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MALTA: RED, WHITE, AND BLUE?

Malta has a love affair with the British. The George Cross is proudly displayed on the national flag, government invited Prince William to celebrate 50 years of Malta’s independence from the British Empire, and if England were to win the World Cup the street parties would last for days. Our cover story (pg. 48) looks into the background behind this relationship.

The flipside of this bond has been a strange dislike of the French. The story goes that back in 1798 Napoleon invaded Malta and stole its riches—a history influenced by the Church and British colonisers who had separate but overlapping agendas. Our cover story focuses on Dr Charles Xuereb’s research, which tries to uncover what has blocked Malta’s memory of the French and what can be done to change this often-negative view.

The issue is packed with other features. Dr Maria Galea tells us about Maltese Sign Language (pg. 42). Her research helped bring a logical framework to the written form of the language, which can help around 400 deaf people in Malta. Cassi Camilleri met an international team of researchers looking inside the human body using MRI to figure out how it ticks (pg. 26). Anne Marie Dimech writes about Dr Gabrielle Zammit’s work on bacteria that took her from the cliffs of Dwejra, Gozo to Malta’s ancient underground catacombs (pg. 20).

The broad range of stories reflects the diversity of research at University. But at THINK we felt we had to go further. Apart from stories from student articles (pg. 17-19), features, reviews (pg. 56-61), and opinion pieces (pg. 12-16), we are introducing Toolkit (pg. 4) that highlights University’s best equipment, Design (pg. 10) that features creative projects, and Without borders (pg. 8-11) that sees different disciplines come together to create something new—all this and more in the latest issue of THINK magazine.

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Malta: Stockholm Syndrome (or why we love the British)

The cover is a social commentary on Malta’s distorted collective memory. The Sette Giugno monument, previously placed in St George’s Square and currently situated in Hastings Garden, Valletta is one of the few monuments which symbolises Maltese revolt. The photograph shows the monument’s reverse side—a side usually forgotten, much like the monument and what it represents. Photography and image composite by Jean Claude Vancell.

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UNIVERSITY OF MALTA
L-Università ta’ Malta
TOOLKIT

The Olympus Fluoview FV1000-MPE
using ultrashort pulsed IR laser

QUICK SPECS

- Peak power at 800nm: 312.5kW
- Average power at 800nm: > 2.5W
- Pulse repetition: 80MHz
- Pulse width: < 100fs
- Tuning range: 710-1040nm
- Cost: €0.82 Million
In the last 25 years, two-photon excitation microscopy paved the road for the most significant advance in bioimaging. This year, four scientists (Winfried Denk, Arthur Konnerth, Karel Svoboda, and David Tank) were awarded the prestigious Grete Lundbeck European Brain Research prize for its invention and development. The method has transformed brain research since it allows real-time examination of the brain’s finest structures. It is powerfully used to investigate stroke, Alzheimer’s disease, migraine, and epilepsy.

The University of Malta’s microscope combines ultrashort-pulsed infrared laser to excite fluorescent molecules up to a depth of 1mm in the rodent brain. The technique allows flexible detection of the brain’s geometries and can look 5–20 times deeper than other types of fluorescent microscopes. The customised setup can perform live imaging to create 3D brain images.

At the University the instrument is used by six scientists on a daily basis with two foreign collaborators in fields which include the evolution of stroke, brain-blood flow dynamics, neurovascular coupling, epilepsy, potassium channel physiology, and white matter injury.

The microscope can acquire images through four simultaneous color channels at 30 frames per second. During imaging of small anaesthetized animals, the microscope is equipped for monitoring vital signs. The instrument is housed in a temperature of 22°C and <30% humidity controlled environment adjacent to a surgical preparation suite and imaging workstation. Two-photon microendoscopy has started to find clinical applications in cancer. There are ongoing developments to image deeper brain structures.
Car Stats 2014

- **ACCELERATION**: 0-75m 3.95s
- **WEIGHT**: 295kg
- **COST**: €15,500
- **TEAM**: 28 students from 5 faculties
Racing Dreams

The University of Malta Racing (UoMR) team designs, builds, and races a Formula Style racing car in a Formula Student competition every year. Last September (2014) they competed in Parma (Italy) with their first car. Building this car brought together students from five different faculties with engineering knowledge, costing, marketing, and business proposals for the judges. UoMR is run like a small vehicle manufacturing company.

The team is currently working on its second car for Parma 2015. Improvements are being made on weight, speed, and design, bringing a faster and better car.

Sponsored by the University of Malta and its Research Trust (RIDT), as well as the Ministry for Education and Employment, Transport Malta, PwC Malta, SKF, Tek Moulds, Trelleborg Sealing Solutions, Playmobil Mould Shop Malta, Continental Cars, Adpro-Instruments, the Farsons Foundation and Alarm Tech.

Formula SAE Results, Parma 2014

- **5th** Cost Report
- **6th** Acceleration
- **20th** Design
- **22nd** Endurance & Efficiency
- **23rd** Presentation
- **27th** Skidpad
- **28th** Autocross

Overall 23rd from 55 combustion engines [80 total number of competitors]
Interdisciplinary research and practices blur boundaries. While the premodern approach to research distills areas into fine categories and certainties, interdisciplinary ideas spread across different fields. Performance is charged with interdisciplinarity.

The University of Malta’s School of Performing Arts conducts interdisciplinary research that connects the performing arts with various disciplines in the Sciences and Humanities. This year’s school annual conference focused on this, in particular on eight overlapping performance categories: everyday life, the arts, sports, business, technology, sex, ritual, and play. The performing arts can endlessly combine these groupings in ways that range from theatre, dance, and music, drawing material from—but also impinging upon—everyday life, to training in performance and in sports. These arts share the drive for efficacy and efficiency with business, besides witnessing an increasing use of technological innovation.

Dr Laura Cull’s (University of Surrey) keynote speech on *Performance Philosophy* at the conference discussed this emerging discipline which “involves staging an “equality of thought” wherein theories and practices originating in the interdisciplinary subject of Performance can encounter those originating in Philosophy on an equal plane.” Cull thinks that philosophy can “turn to performance—as a rich source of techniques for embodying an unknowing openness to others, to the outside: whether as a relation to one’s own bodily gestures, to the foreign movements of another body—human, [and] non-human. It encompasses intermedial, intrapersonal, and interspecies collaboration and extends to recent forms of performance that traverse theatre, music, and dance.

The conference papers show the breadth of discussion on performance interdisciplinarity: from architecture to cognitive behavioural therapy.

For more information visit www.um.edu.mt/performingarts or contact performingarts@um.edu.mt
DESIGN

Assembling a scale prototype of the mecon (above and right).

A rendering of the full scale mecon module as will be exhibited at IASS2015.
Mecon

Mecon is an ongoing research project for the 2015 edition of the IASS EXPO, themed Future Visions which is to be held in Amsterdam between June and August 2015. The project is to design and build a structurally innovative, deployable pavilion in a bid to celebrate Future Visions in the field of engineering design and innovation. Mecon is the solution created by a team of five recently graduated architects.

Mecon is a deployable structure which transforms from a cube into a truncated octahedron (mecon is a term coined by Buckminster Fuller). The change in geometry increases its volume thrice which opens a host of new applications.

Each cube is only capable of transforming into the mecon if its edges are equal in length and follow a specific path dictated by the unique joints the team designed. The transformation is simple, and the joints can be scaled to produce a mecon of any size, but for the EXPO the team had to abide by strict weight, size, and transportation restrictions.

Mecon has only been possible thanks to the support of Prof. Alex Torpiano and Prof. Dion Buhagiar (Faculty for the Built Environment), and Prof. Joseph Grima and the Auxetics Research Group (Faculty of Science, University of Malta), and Lee Bullock from Proto+. After the expo, the pavilion will be reassembled in Malta.

If interested in exhibiting this structure, please contact team@mecon.space and like the Facebook page www.facebook.com/mecon.space
The proposed setting up of a new private American university in Southern Malta raises issues concerning the environment, transparency, and its impact on the Maltese Higher Education scenario. It also rekindles debates on the feasibility of a second university in such a small country, questioning whether it is a good thing to challenge the University of Malta’s traditional ‘monopoly’ in higher education.

The University of Malta’s ‘monopoly’ in the awarding of degrees has long been challenged. We have witnessed the emergence of other degree awarding institutions (such as MCAST). Globalisation’s intensification, through advances in information technology, allows online learning for fee paying students from a wide market to acquire qualifications. These are often supported by scholarships. The market is also bolstered by the emergence of so called ‘franchise agencies’, which prepare students for degrees granted by foreign universities. In addition, Middlesex University (UK) has a Malta campus.

Units in ministries—such as the Ministry of Education and Employment—are challenging the monopoly in research with their own complement of doctoral graduates. So the term monopoly can only be arguably justified when referring to the University of Malta as an institution combining both research and teaching. I believe that there can be no teaching, certainly within higher education, without research. This belief is not shared by those, including influential EU people like former Commissioner Jan Figel, who argue that Europe should follow the US model of having a different tier league separating research and teaching universities.

The franchise agencies that have emerged within the Maltese Higher Education scenario still need to demonstrate whether they will combine research and teaching roles. My impression is that these agencies are mainly teaching institutions that coach students to pass exams set by others.

The University of Malta itself also still needs to show that it is really combining these roles in all faculties and departments. While University has had teaching audits there have been little research audits to date, though I hope the country will be spared the ‘excesses’ of some other countries’ systems (see the literature critical of the UK’s REF audit system).

I have always been in favour of education as a public rather than a consumption good. On the other hand, I have long dreamt of another public university situated in Southern Malta that, while attracting foreign fee paying students at a reasonable rate (way below the astronomical £9,000 per year charged by English universities)
would also generate an economic and cultural spin-off in specific areas, such as Cottonera. My ideal choice for this has always been Bighi, although now this would be difficult to achieve. Think what a good use of an already impressive building (no need to build a new campus and claim more of our limited land) can do for the regeneration of the Cottonera and other areas in the South that have the lowest number of university graduates. And the campus can be extended to include the area built as Smart City, since there has been little take-up by the envisaged companies in this intended ICT haven.

A new university would have to be a public Maltese institution. I would not like to see any precious historical and other public resources ceded to a private corporate entity. It is also important that a proposed second public university would not duplicate but complement MCAST and the University of Malta. To be economically viable, a second public university must be characterised by a strong international drive that would allow foreigners to be charged at moderate rates. This international drive would become a key source of revenue.

