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THINK

IDEAS • MALTA • RESEARCH • PEOPLE • UNIVERSITY



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A Fragile Archipelago

Fragility is core to Malta. As a near-desert island that extracts fresh water from the sea and imports most of its food, Malta could not survive without an outside connection, though there was a time when humans did. Our cover story is about the Temple People who built the oldest free-standing stone structures in the world and survived in Malta for around a thousand years.

The Temple People left behind the megaliths of Ħaġar Qim, Mnajdra, and Tarxien amongst others. Around 2500 BC they vanished off the face of the Earth without a trace. The theory is that environmental degradation and religious extremism killed them off. The FRAGSUS project is trying to find the evidence to see what really happened (pg. 34).

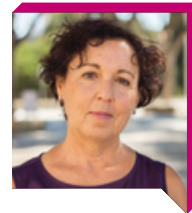
THINK is all about future technology. Local academics are working with industry to find a better concrete brick. A brick that can help Malta meet its environmental goals that it has signed with the EU (pg. 15). Another future technology story, talks about how taking advantage of colour could provide the key to a wave of new products on the market (pg. 42). Fluorescent molecules which give off light could be the next detectors in devices and our bodies.

With regards to health, we have two pieces. An opinion piece (pg. 10) talks about how we should be using more eHealth products to bring down costs. Another looks into Malta's new dementia strategy to help improve the situation of dementia patients and their carers. Other opinion pieces talk about how the University of Malta needs a social policy, and how scientists and government need to chat.

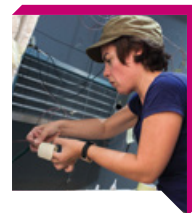
Scientists and politicians need to communicate to safeguard Malta's fragile existence. Malta needs to think its way out of it by investing in research and innovation. We do not want to go the way of the Temple People.

Edward Duca
EDITOR

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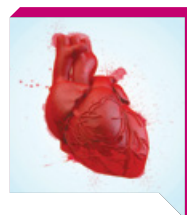
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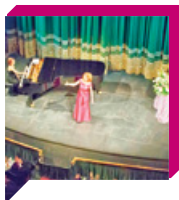
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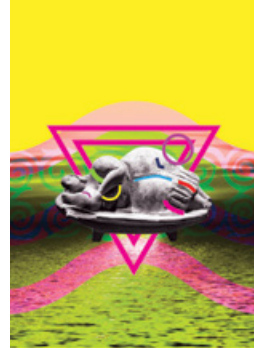
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The cover is the work of in-house designer Jean Claude Vancell who used colour and geometrical shapes to represent the puzzle provided to Maltese archaeology by the Temple people. The cover was treated with spot-varnish to uncover a hidden motif found at Tarxien temples.

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students' THINKing



Maltese olives and their genes



Oriana Mazzitelli

THE OLIVE TREE (*Olea europaea* L.) is one of the oldest species of domesticated trees and the second most important oil fruit crop cultivated worldwide. 97% of the global olive cultivation is concentrated in the Mediterranean Basin. The olive thrives in Maltese soils. Economically, olives are not important for local agriculture, but its cultivation is becoming popular since the Maltese agribusiness has a lot of room for growth to make high quality oil and secondary products.

In the Mediterranean region there are two subspecies of Olive tree. These are the wild olive (*O. europaea* L. subsp. *Oleaster*) and the cultivated olive (*O. europaea* L. subsp. *Sativa*). Each subspecies has several cultivars selected for taste, size, disease resistance or other desirable qualities. There are 1,300 cultivars worldwide and Malta is no exception. The *Maltija* cultivar is probably the most popular Maltese cultivar

and can give a high productivity. The *Bidnija* cultivar, which is believed to be the oldest Maltese olive cultivar (it is thought to date back to Roman times), produces oil of excellent quality rich in polyphenols (these have many health benefits), exhibits high tolerance to environmental stress such as salinity and drought, and demonstrates resistance to pathogens and pests such as the olive fruit fly. The *Bajda* variety produces a characteristic white drupe. Besides the native cultivars, there are a number of Maltese wild olives.

Renowned foreign varieties associated with high productivity tend to have a higher productivity than local cultivars. For this reason, local farmers find foreign varieties more convenient, leaving Malta at risk of forever losing its unique olives.

Till now revival efforts focus on artificial propagation and re-plantation. These trees are identified by their appearance. This is an inaccurate method

since olive growth is influenced by environmental conditions.

To develop a better way to identify local cultivars, Oriana Mazzitelli (supervised by Dr Marion Zammit Mangion) has focused on adopting a genetic approach. She also wanted to examine the genetic diversity of Maltese olive varieties. Mazzitelli compared the genetic patterns of local varieties to those generated by two commercial Italian (*Carolea*) and Tunisian varieties (*Chemlali*). The genetic analysis produced unique DNA profiles that can provide a more accurate means of identification than just looking at the plant.

The genetic variability between varieties was high. The *Bidnija* and *Maltija* stood out for their genetic uniqueness. The differences between local varieties suggest that, despite being allegedly native, the origins of the two are not directly linked. A number of DNA marker regions detected in the foreign cultivars

The fruit of Bidnija produces oil rich in polyphenols which have properties against cancer and cardiovascular diseases



and in the Maltese wild olive were undetected in the Maltese cultivars, suggesting that not all DNA markers are present and amplifiable in foreign varieties have been conserved in the Maltese cultivars. Mazzitelli's work is an important first step to show that local varieties can be identified cheaply through DNA analysis. Without genetic identification, maintaining and cultivating local varieties would be near impossible—a case of genes for good olive oil. ●

This research is part of a Master of Science in Biochemistry at the Faculty of Medicine and Surgery, University of Malta. The research was funded by STEPS (Strategic Educational Pathways) scholarship which is part-financed by the EU's European Social Fund (ESF) under Operational Programme II—Cohesion Policy 2007-2013, 'Empowering People for More Jobs and a Better Quality of Life'.



Kurt Abela

Smaller, Faster, and just as pretty

VIDEO STREAMING uses a lot of bandwidth. Internet service providers can either limit bandwidth or provide more. To bypass this problem newer encoders aim to compact video into smaller packages, to keep the same video quality but a smaller size.

The problem is the variety of video devices available that range from mobiles, tablets, and high definition TVs. This diversity results in various different video transmissions being needed. To avoid encoding the same sequence several times and reduce the traffic over a network, video coding called H.264/ Scalable Video Coding (SVC) was introduced. This type of video coding allows a single stream to encode for time, space, and quality. This technology saves bandwidth. SVC is expected to become the standard for Internet streaming. The only thing holding it back is the need for a complex encoder.

Kurt Abela (supervised by Dr Ing. Reuben Farrugia) proposed the use of a Graphics Processing Unit (GPU) based encoder to speed up the encoder. The Block Motion Estimation (BME) module within SVC takes up the bulk of the total encoding time in standard H.264/ AVC. Abela designed certain modules

to be optimised for NVIDIA GPUs. Through an asynchronous programming model, the video encoder could be run simultaneously on the CPU (Computer Processing Unit) and GPU. By using this novel encoder, encoding was sped up at most 436x times, when compared to a reference model, with no loss in quality. The encoder was sped up even more with further improvements to allow real-time HD video encoding.

This system is much cheaper and easier to use than leading alternatives. GPUs are very cheap and already found in most computers. Further developments on GPUs could soon see them replace more expensive encoders in datacentres. ●

This research was performed as part of a Masters of Science in Information and Communication Technology at the Faculty of Information and Communication Technology, University of Malta. The research is partially funded by the Strategic Educational Pathways Scholarship Scheme (Malta). The scholarship is part-financed by the European Union—European Social Fund, under Operational Programme II—Cohesion Policy 2007–2013, 'Empowering People for More Jobs and a Better Quality of Life'.



An Automatically Tailored Experience

DIGITAL GAMES need to keep players engaged. Since games are interactive media, achieving this goal means that game designers need to anticipate player actions to create a pre-designed experience. Traditionally, developers have achieved this by restricting player freedom to a strict set of actions thereby curating player experience and ensuring the fun factor. However, games are taking a different route with more users making their own content (User Generated Content, UGC) through extensive creativity tools which make it hard to predict player experience.

To overcome these challenges Vincent E. Farrugia (supervised by Prof. Georgios N. Yannakakis), merged game design and artificial intelligence (AI). He developed a software framework for handling player engagement in environments which feature user generated content and groups. The three pronged solution tackles problems during game production, playing the game itself, and making sure the framework is sustainable. To maintain engagement within groups he analysed data for a particular

person within the group but also patterns common across the whole group. Farrugia created software tools, autonomous AI aids, and tools to test and support the framework.

The software framework is made up of inter-operating modules. Firstly, an engagement policy module allows designers to specify theories to express their vision of positive game engagement. Player modelling then shapes this backbone to specific player engagement needs. The module can autonomously learn from player creations as reactions to game stimuli. Individual and group manager modules use this mixture of expert knowledge, AI learnt data, and player game-play history to automatically adapt game content to solve player engagement problems. This procedural content generation (PCG) is tailored for a specific player and time.

The framework's abilities were showcased in a digital game also developed by Farrugia. Various technologies were incorporated to encourage player creativity in group sessions and to



Vincent E. Farrugia

enhance networking. The setup also allowed the AI to quickly learn from each player via parallelism. Initial testing used a simulated environment with software agents. Preliminary testing on real players followed. The simulation was through a personality system to validate the underlying algorithms under various conditions. The resulting diverse game-play styles provide suggestions for AI model improvement. Farrugia is enthusiastic about future work for this AI framework and giving developers better tools to allow player creativity to flourish while maintaining positive game-play experiences. ●

This research was performed as part of a Master of Science degree at the Institute of Digital Games, University of Malta. It was partly funded by the Strategic Educational Pathways Scholarship (Malta), which is part-financed by the European Union—European Social Fund (ESF) under Operational Programme II—Cohesion Policy 2007—2013, 'Empowering People for More Jobs and a Better Quality of Life'.

Science and Politics

Dr David C. Magri



THINK meets up with Dr David Magri to tell us more about how he is trying to help scientists and politicians to network. Evidence-based policies need the input of scientists from all fields and are the future for Malta's policy makers to develop a better, richer, and happier Malta.

Q In a small country like Malta where everyone knows each other, why do scientists and politicians need to network?

Even in a small country like Malta, people do not know everybody. In particular, scientists and politicians are two groups of individuals with busy schedules and different priorities. Because of the inherent nature of their professions, these two groups have no natural reason to meet. Scientists spend a considerable amount of time in their office, laboratory, in meetings, out on fieldwork, and at conferences. Politicians spend a substantial amount of time in their office, in the House of Parliament, at meetings, events, and attending conferences. However, for the nation's interests, science and research policy is important for future competitiveness with regards to technical skills and human resources. Parliamentarians and governments set the national priorities

for research, but researchers need to meet these research objectives. Researchers have a better understanding of what is feasible and what resources are needed.

Q How are you trying to get them to engage?

The Malta Chamber of Scientists has established *Science in the House* as a networking forum between scientists and parliamentarians. Under the auspices of the House of Representatives, *Science in the House* is also a poster exhibition highlighting some of the leading research conducted in Malta, particularly at the University of Malta. Now in its

“Scientists and politicians are two groups of individuals with busy schedules and different priorities”

third year, the event continues to build momentum with greater participation every year. It takes place in the Presidential Palace in Valletta. This year a number of parliamentarians with science-related interests and backgrounds have been asked by personal invitation to attend the opening ceremonies of *Science in the House*.

Q What is the role of *Science in the House* as part of *Science in the City – European Researcher's Night*?

Science in the House is the opening ceremony for the *Science in the City* festival. During the weekend festival the Presidential Palace is open to the public in the evening. The poster exhibition is left on display for parliamentarians to view, and afterwards left on display over the *Notte Bianca* festival allowing the general public including students, parents, and tourists to view the exhibition. During the week an estimated 6,000 visitors viewed the exhibition last year. ●

The event is supported by the Malta Chamber of Scientists, the RIDT University Research Trust, the University of Malta and the House of Representatives. For more information see www.mcs.org.mt/index.php/events and on www.scienceinthecity.org.mt



Social Wellbeing Policy at University?

Prof. Frances Camilleri-Cassar

University can be incredibly stressful. Staff perform high level work with plenty of academic responsibilities, while balancing a private life and leisure time. The number of students at University is rising every year. For academic and support staff this means a more intensive workload, pressure, and stress. For students it is the pressure of attaining good results, maintaining relationships, and other social and emotional wellbeing issues, such as coping with peer pressure, struggling with deadlines, and worries about the future. Numerous studies suggest that examinations negatively impact on student health and wellbeing. Some coping strategies and time management programmes have evolved at the University of Malta, for example by the University Chaplaincy. Such well-meaning initiatives *are* good and *do* good, but tend to happen sporadically and around examination time.

Many University of Malta students balance multiple identities. They often fall outside the typical demographic of an 18-year-old sixth form school leaver. Our students come from diverse so-

cio-economic backgrounds, and may be studying full-time or part-time, with a variety of life roles: mature students, women with care responsibilities, persons challenged by disability or facing problems due to sexual orientation. Whatever the situation in life, each diverse identity places increased demands upon the students' time and private life. These demands influence their University experiences, study perceptions, and learning style. Their peers might treat them differently due to their background.

Besides worries about assignment deadlines and writing exams, many students are also in employment. I am not sure this trend is in line with University of Malta regulations, nevertheless, that

is the situation. Students also worry about future prospects with no guarantee of secure employment after finishing their studies. So it is not only academic concerns that come in the way of student social wellbeing, and these may lead to high levels of stress, anxiety or frustration, depressed mood, difficulties with time management, procrastination, poor concentration, withdrawal from friends or family, or physical symptoms such as headaches, sleep problems, and exhaustion. University life presents numerous stress factors that may trigger off mental health difficulties.

Students experiencing stress are normally recommended psychological intervention and counselling, which may

“A social wellbeing policy will help foster confidence in its approach to academic learning, and to eliminate discrimination in favour of a more inclusive learning environment”



be beneficial for extremely stressed students. However, research suggests that physical activity helps improve mental health and wellbeing. The University of Malta, through its Work Resources Fund, promotes cycling through the Green Travel Plan. The initiative is more about sustainability and the environment, apart from a solution to the parking problem. However, cycling does improve our mental health and wellbeing, and is a free personal de-stressor by taking our mind off work or study, and leads to healthier lifestyle choices.

A social wellbeing policy for University will help foster confidence in its approach to academic learning, and to eliminate discrimination in favour of a more inclusive learning environment. Indeed, the principles of equality and diversity such as gender or disability are essential for a true understanding of social wellbeing, and these same principles need to be included in our University's policy document and implemented in practice. Diversity in a dynamic, intellectual environment enriches professional and educational experiences for both staff and students.

Diversity on campus is needed and important for a healthy University. Internationally, social wellbeing on campus is being promoted through an organisational structure embedded into the ethos, culture, policies, and daily practices of a university. A social wellbeing policy includes an improved occupational health and safety system,

and a commitment to address mental wellbeing, physical inactivity, unhealthy eating and substance misuse. The University needs constant commitment to positively influence the life and work of all staff and students.

The University is encouraged to guard the integrity of its communication system. Collaboration and open communication fosters conversations and relationships necessary to bring about social wellbeing. The communication process needs to be trusted and confidential for team spirit and social wellbeing. For instance, I would strongly argue for an email policy that discourages unnecessary use of *bcc* in emails, as the practice of not telling the original addressee is unethical and downright deceitful.

