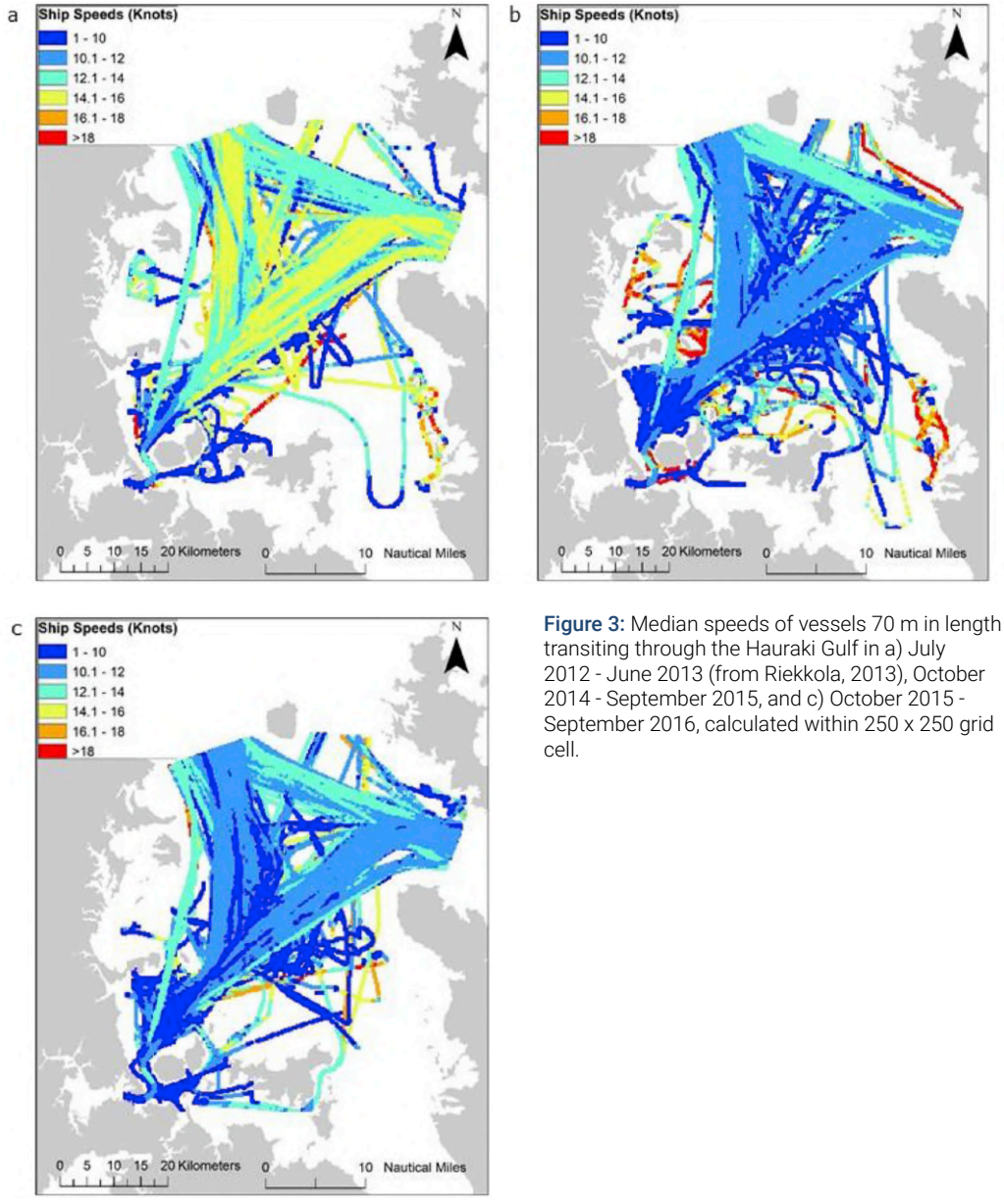


Figure 3: Median speeds of vessels 70 m in length transiting through the Hauraki Gulf in a) July 2012 - June 2013 (from Riekkola, 2013), October 2014 - September 2015, and c) October 2015 - September 2016, calculated within 250 x 250 grid cell.

Moana caused by ship-strike. No vessel has reported on any collisions resulting in injury either. "As long as they continue to go around that 10kts, the risk to the whales of vessel strike mortality is very low," says Dr Rochelle Constantine.

Effective environmental management is imperative to decreasing the threats to biodiversity [3]. When asked how it feels to know you've made a positive impact on the population of Bryde's whales in Tīkapa Moana Dr Rochelle Constantine responded: "It was really a collective that found this solution, the thing I think was most important, for me as a scientist, is that it was science informed. Conservation solutions are never about one person, and we made a real conscious decision in the beginning to have an inclusive process, bringing lots of people together who saw this issue through different eyes, industry, legal, scientists, government and Mana Whenua. I'm proud of us, and it was a really good example of how to get conservation wins."

