

APRIL 2026 • ISSUE 49

THINK

IDEAS • MALTA • RESEARCH • PEOPLE • UNIVERSITY



FREE



CELEBRATING
15
YEARS

What will you
THINK of next?



editorial

Matter

Everything within our physical existence is composed of matter – a complex arrangement of particles defined by mass and volume. Yet it is only through research that these building blocks can be understood and perhaps moulded. In the hands of a researcher, matter is decoded. It becomes a medium that can be meaningfully shaped in response to our societal needs.

At its core, research is a systematic process of inquiry. The value of research lies in its ability to replace guesswork with evidence, allowing communities to solve problems, innovate, and make informed decisions based on reliable data rather than intuition or tradition. It is through the rigours of research that a raw material can become part of a solution or cure.

In the sciences, researchers explore the transmutation of materials and the transformation of bodies, and in the humanities and social sciences, they study the ontological concept of becoming and the development of language, laws, and education systems. In Issue 49, **THINK** asks its own questions: What matters? What is changing?

When **THINK** was first published under the title *Research Matters* in 2011, the magazine set out to bridge the knowledge gap between the University of Malta and the general public. Fulfilling the need for accessible research became our cornerstone, and we've been doing so ever since. And so, returning to our questions: What matters? What is changing? – We firmly believe that research matters, and everything is changing.

'This issue is just an initial snapshot – there is more going on at our Alma Mater – much more than meets the eye. We promise to tell you all about it!'

– Prof. Juanito Camilleri
(Rector Emeritus of the University of Malta)

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contribute



Are you a student, staff, or researcher at the University of Malta? Would you like to contribute to **THINK** magazine? If interested, please get in touch to discuss your article on think@um.edu.mt or call +356 2340 4438

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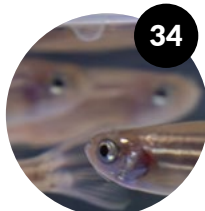


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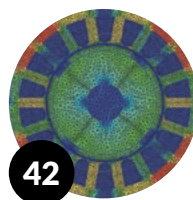
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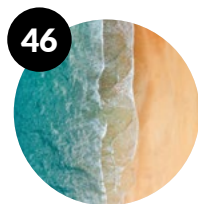


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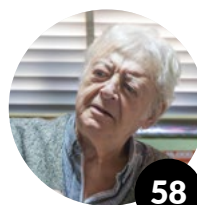
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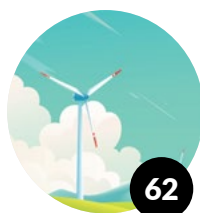


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**L-Università
ta' Malta**

A Maze of Progress: Inside Malta's First Patent Library Centre

Author: James Moffett

A friendlier approach to navigating the complexities of patent applications.

Lightbulb moments are what dreams are made of. The reality, however, is that a wide gulf exists between a great idea and a finished product or service. Bringing projects to life requires one to travel a long and – quite often, confusing – road.

For many years, the University of Malta's (UM) Knowledge Transfer Office (KTO) has been the companion service behind academic breakthroughs, assisting UM inventors, researchers, and project leaders in navigating the complex world of Intellectual Property (IP). Now, that expertise has gone public. With the launch of PATLIB, Malta's first-ever Patent Library Centre, KTO is opening its doors to the wider community of Maltese innovators, startups, and aspiring creators.

THINK met with some of its key individuals: Ing. Michelle Cortis (Director of KTO), Nicola Camilleri (Manager at KTO), and Matthew Pisani (Director of Industrial Property Registrations at the Commerce Department). Together, they discussed how PATLIB is set to reshape the local innovation landscape.

FROM ACADEMIA TO THE PUBLIC

For Cortis and Camilleri, the transition to serving the general public feels like a natural progression. Camilleri, who has been with the KTO since 2014, has spent years supporting UM researchers. 'Through this role, I have been able to work with many teams, bringing their innovations closer to creating an impact beyond the University walls.' Meanwhile, Cortis, a mechanical

engineer by profession, returned to local work in 2024 to lead the KTO after a stint at Imperial College London.

The spark for PATLIB came from a strategic partnership with the Commerce Department within the Ministry for the Economy, Enterprise and Strategic Projects. Pisani explains that the journey began following the 2019 PATLIB Summit, which called for modern, high-impact patent libraries. 'A key milestone was identifying the University of Malta's Knowledge Transfer Office as the ideal host, given its strong research base and experience in technology transfer,' he notes. Following a positive assessment by the European Patent Office (EPO) in 2025, the project moved from concept to reality.

Despite its early days, the demand for the services on offer is already clear. 'While we have not been "open" for long, we have already received a number of requests for support,' confirm Cortis and Camilleri. Interestingly, the public's needs differ from the typical concerns of academics. 'We have noticed a lot of queries related to trademarks, an area we do not generally deal with too often within the UM teams,' they observe; an exciting prospect that will find assured guidance through the PATLIB initiative.

DEMYSTIFYING THE PATENT PROCESS

For many, any connotation associated with the word 'patent' is fraught with legal complications and insuperable obstacles. At its core, Cortis and Camilleri define it as a legal right that prevents others from 'making, using, or



Ing. Michelle Cortis (left) and Nicola Camilleri (right)
Photo by Kristov Scicluna



Matthew Pisani

selling the invention without permission'. Naturally, ideas cannot simply be claimed to be one's own. Instead, a rigorous process ensures that rights to a particular idea or invention are legally binding. This involves several steps:

1. The 'Prior Art Search': before a single word is drafted, it must be verified that the idea is truly novel and unique.
2. The Priority Filing: A patent attorney drafts a detailed application.
3. Substantive Examination: Experts evaluate the application to establish the invention's novelty, inventive step, and industrial applicability.
4. Patent Cooperation Treaty (PCT): This gives applicants the opportunity to protect their invention in multiple countries.
5. Publication: After 18 months from submission, the World Intellectual Property Organization (WIPO) publishes the application, making it 'visible to the world'.
6. The National Phase: Approximately 30 months after submission, applicants select which countries they want protection in, having used the intervening time to secure investors or refine prototypes.

PATLIB isn't just about how to go about protecting one's intellectual property – it provides clear guidelines on the 'why'. Cortis and Camilleri emphasise their role in assisting individuals decide whether an invention is actually worth protecting in the first place. While they do not conduct full market feasibility studies, they urge inventors to research the competitive landscape and identify potential customers to validate the technology. 'One big element is, of course, funding; since IP protection is a costly matter,' they admit. To assist, PATLIB connects innovators with schemes like those offered by Xjenza Malta, Malta Enterprise, and the TAKEOFF Seed Fund Award as well as tools and training which are readily available, such as those on the EPO website. A particularly timely resource is the Small and Medium-sized Enterprises (SME) Fund – an

initiative of the European Commission, managed locally by the Malta Commerce Department – launched in February 2026 to provide IP support for small and medium-sized enterprises.

EXPERT TIPS FOR THE MALTESE INVENTOR

When asked for one piece of advice for private inventors, the experts were unanimous – organisation and timing are everything. For Camilleri and Cortis, the more organised you are, the easier it is to commercialise. 'Maintaining an organised data repository with all the intellectual property you've built, be it know-how, data and results, code and registered Intellectual Property Rights (IPRs),' they ascertain. Meanwhile, Pisani points to the importance of not treating intellectual property as an afterthought, but rather considering it at the earliest stage alongside the creative and technical development of ideas. He also believes PATLIB will become a 'cornerstone of support for Malta's startup ecosystem'. By offering reliable information and guidance, the centre helps startups 'innovate smarter, not just faster'.

LOOKING AHEAD

As 2026 progresses, PATLIB is currently tracking the incoming types of queries, ranging from patent structures to trademark classifications. The team hopes to organise training sessions later this year to help tackle some of those needs or queries. The message is clear: if you have an invention, do not wait until it is executed. Think about protecting it. The KTO doors are open, and the expertise available is ready to assist the next generation of Maltese entrepreneurs. **T**

Reach out to learn more and seek support at:

✉ patlib@um.edu.mt



Mapping Migrant Deportation and Expulsion from Malta

Author: **Timothy Alden**

While deportations in Malta may feature in prominent court cases which enter the public eye, most deportations do not involve criminals and operate in an opaque way, with little data available. Nonetheless, the brutal impact of deportation is not only felt by the deportee but also by the wider community in a very tangible way. **Prof. Daniela DeBono**, who has previously led a research group on deportation from Sweden at the Malmö Institute for Migration Studies (Malmö University), from which a book was published, and postgraduate researcher from the University of Bergen, **Camilla Cardini**, are mapping how deportation operates in practice, and what its increased visibility reveals about the direction of state power.

In September 2025, a Parliamentary Question yielded Malta's first consolidated set of deportation statistics. Until then, little public picture existed of how often people were being removed from the country, who they were, or how the process worked in practice. Prof. Daniela DeBono, Head of UM's Department of Anthropological Sciences, argues that since the COVID-19 pandemic, there has been a shift from 'compassionate repression' to a system she characterises as one of 'repression without compassion'. The state has become more heavy-handed and visible in its efforts to exercise control over migrant communities.

Yet, the data from the Parliamentary Question proved counterintuitive. The figures suggested that the number of deportations had remained relatively stable in recent years, in spite of the increasingly visible enforcement measures such as public arrests, political messaging and new institutional structures. Therefore, as part of joint research with postgraduate researcher Camilla Cardini, DeBono set out to understand the implications of this contradiction,



the real situation around deportations, and what it all says about the evolution of the Maltese state and the direction it is taking, through the lens of critical migration studies.

'We have tried to analyse deportations from a human rights perspective and theoretical framework, to highlight how deportations are a threat to human rights,' Cardini explains.

'There is very little knowledge about deportation in Malta. We lacked clear data, even basic statistics, until the Parliamentary question last year. We wanted to undertake something ambitious and long-term, connecting human experiences with the power dynamics of the state, to ask how individuals and communities navigate the precarity brought about by deportation, including resistance with the help of allies. Much deportation research focuses either on economic consequences for the state or on migrants' well-being in isolation. We aim to interconnect these experiences, to examine how state power is exercised, resisted, and how it is developing, and how the state is being shaped. We also needed to map the system itself: whether removals are

accompanied, whether they are outsourced, as in the United States. In Malta, they are not outsourced; they are carried out by the Ministry for Home Affairs and the Immigration Police, with significant support from Frontex,' DeBono adds.

Over the past decade, Malta has experienced rapid demographic change, with a growing population of third-country nationals living, studying, and working on the islands. At the same time, European return policies have expanded, a national Return Unit has been established, and cooperation with EU agencies has deepened. Within this shifting context, deportation has become an increasingly visible part of migration governance. Deportations not only target new arrivals but also people who have lived in Malta for years.

IS DEPORTATION A COMMON PRACTICE IN MALTA?

DeBono explains that, on average, there have been between 400 and 500 deportations each year over the past five years. She adds that, while it is not uncommon, ➤



there has been a rapid increase in population over the last decade, and so the percentage of people who are deported would have been expected to increase. However, that is not what the data shows. In total, 2,298 irregular persons were deported back to their country since 2021, and 3,183 other persons were transferred to EU Member States. Even these figures remain difficult to interpret, as the category of 'return' includes deportations, voluntary returns, and relocations to other European countries.

Deportation in Malta involves a network of institutions and international actors. Operations are led by the Ministry for Home Affairs and the Immigration Police, with significant operational support from European agencies, particularly Frontex. In recent years, the government has also established a dedicated Return Unit, signalling a more structured approach to removal procedures.

European policy distinguishes between three forms of return. Voluntary return refers to migrants leaving of their own accord. Assisted voluntary return offers financial incentives and logistical support to encourage departure. Forced return follows a removal order and may involve detention and escorted flights. In practice, the boundaries between these categories can blur. Many 'voluntary' returns occur after prolonged detention, where the alternative may be months or years of uncertainty. Financial incentives are modest, yet they often represent a more attractive option than forced removal, which is expensive for the state due to the cost of flights and accompanying officials, and humiliating for migrants.

'Forced returns are very expensive, and they even include the cost of flight tickets of officers escorting the person to their country of origin. Therefore, the Maltese government is trying to promote programmes where they give these people some cash as an incentive to go back home, and it usually works, as even a really low amount is better than being forced out. And it is cheaper for the Maltese government than a forced return. But voluntary return from detention is not really voluntary, as the only alternative they have is to stay in detention for a really long time, up to 18 months, though this is sometimes exceeded. Their prospects are not great,' DeBono explains.

These developments are unfolding within a wider European framework. Recent EU legislation has strengthened return policies by introducing return hubs and expanding



Prof. Daniela DeBono (top) and Camilla Cardini (bottom)
Photos by Kristov Scicluna



cooperation between Member States. Malta's practices reflect these broader changes, with deportation forming part of a continental approach to migration management.

Public imagination often associates deportation with newly arrived migrants. The research suggests a more complex reality. Those removed from Malta generally fall into three broad groups. Some arrive irregularly by boat, are detained, and are deported soon after arrival. Others are visa overstayers who entered Malta for work or study and later lost legal status. A third group has lived in Malta for many years. Many held the long-term 'yellow book' status that allowed them to work and build lives on the islands. Most paid taxes, developed careers, and forged meaningful bonds in local communities. Their sudden detention and deportation after years of residence has been one of the most striking findings of the research. The statistics also reveal that deportations overwhelmingly affect third-country nationals from lower-income countries.

JUDICIAL BOUNDARIES OF BELONGING

Although deportation often unfolds quietly through administrative channels, it comes most clearly into public view when challenged in court. Judicial proceedings expose the reasoning behind removal decisions and reveal how competing principles such as security, migration control, and human rights are balanced in practice. Court cases illustrate the legal complexity surrounding deportation decisions. Appeals based on the right to private and family life under the European Convention on Human Rights have produced different outcomes in Maltese courts.

In one case, an Albanian national who had been fostered in Malta successfully challenged his deportation. In another case, Ethiopian nationals who had lived in Malta for more than a decade were unsuccessful in similar appeals. These contrasting decisions highlight the role of discretion and the difficulty of defining what counts as meaningful social ties.

'The Albanian national's case differed from that of the Ethiopians. He had lived in Austria but had been fostered in Malta since childhood and had clear ties to the Maltese community. In his case, Article 8, calling for respect for private and family life, carried weight. The Ethiopians, despite living in Malta for 13 to 18 years, were found to retain stronger ties to Ethiopia, where they still had family. They had no spouse or children in Malta, and the court did not recognise their links to the Maltese community as sufficiently strong.

That case remains ongoing and may ultimately be taken to the European Court of Human Rights. In the Albanian case, given the strict interpretation of family life, the Court had little room to decide otherwise: he had been fostered here. Yet it raises a wider question. How can someone who arrived at 18 and lived in Malta for decades, holding a tolerated status for years, in long-term employment, or running a barber shop with Maltese suppliers and clients, be seen as lacking meaningful ties to the community?' DeBono states.

THE POLITICS OF APPEARANCES

These legal disputes unfold against a backdrop of shifting enforcement practices. Even where courts intervene, the broader direction of policy continues to shape how deportation is presented and experienced. The available data indicates that deportation numbers have remained relatively stable. Visibility, however, has increased. Public arrests, stronger messaging around return, and a policy framework centred on prevention, return, and relocation have given deportation a new prominence in Malta's migration landscape.

Researchers describe this shift as a form of deterrence. Deportation functions as a warning directed at those considering arrival, while also shaping the daily lives of migrants already living in Malta. Interviews carried out by DeBono and Cardini reveal that fear of detection can influence decisions about seeking healthcare, employment, or social support. Some individuals choose to leave Malta informally, moving elsewhere in Europe before deportation becomes a possibility.

One of the unexpected findings of the study has been the emotional impact of deportation work on professionals involved in the process. Lawyers, activists, and support networks often remain concerned about deportees long after removal has taken place. International research has also documented the psychological toll on detention and enforcement officers, who are negatively impacted by the unpleasant experience of forced detention. Such research suggests that the emotional reach of deportation extends across the entire network of people involved.

The study remains ongoing. As DeBono and Cardini continue to assemble data and testimonies, the emerging picture is of a system that has long existed in the background but is becoming increasingly visible, inviting greater scrutiny. 

WHEN THE SALT BEDS REST

Author: Rebekah Zammit

Do you ever feel guilty for taking a break? Do you feel you need to complete a flurry of tasks just to tell yourself you've done enough and deserve to rest? When you're not productive or busy, do you feel you're doing something wrong? Stop. Join me for a walk down to the Xwejni Salt Pans – your answer is written in the salt.

No matter where you are on our waterlocked archipelago, you're bound to catch a glimpse of the ever-moving, ever-shimmering blue that feeds the storm clouds so well. Wait long enough, and you will spot the cycle – spouting waterfalls from the sky as the clouds take up water and dispel it soon after.

In a landlocked place, you can cross borders – the earth does not discriminate against itself – and so

lands at the borders always hold some kind of multiplicity in their identity. On an island, our identity is fed by a completely different source of change. An island is a protrusion, unmoved by the washing waves, yet always in flux. Waves clash against the rocks' stubborn fixity, and the two form a near-eternal friction that defines their boundaries.

Our air is salt. We breathe it into our conversations. It slips off the tongue into each other's thoughts. Salt – change – is what we know best. Being on an island means being in constant change, shaped by the elements. Change is what brings life.

MEWĠ IL-BAĦAR (WAVES OF THE SEA)

Driving away from Żebbuġ (Gozo), the winding downhill road of Għajn Mhelhel gives way to views of Xwejni Bay. Above the inlet, il-Qolla l-Bajda and its battery separate the bay from its sister, Qbajjar Bay, where a boċċi club holds sessions for its members even in the colder months. Amidst the pops and clinks of boċċi knocking

against each other, glugs echo deep in the rock, coaxing visitors to approach the boat ramp lined with seaweed and take a dip in its chilly waters.

If the water is serene in one bay, chances are, it will be frothy and crashing ashore in the other. The view at Xwejni Bay is dominated by foamy waters and distinctly yellow soft stone – Ġebbla tal-Franka (Globigerina Limestone). Green-painted apertures and the revving quad bikes are a year-round sight on the commute to the salt pans. Patches of Xebb (*Salsola melitensis*) cling to the soft stone like barnacles – stone soaked in years of sea spray and salt. Each time the wind brushes against the hills, it thins them and deposits flecks of salt that leave cracks in the rocks' soft belly for wild things to sink their roots deeper, breaking the way for more sea spray and salt to creep in.

Just off Sagħtrija road, a hut carved straight out of the hill sports pale blue windows and a sea-facing door with flaky paint and rust. It marks the entrance to the salt pans – rectangular pits carved into



Xwejni salt pans in winter
Photo by Kristov Scicluna

the ground to be filled with salty water in the summer months. Signs warning against barbecuing and littering dot the façade of the hut. Ash pollutes the salt that takes so long to collect, concentrate and dry.

The Xwejni salt pans are actively worked and harvested between May and September, excluding stormy days that disrupt the drying of the salt. Harvesting salt is laborious and time-consuming in the summer sun. Yet winter, in all its lashing and outrage, serves to reset the area, washing away contaminants and preparing the beds for the incoming harvest season. And so, over winter, the salt pans nestled between il-Fanal ta' Ġurdan to the left and il-Qolla l-Bajda on the right sit rejuvenated, whipped by wind and sea. Only the salt remains on their skin.

DISSOLVING STAGNATION WITH SEASONALITY

Seasons come and go, but if we do not pause for long enough to glean some wisdom from them, they will pass us by, taking their benefits

with them. In the summertime, the Qbajjar area feels rich in colour and whimsy. Families visit the bays daily, and children's voices fill the air with play – the sister bays are transformed into an idyllic seaside escape. Yet in winter, it is the direct opposite. The area seems derelict, worn, and almost deserted. People avoid the hostile waters, and many locals remain indoors or return to Victoria – Qbajjar goes into hibernation.

And yet, even when our surroundings undergo physical change as great as this, we often remain unaffected. We ignore the importance of change (or of changing) and set up strict routines that take our days for granted, allowing them to blend into a uniform wash of productivity. In doing so, we not only miss the value of taking extended breaks to compose our next milestone, but we also miss the salt – those small opportunities for change. This is the true source of stagnation. Stagnation occurs when we constantly expect ourselves to be on the go, which inevitably prevents us from resetting and allowing new

perspectives to guide our approach or to pique the growth within us.

A salt pan is only as good as it is able to dry out efficiently and have its minerals collected. If it is constantly flooded by rain, then the salt crystals cannot form properly. Conversely, if the beating sun never gives way to winter respite, then the salt beds and their farmers will be too worn to reap the benefits of harvest. It is just the same for us. By choosing to incorporate more breaks between our productive tasks, we allow ourselves to disengage, change focus and actively decide on what is valuable rather than going through the motions. Breaks could be time spent nurturing a new skill or hobby, appreciating seasonality, or setting up a creative monthly project. The result is better mental clarity and more intentional living.

So whether you are a mainlander or an islander, whether you are inspired by salt or by the fluidity of borders, do not let your life develop the stink of stagnation. Let the only recurrence be salt. **T**





Matter

Every piece of research starts with curiosity. That curiosity feeds a question and hypothesis, and from there, planning and consistent action. But without the initial and very human 'why?' and 'what if?' in pursuit of the unknown, our 'and then what?' cannot follow.

In Issue 49, **THINK** spotlights research that is breaking new ground where it matters and paving the way for tomorrow's solutions and cures. Starting with our language, this edition looks at how humans are being shaped by language just as quickly as we create

new words. Next, we will sink our teeth into the five geoscience research projects dedicated to understanding the shifting tectonic plates beneath us. From there, we will learn how plasma-activated liquids are being used in a new combination therapy to overcome tumour resistance.

Then, we will turn our attention to our incredible hands and how supercars can bring prosthetic technology closer to the real deal. Ending with a twist, we will trace the local impact of adolescent idiopathic scoliosis to better early detection.