The University of Malta could establish itself as a national contact point on the European Network for Health Promoting Universities (see www.eurohpu.aau.dk). It would commit the University to place social wellbeing high on its policy agenda. A working document published by the World Health Organisation Regional Office for Europe provides guidance on how to set up and develop a health-promoting university project, which would enhance and protect the social wellbeing of all staff and students.

Finally, I would also suggest an exploratory research study about aspects of university life, stress factors in teaching and learning activities, and how these impact on individual experiences. The

aim is to understand the general quality of life, and how this can be improved for an informed social wellbeing policy document at the University of Malta. ●

This article is based on a paper Camilleri-Cassar presented at a seminar organised by the Faculty for Social Wellbeing in October 2013.

FURTHER READING

- Carroll, A. (2011) 'Exploring the link between equality, diversity and wellbeing'. In Marshall, L. and Morris, C. (eds) *Taking Wellbeing Forward in higher education: reflections on theory and practice*, University of Brighton Press.
- Hagarthy, D. and Currie, J. (2012) 'The Exercise Class Experience: an opportunity to promote student wellbeing during the HSC', *Journal of Student Wellbeing*, vol. 5(2):1-17.
- Hall, C., Ramm, J. and Jeffery, A. (2011) 'Developing the University of Brighton as a Health Promoting University: the story so far'. In Marshall, L. and Morris, C. (eds) *Taking Wellbeing Forward in higher education: reflections on theory and practice*, University of Brighton Press.
- UniHealth 2020: Mission Statement, www.eurohpu.aau.dk/

Think ICT in Health Care

Ivan Bartolo



I have been directly involved in ICT for over 30 years. The last 10 years have been all dedicated to ICT in health.

I have visited hospitals and health centres in the United States, Canada, the United Kingdom, Ireland and Italy. During the several health conferences I have attended, I met with people from practically every corner of the world. Their common denominator: no health system is sustainable unless ICT is perceived as an enabler to assist health providers deliver an improved and more efficient care service that governments can afford.”

Malta shares this concern. The added pressure is its ageing population.

Q How can ICT truly reduce the financial pressures on our Health Service and make it sustainable?

Malta needs to develop a culture where citizens realise their responsibility to monitor their own health and maintain their own online electronic medical record. This can be done through daily, weekly or monthly monitoring of vital signs such as blood pressure, weight and others. Studies prove

that people using eMonitoring services take better care of their own health.

I urge the Ministry of Health to run a simple pilot project in Malta. It could be run amongst the diabetic community. The pilot project would include 1,000 people. 500 of them will use the standard glucose-monitoring device while the other 500 will use a personal, electronic glucose-monitoring device. Within three to six months the results will show the superiority of eMonitoring devices for patient care. These existing health tools can enable people to live healthier lives and stay away from our overburdened hospital. The key is to control a condition without depending on medicines.

Q Length of stay in hospitals and outpatient visits can be reduced through eMonitoring devices. How?

How many patients remain in hospital after medical intervention to have their vital signs monitored? Using these devices patients can be discharged from Mater Dei sooner by being given an eMonitoring kit to monitor themselves from home. The data would be sent

electronically to Mater Dei for doctors or clinicians to analyse. These devices could reduce the patient length of stay and make more beds available at Mater Dei translating into reduced costs and waiting lists. They could alleviate the number of outpatient visits that would reduce pressure on the infrastructure and workforce providing more time to increase care quality. Such devices provide an opportunity for every Maltese citizen to have an online electronic medical record that would be always available to clinicians and general practitioners.

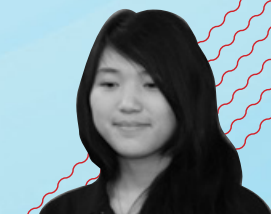
My vision for the Maltese health service is one of empowerment. The patient will be enabled to take better care of him or herself and become more accountable, disciplined, and committed to self-healthcare in the same way someone is committed to their job or hobby. ●

Ivan Bartolo is the Chief Executive Officer of 6PM, a leading IT company delivering award-winning health care products. emCare, a subsidiary of 6PM, provides eMonitoring services. For more information visit www.6pmsolutions.com and www.emcare360.com



LET THE BLOOD FLOW

One third of people will die from heart disease. This statistic shows how vital it is to reduce deaths through research. **MYDER VANG** met up with a Maltese research team doing exactly that



Myder Vang

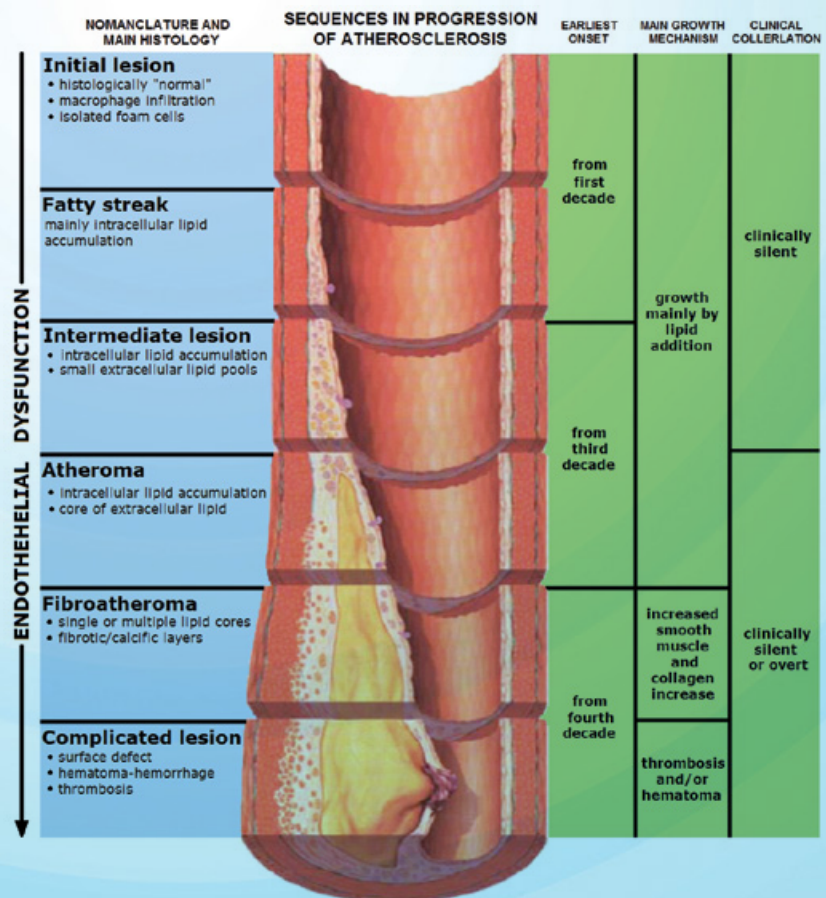
Heart attacks kill over 17 million people worldwide every year and 12.2% of worldwide deaths were from coronary artery disease according to WHO data. Many people have heart stents placed into their blood vessels to prevent heart attacks; however, due to their design, they sometimes fail. Prof. Joseph Grima, Mr Aaron Casha, Dr Daphne Attard, Dr Ruben Gatt and their team at the University of Malta are taking an innovative approach to design heart stents using auxetic materials, which will make them less likely to collapse due to the material's special ability to expand the artery as the flow of blood increases. This capability keeps the artery open and reduces the occurrence of thrombosis, which is when the blood vessel becomes completely blocked leading to heart attacks.

Casha started this research upon his return from the UK, where he completed his medical training as a heart surgeon. In Malta, Casha met Grima, one of the world leaders in auxetic material research, who had always dreamed of finding medical applications for his research. Likewise, Casha had always fantasised about the idea of introducing 'aspects of mechanics and materials [...] into anatomy and surgery' and approached Grima with this idea. Casha said, 'when I saw the patterns they were studying, I looked at them and said you should be doing stents!' And so the start of this groundbreaking research began with a surgeon's idea.

A heart stent is a small tube that can be inserted into a narrowed artery. It is placed in areas filled with plaque to counteract flow obstruction in a small area that can reduce blood flow leading to a heart attack. The stent keeps the blood vessel open and blood flow continuous. The team's research focuses on finding different stent geometries that will maintain a better fit to the contour of the artery and enhance flexibility by



Prof. Joseph Grima



using auxetic technology. If successful, this would mean that the heart stent becomes adaptable, durable, and easier to insert, which would overcome a lot of complications for patients.

Auxetics have other special properties that make them ideal for heart stents. Auxetic structures become wider when stretched, while a rubber band normally would become thinner. This property of auxetics is called a negative Poisson ratio. The reason behind this phenomenon is the arrangement of molecules or components (within a structure) that allow geometries to expand laterally (sideways) when pulled. Because of this unique attribute, auxetic heart stents have an advantage over conventional stents by being able to widen the artery without

shrinking in length hence risking becoming misplaced. Dislodging of heart stents is a major cause of their failure. Auxetic heart stents may overcome many dangers of conventional stents such as sliding out of place or damaging the artery.

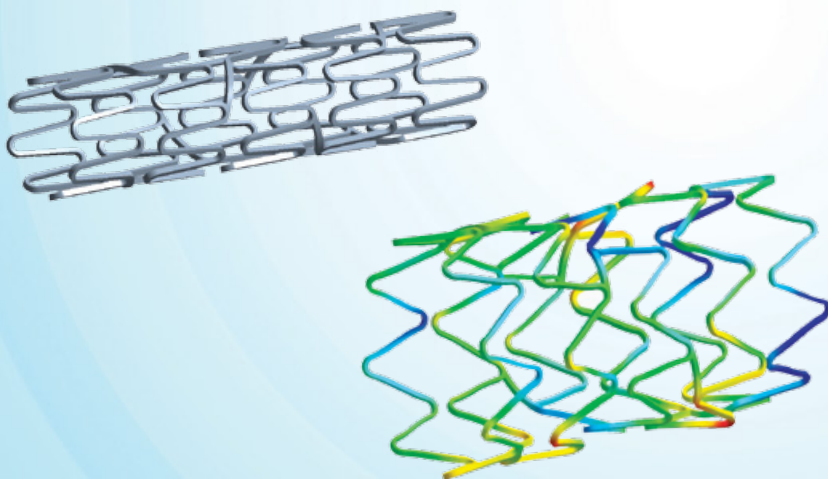
Casha further explained that the research 'looked at the effects [the] Poisson ratio has on geometry', which is not a conventional way of looking at it, so it was rather an innovative starting point since geometries have specific mechanical and biological effects [on the stents]. Since each geometry has its own set of properties, this research is constantly developing, and every different geometry tends to lead to different mechanical properties. With each discovery, the auxetics team comes closer to finding an

optimal solution that is fitted better to the contour of the artery, flexible, adaptable, or more durable. These advantages may increase the stent's ability to reduce the number of heart attacks.

Research is a continuous problem-solving affair. For example, when most stents open up they can put a lot of stress on the vessel, called dog-boning, leading to inflammation. As a result, Casha suggested either making the stents stiffer to prevent them from opening up, or paradoxically softer so that they can rebound and close themselves.

The research on auxetic heart stents is still ongoing. Casha hopes to interest a large company to take over and manufacture the stents widely. »

Below: The stent in a deformed state (left) and in an undeformed state (right)



“As a doctor, Casha wants to see his research help people in the real world but his greatest reward is being able to reach concrete results”



Mr Aaron Casha



Dr Daphne Attard



Millions of heart stents are used every year, only a manufacturing company can satisfy these commercial quantities. As a doctor, Casha wants to see his research help people in the real world but his greatest reward is being able to reach concrete results and share them with others through papers and at conferences. Casha is driven by his passion to solve problems and stated 'when you're almost there solving a question, and you finally see all your results are falling into your predictions [...] it puts you on top of the world.' Along with his research on auxetic heart stents, he has multiple ongoing projects. He is working on developing artificial ribs for cancer patients with rib cage-related problems, skin grafts, tendons, and plenty more. In particular, he mentioned 'we're doing commercialisation on something called the Rib Bridge' which was an invention of Casha that replaces ribs with artificial ones to reconstruct the chest of people who have cancer involving the ribcage. They are currently testing prototypes. Hopefully, this will develop into a tool that doctors can use on cancer patients.

Casha's research interest revolves around reinventing old things. As stated by Grima, 'he does not accept the status quo and say this is the only way of doing it, he's always open to new ideas, so that makes him a medic, an excellent surgeon with the bonus of being open-minded'. So in his own time he collects old

In his own time he collects old phones and fixes them up so that they will work with modern telephone systems

phones and fixes them so that they will work with modern telephone systems. On top of that, Casha loves to teach and continues to develop new and captivating stories to help his students learn anatomy. He has also worked with Heritage Malta to reconstruct ancient artefacts and hopes to someday recreate the original skeleton of the individuals that built the Ġgantija Temples from ancient bits of bone. With the same mentality, he took a look at the already existing heart stents and created a new product from them by using auxetic materials.

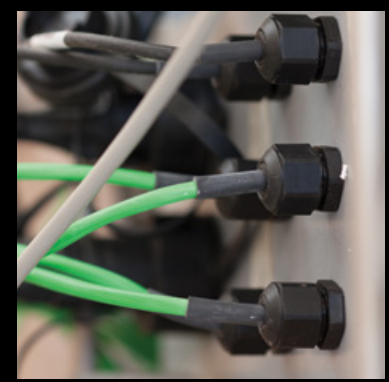
By collaborating with material scientists along with his medical experience, he has discovered an innovative and better way to reduce heart attacks. Casha is already saving lives as a heart surgeon and could someday save hundreds of thousands as a researcher on auxetic heart stents. ●

This work is being funded by Malta Council for Science and Technology through their R&I Program. Myder Vang is an electrical engineering student of Michigan Tech in the USA who, this summer, undertook the Pavlis programme in Malta.



HOT HOUSE
BAD HOUSE

SHAUN AZZOPARDI met up with a team of researchers led by EUR. ING. CHARLES YOUSIF to take the concrete block to the next level. It is more exciting than it sounds.
Photography by EDWARD DUCA





Eur. Ing. Charles Yousif

Buildings use the majority of a country's power. A big chunk of this energy need goes towards controlling its inside temperature. Malta does not suffer extreme temperature swings, the sea keeps everything cooler in summer and hotter in winter. Beijing, for example, experiences temperature swings of around 40°C every year, and Helsinki 60°C.

Despite mild temperatures, Malta's temperature extremes are still high or low enough to make us uncomfortable. This means that heaters dominate winter, while air conditioners are switched on in summer. Energy demands are heavy all year round. Reducing the need for these energy hogs would go a long way towards helping Malta reduce its carbon footprint, at the same time reducing costs. At the University of Malta, a team headed by Eur. Ing. Charles Yousif in collaboration with Prof. Spiridione Buhagiar are working with industry to do just this by developing better building blocks.

Yousif's Postgraduate student, Perit Caroline Caruana, is working on making better concrete blocks. The project is called ThermHCB to refer to the anticipated end product, a more thermally efficient hollow concrete block

(HCB). The academics are collaborating with block manufacturer R.A. & Sons Manufacturing Ltd. and project leaders Galea Curmi Engineering Services Ltd, while being funded by the Malta Council for Science and Technology (MCST). I visited Caroline at the University's well-hidden Institute for Sustainable Energy in Marsaxlokk to learn more about this project.