Dr Constantine mentioned that there will be an abundance estimate of the whale population done next year, a decade since the Hauraki Gulf Transit Protocol implementation. "There are at least 16 whales alive now that would have been dead, had ships continued with their previous speeds. We are anticipating that the abundance estimate will go up." The Hauraki Gulf Transit Protocol is a great example of how a small social change can garner incredible results. The next population estimate for Bryde's whales in Tīkapa Moana will be an imperative statistic that showcases the capacity for effective environmental management by users of the gulf. An increase in the Bryde's whale population will be an absolute win for conservation efforts. There is no end date on the reduced-speed protocol, and it is now the new normal when entering the gulf. This effort has made a lasting impact on the health of Bryde's whale populations in Tīkapa Moana.

Danielle Lucas - Bsc, Marine Science, Biological Sciences

Danielle is a second-year student majoring in Marine Science and Biological Science. She is incredibly interested in cetacean and crustacean ecology and conservation. She plans to do a Masters in Marine Science after undergrad. She is a passionate kaitiaki and prioritises Mātauranga Māori in all areas of study and life.

The Silent Epidemic

Milly Darragh

Endometriosis is a chronic condition that affects 10% of all women and girls of childbearing ages, yet there is still an average wait of over nine years before being diagnosed by a health professional from when symptoms are first presented [1].

I got the chance to sit down with Dr. Wynn-Williams (an expert gynaecologist specialising in endometriosis) and Meg (another woman with endometriosis) to reflect on experiences with this disease, including my own.

What is Endometriosis?

Endometriosis is a chronic inflammatory disease defined by endometrial-like tissue found outside the uterus [3]. This tissue hormonally reacts the same way regular endometrial tissue does — swelling, bleeding, and attempting to shed itself. This leads to nasty symptoms such as severe pain, dysmenorrhoea (painful periods), dyspareunia (painful sexual intercourse), infertility, and symptoms relative to the location of any lesions [2]. However, endometriosis can also be asymptomatic as the severeness of symptoms does not always correspond to the severity of disease [2].

Endometriosis is prevalent worldwide and in Aotearoa with 10% of all females assigned at birth experiencing suspected or diagnosed endometriosis. In 2022, an average diagnosis delay of over nine years in Aotearoa was found, being from when a patient first described apparent symptoms of endometriosis [1].

There is no cure for endometriosis, it is a lifelong chronic disease.

Do I Need to See a Doctor if I Have Any of These Symptoms?

"Whenever your pain stops you from completing and enjoying daily activities in your life," says Dr. Wynn-Williams [3]. Periods are not supposed to be painful.

Why Does it Take So Long to Get a Diagnosis?

"There are two factors, with the patients themselves and healthcare. Endometriosis is a silent disease, so many people think it is normal to have a painful period that stops you from doing what you normally do," says Dr. Wynn-Williams [3]. Contributing factors that delay a diagnosis on behalf of the patient are patient-defined factors. These may include awareness and understanding of what reproductive diseases are, normalisation of abnormal symptoms, and genetic components. There are significant studies linking endometriosis with hereditary factors, making it easier for families to normalise the symptoms [6]. If your immediate family has endometriosis, you are 7-10 times more likely to be diagnosed [7]. This disease is incredibly common, and many women live their lives undiagnosed.

"Not talking about periods is a big reason, although this is improving and changing. For a long time this wasn't talked about," says Dr. Wynn-Williams [3]. There is still a long way to go with improving our attitudes towards periods and reproductive health, it's conversations that need to happen with ourselves, our whanau, our friends, and our communities.

"How many other girls did you know who were sick? There was no one else like me. I felt like it was my fault for being sick," says Meg. Many girls still don't talk about periods, and when we do, the negative symptoms are normalised. Often, sympathy for the cramps we all experience is the first reaction you will receive when talking about periods. Women are often told they are just unlucky to have bad periods, and that this runs in the family. The monthly pain, sickness, and agony we experience is something we are just taught to deal with.

One factor contributing to the delay is access to primary healthcare — "We know that people really struggle to get access to the right healthcare — particularly Māori and Pasifika patients," says Dr. Wynn-Williams [6]. Another significant issue is the difficulty of talking with healthcare providers, and women feeling like their own concerns are minimised by professionals.

"This is a silent disease. There is a stigma in talking about the symptoms, and people normalising the pain," Dr. Wynn-Williams explains. [3]. Access to help is another major setback for this disease with limited beds, doctors, and diagnostic tools. Many hospitals, medical practices, and reproductive health services do not have access to laparoscopic surgeries — the only way to diagnose endometriosis formally.

"I was told I was too young. I always brought it up to my GP but she dismissed me. I looked it up myself when I was 13 and went to family planning telling them. They immediately told me I was a classic case," says Meg [4]. How could a qualified doctor not take a patient with clear symptoms seriously? Meg's story is also not an isolated incident, with one study finding 90% of their participants who did have endometriosis felt disbelieved or dismissed at least once a month by either family members or health professionals [7]. This figure was also accompanied with the finding that 75% of the almost 2,000 participants were misdiagnosed with another condition (physical or mental), before being correctly diagnosed with endometriosis [7].