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Marrying the performance of supercar motors with the coordination of human hands

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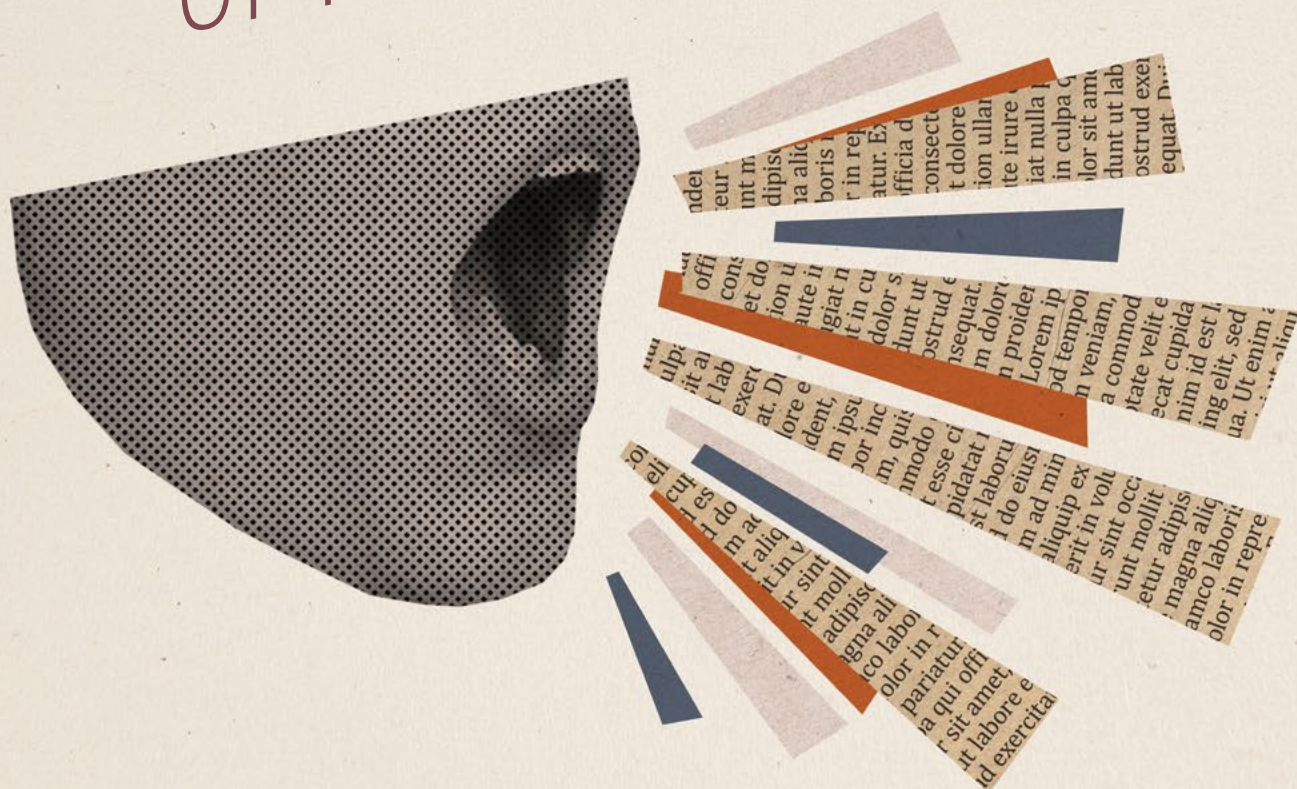


A Learning Curve for Malta

What do we know about adolescent idiopathic scoliosis?

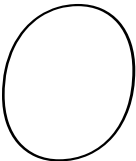
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The Performative Power of Words: Language in an Age of Transformation



Author: **James Moffett**

Understanding the ever-changing nature of the spoken word and its impact

 *omnia mutantur, nihil interit.* Thus writes the Roman poet Ovid in his *Metamorphoses*: 'everything changes, nothing perishes'. Such is the evolving nature of language. It is never still, but rather adapts, reconfigures, borrows, reinvents, and resists itself in response to the changing environment within which it operates. People and societies react and transform in response to current cultural, sociological, and technological trends, which require the use of language – our primary tool of communication – to follow suit. Stasis, therefore, is not an option. **THINK** delves deep into this issue and probes some serious questions concerning the use and the very essence of what it is about language that makes it so clear and yet so elusive at the same time.

PERFORMANCE AND PHILOSOPHY

Dr Sarah Grech and Prof. Joe Friggieri, academics and linguists at the University of Malta, attest that

language is deeply entangled with how we perceive ourselves, how we relate to others, and how we shape the societies we inhabit. Human interaction lies at the heart of evolving languages, and as Grech explains, sociolinguists such as Penelope Eckert describe our language interactions as 'performative' to some extent. When humans interact, 'we are playing a role of some sort. Or we are "performing" a role.'

The concept of performance recalls our daily human act of networking and communicating with others, which changes in subtle or obvious ways. As a personal example, Grech notes, 'I might use different types or varieties of language in my role as a lecturer, teacher, mother, child, aunt, and so on.' Adapting roles to different scenarios and interactions is even more prominent when social landscapes shift. At the same time, 'language also helps to shape our societies.' The relationship is therefore reciprocal.

Meanwhile, Friggieri approaches the metamorphosis of language from a philosophical perspective, especially

when considering that language acquisition is a process hardwired into our brains. 'One applies the knowledge one has acquired through language to the particular situation one finds oneself in.' Experience may expand knowledge, but language is already there, structuring engagement with the world. Drawing on Donald Davidson's concept of language as a sense organ, Friggieri concludes that language and thought co-evolve, and as Grech reflects further, 'humans tend to be versatile and quick to adapt, and our language reflects this versatility.'

VERSATILITY, CHANGE AND NECESSITY

As time progresses, words fall in and out of favour. For example, is 'bro' still in use, and if so, who uses it? Grech provides an example of the use of the word 'clandestine' or '*klandestini*' to elucidate this aspect. She observes that, nowadays, this term carries with it a negative response, prompting the search for a new or alternative word as speakers follow an evolving train of ➤

thought; 'shall we switch to migrants (too vague?), foreigners (too othering?), asylum seekers (inaccurate for many), migrant workforce (a bit more specific?). Before you know it, this type of experimentation, sometimes explicit, sometimes less obvious, also helps to shape the kind of society we want to be part of, or see ourselves in.' Language change is therefore both internal and external: prompted by semantic discomfort and by social accountability. Changes in words and terminologies typically occur gradually, day by day, and in response to stimuli from their speakers; however, as Grech asserts, situations involving cataclysmic events, such as the COVID-19 pandemic, usher in sudden linguistic alterations or inventions to help societies adapt.

This echoes Friggieri's stance on language and thought as evolving hand in hand. 'We perceive the world through language, and in so doing we become aware of what we are and act the way we do.' With this in mind, if vocabulary changes and adapts, do languages force social metamorphosis, whereby

institutions, social structures, and daily life are altered? Friggieri observes that 'the syntax or grammar of a language changes very little compared to the semantics'. In disciplines undergoing 'revolutionary science', 'new words are coined to replace old concepts in the formation of a new theory'. Similarly, 'the words we use to describe social phenomena and events also reflect our attitudes towards them'. Yet, whether or not vocabulary compels behaviour depends on what we think about this new vocabulary and whether 'we are inclined to accept those thoughts, reject them, or merely pay lip-service to the words that are used to express them'.

LANGUAGE AS CREATION AND ASSIMILATION

Different languages respond differently to new realities and the culture they represent. For Grech, this is what makes them a fascinating topic of discussion and study. She brings to the fore an example in both English and Maltese to demonstrate how a language is able to assimilate,

merge, and transform elements from other languages that are in close contact with each other. Maltese, as Dr Grech points out, 'is very much part of this pattern, always shaping itself and borrowing new words in relation to the many languages it encountered across history.' However, the borrowing of words is not a random act. 'These words will only stick if they can be successfully incorporated into a language system.' To do so, such words would typically need to alter their shape, structure, and sound pattern in order to fit comfortably in their new linguistic home. Other languages rely more heavily on internal resources. Dr Grech refers to examples of combining 'two separate concepts like "scrolling" and "doom" in order to create an entirely new idea by putting the two together (compounding).'

This reciprocity between language, thought, and behaviour is evidence of the cyclical nature of words evolving to signify new meanings in response to situational awareness, as well as people's reactions, and vice versa. As



Grech asserts, 'the soft view is that there are certain aspects of language which could be said to shape the way its speakers organise their views of the world.' More intriguingly, she observes how human beings are drawn to the idea of coining new terms in order to best convey a concept, such as 'doomscrolling'. Typically, 'humans notice a new phenomenon and start experimenting with different ways to refer to that phenomenon until something sticks, and we have that Aha! moment where we just know a word really fits.'

DIGITAL TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE: A CAUTIONARY TALE

With the meteoric rise of digital technologies and generative AI platforms, transforming and retransforming meanings, words and the aim of the spoken (or written) word, Friggieri cautions that 'while language may be used as a vehicle for truth, justice, and rational argument, it may also be

employed to bring about intolerance, stupidity, and lies'. Ultimately, 'real social change of any kind can only be brought about by political means'.

In a digital and globalised age, concerns about homogenisation arise. Friggieri acknowledges that 'contemporary technologies of communication use a universal language to deliver their results', requiring users 'to learn that language in order to reap maximum benefits'. Yet he rejects the idea that this entails extinction: 'Natural languages evolve over centuries through culture and living interaction between people. They are capable of expressing the widest spectrum of thoughts, feelings, and emotions'. Technologies are unable to do this, nor should we expect them to carry out tasks for which they have not been designed or programmed.

Meanwhile, Grech also notes that 'while there are over 7,000 languages identified across the globe, over three thousand of those are considered to be endangered'. The 'so-called digital divide is probably accelerating

such losses', since communities whose languages are not digitally supported might find it hard to survive. Ultimately, if a language no longer serves the function of being a mode of expression for a community, it would need to be readapted or abandoned in favour of a more accessible and usable language.

Across their perspectives, Grech and Friggieri converge on a central insight: language and life are inseparable. Language adapts because societies change; societies shift in part because language reshapes perception. Words may be borrowed, compounded, redefined, or abandoned, but they remain intrinsic to human needs, identities, and aspirations. In a world of transformation, language both reflects and creates. The end of a meaning spurs the creation of another. Grech sums this up in her statement: 'The only unchanging thing about language is that it's always changing.'

Thus, as Ovid asserted, nothing stops or ceases to be. It simply evolves. 

BREAKING GROUND

THE PEOPLE AND PROJECTS BEHIND MALTESE SEISMOLOGY

Author: Jonathan Firbank

*The University of Malta's (UM) Department of Geosciences and Malta's capacity to understand its seismic events are growing at an ever-faster rate. In this article, **THINK's Jonathan Firbank** introduces some of the people and projects behind this most essential pursuit – our understanding of earthquakes.*



Dr Matthew Agius
Photo by James Moffett

Earthquakes are constantly transforming our planet, whether at an aeons' pace or with explosive speed. The forces that drive it are numerous and vast. Cooling sea floors compete with flowing magma. The incredible mass of tectonic plates clash and transform one another. Seismology is, necessarily, a broad tent. The movement beneath us is complex and on a scale that transcends national borders. To understand our planet and effectively mitigate natural disasters, the field must be multidisciplinary, multinational, and constantly expanding. This is exemplified by the University of Malta's Seismic Monitoring and Research Group (SMRG; Department of Geosciences).

MALTESE SEISMOLOGY, FROM VAULT TO SCHOOL – DR MATTHEW AGIUS

Dr Matthew Agius is a veteran member of the group, which he describes as 'growing and growing'. He elaborates: 'Founded as a means to monitor local and regional earthquakes, the seismic network has expanded from one station in 1995 to nine, and we are moving onto cutting-edge research.' His background in seismology began under Prof. Pauline Galea, who was instrumental in establishing the seismology group and the first head of UM's Department of Geosciences. 'At the time, with access to only one station, we began the process of cataloguing earthquakes, not just those which are felt but



Luke Said



Daniele Caruana

also weak earthquakes that are not felt locally, let alone abroad. This made us realise that seismic activity around us is far higher than previously thought. Discoveries like this are what motivate me.' Major tasks for Agius are the operation of the Malta Seismic Network, the real-time data exchange with international partners, especially important for earthquake warning, and also public outreach. For example, 'the upcoming Seismology in Schools programme, funded by the APS Bank, will involve providing small seismographs to local sixth form schools and inviting physics teachers to use them as educational tools. This is not just an opportunity to record earthquakes but also to describe how seismic waves propagate through the earth.'

THE MALTA EARTHQUAKE CATALOGUE – LUKE SAID

Luke Said, whilst always inclined to architecture, decided to venture into geoscience instead – a field that is underpinned by geography and physics. 'The fact that I could understand and disseminate the geology around me, whether around my home or while out hiking, was very intriguing.' From there, his interests led him to geophysics, seismology, and eventually a position as a Research Support Officer (RSO) for the Department of Geosciences. His work focuses on enhancing Malta's earthquake-detection tools, particularly for weak earthquakes. Malta and its surrounding sea are known for seismic events, but many are extremely

hard to detect. He is combining his programming skills with physics to redevelop an old homegrown software called Local Earthquake Single-Station Location Analyser (LESSLA) into an open-source Python code with an interactive graphical user interface. This tool is crucial for maintaining a comprehensive Malta Earthquake Catalogue – a key resource for other fields such as structural engineering. The catalogue's importance is twofold: understanding the tectonics around us, and seeking to refine Malta's seismic hazard assessment. Such knowledge is important not just for buildings on land but also for marine infrastructure, such as cable and pipeline laying between countries in the region.

SENSEI – DANIELE CARUANA

Detecting underwater seismic activity is particularly challenging, as installing sea-floor instruments is incredibly demanding and resource-intensive. But for Malta, it's particularly crucial. One solution is to make use of existing infrastructure – the fibre-optic cables that connect us, digitally. RSO Daniele Caruana is working on the international project Smart European Networks for Sensing the Environment and Internet quality (SENSEI), funded by the European Union – a project in collaboration with the Department of Physics under Prof. André Xuereb's supervision. 'I come from more of a pure physics background, having previously worked on certain aspects of fibre optics. But rather than just working on theory, I wanted ▶



Dr Oluwatimilehin Benjamin Balogun

to apply what I do to sectors such as geosciences. With fibre optics, one way of doing that is through seismology.' Seismic activity on the ocean floor, such as earthquakes or submarine landslides, can induce small strains on internet cables. These strains can be detected and measured using laser interferometry, which enables the cables to sense seismic activity. As Caruana points out, the advantage of this technique is its wide coverage, turning our vast global cable network into a system capable of detecting earthquakes, among other geophysical phenomena. The utility of this existing technology is not something to be taken for granted, however. 'It is important to stress the importance of research, which underpins all the technology and instruments we are making use of.' Fibre optic cables, for example, may not have been originally intended for seismology, but they themselves 'are the product of decades of scientific research.'

REMCRUMR – DR OLUWATIMILEHIN BENJAMIN BALOGUN

Dr Oluwatimilehin Benjamin Balogun is a Marie Skłodowska-Curie Research Fellow, pursuing geosciences at UM. His project's title, REMCRUMR, stands for Real-time Monitoring of Deep Crustal Mass Redistribution for Timely Prediction of Earthquakes using Integrated Geodetic, Gravity and Seismic Data, funded by the European Union's Horizon Europe research and innovation programme. It seeks to replace the probabilistic method of earthquake prediction using, as its name suggests, a combination of highly contemporary techniques. 'I first became interested

in the sciences because of the process. Once you have understood the basics, you can innovate, harmonising different forms of knowledge to achieve greater and greater outcomes.' That 'harmonising' is on full display with REMCRUMR. Its methodology relies on measuring changes in the Earth's gravitational field and in the velocity/strain of its tectonic plates. We are examining how minute but anomalous changes in these quantities define the onset of a seismic event, which in time could lead to a model that predicts earthquakes outright. Before an earthquake occurs, 'there has to be some sub-surface redistribution of masses and elasticity anomaly'. We are trying to monitor that in real time (from observable changes in the Earth's ambient gravity field, plate's motion, and strain) and predict when there will be a rupture in the Earth's crust.' This highly ambitious work could radically reduce the human cost of seismic natural disasters by predicting them far before the limits of current reactive detection methods, and with far greater accuracy than the aforementioned probabilism.

WAVEGUARD – PROF. SEBASTIANO D'AMICO

Seismology is an invaluable means of understanding our world as well as a vital pursuit for preserving human life. Malta has a history of seismic activity, and its central position in the Mediterranean means it has been affected by nearby areas of high seismic activity. Its worst natural disasters are gone from living memory, but the scars of earthquakes and tsunamis are still visible in its historic architecture, and have been recorded since the seventeenth



Prof. Sebastiano D'Amico
Photo by James Moffett

century. Conversely, Malta is ideally positioned to extend international monitoring networks. Prof. Sebastiano D'Amico, UM's Head of Geosciences, is coordinating the UM activities of the WAVEGUARD project – Enhanced monitoring and disaster response to mitigate impacts of extreme meteo-marine events (funded by the INTERREG Italia-Malta Programme). WAVEGUARD integrates an incredibly diverse range of data sources to raise awareness of, and thus create an opportunity to mitigate, natural hazards such as storms and high waves. The data ranges from the seismic to the barometric, from radar to video, and more besides. This incorporates work from UM's Oceanography Malta Research Group, which focuses on an equally impactful field of geosciences.

WAVEGUARD is a macrocosm of the ethos behind UM's seismology – an integration of diverse disciplines and heterogeneous data that pulls together for, in this instance, the simple goal of saving lives. It is just one example of how the Seismic Monitoring and Research Group and the Department of Geosciences are an evolving, dynamic combination of specialisations, which is then joined to equally fluid networks of study, safeguarding and response. Like the ground beneath our feet, it must constantly change. 

Further Reading

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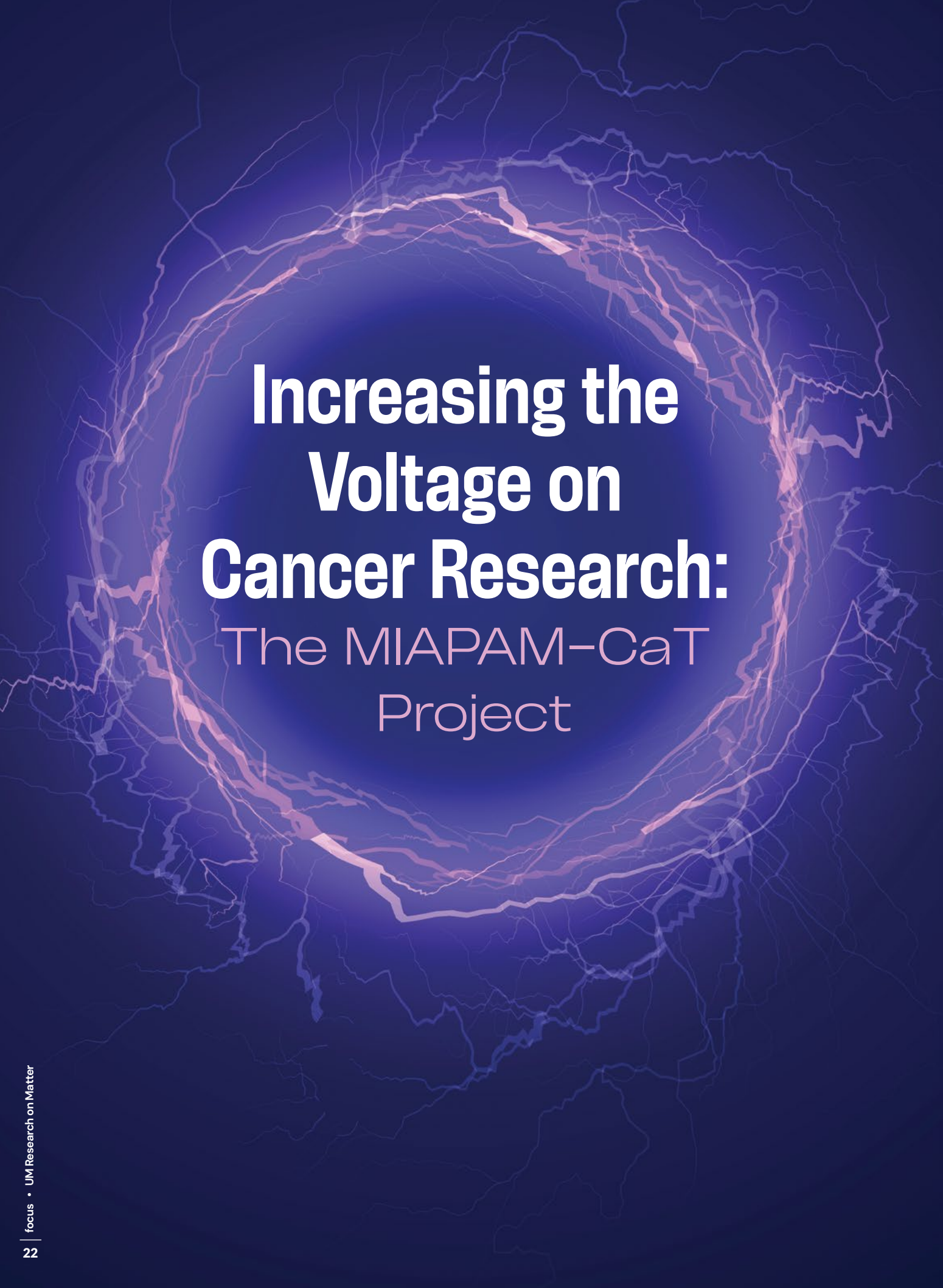
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Increasing the Voltage on Cancer Research:

The MIAPAM–CaT
Project

Author: **Sofia Dias**

In 2025, **THINK** readers were introduced to an ambitious idea: using non-thermal plasma to attack cancer cells in a new way. In the website article **A Reactive Treatment: Using Non-Thermal Plasma Chemistry Against Cancer**, we explored how the **MIAPAM-CaT project** aimed to develop a new combination therapy to overcome tumour resistance. The team behind the project has now returned with further results, valuable lessons learned, and a clearer picture of where this line of research stands and where it may go next.

The story behind the MIAPAM-CaT project began long before the grant was awarded in 2024. Prof. Byron Baron (Centre for Molecular Medicine and Biobanking) first started working with plasma-activated medium (PAM) in 2019, in collaboration with researchers at Nihon University in Japan. They focused on understanding how PAM affects mitochondria – the energy-producing structures inside cells – and whether this could be harnessed for cancer treatment.

Around the same time, Dr Jefferson de Oliveira Mallia (Metamaterials Unit, Faculty of Science) was investigating the use of plasma-activated liquids for disinfection purposes, working alongside Prof. Ruben Gatt. He was interested in how plasma chemistry could alter liquids and give them new reactive properties.

During a Xjenza Malta information session in 2022, Baron and de Oliveira Mallia realised they shared a common

curiosity: what would happen if plasma-activated liquids met mammalian cells?

They began collaborating, initially supervising an undergraduate dissertation project. This early partnership paved the way for a successful Research Excellence Programme (REP) grant, which formally launched the MIAPAM-CaT project.

WHAT EXACTLY IS PLASMA-ACTIVATED MEDIUM?