Limestone is Malta's traditional construction material, but due to dwindling supplies hollow concrete blocks are being widely used. A mixture of specific proportions of sand, cement, aggregate and water is moulded into blocks (roughly a cuboid with two large holes). Briefly, the project involves playing around with these proportions, and introducing new materials into the mix, to achieve a better block. But what makes a better block?

ThermHCB aims to produce a hollow block that has 'the same size, the same hole dimensions, such that both the builders and the public, who are the ones using it at the end of the day, will not find it difficult to adapt to'. A better block would therefore simply have the same strength properties of a normal one, with the difference of allowing less heat transfer between both the inside and the outer surfaces. In winter less heat would



Shaun Azzopardi

escape a building, while in summer less heat will seep into a building.

Changing the block's shape was not an option. 'We couldn't', said Caroline, 'if the manufacturer has to change the design of the block he would also need to change the [whole] production line'. For this reason, she is focusing on how to change the proportions of the constituents and introduce new materials to maintain the standard properties while improving the thermal (heat/cold-related) characteristics. A basic property that must be maintained is the compressive strength of the normal block, which measures its load-bearing capability. Since buildings need to stay up, the load-bearing capacity cannot be compromised as it would make the block unusable for that purpose. Its only use would be internal partitions which do little to insulate houses.

Caroline is an architect by trade. She finished her first degree in architecture in 2000 and worked for many years with a local company. She explained

how attuned she is to the needs of industry, 'I have always been interested in energy, [...] my dissertation for my degree was about energy in buildings with the Institute [for Sustainable Energy]'. She did not immediately start a post-graduate course and instead obtained some hands on experience through industrial work. This allowed her to tap into how industry operated, making her ideal in this collaborative project with such wide industrial potential.

In the backyard of the Institute, I had the chance to see two small rooms shaded by some green netting. Caroline and the team built these rooms as prototypes for testing ThermHCB hollow cement blocks.

“In winter less heat would escape a building, while in summer less heat will seep into a building”



Left: Perit Caroline Caruana
Above: A heat-sensor used to measure temperature inside the building

The Institute could not build these test rooms without vital industrial partnerships. This is where R.A. & Sons Manufacturing Ltd., a local concrete block manufacturer, comes into play. Since ThermHCB blocks use the same standard shape of locally available HCBs, the researchers could use the company's production line to manufacture the expected thermally improved blocks. In a typical experiment, enough blocks are created to build a wall, which is then tested by both the Institute and Galea Curmi Ltd., using different methods.

At the Institute, thermal testing is carried out to measure the transfer of heat through the blocks. The technique applied is called the heat flow meter method, which incorporates the use of heat flux sensors and thermocouples (a type of heat sensor) placed on the internal and external surfaces of the blocks making up the test walls.. The heat flux sensors measure the rate of heat transfer between inside the room and outside. From this data the U-value of the block is computed; a value that indicates the thermal conductivity of a wall. In other words, the bigger the U-value, the faster the heat flows. The project is pushing for a smaller U-value that would better insulate houses.

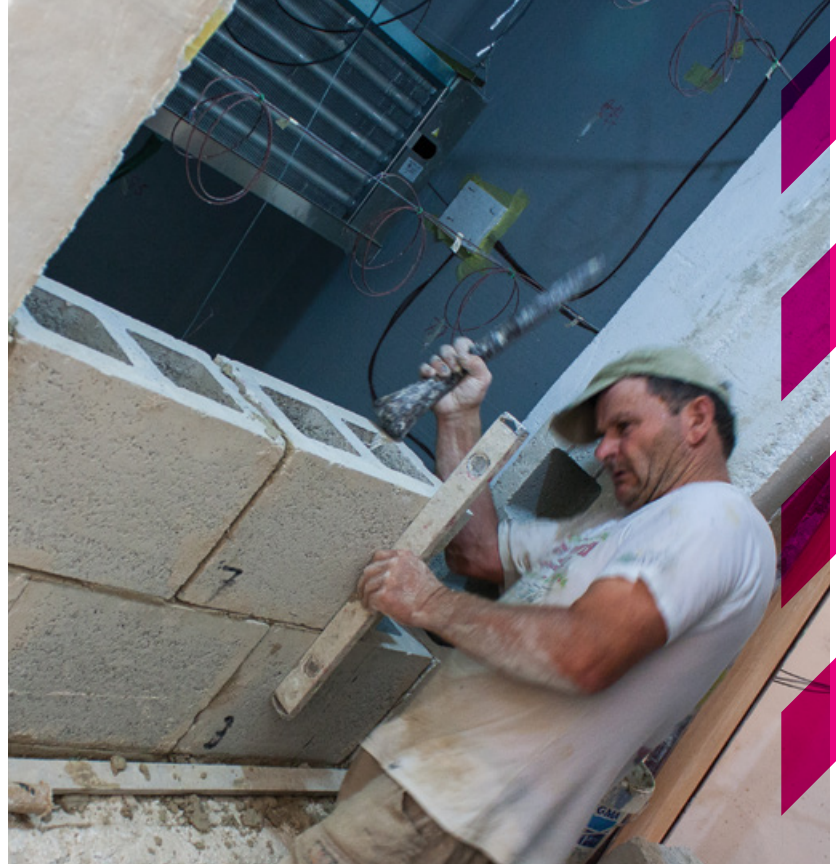
The prototype wall is first built *in situ*. This allows for valuable data that reflects accurately how the blocks perform when used in real world conditions outside. Caroline explains how she gathers data for at least a week before analysis is carried out. This reduces data errors emancipated through fluctuations between day and night.

Solely relying on real-world data is problematic. The weather plays an important role because the higher the temperature difference between the two sides of the wall, the higher the U-value calculated. The U-value varies: it is not a constant even for the same material. Thus the same wall (taken down »

and rebuilt exactly) is also tested in a controlled space, where the temperatures on either side of the wall are controlled. The wall is placed inside a hot box. 'The values gathered from the *in situ* setup [the ones from the external hot box] are very well correlated' according to Caroline, which she says is a good sign and helps confirm that the real world testing is correct.

This hot box was purpose-built for this project according to international standards, however it means much more for the Institute. Yousif explained how they 'can use it to test other products of different industries. It can be insulation material, a wall [and] anything which has to do with buildings' and they want to use it to 'further our collaboration with industry'. So this project has already borne some fruits for the Institute. They have already used it to test insulation material for a private company.

Getting the methodology of the experiment just right was not always easy, especially when summer started, explained Caroline. An important aspect for data gathering was to try and keep the temperature difference between inside and outside at least 10°C, but the Maltese summer sun was too strong, increasing the possibility of experimental errors. Polycarbonate sheeting, air conditioners and fans were all used in different ways to try to alter the temperature difference, however they proved unsuccessful. They finally settled on a green netting, shading the test walls. This simple measure succeeded in re-



ducing errors from minor temperature differences. Getting the methodology right at first go is not easy (or normal), as some unexpected problems always crop up. In many cases, it is hard to find solutions to such problems simply by reading through publications or books; it has to happen through trial and error—the approach of this team.

The other test performed by Galea Curmi Ltd. on the concrete blocks is the infrared method. For this test, the infrared radiation from the inside of the test wall is measured. Infrared is the wavelength of light at which most heat emitted from objects, including from us, travels. By detecting infrared radiation the industrial researchers can pin down the level of block heat transfer. Caroline explained that values gathered from using this method varied from the heat flow meter method. The infrared method is newer and the procedure is

still in draft ISO standard mode—it has not been made uniform. It is not as reliable as the heat flow method but scientists see a potential in this method since it is faster and can be carried out *in situ*, practically anywhere.

The project first tested three prototype blocks. The best performing block improved the U-value, lowering it by 8%. The block was a better insulator. This value does not give the whole picture; compressive strength must not be compromised. It is useless to have a good insulating block that cannot keep a building up. Compressive strength tests were carried out under the direction of Prof. Spiridione Buhagiar (Faculty of the Built Environment) that showed that this prototype block had appropriate compressive strengths. From these first results another three mixes were created and are currently being tested.

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If this project is successful, the block will be a step closer to reaching the market. This requires further investigation. Research takes time. ‘It is not enough to test the material against compressive strength, you want to [also] see lateral strength, [...] how it changes with humidity levels, what happens when it gets wet, [its] fire rating, acoustics [...],’ explained Charles. The part he is least worried about is ‘the marketing stage, because once you have passed all the tests it is only a matter of advertising it and using it to construct two or three buildings, and people will latch on to the idea.’ The block is likely to be more expensive when launched. Government support is needed through financial grants and tax rebates, similar to solar heaters and solar photovoltaic panels. ThermHCB can contribute towards Malta’s binding targets to increase energy efficiency by 22% by 2020.

Charles wants to attract more people like Caroline (he calls them ‘old graduates’), who have experience in industry, to University. ‘I think we need to open up University’s doors to all graduates and reach out to industry. This requires collective effort from all entities both within university and outside it.’ He feels that there is a big gap in the knowledge of graduates who obtained their degree some time ago; they have little time to learn about new products. He talked about double-glazed glass windows, which his Ph.D. research has shown does not improve energy efficiency significantly in residential buildings, yet grants are being given out to encourage people to do just that. Even though, ‘if the same amount [is given] to insulate walls [...] for the same amount, or a bit more, [one] can achieve more energy savings.’ Highly efficient building blocks and wall insulation are not being financially supported.

The Institute is performing other research to try and create zero-energy

buildings. A recent study investigated how this reduction in energy use can be made in a cost-optimal manner. Charles explains cost-optimal as ‘the least painful way of achieving a better building standard’. By painful, he refers to the best value for money when trying to reduce energy use, such as walls, roof insulation, or using solar water heaters. The Institute’s studies have been presented to the relevant ministries and energy agencies to provide them with the expert knowledge needed for government to catch up on its energy reduction obligations set by the EU.

‘We have to achieve 22% energy efficiency by 2020, besides the other mandate of having 10% renewable energy by 2020 [...] and therefore we need to think not only about solar panels, solar

heaters, and renewables in general, but also on how to improve the building fabric, how to address the issue of energy consumption in buildings, space heating and cooling, and also water heating.’ The Institute is working on all these fronts. It is collaborating with Ferrara University in Italy and Valladolid University in Spain, to kick-start a project to improve space heating and cooling. This project differs from ThermHCB since ThermHCB cannot be used on current buildings. The other project uses shallow ground around existing buildings (such as a walkway or pavement), to store energy to heat or cool an entire building. Existing buildings in Malta and elsewhere could be revolutionised, without having to go too deep underground.

“We have to achieve 22% energy efficiency by 2020, besides the other mandate of having 10% renewable energy by 2020”



Many exciting projects are being carried out in the name of sustainable energy, ensuring that some solutions to our energy problems will be found. By involving industry, these solutions could be applied to reach the market and end-user. That is the only way the findings of these projects will actually be used. This provides hope that ThermHCB, once fully developed, will not be difficult to bring to the market. Charles is confident that ‘definitely by 2020’ we will have ThermHCB-built buildings. I hope that will be around the time I will start building my first home. ●



THE POOL PARTY

LIFE AT THE EXTREME

Shrimps, water fleas, waterworts, and pondweeds, this is one wild party. Dry summers with temperatures of over 40 degrees in summer and flooded winters, life in a rockpool is not easy. Decades of research by local ecologists have shed light on this extreme habitat—**DR SANDRO LANFRANCO, KELLY BRIFFA, and SHERYL SAMMUT** tell us more

Crawling on all fours in the countryside whilst mumbling phrases in Latin is not generally considered a mainstream social norm. Behaviour like this is par for the course for a group of researchers whose efforts are focused on unravelling the secrets in temporary freshwater rock pools.

These pools form in small rocky hollows in the jagged terrain of the coralline limestone landscapes of the Maltese Islands. They fill with water following the first autumn rains in September or October and retain water continuously or intermittently, a phase called the 'hydroperiod', until drying out completely in April or May. This seasonal alternation between a dry and a flooded phase attracts three different

classes of pool inhabitants: those that can only survive in water, those that can survive only in dry conditions, and those that can exploit conditions between dry and wet.

Rock pools are a miniature natural laboratory where the seasonal cycle of life and death is played out. They tend to be small and scattered yet obey the same laws as larger habitats. By understanding how rock pools work we can grasp how larger and more complex habitats function.

Beauty sleep?

When the first autumn rains arrive, a survival race is triggered in rock pools. The first to hatch or germinate win. This race is largely hidden from view as it is

played out in the sediment layer that accumulates at the bottom of a pool. This sediment—just 'mud'—is vital for a pool's ecosystem. It is a storehouse of seeds, eggs, and spores, all waiting for the right conditions to trigger their emergence into the outside world. This world is unkind.

The seeds of plants and the eggs of animals are in a dormant state during the dry phase and the breaking of dormancy is key. Most plant seeds and animal eggs are triggered by the same stimulus—water. But their responses differ slightly from species to species and even within clutches of seeds or eggs from the same species. It is these small divergences that represent the difference between success and failure, between life and death. The plants and



Dr Sandro Lanfranco



Kelly Briffa



Sheryl Sammut

“Females dominate this shrimp-world. They rule since evolution partially got rid of the males”

animals that react first gobble up space, nutrients, food, and light that latecomers will miss out on. The breaking of dormancy comes with its own risks and needs careful timing. Erratic deluges or showers in late August or early September may briefly fill the pools with water before they dry out in the hot sunshine. Break dormancy this early and the existence of any plant or animal is doomed to be brief. The organisms would not have enough time to complete their life-cycle and give life to the next generation. The winners would be the late starters who need a lot more water or who respond to other cues such as temperature. In fact, most species respond best to a combination of prolonged wetting and lower temperatures. Life in this environment is unforgiving.

Suspended animation

The stakes are high in this race. Cryptobiosis is one of the most high-risk, high-stakes strategies. In this strategy, animals coat themselves with a protective cyst at the end of the wet season and enter a state of suspended animation. They remain in this protected state until the pools flood again the following autumn, at which time they emerge as adults. Being fully-grown they would be two steps ahead of other species that would still need to grow into adults after hatching. Of course, things do not always go according to plan. These animals die if the rain is inconsistent and the pools dry up again, or if it rains later than expected. The cryptobiotic animal may not be revived at all, in this case, »

and would die in the sediment at the bottom of the pool.

The plants and animals that do manage to hatch or germinate face multiple challenges in this ephemeral environment. Rock pools tend to dry up quickly when rains stop. In Malta this can happen even in the winter months. The organisms that call rock pools their home have adapted by compressing all their life-cycle into the wet season. They quickly hatch and germinate, pass through a few phases, become adults, reproduce, and produce the next generation before the rock pools dry up.

The race to be the first to hatch or germinate is quickly followed by another race: that to be the first to reproduce. The ultimate goal of all animals, all plants, all living organisms, is to pass on their genes; the evolutionary success of any generation is measured by how many successful offspring it produces. In these temporary pools, reproduction has an added constraint: it has to happen while the pool actually exists, a short time window. Reproduction is efficient and rapid, with a large number of offspring produced. The plants are remarkable. They grow, flower, fruit, and set seed, in weeks rather than months. Any adaptation that buys them time may represent the difference between reproductive success and genetic death.