Another suggestion is that the stipend for Maltese students should be topped up as fees to be paid back, otherwise foreign EU-based students cannot be charged and that would be unfair on the Maltese taxpayer. Foreign students should, however, be charged moderately not astronomically. The pool of potential students needs to be broadened and not confined to Maltese students since, in the latter case, a second public university would not make sense given the small size of the island, its population, and the extra costs involved. Duplication comes at a considerable expense in a small state with a small population.

Several public European universities charge moderate fees. I would like to see Malta adopt this kind of model, which enhances the international dimension in higher education with spin-offs for the surrounding communities that can enhance their cultural milieu. And this model retains the idea of higher education as a public good, something which I believe the University of Malta and MCAST are already doing, certainly when compared to trends witnessed in North America and many European countries. It would be an institution that responds to social, economic, and democratic needs, including regional regeneration needs, and not simply corporate greed. This approach should also create good quality jobs (not those created by increasing bureaucratisation) while generating cultural and social renewal in the surrounding area with potentially long term positive effects.
The human brain is the most complex organ in the known universe. This complexity makes it the last and hardest frontier in medical research. Unraveling the brain's secrets could change the lives of millions of people of all ages suffering from neurological and psychological conditions, lesions and addictions. Brain diseases can affect anyone. One in three Maltese people and about one billion people worldwide suffer from some form of condition or disease at some point in their lives. Examples like autism, multiple sclerosis, depression, and dementia are brain disorders that represent the most important challenge to public health in the 21st century. We need to develop new ways to cure these conditions rather than simply treat them.

To find the reasons behind brain disorders needs the collaboration of many different scientific disciplines and clinicians. Researchers also need the participation of patients, families, health workers, and related non-governmental organisations. To encourage this web, I have created the Malta Neuroscience Network with those scientists and clinicians whose shared vision is to solve these issues in the 21st century.

We are currently in a golden age of neuroscience. Now we have a much deeper understanding of the brain's complexity that has greatly improved human health. Over the last few years, we have made important discoveries like a better understanding of the mechanisms behind human consciousness, the discovery of mirror neurons, and we have created technologies which allow brains and computers to communicate. We have also increased our understanding about the genetic basis behind diseases like autism, schizophrenia, Parkinson's and Alzheimer's disease.

These advances are promising, but further steps need funds that allow researchers to translate these findings into treatments. Basic researchers need to work with clinicians, to ensure that these new discoveries from the lab bench end up on the bedside. This is the only approach that will allow us to understand the brain, protect brain health and benefit patients,
their families, and health workers. These challenges need the strong support of the community (government and society). Global collaboration efforts such as the BRAIN initiative in the USA and the Human Brain Project in Europe have been fundamental in fast tracking discoveries in brain research. Malta is also contributing with many Maltese researchers by publishing high quality research on the brain. This has happened despite the Maltese Government’s small investment in neuroscience research.

A big question in research funding is whether the focus should be on basic research or on research with commercial potential. The answer is logical: both! Unfortunately, Government has blindly decided to exclusively finance research with immediate commercial potential. In truth, one form of research cannot live without the other.

By creating the Malta Neuroscience Network and the University of Malta Research Trust (RIDT) Brain Funding program we want to raise awareness about the brain and what happens when things go wrong. We want the Brain fund to support more excellent and innovative brain research. We hope that the Government of Malta will match private and other donations. The RIDT Brain fund will be the first major investment in brain research ever made in Malta. We want to turn these funds into benefits for the Maltese people and others beyond our shores.

The new Malta Neuroscience Network is a community of researchers (neurologists, psychiatrists, radiologists, biomedical scientists, engineers, psychologists, cognitive researchers, ICT scientists and others). It will launch a Brain Awareness Week (December 1-6, 2015) with prominent neuroscientist Prof. Giacomo Rizzolatti, who discovered mirror neurons and has been nominated for a Nobel Prize in Physiology and Medicine.

Follow Malta Neuroscience on www.facebook.com/GDGNeuroscience and @uomneuroscinet on Twitter.
Why do we need research? Why should the University of Malta invest in research? The answer is simple: knowledge. Education has no meaning without a thirst for new information through research.

Universities should be obliged to generate new knowledge by creating thinkers and investing in them. This includes creating an environment where both students and corporations are eager to invest time and money into knowledge worth pursuing. How can this be achieved if students, once they graduate, lose their enthusiasm to find new knowledge? Postgraduate students are faced with insufficient funds and extremely short time frames. Our University has already started moving in the right direction. However, we lack a stable workforce capable of sustaining continued research. This is not easy. Only through dedication, planning, and investment can we break the surface and become a self-sustaining organisation worthy of an academic university.

As a move towards this direction, Kunsill Studenti Universitarji (KSU) believes that students should be incentivised to embark on projects which will further enhance their educational experience. Projects like these introduce a more practical approach to study programmes. Therefore, for the 2014/2015 scholastic year, KSU enhanced its own Research and Opportunity Fund by offering €20,000 in funds for students to pursue research.

The funds supported research projects, travel grants abroad, and greater access to academic resources. These are how KSU is trying to incentivise more research and active participation in student life. We hope that this contribution will make a difference for these students. This fund receives many applications. This shows that students want to enhance their educational experience if they have the necessary resources.

Over the last few years the University of Malta has invested in its research infrastructure. By participating in EU-wide research projects, University is supporting more postgraduate students, postdoctoral students, and resident academics. The institution has also engaged in various activities to tap into a number of funds to step up research activity, in collaboration with both the industry and international counterparts. Significant progress has already been made but there are still financial restrictions which hinder the continuous improvement of local research. The Students’ Council will continue to put pressure on the Government to invest in this area especially fundamental (basic) research.

Research is an important pillar to create a Third Generation University, which we should all strive to enhance.

Cleaning Contaminated Land with Plants

Carmen Sanchez Garcia

Soil sustains wildlife, landscapes, crops, forests, and air and water quality. Our survival and development depends on soil. However, a large amount of metals is being released daily into the environment through household waste, agricultural practices, and industrial activity.

Soil acts as a ‘sink’ for pollution, and depending on the soil’s chemical conditions, metals may persist there for long periods of time, posing a risk for humans and ecosystems. Maltese soils have a high concentration of lead, zinc, and copper. At high concentrations, these metals are harmful to many forms of life and can lead to a host of diseases including cancer. Carmen Sanchez Garcia (supervised by Dr Anthony Sacco) studied how to reduce the level of these metals in Maltese soils using plants instead of conventional methods.

Conventional soil remediation techniques (like capping or removing the polluted soil) are expensive and alter the site even more. Plants are now being used as a better alternative. Some plants, known as phytoaccumulators, have the ability to adsorb and accumulate large amounts of metals in their tissues and can be used to clean contaminated soils. This technique is known as phytoextraction and offers a sustainable alternative to the conventional approaches being used. Phytoextraction is an environmentally friendly technique which does not compromise the future use of the site. Increasing the greenery also brings other benefits that will help reducing further threats to Maltese soils such as soil erosion or decreasing organic matter.

Carmen Sanchez Garcia used the mustard plant (*Brassica juncea*) to reduce lead, copper, and zinc levels in Maltese soils. The plant is well known for its ability to accumulate metals. She tested the plant on two of the most common agricultural soils in Malta: a clay loam, sampled from the Government Farm in Għammieri and a silty loam taken from the Ta’ Qali area. The plant was efficient at uptaking metals from the soil, which opens the door for future sustainable remediation of Maltese soils for a cleaner environment.

This research was performed as part of a Master of Science by research in Environmental Management and Planning at the Institute of Earth Systems, University of Malta. It is partially funded by STEPS (the Strategic Educational Pathways Scholarship—Malta). This scholarship 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’.
Atmospheric carbon dioxide (CO$_2$) levels have increased dramatically in the last few decades. Famous for causing global warming, CO$_2$ is also resulting in the acidification of seas and oceans. This disturbs the rich life of the marine ecosystem, which affects human communities dependent on this environment for their livelihood. For islands like Malta and Gozo, this problem is particularly important. This ‘silent crisis’ has attracted the X-prize Competition organisers who have set a $2 million dollar prize to be awarded to anyone that can develop stable, inexpensive, and precise acidity (pH) sensors to help understand the acidification of marine environments.

At the same time, a European COST initiative (Supramolecular Chemistry in Water) is encouraging the design of water-soluble molecules which can recognise analytes. Most chemical sensors do not perform well in water. As a step to solve this problem, Maria Cardona (supervised by Dr David C. Magri) developed a number of water-soluble indicators that monitor pH levels by changing colour. The change is easily visible. The pH is a measure of the acidity or basicity of a solution. The indicators (pictured) were synthesised in the lab using standard synthetic techniques.

The colorimetric pH indicators are based on the dye azobenzene and show brilliant and distinct colour changes with transitions between high to mild acidity, pH 1 and 4 (pictured). The molecules are water-soluble due to the incorporation of sulfonate groups onto the azobenzene-based molecules. A sulfonate group is a charged entity consisting of sulfur and three oxygen atoms. By its very nature, a sulfonate group is very polar and makes molecules more water-soluble. This contrasts with commercial azobenzene-based compounds such as methyl yellow and methyl red that have no charge and are not so soluble. The indicators’ structure and mechanism were further studied using a number of spectroscopic techniques to understand how they work.

The three azobenzene-based pH indicators are very brightly coloured. This class of compounds is widely used as colorants for food and cosmetics. Pending further tests to show non-toxicity, the azobenzenes could be used in common applications. Though a number of azobenzenes have been banned from use in edible products, the synthesized molecules are promising to be much safer because of the presence of the two sulfonate groups. They allow the molecules to be quickly and safely eliminated from the body.

The synthesis and study of readily soluble pH indicators is one approach to developing pH indicators to monitor the acidity of seas and oceans. By incorporating sulfonate groups, molecules can be rendered soluble in water. This is a significant contribution towards the detection of acidity in water.

Test strips containing 1-3 (left to right) adsorbed on filter paper. In each case, the strip on the left is treated with alkali and the strip on the right is treated with acid.

This research was performed as part of a Master of Science in Chemistry at the Department of Chemistry within the Faculty of Science, University of Malta. It is partially funded by STEPS (the Strategic Educational Pathways Scholarship—Malta). This scholarship 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’. 
In medicine a timely and accurate diagnosis can decide the chances of survival of a patient. Supramolecular Chemistry is a field that explores the design of intelligent molecules that can assist doctors when taking lifesaving decisions. These intelligent molecules can identify the type and amount of proteins in a patient’s blood or tissue that would indicate disease—in a similar method to blood glucose test strips.