Furthermore, access to contraception, diagnostic investigations (limited in the public system), and access to secondary care (hospitals) were exacerbated by Covid-19. There are a lot of factors related to the delay, making it a complex issue to tackle.

How Do Māori and Pasifika Women Fare With Endometriosis?

Not a single study has been conducted to investigate the impacts, factors, or experiences of Māori and Pasifika women with endometriosis. Furthermore, no ethnic minorities have had clinical studies of endometriosis experience in Aotearoa [5]. What we do know is that Māori and Pasifika women struggle with access and diagnosis at a higher prevalence than Pākehā or other ethnicities. [2]. All studies regarding endometriosis have either disregarded the ethnic diversity within our population, or met the same ratios of minority groups in the population with participants. If we know that Māori and Pasifika women have more barriers accessing help for an already difficult disease, why is there no research investigating the prevalence and existing mechanisms in endometriosis and women's health?

Can We Improve the Delay?

The good news is yes, we can. The bad news is how long it's going to take.

The UK has committed to reducing the diagnostic delay to one year by 2030. That's right, they plan on taking eight years to make enough changes only to reduce the delay to one year, not for treatment or substantial progress to be made in alleviating the symptoms. A year is still a long time to wait for a diagnosis, and would mean there are women waiting far longer than a year. If this is all hypothetically beginning in eight years, what about the thousands of patients needing help between 2022 and 2030?

Endometriosis UK published a research article in 2020, using data from over 10,000 women who had an average diagnosis delay of eight years despite:

- 58% of these patients visiting their GP over 10 times
- 53% visiting A&E for symptoms of endometriosis
- 21% of patients visiting a doctor in hospital over 10 times

All of these occurred prior to their official diagnosis [7]. However, one of the scariest statistics published from this investigation was 90% of these women wanting psychological support in regards to their symptoms and conditions, were not being offered any [7]. That's approximately 9,000 women who needed psychological help and were not given it — just from this selected study.

Australia has poured $58 million money into research, community, and primary and secondary healthcare education. This includes the funding of expertise and multidisciplinary pain centres as well [2].

"There needs to be a mindset change in the way we deal with endometriosis and the traditional model, we need to recognise endometriosis as a chronic disease. There is no cure, and we need to start interdisciplinary care early on." Dr.Wynn-Williams says [3].

Interdisciplinary care refers to multiple specialists or backgrounds of health professionals, using different elements and models of care to aid an individual [8]. Dr Wynn-Williams described an example of interdisciplinary care for endometriosis as a combination of physiotherapists, psychologists, pain specialists, dieticians, and others [9].

What Are We Asking For?

Funding. Funding for education, awareness, training, accessibility, treatment, research, and surgeries.

In 2017, the Australian government offered a formal apology to endometriosis patients as a part of their endometriosis intervention program. This saw $53 million in input to treat, diagnose, and care for dealing with endometriosis [2]. This apology started when a group within parliament formed — parliamentary friends of endometriosis — by women in parliament themselves who were affected by endometriosis [10]. This led to communication between support groups and parliament, and eventually, a public apology was made. "The big thing about public apology is awareness" — something we are so desperately trying to accomplish [3].

There are now calls from patients, professionals, and allies for a public apology to be made by the New Zealand Government. With as many people living with endometriosis as people with diabetes [1], would you ever doubt someone who told you they had diabetes the same way you would doubt someone with endometriosis?

Why has it taken so long for progress to be made? Dr Wynn-Williams is currently calling for an action plan from the New Zealand government to apologise for the lack of care that endometriosis sufferers have endured for years.

The average diagnosis delay of both type 1 and type 2 diabetes is 2.3 years in the UK, a disease occurring at the same prevalence of endometriosis [8]. Interestingly, the main factor contributing to the delay of a diabetes diagnosis was being female [9].

This brings us to the very complex (yet simple) question; Would things be different if endometriosis wasn't a disease that only affects women?

How Does Fertility Interplay With Endometriosis?

One of the other main issues close to my own heart is the prioritisation of fertility over the quality of life. Endometriosis can affect fertility, usually in the later stages. However, preserving fertility and the ability to give birth over a woman's health and quality of life is a horrid phenomenon that is far too common. Treatments like hysterectomies (removal of uterus) or oophorectomies (removal of ovaries) can be beneficial for some patients, but of course these have impacts on a patient's ability to conceive. These treatments are rarely used, and will usually have the prerequisite of already being a mother, and knowing that you do not want to conceive anymore children. This means young women, single women, women who do not want children, are often not given as many choices in their treatment for endometriosis in comparison to women who have already had children, so that their fertility can be preserved. Does it not feel rather unnecessary to limit the treatment options of a disease that has few treatments to begin with?