Shrimp Cocktail

Rock pool animals are both weird and wonderful. The Fairy Shrimps (*Branchipus*) are small, transparent shrimps that swim on their backs using multiple sets of appendages as flippers. The Clam Shrimps (*Cyzicus*) are mostly bottom dwellers, usually half-buried in the sediment, where they feed on organic matter. The ostracods (*Cypris*, *Eucypris* and others), also shrimps, are small and



“The ultimate goal of all animals, all plants, all living organisms, is to pass on their genes”

seed-like and scurry around the bottom of the pool mopping up everything in their path—nature’s great scavengers. In the water column, water fleas (*Daphnia*, *Ceriodaphnia*) of many kinds bob up and down feeding on plankton.

Females dominate this shrimp-world. They rule since evolution got rid of the males, at least partially. These shrimps mostly reproduce by asexual reproduc-

tion making copies of themselves. This reduces genetic variety but also removes one of the costs of sex: slow population growth. Males cannot give birth to offspring, and therefore halve the number of progeny. When the pool is full of water and stable, animals need to reproduce but genetic variety is not so important in a stable habitat. So, during the wet season, these females simply produce plenty of asexual eggs that grow into other females. Things change as things get drier. Spring brings less frequent rainfall, rising temperatures, and falling water levels. These aquatic shrimps are in trouble since their habitat is disappearing. In this stressful time, males appear. Some eggs hatch into males, sometimes merely dwarf males, whose only task is to fertilise females. This last hurrah now produces eggs that differ genetically from each other and that have thick outer walls, resistant to drought. These are the eggs that will try to survive the hot, waterless summer, »





where soil temperatures regularly exceed 40°C. The length of the dry phase is unpredictable and is the reason why genetic variety is now so important. Different eggs or seeds have different hatching or germination needs, meaning that some will burst into life at the first drop of water, while others need plenty of water and cooler temperatures. By hatching at different times there will always be some that survive the following autumn.

Green fingers

The plants that live in these pools have to cope with the two principal problems faced by all plants on Earth: either too little water, or too much of it. During the wet season, the pool is flooded, and would therefore favour hydrophytes: plants that can survive submerged in water. These plants, rooted in the bottom sediment, are often delicate and fragile, with linear, finger-like leaves. They have no need for elaborate support structures as the water they live in provides this function.

Another group of plants, the amphiphytes, can have the best of both worlds. They live in water, but can also survive short dry periods. They have the wispy leaves of aquatic plants but also, later on in the wet season when the pools are drying out, the broader, stouter leaves of land plants. Because of these adaptations the plants can live where no other plant can: the boundary zone between dry and wet. This adaptation extends the plants' life-cycle by a few critical

days at the end of the wet season, giving them some more time to reproduce and release their seeds—the next generation—into the sediment for the next wet season. As long as the soil is moist, amphiphytes can survive. But when the soil dries out completely even the amphiphytes disappear leaving just their seeds. The dry pool is now the realm of terrestrial plants that are encroaching from the surrounding dry land, and of scavenging animals, such as woodlice and ants, feeding on the remains of the dead aquatic animals.

Time and Space Travel

Plant seeds and animal eggs are resistant, self-contained time capsules that allow survival through periods of environmental stress. In their most basic form seeds and eggs consist of an embryo, a food supply, and a tough, protective outer covering. In this state, embryos can bide their time and emerge in favourable conditions. For plants and animals that live in rock pools, 'favourable' conditions imply rain and a drop in temperature. Since this aquatic phase depends on an unpredictable climate, embryos may sometimes need to wait for a long time before breaking dormancy and emerging. They cannot wait forever. The genetic differences between seeds and eggs from the same species mean that some are able to remain viable in the dormant state for much longer than others. Some may only tolerate a few weeks or months of waiting; others may, in the style of Rip

Van Winkle, wait successfully for years or even decades before emerging. These are nature's incomparable time-travellers. This longevity of dormancy gives some of the pool inhabitants extraordinary resilience. Almost miraculously, they will spring back to life after a long succession of unfavourable years. Some seeds and eggs lie in reserve waiting for that downpour and temperature drop.

Seeds and eggs are also a means of travelling from place to place, and both animals and plants generally devote much effort to ensure that their seeds disperse widely. Dispersal allows species to colonise new territories and therefore hedge their survival bets in multiple spots.

Rock pool species do not follow this trend. They simply leave or lay their seeds and eggs in the bottom sediment without trying to disperse offspring

“These habitats are treasure troves of biological diversity. The plants and animals that live there are comparatively rare, because their habitat is also rare”



far and wide. This evolutionary trend is explained by the nature of the rock pool habitat. A pool is an island of 'favourable' habitat within a much larger area of 'unfavourable' terrain. If seeds and eggs travel far, they will disperse beyond the boundary of the pool and into inhospitable territory where they cannot germinate or hatch. Offspring that travel far are not likely to survive. There are exceptions. Pools attract other animals, including birds. When birds wade in a pool, some of the bottom mud—containing seeds and eggs—may stick to their feet. When the bird takes flight, the seeds and eggs do so too, and in this way may travel very long distances into other wetlands.

Vital rockpools

Rock pools are small and scattered, why should they be considered important? These habitats are treasure troves of biological diversity. The plants and animals that live there are comparatively rare, because their habitat is also rare. They are at the merciless hands of extinction.

Rock pools are whole ecosystems in miniature. They can be used to test different ideas in ecological theory without many of the complications and additional factors present in larger ecosystems, like a whole forest or swamp.

These pools could survive a warming climate. Global warming is already

rapidly changing the environment. The short life-cycles of pool organisms means that they should respond quickly to change and adapt successfully. Larger systems might not adapt in time. The effects of global warming are observable in pools long before more complex ecosystems.

Our research group wants to answer all of these questions. Early studies characterised rock pool habitats in Malta, their species and dynamics. A later study showed how these pools can be used as an early-warning system for global warming. A consistent temperature increase will increase the number of amphiphytes while decreasing hydrophytes. The ratio between these two plant types is an indicator of climatic change. More recent work focused on specific aspects of the pool environment or on individual species. Another study investigated the germination requirements of pool plants to try and understand which stimuli promote the presence of particular species over others. A number of more recent studies have been looking into how the species present in a pool are affected by the location of pools in an area, the pool basin's shape, and of the length of hydroperiod.

These studies have answered some questions but raised plenty of others. It seems that there will be students crawling on all fours and mumbling in Latin for some time yet. ●

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I'm sorry I forgot:
Is dementia Malta's next national crisis?





Cassi Camilleri

In 2010, the total number of individuals with dementia in Malta stood at about 5,000. By 2030 that figure will double to 10,000. The evolution of healthcare technology has bestowed a longer life upon the human race. But this extended lifespan comes at a price. The prevalence of neurodegenerative diseases normally associated with old age, such as the many forms of dementia, is on the rise. With no cure in sight, the future depends on the development of effective prevention and care methods. This is the mission of **DR CHARLES SCERRI, ANTHONY SCERRI**, and their team as they join forces to battle dementia

It was on June 5th of 2011 that 80-year-old Briton Geoffrey Morgan went missing from Ghajnsielem, Gozo. One minute he was sitting at home while his wife and daughter were preparing breakfast, the next he was gone—disappearing into thin air.

An intense search by friends and family proved fruitless. The local police were called in. Feelings of both immense relief and worry consumed the family as Geoffrey was located on CCTV footage, wandering aimlessly down Gozitan streets, exhausted, disorientated, and obviously lost. Rescue dogs were dispatched immediately to track him down. But to no avail. Sadly, this story was not to have a happy ending. Geoffrey Morgan's body was found months later in Qala. Geoffrey had Alzheimer's, a form of dementia.

The tragedy that befell the Morgan family struck a chord with the Maltese population, bringing dementia and its related illnesses into the public eye

like never before. Questions started being asked, and not just around what dementia entails but also on the bigger picture—what is being done to prevent such horrible events from happening in the future?

The reality is that we, the population as a whole, both globally and nationally, are aging fast. Funding care is becoming more and more difficult for families to afford and an increasingly heavy burden on the state. In Europe, an individual with dementia costs an average of €22,000 annually. In Malta, this figure translates to an overall yearly expenditure estimated to range between €63 million and €96 million.

Plainly speaking, we are not prepared for the future that awaits us—financially, infra-structurally, or even socially. This is where Dr Charles Scerri and Ph.D. student Anthony Scerri come in.

In the bid to help prepare Malta, Charles and Anthony's goals are to build awareness, train professionals

66% of professionals wrongly believe dementia is a natural follow up to old age

- Anthony Scerri

and, through research, paint a comprehensive picture of dementia with all its ramifications. This effort is not just happening in Malta but there are many researchers studying dementia worldwide. This is the only way to tackle the beast. But the road for Charles and Anthony has been far from easy.

In 2004, while working at the University of Malta, Charles co-founded the Malta Dementia Society and continued his research into preventative measures in dementia. He wanted to give something back to society by starting a dialogue on the illness and, in so doing, help the people it affects. But instead of support he found widespread, unbridled apathy. 'Dementia was not even considered a topic of discussion. It was a subject that was shunned, set aside and hidden, like many other mental illnesses,' he points out. 'Those affected behaved in too "strange" and "embarrassing" a way to be acknowledged, so people decided it was better to stay away rather than address the problem.'

Sadly, this state of affairs has not improved much. Because early manifestations of dementia tend to be small, they are often deemed insignificant, especially since they are related to old age. Sarah Morgan recounts how the earliest sign of her father's Alzheimer's was his forgetfulness. Geoffrey sometimes forgot what day it was. Then there were instances when he would walk into a room and then back out for no apparent reason. They would later realise that Geoffrey had planned on doing »



Dementia: *A quick overview*

The World Health Organisation (2012) defines dementia as 'a syndrome due to illness of the brain, usually of a chronic or progressive nature, in which there is disturbance of multiple higher cortical functions, including memory, thinking, orientation, comprehension, calculation, learning capacity, language and judgement.'

When it comes to risks, increasing age remains the most important factor. High blood pressure in middle-aged people also makes them more prone, as does high blood cholesterol levels, diabetes, obesity, and stroke. Some studies link depression and dementia even though the exact cause is unknown. Finally, repeated head trauma, as experienced in boxing or rugby, could trigger processes in the brain that result in chronic traumatic encephalopathy.

There are also reversible forms of dementia. Vitamin B12 deficiencies for example can be treated to reverse the symptoms of dementia that it causes, as in the case of Hypothyroidism, Lyme disease, and neurosyphilis.

The onset of dementia, usually common after the age of 65, can be delayed by engaging in mental, physical, and social activities. Additionally, a healthy and balanced diet low in saturated fat reduces heart disease and stroke, and consequently dementia. That being said, it is not impossible for dementia to affect younger people. But when this happens usually the patient would have inherited some form of the disease from relatives. The presence of frontotemporal lobar degeneration and Huntington's disease could also drive development in younger people, as well as other neurodegenerative disorders such as Huntington's disease, Parkinson's disease, and amyotrophic lateral sclerosis (ALS).



Nurse Anne Agius and researcher Anthony Scerri. Photo by Jean Claude Vancell

Treatment and care

Symptoms of dementia vary, but for those looking out for early signs of dementia, according to the Alzheimer's Association, at least two of the following mental functions need to be significantly impaired to be considered dementia: memory, communication and language, ability to focus and pay attention, reasoning and judgment, and visual perception.

In practical terms, this means people with dementia could experience problems with short-term memory. They also have issues with keeping track of their money. Paying bills becomes difficult, as does planning and preparing meals, remembering appointments or travelling beyond their own neighbourhood.

Many iterations of dementia develop in a progressive manner. This means symptoms start small and gradually get worse. Changes in thinking abilities and difficulty with memory should not be ignored. If you or a loved one are going

through such changes, contact a doctor and determine the cause. It may be that a professional evaluation will point to a treatable cause. Should a form of dementia be in play, however, this means an early diagnosis will allow the person to develop a lifestyle and undertake treatments that can delay the disease or make it easier to cope with. The extra time also allows volunteering for clinical trials or studies.

Clinical trials in the development of novel drug therapies for the most common forms of dementia have failed to date. The brain is a complex organ and identifying the cellular mechanisms governing neurodegenerative disorders is extremely difficult. The most promising targets to which most research is currently being directed are those involving the beta-amyloid peptide of which accumulation leads to the development of amyloid plaques and consequent brain cell death. Many of these therapies work by directing antibodies against the beta-amyloid thus removing plaques and halting disease progression.

something but forgot by the time he got there.

Educating the public is essential. Charles and Anthony place it high on their list of priorities. But the highest priority is the ‘alarming’ lack of basic knowledge about dementia among professionals. ‘Published studies that have been carried out at the University of Malta are up to par’, says Charles. Erroneous practices see many people with some form of dementia not being referred to the right consultants. In defence of such actions, some practitioners will say that since the disease is incurable, then there is nothing more to be done. Shockingly, 10% of professionals wrongly believe dementia is a natural follow-up to old age. But this cannot be farther from the truth. Charles sets the record straight. ‘Yes, the chances of having dementia increase with age but it doesn’t have to happen. People over 90 have a 50% chance of getting it. The other 50% will not.’

But not all is lost. Marrying practice and research, Anthony’s Ph.D. focuses on training professionals and improving care within the hospital setting. Working with charge nurse Anne Agius and her staff at Karin Grech Rehabilitation Hospital, Anthony is leaving the problem-based approach behind and putting people, patients, families, and carers, at the centre of it all.

The one common denominator in dementia-related illnesses—a lack of cognitive function—is the most marked and most difficult to handle. While the progress of the disease is incremental, it slowly sees the sufferers become completely dependent on their carers. In Malta, with its ingrained traditional family system, most make the immediate decision to take on the responsibility of caring for their loved ones. The Morgan family too made this decision upon Geoffrey’s diagnosis. His daughter Sarah was with her parents on the day of diagnosis; ‘the psychiatrist



“Dementia was not even considered a topic of discussion. It was a subject that was shunned, set aside and hidden, like many other mental illnesses”

- Dr Charles Scerri

confirmed his short term memory was failing and although I heard her say dementia, I immediately said, “It’s ok. We are a strong family. We can fight this.”

Studies have proven that the best option for dementia patients is to keep living at home and be active within their communities. It saves them the distress brought about by the sudden change in environment. Unfortunately, this is not always possible and society is changing. Economic realities mean the ‘traditional’ family structure of a woman staying at home to take care of domestic duties is disappearing fast. The pressures on the family unit are now heavier than ever before. There have been numerous cases in which family members caring for relatives with dementia would suffer severe burnout, leaving them having to resort to care themselves. It is a vicious circle. Anne rightly points out that ‘In a way you hold your hands up and say: “what is the alternative?”’ Answering her own question, she says that having better community support is essential for people to cope.

Even when under home care, dementia patients regularly need to be admitted to hospital. Anne described ‘acute events’, which range from a simple ear »

infection to a nasty accident at home. At this stage, the hospital's carers need to swoop in and deal with the situation. Naturally, this does not only involve the patient but also the family which would be going through a crisis at the same time. This is no mean feat, especially if certain 'difficult behaviours', such as shouting and aggression, have already developed in the patient. This difficult behaviour can trigger bad reactions from the other dementia patients in the ward. In fact, Anne warns that just because someone has the academic qualification, it does not mean they are emotionally equipped to handle the challenges of working with people who have dementia. Sarah Morgan describes it as 'a silent battle of the wills between the mind of the dementia sufferer and the carer who is just watching out for the patient.'