Kristina Farrugia (supervised by Dr David C. Magri) recently designed a series of eight novel intelligent molecules based on the thiourea (structurally similar to urea) unit. They were tested for their ability to detect inorganic anions involved in key biological processes such as fluoride, chloride, acetate, and phosphate. A drastic colour change visible to the naked eye signalled the successful interaction of the anions with the sensing molecules.

The colour changes were accurately observed by the techniques called UV-visible absorption and 2D ‘H NMR titration spectrometry. They determined that the mechanism of anion detection was due to the deprotonation of the sensor molecules, through an acid-base reaction. This major finding goes contrary to previous research, where anions are reported to interact with the sensor molecules through complexation. Knowing a molecule’s mechanism of action is important since it will limit how these sensors can be used in patient diagnosis.

The molecules synthesised by Farrugia can serve as the basis for more complex systems. Supramolecular chemistry shows how chemistry can play a key role in the medicine of tomorrow.

This research was performed as part of Master of Science in Chemistry at the Faculty of Science, University of Malta. It is partly funded by STEPS (the Strategic Educational Pathways Scholarship—Malta). This scholarship 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’.
nature has provided the source for several medicines that save lives on a daily basis. Many medicines currently in use were originally derived from animals, plants, and microbes. These include the painkillers morphine and aspirin, anticancer agents such as vincristine and vinblastine, and many antibiotics including penicillin. With all that has already been found, it is hard to imagine that there is anything left to discover. Dr Gabrielle Zammit (Department of Physiology and Biochemistry, University of Malta) showed me just how wrong I was. Dr Gabrielle Zammit is currently working on sequencing the genome of new strains of cyanobacteria, an ancient type of photosynthetic blue-green bacteria, first extracted from Maltese catacombs. As we settle down in the lab, I learn that Zammit’s initial involvement in research was far-removed from the workings of subterranean bacteria and dealt with endemic shrubs living on the sheer, coastal cliffs of the Maltese islands. It is soon evident that Malta is the one seamless thread that runs through the heart of all of her diverse research. She has always been aware that ‘although Malta is tiny, it is unique in its natural history, biodiversity, and cultural heritage.’ It is this awareness, together with her love of nature, that led her to approach leading botanists Edwin Lanfranco and Professor Radmila Vujicic for her undergraduate and postgraduate research.

SAVING THE SHRUBS

Zammit developed an efficient way to produce a large number of two endemic shrubs in the lab (using micropropagation): the Maltese Cliff-orache (Cremnophyton lanfrancoi) and the Maltese Everlasting (Helichrysum melitense). Both shrubs grow on rocks, technically called a rupestral habitat, and are found growing along small areas of the northwestern and southern cliffs of the Islands. In Malta, the project was the first to try using modern plant cloning techniques to cultivate local endangered plants. These two plants were chosen since they spread and grow very slowly in the wild. Coupled with human pressures, this resulted in dwindling populations, and the plants have been slapped with a ‘critically endangered’ label on the IUCN Red List of Threatened Species.
The Maltese Cliff-orache, *Cremnophyton lanfrancoi*, was described by two Sicilian botanists and named after Edwin Lanfranco. A paper recently questioned its placement in the genus *Cremnophyton* suggesting it should be moved to the related *Atriplex*—although still a matter of hot discussion. Its natural habitat are the seaside cliffs along the northwestern and southern coast of Malta and Gozo, but it now grows in an area smaller than 100 km². It became critically endangered due to a combination of factors, which include an endangered habitat, replacement by invasive alien species, and very low regeneration due to an insect (a parasitic hymenopteran discovered by Zammit, belonging to the same order as bees) that feeds on the endosperm. Apart from the insect, a fungus that seems to infect all mature plants, limiting their ability to reproduce.

The Maltese Everlasting, *Helichrysum melitense*, prefers sunlight and grows on intact limestone coastal cliffs. Only one population remains on Gozo and Fungus Rock, covering an area smaller than 25 km²; this shrub is probably extinct in the wild in Malta. This has happened due to invading alien species and a drastic decrease in its natural environment because of development.

which is just one step away from extinction. So important are these plants, that even Zammit needed a special permit to take plant cuttings for her research to try and save them.

Once the cuttings were in hand, tiny sections of plant tissue were extracted from them. These were cultured in media with different growth hormones to identify the culture medium that enabled the growth of masses of undifferentiated cells—a growth callus—as well as shoots and roots in sterile glass jars. Methods were then developed to transfer the plantlets from laboratory growth rooms to controlled ambient greenhouses and shaded glasshouses. The shrubs were successfully rejuvenated and planted in locations ranging from the University’s botanic gardens to other public gardens, such as Ġnien Indipendenza in Sliema. Some of the plantings are still flowering 15 years later, therefore helping to ensure the continued existence of these two very important shrubs.

**GOING UNDERGROUND**

After this research, Zammit started lecturing biochemistry to degree students in artwork conservation. This helped her marry her area of expertise with another great passion of hers—art. During this time, she met many conservators, curators, and restoration architects who, discussed with her the nature of growths they saw on underground wall paintings, such as in catacombs and hypogea. Zammit explains that traditionally, ‘even in Melitensia, historians and curators used terms such as *moffa*, or *ħass*, indicating that the films were biological. However, there was no knowledge of what was actually going on because no systematic studies had ever been carried out.’

For Zammit these ‘alterations’ needed to be documented, described,
The underground sites are strangely good places for these life forms. A bit of light enters through entrances and artificial lamps.

and mapped. Discovering the nature of the growths, and knowing whether they were chemical or biological, would help to find ways to control or prevent their development and mitigate damage. Inspired by these discussions, she contacted one of this field’s pioneers, phycologist Professor Patrizia Albertano (University of Rome). Her initial study turned into a fully-fledged Ph.D. project and Professor Albertano eventually became her supervisor. To figure out what these ‘alterations’ were, Zammit also collaborated with research teams from the Spanish National Research Council, the National History Museum (UK), and the University of South Bohemia (Czech Republic).

The research performed, revealed a wealth of knowledge on how biological and chemical phenomena were deteriorating priceless art works.

STUDYING ROCKS

Zammit researched the ancient Ħal Saflieni Hypogeum (see THINK issue 10, pg. 34, The Death of the Temple People) and three paleo-Christian catacomb sites (St. Agatha’s Crypt and Catacombs, St. Paul’s Catacombs, and the Abbattija tad-Dejr Catacombs). With the necessary permits in hand, she first took non-invasive samples from wall paintings, ochre inscriptions, and ancient mortars. To understand the various layers of these sites she also took tiny 1 mm micro-invasive samples. She examined them under various microscopes and saw that the ‘alterations’ were biofilms made up of cyanobacteria and other bacteria, microalgae, fungal spores, and occasionally, moss.

The underground sites are strangely good places for these life forms. A bit of light enters through entrances and artificial lamps. The temperature is stable at a reasonable 19–21°C throughout the year, and humidity levels are constantly above 97%, so moisture is plentiful. The biofilms are held together by a thick, sticky substance made up of various sugars called the exopolysaccharide matrix. This matrix is created by the organisms to help them survive. It aids their adherence to the surface to infiltrate it. It also helps capture moisture and slowly release it for the growing microorganisms.

Zammit analysed the chemical makeup of the samples using techniques called Elemental Analysis (SEM-EDS), X-ray micro-diffraction (XRD), and X-ray fluorescence (XRF).
Cyanobacteria are believed to have been among the first living organisms to colonise the earth and to give it its oxygen-rich atmosphere. This eventually let human beings and a host of other animals evolve. Cyanobacteria are unique in being bacteria that can photosynthesise, glide without the aid of flagellae and fix nitrogen through specialised cells, while adapting and surviving in hostile environments.

Apart from their importance in evolution, cyanobacteria have recently come back into the spotlight because of wide-ranging biotechnological applications. They are being studied to make biofuels and help degrade plastic. They are also used in the production of cosmetics and lubricants. Molecules made by these bacteria have shown antiviral, antibacterial, antifungal and anticancer properties that can lead to the production of new medicines.

She identified soluble salts like halite (sodium chloride) and gypsum (calcium sulphate) that were thought to be reaching the catacombs by rising through the ground or by infiltrating the ceiling. Cyanobacteria were commonly found growing on the gypsum layers, probably because they use the gypsum as a source of sulphur, an element required for their growth. Halite helps the microorganisms dissolve the rock surface, which is composed of different forms of calcium carbonate.

Much of the damage caused to wall paintings by these microorganisms is because they dissolve calcium carbonate. Zammit then used other techniques to show that the cyanobacteria were forming calcite crystals around them. The bacteria dissolve the calcium carbonate then re-form it by biocalcification in specific shapes and sizes depending on the type of bacteria. These processes lead to the formation of layers of biomediated calcite over the wall paintings that deteriorate these artworks.

**SEQUENCING NEW MICROORGANISMS**

Zammit’s research did not stop there. She next turned to focus on the microorganisms forming these biofilms. She cultured and identified these fungi, chemoorganic bacteria, cyanobacteria, and microalgae. They now form part of an extensive culture collection of hundreds of different strains—many are new to science. Each strain was studied to identify every stage of the life cycle, the external and internal arrangement of the cell and their genetic makeup. The genetic studies sequence specific parts of the strain’s genes to be able to compare them with other species. This is done using online databases to help describe and classify them.

In this way, Zammit discovered a group of cyanobacteria made up of reddish filaments that have a conspicuous photosensitive tip. The filaments are able to glide to the top of biofilms to be closer to light. The group was composed of seven different strains that are 99% similar amongst themselves, but are only 92% similar to the Leptolyngbya genus of cyanobacteria with which they were normally clustered. 92% is low in genetic terms (humans are nearly 99% similar to chimps), which meant that these strains contained a new genus and species that Zammit named *Oculatella subterranea*. The first part of the name refers to the photosensitive tip, or ‘small eye’ which features in
all the strains. Other groups of novel strains are presently being studied.

Zammit is presently collaborating with medical geneticist, Professor Alex Felice to sequence the whole genomes of these new strains of cyanobacteria and microalgae. When genes are read they produce proteins, in our case responsible for eye colour, hair colour, height, and other features. For these microorganisms, this can relate to how sensitive they are to light or the substances they can produce. She is translating the vast amount of data that genome sequencing generates into protein structures using bioinformatics tools. It allows the researchers to build a picture of how the strains metabolise and synthesise different sugars, fatty acids and antibiotics. This picture is needed to figure out how the microorganisms function as a living system that influences the effect they have on their environment. It also facilitates the genetic engineering of the microorganisms, so that they can be used in the industrial production of specific molecules. Bacteria are already vital in making insulin available for diabetics around the world. The potential is great, and amongst many possible applications, this sequencing may lead to the development of new medicines.