I first started treatment for endometriosis at age 17, and I can't even count the amount of times I had been told I can't have certain treatments that may benefit me because, "What if you want to have kids later on?" After years of dealing with this brutal disease, when I tell people I have endometriosis the majority of people ask about if I can still conceive children. It is incredibly frustrating having to justify your illness to doctors, yourself, as well as those around you. Most young women care a lot more about their pain and physical symptoms instead of whether they can still have kids.

"I was 13 when I was first told I was infertile and could never have kids. What 13-year-old needs to be talked to about her fertility? I was in pain." says Meg [4].

"Endometriosis is not cured by pregnancy," Dr Wynn-Williams explained to me [3]. There is a massive misconception that bad periods and women's health issues can be solved by pregnancy. "I am a firm believer that you should only consider pregnancy when you are ready to bring a child into the world, not to treat the pain."

Historically, endometriosis was thought to primarily affect "career-driven women," who did not conceive children. The disease supposedly arose from these women experiencing more menstrual cycles over their lifespans, as they did not become pregnant. This led to the damaging prescription of pregnancy to solve symptoms of endometriosis [10]. Of course, this is completely false. For most of history this was the perception of this disease, which has contributed to the victim blaming culture that is still present within endometriosis and women's health in general.

Yes, infertility can be an issue, with 30% of endometriosis sufferers dealing with fertility issues [5]. Interestingly though, 50% of women who struggle with infertility are later diagnosed with endometriosis [5]. There is currently no widely accepted understanding of how fertility and endometriosis interact, or their mechanisms [6].

It is definitely important to be aware of the interactions between endometriosis and fertility, however it can be a huge issue when fertility becomes prioritised over a patient's well being and pain. We are more than child-bearers.

"We are women, women who deal with pain, and women who deal with chronic illness." [4]

Milly Darragh - BAdvSci (Hons), Cognitive Neuroscience

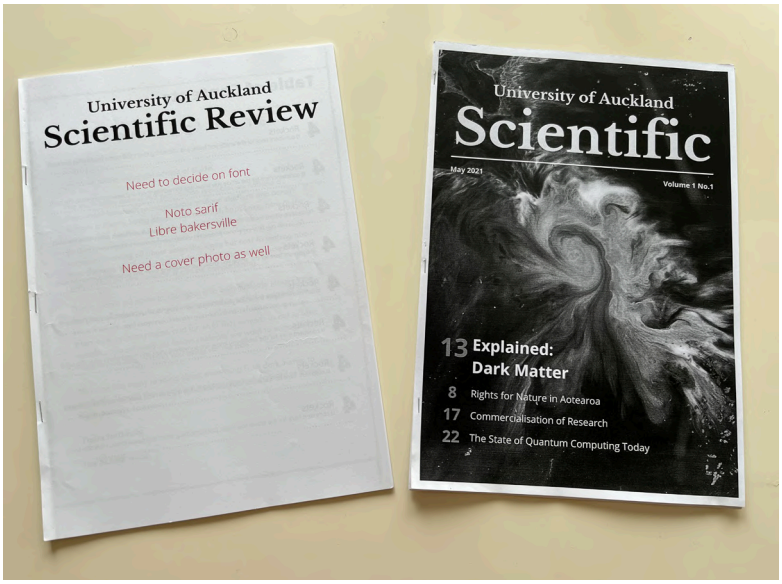
Milly is currently in her third year of undergraduate studying, with a love for neuroimaging, neuropathology, and neuroplasticity. She is very passionate about womens health, travelling, her dogs, and green tea matcha lattes.

The Journey So Far: Looking Back on Two Years of *UoA Scientific*

A common debate amongst scientists is whether the execution of an idea is more important than the idea itself. Whichever you believe in, the success of this publication is the epitome of the former. With the help of more people than we could list on these pages, the simple idea of creating a scientific publication came to fruition through many hours of dedication by countless people. As we close out 2022 with this last issue, we would like to reflect on the past two years of this publication, tell a little bit about its history, and thank the people who have supported it along its way.

UoA Scientific is an evolution of a monthly science magazine produced by the Science Students' Association in 2020 called *Moonshot*, which was led by Struan Caughey and written by Nina de Jong, Caleb Todd, and Louisa Ren, all founders of *UoA Scientific*. We realised the potential a high-quality publication could have, and in 2021 we founded *UoA Scientific* – to promote open science communication and give students an avenue to share their research and passion.

We began the club with little to no knowledge of how to produce a publication, and our execs wrote all the articles in our first edition. The first issue was designed in Canva as opposed to the much more sophisticated Adobe Illustrator we use now, and we stayed up to 4 am to complete the initial design. It was truly exciting to print out the first test copy of the Scientific the following day (see photos below), and we had a feeling that we were onto something special (If you have a copy of the first edition, hold onto it as it will become a coveted collector's item in the future!). After much debate on which type of paper to use, how to lay out the articles, and finally securing funding from the Faculty of Science, we published our first issue in May 2021 with eight articles.