To grow cells in a laboratory, researchers need a nutrient-rich liquid, known as a cell culture medium. Plasma-activated medium, or PAM, is a standard cell culture medium that has been enriched with reactive chemical species. PAM is produced by passing a noble gas, such as argon, through an electric field to create a partially ionised state known as a non-thermal plasma. 'The ionised noble gas acts as a charge-transfer intermediate, causing excited atoms and electron impacts that lead to the breakdown of molecules in the

solution and producing highly reactive free radicals,' says de Oliveira Mallia.

The result is a mixture of short-lived reactive species that can induce chemical stress in cells.

As these reactive molecules have a short lifespan, PAM must be produced on-site just before use. Developing and validating a local system capable of reliably generating PAM was one of the project's central technical achievements.

STRESSING CANCER CELLS TO DEATH

Cancer cells are often described as being under constant internal pressure. They divide rapidly, consume energy at high rates, and exist in a state of metabolic imbalance. To cope with this, cancer cells rely heavily on protective molecules known as antioxidants, which neutralise harmful reactive species.

PAM disrupts this balance. By introducing additional reactive molecules, PAM depletes the cells' antioxidant reserves. 'Without these ➤

A) Plasma discharge into the medium

B) Western blot for lysine methylation in colorectal cancer cell line

C) Spheroids of the colorectal cancer cell lines HCT 116, DLD1 and LoVo on a micropatterned surface

Images courtesy of the MIAPAM-CaT Team

molecules, cancer cells suffer chemical damage which eventually results in their death,' explains Baron.

Fast-growing cancer cells are particularly vulnerable because they tend to have lower antioxidant reserves. This makes them, in theory, more susceptible to being overwhelmed by the oxidative stress induced by PAM.

THE METHYLATION STRATEGY

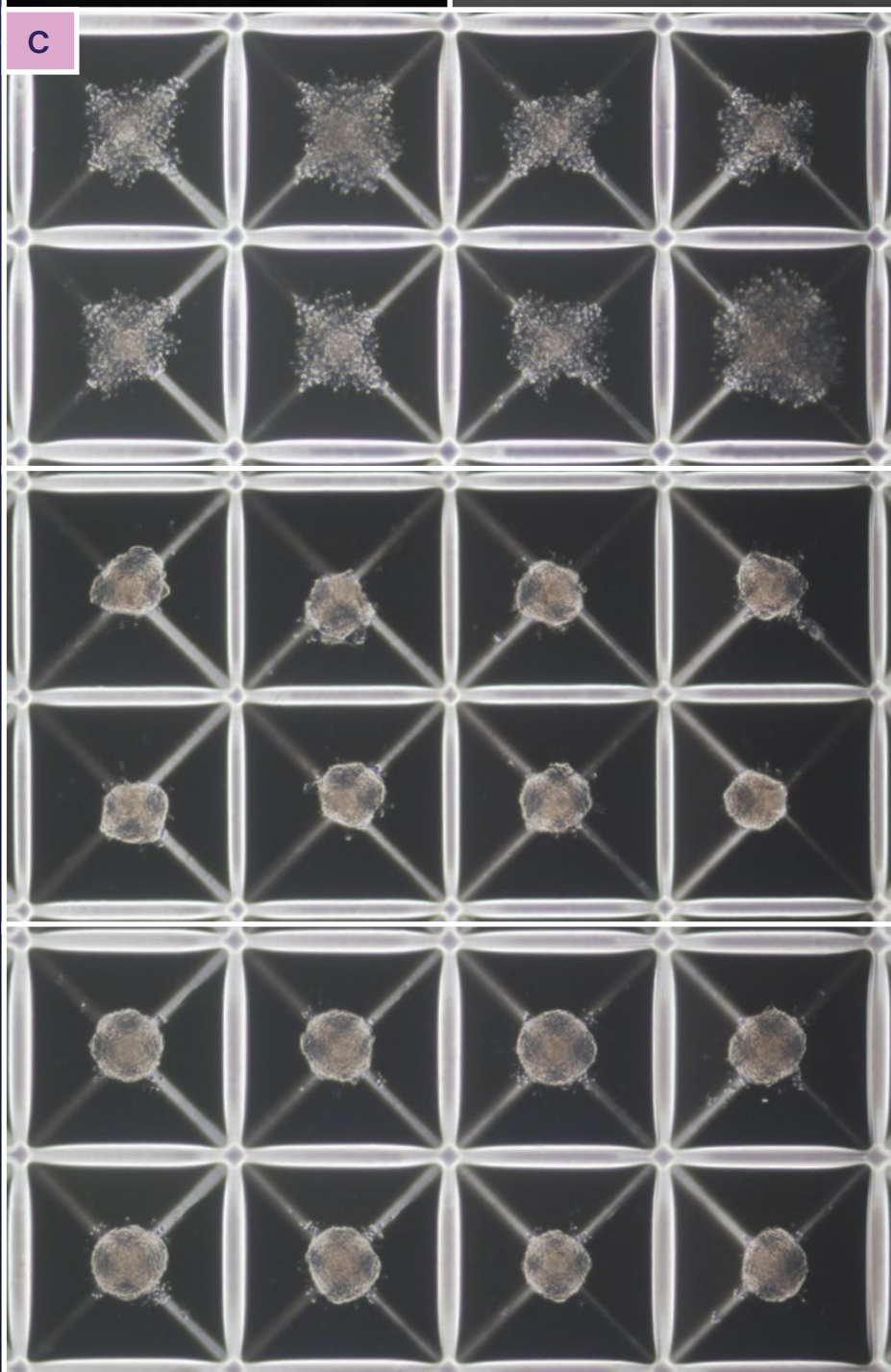
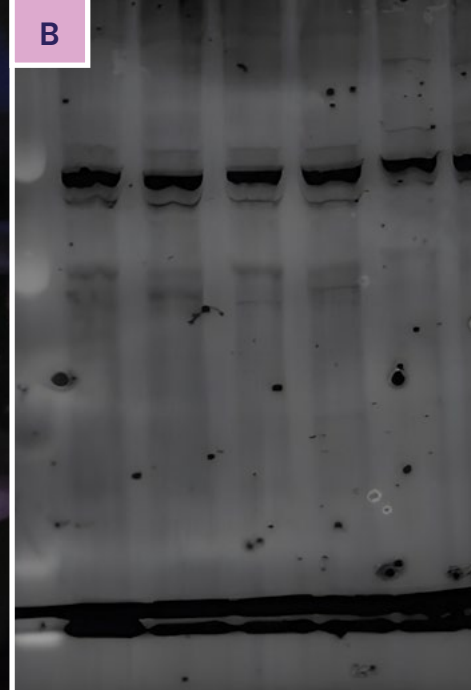
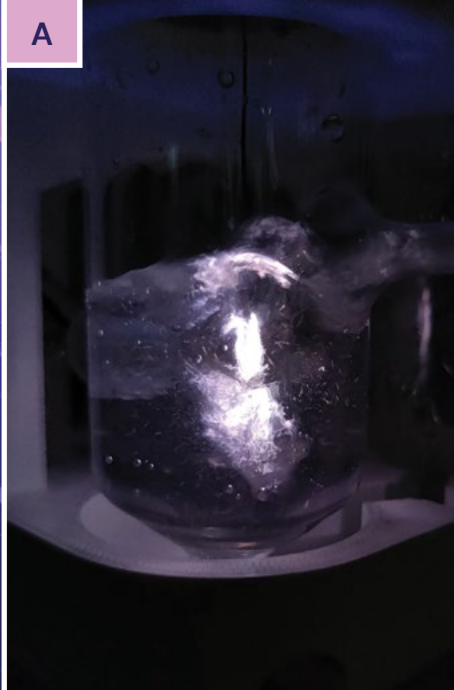
The MIAPAM-CaT project did not rely solely on PAM. The team also targeted protective enzymes known as methyltransferases (MTs). These enzymes add a methyl group to proteins, thereby altering cellular behaviour. In cancer cells, 'one of the observed effects is increased survival in response to external interventions, including chemotherapeutics,' explains Baron.

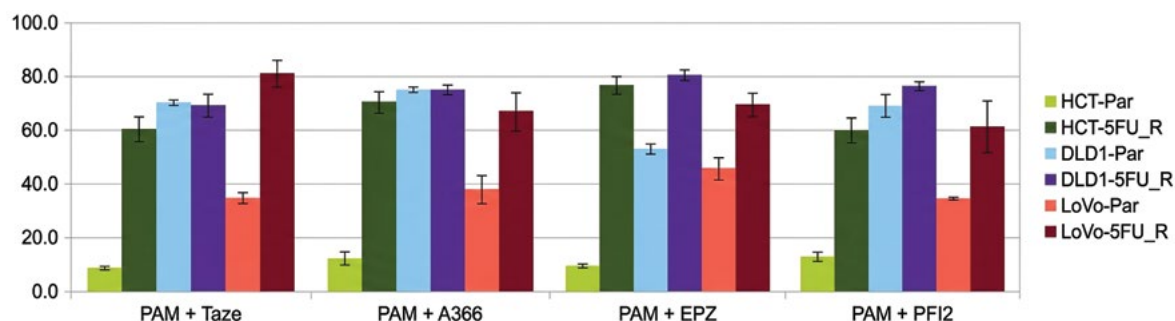
The idea was straightforward: first, use protein methyltransferase inhibitors (pMTIs) to weaken the cancer cells' survival pathways; then, apply PAM to push the already-compromised cells beyond recovery. In other words, block the escape routes before increasing the chemical stress.

WHAT THE RESULTS REVEALED

However, science rarely follows a neat script.

The team found that PAM alone caused significant cancer cell death. Adding pMTIs produced some additional effects, but not to the extent envisaged by the researchers. At least one of the four combinations





Bar chart showing the combinatorial effects of PAM and selected MTIs
Image courtesy of the MIAPAM-CaT Team

tested was expected to demonstrate strong synergistic effects. Instead, most of the observed cell death was attributable to PAM itself, with only a small contribution from the inhibitors.

'The cell viability assays also did not support the hypothesis that the combination therapy successfully prevented cancer cells from "switching on" survival pathways to evade death,' explains Baron. The proteomic analysis, which is the large-scale study of proteins, is still ongoing, so it is too early to determine precisely which molecular mechanisms are being altered by PAM.

While the results do not invalidate the concept, they do suggest that the situation is more complex than the researchers initially anticipated.

A more sobering finding involved healthy cells.

'Unfortunately, the healthy cells in culture were extremely sensitive to the effects of PAM, most probably because the conditions provided in culture are far from optimal for these delicate cells,' says Baron. Nevertheless, this finding emphasises the importance of refining dosage, delivery methods, and model systems before drawing conclusions about clinical safety.

MEETING CLINICAL STANDARDS: A LONG-TERM VISION

Although PAM can now be generated locally, achieving clinical-grade standards is a far more demanding process.

'Initially, extensive preclinical work must be conducted on the device and on establishing the administration protocol for PAM therapy. Then, any medical device must comply with criteria set by the European Medicines Agency and the U.S. Food and Drug Administration (FDA), including guarantees of pyrogen- and endotoxin-free production,' explains de Oliveira Mallia. 'Additional in vitro studies using advanced multicellular models and microphysiological systems are also needed before testing relevant in vivo rodent models.'

Even under ideal conditions, with consistent technical and financial support, developing a new therapy from discovery to regulatory approval typically takes 10–15 years. When the early stages of discovery and translation are included, this timescale can increase to 20 years or more.

MIAPAM-CaT is at the beginning of this journey.

NEXT STEPS ON A CHALLENGING PROJECT

Working in biomedical sciences or cancer treatment is never easy. This is no exception for the MIAPAM-CaT team.

The researchers encountered numerous challenges. One was producing a sufficient number of evenly sized spheroids in three-dimensional cultures, which are miniature clusters of cells that better mimic real tumours. They also struggled to source antibodies that yielded strong and

clear signals. Even during mass spectrometry sample preparation, they had to minimise protein losses.

Although challenges like these are part of the daily reality of experimental research, this does not mean that the project is unfeasible. Instead, they enable researchers to refine their methods and protocols.

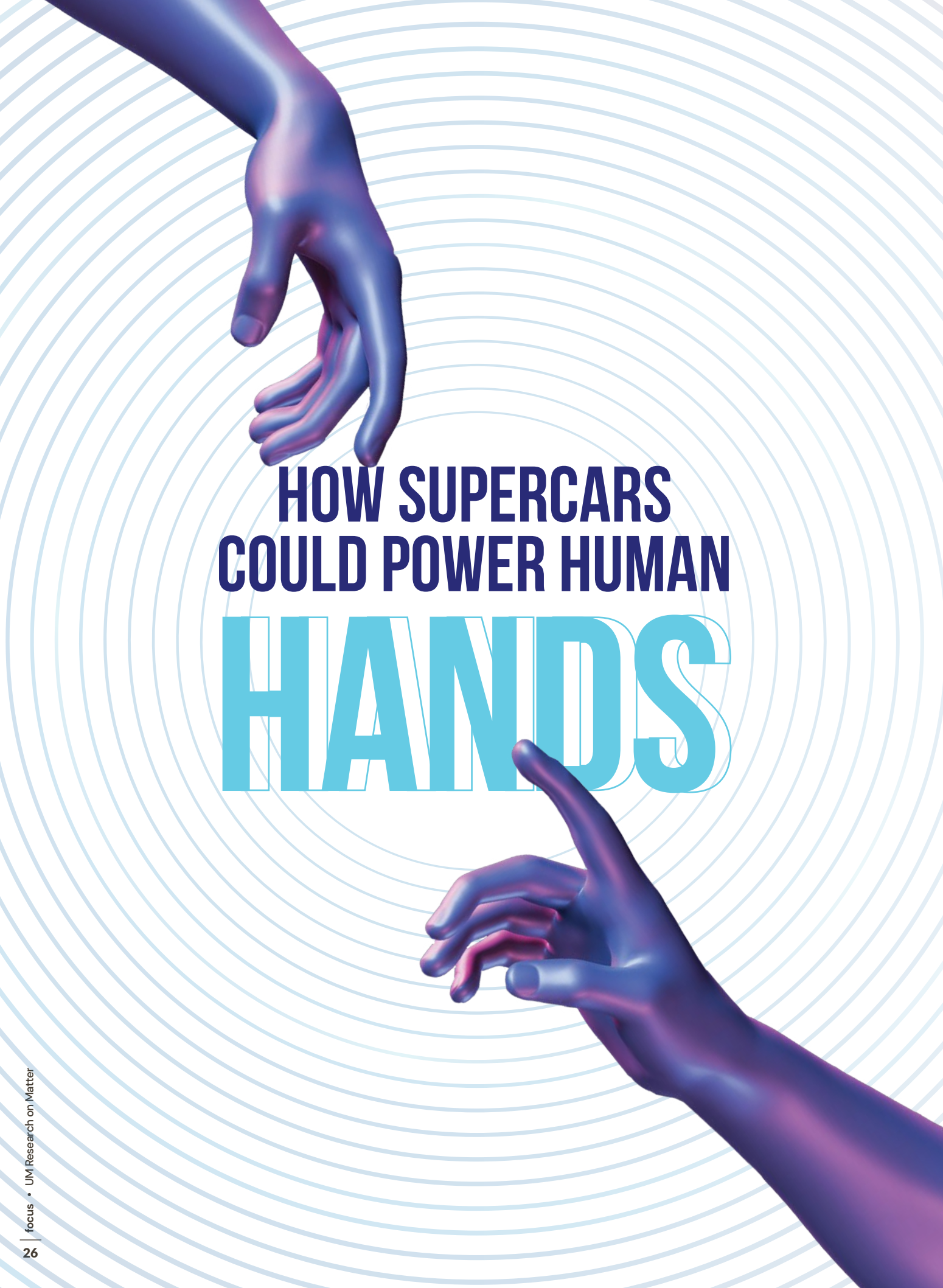
The next phase of the project will involve conducting a more in-depth proteomic analysis to identify alternative pathways that could be targeted in future combination therapies. If methyltransferase inhibition does not provide the anticipated benefits, other molecular routes may prove more promising.

Meanwhile, the team will continue to advance through the necessary preclinical checkpoints required for clinical translation.

The MIAPAM-CaT project has already achieved something significant: it has demonstrated that PAM can be produced locally and exerts a strong cytotoxic effect on cancer cells. It has also clarified the limitations of current assumptions and redirected scientific enquiry towards more specific targets.

The "voltage" around cancer research is increasing. The challenge now is to learn exactly where to direct the current to illuminate future research efforts. 

Project MIAPAM-CaT (REP-2024-028) was financed by the Malta Council for Science & Technology, for and on behalf of the Foundation for Science and Technology, through the FUSION: R&I Research Excellence Programme.

The image features two stylized, metallic-looking hands in shades of blue and purple. One hand is positioned at the top left, reaching downwards, while the other is at the bottom right, reaching upwards. They are set against a background of numerous concentric, light blue circles that create a sense of depth and focus. The hands are positioned as if they are about to grasp each other, framing the central text.

HOW SUPERCARS COULD POWER HUMAN HANDS

Author: **David Mizzi**

*Could the same motors that push electric supercars drive innovation in the world of prosthetics? **The PROJOI project** aims to adapt these high-performance designs to rethink artificial limbs.*

With prosthetics, the goal is to create something that can adequately mimic an organic limb. Prosthetic limbs are typically powered by small electric motors, but creating a motor that can match the performance of a human limb is a notoriously difficult task. However, Prof. Ing. Reiko Raute, Associate Professor at the Department of Electrical Engineering, and Prof. Ing. Michael Saliba, Professor at the Department of Mechanical Engineering, have drawn inspiration from the world of electric supercars to develop a small but powerful motor that could tip the balance.

THE STRONG BUT SILENT TYPE

Forget science fiction; ultimately, prosthetics are nowhere near close enough to match the performance of their original human counterparts. Organic human limbs are

feats of bone and muscle; strong enough to climb, push and pull, yet sensitive enough to pick a flower. Even something as simple as holding an egg requires an extraordinary amount of coordination between your brain and finger muscles. Essentially, your fingers 'sense' the right amount of force needed to pick the egg up without cracking it. This is known as proprioception, and it is crucial for spatial awareness and for gauging the force required for certain tasks. It is also one of the many challenges engineers face when building prosthetics.

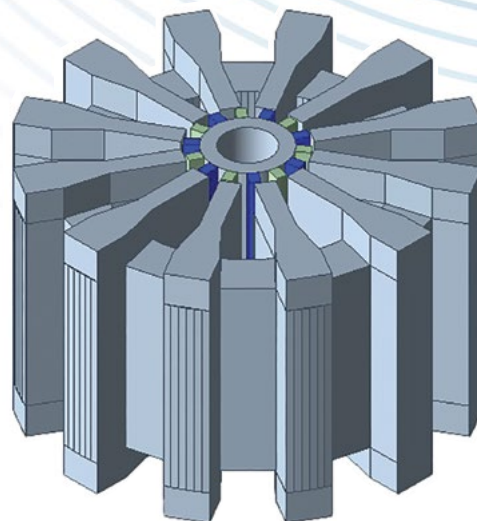
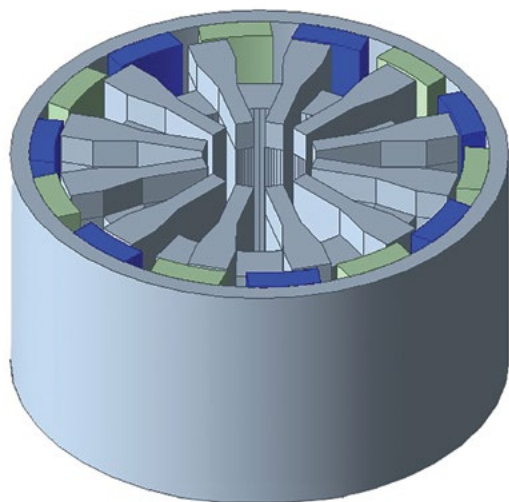
'Our fingers are backdrivable, so we can push them back and forth,' explains Raute. Secondly, we also get some feedback from the outside world. 'A typical prosthetic would have a high-ratio gearbox, so the finger would move with a gearbox, but then you cannot push it back. There would be no feedback,' he explains.

There is also the question of torque. Torque is the amount of force needed to rotate an object around a point. It is

a twisting force. Think of a door; trying to open it close to the hinges is harder than opening it from the handle. With a hand, your finger is the hinge, and without enough torque, you would not even be able to lift a mug of coffee.

To generate this torque in a prosthetic, you need a small motor; however, small high-speed motors, like dentist drills, make high-pitched sounds. Hearing the high-pitched whirring of a dentist's drill every time you use your hand is something most sane people would prefer to avoid. 'My colleague, Michael Saliba, is working on the mechanics of the prosthetic hand to generate the right torque. We need slow movement but high torque,' explains Raute.

Creating a prosthetic that is lightweight, strong, and silent, while also being proprioceptive (flexible), requires a special type of motor. To build such a motor, Raute and his team drew inspiration from an unlikely source: Koenigsegg's high-performance sports cars. ➤



Outer rotor with radial magnets (left) and inner rotor with radial magnets (right)

Images courtesy of the PROJOL team

WHAT DO SPORTS CARS HAVE TO DO WITH PROSTHETICS?

It comes down to motors and magnets. Many modern electric cars typically use permanent magnet synchronous motors (PMSM), whereas high-end electric sports cars have recently started using radial-axial motors and YASA axial motors. Before we go further, let's break these down.

When an electric current passes through a magnetic field, it generates a force. That is the underlying principle of all electric motors. In electric motors, interactions between magnetic fields generate torque that makes the rotor spin. You can have an inner radial motor, where the rotor is inside the stator, or an outer radial motor, where the rotor is outside the stator. We will

return to these shortly. Note that the rotor is the part that rotates, while the stator remains stationary.

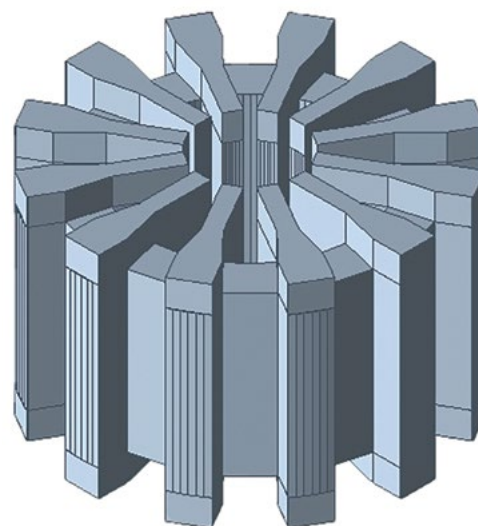
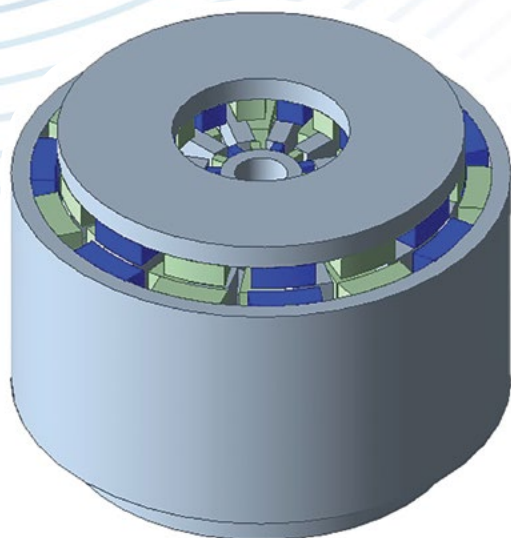
Let us have a look at a PMSM inner radial motor to illustrate this. Copper windings sit outside the rotor, facing inwards. In this configuration, the permanent magnets are on the inside with the rotor, facing outwards. Because the rotor is inside, it has a smaller diameter.