Trained professionals are key. "The constant adaptation of dementia care depending on the patient's needs requires stamina and a great deal of understanding," says Anthony. A patient-centred approach in its truest form must become standard practice. The one size fits all method most hospitals work with—breakfast at 9:00a.m., lunch at 12:00p.m., dinner at 5:00p.m.—has no place among those with dementia. This is going against all established organisational structures currently in place. Anthony knows that he will face resistance but insists that these changes are essential.

A clear reflection of the effectiveness of Anthony's theories is the progress already being made at the Karin Grech Hospital where they are put into practice. There has been an immensely positive response, not just from patients, but also from staff who were consistently consulted at every step, says Anne. 'People felt they were involved and that their voice was being heard. As much as we always try to make the patient the main priority, it needs to be taken into account that caring for someone with

“In Europe, an individual with dementia costs an average of €22,000 annually. This means that in Malta, the overall yearly expenditure is estimated to range between €63 million and €96 million”

dementia is a challenge in itself and we need to deal with both mental and emotional needs. It can be emotionally draining on the professional as well. The fact that someone is acknowledging this is very helpful.

With much left to be done, everything is now coming together in *Malta's National Dementia Strategy* written by Dr Charles Scerri who is the National Focal Point on Dementia since July, 2013.

The National Dementia Strategy is becoming more and more crucial as we try to take the bull by the horns and deal with dementia and its effects on the whole country. The plan puts forth a set of proposed measures across six categories; some have already been mentioned. It tackles increasing awareness, improving timely diagnosis and early intervention, development of a specialised workforce, improving treatment and care, promoting ethical approaches, and promoting and fostering further research in the field.

This strategy needs the support of policy makers for it to be implemented.



Dr Charles Scerri

While the strategy puts Malta at the forefront of all dialogue on dementia, being one of only 16 countries worldwide who have such a strategy, its successful implementation also means that there needs to be a huge attitude change on national level and an equally large amount of fiscal investment.

It is certain that the spread of dementia will bring about a significant demand not only on the health and social care services but also on society as a whole. The impact of dementia cannot be ignored. The cost of doing so, of choosing to sweep dementia under the rug, would be devastating.

For those wondering about a cure, it will be a while yet before one is found. Unfortunately, that area of research has

been painstakingly slow. Much like the different types of cancer, there are various iterations, each with different causes and pathologies. Progress has been set back also due to the number of years which have to pass before the symptoms begin to manifest themselves, at which point a lot of the damage has already been done.

That is why Charles and Anthony are in agreement that the focus here and now should be on quality of life. Care and communal support are critical, as is understanding. Dementia presents us with a challenge—to always keep sight of the person behind the disease. This is the battle we must always win, never allowing the disease to mar our view of the person. This is how we will win the war. ●



Malta's National Dementia Strategy

A deeper look

Malta's National Dementia Strategy aims to enhance the quality of life for individuals with dementia, their caregivers, and family members through measures in dementia management and care. To do so, the plan focuses on boosting awareness, improving diagnosis times and ensuring early intervention, development of a specialised workforce, improving treatment and care, promoting ethical approaches, and promoting and fostering research in the field. The strategy spans nine years from 2015 to 2023.

Awareness of dementia will eliminate myths surrounding the disease and increase the chance of early diagnosis, hence limiting institutionalisation. This would be done with the help of media through ongoing information campaigns providing basic knowledge to the public. There also needs to be targeted information sessions as well as the strengthening the Dementia Helpline.

The strategy also calls for training opportunities to be provided for professionals, including family doctors. This will boost referrals to specialists. Reducing waiting times for appointments is also needed, therefore, additional specialists will need to be brought on board.

The strategy highlights the need for increased training of healthcare professionals. Few staff working with individuals with dementia have adequate specialist training. Towards this end the University of Malta is being urged to develop undergraduate and postgraduate level study units focusing on dementia.

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The Death of the Temple People

Welcome to Malta's largest archaeological attraction: the Temple Period. We have Maltese and British archaeologists to thank for this heritage that has been dug up since the early 20th century. Yet there are still unanswered questions why these people survived for so long then suddenly vanished. The FRAGSUS project—the largest international archaeological collaboration in Malta and Gozo—is trying to answer why. Words by **THE EDITOR**

Let us start on a journey. A journey back to a time when the Maltese population lived in Malta and Gozo with a cult obsessed with life and death. Symbols of sexuality were common, with many phallic shapes and fertile obese figurines strewn around the remains that have survived to the modern era.

Settlers from Sicily had arrived around one and a half millennia before this culture developed bringing goats, cows, sheep, crops, and quickly deforested the island. At some point over this time the population developed an obsession with temple building, and a complex culture around it, that only became more extreme as the civilisation flourished. ‘The Maltese Islands seem to have gone on a complete tangent from what was going on around them giving expression to the Temple Period which lasted for just over a millennium,’ Dr Nicholas Vella (Department of Classics and Archaeology, University of Malta) said.

The Temple Period civilisation is famous for having built the oldest free-standing stone structures in the world. They covered Malta and Gozo with over 30 temple complexes over their 1100 year history. Apart from extensive temple sites cluttered with the evidence of complex rituals and animal sacrifices, intricate burial complexes were also built showing a deep respect for death.

During the Temple Period artwork flourished. Hundreds of statues have been discovered. Although famous for abundantly fertile ‘fat ladies,’ these only make up around 15% of the statues found, with phallic and especially androgynous symbols being much more common. How the Islands managed to

sustain such a rich culture is a mystery. Another mystery is how it all ended. The Temple people did not suffer from any obvious disease, lack of food, or invasion, at least that is the story the studies carried out until now tell us. One theory is that environmental stress and religious extremism somehow killed them off. The Temple people came and left, ‘we cannot find a successor,’ stated Prof. Anthony Bonanno (Department of Classics and Archaeology, University of Malta).

A Light in the Darkness

In the early 20th century, Sir Themistocles Zammit’s unearthing of underground burial complexes—hypogea—with the adjoining megaliths of the Tarxien Temples solidified Malta’s identity with this stone architecture. Unfor-

Although famous for abundantly fertile ‘fat ladies,’ these only make up around 15% of the statues found, with phallic and especially androgynous symbols being much more common

tunately, by the 1950s archaeology had lost its importance in Malta. The craze generated by Temi Zammit’s findings had long died out, and as independence rolled on in 1964 things just got worse culminating in Mintoff’s government that dissolved the whole Faculty of Arts at the University of Malta.

In those days, Bonanno was a lecturer with a lot of time on his hands. ‘I had very little teaching.’ So it came as a lifesaver when the Director of the Tourism Department approached him to organise a conference that, after approval from a new Rector, culminated in a conference in 1985 on Fertility Cults in the Mediterranean. At the conference, amateur archaeologist Joseph Attard Tabone showed how he thought he had rediscovered an ancient stone circle immortalised by Charles de Brocktorff’s watercolours.

Amazed by the revelation, world-leading archaeologist Colin Renfrew was easily persuaded to organise a dig in Gozo. By 1987, the British were back with Dr David Trump, Prof. Caroline Malone (Queen’s University Belfast, back then Cambridge) and Dr Simon Stoddart (University of Cambridge) all digging alongside the Maltese team that included Bonanno, Dr Tancred Goudier (Museums Department), Vella (back then as a student), and others. A change in government that year reinstated the Faculty of Arts—archaeology was back in the picture.

The Brocktorff or Xaghra Stone Circle ‘was a lost site. We went there thinking, “we cannot do too much damage, let’s dig a hole in the ground” and it turned into very much more. Our original programme of five years was extended to seven. [...] Babies were brought »



Researchers and students from the University of Malta, University of Cambridge, and Queen's University Belfast working at the Taċ-Ċawla site. Photography by Edward Duca

to the site. It has taken up a lot of our lives [...] then we decided that that was the limit of our funding and energy,' recollected Malone.

Seven years of digging and 220,000 bones from 800 individuals later, and they revealed 'a great crater left by a collapsed cave, it had been a hypogeum. A natural hypogeum enhanced by megalithic monuments that probably lasted around 1500 years till 2500 BC as part of the Ġgantija complex.' They had found an archaeological goldmine that helped train a new generation of archaeologists who are all now prominent in the field.

Squaring a Circle

The Xagħra Stone circle was an extensive underground burial complex. Not as big as the hypogeum at Ħal Saffieni, that Sir

Isotope and trace element analysis of the bones showed that they were healthy and mostly ate meat or vegetables

Themistocles Zammit estimated housed around 6,000–7,000 individuals, but it revealed a civilisation whose complexity is unusual for its age and it took over a decade for the Anglo-Maltese team to compile extensive results from the digs.

The rituals of the burial practices changed greatly with time. At the early Żebbuġ Period between 4000–3500 BC the rock-cut or natural caves housed family units, one generation on top of the other. Bones seemed to have been pushed to the side to make space for the most recent burial. Several gifts were placed with the dead but no obvious human figurines.

After this time, the Temple Period flourished. The burial complex was extensively modified with the internal caverns extended and subdivided into rooms with many more enclosed spaces for burials for their complex death



rituals. More communal burials seem to emerge with large pits housing hundreds of individuals whose bones have been separated, sorted, and stacked on top of each other. Grave gifts had transformed to the famous 'fat ladies' that are clearly female in this case. At ground level another grave-pit was found exclusively for male body parts without grave

gifts, nodding towards a matriarchal society. It seemed that older burials were removed and body parts sorted into mass pits with newer burials placed in the compartmentalised caves or chambers.

To take care of these complex rituals a priest caste arose. '[They] managed the conduct of these buildings [that] served

an economic and political purpose.' This clue is one reason for the idea that religious extremism developed and extinguished the temple flame.

Isotope and trace element analysis of the bones showed that they were healthy and mostly ate meat or vegetables. The trace elements left by eating copious amounts of fish or seafood are absent. The Temple people were not fishermen but neither were they riddled with disease.

Accompanying the magnificent temples and hypogea was an overflow of art. 'The art has three forms of human representation: [...] one form is dressed, usually standing, ungendered, they have elaborate hairdos, belts, necklaces, and skirts, perhaps a status of office. Another form is the naked fat figures, again mostly ungendered though some are female, like the Sleeping Lady and the Venus of Hagar Qim. There is no evidence that they were being worshipped, but they are representative of ancestors. [...] Finally there is another form: the abbreviated or monstrous. You get all sorts of funny little representations: you get phallic symbols, tiny knobs for arms and legs, and all sorts of curious things.' »



Charles de Brocktorff's watercolour

In this group you also have everyday domestic animals being shown, reptiles and fish, and birds,' explained Bonanno.

'The Gozo dig showed new facets of artistic production.' Bonanno wrote about a set of six plank-like human figurines. They were found interred with presumably the artist. 'They represent several works of the same artist in different stages of production. One is simply a rough cut, two others showing intermediate stages, and two completely finished products.' Bonanno compared the sculptor to Michelangelo's unfinished Prisoners or Slaves.

The archaeologists also found a seated pair of near-identical ungendered human figures. 'One carries a cup, the other a miniature version of itself' leading Bonanno to think about the triad, again walking away from a singular mother goddess. 'The dual figure is only about 15cm across and 13cm high.' Some statues are much larger. There is 'only one example of a colossal statue standing 2.5 to 3m high at Tarxien. Only the lower half has survived. Its position in the vestibule, behind the entrance in the Tarxien Temples, with the area being decorated with spiral reliefs, is the best candidate for the representation of a divinity', said Bonanno. Human sculptures with multiple figures are very rare during this time. This level of artwork was 'unparalleled' exclaimed Bonanno. So why did it all end?

The European White Knight

Enter FRAGSUS. The Europe-wide €2.3 million study that brings together seven countries, five institutions (the Universities of Cambridge, Malta and Queen's Belfast, Heritage Malta and the Superintendence of Cultural Heritage), 19 academics, 10 post-doctorate



Dr Reuben Grima

researchers, and around 50 students, all coordinated by Prof. Caroline Malone and all focused on trying to answer the questions: What killed off the Temple people? Why do some civilisations survive for millennia in fragile environments and others do not?

To answer these questions (and plenty others) needs so many experts on board from fields as diverse as geologists to biologists, apart from archaeologists to interpret it all. They are also using scientific techniques to an extent never seen before on the Islands, from soil and pollen studies to GPS and LiDAR (Light Detection and Ranging laser) technology, all to try and reconstruct the past.

A key ingredient are 12 cores that are being taken of Maltese soil and sed-

iments. A core involves taking a circular sample of soil down to the bedrock. In Malta and Gozo this ranges from 2 to 20m in depth. 'This is like taking a sample to carry out a biopsy: from a tiny sample you try and build up a general picture, [...] if I find material in the core that is suggestive of a very wooded environment it means that the environment was wooded but then eroded. If erosion has taken place it means that the landscape might not have been heavily terraced. Everything is linked,' illustrated Vella.

Research on the Temple people did not stop after the Xaghra Circle dig and these cores are developing on previous ones, however they have never been studied so systematically. Prof. Patrick J. Schembri (for more about his research



Chris Hunt examining a section at Ta' Kuljat, Gozo

see issue 9, p. 30; www.um.edu.mt/think/a-life-studying-life/) is leading the local team studying molluscs, which includes snails, found within these cores to figure out the past environment and cultural habits. 'We found a great many species that not only tell us about the environment at the time but also about how this has changed. As a bonus they also tell us about human activities,' stated Schembri.

Researcher Dr Katrin Fenech went into greater detail about how much information we can glean simply by studying assemblages of snails. For a snail, the Maltese Islands and seas have not changed too much over the last seven thousand years, so you find similar species back in the Temple Period as today. 'The species can be broadly categorised into 'land snails', 'brackish water molluscs' and 'marine molluscs,' said Fenech. These categories can be split into whether the snails live in the open countryside, or love shade, or live just about anywhere. So if you find a shade-loving snail (such as *Ferrussacia folliculus*) in a place that is today rocky and dry, you can assume that just before Neolithic humans landed on Malta there were a lot more trees. Because they are taking so many cores they can refine these statements to specific areas.

At Tas-Silġ, a Neolithic temple site which was reused by subsequent civilisations, 'the marine molluscs that were found all came from habitats at Marsaxlokk Bay that still exist today or were known to have existed in the not so distant past,' said Fenech. Since the marine molluscs are edible this shows that, although sea food was not a regular on the menu, it was part of their diet.

Land snails seem to have been a preferred delicacy. 'At Taċ-Ċawla [a Neolithic settlement during the Temple

Period] we recently found and excavated the first ever true shell middens in the Maltese Islands. These consisted of thousands of large edible land snails. Over 90% of snails were the red-banded snail (*Eobania vermiculata*) This snail is still found all over Malta, but while still eaten in Crete, it is off the menu for the modern Maltese.' It's a cultural notion, whether you eat them or not. At Taċ-Ċawla, they quite clearly ate them, at Tas-Silġ and at any other archaeological sites in Malta, this is not so clear,' explained Fenech.

Prehistoric Malta has often been depicted as a wooded wonderland, pristine before the taint of humanity. Molluscs nod towards a different story. 'The very few typical forest or woodland species that exist in the Maltese Islands (e.g. *Lauria cylindracea*) have not been found in any archaeological deposits.' If Malta were wooded, it was not Island-wide. 'The Islands had

large patches of extensive vegetation cover, although whether this was forest, woodland or scrub-land is a matter of definition. This is one area that FRAGSUS is investigating,' emphasised Fenech.