First ever printed copies of *Scientific*.

The aim of the publication has always been to bridge the gap between research/thought-provoking scientific topics and students. Specifically, our goal is to give students an avenue to showcase their research to a broader audience and facilitate discussions on complex issues in science. The level of praise and excitement we received from our first issue from students and staff was surprising and encouraging. It is a testament to the passion and willingness to share ideas in the science community, something we want to empower through our publication. Many copies disappeared into student and staff offices that day.

We had always envisioned growing the club to more than five executives, and by the time we had published our first edition, our team had grown to nine. Shortly after the publishing of our first ever issue, we expanded, bringing on board Jasmine Gunton, Gene Tang and Stella Huggins. With a larger team and new execs that brought about much-needed skills, the quality of our publication improved immensely. The rest of 2021 saw some fantastic issues, exciting recognition, and a realisation that we needed more hands on deck yet again. At the end of 2021, we recruited Aimee Lew, Celina Turner and Sarah Moir.

In 2022, we continued to make leaps and bounds. Creative Director Gene, and Marketing Coordinator Aimee, both made strides in the visual design of our publication, providing original art for all of our covers this year. Our writing coordination team for 2022 (Louisa, Nina and Sarah) has also made enormous contributions in refining our guest writer process, and are continuing to refine it right up until we hand over to 2023's executive team. Our quote-on-quote leadership section (we're a flat-structured club in reality!) consisting of: Alex, our treasurer, Jasmine, our secretary, and Stella, our president — have worked to coordinate with external, and internal partners, as well as the rest of the team, to make our shared vision for *Scientific* a cohesive reality. We've just finished up the recruitment process for the future of 2023, and our recurring theme of growth continues. We can't wait to announce the team of a hefty 14 team members.

Looking back at the first issue, it pales in comparison to the quality of the publications we produce today.

This publication would not be a reality if it weren't for the countless people that have supported us over the last two years. We would like to take these last few pages of the year to thank each and every one. The publication is nothing without its writers. We firstly thank all the guest writers who have written for us about their research or passion: You-Rong F. Wang, Toby Elliot, John Bailie, Hazel Watson-Smith, Emelina Glavaš, Sophie Piesse, Liam Quinn, Kevin Stitely, Maira Fessardi, Alicia Anderson, Ella Speers, Max Dang Vu, Anne Newmarch, Lucas Tan, Sheeta Mo, Eugene In, Nargiss Taleb, Isla Christensen, Katherine McLean, Steph Claridge, Angeline Xiao, Jae Min Seo, Danielle Lucas, and Milly Darragh.

This publication would also not be possible without the help and funding from the Faculty of Science and the University of Auckland staff. In no particular order, we would like to thank:

The Faculty of Science, in particular:
John Hosking, Linda Thompson, Glenda Haines, Hana Mata'u, Duncan McGillivray, Douglas Elliffe, Grace Manabat, Holly Honeysett, Joel McGeorge, Tatiane Jacobs, Yue Zhang, and Irene van Schalkwyk.

Staff members and students of UoA, and experts who gave up their time to speak with us for interview articles:
Geoff Willmott, Cristian Calude, Rochelle Constantine, Brad Coombes, Ariel-Michaiah Heswell, and Rosie Bosworth.

Members of the UoA Library staff who aided us on our copyright journey:
Suzanne Acharya, and Berit Anderson.

The Science Students' Association for the generous and routine use of their facilities for our launch events, in particular, 2022 President Dania Shafiq.

Staff at The Auckland War Memorial Museum, Tāmaki Paenga Hira, for their mentorship and advice on developing the vision of *Scientific*:
Charlotte Milne, Ainslie Dewe, Bhakti Patel and Sarah Knowles.

We would also like to thank the outgoing execs, Struan Caughey, Stella Huggins, Nina de Jong, Louisa Ren, Celina Turner, Alex Chapple, and Caleb Todd. All have been here since the early days and have been instrumental in making this publication a reality. We are looking forward to having you back as guest writers in the future.

Finally, we want to thank you, the readers, for picking this publication up. We hope you've enjoyed reading this issue, and consider writing for us in the future!

We can't wait to see you again next year.

Sincerely,
UoA Scientific Executive Team 2021-2022

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References

Have We Got Alzheimer's All Wrong? Research Fraud Threatens Science

[1] Mayo Clinic Staff. "Alzheimer's Disease." Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/alzheimers-disease/symptoms-causes/syc-20350447 (accessed Sept. 6, 2022).

[2] O. Zanetti, S. B. Solerte, and F. Cantoni, "Life expectancy in Alzheimer's disease (AD)," Arch. Gerontol. Geriatr., vol. 49, pp. 237–243, Feb. 2009, doi: 10.1016/j.archger.2009.09.035.

[3] S. Lesné et al., "A specific amyloid-β protein assembly in the brain impairs memory," Nature, vol. 440, pp. 352–357, Mar. 2006, doi: 10.1038/nature04533.