Zammit is passionate about the new developments her research has taken—from saving plants to saving human lives. Her love of Malta’s natural and cultural heritage has driven her work to safeguard Malta and its environment. Although one person’s research is only a sliver in the contribution to scientific knowledge, every step is vital to create a picture that can save others, and perhaps with these efforts nature will provide yet another medicine.

FURTHER READING

SEEING THE UNSEEABLE

UNLOCKING THE MYSTERIES OF THE BRAIN WITH MRI

Everything we think, say, or do depends on our brain. It is the most vital organ of our body but one of the least understood. Recent advances are changing things. With magnetic resonance imaging (MRI), scientists and researchers are getting an inside look into what makes us tick. Cassi Camilleri speaks to Dr Sonia Waiczies Chetcuti, Dr Helmar Waiczies and Prof. Kenneth Camilleri about their vision for experimental MRI in Malta. Illustrations by Sonya Hallett.
The brain is a unique machine. Its intricate wiring, made up of billions of neurons firing relentlessly, keeps it in constant contact with every part of the body. No supercomputer can compare. This level of complexity has made it deeply difficult for humans to study how the brain interacts with the body’s various systems. Treating it when something goes wrong is even more difficult.

This is where Dr Sonia Waiczies Chetcuti comes in. Starting her career in pharmacology, Sonia experimented with molecules found within cells with the long-term goal of developing new therapies for various ailments. However, the microscopic level at which she was working, as well as the uncertainty of whether or not her work would ultimately be used in the medical field, saw her interests wander: ‘I believed that looking at the organism as a whole brought you closer to the reality of life.’

It was within the field of neuro-immunology, the study of the interaction between the immune system and the nervous system, that she eventually found her niche.

‘What fascinated me is this balance in the immune system. On one hand, it can trigger a healthy response to protect the brain against harmful invading organisms, while on the other hand, it can go overboard, attacking itself.’ This is the principle of autoimmunity that underlies Sonia’s Ph.D. She believes that ‘understanding [this] will help us learn how to control it.’

For her Ph.D. (carried out at the Charité Medical University between 1999 and 2003) Sonia focused her attention on studying the autoimmune reaction in Multiple Sclerosis (MS) using animal models. The pathology underlying MS sees the immune system trigger a chain reaction where white blood cells called T-cells are recruited by the Central Nervous System (CNS), consisting of the brain and spinal cord. The persistent presence of T-cells here leads to the damage of neurons, an insidious process which results in the disintegration of the fatty myelin sheath insulating the neuron—analogous to stripping a copper wire. Its removal inhibits the neuron from firing messages as quickly and efficiently as it normally would. At this stage, lesions develop in the brain, and, when a sufficient number of neurons have been affected, clear symptoms begin to manifest, typically diplopia and ataxia, double vision and impaired bodily movement.

The all important issue Sonia tackled in her research, and which is still unanswered, is: ‘What is this trigger that sets the immune system haywire? What is the root cause?’

While various scientists and researchers have looked into mapping molecular movement in cells when the illness hits, this highly focused approach has so far failed to properly shed light on the hows and the whys of MS. Many times, the work is disjointed, with professionals working separately, focusing on their own fields. Geneticists look at genetics. Clinicians and epidemiologists look at environmental and socioeconomic factors.
But the reality is that ‘various factors need to be considered at the same time for an answer to be found,’ says Sonia. She likens their endeavour to that of looking for a needle in a haystack and, coincidently, the solution she applied elegantly fits both problems. In both cases, a very powerful magnet is required. Energised by the concept, Sonia sought to apply the use of MR technology to her study of MS.

Inspiration came in the shape of an article by Eric T. Ahrens in Nature Biotechnology called *In vivo imaging platform for tracking immunotherapeutic cells*. Using fluorine, an element not commonly found in nature, the researchers tagged dendritic cells and tracked their movements in a living mouse using MRI.

Sonia’s work on the animal model of MS had already succeeded in identifying a compound, extracellular-related kinase-1 (ERK-1), which has been shown to be essential to immune system regulation. Removing the molecule contributed to more severe autoimmune disease. This made certain immune cells more prone to attack self tissue in the body they reside in. A few years back, Sonia figured out that a principle would be beneficial to exploit in cancer, where the body replicates endlessly to unfortunate consequences: tumours.

It is in our interest that tumour tissue is destroyed by these immune cells. To this end, she studied this concept (at the Max Delbrück Center for Molecular Medicine), whereby mice with gliomas (a type of brain tumour) were given these immune cells which had ERK-1 removed as a cellular therapy. This resulted in a halt to the tumour’s growth. Now they are using fluorine to track these potent cell therapies in animal models by using various MRI techniques. In the case of MS, neuronal damage can be measured by quantifying the performance of specific regions of the brain with the use of functional MRI. Magnetic resonance spectroscopy also does this by looking at variations in the metabolites found in the brain. Since MRI is completely non-invasive and makes no use of harmful ionising radiation, it allows researchers to take multiple scans and observe what is happening at various disease stages. This is not just in the case of MS; a plethora of other diseases can be studied in this manner, including Alzheimer’s and Parkinson’s disease.

This leaves little doubt as to the massive potential MRI technology holds. Used as an experimental tool, it
MRI is a non-invasive medical test that aids doctors and physicians in their diagnoses and treatment of various medical conditions.

During an MRI scan, the subject lies in a strong magnetic field with radio-frequency waves directed at them. The magnets in the MRI scanner line up the protons (H⁺ ions) in the body in the same direction because they are sensitive to a magnetic field.

Short bursts of radio waves are then sent to particular areas of the body, knocking the protons out of alignment. When the radio waves are turned off, the protons then realign and in so doing they send out radio signals, which are picked up by receiver coils.

These signals provide information about the exact location of the protons in the body. Then, in the same way that millions of pixels on a computer screen can create complex pictures, the signals from the millions of protons in the body are combined to create a detailed image.

These images enable physicians to evaluate various parts of the body and determine the presence or development of certain diseases.
Our immune system is there to resist attack from invading microorganisms such as viruses, bacteria, and parasites. White blood cells, particularly T-lymphocytes, are called upon by dendritic cells, which tag the invaders to make it clear what the lymphocytes should attack. Dendritic cells will ‘present’ uniquely identifiable proteins, antigens, found on the invading organisms, much like a cellular ID card. The immune system is then able to make a very important distinction between what is self and what is non-self, based on these antigens. This is called tolerance, whereby self is tolerated, and non-self, is attacked. It is the only discriminatory act the immune system makes.

Autoimmunity is what happens when those self antigens, are, for some as yet incompletely understood reason, now seen as non-self, and so, would be targeted as if they were just another troublesome bug. The cellular process that leads to autoimmunity diseases can be normal in a healthy body. For example, autophagy (the planned and controlled death of cells and their clearing) sees potentially harmful products of cell breakdown cleared out. In these cases, even though it is our own cells that are being done away with, they are cells which are no longer useful or needed, and so tolerance is still maintained. The problem with autoimmune disease is when no distinction is made anymore between redundant cells and fully functional cells. The functional cells then start being cleared out for no good reason. Why this happens is still largely unknown, but contributing factors include inheritance of genes that could disrupt different tolerance pathways (genetic predisposition), and some environmental trigger. Apart from this autophagy process others have been proposed to explain why the immune system can go berserk leading to autoimmune disease.

Auto-immunity
HOW DOES IT HAPPEN?

The cellular process that leads to autoimmunity diseases can be normal in a healthy body. For example, autophagy (the planned and controlled death of cells and their clearing) sees potentially harmful products of cell breakdown cleared out. In these cases, even though it is our own cells that are being done away with, they are cells which are no longer useful or needed, and so tolerance is still maintained. The problem with autoimmune disease is when no distinction is made anymore between redundant cells and fully functional cells. The functional cells then start being cleared out for no good reason. Why this happens is still largely unknown, but contributing factors include inheritance of genes that could disrupt different tolerance pathways (genetic predisposition), and some environmental trigger. Apart from this autophagy process others have been proposed to explain why the immune system can go berserk leading to autoimmune disease.
probe structure. This reduced noise, thus allowing for signals to be picked up better, and resulting in sharper images.

‘The current technological restrictions of MRI means that the role of physicists in this work cannot be understated,’ says Sonia. Engineers need medical professionals to know what ailments can be improved using technology. Biologists need to know how far technology can go. In MRI research this interdisciplinary approach is crucial.

This is perfectly in line with what Prof. Kenneth Camilleri, from the Centre for Biomedical Cybernetics at the University of Malta, thinks. The Centre brings together engineers and clinicians to open the channels of communication and collaboration. It promotes the sharing of ideas, fosters discussions, and pushes for research to be applied in the real world.

Camilleri is working with Sonia in bringing her vision for the development of MRI technology to Malta. Through the Magnetic Resonance Imaging Group Initiative, they are working together to establish an experimental MRI Centre at the University of Malta.

The challenge is difficult because it needs around €3–5 million to set up. There would also be recurring maintenance costs of half a million Euro each year. ‘There is no denying that finance has been a problem. However, the returns from having such a facility on the Island would come in many forms,’ points out Camilleri.

Not only would the Centre put Malta on the map in the field of medical and engineering research but it would also provide various services both locally and internationally. Clinical drug studies would become a possibility, attracting pharmaceutical companies from all around the world. This would offer a new opportunity for the provision of service to various investors.

The Centre would also benefit cultural heritage agencies such as Heritage Malta. Artefacts can be scanned in 3D to help restoration and conservation effects, thereby indirectly providing a service to the local tourism industry.

According to Sonia, however, one of the most important applications of the centre will remain in healthcare. ‘We are living in an aging society. So we really have to invest more in screening people.’ In Germany, regular screenings help identify disease before it becomes incurable. This regular testing also provides a wealth of data for researchers to develop a better understanding of various diseases. In Malta, this has not been adopted systematically. However, with the country’s reputation as a retirement haven becoming entrenched, this makes the Centre even more important.

There is no denying that care is crucial. However, being able to differentiate between diseases better and earlier will prove essential in the long-run. It is about working backwards and trying to improve on what is already known to develop better treatments and improve people lives. As Sonia rightly says, ‘It’s about taking the bull by the horns.’

Camilleri is working with Sonia in bringing her vision for the development of MRI technology to Malta.