Conversely, a PMSM outer radial motor has the rotor located outside the stator. The magnets are on the external rotor, facing inwards, while the copper windings are on the inside, facing outwards. In this case, the rotor has a larger diameter, which generally generates more torque.

Axial flux motors, also known as 'pancake motors', use a different geometric layout. Instead of the

longer radial motors, axial flux motors are flat. The magnets are on the circumference of the rotor, inside and out. Interestingly, this results in the magnetic field being perpendicular to the shaft. While this means you need more magnets, it also means you get more torque with the same diameter when compared to an inner radial motor. Furthermore, axial flux motors weigh less and, as a result, have a higher power-to-weight ratio. Thanks to their high performance, YASA uses these types of motors for the Mercedes-AMG models.

'Koenigsegg took this a step further and combined both the radial flux and axial flux machines into a single structure – a configuration known as a radial-flux motor. While this uses three sides to place the magnets, ours uses four. We combine



Fully assembled motor, with radial and axial magnets (left) and stator core of motor (right)

magnets on the top and bottom sides, inside and outside. The stator is almost completely surrounded by the magnets,' explains Raute.

While these supercar motors can generate an immense amount of torque, ultimately, the motor for a prosthetic needs to be much smaller. For PROJOL, the motor needs to be 25 x 25 x 40mm and weigh less than 60 grams. A radial-flux motor design allows for maximum torque generation within a small space, making it the optimal choice. The question is, how did this motor perform?

CHASING THE HUMAN HAND

The overarching goal is to create a motor that can equal or exceed the performance of a human hand. 'We are still only at about 25% of the desired performance, so we would still need

to implement a gearbox. However, while typical prosthetics use a gearbox with a 1:100 ratio, we would need a 1:4 gearbox, which would allow for some proprioceptive feel,' says Raute.

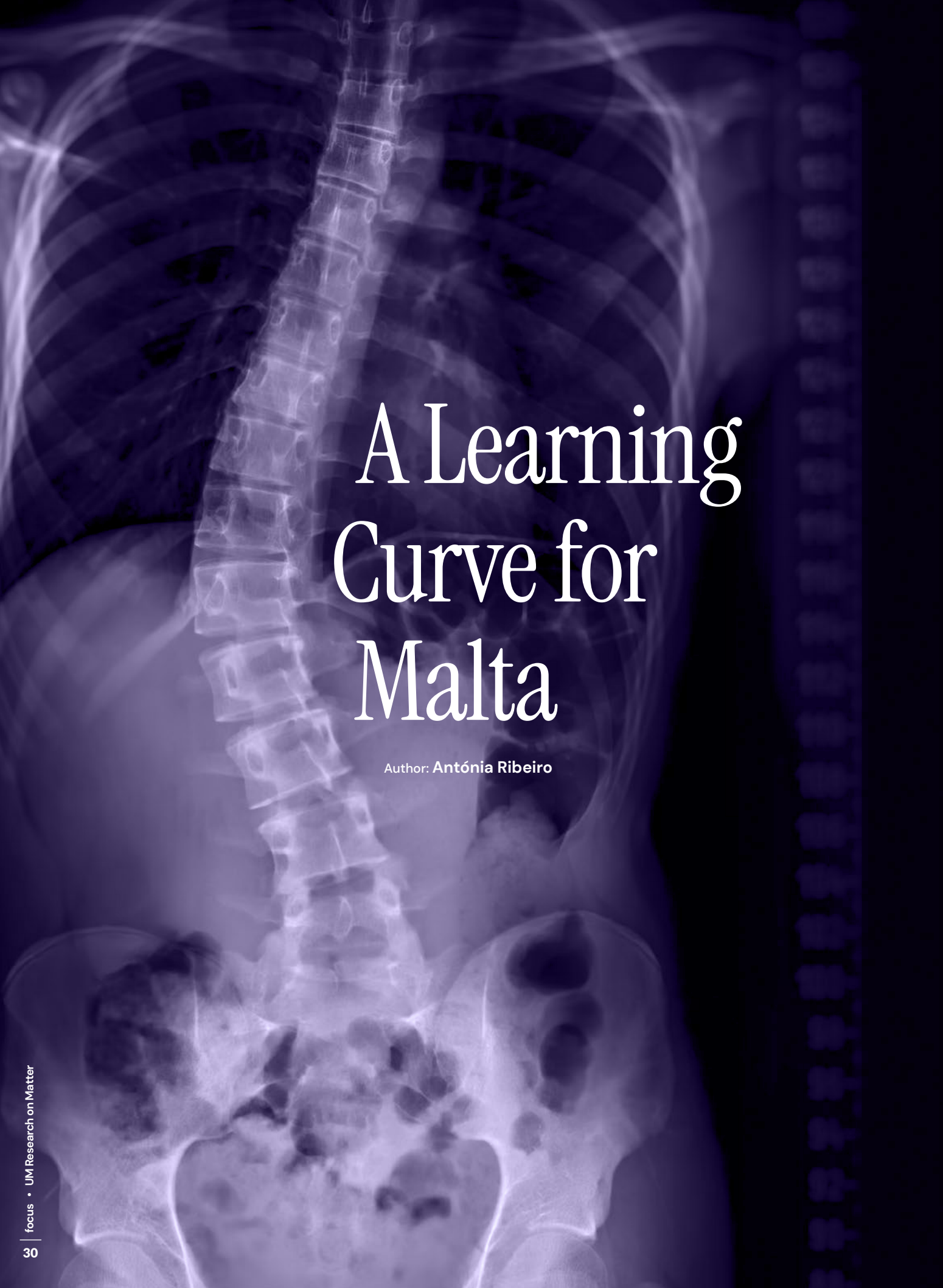
Another challenge lies with the materials, specifically magnetic saturation. While engineers can increase the current or use stronger magnets, the steel inside the motor can only carry a limited amount of magnetic flux. Once the steel saturates, extra current or magnetic field strength no longer increases torque. 'For example, we had one design with several magnets, but then the steel saturates and the flux is not there. So we made the stator steel a bit thicker and the magnets a bit thinner, which allowed more room for the flux,' Raute explains. That being said, Raute is optimistic. 'We have computer

simulations and a 3D CAD model to simulate the forces in the electric motor during operation. The next step is to develop the prototype,' he says.

Trying to design a motor for a prosthetic is no easy task. However, the same engineering that drives electric supercars could also help accelerate the development of better prosthetic limbs.

Of course, none of this would have been possible without adequate funding. 'I am really happy with Xjenza Malta and the new funding opportunities. Things have come a long way from 10 years ago. Xjenza provides the means for us to excel further,' Raute adds. **T**

The project 'Proprioceptive Prosthetic Joint Actuator (PROJOL)' is financed by Xjenza Malta through the FUSION: R&I Research Excellence Programme 2025.



A Learning Curve for Malta

Author: Antónia Ribeiro

Doctors, spinal surgeons, nurses, radiographers, radiologists, medical staff, school staff, family, and friends are all part of our medical journey. Medicine is a collective endeavour that relies on collaboration across disciplines and social groups. This is especially true for adolescent idiopathic scoliosis – a deformity of the spine that starts developing in children aged 10 years or older. Researchers acknowledge a lack of awareness of the condition in Malta. **THINK** investigates what is being done to solve this.

Adolescent idiopathic scoliosis (AIS), timing is critical. As Dr Sarah Cuschieri, a medical doctor, chronic disease epidemiologist, and senior lecturer at UM's Department of Anatomy, explains, 'Early identification and appropriate management can prevent progression to severe deformity and reduce the need for invasive treatment.' Delays in diagnosis allow curves to worsen, thereby decreasing treatment options. In addition to these time-sensitive aspects, spinal vertebral deformities that progress beyond certain curvatures are more likely to continue progressing into adulthood.

Early diagnosis is essential in AIS, and an attentive eye at school, or among family and friends, can truly make a difference. Changes in the spine's curvature are usually spotted by academic staff at secondary schools. However, Cuschieri stresses that a visual check is not diagnostic and needs to be followed by a medical assessment. Strengthening AIS education for medical students is also essential to ensure that future doctors can detect deformities early and refer patients to specialised services.

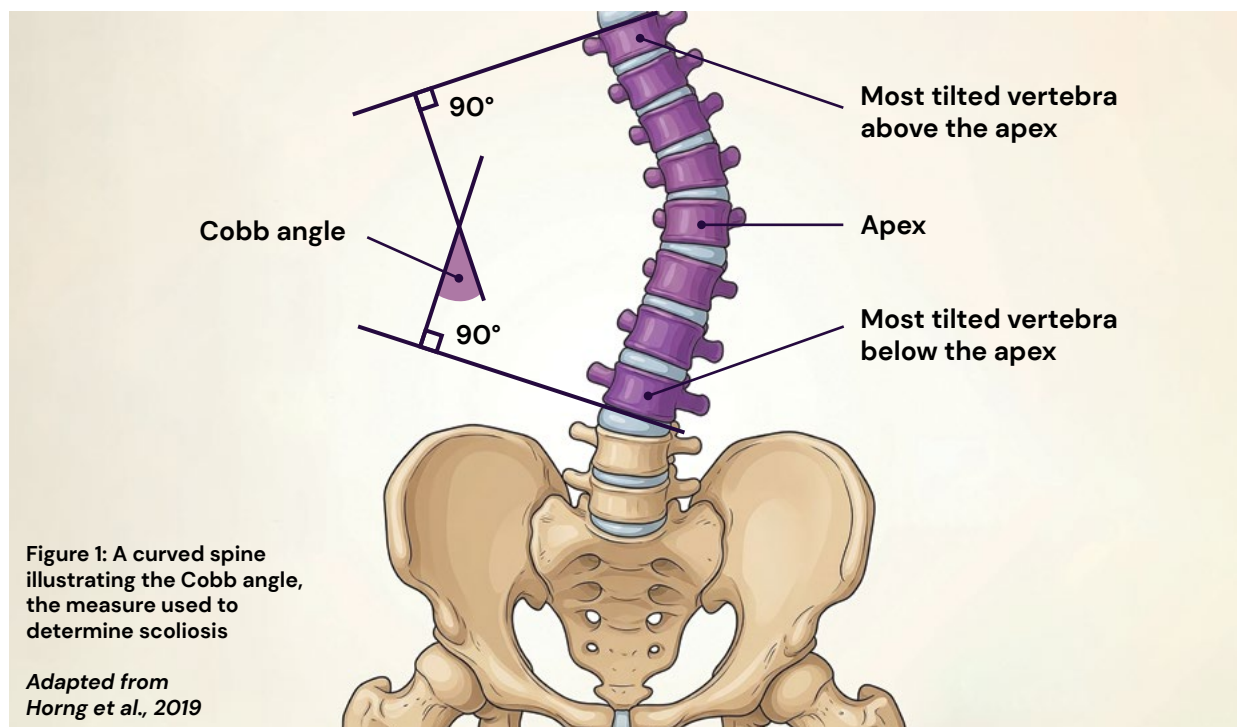
AIS is a three-dimensional deformity of the spine, with no underlying cause. Contrary to popular belief, AIS is not caused by poor posture or carrying heavy bags. Clinically, it is diagnosed when the spinal curvature has a Cobb angle (a widely used measure of spinal deformation – see Figure 1) greater than 10 degrees. Congenital or neuromuscular causes need to be ruled out before reaching an AIS diagnosis.

PSYCHOLOGICAL IMPACTS

Patients with untreated AIS can still have a good quality of life, yet spinal curves can cause limitations and, in severe cases, can even lead to cardiopulmonary issues. A condition that affects physical characteristics during an emotionally sensitive period, such as adolescence, is bound ➤



Dr Sarah Cuschieri
Photo by James Moffett



to bring complicated emotions. AIS has a real impact on teenagers' emotional well-being and self-esteem, even when there are no observable impacts on physical function.

Treatment for AIS varies according to factors such as curve severity, skeletal maturity (related to the patient's age), and risk of progression. As spinal curvature increases, so does the invasiveness of the treatment. For mild, low-risk curves, no intervention is needed, and patients are followed up by spinal orthopaedic specialists. Moderate curves in adolescents are tackled with bracing, 'which has strong evidence for reducing progression,' Cuschieri explains. Surgical intervention is considered for severe curvature (over 40 degrees) when conservative options are less likely to be effective.

However, research shows that surgery does not ensure a better quality of life. Cuschieri argues that AIS requires holistic approaches, 'including psychological support, shared decision-making, consistent outcome measurement, and health system designs that minimise late presentation.'

UNDERSTANDING AIS IN MALTA

Cuschieri is a researcher focused on the epidemiology and burden of non-communicable diseases. She is particularly interested in conditions like AIS, which manifest early in life and have long-term health, social, and economic consequences.

Her most recent study looks beyond the condition's clinical implications. The research project integrates clinical experience with population analysis through a collaboration with Stephan Grech, a spinal surgeon specialised in AIS and

a consultant at Mater Dei Hospital. Together, Cuschieri and Grech are exploring and assessing how AIS and its treatments are experienced, perceived, and understood by teenagers. The study also goes beyond typical clinical assessment by looking into the impact on quality of life, well-being, and sleep patterns.

In addition, Cuschieri seeks to examine the relationship between clinical severity and impact on quality of life. The severity of the condition is determined by the Cobb angle, as indicated by a scolliogram, which is a radiological image of the spine. The decision to proceed with surgery is based on this marker, yet there is no data to establish whether clinical severity aligns with patients' lived experience.

The researchers aim to pinpoint knowledge gaps among both the overall population and medical students. 'Together, these components allow us to identify gaps in awareness, education, and support that can be addressed at a national level,' Cuschieri explains.

Finally, the study will bring important epidemiological data about the Maltese context. Having national data, instead of relying solely on international statistics, allows for evidence-based service planning. With reliable local data, needs can be better assessed, which in turn strengthens early detection and referral strategies.

COULD YOU SPOT AIS?

The study is two-fold: 1) assessing the AIS patients (described in the previous paragraph), and 2) collecting data from 500 participants (who are not AIS patients),



including adolescents, secondary school teachers, medical students, and the general population. The results clearly indicate a gap in basic AIS knowledge at the population level. Analysis of the collected answers also suggests that most knowledge of the condition is driven by personal exposure (for example, having the condition or knowing someone with AIS) rather than by education or public awareness.

Secondary school teachers are in an optimal position for early detection of AIS. However, this group reports low confidence in identifying the condition, which Cuschieri describes as a 'missed opportunity for early detection within the school setting'. Similarly, medical students show gaps in knowledge about risk factors, screening, and non-invasive treatment. Instead of formal teaching, prior exposure emerged as the main predictor for better knowledge of AIS – a concerning pattern for future doctors.

From these results, Cuschieri concludes that 'AIS in Malta is still under-recognised, inconsistently understood, and largely dependent on chance exposure rather than systematic education.' To ensure early detection and avoid curvature progression, the researcher emphasises the need for education strategies across healthcare, schools, and the general public.

CREATING AWARENESS

Although some results have already been extracted from the collected knowledge-related data, the research team still needs to analyse the full national dataset. Results from the clinical, psychosocial, and knowledge-related

components will then be integrated into the holistic analysis of AIS. Cuschieri and Grech aim to assess the quality of life, well-being, sleep, lived experience, and awareness of AIS patients and correlate these with clinical severity.

Cuschieri intends for the study to improve awareness among healthcare professionals and the general population. The researcher also highlights important gaps in current clinical practice, which her study helps to unravel. First, clearer referral and follow-up pathways need to be implemented to ensure timely management. Then, conservative management services need to be better integrated, and patient-reported outcomes should also be considered when making clinical decisions for AIS management.

Finally, Cuschieri hopes that the new data will inform policies driving investment in adolescent musculoskeletal health. Once the data analysis is complete, the research team wants to ensure that their data does not stay on paper. To increase AIS awareness, clinicians, educators, policymakers, and the wider public need to be actively engaged. **T**

Further Reading

Horng, M. H., Kuok, C. P., Fu, M. J., Lin, C. J., & Sun, Y. N. (2019). Cobb angle measurement of spine from X-ray images using convolutional neural network. *Computational and Mathematical Methods in Medicine*, 2019, 6357171. <https://doi.org/10.1155/2019/6357171>

feature

STRONG Insights

**How Zebrafish Are Shaping the Future
of Bone and Muscle Research**

Author: **Courtney Ekezie**

*Used in scientific research since the 1980s, zebrafish (*Danio rerio*) have evolved into a strong contender in translational studies. At the University of Malta, Prof. Melissa M. Formosa and her team are utilising this model for Project STRONG, a research initiative centred on osteosarcopenia – the degenerative concurrent loss of bone and muscle.*



The origins of Project STRONG are rooted in Project ZeEBRA (R&I-2019-018T), a three-year initiative that laid the groundwork for establishing zebrafish as a viable biomedical model locally, as well as a housing facility for them. Initially focused on osteoporosis, the ZeEBRA team developed and optimised drug toxicity testing protocols. Research Support Officer Margherita Muscat explains that these early years were challenging because the team was developing approaches without well-established protocols. Standardised zebrafish embryo protocols typically only extend to four days, before significant bone mineralisation occurs. To study skeletal outcomes, the team had to extend the experimental window to seven days, optimising variables such as multiwell size, fish density, and media volume to achieve reliable, reproducible results. Prof. Melissa M. Formosa notes that this validated methodology became the 'backbone' of STRONG, allowing the team to move directly into compound testing with a robust experimental framework.

WHY ZEBRAFISH?

Setting up a new model organism is a rather demanding task. Formosa gained training on zebrafish in the Netherlands, but replicating those systems in Malta required significant adaptation. Research Support Officer Dr Sherif S. Suleiman notes that variables such as water conditions and temperature play a critical role. Ultimately, keeping the fish 'happy' through optimal environmental conditions is the foundation for reliable results. Once established, the advantages of zebrafish are immediate. Their high fecundity allows for large numbers of embryos to be generated, enabling statistically powerful experiments within a short timeframe.

Zebrafish develop rapidly, and by five days post fertilisation, most organ systems are formed. This short developmental timeline allows many experiments to generate results within one week, substantially reducing experimental time compared with many mammalian models. During early development, the embryos are optically transparent, which enables direct observation of internal

biological processes *in vivo* without the need for invasive procedures. Zebrafish also share considerable genetic similarity with humans, with around 70% of human genes having at least one zebrafish orthologue. Although they do not possess limbs, zebrafish are widely used to investigate skeletal biology, including fracture repair and regeneration, in part because of their capacity to regenerate fins and scales.

OSTEOSARCOPENIA: THE DUAL THREAT

Osteosarcopenia represents two age-related conditions: osteoporosis (loss of bone mass with increased susceptibility to bone fractures) and sarcopenia (reduced skeletal muscle mass and strength). Formosa explains that while osteoporosis is widely studied, there is a lack of osteoanabolic therapies that actively build new bone, as most current treatments are antiresorptives that merely slow bone loss. Sarcopenia, meanwhile, lacks any approved pharmacological treatment.

Emerging research shows that bone and muscle are biologically interconnected, sharing molecular





From left to right: Dr Sherif S. Suleiman, Margherita Muscat, Prof. Melissa M. Formosa, Amy Marie Vella, Matthew Camilleri
Photo by Kristov Scicluna

signalling pathways. As populations age, the simultaneous decline of both tissues increases the risk of frailty and fractures. Identifying therapeutic targets that strengthen both tissues at once is now a global priority.

THE CHEMICAL LIBRARY: NATURAL VS SYNTHETIC

A central pillar of Project STRONG is the diversity of compounds being screened, including natural, semi-synthetic, and fully synthetic products. Muscat notes that to date, approximately a dozen candidates have been screened, with several showing promise in enhancing bone mineralisation. Each category presents its own unique advantages and disadvantages. Natural products, for example, often found in existing supplements, offer a potentially faster route to market, though they present challenges regarding solubility and stability in an aquatic environment, Suleiman notes. Synthetic libraries are readily available and stable, but carry a higher risk

of toxicity. Formosa describes the process as a 'learning curve' in which the safety profile and outcome shift depending on the individual product's chemical properties.

VISUALISING THE DATA: BONE AND MUSCLE

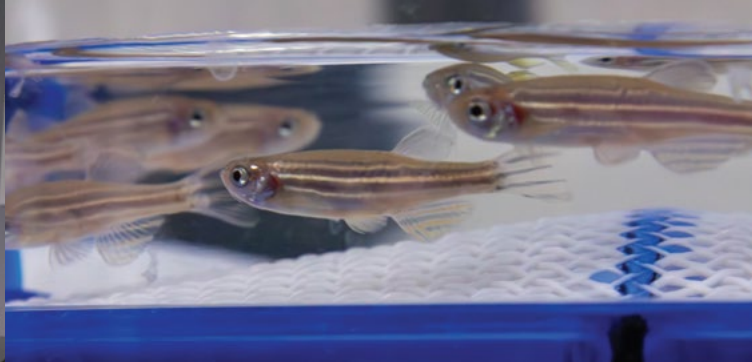
Muscat explains that for bone studies, zebrafish larvae are exposed to compounds from three to seven days post fertilisation. To maintain stable dosing and prevent toxicity, half the medium is refreshed daily. On Day 7, larvae are stained to visualise the operculum, which is the bony plate proximal to the gills that serves as a reliable readout of skeletal development. Several treated larvae have shown increased mineralisation compared to controls, suggesting true osteoanabolic potential.

The focus is now expanding to the muscles. Using polarised light microscopy, researchers can visualise muscle fibre integrity in live, sedated larvae. Since the larvae are transparent, differences in muscle structure can be

assessed non-invasively. Functional analysis adds another layer of insight. Using visual tracking technology (known as the DanioVision), individual larvae are placed in multiwell plates to record velocity, total distance travelled, and movement patterns. Light- and sound-based stimuli can also be introduced to trigger startle responses, providing data on neuromuscular integrity and neurotoxicity. Together, these parameters generate a detailed picture of muscle performance and coordination.