Going back to the puzzle of what killed the Temple people off, when I asked Fenech about the idea of rapid ecological change, she quickly replied with 'define "rapid".' There is evidence from Marsa that indicates warmer, wetter periods as well as cooler, drier periods. Whether this change was sudden or gradual is impossible to say.' The problem is inadequate radiocarbon dating to get more accurate dates and the low number of cores studied. FRAGSUS should change that.

The Maltese team are not the only ones looking at these cores. They are being split in half with Dr Chris Hunt (Queen's University Belfast) and other colleagues looking at its pollen, »

Prehistoric Malta has often been depicted as a wooded wonderland, pristine before the taint of humanity. Molluscs nod towards a different story



The Neolithic temple of Ġgantija, Gozo

soil composition, bone fragments, and tephra (although the Maltese team are studying some of these as well), which all tell you about the conditions under which the soil was created. 'Most of our cores are from coastal locations which are great because you get deep cores and good preservation due to the anaerobic [oxygen-free] conditions,' explained Dr Reuben Grima. Malone had previously emphasised, 'every last granule here we will date'. While probably an exaggeration, the approach is important, study everything using any scientific discipline you have at hand, then piece the puzzle back together.

Another important piece of the Temple people puzzle is the studies into ancient and modern landscapes. The local specialists are Dr Nicholas Vella and Grima aided by researcher Dr Gianmarco Alberti. Part of their work involves studying the landscape to see how people exploited the land for cultivating crops and raising animals.

These two ways of life were the mainstay during the Temple Period.

What would have made most sense to the Neolithic Maltese was to mix and match these lifestyles. 'In a small island rainclouds can literally pass you by, missing you time and again.' Poor harvests could have been regular. 'They would have had a range of crops like wheat and barley, as well as lentils, fruit, and olives' explained Grima. They also had sheep, goats, and cattle as abundantly found around the Tarxien Temple Complex. 'At the megalithic monuments they were either practising ritual sacrifice or ritual feasting,' either as a gift to the god/s or to keep the population happy, healthy, cohesive, and power to the priest caste. Using these strategies they survived for hundreds of years.

To make sense of the huge amount of information needed to understand how an entire civilisation lived, the archaeologists are using models to reconstruct the past. Grima modelled the Neolith-

ic monuments in his research. He used a GIS model to map all the temples in Malta and study why those sites were chosen. The temple builders chose 'areas near fresh water springs, close to low-lying areas with a low gradient which are better suited to accumulate soil, rather than high windswept areas prone to erosion. The temples have a convenient access point to the sea, with a preference for south facing slopes for the megalithic monuments.' It is likely that the Temple people built their huts near these monuments. 'At Skorba [another Neolithic site] it is very obvious because you have huts built next to and in some cases below the foundations of megalithic monuments.' FRAGSUS is allowing the reexamination of these temple, hypogeum and residential units with a much wider range of specialists, tools, and resources.

In the Knights' and British periods, Vella and his team are figuring out that 'landholdings would have a bit of the garigue on top because that is perfect for collecting firewood and for a degree of pasture. [Underneath this] is where you will have a spring, therefore your farm and garden are found there. Horticulture would be practised at that level. Then you have a clay slope, and that is where you will plant your grain. You don't need to water it because the clays are going to keep moist even throughout summer. Then you will probably reach the valley bottom, which does not belong to anyone because you need to have running water (recently ignored by the Maltese construction industry),' explained Vella. Again, FRAGSUS is going to bring a wealth of new information from the core studies and over five dig sites around the Islands.

'The above all leaves a lot of unanswered questions,' remark Grima and Vella. How did the ancients raise their animals? What did a day in their life



Prof. Patrick J. Schembri with Dr Katrin Fenech studying a snail midden at Tač-Čawla

look like? Why didn't they fish much? How much trade was there with other civilisations? Who was being buried at these sites—the leaders of the settlements or everyone? Was everyone healthy? To try and understand the FRAGSUS team have just dug up a Neolithic settlement in Gozo.

A Residential Area

Dig sites are the other key source of information for archaeologists. I went to visit one at Taç-Ċawla in Gozo two weeks into the dig. It is one of the few examples of prehistoric domestic life and might help answer many of the questions Grima and Vella pose. Despite its importance, 'it was a dumping site for 20 years, since the council never took [the rubbish] away. I'm afraid it has been neglected,' decried Malone, on site with a team of enthusiastic students from Malta and Britain.

The site was found around 25 years ago because of 'some Dutch amateur archaeologists who made a big cry about [...] an illegal building on this very spot we are sitting in here'. I was shocked but not surprised. The building spree in Malta has rarely honestly cared about the history and ecology of the Islands with many artefacts probably destroyed.

At Taç-Ċawla 'we have a very intense settlement, wonderful material culture is coming out—pottery and dark soil which makes us very happy'. Malone went on to explain that dark soil 'is full of charcoal and human excrement, all the stuff that represents living and it tends to be black like a compost heap'. By examining what these people threw out lets archaeologists know the people's diet, lifestyle, and culture.

The archaeologists will 'be sieving this dark soil, all this carbonised material [...] to float off all those light-weight bits into mesh and then look



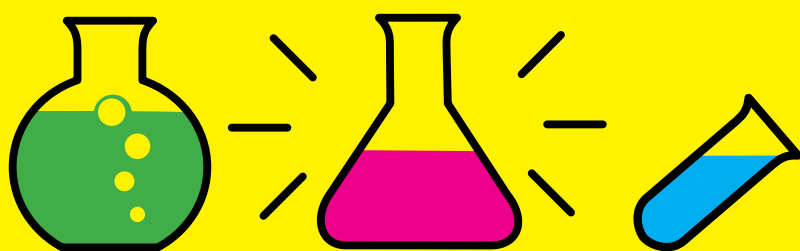
under a microscope to identify bits of chaff, plant remains, tiny teeth, bones, all sorts of stuff and recognisable seeds,' explained Malone. They are splitting the area up into square metres to study it all and be able to plot where and what they did in each area. This is a 3D model of their lives. Such a systematic approach has rarely been undertaken on the Islands and never on this scale. It needs this big team and millions of Euro.

The approach is necessary because archaeology has moved on in leaps and bounds from the time of Temi Zammit. It has become a rigorous science. 'Archaeology has changed out of all recognition from retrieving material to understanding the relationship between all the component parts into something that is far more meaningful,' explained Malone. 'We already have an idea that they ate rather less well at the end of the Temple Period than at the beginning. They got less meat and they had no fish.' If this team get it right within a few years they would have cracked the code.

The FRAGSUS team are planning to take things further. Site digs are being planned all over the Islands but it is also an opportunity to go for 'field walks, collecting pottery to try and see if there are concentrations which might conceal an archaeological site,' explained Vella. It could provide new sites to dig for decades. All of this will feed into that model of prehistoric Malta, giving more and more clues to build a picture out of this jigsaw of evidence.

The Maltese team are seeing this as an opportunity not only to figure out this puzzle so closely linked to the Islands' identity, but an opportunity to study a big chunk of Maltese history through all ages. For example, at the Taç-Ċawla site they had to remove classical (Punic/Roman) vine trenches which will also be studied. In Malta and Gozo history has tended to pile up on top of itself. The advantage of being so small.

FRAGSUS is a fantastic opportunity to put the spotlight on Malta and invest properly in Archaeology. Archaeology is not a discipline obsessed about the past. You can only know the present by understanding the past, and the idea of a fragile ecosystem is still prevalent in Malta. Our environment defines our situation. 'There are island environments which are overpopulated and yet they manage to survive because, presumably, they have some form of in-built resilience. It is a word we use a lot because of the financial crises, the resilience of certain places more than others. How far can you go in a place where resources are finite and when you have to depend on help from abroad?' cleverly pointed out Vella. We are quite sure how the Temple people did not die, but uncertain about why they did. Even if we cannot draw a direct lineage from the Temple people to us, by figuring out how they died, Malta can figure out how to flourish. ●



Colouring Chemistry



Alexander Hili

Smart, logical, and colourful. **DR DAVID MAGRI** and his team develop intelligent molecules. They are not only smart because they perform logical functions, similar to computers, but because they can detect miniscule changes in their surroundings that causes them to emit a large array of colours. These colour changes are intriguing researchers and are a great benefit to society



Dr David Magri



Colours fascinate Dr David Magri. He and his team create molecules that can detect biologically important chemicals and emit light. As molecular sensors they provide a simple and beautiful method with boundless applications from the detection of explosives in war zones to new medical and environmental diagnostic applications.

Some molecular sensors work by detecting a substance, or specific mixture of substances, and emitting light. They can work in a number of ways, but the underlying principle is that these molecules detect a substance, normally the presence of acids or toxins, that makes another part of the molecule sensitive to be powered by light. This second part can now adsorb UV light, which we do not really see, and emit coloured light, which we do. This coloured light can be seen by our eyes or some technology letting us know, for example, the levels of calcium in bones to find minuscule bone damage.

Captivating Colourful Chemistry

Colour is one of the world's most captivating experiences. We often describe an intense day full of different experiences

as being 'a colourful day'. Different colours elicit unique emotions and experiences. However, colour is also a form of energy, a radiation, which can be interpreted as a form of data. Researchers are taking advantage of this property to detect and measure chemicals in the environment around us. Colour is central to these molecular sensors that have applications ranging from determining a swimming pool's acidity or pH to measuring blood sodium levels.

Molecular sensors that exhibit colour

“Colour is central to molecular sensors that have applications ranging from determining a swimming pool's acidity or pH to measuring blood sodium levels”

are tiny, even smaller than a hair's width, smaller than a living cell. They can go to places in our bodies that many other technologies cannot. These sensors can monitor parameters inside living organisms as they go about their daily activity. For example, in a cancer patient they could monitor specific protein levels in their blood stream without constant blood tests. Other medical conditions like diabetes could also be detected through a colourful display of fluorescent molecules.

These intelligent molecules are like '007 agents', said Magri. They could go inside living systems unlike current semiconductor technologies. They are used as probes for environmental changes. Soils are commonly polluted around landfills. Molecular sensors can easily detect minuscule amounts of chemicals that have leaked. This warning signal would be a specific colour. The intensity of the colour would translate into the quantity of substance being detected. These sensors can detect mercury, cadmium, lead, and other toxins. A sensor can detect one molecule but they can become a lot more useful if they detect multiple chemical substances together.

Multiple substances, or inputs, can be detected using the concept of logic gates. Logic gates are a fundamental »



Colour

Light travels in waves. Radio, microwaves, visible light, and X-rays are all waves of light. Colours are a small part of this spectrum. They vary in three properties: one is their wavelength—the distance from one wave to another. Colours can be defined by the different wavelengths they have, red having a longer wavelength and blue a shorter one, the colours of the rainbow spread in between. This works well for spectral colours but combinations of different wavelengths of light can also represent the same colours to our eyes (or more correctly, brain). So colour can be defined as light, and light is a form of energy, making colour a type of energy. Molecules can either emit light as a by-product of a chemical reaction releasing energy, or by adsorbing one wavelength of light and emitting another coloured light—these molecules are called fluorescent.

Fluorescent molecules work by adsorbing light energy. Electrons circling around nuclei in atoms adsorb this energy. Adsorbing light makes the electron increase to higher energy levels, but also become unstable. The electron must return to the lower energy levels and when it does it emits light.



component of modern technologies such as computers and smartphones. But let us go back to basics: the light bulb. This is the simplest possible logic gate. It has two states: 'off' (called 0 in binary), with no light emitted, and 'on' (called 1 in binary) when you flick the switch. The simplest molecular sensors work in the same way. In the 'off' state they are colourless or dark, but on detecting a desired chemical, the molecule switches 'on' and either changes colour or glows brightly.

More sophisticated molecules can detect multiple substances, which act as the inputs. In the case of two-input logic gates two substances can be detected simultaneously. The most common examples are the AND gate and the OR gate. In an AND gate, if both switches are set to 1, the gate is switched on.

When either switch, or both switches, are set to 0 the gate is switched off. An OR gate also has two inputs, but only needs one input to be switched on. To relate this to molecular sensors, molecules that can detect sodium and an acidic environment could be used to detect cancerous tissue.

Breaking Boundaries

Magri's research team is developing molecules that work with water-based solutions rather than oily organic solvents that they typically work with. Maria Cardona, Magri's graduate student, has been developing new water-soluble pH azobenzene dyes that are widely used in colouring perfumes, soaps, sweets, and food. The problem is that many of these dyes are toxic. Cardona modified one of these dyes



Maria Cardona



by adding sulfonate groups to the molecule, which made it potentially much less harmful. These new molecules could be used to make safer food additives, keeping our food coloured without the harm.

Another student, Kristina Farrugia, is developing new molecular sensors to detect anions like fluoride—important for dental health. Her aim is to understand how these anions are detected. She is also trying to make them work in water-based environments to make them safer to use in humans.

Magri's team has also created a new class of molecular sensor called a 'Pourbaix sensor'. These sensors emit light when they detect acidic and oxidizing solutions. Oxidation is the process that turns iron into rust. The sensors are named in honour of Marcel Pourbaix, a French electrochemist, who studied the relationship between pH and oxidation for many elements.

The research team has taken 'Pourbaix sensors' to the next stage by developing a prototype that detects three inputs. The molecular logic gate needs three inputs at the same time to light up. When only two, or fewer inputs are present, the molecule does not glow. When all three substances, or inputs, are present the molecule fluoresces and gives off a blue-coloured light. To operate successfully, the solution must contain high enough quantities of sodium, iron and protons (protons measure the acidity of a solution). When all of these substances are in a solution with the Pourbaix sensor, this sensor gives off a bright light.

The Pourbaix sensor is an example of the 'lab-on-a-molecule' idea, a molecule that gives a yes or no decision when it detects multiple substances and conditions. For example, high levels of sodium, iron, and pH can be linked to certain types of cancer. Molecules like the



Kristina Farrugia, part of the research team

Pourbaix sensor can detect all of these things and light up, potentially identifying cancer in a person. Though it will take years, these molecules may be clinically useful in hospitals.

Revolution

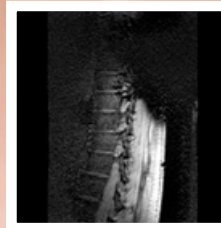
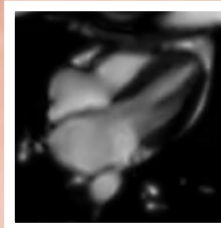
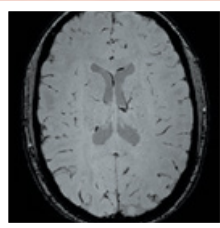
The best thing about these molecules is their size. Used instead of other technologies, these molecules are so tiny that they can go where many other technologies cannot. Microchips cannot enter living cells, while molecular sensors are ideal for infiltrating cells and sending back information about the cell's health. Examples of these sensors are used today in medical equipment to diagnose the blood analytes of patients. Since these molecules emit light that can easily be detected, researchers and medical practitioners only need to wait a few minutes for test results.