FURTHER READING

A new hallmark for graphene, the wonder material of the 21st century, has been found. It has a range of applications—from biomedical to new, smart materials. To gain a better understanding of this discovery, Claire Testa met metamaterials researcher Professor Joseph N. Grima and his team (Department of Chemistry, University of Malta). Photos by Elisa von Brockdorff.

The crumpled paper in the dustbin next to your office desk appears like a mundane object. However, if you grab a piece of paper and pull from both ends to open it up, it will grow longer and fatter. This seemingly unremarkable property could result in the next revolutionary material.

Professor Joseph Grima is one of the leaders in the field of auxetic materials. He starts by explaining the obvious. When something is stretched it tends to become longer and thinner. Auxetics defy this logic. They become wider when stretched. The extent to which a material gets fatter or thinner is called the Poisson’s ratio. A positive Poisson’s ratio is when the material gets thinner, a rubberband is a good example; while if a material widens when pulled it has a negative Poisson’s ratio. This makes a material auxetic. This property is ‘scale independent,’ explains Dr Daphne Attard—a researcher in Grima’s lab—and may exist in large and small structures. ☞
A STRANGE MATERIAL

Graphene has been proclaimed as ‘the wonder material of the 21st century.’ Its potential is astounding with applications in display screens, electrical circuits, tissue engineering, water filtration, and nanotechnology. In 2010, Andre K. Geim and Konstantin S. Novoselov received the Nobel Prize in Physics for their work on this super material.

Luke Mizzi, a young Ph.D. student, explains how graphene is a form of carbon made of single atom-thick layers. They appear like sheets of paper with clouds of electrons on each side. These are really thin layers, graphene is amongst the thinnest materials that ever existed. One graphene layer, for example, is invisible to the human eye being thinner than a soap bubble film, yet nearly as strong as diamond. This unique structure combines strength with an ability to pass electricity and heat. Thus making it promising for several future applications.

MAKING THE CONNECTION

Grima compares graphene sheets to the sea in autumn. The small ripples on the surface of the sea resemble graphene sheets, which are not perfectly flat. Graphene has ripples in it. Nevertheless, unlike the crumpled paper mentioned before, graphene is not naturally auxetic. It does not get wider when stretched.

Grima’s team shows how graphene’s already remarkable properties may be improved by modifying its nanostructure. Graphene has a perfect arrangement of atoms. To make it auxetic, Grima explains, ‘one needs to disturb its perfect arrangement of atoms which looks like chicken wire.’ The atoms in graphene are arranged like a net of hexagons. This can be performed at ambient conditions by the removal of certain atoms and by the setting up of new connections. This introduced some five-sided pentagons in a layer that previously only contained six-sided hexagons. The presence of these pentagons geometrically disturbs the graphene sheet, which dramatically increases the amount of ripples.

Grima’s team succeeded in showing that putting enough defects in graphene imparts it with auxetic properties. As a result of these defects, ‘the imperfect graphene’ adopted a real crumpled shape, giving it the necessary geometry similar to that of a ‘highly wrinkled paper’, so that when one stretches it, it also widens, explains Grima. Additionally, Grima says that one can increase the extent of auxetic behaviour by increasing the amount of defects.

Grima and his team (including collaborators from the Polish Academy of Science and Gdansk University of Technology) used realistic computer simulations to study whether graphene could be auxetic in the real world. The simulations took months of
supercomputer power to verify that this modified graphene works. These calculations represent the ‘blueprint’ for making graphene, as well as other sheet-like materials, auxetic. The possibilities are phenomenal.

**SMALLER THAN SMALL**

This new material ‘shows a very elegant link between the macroscale and the nanoscale,’ says Grima. He goes on to state that this is indeed a fantastic material with ‘multifunctional characteristics’. Here, one needs to consider two points. First of all, that graphene is a super material in itself with numerous applications. Secondly, that auxetic materials have wonderful properties. By combining these two features, Grima explains how a highly complex material such as graphene has been shown to mirror almost everything that is typically observed on a large scale into a crumpled sheet of paper.

Try and wrap a sheet of paper around your elbow. This becomes saddle-shaped and it does not cover your elbow properly, explains Grima. Now open up a crumpled sheet of paper and try to cover your elbow with this instead. The wrinkled paper drapes more easily over your elbow because auxetic materials tend to form a nice dome shape. A scaledown of this fabulous feature could potentially lead to applications of graphene with a negative Poisson’s ratio in nano-domes. These domes could make the perfect protective material.

Dr Ruben Gatt, a lead researcher in Grima’s team, described another amazing property of auxetic materials. When one tries to firmly press a cushion, it tends to shrink in all directions. The cushion gets smaller. Auxetic materials act differently. They densify where you press, which means that if you try and push the foam, the material gets larger not smaller. ‘Imperfect graphene can also be potentially used as a nano-cushion,’ said Grima. Auxetic graphene could also be used to make smart nanoelectromechanical devices or smart filters.

Grima worked with his whole team to make this discovery. It was well known that, by adding defects to graphene, it would have more wrinkles, as was the auxetic nature of a crumpled sheet of paper. But they ‘connected the dots’. The dots were already present, but the team linked them all together.

Auxeticity is a marvellous property which opens up enormous possibilities, ‘as broad as the imagination can stretch,’ explains Attard. This leaves us to wonder what other fabulous material Grima’s team will come up with next.

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**FURTHER READING**

In Malta, buildings cover one third of the Island, leaving greenery in the dirt track. Green roofs are one way to bring plants back to urban areas with loads of benefits. Antoine Gatt, who manages the LifeMedGreenRoof project at the University of Malta, tells us more.

Winter in Malta sees reasonable downpours, flooding roads turning some areas into water wonderlands; summer sees air conditioners being switched on with bills skyrocketing and the occasional power cut. These are common problems for highly urbanised areas with few green spaces. Flooding occurs because water cannot seep and percolate into the underlying rock. Urban areas also act as heat islands because hard surfaces absorb the sun's energy releasing it during cooler periods that cause air temperatures to spiral upwards. Green areas reduce these problems.

Malta is not the only place suffering these problems. The situation is chronic in large cities within mainland Europe. The European Commission has stepped in by issuing publications to encourage member states to move towards sustainable urban areas and is enforcing directives to reduce the carbon footprint of buildings.

Green infrastructure involves making urban spaces greener to provide services to the community and increase the quality of life. It provides ecosystem services, ranging from jobs to cultural benefits, to aid people. Importantly, it mitigates urban problems that include flooding, pollution, and the heat island effect. This infrastructure makes urban environments sustainable, providing services that are much cheaper than their cost.

Germany led the way in green infrastructure with the rebirth of green roofs, roofs covered by vegetation and growing medium. Their development originally began for aesthetic and practical reasons. However, over time, roof greening clearly started showing advantages for the whole community. Research has shown that green roofs are capable of mitigating urban related problems and increase the quality of life. The technology has been so successful that it has been replicated on six continents. The majority of green roofs have been constructed in Central and Northern Europe. These countries invest the most in research into green roofs and government incentives that encourage their installation on buildings.
Although gaining ground, green roof research within the Mediterranean region lags behind. Green roofs have an important part to play in making towns and cities more sustainable and better places to live in. The Mediterranean’s hot climate could be mitigated with these roofs.

My interest in green roofs germinated during a visit to Monaco years back. It was reinforced when I visited the Jardin Atlantique, a green roof atop the Montparnasse station in Paris, for a field trip while reading for a degree in landscape architecture. I saw the beauty of these roofs and the potential they had back home first hand.

GREEN ROOFS IN MALTA

Green roofs in Malta have never really taken off because of misconceptions and the fear of flaws leading to issues like water leaks. There are other problems.

Green roofs in warmer climates often report plant failure especially when using stonecrops (Sedums ssp.), which are normally used in Northern Europe. Water management is another issue with Malta’s poor and irregular rainfall. Another problem is that green roofs cannot use soil. Soils tend to be heavy especially when saturated. They become compacted, loose bulk, and contain silt and clays that lead to ponding (water collection). If green roof technology is to advance locally it needs to be convenient, easy to maintain, reliable, and cost effective.

To solve these problems, back in 2013 the EU funded (LIFE+ programme) a LifeMedGreenRoof project to create a baseline study about green roof construction and performance in Malta. The idea is to demonstrate the potential green...
Malta is not an easy climate for green roofs. There are issues with high winds and temperatures, plant choice, heavy rains, and soil type.

Roofs have to solve urban problems by reducing storm water runoff and improving a building’s energy consumption.

The Faculty for the Built Environment (University of Malta) manages the project. Three other partners are involved. Both Minoprio Analisi e Certificazioni (MAC; a horticultural laboratory) and Fondazione Minoprio (FM; a research and educational establishment specialising in horticultural/agribusiness) have ample horticultural knowledge in terms of plant choice, propagation and cultivation of green roofs. The Malta Competition and Consumer Affairs Authority (MCCAA) will be responsible for drafting a document to set a national standard on green roof construction.

Malta is not an easy climate for green roofs. There are issues with high winds and temperatures, plant choice, heavy rains, and soil type. The growing medium for plant cultivation needs to be suited to Malta's climate. Rainfall is generally sporadic, heavy, and concentrated over a short period of time, between late September or early October, and February. The rest of the year is very dry so some irrigation is necessary. This weather pattern means that the media used should be free-draining but able to retain enough moisture for the plants to survive the dry months. Ideally the growing media components should be sourced locally. Tests have been carried out on media made from locally produced compost, soft-stone and hard-stone aggregate, and crushed concrete but these were not adequate because of their chemical make-up, especially their high pH levels. Inert industrial waste was unavailable. As a result, materials were sourced from abroad. The use of local materials would have been ideal since they would have reduced the green roofs’ carbon footprint, as well as reducing waste and transport costs.

Our next problem to solve was which plants to use. This time we managed to go local. Plants are essential in making the roof look beautiful, trap water, and trap solar energy. Not all plants are able to survive the microclimate at roof level. The stonecrops used in Northern European temperate climates are not appropriate for Malta because of its semi-arid climate. On the other hand, indigenous species are adapted to local conditions and generally require less maintenance—they grow naturally in the wild.

By studying the native flora habitats we decided that plants from the garigue habitat (xagħri: stony ground with shallow pockets of soil) would...
be the best contenders. The garigue habitat conditions are very similar to what plants experience on roofs: they tend to be exposed to high winds and solar radiation with limited soil depth. Over 15 species of native perennial (long-living) shrubs were earmarked for testing.