BRIDGING THE GAP TO HUMAN HEALTH

Formosa explains that while direct extrapolation from fish to humans is complex, the team validates their findings using positive controls. They frequently use bisphosphonates – a class of prescription medications used for treating osteoporosis. When these existing drugs produce the expected effect in zebrafish, it validates the model's relevance to human physiology. The sheer scale of



Zebrafish spawning systems designed to effectively collect large numbers of embryos (left)
Wild-type (AB) zebrafish (top right)
The DanioVision is designed to track the activity and movement patterns of zebrafish (bottom right)
Photos by Kristov Scicluna

zebrafish research also adds weight to the findings. The ability to test compounds across large sample sizes provides a level of statistical power that is often cost-prohibitive with other traditional models. As Suleiman notes, this makes the results far more robust for future translational steps.

BEYOND STRONG: INTERNATIONAL IMPACT, DIABETES AND OSTEOARTHRITIS

Project STRONG's influence has reached beyond the Maltese Islands. The natural compounds under investigation are supplied by Prof. Attila Hunyadi, from the University of Szeged in Hungary, who is interested in their effects on muscle, where pharmacological options remain limited. The strength of these findings has already sparked discussions regarding intellectual property and potential patenting.

Furthermore, the team's success has led to the launch of Project ZEDCOM (Zebrafish Evaluation of Diabetes

COMorbidities and drug targets), which is financed by the Research Excellence Fund of the University of Malta. Muscat explains that the progression into diabetes research was a natural one, driven by the high rates of diabetes in Malta and the shared signalling pathways involved in osteoporosis, sarcopenia, and diabetes. Additionally, the zebrafish's incredible regenerative properties make it an excellent model for studying wound healing – a critical component of diabetes care.

Building on the foundations of Project STRONG and the earlier ZeEBRA work, the team is now moving into an exciting new collaboration through a TÜBITAK grant, known as OSTEOBOOST. This initiative continues the group's established expertise in zebrafish-based drug testing, but with an expanded focus beyond bone alone. OSTEOBOOST will explore compounds targeting both bone and cartilage, addressing the overlapping burden of osteoporosis

and osteoarthritis, which are two of the most common musculoskeletal conditions affecting older adults.

Therefore, through these integrated projects, the Project STRONG research team is not simply studying individual diseases, but the complex, interconnected nature of human ageing and metabolic health. **T**

Project STRONG is financed by Xjenza Malta, for and on behalf of the Foundation for Science and Technology, through the FUSION: R&I Technology Development Programme LITE (R&I-2024-007L).

Project OSTEOBOOST 'Targeting transient receptor potential calcium ion channels in bone health: Investigation of drugs to be repurposed in osteoporosis treatment by using in silico, in vitro, and in vivo approaches' is financed by Xjenza Malta and the Scientific Technology Research Council (TÜBITAK), through the Xjenza Malta-TÜBITAK 2025 Joint Call for R&I projects.

Back with a Bang: Malta's Medical Community Reunites

Author: **Andrea Cuschieri**

Malta's medical community gathered in force for the **11th Malta Medical School Conference**, returning after a COVID-19 hiatus. With over 800 participants, 558 research presentations, and a heartfelt tribute to **Prof. Alex Felice**, the event celebrated Maltese medical academia while fostering learning, networking, and innovation for the next generation of researchers. Beyond its formal sessions, the conference served as a living testament to the resilience, collaboration, and shared purpose that define Malta's medical community.

The return of the Malta Medical School Conference at the end of 2025 was more than just a resumption of tradition.

It was a powerful reaffirmation of Malta's medical community. After a pause imposed by COVID-19, the 11th edition carried extra significance. With over 800 registrants and the highest number of invited speakers in the event's history, the conference underscored the vitality and ambition of Malta's research in medicine.

The conference was hosted at the Malta Mediterranean Conference Centre, a venue steeped in history. Once the **Sacra Infermeria** of the Knights of St John – the pinnacle of medieval medical practice and innovation – today its modern facilities provide a platform for cutting-edge learning and research. This subtle interplay of history and modernity reflects the essence of Maltese medical education – grounded in tradition yet always looking forward. The building itself set a tone of gravitas, quietly reminding attendees that they are part of a continuum of medical progress spanning generations.



The 11th Malta Medical School Conference held at the end of 2025
Photo by Kristov Scicluna

Prof. Simon Attard Montalto captured the spirit of the event in his opening remarks, urging participants to 'look at it as a celebration of Maltese medical academia.' His words framed the conference not merely as a series of presentations, but as a celebration of community, curiosity, and shared purpose – a gathering that brings together generations of students, researchers, and educators.

Participants came from a range of specialties and professional stages, from medical students presenting their first research to seasoned clinicians sharing decades of experience. International speakers added global perspectives, highlighting Malta's role in wider medical discourse while reinforcing connections across borders.

The sheer breadth of expertise and enthusiasm brought a dynamic energy to the event, showcasing the Faculty's commitment to both excellence and inclusivity.

REMEMBERING A VISIONARY: THE LEGACY OF PROF. ALEX FELICE

A highlight of the conference was a special tribute to Prof. Alex Felice, a pioneer in Maltese medical research. From advancing thalassemia studies to championing rare diseases, Prof. Felice helped shape the Faculty of Medicine and Surgery's vision and inspired generations of students and researchers.

In recognition of his contributions, the rare diseases session was renamed 'The Prof. Alex Felice Memorial Symposium', ensuring that his legacy continues to resonate with new generations of researchers and clinicians. Beyond his scientific

achievements, Felice embodied the ethos of mentorship, enthusiasm, and dedication that the Faculty strives to cultivate in all students. His work in rare diseases demonstrated the importance of focusing on often-overlooked areas of medicine, showing how sustained research can have a global impact while remaining firmly rooted in a local context.

This acknowledgement was more than ceremonial. It reinforced a key principle of the Faculty's mission: that research and education must be interwoven with values of collaboration, curiosity, and social responsibility. By highlighting Felice's contributions, the conference sent a clear message to attendees: excellence in medicine requires not only technical skill but also vision, empathy, and leadership.

FIRST STEPS, BIG IMPACT: STUDENTS TAKE THE STAGE

For many participants, the conference offered a transformative experience. Students and early career practitioners

had the opportunity to present research for the first time, engage with peers and international experts, and explore learning beyond traditional lecture halls. These experiences fostered confidence, collaboration, and a deeper sense of belonging within Malta's medical community.

The conference demonstrated that its success was built on speakers' active contribution to a vibrant exchange of ideas and energy. Each presentation, discussion, and question added to a culture of intellectual curiosity, where learning is both interactive and communal. It highlighted the Faculty's commitment to nurturing students' holistic development.

Participation at this scale also underscored the Faculty's strategic vision. By providing students with opportunities to engage with global experts, the conference encourages the development of skills that extend beyond the classroom: critical thinking, research literacy, and the ability to communicate complex ideas ➤



A special tribute to Prof. Alex Felice
Photo by Kristov Scicluna



effectively. These competencies are essential in preparing Malta's next generation of medical leaders.

LEARNING BEYOND THE LECTURE HALL

The conference offered much more than a formal schedule of talks. For participants, it was an opportunity to engage in professional dialogue, where ideas can be tested and challenged. It also allowed students to see theoretical principles come to life through local findings and innovations, countering the perception that meaningful studies and research happen abroad. In turn, exposure to ongoing local research further reinforced the value of grounding global medical knowledge in the realities of one's own healthcare context.

The diversity of sessions allowed attendees to explore multiple facets of medicine. This breadth of content reflects the Faculty's vision of medicine as a multidisciplinary field – one in which research, education, and

patient care inform and strengthen one another. By encountering both international perspectives and locally generated evidence, the conference reinforced the importance of cultivating broad perspectives alongside deep expertise to navigate complex challenges in future careers.

BUILDING BRIDGES: PROFESSIONAL GROWTH AND NETWORKING

Workshops, panel discussions, and interactive sessions created avenues for meaningful exchange. For the Faculty, these moments are more than logistical achievements. They reflect a commitment to enriching future leaders in medicine by encouraging students and early-career researchers to cultivate skills beyond research – communication, critical thinking, and professional networking.

By bringing together seasoned researchers and emerging professionals, the conference fostered intergenerational collaboration by strengthening connections that will

shape the future of Maltese medicine.

It demonstrates that academic growth is inherently communal, built on mentorship, dialogue, and shared expertise. The Faculty's active involvement ensures that these connections extend beyond a single event, embedding participants in networks that support career development and lifelong learning.

This networking also provides an invaluable opportunity to discuss local and regional challenges in healthcare. By connecting clinical experience with research innovation, the conference emphasises the Faculty's dual commitment to education and societal impact, reinforcing Malta's role as a hub for medical scholarship in the Mediterranean.

LOOKING FORWARD: CELEBRATING LEGACY AND PROGRESS

The 11th Malta Medical School Conference was a reminder of what can be achieved when vision, dedication, and collaboration



Left: Medical professionals and students gathered at the 11th Malta Medical School Conference, deeply engaged in the presentations and discussions

Right: Chair of the organising committee, Prof. Simon Attard Montalto

Photos by Kristov Scicluna

converge. It celebrated not only the legacy of pioneers like Prof. Alex Felice but also the enthusiasm and talent of the next generation of medical professionals.

For the Faculty, the event reinforces core values: a commitment to academic excellence, the cultivation of research and teaching, and the creation of opportunities for students to develop their potential. Beyond this, it represents a tangible manifestation of the Faculty's mission to foster a culture where mentorship and collaboration are central to medical education. It is a celebration of the present achievements of Maltese medical academia and an investment in its future.

The conference also reminds the community that Malta's medical identity is both local and global. By fostering connections with international speakers and encouraging research that addresses both local healthcare needs and broader scientific questions, the Faculty cultivates

a medical ecosystem that is forward-looking while grounded in its societal responsibility.

THE TEAM BEHIND THE SUCCESS

No conference of this scale is possible without careful coordination and the collective commitment of dedicated individuals working diligently behind the scenes. The administrative team, together with the volunteers from the Malta Medical Students Association, played a pivotal role in ensuring that every aspect of the event was executed seamlessly – from meticulous logistical planning to providing continuous support to delegates and speakers. Their professionalism, efficiency, and enthusiasm were further strengthened by the important contribution of the members of the Malta Medical School Conference Committee, whose guidance, experience, and oversight helped maintain the high academic and professional standards that defined the conference.

Special recognition is also due to the Dean of the Faculty, Prof. Godfrey LaFerla, whose leadership and steadfast commitment to academic excellence continue to foster an environment that encourages scholarly advancement and professional growth. The vision, dedication, and tireless efforts of the Chair of the Organising Committee, Prof. Simon Attard Montalto, together with the Chair of the Scientific Committee, Prof. Christian Scerri, were instrumental in shaping a scientific programme of high calibre, ensuring both its relevance and its lasting impact. Their expertise, strategic direction, and unwavering support were invaluable throughout the entire organisational process.

The combined efforts of all those involved ensured not only the smooth and efficient running of the conference but also its overall success. Their dedication serves as a powerful reminder that progress in medicine is a shared endeavour, built on collaboration, commitment, and a collective pursuit of excellence. **T**

Listening to the Motor Without Asking Where the Rotor Is

Author: **Christian Keszthelyi**

Modern alternating-current motors have an awkward dependency: the drive control system must always know the rotor's position. That tiny fact – a position, measured again and again – decides whether a car glides off the line or shudders, whether a crane holds steady or lurches. It matters far more than it sounds.

In electric cars, trains, cranes, and aircraft, the rotor inside the motor has to stay in sync with the electrical currents that power it. If the timing is off, the motor can stutter, shake, or stop working. To prevent this, most modern electric motor drive systems use position sensors.

'It is a very important device. But it is also the weak link,' says Prof. Ing. Reiko Raute, Associate Professor of Electrical Engineering at the University of Malta and Principal Investigator

for the project 'Permanent Magnet Synchronous Motor Design for Position Sensorless Drives (SensorlessPMSM)'.

Position sensors report the rotor's location to the controller thousands of times per second. They help motors run smoothly and reliably, but they also add cost and complexity, and make the system more fragile.

'In a small motor, sometimes the motor itself is cheaper than the sensor,' Raute explains. 'And when something breaks, it is often the sensor that breaks first.'

Raute's research asks a simple question: Can we design a motor that does not need a sensor, since we can figure out its position from its behaviour?

WHY MOTORS NEED TO 'KNOW THEMSELVES'

Think of pushing someone on a swing while blindfolded. If you cannot tell where the swing is, you might push at the wrong time or in the wrong direction. The swing slows down or moves unpredictably.

Electric motors face a similar challenge. Modern motors – especially

permanent magnet synchronous motors (PMSMs) used in electric vehicles – run on carefully timed alternating currents. These currents must always align with the position of the rotor's magnets.

'The phase of the voltage we apply is always aligned with the magnets,' Raute says. 'Otherwise, the motor will not work very well.'

This alignment is not optional. It happens continuously, often more than 2,000 times per second. The controller reads the rotor's position, calculates the correct current, applies it and repeats – over and over again.

That's the job of position sensors. They work like a GPS for the motor, always reporting the rotor's location. But what if we could read the rotor's position another way?

THE COST OF KNOWING TOO MUCH

Position sensors are precise, but like any mechanical part, they wear out and can fail over time.

'They are fine mechanical systems with small cables,' Raute explains. 'They can break more easily than the motor itself.'

A sensor might cost a car maker about €50, but replacing it can cost the owner hundreds. Across millions of cars, this becomes a big expense.

In safety-critical systems – like electric aircraft or high-speed trains – the stakes are even higher. ‘They often use double encoders,’ Raute notes, ‘because this is a functional safety device.’

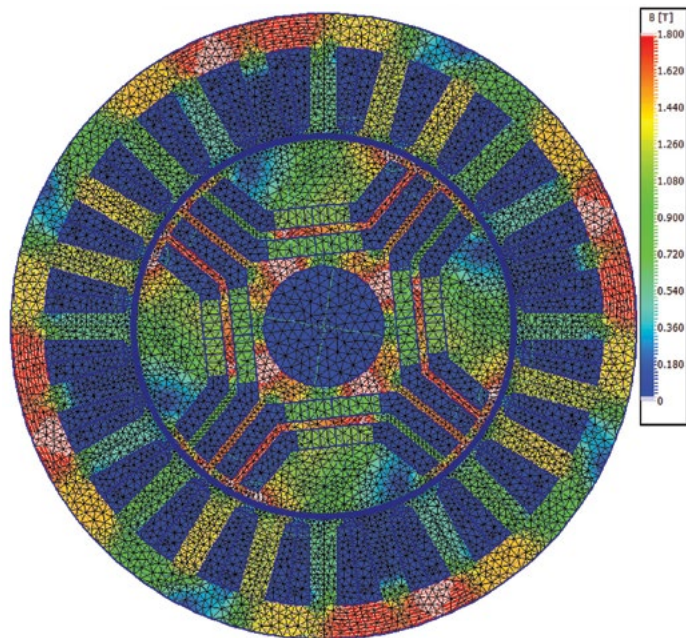
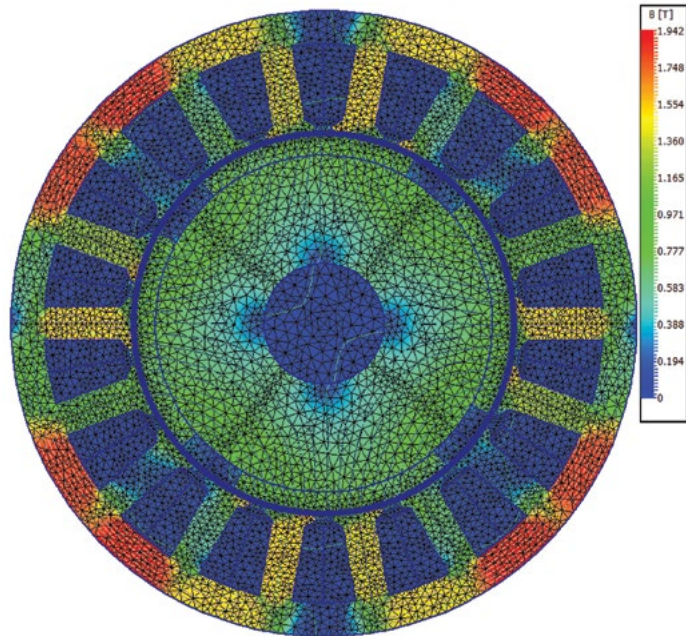
More parts mean more potential points of failure. More wiring adds weight. More maintenance leads to more downtime. If we could remove the sensor and still have reliable control, it would represent a substantial shift.

THE PROMISE – AND LIMITS – OF SENSORLESS CONTROL

Engineers know that motors emit useful signals as they run. When a motor spins, it creates voltages and currents that indicate what is happening inside. At medium and high speeds, these signals are clear, and back-EMF methods are common. Back-EMF is the small voltage a spinning motor generates in opposition to the power driving it – effectively, it is the motor talking back to its controller.

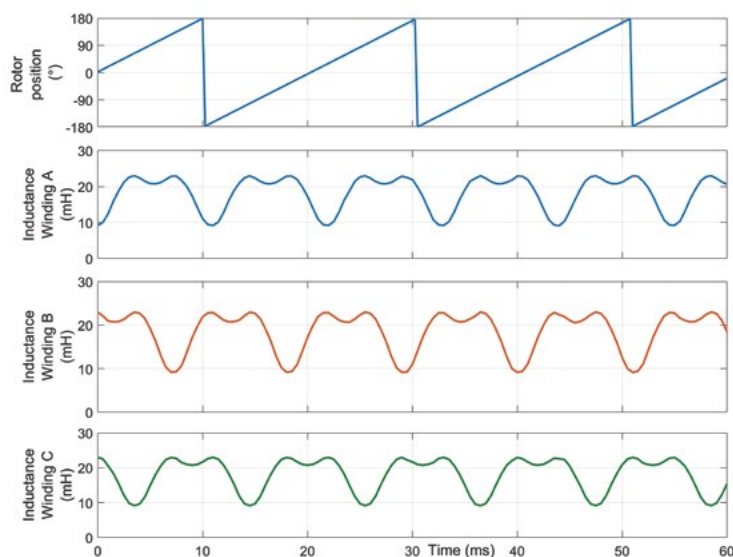
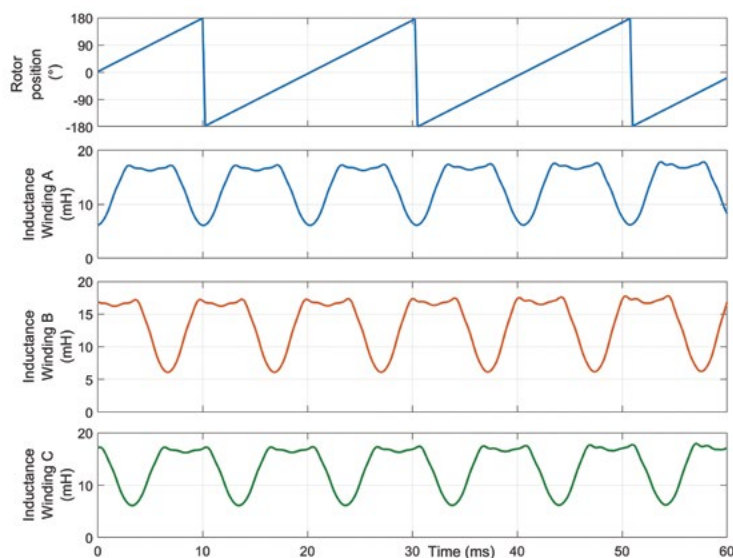
‘When the motor rotates fast enough, this problem is solved,’ Raute says. ‘You can buy many motor controllers with sensorless control.’ The problem arises at low speeds, especially when the motor is stopped. At zero speed, there’s no back-EMF, since it only appears when the motor is turning.

But this is when control matters most – like starting a car on a hill, moving aircraft wing flaps, or lifting with a crane. At low speeds, engineers look at another signal: inductance. ➔



Electromagnetic motor simulations: The red areas indicates magnetically saturated steel where inductance is reduced.

Images courtesy of Prof. Ing. Reiko Raute



READING THE MOTOR'S FINGERPRINTS

Inductance changes as the rotor moves because of the motor's shape and materials. Steel, magnets, and air all affect the magnetic fields inside. In theory, these changes can be measured, and the rotor's position estimated, even when it is not moving. But in practice, every motor is different, and the signal is complex.

'The signal that you see is sometimes very weird and difficult to understand,' he explains. 'And this signal depends on the motor design.' For years, researchers have tried to build better algorithms to read these signals. Raute worked on this during his Ph.D. research more than 20 years ago.

'We put intelligence into the inverter,' he says. 'We could see clear signals, but sometimes they did not make sense.' Over time, it seemed the issue

Graphs showing how the 3-phase motor inductances change with rotor position.

Images courtesy of Prof. Ing. Reiko Raute

might not be with the algorithms, but with the signals from the motor itself.

TURNING THE PROBLEM INSIDE OUT

Most research tries to get better information from existing motors. Raute's team asks a different question: what if we designed the motor to give clearer signals? 'Up to now, people always worked with off-the-shelf motors,' he explains. 'But most motors give very weird signals at some point.'

Modern simulation tools make this possible. Using finite-element software, Raute's team builds detailed virtual motors, including the steel, magnets, and windings, and studies their behaviour.

'Fifty years ago, this was not really possible,' he says. 'Now we can really see how the motor behaves.' The simulations show that even small changes in magnet placement, shape or steel geometry can make the inductance signal much clearer – or much more erratic.

'It may be very simple to arrange the magnets a little bit differently,' Raute says, 'so that sensorless control works much better at very low speeds.'

A NEEDLE IN A MAGNETIC HAYSTACK

Designing motors is already a trade-off. Engineers have to balance efficiency, size, torque, cost and material

availability. Rare-earth magnets are strong, but they are expensive and difficult to source. These are permanent magnets manufactured from alloys of rare-earth elements – primarily neodymium (NdFeB) or samarium-cobalt (SmCo) – which belong to the lanthanide series of the periodic table and enable exceptionally high magnetic energy density relative to their size.

'Manufacturers try to get the highest efficiency, the smallest size, and maybe even get rid of some permanent magnet material,' Raute explains. Making the motor easier to read without sensors adds another challenge.

'There are endless possibilities,' he says. 'The size, the shape, and the location of the magnets – they change everything.' Right now, the research is a mix of science and trial-and-error.