Molecular sensors could have a wide range of applications from disease detection to, perhaps, the creation of new brands of coloured sweets. Magri and his team have a long and colourful road ahead of them which will be filled with pockets of vibrant surprises. ●

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ALUMNI talk

Beneath your skin

INGRID VELLA writes about her career in medical imaging and how she ended up with pictures of her kidneys



FROM A YOUNG AGE, I have shared a passion for both engineering and medicine. I was intrigued by how stuff works: how a TV receives signals, how an aeroplane flies, how a bulb lights up, how humans move their arm. My father, a physics teacher, answered most of my questions but this only fuelled my curiosity to read for an Honours Degree in Electrical Engineering at the University of Malta. During my degree I spent one semester on an Erasmus exchange at the University of Nottingham.

In my final year project in Malta, I analysed ElectroEncephaloGraphy (EEG) data that can detect a person's brain waves to decipher which limb they are trying to use, which is useful, for example, to paralysed people who need to move a robotic arm. This study encouraged me to read for a Masters in Biomedical Engineering at Imperial College, London in 2011.

During my M.Sc., I worked on a research project in the Brain and Behaviour Lab at Imperial. The aim was to devise an objective and quantitative way to determine if a person had problems with movement. To this end, I record-

ed 300 hours of movement data using a motion capture suit, and analysed the similarities and differences in movement among healthy people against patients suffering from Parkinson's Disease.

Following my Masters Degree, I started a Doctorate in MRI (Magnetic Resonance Imaging) Physics at the University of Nottingham. MRI is a way to image parts of the body without the need for messy surgery. I chose the University of Nottingham because it is a pioneer university in MRI research. Sir Peter Mansfield, a professor at the University of Nottingham, was awarded the Nobel Prize for Medicine in 2003, shared with Paul Lauterbur, for discoveries in MRI. The University of Nottingham boasts cutting edge technology.

In Nottingham, I am trying to improve MRI hardware that is used to image the human brain at Ultra High Field (UHF). The typical MRI magnets used in hospitals are three Tesla strong, whereas MRI magnets at UHF are at least seven Tesla strong. The higher the magnetic field the better the resolution of the image. When a person's head is

subjected to the magnetic field from an MRI magnet, the magnetic field becomes inhomogeneous, which is not good. The aim of my project is to find ways by which to keep the field as homogeneous as possible during imaging of the human head.

I am also working on a project using MagnetoEncephaloGraphy (MEG) aimed at creating a new way to image using this technology. MEG is a non-invasive technique that is typically used to measure the magnetic fields generated by the neuronal activity of the brain.

Since my colleagues and I need to test our research, it is inevitable that we volunteer as each other's subjects. I enjoy taking part in my colleagues' experiments, and I find that by participating in them, I learn more about their research projects. Thanks to these experiments, I have images of my brain, spine, and kidney, as well as a cool video of my heart pumping. I predict that by the end of my Ph.D., I would have gathered multiple images of all my organs! These are some strange benefits of embarking on a research career in medical imaging. ●

Better than the best

DR NEVILLE GRECH writes about his research career in automating software

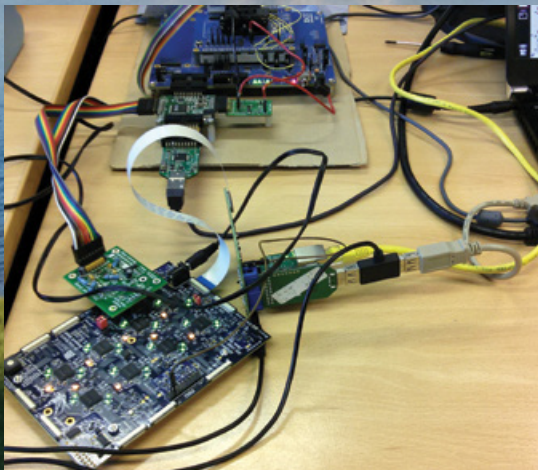
TODAY WE RELY on computers. Computers are present inside car engines, mobile phones, and even medical implants. Programming languages are the way humans can dictate how these machines behave. Programming a machine is difficult, involving a lot of trial and error until the machine starts behaving as the human programmer wants. Programmers spend their time testing programs; however, despite all their efforts, most programs that are used in production systems are still error laden.

Languages such as JavaScript, called dynamically-typed languages, have gained a strong foothold amongst programmers. These languages enable writing software quickly. The JavaScript language is ubiquitous on the web, and dynamically-typed languages are very common in the software industry, including Malta's. Unfortunately, these programs are also littered with errors (called type errors) that can break an entire system. Programmers would benefit by detecting type errors in their code at an early stage, without imposing

unnecessary restrictions on their programs. Due to their dynamic nature, no such tools exist. For my Ph.D. research I chose to fill this gap by developing a mechanism called "pre-emptive type checking", that can automatically find type errors early on. It can be applied to languages such as JavaScript or Python. In fact, I have developed a proof of concept implementation for the Python language, one of the most commonly used programming languages. Various research institutions are working on different ways to make dynamically-typed languages more reliable, with Microsoft Research (MSR) spearheading this kind of research. Researcher Gavin Bierman, working for MSR (now Oracle), has worked on a recent programming language called TypeScript, together with a number of others in use today. Bierman was my external examiner for my Ph.D., and discussing these issues with him during my viva was a truly enriching and intellectually stimulating experience. Despite the large number of people working on the problem, I have managed to tackle the problem from a

different angle. My work focused on creating a mechanism to find type errors as quickly as possible. The earlier a mistake is detected, the less damage is caused and the earlier one can fix it.

Following my Ph.D. in Southampton, I moved to the University of Bristol to pursue post-doctoral research on compilers, which are programs that turn human readable programs into machine-readable code. Computer energy consumption is a major industry challenge, and the software is a large drain on battery life. I collaborated with semiconductor companies and other top research institutions to develop software tools that estimate energy consumption when running different programs. I also developed techniques to automate the process of writing energy efficient software. Software that is more dependable, maintainable, and more efficient than the best systems currently available. ●



A glimpse of the future? An embedded computer system, with 256 efficient processor cores running at 500Mhz. My research at Bristol with XMOS is helping with the automation of writing energy efficient software for this, and similar, platforms.



Informal and formal cultural disruption



Dr George Cassar
Caldon Mercieca

Valletta is preparing to be the European Capital of Culture (ECoC) in 2018. In its run-up a Cultural Mapping Project is currently being implemented in Malta to map cultural places around the Islands. The project is focusing on public space discourse in a contemporary urban setting.

Malta is small and its localities are complex environments with multiple uses ranging from economic activity and rituals, to history and community. All of these interests are jostled between the locals, central and local government. Despite such diversity, many view these spaces as only serving one function, normally due to commercial or administrative demands. At the same time, the public is discussing how cultural resources should be regulated for better management, economic benefits, and to attract new investment into cultural spaces. Public space seems to be mirroring cyberspace regulation: a precariously-balanced dynamic of market forces, architectural constraints, unwritten social norms, and hard legislation.

We, the authors, have researched how Maltese public cultural space has been informally 'mapped' in policy documents, legislation, and economic strategy, and the tensions this creates with ECoC's objectives. Our analysis showed some constraints but also possibilities of interaction with individuals and independent cultural players that could disrupt institutional mapping efforts, yet enrich community-based culture.

Malta's first cultural mapping exercise is happening against a unique climate. These cultural developments highlight the more holistic and strategic approach towards cultural development in Malta. This atmosphere comes about on three main processes. Firstly between 2009–2011, the drafting and publication of the National Cultural Policy. Secondly in 2010, the establishment of a Creative Economy Working Group. Thirdly in 2011, the establishment of the Valletta 2018 Foundation, and in the following year the awarding of Valletta as European Capital of Culture for 2018.

Malta is carrying out a new Cultural Mapping Project that will be concluded in 2015. The Valletta 2018 Foundation remains crucial in serving as a critical node in the network of contributors; a role needed to fulfil its objective of community facilitator and ena-

bler. This network can be expanded, yet several challenges need to be addressed during this process. A main challenge is to balance administrative requirements amongst project partners with an openness for collaboration between existing and new stakeholders. Some stakeholders, while not opposed to the project, might not share the same project vision as those leading it. New spaces for dialogue need to be opened up in the project's infrastructure as well as in informal contexts to aid the project in becoming a tool for cultural community empowerment. ●

This article is an edited version of the paper delivered at the Mapping Culture Conference, held in Coimbra, Portugal in May 2014. Dr George Cassar and Caldon Mercieca are members of the Valletta 2018 Foundation Research Coordinating Committee.



Photo by Malta Tourism Authority



An Eventful Research Summer

Wilfred Kenely

Maltese summers can be harsh and exhausting. Luckily, this year's was not a summer to be particularly remembered for its heatwaves or for its breathless nights. Still it is always better to be on holiday, enjoying a sea breeze or, even better, enjoying the beauty of some remote, cool mountainous resort. Some were lucky enough to spend their summer in such manner. Other not so lucky ones, continued with their routine while dreaming of next year's summer.

Then there were others, 45 of them, who for seven summer days cycled more than 1000 km for a noble cause. The ALIVE challenge kicked off from Prague on 10 July. The group cycled to Vienna, then through Bratislava, Budapest, and Belgrade covering a daily average of 155 km. This year's route was notably hilly and much tougher than last year's with one particular elevation reaching 2,600 m. All this was done to raise over €65,000 to be directed to the Research, Innovation and Development Trust (RIDT) of the University of Malta. Last year these cyclists raised €55,000 for the same purpose and managed to raise the bar this year.

Also in summer the RIDT, together with Action for Breast Cancer Foundation (ABCF), organised a concert entitled 'A Night for Life' in



Participants of the ALIVE challenge in Prague, from where they cycled more than 1000 km

memory of the late Mrs Helen Muscat, co-founder of ABCF. Renowned soprano Lydia Caruana entertained a jam-packed Manoel Theatre on the 7th of June, with proceeds going towards breast cancer research and awareness. The concert also presented other established performers including Mro Dominic Galea, Ms Yvette Galea, Mr Ray Calleja, and a much-appreciated guest appearance by cardiac surgeon Mr Alex Manche, who accompanied the soprano on piano. The concert raised over €10,000 and was supported by the Manoel Theatre and by a number of corporate sponsors.

As summer starts to retreat, the RIDT looks forward to September and to our participation in the third edition of Science in the City. This year the event has been beefed up and will include some very innova-

tive ideas which will give it a festival outlook. It will also feature stronger participation by the private sector and will serve as another platform from which the University of Malta can showcase its research activities. The big day is the evening of Friday 26 September and there will be related events on the days before and after that date. A detailed programme has been announced on www.scienceinthecity.org.mt

Following that, the RIDT will be launching a series of new initiatives and schemes starting in October, which will be aimed at raising more funds for research and engaging with more sectors of the Maltese community. Details will be announced in the next issue of SUPPORTER, the RIDT newsletter which will be out at the end of September. ●

GAME REVIEW

by Costantino Oliva

Metal Gear Solid V: Ground Zeroes

WHY IS *Metal Gear Solid V* one of the most relevant games of the season? After all, new iterations of this franchise have been released for the past 25 years. Sure, *Ground Zeroes* boasts a new graphic engine and a vivid open-world structure. Enough to keep the tech savvy fan happy. But it's Hideo Kojima's authorial take that makes the difference.

Kojima's strong hand is clear when you hear Baez and Morricone's *Ballad of Sacco and Vanzetti* in the emotional opening sequence. Themes of freedom, detention, and torture are presented in a raw fashion and the game questions post-9/11 methods of

security. All of this is juxtaposed against the exaggerated hyperbole of a Hollywood blockbuster. Kojima dances between popular culture and authorial ambitions: a tension embodied by the medium of digital games.

Critics have commented that the game is really short, but this is a misunderstanding. For all its cinematographic inspiration, *MGS5* is not about the plot. This is a game of *space*: you are buying a Guantanamo-inspired military base populated with guards, traps, and secret passages. By the end of the experience you will be familiar with the space and left haunted by feelings of loss and powerlessness. ●

Developer:

Kojima Productions/Konami

Platform:

Playstation 4 (version tested)/
Xbox One

Game Rating: ★★★★★



FACT or FICTION?

Why do banana-flavoured sweets taste differently from real bananas?

by Alexander Hill

The flavour profile of banana sweets was created using the Gros Michel banana. This variety was the original reference banana flavour. In the 50s the fungal Panama disease wiped it out.

Why did the Gros Michel banana fall prey to disease?

Well, commercial bananas are clones—identical copies to one another—so when a disease infects one banana it can quickly spread through-

out plantations. Couple that to a globalised world and the fungal infection spread like wildfire. With no resistance and time to adapt, this banana variety was doomed.

The Cavendish banana was introduced to meet commercial demands. Unfortunately for us, this banana is a bit bland. The superior taste of the Gros Michael banana was relegated to artificial flavours leaving us with a hint of the original banana taste.



FILM REVIEW

by Noel Tanti and
Krista Bonello Rutter Giappone



Afflicted

Film: *Afflicted* (2013)

★ ★ ★ ★ ★

Director: Derek Lee, Clif Prowse

Certification: 15

Gore rating: ● ● ● ● ●

Noel: I was surprised to see that *Afflicted* was a vampire movie. From the trailer I gathered that it was going to be a contagion film. Vampires and pestilence share a common history but I was thinking *28 Days Later* (2002) rather than *The Addiction* (1995). Unfortunately, despite finding it entertaining, it hardly broke any new ground in terms of vampire lore. Apart from its use of shaky-cam film-making, we've seen it all before.

Krista: Speaking of vampire lore—one highlight for me was the ill-fitting conversation referencing 'traditional' vampire lore ('Well you should have the ability to turn into mist.') which contrasted with that attempted 'realist' style. I'm actually impressed that they didn't fall into the usual US stereotyping and made it happen in some 'mysterious' backwoods of 'Old Europe', but chose Paris as a hub of civilisation.

N: However the filmmakers still kept the vampire at arms' length, making the monster foreign. As you pointed out, it's not Transylvania or the Yorkshire moors; but it's still an American who got infected by a European.

K: I also liked that despite their attempt to be innovative, they weren't

pretentious and even included traditional jump scares. I liked the first-person perspective (fpp) during the run—kind of game-like.

N: His heightened perception and supra-human powers reminded me of *Chronicle* (2012). It was fun but I wouldn't want to watch it again.

K: The film spends a while setting up the friendship, so I'm not sure why it was ended early. It *was* a brave move and foregrounded isolation but the ending fell flat for me. I was disappointed with the half-hearted fight sequence and the cringe-worthy moralising and sentimentalising. That vigilantism could be an interesting parody and critique of institutionalised 'justice', seen in many 'revenge films'. But here it just brought it back in line with conservative morality.

N: The moralising was a shaky-cam version of Louis in *Interview with the Vampire* (1995). Even if we had to isolate Derek's crisis (the main character) and take it for what it was, it's still not that interesting. It reminded me of a bad Pepsi Max advert, highlighting thrills and shallow been-there-done-that moments. On another note: what do you think about the found footage?

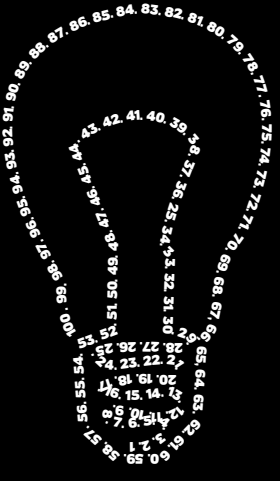
Is it overstaying its welcome? I think so. I'm finding it tedious and boring for an entire feature-length film. Get a tripod!