We constructed 20 test trays (1 m x 1 m) from recycled plastic and filled them with two different growing media. Our horticultural partner, MAC, produced them especially for Malta. They ran lab trials on many different media to identify these two specific mixes for the Maltese trials. Our Italian partners are also running parallel green roof tests in Italy.

Green roof growing media is normally composed of very little organic matter, in our case, a maximum of 25%. The rest of the growing media is volcanic aggregate, ranging from 3–10 mm in diameter. The difference between the two mixes is that one has biochar while the other does not. Biochar is a type of charcoal used in horticulture to enhance soil fertility.

In 2014, we planted the test trays with one or two species of the selected plants. Both growing media mixes had the same plant species and planting configuration to compare the effect of biochar and see how the plants fare on the green roof. The plants are being monitored by overhead photography to analyse their development. To date, we have had few losses (less than 5%).

Plant development has been very encouraging. All plants have reacted well to the growing media, although growth in the biochar mix has been slow. The plants are growing healthily especially the Rock Samphire (Crithmum maritimum), Shrubby Crown Vetch (Coronilla valentina ssp. glauca), Greater Snapdragon (Antirrhinum tortuosum), and the native perennial Mediterranean Stonecrop (Sedum sediforme).

THE FUTURE IS GREEN

In the coming months, the test trays will be replaced by a fully-fledged green roof. On the building of the University’s Faculty for the Built Environment a higher roof level will be used as an open air laboratory, with a public garden in the larger lower level. This garden will be open to all visitors so that everyone can appreciate the potential of green roofs in Malta.

The next step will be to test just how much energy saving and storm water mitigation green roofs in Malta can achieve. The roof and underlying rooms will be monitored to see if these rooms are cooler and need less air-conditioning. Water run-off will be monitored to quantify the potential green roofs have in controlling local flooding. Armed with the above data, the project will be in a position to showcase roof greening in Maltese towns and villages. For green roofs to...
be effective, the area green roofs cover needs to be large, a single green roof will only benefit the owner and maybe neighbours.

The greatest hurdle for green roofs is whether households and businesses will buy into the technology. Cost is the main stumbling block, although private individuals, educational institutions, design professionals, and corporate bodies have already approached us. Cost depends on the type of green roof (whether intensive or extensive) and plant choice. The initial capital should be recouped relatively quickly. A green roof would increase the property’s value, and the value of nearby properties. In Paris, the rent of apartment buildings around the Montparnasse station skyrocketed after the Jardin Atlantique was built.

After cost, irrigation is the second hurdle. Water is needed to maintain a healthy plant community. Summers in Malta are long and dry. Whichever plants are used, irrigation is required, and this might be a drawback for buildings without a water cistern or well. However, water needs depend on the plant species used with native vegetation generally requiring less irrigation. Our tests are showing that plants cultivated in the biochar growing media require less water. At their driest, the maximum amount of water given per week to each plant is 1.5 l. Between October 2014 and April 2015 the plants were not irrigated. Last winter was particularly wet, but these are still promising trials.

To date, the results are very encouraging. The plants are growing well and have attracted many beneficial insects. The Maltese swallowtail butterfly (Papilio machaon ssp. melitensis), numerous bees, and other insects have been recorded. Green roofs might just help Malta become a cooler and more beautiful country. To learn more about the LifeMedGreenRoof Project visit www.lifemedgreenroof.org or follow on Facebook www.facebook.com/lifemedgreenroofproject. To arrange a visit contact 2340 3621, antoine.gatt@um.edu.mt or vince.morris@um.edu.mt. The project is part-financed by LIFE+ programme which is the EU’s funding instrument for the environment and climate action ec.europa.eu/environment/life/about
Dr Maria Galea writes about her journey into the world of Maltese Sign Language and bringing a logical framework to the written form of the language. This work has the potential to empower the approximately 400 deaf people in Malta.
In the 1970s the ballerina Valerie Sutton was unable to pursue her passion for dance due to a life-threatening skin condition. Instead, she invented a notation system that allowed her to write body movements for dance choreography. This was the birth of DanceWriting. While Sutton was teaching at the Royal Danish Ballet, the sign language researcher Lars von der Lieth thought her system could be adapted to encode sign language. The same notation-system could represent hand-shapes and movements, spatial locations and orientations, as well as facial expressions and body movement. Sutton dedicated her life to the growth and spread of the writing system that can be used by deaf people all over the world.

Today the system has transformed into the fully developed International SignWriting Alphabet (ISWA 2010) used worldwide. It consists of 652 BaseSymbols required to write any sign language in the world. These SignWriting symbols represent distinct hand-shapes, their location and orientation in relation to the body, facial expressions, and movements that characterise sign languages. Deaf signers can represent signs in writing in the same way as words in spoken languages represent sounds. The main difference is that sign languages do not use the sounds, but instead use visuals and gestures to create units of meaning.

MALTESE SIGN LANGUAGE

In Malta, around 400 people are born deaf. From these over 100 people are estimated to use Maltese Sign Language, which is the local sign language with its own hand gestures and other body movements. Worldwide, around 300 different sign languages are used. I learnt Maltese Sign Language from the Deaf community, and before I started my academic work, I was the first full-time sign language interpreter in Malta, hired in 2001 by the Maltese Deaf People’s Association which was founded in 1973. For years, I helped empower deaf people simply by interpreting and channelling their communication to be able to participate fully in Maltese society. During this time, I also noticed how much deaf people enjoy being in each other’s company and use Maltese Sign Language spontaneously, a language I learnt and fell in love with as well. With SignWriting I saw the beautiful reaction of Deaf people as they discovered the relationship between signing and written signs, which corresponds to the relationship between spoken and written language. When they learn SignWriting they can express themselves in written form in their own language to write poetry, novels, or love letters if they wish. They have started to realise that their language is as important as
spoken languages. All of this motivated me to start a doctorate in Maltese SignWriting.

In Malta, no one had ever undertaken a study in Maltese Sign Language at doctoral level. The grammar of this language had several aspects that still needed a description.

My study attempted to use the study of the grammar to develop a language-specific SignWriting. My study helped establish an orthography (language-specific rules of a writing system) that built upon the previous publications, such as the Maltese Sign Language Dictionary volumes. A manual that instructs its users in the SignWriting of Maltese sign language was also completed. Deaf people find this very manageable and rewarding.

To this end, between 2008 and 2010, I worked on the Sign Language Research project of the Institute of Linguistics (University of Malta) to translate children’s stories into Maltese Sign Language. One publication was the Christmas story (on CD) that includes excerpts from the Gospels of Luke and Matthew. Such publications help increase literacy amongst the Deaf, who have the additional difficulty of never having heard how words are spoken as hearing people do. It is hoped that this work will serve to continue to push towards their empowerment which can only be achieved if more interpreting services are made available. These services would ensure access to the same opportunities as everyone else.

WHAT IS SIGNWRITING?

Written Maltese Sign Language may look like hieroglyphs or Chinese script. However, this writing system has nothing in common with these. SignWriting is a featural writing system where every symbol represents a feature of sign language such as a handshape or hand movement. SignWriting resembles ancient Korean, where the symbols represent the actual physical articulation of the language. For example, in ancient Korean the ‘t’ sound would be represented by a symbol that shows the tongue touching the roof of the mouth that occurs in the production of the sound ‘t’.
Karl Borg conversing using his hands to express himself in Maltese Sign Language with Keith Callus who receives it through vision. Photo by Jean Claude Vancell

It is hoped that this work will serve to continue to push towards their empowerment that can only be achieved if more interpreting services are made available.

So if the hand moves straight ahead it attaches to the 2nd person point and the result means ASK-YOU. On the other hand, if the hand moves to the side of the signer it attaches itself to the 3rd person point and the result is ASK-HIM/HER.

Maltese Sign Language agreement verbs need to be properly marked in SignWriting in order to be read with ease. This is because, within what looks like a single sign, often multiple elements can be marked. Just as the single Maltese word fakkarthiela (the equivalent in English of ‘I reminded her of it’) is made up of the verb ‘fakkar’ (to remind) ‘t’ (past tense plus 1st person singular ‘I’) ‘hie’ (feminine ‘it’) and ‘lha’ (to her), the same sign can simultaneously indicate subject, object, as well as adjectives and adverbs.

In some cases, simply writing the notation to indicate left or right does not adequately indicate to which...
person the verb refers. Pronouns and person marking on verbs are crucial. If these are not indicated in the written form, Maltese Sign Language cannot be read properly. Once these are clearly marked, subjects and objects of verbs—the ‘doers’ of actions or who did what to whom—can be identified.

Sign linguists disagree whether agreement marking is properly indicated in grammar or whether agreement simply indicates where to point in space. If pronoun marking does not exist in a patterned systematic way, then some would argue that sign language is not actually ‘language’ (since a signer would be simply pointing to things). Whilst this was a controversial issue in the 1970s, most sign linguists are now open to sign language being both a mix of linguistic and gestural features. My findings push forward the argument that agreement marking is grammatical. It needs to be learnt and must be marked in the written form. This strengthens the argument that Maltese Sign Language is a complete language.

In order to disambiguate pronominals in signwriting Maltese Sign language, I introduced the adoption of an ‘anchor’ (a shoulder glyph). The combination of this anchor with another marker to identify different location points in space can show the different locations for 1st, 2nd, and 3rd person (right and left) points. This allows the

SignWriting evolved from a ballerina’s invention to write choreography, into a way to write many different sign languages across the globe.
relationship between the signer’s chest location and the pronominal points to become graphically clear; the signer can indicate exactly which action is happening to whom.

SignWriting evolved from a ballerina’s invention to write choreography, into a way to write many different sign languages across the globe. SignWriting is now so widespread that Sutton, the inventor, is no longer able to list and record all uses of SignWriting worldwide. SignWriting enables all Deaf people to write their native languages, and many languages already have large compilations of texts. The next step involved is the gradual establishment of the different alphabets and different orthography rules to write these different sign languages. My doctorate published the first manual that can help empower Maltese deaf people. What is needed now is a concrete push to help bring Maltese SignWriting to all Deaf people in Malta to build a bridge towards their move into literacy of the spoken languages, which is an indispensable tool for educational development.

For more information about SignWriting visit [www.signwriting.org](http://www.signwriting.org); [www.signbank.org](http://www.signbank.org). The Ph.D. was carried out following the award of a STEPS (the Strategic Educational Pathways Scholarship—Malta) scholarship. This scholarship 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’.