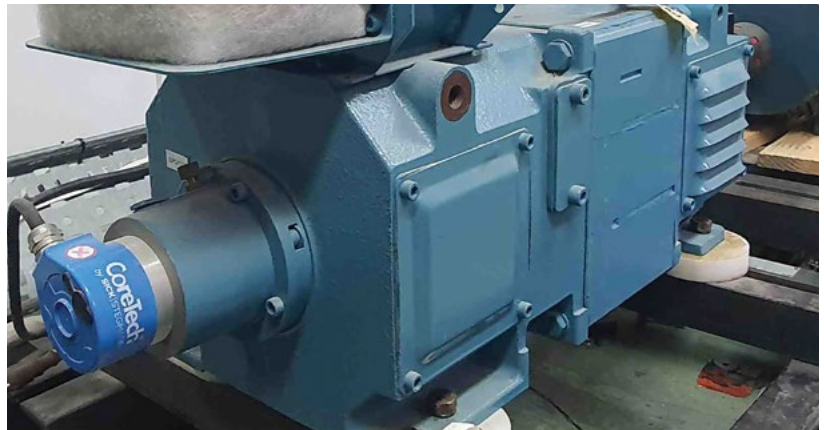
'We are still a bit in a trial-and-error phase,' Raute admits. 'We try many different designs and see what effect they have.' The team examines factors such as current effects, magnetic saturation, and steel geometry, and studies how they interact.

Artificial intelligence may help search through all these design options in the future. But first, the fundamentals need to be understood. 'AI needs to be trained on something,' Raute notes. 'And no one has done this before.'

WHY ZERO SPEED MATTERS

Most people do not think about zero-speed control until something goes wrong. 'A motor usually starts from zero speed,' Raute says. 'And in this state, you want to know the rotor position very well.'

If the controller does not know the rotor's position, it might send the wrong current. The motor can



An example of a motor at the Engineering lab with installed position sensors
Photo courtesy of Prof. Ing. Reiko Raute

jerk, shake or act unpredictably. That is why cars use encoders to sense position. 'As soon as you turn on the electronics, it knows where the rotor is,' Raute explains.

If sensorless control worked well at zero speed, many systems could be simpler. Cranes and lifts could hold loads more safely. Aircraft could use lighter electric systems instead of hydraulics on wing flaps. 'The piping system of hydraulics is very heavy,' Raute says. 'The cables of a motor are lighter.'

FEWER PARTS, FEWER FAILURES

Reliability might be even more important than cost savings. 'Motors themselves are very strong,' Raute says. 'Big copper windings, big bearings.' But sensors are fragile. 'If you can remove the encoder,' he explains, 'you reduce maintenance, space and failure points.'

And because PMSMs are already the preferred choice for electric vehicles and aircraft – thanks to their efficiency and power-to-weight ratio – improving their robustness has an outsized impact. 'If you have some intellectual property on how to

design the motor cleverly,' Raute says, 'this would be worth a lot of money.'

WHERE THE RESEARCH STANDS

The project is still in progress, and the research team continues to move at a steady pace. 'We hope at least to have a good software model by the end of April,' Raute says. A hardware prototype might come later, but simulations are not perfect yet.

Still, the goal is clear. Instead of making algorithms work harder to read noisy signals, the team wants to redesign the motor to produce a cleaner signal. As Raute says: 'We try to design a motor that gives us a clean signal that we can really use.'

If motors can be designed to reveal their position through their own physics, one of electrification's most persistent dependencies simply falls away. **T**

Project 'Permanent Magnet Synchronous Motor Design for Position Sensorless Drives (SensorlessPMSM)' is financed by the Malta Council for Science & Technology for and on behalf of the Foundation for Science and Technology, through the FUSION: R&I Research Excellence Programme.

WHERE IDEAS MEET THE SEA

BRIDGING MINDS ACROSS THE MEDITERRANEAN

Author: **Catherine Camilleri**

Mediterranean voices intertwine this spring to reimagine our shared waters, converging at the REMED postgraduate Spring School and the Department of English Postgraduate Symposium to (re-)visit the Med through literature, culture, and connection.



Spring is in full bloom on the Maltese islands. The hills and fields are still lush before the dryness of summer, and the Mediterranean Sea grows warm and inviting as it shakes off those last chilly vestiges of winter. The University of Malta Valletta Campus is equally abuzz with transformation, humming with the energetic rhythm of cross-cultural connection. Students and academics have flocked to Malta, crossing the Med from Italy, Cyprus, Tunisia, and Ireland for two weeks of intense discussion, intercultural learning, and social connection bound by shared curiosity.

It is the second year of the (Re-) Visiting the Mediterranean: Literature, Culture, and Environment project (REMEDI), an EU-funded initiative through the Erasmus+ Cooperation Partnerships in Higher Education Scheme. REMEDI is a collaborative exchange among the University of Malta, the National University of Ireland Maynooth, Università degli Studi di Firenze, the University of Cyprus, and Carthage University, and deep-dives into the intrinsic, ever-evolving dynamics found within Mediterranean literature, culture, and landscape. REMEDI partly draws from the Blue Humanities, an interdisciplinary field which explores how bodies of water shape our understanding of the world around us, representing an innovative approach to ecocriticism. REMEDI draws us close to home, focusing on

how the waters that surround the Maltese islands are conceptualised and re-imagined through literature, art, and human experience. But the Mediterranean is more than a static geographical backdrop – it is a living archive where ecological, cultural, historical, and political narratives merge. REMEDI situates itself within this vast intersection, providing space for academics and researchers to adopt an ecocritical lens and explore the nexus of literature, culture, and the environment in the wine-dark waters of the Mediterranean.

MEDITERRANEAN VOICES MEET AT SPRING SCHOOL

At the project's centre are Prof. Stella Borg Barthet and Dr Marija Grech from UM's Department of English, who are no strangers to interdisciplinary collaboration. With Mediterranean literature close to the department's heart, the REMEDI project has been years in the making and represents the collective efforts to sustain a common intellectual homeland among academics embedded in the Mediterranean's diverse realities. The first highly received session was held in 2025, with participants lauding the shared, open space where multidynamic thoughts could grow.

This spring, Grech and Borg Barthet return with their international partners to facilitate two weeks of academic and social activities for REMEDI participants, with the Spring School serving as the crucible for a melting



Photos taken at the REMED postgraduate Spring School and the Department of English Postgraduate Symposium
 Photos by James Moffett

pot of cross-cultural exchange. Each day, participants converge upon the Valletta campus for intriguing lectures which embrace the complexity of the Mediterranean waters, dissecting texts from across the ages with a critical eye on symbolism, historical context, cultural traditions, and ecological transformation. Students explore a chronology of Mediterranean literature, from Ancient Greek tragedies to Shakespearean plays, Victorian novels, and post-colonial and contemporary fiction, but beyond the lecture, something equally valuable takes place. At the Spring School, students bring the dynamics in these texts to life, sharing ideas built from lived experiences and shared realities of being within the Mediterranean basin. It is here that cross-cultural connection is sustained, where participants from different walks of life meet under a mutual curiosity to understand and conceptualise the space we share.

Discussions teem through UM's sun-soaked halls as debates from the most recent lecture spill into the stairways, where lingering thoughts are eagerly exchanged between sandwich bites and cold Kinnie. The afternoon brings in-depth seminars which delve deeper into the morning's topics, where ideas

that bubble up during lunch have space to be shared. Seminars encourage participant-driven discussions, opening the doors for multi-national perspectives that honour differences and stay attuned to the complexity of living within such a multidynamic environment as the Mediterranean. As conversations weave from classroom to corridor, the Spring School's academic efforts transform into a living dialogue. This dialogue is on full display at the English Department's yearly Postgraduate Symposium, this year aptly themed 'Voices', where Spring School participants share the fruits of the programme within the academic discourse. The Symposium becomes a meeting ground where the Mediterranean's layered histories serve to deepen our understanding of one another.

REMED invites the academic community to embrace the multiplicity of the Med and challenges us to sit with its dissonance, as a space that embodies vastly different realities. The Mediterranean is, at once, a migration route and a tourist destination, a living symbol etched in history and a tangible ecosystem we strive to protect in the present. In recognising that the Mediterranean means

different things to different people, the Spring School and the Postgraduate Symposium create a space where these voices do not compete, but coexist and intertwine. The transformative power of the REMED project lies in this marriage of perspectives, where scholars are invited to share and to listen to the plethora of lived realities that find a home on the Med's shores. At this crossroads of voices, a deeper understanding of our interconnectedness grows, and the boundaries of the Med are no longer fixed but continually reimagined.

COMMUNITIES BEYOND THE CLASSROOM

REMED isn't just an academic exercise – academic lectures build on the social connections made outside the classroom, as visiting students integrate with Maltese participants over a shared love of literature and culture. Participants enjoy outdoor excursions, travelling to the Blue Grotto, Mdina, and Ħaġar Qim to explore Malta's history and landscape. Film nights showcasing Mediterranean cinema and open mics where students can share their creative works bolster a shared space where ideas and connections flow.



REMED participants eat, work, and live together, sharing stories of experience well beyond the boundaries of the classroom. This social exchange is equally valuable to the academic rigour of Spring School, solidifying bonds to form a lasting academic community grounded in shared curiosity, mutual understanding, and strengthened ties to the Mediterranean. It is this change that REMED seeks to actualise: a far-reaching network of intellectuals who share ideas, collaboration, and bonds of friendship that bloom in tangible projects and future innovations. Participants leave the programme with a sharpened eye for how language functions, how it can be critiqued, and how implications are formed. They also leave with lifelong friendships they can call upon to share expertise within their communities, and university connections are strengthened through this exchange of ideas, projects, and passions. Such ties will inform the future of the Humanities in the Mediterranean basin and provide more opportunities to unpack the complex realities that live alongside us.

REMED is also stoking passions within the wider academic community here in Malta. The project invites sixth-form students to share their

own voices through a short-story competition, and last year's submissions showcased the evocative writings of budding creative writers. This year, the competition opens the floor to submissions of both poetry and short stories. It is currently accepting submissions (until 30 April 2026) under the call 'Seeing the Sea', which encourages deeper reflection on Mediterranean identities and asks students what the Med means to them. Secondary students with an aptitude for the arts can also participate in a poster-making competition titled 'Protecting the Sea', which encourages young scholars to think more about marine conservation and the environment around us. These initiatives not only promote literary and visual art but also get students to critically reflect on how creative representation can instigate dynamics of change. Apart from promoting the Humanities, REMED empowers future scholars to see their creativity as a tool for environmental awareness and a medium for exploring and sharing their ideas. By nurturing the Humanities' future and keeping the Med at the forefront, REMED renews a sense of identity, responsibility,

and kinship to both the region and others who call it home.

(RE-)VISIT THE MED

The Mediterranean's richness goes beneath the surface of its blue waters and draws us into conversation. REMED invites us to rethink how we view Mediterranean identity, not as a singular entity divided by maritime borders but as a fluid, relational space shaped by centuries of interconnection and change. REMED is not only shaping academic discourse but also transforming it, encouraging communities to actively participate in assessing and sustaining the cultural, ecological, and social vitality of the Mediterranean waters we share. Through its Spring School and Symposium, REMED creates space to examine some of the Mediterranean's most urgent realities, particularly migration and environmental instability, and transforms an academic gathering into a shared, living dialogue – one that is eager to add your voice to the mix. **T**

Learn more about the REMED project, how you can register for the Symposium, and participate in the creative writing and poster competitions at revisitingthemediterranean.eu

Culture, Power and Education

Author: **Timothy Alden**

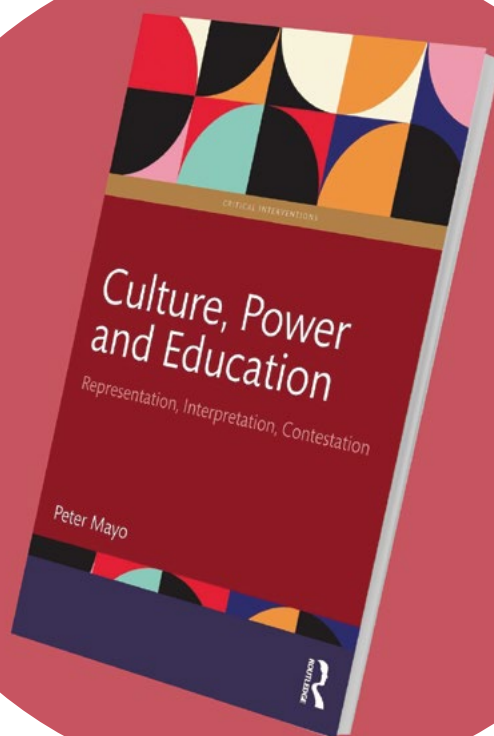
*Is education merely the passing on of information in a classroom, or does it play a central role in how power and control are exercised? Does education stretch beyond the classroom into lived culture in our daily lives? This essay analyses **Peter Mayo's** *Culture, Power and Education: Representation, Interpretation, Contestation*, focusing on how his expansion of pedagogy to cultural institutions reveals the subtle mechanisms through which power is reproduced and contested.*

Prof. Peter Mayo's recently released book, *Culture, Power and Education: Representation, Interpretation, Contestation*, offers a theoretical lens through which we can identify and interpret the power structures holding today's turbulent world aloft. Mayo draws on key thinkers in the field of education, such as Antonio Gramsci, to establish a foundation that recognises that education is itself political and plays a central role in hegemonic power struggles. Where Mayo goes further is by contextualising this within a wider understanding of education than the formal kind. In Prof. Bob Jessop's (Professor Emeritus of Sociology, Lancaster University, UK) words, Mayo 'shows how popular and elite culture are thoroughly embedded in

wider social relations.' As the UNESCO Co-Chair of Global Adult Education, Mayo has drawn attention to non-formal education outside the school system. It is in this spirit that Mayo examines the roles of museums, the fine arts, and cultural traditions such as 'Holy Week', when considering how education relates to power.

EDUCATION AND HEGEMONIC POWER

Mayo begins his book by introducing the thinkers who shaped his work, situating their literary contributions within the context of his own reflections. Gramsci is best known for his work on the concept of hegemony, which Mayo states is 'concerned with the exercise of influence and winning of consent' and thus that 'all aspects



of social reality are conditioned by or supportive of a single class or group'. This hegemony is then promoted or opposed by intellectuals, and thus, through education, which presupposes certain perspectives and values. As Gramsci developed his ideas, all around him were instruments of popular culture such as comics, radio, and football, which were instrumental in propping up what Michel Foucault described as 'regimes of truth'. Thus, Mayo fundamentally draws attention to those who benefit from certain power structures and explains why they emerge in the first place. To Gramsci, 'every relationship of hegemony is a pedagogical relationship'.

Separately, Mayo lauds Don Lorenzo Milani, whom he dubs 'one of Italy's most heralded educators'. Milani sought

to offer students of poorer status an opportunity for a robust education. On this, Mayo quotes one line from a survey on social-class bias in education that compares 'the public school to a hospital that treats the healthy and rejects the sick'. Milani established the School of Barbiana, which, through its operations, communicated a non-hegemonic set of values and principles. Nonetheless, Milani believed his school was unique to its place and context, and could not be reproduced elsewhere. A stark contrast is offered in this regard to the mass factory-farming approach of neoliberal education, which merely prepares students for the market economy in a one-size-fits-all approach.

Delving deeper into theory, Mayo introduces Paulo Freire, renowned for his usage of the term 'praxis', which

itself dates back to ancient Greece. Put simply, praxis may be understood as the application of reflection and theory to transformative human activity. Mayo states that 'praxis is geared to transforming the world as one intervenes in history to contribute towards its development'. It helps to identify possibilities for change and to understand social relationships.

PEDAGOGY AND RESISTANCE

To Freire, the pedagogical approach involves his concept of 'conscientização', which represents the process of coming into critical consciousness. For Freire, the pedagogical process is therefore inseparable from power, as education either reproduces existing social relations or enables their ➤



Prof. Peter Mayo (left) presenting a copy of his publication to the UM rector, Prof. Alfred J. Vella (right)
Photo by Kristov Scicluna

transformation. Conscientização involves not merely becoming informed but also developing the capacity to recognise one's position within structures of dominance and to act upon that knowledge. In this sense, education is never neutral. It either serves to domesticate or to liberate. Mayo adopts this Freirean position in order to argue that critical pedagogy must extend beyond formal schooling, as the

forces shaping consciousness are not confined to the classroom.

Mayo further develops this argument through his reading of Henry Giroux, whose contribution lies in foregrounding education as a central site of democratic struggle. Giroux extends Gramsci's concept of hegemony by focusing on how neoliberalism reshapes education into a depoliticised, market-oriented enterprise. Under such conditions,

schools and cultural institutions no longer cultivate critical citizens, but compliant subjects suited to economic productivity.

Giroux is particularly concerned with what he terms authoritarian populism, whereby culture and education are mobilised to legitimise inequality while discouraging critical dissent. Mayo draws on this framework to argue that contemporary education increasingly suppresses critical pedagogy in



Museums, works of fine art, and religious traditions function pedagogically by shaping what is remembered, celebrated, and rendered invisible.

favour of technical competence and managerial efficiency. This shift not only narrows the purpose of education but also erodes its democratic potential. Furthermore, there has been the emergence of a 'carceral state', which refers to governments investing in punitive control systems like prisons, prioritising control over investment in education.

Crucially, Giroux insists that educators retain a moral and political responsibility to resist neoliberal trends. Teaching, for Giroux, is an ethical practice that demands engagement with questions of power, history, and social justice. Mayo adopts this position to reinforce his central claim that education, whether formal or cultural, is always implicated in power relations, and that refusing to acknowledge this serves hegemonic interests.

CULTURE AS INFORMAL EDUCATION

It is at this point that Mayo broadens his analysis to cultural institutions and practices that often present themselves as apolitical or purely aesthetic. Museums, works of fine art, and religious traditions

function pedagogically by shaping what is remembered, celebrated, and rendered invisible. By framing culture as a site of informal education, Mayo demonstrates how hegemonic power is sustained not through coercion alone, but through the subtle cultivation of consent. These spaces, much like schools, become arenas in which dominant narratives are normalised and alternative interpretations are marginalised, thus reinforcing the very power structures that critical education seeks to challenge.

In examining these cultural sites, Mayo is particularly attentive to the ways in which claims of neutrality function as a mechanism of power. Museums, for instance, often present themselves as spaces of preservation and appreciation, yet the choices surrounding curation, display, and omission inevitably reflect broader ideological positions. What is framed as heritage or aesthetic value is therefore inseparable from histories of domination, exploitation, and exclusion. Mayo's intervention lies in insisting that such institutions should be read not simply as repositories of culture, but as active pedagogical agents within hegemonic formations.

This analysis extends to religious and cultural traditions such as Holy Week, which Mayo treats not merely as expressions of faith or communal identity but as practices through which values, hierarchies, and collective memories are transmitted. These rituals educate participants and observers alike, shaping understandings of suffering, authority, and belonging. In doing so, they can either reinforce existing power relations or, when critically engaged with, open up possibilities for contestation and reinterpretation.

Ultimately, Mayo binds the theoretical frameworks together with the goal of showcasing the 'contested nature' of 'cultural production'. According to Mayo, this production cannot be extricated from its context, and the 'selective structures in which they are embedded historically'. One is left, however, with a clearer vision of the role that education and culture play in the exercise and wielding of power, particularly in enforcing one hegemony or another. In today's increasingly hostile world, the technologies evolving at our fingertips and the information and narratives they communicate may be examined anew through Mayo's *Culture, Power and Education*. 

In addition to its English publication, Culture, Power and Education by Prof. Peter Mayo is available in Spain (in both Spanish and Catalan translations) and in Türkiye (in Turkish translation).

Keeping Neuroscience Reliable

Building a Phantom Brain That Never Thinks But Always Knows

Author: **Andrea Cuschieri**

*Neuroscientists usually scan real brains to understand the mind. A team at the University of Malta is doing the opposite: they are building a fake brain first – not to think, but to keep neuroscience reliable. Their project, **SARA**, blends Functional Magnetic Resonance Imaging (fMRI) with delicate biochemistry in an unlikely marriage that could make brain imaging more reliable and more reproducible.*

Functional Magnetic Resonance Imaging, better known as fMRI, is one of the most powerful tools modern neuroscience has ever created. It does not photograph neurons firing. Instead, it tracks changes in blood flow that occur when brain regions become active. When a cluster of neurons works harder, it consumes more oxygen. Fresh blood rushes in to replenish it, subtly altering the magnetic properties of that blood. The scanner detects these tiny shifts and transforms them into colourful maps that appear to show 'thought in action'.

Over the past two decades, fMRI has allowed researchers to peer into memory, emotion, decision-making, movement,

and even creativity. Clinically, it holds promise for understanding conditions such as Alzheimer's disease, epilepsy, and schizophrenia – all without a single incision.

Yet behind its glossy images lies a much more complex reality.

WHEN BIG MACHINES GET IT WRONG

Like every scientific instrument, an fMRI scanner is imperfect. The signals it measures are weak, noisy, and heavily processed by complex software before scientists ever see them. What looks like brain activity is partly biology, partly physics, and partly statistics.

Brains themselves make things even harder. No two are shaped the same, so researchers must warp each brain into a standard template by stretching and

squeezing individual anatomy so that scans can be compared across people. That step is essential for research, but it also risks distorting the underlying data. The problem is not that fMRI is useless – far from it – but rather that it can be overtrusted. A bright blob on a brain image can look definitive even if it partly reflects scanner artefacts, software assumptions, or statistical quirks rather than true neural activity. As Dr Claude Bajada, the principal investigator of Project Synthetic Anatomy for Radiological Applications (SARA), explains, uncertainty is unavoidable: 'Every analysis has noise... it is good practise to investigate what the noise is to validate how robust the analysis techniques are.'

This matters because if the technology is unreliable, the



The SARA Team from left to right: Sephora Galea, Dr Claude Bajada, Prof. Therese Hunter, and Dr Brandon Seychell
Photo by James Moffett

consequences could include misinterpretation of results or clinical trials built on unstable foundations. As Bajada bluntly put it: 'If you get this wrong, you risk entering clinical trials on a foundation that doesn't make sense, potentially wasting millions in funding.'

So, how do you test whether fMRI is producing accurate readings or not?

FLIPPING THE SCIENTIFIC METHOD ON ITS HEAD

This is where Project SARA takes a radical turn. Normally, scientists scan real brains and try to infer what is happening inside them. SARA does the opposite: it works to create a fake brain where the answer is already known, then tests whether the scanner and analysis pipeline can find it. Instead of asking, 'What is the brain doing?' SARA asks, 'If we already know what should be there, do the fMRI and data processing algorithms detect it correctly?' This provides what researchers call ground-truth data, a reference reality against which every measurement, algorithm, and assumption can be

checked. As Bajada described it, this is essentially neuroscience in reverse: 'You know what to expect... it is more about calibration – if you know what the outcome is meant to be.'