[4] M. Goedert and M. G. Spillantini, "A century of Alzheimer's disease," Science, vol. 314, no. 5800, pp. 777–781, Nov. 2006, doi: 10.1126/science.1132814.

[5] C. Piller, "Blots on a field? A neuroscience image sleuth finds signs of fabrication in scores of Alzheimer's articles, threatening a reigning theory of the disease," Science, vol. 377, no. 6604, pp. 358–363, Jul. 2022, doi: 10.1126/science.add9993

[6] C. Haass and D. Selkoe, "If amyloid drives Alzheimer disease, why have anti-amyloid therapies not yet slowed cognitive decline?" PLoS Biol., vol. 20, no. 7, art. e3001694, Jul. 2022, doi: 10.1371/journal.pbio.3001694.

[7] D. R. George and P. J. Whitehouse. "Alzheimer's, Inc.: When a Hypothesis Becomes Too Big to Fail." Scientific American. https://www.scientificamerican.com/article/alzheimers-inc-when-a-hypothesis-becomes-too-big-to-fail/# (accessed Sept. 8, 2022).

The Sword of Damocles — Virus, Bacteria & the History of Pandemics

[1] D.T. Dennis, "Plague as a biological weapon. Bioterrorism and infectious agents: a new dilemma for the 21st century," Nature Public Health Emergency Collection, pp. 37-70., 2009. doi: 10.1007/978-1-4419-1266-4_2. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7120598/

[2] D. M. Morensa, P. Daszakc, H. Markeld, and J. K. Taubenberger, "Pandemic COVID-19 joins history's pandemic legion," mBio, vol. 11, no. 3, May/June, 2020. [Online]. Available:https://doi-org.ezproxy.auckland.ac.nz/10.1128/mBio.00812-20

[3] C. J. Duncan and S. Scott, "What caused the Black Death?" Postgrad. Med. J., vol. 81, (955), pp. 315, 2005. doi: https://doi.org/10.1136/pgmj.2004.024075.. [Online]. Available: http://ezproxy.auckland.ac.nz/login?url=https://www.proquest.com/scholarly-journals/what-caused-black-death/docview/1781593758/se-2

[4] T. H. Tulchinsky, E. A. Varavikova, "Chapter 1 - a history of public health," in The New Public Health, Edition 3., T. H. Tulchinsky, E. A. Varavikova, 2015, ch. 1, pp. 1-42., [Online]. Available: https://doi.org/10.1016/B978-0-12-415766-8.00001-X

[5] C. J. Mussap, "The Plague doctor of Venice," Internal Medicine Journal, vol. 49, no. 5, pp. 671-676., May, 2019, [Online]. Available: https://doi-org.ezproxy.auckland.ac.nz/10.1111/imj.14285

[6] C. N. Fabbri, "Treating medieval plague: the wonderful virtues of theriac," Early Science and Medicine, vol. 12, no. 3, pp. 247-283., 2007. [Online]. Available:https://www.jstor.org/stable/20617676

[7] "Plague." World Health Organisation. https://www.who.int/news-room/fact-sheets/detail/plague (accessed August 24, 2022).

[8] F. Frischknecht, "The history of biological warfare. Human experimentation, modern nightmares and lone madmen in the twentieth century.," EMBO Rep, vol. 4, no. S47-52, Jun, 2003. doi: 10.1038/sj.embor.embor849. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1326439/

[9] "Smallpox." World Health Organisation. https://www.who.int/health-topics/smallpox#tab=tab_1 (accessed September 07, 2022).

[10] J. G. Breman, "Smallpox," The Journal of Infectious Diseases, vol. 224, no. 4, pp. S379–S386., Oct, 2021, doi: https://doi.org/10.1093/infdis/jiaa588

[11] D. A. Henderson et al., "Smallpox as a biological weapon: medical and public health management," JAMA, 281(22), pp. 2127-2137., June, 1999, doi:10.1001/jama.281.22.2127.

[12] "Smallpox research." Centers for Disease Control and Prevention. https://www.cdc.gov/smallpox/research/index.html#:~:text=There%20are%20two%20WHO%2Ddesignated,%2C%20Novosibirsk%20Region%2C%20Russian%20Federation (accessed August 24, 2022).

[13] "WHO Coronavirus (COVID-19) dashboard." World Health Organisation. https://covid19.who.int/ (accessed August 29, 2022).

[14] A. A. Khasnis, and M. D. Nettleman, "Global warming and infectious disease," Archives of Medical Research, vol. 36, no. issue 6, pp. 689-696., Nov/Dec, 2005, doi: https://doi.org/10.1016/j.arcmed.2005.03.041

Conquest of Spaces — A Review of James Webb Space Telescope's First Five Images.

[1] JWST First Image Press Releases. https://www.nasa.gov/webbfirstimages

[2] Garner, Rob (2022-07-08). "NASA Shares List of Cosmic Targets for Webb Telescope's 1st Images". NASA.