**FURTHER READING**

Can you imagine 10% of the population being killed? Or one in every 10 people you know losing their life and being forgotten? Their sacrifice for Church, God, and country was lost in time till Dr Charles Xuereb’s long overdue book *(France in the Maltese Collective Memory)* brought their sacrifice back to light.

I was shocked. 10,000 Maltese died in what partly resembles a civil war between rural Malta and the city folk between 1798 and 1800. This was a time of fallen-from-grace-knights, French Revolution Napoleonic France, Imperialist Britain and an all-powerful Church. And in 1798, Malta became centre stage of this conflict.

Before the arrival of the French, three institutions jostling for power ruled Malta. The Order of the Knights of St John had been the dominant ruler since 1530. They did not tax the Maltese or allow them to become knights. When Maltese writer and philosopher Mikiel Anton Vassalli suggested that Maltese citizens should be allowed into the Order he was imprisoned.

Really, the only way for the Maltese to gain prominence would have been through the Curia (Catholic Church). The Curia owned one third of the Islands through a clever scheme invented a few hundred years earlier. Rich sinners could leave their property to the Church in their will. ‘The income of that property [would fund] masses for your soul forever,’ explained Dr Charles Xuereb. Instant forgiveness. Malta must have had quite a few guilty consciences.

The third power centre was the Inquisition, but although strong they were doomed to the history books; that institution should never have lasted so long.
A BLOODLESS INVASION?

This situation pre-1798 left the Maltese oppressed, exploited, and rather unhappy. Vassalli led around 11,000 insurgents who then merged with the Jacobins that helped Bonaparte take over the Island on 12th June 1798. A year before landing on Malta, Bonaparte stated that nearly 40,000 people supported the French in Malta, just under 40% of the population. Xuereb bases these statements on several accounts—including his own research—through archival letters, meetings, and documents, in addition to British, pro-British Maltese, and just one French account (by Frenchman, Jean de Bosredon de Ransijat). This bloodless event is not the same history I was taught at school.

Xuereb contrasts this with Canon Panzavecchia’s account published in 1835, the first Maltese point of view of the reviewed period. Panzavecchia, who was one year old in 1798, influenced many subsequent history books. Panzavecchia describes ‘two years of calamitous occupation’ after an invasion that saw Bonaparte trick the Order into submission. He also mentions a degrading convention, with the Maltese being forced to sign an unfavourable treaty to integrate Malta as part of France in 1798. He forgets to mention the benefits Napoleon brought to the country, the support he elicited, or the bloodless ‘invasion’. Panzavecchia was celebrated and achieved a good position soon after the British approved the publication. The time of press liberty had not yet come.

An account like Panzavecchia’s influenced the Maltese collective memory; the shared memory of a group of people. Most Maltese perceive the French as evildoers who pillaged our churches carrying off all our silver, who stole the Knights’ treasures, and caused endless harm to Malta.

Most Maltese perceive the French as evildoers who pillaged our churches carrying off all our silver, who stole the Knights’ treasures, and caused endless harm to Malta.

Xuereb analysed the Maltese collective memory to discover why it was blocked, and still hinges on this anti-French attitude. This attitude is bizarre. Italy and Germany both bombed Malta in World War II but ‘we don’t hate the Germans for that, we don’t hate the Italians, they are close to us and remain very close’ he told me during our interview, his voice becoming passionate. ‘Why are we still keeping in our hearts something against the French [because of something that happened] 217 years ago? What’s the reason? The [Maltese] collective memory [has been manipulated to] demonise the French period.’

Elements of this influence can be seen till today. I recently visited the new Heritage Malta National War Museum at Fort St Elmo (built by the Order). While nicely laid out with proper contextualisation of colonial powers, the exhibition puzzled me. It goes at length to explain how Napoleon improved Malta: the liberties, education (he even encouraged Maltese to study in Paris), the abolition of slavery, and so on, but it failed to explain why the Maltese revolted after less than three months of French rule. It mentions that Napoleon bombarded Valletta, then mentions that no blood was spilled. French ship cannons must have been notoriously inaccurate. Maybe that is why they lost at Trafalgar. It seems to be contradictory with previous smear campaigns while keeping with the facts, leaving an impression of confusion on visitors.

Apart from a rigorous historical analysis, Xuereb uses analysis of collective memory theory to figure out why the Maltese memory is blocked. He focuses on Maurice Halbwachs’ presentist theory of collective memory, but mentions many others like Pierre Nora and Paul Ricoeur. Importantly, this theory coalesced the concept of collective identity with how memories are shared between countries. The Maltese collective memory is what gives Maltese people an identity, as remembered through ‘images of the past through places, monuments, and rituals of commemoration’, writes Xuereb. These interpretations are also always reflected in the present. In Malta, many of our place names, monuments and public holidays are
British leaning. The British had a lot to gain by making the Maltese love them; but before we get to why the French were demonised, let us continue with our story.

MALTESE WAR CRIMES

The stage has been set. 1798: Bonaparte is heading to Egypt while Nelson is fast chasing him. He knows that in Malta, he can quickly and easily overthrow the rich despotic knights thanks to local support, while replenishing his troops and coffers.

On 9th June he arrived in Malta and by the 12th he had taken it over without shedding blood. His troops landed in several places including Spinola to water the fleet at the infamous Bjar ta’ Napuljun (cisterns of Napoleon). The history books paint this as subterfuge by the French to sneak an attack on the Knights, while official documents show that the watering process was documented.

With the troops watered and fed, Napoleon’s next problem was money. He cleverly relocated the knights’ Grandmaster to France, while taking over their possessions. With the Church there was an agreement in front of three notaries for silver and property in exchange for ‘St John’s Co-Cathedral which, up to then, the Maltese Curia could not use, but they were invited as guests occasionally. […]’ The first mass by the Maltese bishop, Labini, was celebrated on 14th July 1798 […] and, whenever the French took silver, it was documented. [In fact,] there are published calculations with how much the government received from the Church—written details of every item—a sum that amounted to circa €49,000. The French took a lot of silver to fund Malta’s administration and their war, but they did not steal it all.

The French did pillage. ‘We know of four small incidents. [French soldiers] were reported by parish priests to have stolen some silver and priests’ vestments. […] Bonaparte, on his second day in Malta executed one of his senior officers because [the officer] went with a group of soldiers to St Catherine’s convent in Valletta near St Dominic’s church and tried to [steal].’ Bonaparte ordered that all of them be executed. He relented by condemning only the most senior officer to the firing squad, there and then. Bonaparte clearly wanted to show that pillaging was not allowed in Malta. In fact, he had plans to use some of the silver and Church property for education and hospitals. The French also planned to tax the Maltese—a new concept—to be able to provide government services for the country. This must have annoyed several nobles and clergymen.

A major thorn blocking the Maltese collective memory from forgiving the French is that Bonaparte took many of the Order’s treasures. British historians said he loaded L’Orient, his flagship, with over a million pounds’ worth of loot. Other historians calculated that this was much less, but the facts are hard to verify. When recent underwater searches examined the resting place of L’Orient in Aboukir no Maltese treasure was ever found. The French did take some artefacts, famously La Valette’s ceremonial sword now exhibited at
the Louvre. The French took the item, together with several others, as part of the legal agreement they signed with the Order. But if France is serious about improving the Maltese collective memory it should be returned—a point Xuereb fails to emphasise. It is common practice for the old colonial powers to return ill-gotten items to their rightful owner. This also applies to the British, who captured the French Sensible in 1798, which did have several Maltese artifacts like Ximenes’ canon that the British never returned.

After introducing a new Republican government and liberal reforms, the Maltese revolted against the French by 2nd September 1798. ‘After 82 days [the Maltese] rose against the French, whom they had previously asked for liberation. It doesn’t make sense,’ said Xuereb, ‘I remember him [Xuereb’s Lyceum history teacher] telling me … “Xuereb that is a pertinent question but there are no answers. We know so little about what really happened, and you have to dig very deeply to find the truth.”’ Now Xuereb seems to have found that truth.

In 1798 Malta did not have one unified population (neither does it today, being split between a red and blue political split). Xuereb uncovered a great divide. ‘The upper classes of the Maltese [in the harbour region] appeared to favour the French,’ writes Xuereb, while ‘the illiterate villagers, “dominated by the clergy,” executed the historical and successful peasants’ revolt.’ But why would God-abiding clergymen push the Maltese to revolt? On 10th June 1798, two days before the Order surrendered, Labini—the Bishop of Malta—offered Mdina’s keys to the French and invited French General Vaubois to lunch at the Episcopal Palace. ‘But then the Church realised that it would lose much of the privileges it had over the people [of Malta].’ These privileges included growing tithes, stipends from the Curia, payments for services to the parishioners (funerals and payments for receiving the sacraments), one tenth of peasants’ harvest, rent, and a few more. It was a very different Church from today. The revolt was led by a prominent merchant, clergymen Canon Caruana, and Fraternity Rector Emanuel Vitale with a few other businessmen such as cotton entrepreneur Vincenzo Borg, who used to supply the Order but was now risking failure. For the successful revolt, the Canon was rewarded by being anointed Bishop of Malta. The Church had good reason to counter-revolt and reverse Bonaparte’s reform. The British cleverly realised the power of the Church and supported the Catholics.

Another clue lies in the brutality of the revolt. It started on 2nd September, when the government was auctioning off appropriated property belonging to religious orders. Ironically, this government was made up of two [French] out of 70 [Maltese]. The initial clashes soon turned into the massacre of over 60 French soldiers in Mdina, together with their women and children. The soldiers were cut open with their livers removed, cooked, and eaten. Maltese sympathisers either ate human liver or faced death. Such violence left little choice for the peasantry: either force the French out or face severe repercussions.

Other violent incidents occurred. After Mdina, the peasant army led by the clergy circled the built-up harbour region and started the two-year long siege on the 4,000 strong French army within. In two vicious incidents, two young boys and a lady were brutally killed when leaving the besieged area for vegetables, while a French soldier...
was beheaded for eating a fig, his head left on a spike. Xuereb thinks that the clergy and traders bought the services of mercenaries. They then used them to tie the hands of the Maltese peasants into a fully-fledged countryside revolt. These mercenaries were probably the very slaves Bonaparte’s reforms had just freed.

On 1st September 1800, Alexander Ball estimated 3,000 troops were occupying the front posts besieging the French. The author Cavaliero had stated that Bonaparte had freed around 2,000 slaves—1,400 Moors and 600 Turks—who would have been treated brutally before being freed, much more likely culprits to the atrocities.