Unlike a real brain, the SARA phantom will never think, but it will always generate exactly the signal that it was designed to produce.

THE TEAM BEHIND THE SYNTHETIC BRAIN

SARA is led by Dr Claude Bajada from UM's Boundaries of the Brain (BOB) Lab, together with Prof. Therese Hunter from UM's Biochemistry and Protein Science Lab. Dr Brandon Seychell and Sephora Galea contribute to the project through the physical construction of the phantom, experimental design, and data analysis.

From the outset, the team faced two intertwined challenges: first, to make the phantom look like a real human brain; and second, to make it behave like one inside an MRI scanner.

The shape matters enormously. Modern fMRI analysis depends on standardised brain templates, so a phantom that does not resemble

real anatomy would be useless for testing real-world methods. As Bajada explains, 'A lot of the analysis depends on preprocessing, and this needs to have the same shape of a brain to fit into the standard protocols.'

MIMICKING THE BRAIN: DEVELOPING HYDROGEL-BASED BRAIN PHANTOMS

Building a stable, detailed, brain-like object that could survive inside a powerful MRI scanner required many rounds of optimisation, trial and error, and careful craftsmanship. The concept seems simple – to ensure that fMRI machines and associated data-processing algorithms are measuring what they intend to. Yet, as Hunter eloquently sums up, 'The project started from a very simple place to create something that is not so simple for a very complicated and complex experiment.'

Such a complex undertaking requires creativity and an unlikely merger of two distinct disciplines on either end of the scientific spectrum. At first glance, fMRI neuroscience and biochemistry seem worlds apart – one deals with ➤



3D-printed brain slab used for phantom production – bottom view (left) and top view (right)
Photo courtesy of the SARA team

colossal magnets and radio waves, the other with delicate molecules and chemical reactions. Project SARA deliberately bridges this gap.

The physical brain model is built from hydrogels, which are soft, water-rich materials that mimic the mechanical and magnetic properties of real brain tissue. These gels can be shaped to reproduce the brain's intricate folds and differentiate between grey matter and white matter.

But structure alone is not enough. Most existing brain phantoms generate signals using simple electronics. The SARA team is trying something different by achieving signals using biochemistry. They are experimenting with hemin, a molecule closely related to haemoglobin, the oxygen-carrying protein in red blood cells. By alternating hemin and saline solutions and exploring the

magnetic changes in the presence and absence of hemin's iron, the team aims to create controllable MRI signals that mimic changes of blood oxygenation in a living brain.

The goal is not to perfectly replicate human physiology, but to generate repeatable, predictable, brain-like signals that can be turned on and off at known locations inside the phantom. In a sense, SARA is a brain that rehearses activity without consciousness.

TOWARDS A BRAIN THAT ALREADY KNOWS THE ANSWER

One of the most powerful features of the SARA phantom is not just where the signal appears, but also how that signal switches on and off over time and whether analysis algorithms can correctly recognise that pattern.

In human studies, many fMRI analyses are built around expectations. For example, during a task the brain should show a clear on-off-on-off pattern of activity that matches the experimental design. Scientists then ask which parts of the brain follow that pattern. The problem is that this assumes both the scanner and the analysis are faithfully capturing what really happened.

With SARA, that assumption is removed. The team can program a precise, known 'on' or 'off' signal into the phantom and then test whether the fMRI scanner and the analysis pipeline detect it as they should.

This is especially important for newer, data-driven approaches such as resting-state fMRI, where people lie still and researchers search for spontaneous patterns of connectivity. These methods are promising but



T1-map of the brain phantom, showing contrast between grey matter and white matter compositions
Photo courtesy of the SARA team

difficult to validate because there is no obvious correct answer in a real brain. As Hunter emphasises, ‘You cannot assume anything is a real signal – whether it is noted through an MRI or a huge DNA-sequencing machine.’

SARA therefore provides a controlled way to stress-test not just scanners, but the mathematical assumptions behind fMRI analysis itself, before those techniques are used to make big claims about how the human mind works.

FROM PHANTOM BRAIN TO REAL IMPACT

SARA is not meant to replace research on real brains; they will always be essential. Instead, the phantom acts as a quality-control brain, a trusted benchmark that keeps the entire imaging system accurate. It helps scientists compare

MRI scanners, identify sources of noise, test new analysis techniques, and understand how preprocessing and brain-warping affect results.

In the long run, this could make fMRI more reliable in clinical settings. Better-calibrated scanners and more trustworthy analyses may give doctors greater confidence when using fMRI to support diagnoses of conditions like schizophrenia, epilepsy, or neurodegenerative diseases. The impact is indirect but powerful: better tools lead to better science, which leads to better medicine.

In many ways, SARA feels like science fiction: a manufactured brain built not to think, but to teach machines how to see thinking. Yet the aim is deeply practical. By reversing the usual logic of neuroscience, the team hopes to make one of science’s most dazzling tools more dependable. **T**

The SARA research team gratefully acknowledges the provision of scanning services by the University of Malta’s MRI Platform (UMRI).

Project ‘Synthetic Anatomy for Radiological Applications – Generating a Functional MRI Phantom (SARA)’ is funded by Xjenza Malta through the Research Excellence Programme (Grant no. REP-2024-033), on behalf of the Foundation for Science and Technology.



Living the Mystery: Inside the Mind of Anton Grasso

Author: **Martina Treeby**

For decades, **Anton Grasso**, Malta's Master of Horror, has thrilled and terrified readers with stories of the supernatural. With over 40 years of writing experience to his name, why are fear and mystery such compelling topics for Grasso? **THINK** sits with Grasso to find out how fear has shaped his art.

Known as Malta's literary master of horror, Anton Grasso has spent more than 40 years exploring fear, the supernatural, and the limits of the unknown. But this raises a deeper question at the heart of his work: what kind of mind spends a lifetime chasing mystery? Beyond the printed page, Grasso's fascination with fear found one of its most recognisable expressions in *Enigma*, the paranormal programme that once held Maltese audiences firmly in its grip.

For many horror fans in the 1990s, *Enigma* was a familiar Monday night ritual, tuning in to see stories of apparitions, uncanny encounters, or the notorious White Lady – tales that sit at the edge of belief and linger long after the episode ends. These stories have a way of creeping into your subconscious, making even the most hardened sceptic nervous once the lights go out.

Why are fear and mystery so compelling, not just for Grasso, but for us as well? 'Fear isn't what you can see really, but what you can't see, that which is mysterious,' Grasso explains. And that philosophy is precisely at the heart of *Enigma*.

ENIGMA'S HUMBLE BEGINNINGS

Although *Enigma* later became a successful television series, its origins were modest. The project began as a radio programme built around interviews with individuals willing to share experiences they could not explain. From the outset, Grasso was careful not to frame these narratives as evidence or spectacle; instead, the programme allowed them to exist in a space of uncertainty. While occasionally juxtaposed with perspectives from experts such as priests and psychiatrists, the aim was not to solve the mystery, but to sit with it. As Grasso would insist, 'a mystery doesn't remain a mystery once you discover it.'

The atmosphere surrounding *Enigma* seemed, at times, to echo its subject matter. The programme began recording on the dreaded Friday the 13th, and Grasso recalls a story about an early interviewee whose testimony had made a strong impression. An equipment malfunction resulted in this audio being lost. However, Grasso would never get the opportunity to re-record the missing interview: 'The week after, we went to see this man

again, and they told us he had died.' Such moments were not presented as proof of anything supernatural, but they contributed to the sense that the unknown could never be fully controlled or explained. For Grasso, this ambiguity was essential: 'the curtain remains black and if you open it, you find nothing, and everything is lost.' When *Enigma* transitioned to television on TVM, its popularity revealed a widespread fascination with the paranormal among Maltese audiences – something that reflected the innate curiosity we all have when it comes to the unknown.

Enigma established Grasso as a public identity distinct from his literary career, becoming a cultural reference point in its own right. Yet for him, the programme's success confirmed something more fundamental: that fear and mystery are not anomalies, but universal and permanent features of human life. 'Believe it or not, accept it or not, fear is part of our lives.'

Grasso's book *Enigma* would go on to become his favourite work. Unlike many of his horror stories, which he approaches with relentless self-criticism, *Enigma* represents a convergence of his interests as a writer and thinker, a worldview in which ➤



Top: Anton Grasso at his home office.

Bottom: *An evening with Anton Grasso* – the acclaimed author in conversation, sharing insights into his craft together with a selection of his published works on display during the event.

Photos by Kristov Scicluna



the supernatural is not reduced to explanation, and fear is not something to be overcome. But behind the measured voice and calm presence associated with the author lies a figure shaped by fear from an early age.

THE CHILD WITHIN

'From when I was young, I was always, always, fearful but curious.' Recalling his early encounters with horror imagery, Grasso speaks of being drawn to stories that unsettled him while simultaneously demanding his attention. 'In Birzebbuga, we stayed in a house opposite the movie theatre called 'Lido'. And I heard screaming from it. I was just a small boy hearing this scream, wanting to know what was happening in there, but at the same time being scared,' he explains. This tension between the known and the unknowable would later form the philosophical backbone of *Enigma* and his horror writing more broadly.

Grasso resists the idea that writing horror was a deliberate or strategic choice. He insists that he never set out to write horror stories, nor did he see writing as a way to purge himself of fear. 'My fears have never left me,' he states plainly, rejecting the notion that storytelling functioned as a form of release. Instead, fear remained constant, shaping his imagination without ever being resolved.

Central to Grasso's self-understanding is the idea that the



child within him – the ‘inner boy’ – never disappeared. This emotional openness, he suggests, is not something he outgrew, nor something he wishes to lose. ‘The boy never dies,’ he muses, ‘This boy that never grew up, that still chases butterflies, that still blows bubbles and pops them – a child. He stayed there, you know, and he will stay there. So, that’s the dichotomy, the great divide between the author and the human.’ It is this same vulnerability that makes him acutely responsive to stories of loss, illness, and death, and that distinguishes between his authorial persona and his real life.

THE ULTIMATE ENIGMA: DEATH

Grasso’s lifelong engagement with the paranormal ultimately leads to a far more intimate and disturbing preoccupation: death itself, and more specifically, burial. Grasso is explicit in distinguishing between a general fear of dying and his own particular obsession. Death, for him, is inseparable from what follows it. ‘When someone dies,’ he reflects, ‘nobody stays with the dead continuously. The irony is, when someone dear to you dies, you do everything you can to get rid of them and bury them as quickly as possible.’

Having suffered the loss of his father as a child, and more recently the loss of his younger brother,



Anton Grasso signing copies of his books
Photo by Kristov Scicluna

Grasso is intimately familiar with the grieving process and the fear and uncertainty death brings with it. What terrifies him is not only death’s inevitability, but the silence and abandonment that surround it.

‘The sealing of the coffin is the sealing of life,’ he suggests, marking the point at which separation becomes absolute. Grasso’s fascination with the supernatural gradually narrows into an intense focus on death as the ultimate mystery. Whereas *Enigma* dealt with moving curtains and unanswered questions, death confronts the immobility of the grave. Yet even here, Grasso resists consolation. He rejects the idea that fear can be resolved through belief, ritual, or explanation. Religion, he acknowledges, is itself

a mystery – one that offers meaning without certainty of what lies beyond. What matters, instead, is learning how to live in the shadow of death. ‘The secret of living,’ he recalls reading, ‘is knowing how to die.’

A life lived in constant awareness of mystery sharpens the present rather than diminishes it. As he reflects, ‘life is so short. What you want to do with your life, you should do it now, whoever you want to love, love them now,’ because the future, like all things that matter most, remains unknowable. ‘You need to do something in life. You have to leave your mark. And it is important that you leave this mark. No matter what you discover, nobody will ever know – that is life’s enigma. And that is life’s mystery.’ **T**

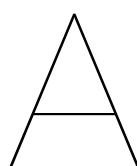
idea

TenSyGrid

Powering the Transition to
100% Renewable Energy

Author: **Prof. Ing. John Licari**

*The transition to renewable energy is fundamentally reshaping how power systems behave – and challenging the tools used to keep them stable. **TenSyGrid** tackles this emerging problem head-on by developing a new generation of tensor-based analytical methods designed for electricity grids powered almost entirely by power-electronic converters.*



cross the world, electricity systems are undergoing one of the most profound transformations since their inception. Driven by climate targets, energy security concerns, and rapid technological innovation, power grids are shifting toward ever higher shares of renewable energy sources such as wind and solar. These sources are largely connected to the grid via static power-electronic converters rather than traditional synchronous generators. While this shift enables cleaner electricity, it also fundamentally changes how power systems behave.

UNLOCKING STABILITY IN CONVERTER-DOMINATED POWER GRIDS

The TenSyGrid project – Tensors for System Analysis of Converter-Dominated Power Grids – was launched to address one of the most critical challenges emerging from this transformation: how to reliably analyse and ensure the stability of future power systems dominated by power electronics. The TenSyGrid team at the University of Malta includes Prof. Ing. John Licari as Principal Investigator, Prof. Ing. Cyril Spiteri Staines and Prof. Alexander Micallef as senior researchers, and Dr Ing. John Caruana and Ing. Brian Micallef as RSOs. Coordinated by Fraunhofer

IWES and backed by a strong European consortium, TenSyGrid aims to provide grid operators and engineers with an innovative analytical tool that enables direct methods for assessing stability in the real-time operation of future large-scale power networks – namely, those powered entirely by renewable energy.

WHY TODAY'S POWER SYSTEM TOOLS ARE REACHING THEIR LIMITS

The traditional analytical tools used for power systems were developed for grids dominated by large, comparatively linear synchronous generators. These generators supply inertia to the power system by converting mechanical energy into electrical energy. Their dynamic behaviour has been extensively studied and is well understood. In contrast, modern converter-based resources such as wind and solar are programmable, fast, and highly nonlinear. Their controls interact across a wide frequency range – from slow system-wide dynamics to high-speed electromagnetic phenomena.

Today's industry-standard tools rely heavily on simplified simulations or linearised models. While computationally efficient, these methods often fail to capture critical nonlinear interactions in new, converter-dominated networks. At the other extreme, detailed simulations can represent these effects accurately.

However, their large computational burden makes them impractical for large-scale or real-time studies.

As a result, system operators are forced to be conservative. For example, they must impose limits on instantaneous renewable penetration – that is, the amount of power that renewables provide to the grid. This is not because renewable generation is unavailable, but because analytical tools cannot yet guarantee stability beyond certain thresholds. TenSyGrid directly tackles this bottleneck.

A NEW PERSPECTIVE: MULTILINEAR MODELS AND TENSOR MATHEMATICS

At the heart of TenSyGrid lies a novel mathematical approach based on hybrid implicit multilinear time-invariant models and tensor decomposition. Multilinear models occupy a unique middle ground between the efficient, simple linear models and the computationally demanding, fully nonlinear models. They are rich enough to capture key nonlinearities inherent in power-electronic converters, while remaining structured and computationally efficient.

Crucially, multilinear models can be represented as tensors – mathematical objects that generalise matrices to higher dimensions. These are interpreted via modern tensor decomposition techniques, which ➔



The UM TenSyGrid Team from left to right: Prof. Alexander Micallef, Ing. Brian Micallef, Prof. Ing. John Licari, Dr Ing. John Caruana, Prof. Ing. Cyril Spiteri Staines
Photo by James Moffett

allow these high-dimensional objects to be stored and analysed in compact, simpler forms. This dramatically reduces computational complexity and enables the analysis of very large systems.

By transforming complex, nonlinear power system equations into structured, multilinear tensor representations, TenSyGrid opens the door to analytical stability assessments that were previously infeasible at scale.

FROM BLACK BOXES TO INTERPRETABLE MODELS

Another pressing challenge in modern power systems is the widespread use of 'black-box' models supplied by equipment manufacturers. The methodology and inner workings of these models are hidden from users. While they protect intellectual property, they limit system operators' ability to understand the root causes of instabilities or unexpected behaviour.

TenSyGrid is addressing this issue by developing interpretable system identification methods for

converter-dominated systems. Instead of relying on artificial intelligence and machine learning methods, the project's multilinear framework produces structured models whose parameters can be meaningfully interpreted. This enables engineers to trace how specific components or interactions influence system stability – an essential capability for real-time operation and post-event analysis.

THE TENSYGRID TOOLBOX: FROM THEORY TO PRACTICE

All methodological advances in TenSyGrid converge in the development of the TenSyGrid Toolbox. This software framework builds upon the existing open-source MTI Toolbox developed by one of the partners (Hamburg University of Applied Sciences) and extends it with power-system-specific capabilities.

Key features of the toolbox will include:

- **A library of multilinear power system component models**, covering converters, generators,

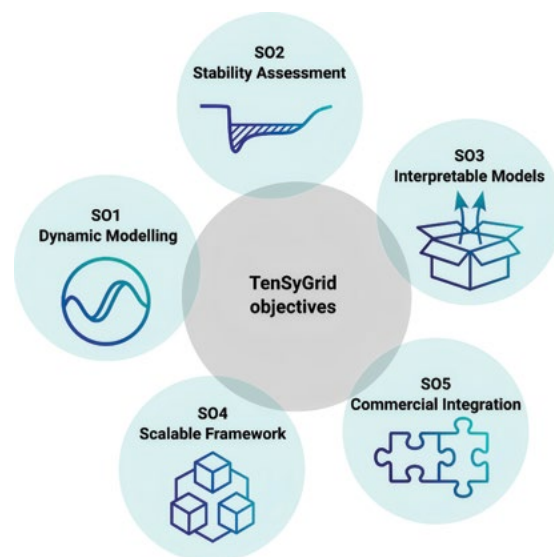
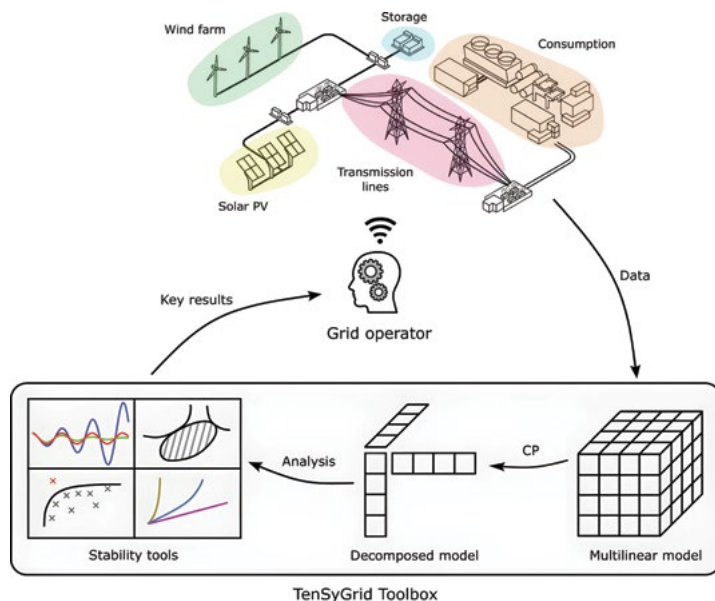
loads, High-Voltage Direct Current (HVDC) links and storage systems.

- **Direct stability assessment methods** that extend beyond classical analytical methods and are applicable under high levels of renewable penetration.
- **Scalable and interpretable models** that can adapt as grid topology and operating conditions change.
- **Compatibility with commercial software** widely used by practitioners to ensure seamless integration into existing workflows.

The toolbox will be designed with real-world applications in mind. It targets both offline planning studies, such as grid expansion scenarios, as well as real-time operational support, where computational speed and interpretability are paramount.

VALIDATED ON REAL NETWORKS

To ensure practical relevance, TenSyGrid places strong emphasis on validation using realistic power system



Left: An overview of the TenSyGrid Toolbox and its connection with the grid operator, enabling advanced analysis of converter-dominated power systems.

Right: The key objectives of the TenSyGrid Project

Images by eRoots

models. Case studies range from mid-size benchmark systems to large-scale national networks, including detailed studies of the Maltese power system and scenarios approaching 100% renewable penetration.

These demonstrations are complemented by close collaboration with transmission and distribution system operators (Enemalta, KEPCO, RTE), software vendors (MATLAB and IPSA), and technology providers (OPAL-RT) across Europe and beyond. Feedback from these stakeholders ensures that TenSyGrid's methods address real operational challenges rather than purely academic problems.

IMPACT BEYOND THE PROJECT

By the end of the project in 2027, TenSyGrid aims to reach a technology readiness level of 5, having demonstrated its tools in relevant operational environments. The long-term vision extends even further: to establish multilinear and tensor-

based analysis as a new paradigm for power system stability assessment.

In a world racing towards climate neutrality, the ability to understand, analyse and actively control converter-dominated power grids will be decisive for the success of the energy transition. As electricity systems move closer to 100% renewable energy operation, stability can no longer be ensured by simplified models or overconservative operating margins. TenSyGrid responds to this challenge by providing a robust new set of lenses through which the future power system can be analysed clearly and efficiently.

By combining multilinear modelling, tensor mathematics, and close collaboration with power grid operators, TenSyGrid equips engineers with practical tools to operate future grids safely, efficiently, and with confidence. In doing so, it not only removes a key technical bottleneck for high renewable penetration but also lays the foundation for a new

paradigm in power system analysis – one capable of supporting the resilient, flexible and fully renewable electricity networks of tomorrow. **T**

The TenSyGrid project is coordinated by the Fraunhofer Institute for Wind Energy Systems and involves leading contributors, including Universitat Politècnica de Catalunya, eRoots Analytics, Hamburg University of Applied Sciences, and the University of Malta. Further information can be obtained from the dedicated project website at tensygrid.eu or by contacting the UM principal investigator directly at john.licari@um.edu.mt.

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Is It Possible to Predict Miscarriages?

Author: **Antónia Ribeiro**

Threatened miscarriage is a common early pregnancy complication, but clinicians have lacked structured, locally validated tools to accurately predict outcomes. While management typically involves monitoring and progesterone therapy, uncertainty remains high. New research from the University of Malta has developed a high-accuracy predictive model that integrates ultrasound and blood markers to support more informed, personalised care.

According to the European Research Council-funded project SOC-MISC, 25% of women have experienced a miscarriage before 24 weeks of gestation. Losing a pregnancy is, in itself, a desolating experience. It becomes much worse when one adds endless waiting, uncertainty, and a lack of answers from doctors.

This is the common scenario for pregnant people suffering from a condition called 'threatened miscarriage'. This condition is characterised by bleeding during the first weeks of pregnancy, while the cervix remains closed. Despite the bleeding, the embryo (the technical name given during the first nine weeks of gestation) or foetus (the technical name given to the developing body until birth) is alive.