[3] Naidu, Rohan P.; et al. (July 2022). "Two Remarkably Luminous Galaxy Candidates at z ≈ 11 – 13 Revealed by JWST". arXiv:2207.09434

[4] Pontoonidan, Klaus; et al. (July 2022). "The JWST Early Release Observations." arXiv: 2207.13067

[5] "Two Weeks In, the Webb Space Telescope Is Reshaping Astronomy", Quanta Magazine https://www.quantamagazine.org/two-weeks-in-the-webb-space-telescope-is-reshaping-

astronomy-20220725/
[6] Nikolov, N., Sing, D.K., Fortney, J.J. et al. An absolute sodium abundance for a cloud-free 'hot Saturn' exoplanet. Nature 557, 526–529 (2018). https://doi.org/10.1038/s41586-018-0101-7

Going Cuckoo: Parasites of the Avian World

[1] R. Dawkins, J. R. Krebs, J. Maynard Smith, R. Holliday, "Arms races between and within species," vol. 205, no. 1161, pp. 489–511, Sep. 1979, doi: 10.1098/rspb.1979.0081.
[2] N. B. Davies, "Cuckoo adaptations: trickery and tuning," vol. 284, no. 1, pp. 1–14, 2011, doi: 10.1111/j.1469-7998.2011.00810.x.
[3] M. Hauber and K. Montenegro, "What are the costs of raising a brood parasite? Comparing host parental care at parasitized and non-parasitized broods," vol. 10, pp. 1–9, Jan. 2002, Accessed: Aug. 21, 2022. [Online].
[4] C. Moskat and M. Honza, "Effect of nest and nest site characteristics on the risk of cuckoo Cuculus canorus parasitism in the great reed warbler Acrocephalus arundinaceus," Ecography, vol. 23, no. 3, pp. 335-341, Jun, 2008, doi: https://doi.org/10.1111/j.1600-0587.2000.tb00289.x
[5] S. Freeman, "Egg variability and conspecific nest parasitism in the Ploceus weaverbirds," vol. 59, no. 2, pp. 49–53, 1988, doi: 10.1080/00306525.1988.9633694.
[6] J. A. Welbergen and N. B. Davies, "Strategic variation in mobbing as a front line of defense against brood parasitism," vol. 19, no. 3, pp. 235–240, Feb. 2009, doi: 10.1016/j.cub.2008.12.041.
[7] N. B. Davies and M. de L. Brooke, "Cuckoos versus reed warblers: adaptations and counteradaptations," vol. 36, no. 1, pp. 262–284, 1988, doi: https://doi.org/10.1016/S0003-3472(88)80269-0.
[8] J. N. M. Smith, P. Arcese, I. G. McLean, "Age, experience, and enemy recognition by wild song sparrows," Behav Ecol Sociobiol, vol. 14, no. 2, pp. 101-106, Feb, 1984.
[9] R. B. Payne, "Interspecific Communication Signals in Parasitic Birds," vol. 101, no. 921, pp. 363–375, Sep. 1967, doi: 10.1086/282504.
[10] O. Krüger, N. B. Davies, M. D. Sorenson, "The evolution of sexual dimorphism in parasitic cuckoos: sexual selection or coevolution?" vol. 274, no. 1617, pp. 1553–1560, Jun. 2007, doi: 10.1098/rspb.2007.0281.
[11] J. J. Soler, J. M. Aviles, M. Soler, A. P. Moller, "Evolution of host egg mimicry in a brood parasite, the great spotted cuckoo," vol. 79, no. 4, pp. 551–563, Aug. 2003, doi: 10.1046/j.1095-8312.2003.00209.x.
[12] K. Schulze-Hagen, B.G. Stokke, T. R. Birkhead, "Reproductive biology of the European Cuckoo Cuculus canorus: early insights, persistent errors and the acquisition of knowledge," J Ornithol 150, 1–16 (2009). https://doi.org/10.1007/s10336-008-0340-8
[13] S. I. Rothstein, "Mechanisms of avian egg-recognition: Do birds know their own eggs?" vol. 23, pp. 268–278, May 1975, doi: 10.1016/0003-3472(75)90075-5.
[14] O. Krüger and N. B. Davies, "The evolution of egg size in the brood parasitic cuckoos," vol. 15, no. 2, pp. 210–218, Mar. 2004, doi: 10.1093/beheco/arg104.
[15] C. Darwin, "The origin of species by means of natural selection," 1859, London: John Murray.
[16] T. Grim, "Constraints on host choice: why do parasitic birds rarely exploit some common potential hosts?" vol. 80, no. 3, pp. 508–518, 2011, doi: 10.1111/j.1365-2656.2010.01798.x.
[17] A. Baddeley, "Elements of episodic–like memory in animals," vol. 356, no. 1413, pp. 1483–1491, Sep. 2001, doi: 10.1098/rstb.2001.0947.
[18] J. C. Reboreda, N. S. Clayton, A. Kacelnik, "Species and sex differences in hippocampus size in parasitic and non-parasitic cowbirds," vol. 7, no. 2, pp. 505–508, 1996, doi: 10.1097/00001756-199601310-00031.
[19] R. M. Kilner, D. G. Noble, N. B. Davies, "Signals of need in parent-offspring communication and their exploitation by the common cuckoo," vol. 397, no. 6721, pp. 667–672, Feb. 1999, doi: 10.1038/17746.
[20] K. D. Tanaka and K. Ueda, "Horsfield's Hawk-Cuckoo Nestlings Simulate Multiple Gapes for Begging," Apr. 2005, doi: 10.1126/science.1109957.
[21] T. Redondo, "Exploitation of host mechanisms for parental care by avian brood parasites," vol. 3, pp. 235–297, Jan. 1993, Accessed: Aug. 26, 2022. [Online].