K: I'm surprised that found footage has outlived its 'novelty' factor. I was kind of sceptical about that but several films, including *V/H/S* (2012), have convinced me there's still life in it. I have three main reasons: (1) its DIY possibilities, which gives a new lease to indie directors without the backing of glossy production; (2) its proximity to some fpp video games—disorientation, chase; (3) it seems to be associated with the horror genre. Other genres borrow it as a device; horror embraces it. I'm not sure why exactly but 'found text' is found in horror literature, from Bram Stoker to Mark Z Danielewski, it's an established device.

N: So, final verdict? I recommend *Afflicted* if you're looking for an hour and a half of harmless entertainment. A camp-fire story for the tech-savvy generation.

K: Perhaps more of a 'teen adult' horror; it references a horror tradition, but doesn't add much that's new, perhaps more rewarding for less 'seasoned' horror fans. ●

100
WORD
ideas to
change
MALTA



Algae Farm

by ALEXANDER HILI

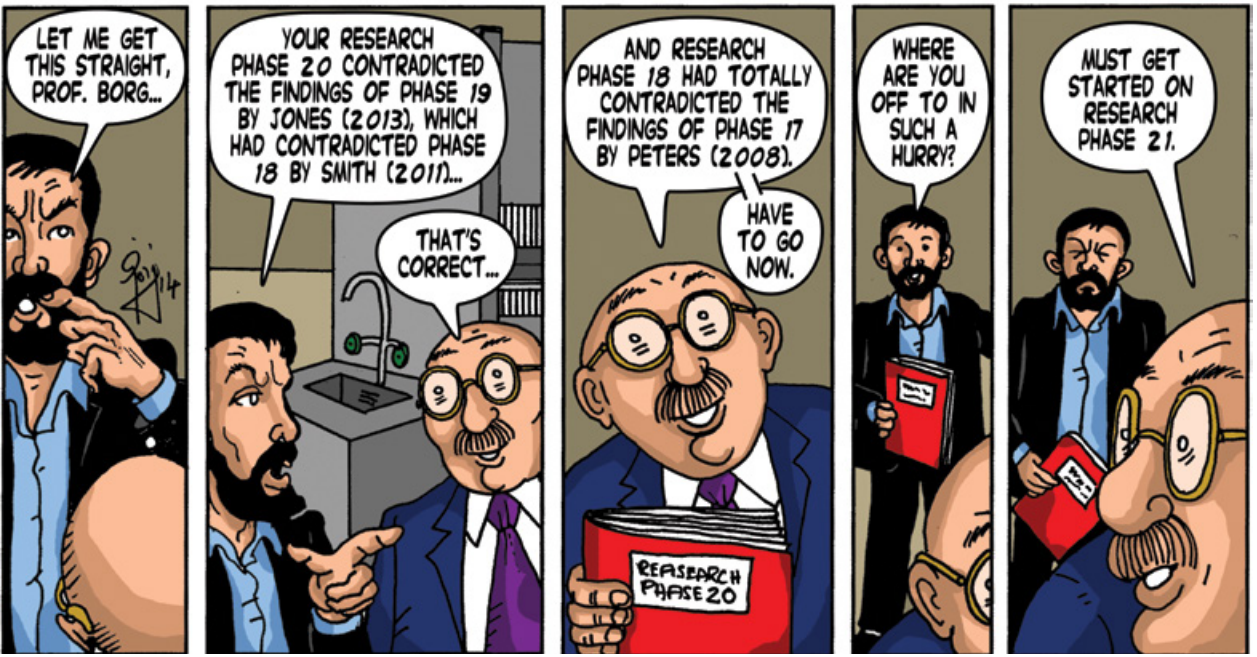
What is Malta's most abundant resource? The sea and sun. Till now very few uses have been found for such resources due to the lack of applications in conventional industries. However, what would happen if we became unconventional?

Think Algae farms. Malta and Gozo could be using the warm

waters around them to produce a cheap, healthy food. With copious sunlight prevalent throughout the year, local sushi bars could serve sushi wrapped in local *nori*. Malta could export to large profitable markets overseas. The farms could provide a large influx of work and increase cash flow to the Maltese Islands. ●

[Don't] THINK!

by Dr Ġorg Mallia



TECH REVIEW

by Matthew Cesareo
from the Gadgets team

gadgets
IL-FUTUR JINSAB MACHINA

The Hottest Gadgets of 2014

2014 has welcomed a slue of new and innovative gadgets, partially thanks to crowd funding sites. These sites help inventors bring their ideas to life. I took the opportunity to compile a small list of 2014's top gadgets

Sense

This gadget is a clever sleeping aid that has made Kickstarter history by attracting \$1.8 Million in pledges, when their goal was set at \$100,000. Its sensors track your movement, the dust particles in the air, humidity, sounds, and lighting variations during your sleep. Afterwards, it finds simple solutions to improve your sleep. Perhaps the best feature of this product is the smart alarm, which will wake you up at the best possible time (whilst your body is not in deep sleep). At last, I might wake up with a huge smile on my face.

The Coolest Cooler

The ultimate picnic cooler, set to revolutionise BBQs and picnics. The cooler sports an inbuilt battery, which powers a USB charging station and blender... yes, an inbuilt blender. It also comes with a battery powered, detachable Bluetooth compliant speaker—mind-blowing. The cooler has a hidden compartment to store plates and a ceramic knife, with its very own inbuilt cutting board. It sits on two wheels which easily travel through rough terrain, and comes with retractable bungee cables to strap onto your camping gear.

DJI S900

This year, drones are the most popular gadget amongst photography enthusiasts. They will surely love DJI's new professional drone: the S900. Six 15" propellers power this drone. They are fitted on a folding carbon fibre structure, which is not only lighter, but sturdier and more stable. The ro-

tors allow the drone to carry a 5 kg weight. That weight allowance is enough for photographers to use their SLR camera instead of an action camera.

Jibo

Many of us dream of having our own robot. 2014 seems to be the year it might come true. Dubbed as the world's first family robot, Jibo, brings personal assistant technology to a whole new level. With its array of HD cameras, microphones, and face detection technology, this bot is able to recognise family members, learn their routines, and adapt to their needs. Through voice command, users can interact with Jibo, and thanks to smartphone synchronisation, they can basically operate their phone's features through Jibo—stunning.

Google's Self-Driving Car

The future of sustainable road safety is here, thanks to Google. The Internet giant has unveiled their much anticipated self-driving car. Steering wheels and pedals have been replaced with an intelligent on-board PC. Their software is capable of understanding road markings and obey road rules, whilst compensating for other vehicles and obstacles. Google have released the first beta versions of the vehicle for testing and aims at making the technology available by 2016 to drastically reduce road deaths.

These innovations amaze me. In this golden age of technology anything is possible and I cannot wait to see what the next year will bring. ●



BOOK REVIEW

by The Editor

Pathfinders: The Golden Age of Arabic Science

Jim Al-Khalili

Quill rating: 

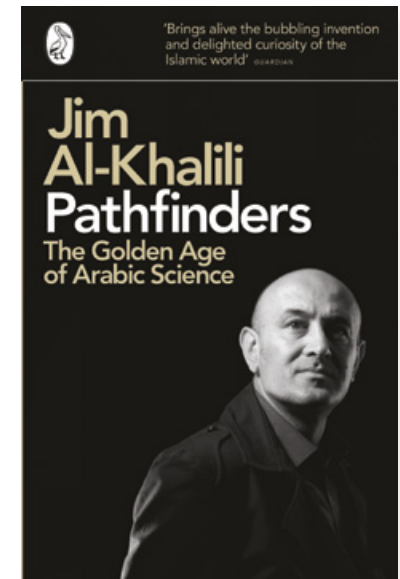
THIS BOOK WAS published in 2010 but unfortunately remains one of the few examples of positivity towards Islam coming from the West. British Jim Al-Khalili was born in Iran and he wrote about science during the early days of Islam, also giving a beautiful picture of life before the Islamic revolution of 1979 that forced his family to flee. Al-Khalili is an accomplished theoretical physicist and broadcast presenter for *BBC Horizon*, *The Big Bang*, *Tomorrow's World* and *Science and Islam* (the parallel TV series to this book).

If you love history, you will love this book as Al-Khalili goes into great depth—three whole chapters—to explain the circumstances that led to the golden age of science within Islam. The standard history of science texts usually paints the Islamic Empire (the scientific golden age was mostly from the 8th till 13th century) as being the great saviour of Greek texts having translated the works of Pythagoras, Aristotle, and other Greek scientists that then instigated the Renaissance in Europe when they were translated into Latin and other languages. Al-Khalili shows that these scholars were not mere translators but innovative in Mathematics, Astronomy, Medicine, Chemistry, and other fields. Scholars came from all major faiths.

Al-Khalili takes till Chapter Four to start detailing these scientific achievements. I would have preferred if these came sooner. He reveals facts such as that the zero was not invented by the Arabs but by the Indians, the Arabs simply used it to powerful effect. The Arabs pushed mathematics by leaps and bounds and Al-Khalili uses multiple

“He reveals facts such as that the zero was not invented by the Arabs but by the Indians, the Arabs simply used it to powerful effect”

chapters to outline them all. They invented decimal fractions, part-invented the decimal system, and invented proofs of mathematical equations through induction, using pages of equations to break down the initial equation and



prove it absolutely, which is still the gold standard for modern mathematicians.

He talks about the polymath al-Razi (854 AD–925 AD). Al-Razi lays claim to classifying substances according to their properties based on experimentation. He used experimentation to select the most hygienic site for Baghdad's hospital, improved medical ethics and even accepted mentally ill patients (when concurrently the Christian world saw them as devil-possessed), distinguished between curable and incurable disease, clinical trials, and many other advances. His medical textbook *al-Kitab al-Hawi* fills 23 modern volumes, the largest in the Arab world.

Al-Khalili talks about plenty of other advances and scholars that are sure to surprise readers. The book can be slightly challenging for people to get through. Al-Khalili writes beautifully, clearly, but somewhat academically. If you're interested in learning about a neglected part of the history of science, this book is for you.

I spoke to Al-Khalili back in 2010 about the TV series related to this book. His final words were that I had to bring his series to Malta. Words relevant then as they are now: a shining light on the possible positivity within Islam interpreted in the right way. ●

BOARD GAME REVIEW

by David Chircop



Love Letter

THE MICROGAME is a buzzword that has exploded over the last year in the board game community. Microgames are video game mini-games but analog and a lot more awesome. *Love Letter* is the microgame that popularised the format—Kanai's 16-card wonder.

Love Letter was not the first microgame, it wasn't even Kanai's first microgame. *R*, another game of his was a popular title which you could buy by emailing the designer. He would then mail you an envelope with the cards in it, which was the board game itself. *Love Letter* is a spiritual successor to 'R', and the first of his works to have an international distribution.

In *Love Letter* you are trying to deliver the proverbial letter to the princess. You do this by gaining the favour of her closest friends. The deck is made up of these people, all having a number. The person who holds the card with the highest number at the end of the round, or the last person standing, wins.

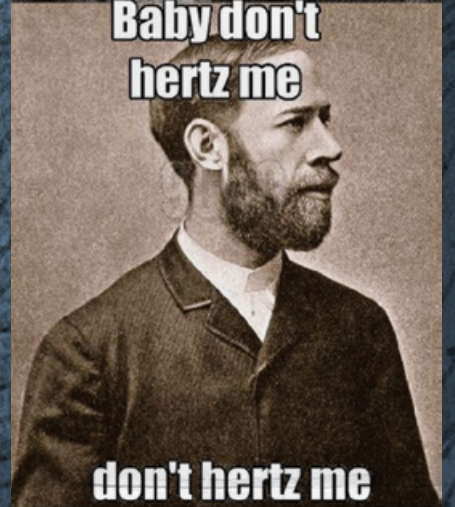
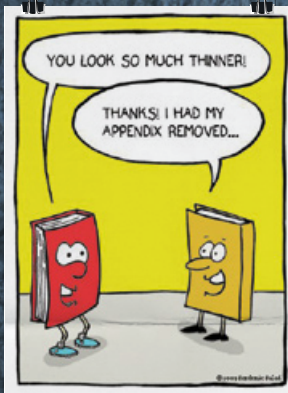
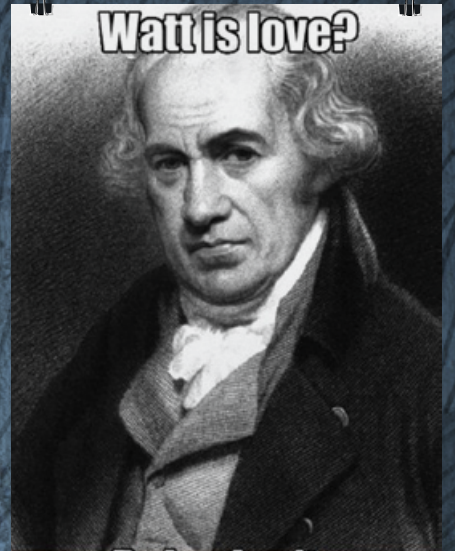
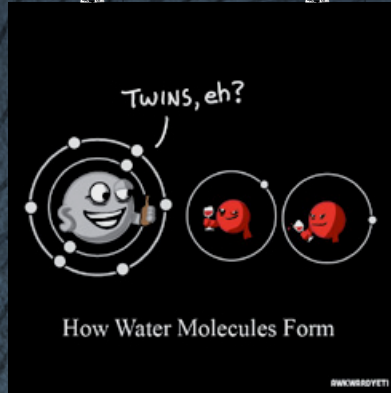
In the game you always keep one card in your hand, and at each turn you draw a card and choose one of the two to discard. Each card though, has a specific ability, which activates as soon as you discard it. For example, if you play a Guard, you have the opportunity to try to guess another player's card. If you do, that player is out. The Countess for example, cannot be caught with the Prince or the King (you must discard her if she does). This would mean fornication. The Priest can see another player's card, since this constitutes confession, and the Baron can kick out anyone of a lesser number than him due to politics.

The game takes a little bit of getting used to. It is quite different from other mainstream games but I have not had so much fun with cards since I first found money in birthday cards.

With almost infinite replayability, a price point of around €9, extreme portability, and tight, nail biting moments, *Love Letter* is a definite buy. There is very little chance of going wrong. Five Stars. ●

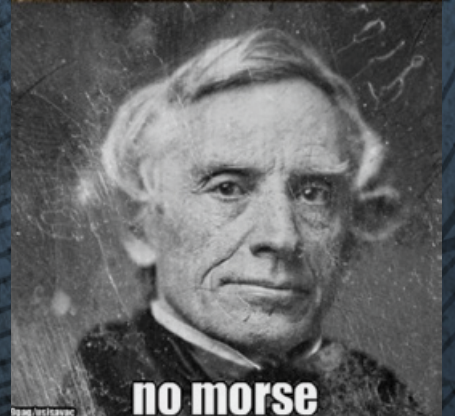
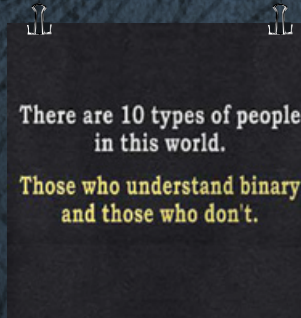


Designer: Seiji Kanai
Publisher: Alderac Entertainment
Game Rating: ★★★★★



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