Currently, progesterone supplementation is given to support early pregnancy, particularly where there is an increased risk of miscarriage. Medical professionals rely on ultrasound findings and clinical

experience to guide discussions. However, until now, there has been no locally validated prediction tool to support risk assessment in threatened miscarriage. This means that patients go home not knowing whether they will experience a miscarriage. Moreover, psychological support during this period can be inconsistent, as services are not always structured specifically around early pregnancy complications.

Adding to an already complex condition, threatened miscarriage has not been previously investigated in Malta. The Directorate of Health Information and Research does not collect data prior to 22 weeks' gestation, meaning that threatened miscarriage cases are unrecorded. In most cases, this condition affects the first trimester (the first 12 weeks and 6 days) of pregnancy. However, any vaginal bleeding that occurs before 20 weeks' gestation in a viable pregnancy with a closed cervix is referred to as threatened miscarriage.

Dr Lara Sammut is a radiographer at Mater Dei Hospital with a Master's in foetal anomaly ultrasound screening.

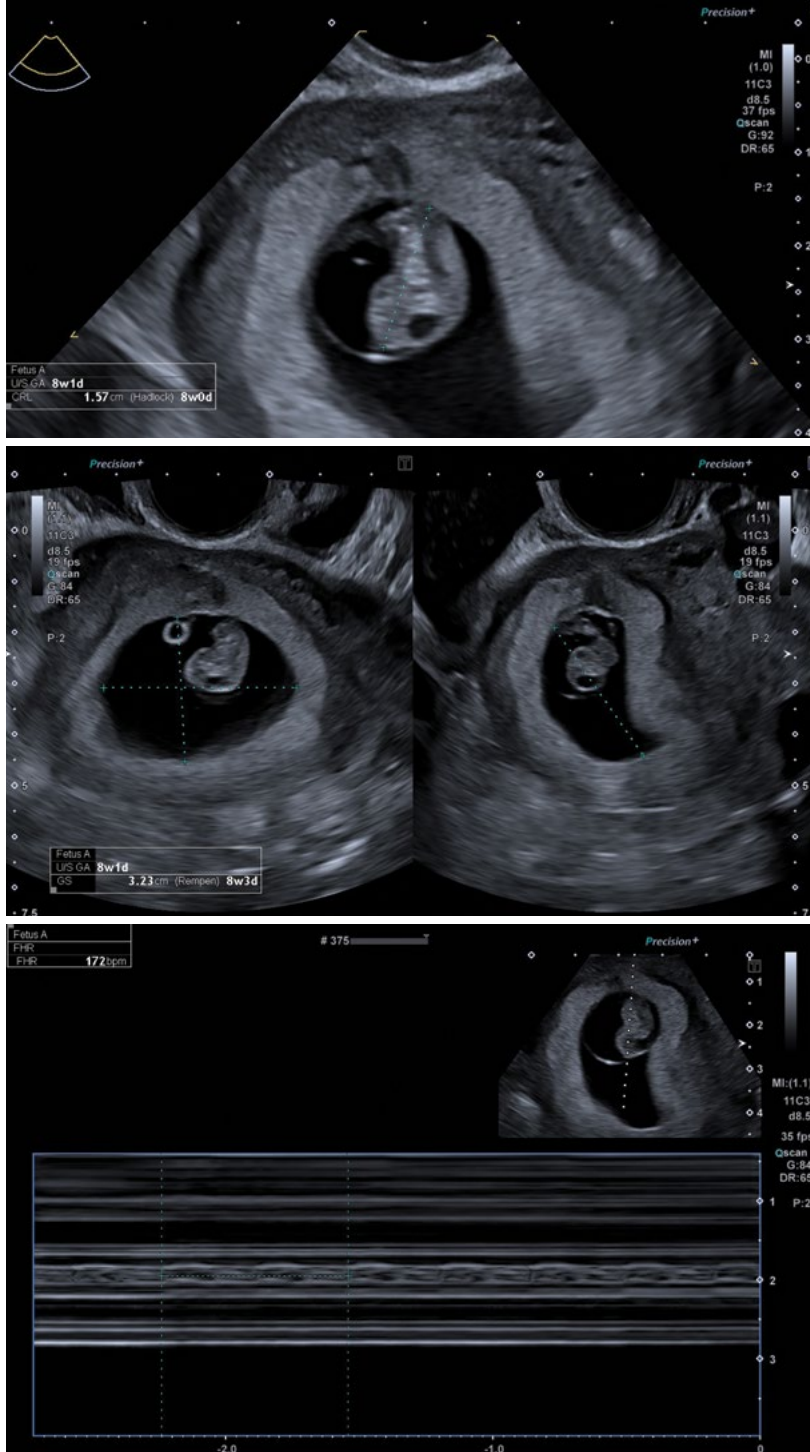
After 13 years of witnessing the impact of threatened miscarriage at the Obstetrics and Gynaecology (Ob/Gyn) Department, the researcher, radiographer, and lecturer decided to start her Ph.D. research to address this knowledge gap.

FROM LOCAL DATA TO NATIONAL DIALOGUE

Sammut's research provides the first locally derived data on pregnancy outcomes following threatened miscarriage in Malta, establishing a



Dr Lara Sammut



Transvaginal ultrasound images showing an eight-week embryo
Images courtesy of Dr Lara Sammut

23% loss rate within a prospectively studied cohort. Sammut developed and validated a predictive model that integrates ultrasound findings, biochemical markers, and maternal characteristics to improve early pregnancy risk assessment.

She divided her Ph.D. research into three phases. First, she studied the prevalence of threatened miscarriage in Malta through a retrospective study. Then, she conducted a scoping

review of the literature to identify markers that have already been investigated to predict the outcome of a pregnancy after a threatened miscarriage. The findings from the first and second phases of the study informed the third phase – a prospective case-control study that used data collected from patients at Mater Dei Hospital over two years.

Data from ultrasound, blood tests, and maternal characteristics

were collected from 177 women and analysed using both multivariate logistic regression (MLR) and a random forest (RF) model. The RF model achieved 93% overall accuracy in predicting pregnancy outcome.

In June 2025, Sammut was invited by the Parliamentary Secretary, Hon. Dr Andy Ellul, to deliver a keynote address at the Miscarriage Leave Public Consultation in Gozo, thereby further strengthening the national conversation on miscarriage recognition, evidence-based care, and the need for structured support services in early pregnancy. She explained in her speech that the predictive model she developed 'could provide patients with clearer information, personalised care, and appropriate counselling based on their individual risk.' Following this, Malta enacted a new law in 2026, granting miscarriage leave.

BUILDING A RIGOROUS FRAMEWORK FOR PREDICTION

During the first phase, a retrospective cohort study drew on data from Mater Dei Hospital collected in 2019. This year was specifically chosen to avoid COVID-era distortions in care. The result was a highly representative sample of the national population, since Mater Dei is the only local, state hospital, and national data included both public and private births.

In the second phase, the study progressed to a scoping review, designed to map the global evidence on first-trimester ultrasound and biochemical markers used to predict pregnancy outcomes. Instead of limiting the review to one marker, it explored how multiple markers could work together. ➔

During this stage, Sammut also explored the ratio of two molecules linked to blood vessel formation – placental growth factor (PIGF), and soluble fms-like tyrosine kinase-1 (sFlt-1) – to determine whether they could add value to predicting early pregnancy outcomes. Although sFlt-1 and PIGF did not emerge directly from the scoping review, as previous studies only examined them in isolation, several papers referenced them in relation to placental dysfunction.

Together, these findings highlighted the need for a prospective case-control design that could ensure consistency in how variables are defined and measured.

ESTABLISHING MALTA'S FIRST PREDICTIVE MODEL FOR THREATENED MISCARRIAGE

In the third phase of the study, Sammut collected data from the Ob/Gyn Department at Mater Dei Hospital for the development of the predictive model. The researcher collected data from 177 women with a viable gestation in their first trimester of pregnancy. The study included an ultrasound assessment, blood tests, and the collection of clinical and sociodemographic data, as well as birth outcomes. One of the most significant contributions of this research was establishing Malta's first recorded pregnancy loss rate following confirmed threatened miscarriage. The prospective study identified a 23% loss rate within the study group, thereby providing, for the first time, locally generated data to inform counselling, policy, and service planning.

All collected data was analysed using MLR and an RF machine-learning model. The MLR estimates the probability of pregnancy loss from multiple predictors and provides clinically interpretable outputs in the form of odds ratios. To explore whether predictive accuracy could be improved,

Sammut also applied an RF model – a machine-learning approach that falls within the broader field of artificial intelligence. This method builds multiple decision trees and aggregates their predictions, enabling the detection of complex nonlinear interactions among ultrasound findings, biochemical markers, and maternal characteristics.

The use of an RF model that combines first-trimester ultrasound and biochemical markers represents one of the first AI-driven applications worldwide, specifically targeting threatened miscarriage prediction. Rather than replacing clinical judgement, the model is designed to support clinicians by providing structured, data-informed risk assessment. As Sammut explains, 'the RF model consistently outperformed the MLR model with 93% overall accuracy in predicting pregnancies that continued and those that resulted in loss.'

REDEFINING EARLY PREGNANCY CARE IN MALTA

For her next steps, Sammut hopes to secure additional funding to analyse the prevalence of threatened miscarriage in Malta using more recent, post-COVID-19 numbers and to further develop the RF model and enable its use in everyday clinical practice.

Her findings were presented during national policy discussions on miscarriage leave, bringing scientific data into legislative dialogue at a pivotal moment. The subsequent opening of the Early Pregnancy Assessment Unit at Mater Dei Hospital reflects a system increasingly informed by evidence, where research, policy, and clinical service development are integrated. Previously, pregnant people facing complications were seen in emergency departments or outpatient clinics. This means they often witnessed families leaving postnatal wards or late-stage pregnancies, all of which can cause deep distress.

Sammut's work illustrates how evidence-based research can redefine women's health priorities. By quantifying risk, introducing AI-driven prediction, and contributing to national policy dialogue, her research has helped move early pregnancy from the margins of healthcare to the centre of public health attention. It is a reminder that when science listens to women's lived experiences, systems can change. **T**

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IL-MUŻA

Author: Pierre Sammut

Għandu biss tnejn u għoxrin sena, Peter Summit kien iħobb jikteb. Hekk kif ilesti jistudja, minflok joħroġ ma' shabu, kien jinqafel f'kamartu joghxa jħarbex novelli u stejjer qosra. Imma ħass li seta' jikteb aħjar, xtaq jitfa' ruhu. Ried lil xi hadd li jurih fejn seta' jmur aħjar. Jaħseb fuq hekk xorta baqa' jistinka u jikteb. Wara snin jikteb in-novelli, fl-aħħar kellu l-ewwel ġabra ta' stejjer tal-biża' lesta.

Waqt li kien bilwieqfa fil-kju biex l-awtur favorit tiegħu jiffirmalu l-aħħar ktieb li ħareġ, kien qiegħed iżomm kopja f'idejh, li ma riedux jieqfu jirtieġdu. Kien mument li ilu jistennieh snin.

Bilqiegħda mal-mejda kien hemm Anthony Magro, l-awtur favorit tiegħu li minħabba fih beda jikteb. Magro ma kienx biss awtur tal-generu tal-biża', iżda kien ukoll kirurgu famuż, u kien ta' sikwit isiefer biex jagħti lekċers fl-ikbar universitajiet madwar id-dinja. Din il-ħajja doppja kienet tgħaġġeb lil Peter: raġel li jsalva l-ħajja matul il-jum u li jbeżża' lill-qarrejja bil-lejl. F'għajnejn Peter, kien qisu figura tas-supereroj.

Meta wasal quddiemu, it-tbissima ta' Magro ffurmat bil-mod. Kien hemm xi ħaġa fil-mod kif ħares lejha, qisu ra fih aktar milli Peter ried jurih.

'Prosit, ili nsegwik ħafna snin issa,' qallu ż-żagħżuġh, waqt li mess il-qoxra tal-ktieb b'subgħajh, u fl-istess hin stqarr: 'Nixtieq parir. Jien nikteb ukoll imma nħoss li għadni fjakk. Kif nista' nkun aħjar? Minn fejn iġġib il-muża tiegħek?'

Għajnejn Magro ċkienu, f'dija ta' interess. 'Ah. L-ispirazzjoni? Sabiha, imma hija mistoqsija sensittiva u personali.' Kienet risposta li ma kienet tagħti xejn, iżda li fl-istess hin fethet b'wieb il-kurżità ta' ġewwa fih.

Għaddilu karta żgħira mitwija fi tnejn. 'Ibghatli l-kitba tiegħek bil-kurrier kmieni għada filgħodu. Se nkun barra minn Malta għal-lekċers din il-ġimgħa u nāħseb naqrah fl-ajruplan, u filgħaxija, wara li nkun lest mil-lekċers.' Qallu dan b'vuċi tant kalma li Peter kważi nesa jieh u n-nifs.

Dak il-lejl Peter ma raqadx. B'moħħu b'sentimenti mħallta, bejn eċitament u biża', beda jaħseb. 'U jekk jgħidli li m'għandix talent? U jekk jgħidli li kien aħjar ➤

ninsa kollox?' Imma fl-ahħar bagħathom xorta waħda u f'dak l-att sempliċi, qisu fetaħ tieqa għal xi haġa akbar, u hassu li strah bħal xi hadd li mar għamel qrara twila.

Gimġha u nofs wara, ċempillu Magro. 'Qrajtu kollu!' qallu b'vuċi ta' min qisu rebah il-lotterija. 'Għandek potenzjal. Ejja d-dar tiegħi, nixtieq niddiskutihom kif jixraq.' Bl-entużjażmu Peter ma kienx jaf x'laqtu u hekk bejniethom waqa' bħal skiet li t-tnejn hassew.

Peter wasal id-dar tal-kirurgu ftit wara nżul ix-xemx tal-ġurnata miftiehma. Il-post kellu riħa ħafifa ta' diżinfettant, riħa kemxejn sterili, qisek fi sptar tal-moħħ, imma fl-istess ħin, qisha kienet qed tistiednek tidħol ġewwa. Magro laqgħu fi studju mimli kotba u offrilu te.

L-ahħar haġa li kien jiftakar Peter kienet li qabbad it-tazza ma' xofftejh, it-togħma kienet f'tit helwa għal gostih u wara l-baħħ.

Meta qam, l-arja kienet kiesha u qawwiya. Id-dawl abjad kien jiddi fuqu. Minkejja li pprova jiċċaqtaq, sab idejh u saqajh marbutin b'ċineg tal-ġild ma' mejda tal-operazzjonijiet.

Il-metall ta' taħtu kien kiesaħ daqs il-borra. L-ghodda tal-kirurgija tleqq fuq mejda biswit, bħal klieb tal-azzar bil-ġuħ.

Sema' xi passi jersqu lejha. Anthony Magro ħareġ mid-dellijiet liebes il-liba ta' waqt l-operazzjonijiet.

'Staqsajt, minn fejn ingħib il-muża?' qallu b'vuċi kalma, kważi dgħajfa. Din id-darba, it-ton tiegħu ma kellu xejn uman.

Peter ipprova jgħajjat, imma l-mistura kienet għadha ttarrxu u thawdu. Leħnu ħareġ bħal fwar.

Magro rranġa d-dawl biex jara għajnejn Peter jiddu, għajnejn mimlija biża', eżatt kif xtaqhom hu.

'L-istorja li jmiss,' kompla jgħid b'ton ħafif, waqt li qabad xafra kirurgika, 'se tkun dwar student żagħżuġ b'talent, li jkun qed jfittex parir u li wara jinstab imqatta' biċċiet u b'partijiet minnu mikulin mill-ħamiam f'ġnien pubbliku.'

Resaq itkar qribu, b'tbissima li ma kinitx ta' bniedem f'sensih. 'U din,' qallu f'widnejh, 'hija kif insib l-ispirazzjoni tiegħi!'

Daħka belha, kważi miġnuna, irbombrjat fil-kamra ta' taħt l-art u hekk kif għal Peter kollox sar dlam, fehem li kien sar parti minn storja tal-biża' li però kitibha ħaddieħor, u mhux hu! 

THE MUSE

Translator: **René Monseigneur**

At just twenty-two years old, Peter Summit loved to write. After he finished studying for the day, he would shut himself away in his room to scribble novels and short stories instead of hanging out with friends. Yet he felt he could be a better author, one who poured his soul into his writing. He longed for someone to guide him and help him improve. Despite his insecurities, he kept striving, and after years spent working on novels, he finally completed his first collection of horror stories.

Whilst standing in line, waiting for his favourite author to sign the newly released book, he clutched a copy in his trembling hands. It was a moment he had been looking forward to for years.

Sitting at the table was Anthony Magro, his favourite author, who had inspired him to start writing. Magro was not only a horror fiction author but also a renowned



Pierre Sammut meets renowned horror writer Anton Grasso for the first time during THINK Magazine's 'An Evening with Anton Grasso' at the UM Library. Photo courtesy of Annette Apap



Left: Pierre Sammut reveals a rare first edition copy of Anton Grasso's 'Wirdien' ('Cockroaches') published in 1976. Right: Anton Grasso signs Sammut's copy of his first publication, 'Iljieli bla Qamar' ('Moonless Nights') – the first modern collection of horror stories in Maltese.
Photos by Kristov Scicluna

surgeon, frequently travelling to deliver lectures at leading universities around the world. This double life fascinated Peter: a man who saves lives by day and terrifies readers by night. In Peter's eyes, he was something of a superhero.

When he reached him, a smile formed on Magro's lips. There was something in the way he looked at him, as though he saw more in him than Peter wanted to reveal.

'Congratulations, I've been following your work for many years,' the young man told him. His fingers brushed over the book's cover before he quickly added, 'I'd like some advice. I write too, but I still feel something is lacking. How can I improve? What inspires you?'

Magro's eyes glinted with interest. 'Ah. Inspiration? A good question, but one with a sensitive and personal answer.' It was a reply that gave nothing away, and yet piqued Peter's curiosity.

He slipped him a small piece of paper, folded in half. 'Send me a sample of your writing by courier early tomorrow morning. I'll be giving lectures abroad this week, and I plan to read it on the plane and in the evening, after I finish lecturing.' He said this in such a calm voice that Peter almost forgot to breathe.

That night, Peter did not sleep. Excitement and fear occupied his thoughts. 'What if he tells me I have no talent? What if he tells me I would be better off forgetting it all?' But in the end, he sent it anyway, and through that simple act, it was as if he had opened a window onto something greater. He felt a deep sense of relief, just as one would after a long confession.

A week and a half later, Magro called him. 'I've read everything!' he told him in a jubilant voice, as if he'd won the lottery. 'You show promise. Come to my house, I'd like to discuss your work at length.' Overwhelmed with enthusiasm, Peter was lost for words. And just like that, a silence fell between them, a silence that both of them felt.

Peter arrived at the surgeon's house shortly after sunset on the agreed day. The place smelled faintly of disinfectant. It was somewhat sterile, akin to the smell one finds in a mental hospital, yet at the same time, an inviting one. Magro greeted him in his study, which was brimming with books, and offered him tea.

The last thing Peter recalled was bringing the cup to his lips. The taste was too sweet for his liking, and then, everything went black.

He woke up to frigid air. Pure white light flooded over him. Despite his efforts to move, he found that his hands and feet were bound with leather straps to an operating table. The metal beneath him was like snow against his back. Surgical instruments gleamed on a table nearby, like starving steel hounds.

He heard footsteps approaching. Anthony Magro emerged from the shadows. He was wearing his surgical scrubs.

'You asked after my muse,' he said in a calm, almost imperceptible voice. This time, his tone held little trace of humanity.

Peter tried to scream, but the drugs were still numbing and confusing him. His voice came out in a hiss, like steam.

Magro angled the light so that he could see Peter's eyes, glowing and drowning in fear, exactly as he wanted them to.

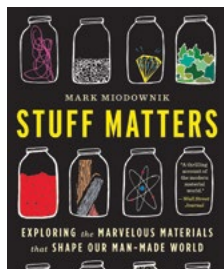
'The next story,' he continued in a soft tone, picking up a surgical scalpel, 'will be about a young, talented student who sought out advice, and was later found dismembered, with parts of his body eaten by pigeons in a public garden.'

He drew closer, wearing a demented smile. 'And this,' he whispered in his ear, 'is how I find my inspiration!'

An impish, almost insane laugh echoed through the underground room, and as darkness closed in around him, Peter realised that he had become part of a horror story, only this time, it was written by someone else! **T**

to-do list

book



Stuff Matters:
Exploring the Marvelous
Materials That Shape
Our Man-Made World
by **Mark Miodownik**

Materials scientist Mark Miodownik explores the molecular 'why' behind everyday substances like steel, paper, and chocolate. By blending personal narrative with materials science, he reveals how atomic-level structures dictate macro-scale properties – proving that the history of human civilisation is essentially the history of our mastery over matter.

videogame



BeamNG.drive
by **BeamNG**

BeamNG.drive, a sandbox driving simulator, offers a driving experience with near-limitless possibilities. Expertly engineered through years of rigorous development, the team have designed a soft-body physics engine that delivers authentic handling and visceral, true-to-life crashes through an incredibly accurate damage model.

music



Symphonies of
the Planets (NASA)

A five-volume collection of eerie soundscapes created from data captured by the Voyager probes. NASA converted electromagnetic radiation and plasma waves into audible frequencies, revealing the haunting, 'musical' vibrations of the solar system's celestial bodies.



podcast



Constant Wonder (BYUradio)

Hosted by Marcus Smith, Constant Wonder explores science, art, and history to find awe in our phenomenal world. Through stories of human connection and natural mysteries, it shares the infectious curiosity of experts and adventurers to move listeners beyond words.

Brian's Corner

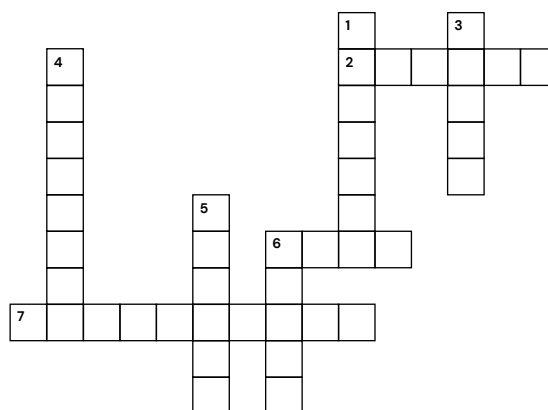
Crossword Puzzle

Across

2. A group of people with a common statistic
6. A mineral used for seasoning food or as a preservative
7. An imitation; produced by humans

Down

1. A surgical knife with a short, thin blade
3. Force or influence
4. A person who makes something new
5. a nutrient-rich substance for growing microorganisms or cells; small, _____, large
6. The backbone



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