Voluntary Speed restriction in Tīkapa Moana; saving endangered Bryde's Whales

[1] Constantine, R., Johnson, M., Riekkola, L., Jervis, S., Kozmian-Ledward, L., Dennis, T., Torres, L.G., Aguilar de Soto, N., 2015. Mitigation of vessel-strike mortality of endangered Bryde's whales in the Hauraki Gulf, New Zealand. Biol. Conserv. 186, 149–157. https://doi.org/10.1016/j.biocon.2015.03.008.
[2] Ebdon, P., Riekkola, L., & Constantine, R. (2020). Testing the efficacy of ship strike mitigation for whales in the Hauraki Gulf, New Zealand. Ocean & Coastal Management, 184, 105034.
[3] Silber, G.K., Adams, J.D., Bettridge, S., 2012. Vessel operator response to a voluntary measure for reducing collisions with whales. Endanger. Species Res. 17 (3), 245–254. https://doi.org/10.3354/esr00434.
[4] Vanderlaan, A.S., Taggart, C.T., 2007. Vessel collisions with whales: the probability of lethal injury based on vessel speed. Mar. Mamm. Sci. 23 (1), 144–156. https://doi. org/10.1111/j.1748-7692.2006.00098.x.

Figure retrieved from:

- Ebdon, P., Riekkola, L., & Constantine, R. (2020). Testing the efficacy of ship strike mitigation for whales in the Hauraki Gulf, New Zealand. Ocean & Coastal Management, 184, 105034

The Silent Epidemic

[1] Medical Research Institute of New Zealand. (2022, March 18). Landmark nationwide study offers wake-up call for endometriosis and chronic pelvic pain healthcare. New Zealand Doctor. https://www.nzdoctor.co.nz/article/landmark-nationwide-study-offers-wake-call-endometriosis-

and-chronic-pelvic-pain-healthcare
[2] (n.d.). endo-aust. https://www.endometriosisaustralia.org/
[3] Dr. Wynn-Williams, M. (2022, August 23). Personal communication (Personal Interview)
[4] Eberly, M. (2022, August 24). Personal communication (Personal interview)
[5] Verkauf, B., (1987) Incidence, symptoms, and signs of endometriosis in fertile and infertile women J Fla Med Assoc, 74(9)
[6] Macer, M., & Taylor, H. (2012) Endometriosis and Infertility: A Review of the Pathogenesis and Treatment of Endometriosis-associated Infertility. Obstetrics and Gynaecologist Clinics of North America, 39(4), 535-549
[7] Endometriosis in the UK: time for change. (2020). APPG on Endometriosis Inquiry Report. Endometriosis APPG Report Oct 2020.pdf (endometriosis-uk.org)
[8] Type 2 diabetes diagnosis delayed by two years. (2021, April 28). The Diabetes Times. https://diabetestimes.co.uk/type-2-diabetes-diagnosis-delayed-by-two-years/
[9] Hippocratic Post. (2021, April 27). Type 2 diabetes diagnosis: Over 2 year wait. The Hippocratic Post. https://www.hippocraticpost.com/diabetes/type-2-diabetes-diagnosis-over-2-year-wait
[10] Parliament friendship groups. (n.d.). Home – Parliament of Australia. https://www.aph.gov.au/About_Parliament/Parliamentary_Friendship/

Fun Fact

Einstein's birthday is on March 14th, Pi Day.

Closing Comments

Thank you once again for picking up our publication. We are incredibly proud of the quality of articles in our final edition for this year. Our guest writers are bringing their passion, values, scientific integrity and knowledge to their articles in a way that makes for fascinating reading. We would like to thank them for their hard work and we are looking forward to their future contributions.

We'd also like to thank everybody who showed interest in being on the 2023 executive team for *UoA Scientific*. The process for electing a new executive team is nearly finished. We've had so much interest and it's been a massive learning experience for us. We are really excited for the quality of next year's executive, it's going to be an amazing year!

We hope you've enjoyed Volume 2 of *Scientific*, and we can't wait to hear from new and old writers in Volume 3. Until then, ka kite anō au i a koutou!

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I'm a magazine, but I have feelings too. Don't throw me away!