Xuereb then goes on to say that, when the French fell, there were ‘summary executions, attacks on property, punishment, and banishment’ of Maltese. Jacobins, doctors, and magistrates were killed, proper trials appearing unnecessary. This seemingly contrasts with a people unable to commit atrocities, and seems more likely to be committed by mercenaries.

WHY THE FRENCH HAVE A BAD REPUTATION IN MALTA

The British had every reason to encourage the Stockholm Syndrome (when hostages empathise with their captors) in the Maltese. For all the brutalities committed, Malta managed to beat one of the greatest powers of the 18th century, a victory that left at least 10,000 Maltese dead. [...] Till today, the victory is not even celebrated as a national holiday.

Malta managed to beat one of the greatest powers of the 18th century, a victory that left at least 10,000 Maltese dead. The greatest loss of life ever experienced. Till today, the victory is not even celebrated as a national holiday. By glossing over this part of history, the British made sure that the Maltese would never gain the ‘self-confidence to aim at total autonomy.’

The British did not want to empower the Maltese, but instead wanted a servile colony to be used as a military fort and port. When the French surrendered due to the combined efforts of a British sea blockade and Maltese-led land siege, the Maltese were not involved in any treaties. The 5th September 1800 capitulation basically signed Malta off to the British. The British were meant to leave, but did not—not that the Maltese wanted the Order back. This handover was cemented in 1814. In the meantime the Maltese tried to claim their political rights but failed. Malta was deemed unfit to govern itself.

The Catholic Church supported British rule in Malta; an uneasy relationship at times, since the Church still owned one third of their colony. However, ‘the British had a trick with the local Church; they used to go to the Holy See first. [...] The Holy See used to accept a lot of the British proposals in Malta because it was working hard to gain recognition of Catholics in England. Catholics were still barred from all the major positions in government. In return, they accepted any proposal that [the British] wanted for Malta,’ explained Xuereb.

Bizarrely, it reached a point where the Anglican Head of Church sanctioned the Head of the Church in Malta. For example, Archbishop Michael Gonzi was appointed because the British consented. [Archbishop Joseph

NOTEWORTHY PEOPLE TO REMEMBER

Mikel Anton Vassalli (1764–1829) needs to be remembered with a monument in Valletta. In Paris there is a new authentic description of Vassalli that Xuereb found in 2013. Vassalli was not just as a linguist but as a patriot and politician. He has not been wholly rehabilitated. Another monument should be dedicated to the 10,000 people who perished between 1798–1800 no matter which side they fought for. They should be included in a monument that remembers the event without taking sides.
CORRECTING THE COLLECTIVE MEMORY

The French came to liberate the Maltese from a despotic, ailing Order from the feudal era. Vassalli's nationalistic aspirations made this possible. After the French Revolution, a republican system of government was put into place in Malta to secularise administration and give people rights. Ecclesiastical leaders aided by the British Navy in the Mediterranean stopped all of this progress and restored privileges to the elite, justifying the counter revolt by demonising the French as anti-religious and anti-Maltese. As a result, public education was delayed for another 80 years and representative government for more than a century. Malta was humbled into a fortress colony and its people deemed unable to govern themselves.

Mercieca was the first [unsanctioned] bishop. The British made sure that even the Church was British-leaning, cleverly reversing some French reforms and slowly reintroducing what suited them with the above tactic.

The Maltese also realised that 'the more they appease the colonisers, the more opportunities they would have to obtain posts, receive business privileges, and gain pensions.' So, the Maltese started to love their oppressors, ignoring that the Maltese education system was pushed 'back by 80 years from when Bonaparte wanted to introduce free education in 1798. The British introduced public education in 1878.' When they did introduce it, they controlled it. Back in 1813, British governors of Malta had orders to 'do whatever it takes to make the Maltese loyal to the British crown' according to Xuereb. Maltese sovereignty was stalled by over 120 years till the Sette Giugno (7th June 1919 bread protests with four Maltese shot dead) riots forced the British to accede some self-governship rights to Malta. In his book, Xuereb goes through a rigorous account of how the historical accounts written by 'British forces personnel and ecclesiastical appeasers' distorted history to suit the colonisers: French are evil, British are good and have saved the Maltese. 'Since Independence [in 1964] some progress seems to have been made [but] we are still far from making history our vehicle to help future generations 'self-define and identify' themselves as new proud members of a liberated community', states Xuereb.

BECOMING MALTESE

The manipulation of the perception of the British by the Maltese—the collective memory—is very extensive. Till today, in Malta's capital there are 'eight outsized British coats of arms around the Maltese Presidential Palace [built by the Order, and] over twenty British monuments, the majority of sepulchral nature [that] make more sense in a British naval cemetery,' opines Xuereb. Maltese heroes have not received the same standing.

So why have Maltese politicians with over 50 years of Independence not put matters straight? Xuereb thinks that British indoctrination is still too widespread—take as an example how the Anglican British joined local band clubs and sat on the right hand of the Catholic Archbishop. The largest axe Xuereb grinds is the George Cross on the Maltese flag. King George VI placed the George Cross on the Maltese flag on 29th December 1943 for Malta's valour in WWII. 'It is a medal of […] courage, but a medal is for a museum. On a flag it becomes
a symbol. [...] We are practically one of the last ex-colonies who still carries the symbol of colonialism on our flag.’ Fiji and New Zealand are both planning to redesign their flags. Xuereb does not think the Maltese associate with this colonial symbol at all. The Maltese Cross—not the George Cross—is found on Maltese Euro coins, in logos, in Malta-branded patterns, sports, on the National airline, the examples are endless. Back in the 60s and 70s, it made political sense to keep the George Cross: ‘Maltese people were still employed by British forces in Malta and there were still Maltese on [British-paid] pensions.’ Now, it seems that the George Cross is either vehemently supported by British sympathisers or its symbolism is forgotten.

Removing the George Cross from Malta’s national flag is not the only change Xuereb advocates. Our politicians ‘relegated the Sette Giugno monument to the periphery of our capital city’ while the city’s founder La Vallette was ‘dumped behind the ruins of the Opera House, now half-baked into some kind of unfinished symphony.’ These decisions need to be corrected.

The Maltese heroes ‘Vassalli, Mitrovich, Sciberras need to be remembered,’ states Xuereb. History needs to be more balanced with more than one narrative taught to children. ‘Young Maltese citizens should be brought up respecting their own national story. With research, critical analysis, and debate we should put each and every past relationship in its proper dimension. [...] It was wrong to distort the French connection, and likewise, it would be wrong to erase the British one after Independence.’

Xuereb outlines it best: ‘the country needs a proper citizenship campaign that identifies what is Maltese and what a Maltese citizen could be proud of besides modern politicians and legends of bravery. Visionary Maltese who gave all their energy, personal belongings and, sometimes, their lives should be acknowledged even if they are not well known. Let us stand on our two feet and stop feeling inferior by adopting colonial symbols and monuments erroneously believing that it would distinguish us internationally. On the contrary, it is only prolonging our mediocrity.' Throughout our history, it seems that the Maltese people have done their best with the short end of the stick. Malta needs to cure itself of the Stockholm Syndrome.
BOOK REVIEW
by Dr Jurgen Gatt

God is Not Great, How Religion Poisons Everything
CHRISTOPHER HITCHENS
Quill Rating: ★★★★★

Please accept my apologies for reviewing a well-known book by a renowned, and late, atheist almost ten years after publication. My reasons for doing so are threefold. Firstly, the book and author have both lost some of their notoriety with younger students. Secondly, the book should appeal to both humanities and science students and will, with luck, generate conversation across disciplines. And finally, the book is brilliantly written, cleverly argued, and deserves to be read particularly after the dust of the New-Atheist movement has started (perhaps) to settle.

Christopher Hitchens was an Oxford-educated journalist with a prodigious ability to consume whiskey. He is famous for his stance on the Iraq war (he was a fervent advocate) and for his staunch anti-theism. God is Not Great is the culmination of a life-long effort to wrestle with the problem of religion. It is, perhaps, for this reason that the book reads like a series of essays united by autobiographical touches and by the author’s presence which hangs on every page.

Yet the book is far more than a memoir of an atheist. It frequently challenges the reader to reflect on his own beliefs and ideas. It piques the reader’s interest in a matter of history, an argument, a poem.

Hitchens’ writing style is brilliant and provocative, as one quote will easily prove, ‘[...called] Manger Square, the centre of a tourist trap of such unrelieved tawdriness as to put Lourdes itself to shame’.

To dwell on the author’s many arguments would be long-winded and rather undermine the joy of reading the book. Instead, I will consider Hitchens’ most interesting and original argument; religion harms individuals and societies. Hitchens argues his point principally by historical arguments, as any good ex-Marxist would. In this way, Hitchens attempts to prove his fundamental thesis: religion is a man-made construct with which a priestly caste of people attempts to place itself in a position of real power in this world. To illustrate his point, Hitchens suggests that the fatwa against Salman Rushdie issued in 1988 by Ayatollah Khomeini was an attempt to create an issue to distract his Islamic subjects. The argument, as it stands, fails to completely convince and attempts to prove only the second part of Hitchens thesis. Yet Hitchens assures that more arguments lie in wait.

Finally, a climatic suggestion: the Maltese summer is an ideal time to read this book. What better, after a much-yearned-for, post-exam swim, than to contemplate the existence of God?
Amber Route

The ‘draw a card and see what you encounter’ mechanic in board games is strangely appealing. Despite being undeniably simple, it has sparked the imagination of many people over the years—especially in the fantasy adventure genre. Most famously, Steve Jackson’s best-selling hit Munchkin, controversially used it as the only tangible mechanic.

Talisman is another genre market dominator, which has spawned a multitude of variations and expansions. So it has always intrigued me when other companies decide to challenge the well-established franchises. The genre is old. The simple ‘draw a card and see who you meet’ mechanic is even older. Yet it keeps reappearing.

I discovered it again at the Internationale Spieltage SPIEL board game fair last year, at a booth that really caught my eye. I hadn’t heard of the Polish company called Bomba Games but their artwork was astounding. They only had two games on display, Black & White, a tactical block war-game, and Amber Route, a family friendly adventure game with a sticker on it that said ‘with real amber inside!’ I wanted to know more.

In Amber Route you draw a card to see what you will encounter next. The difference here is that, while in Talisman you’d fight a generic orc or some other fantasy trope, in Amber Route, you draw and try to beat creatures from slavic folklore. Charming. The gameplay itself is simple and intuitive—perfectly fitting for the adventure game’s target audience—and features a few twists. Amber Route’s board presents a race to the finish through tiles which fit into each other in a puzzle-style contraption. The result is a sure start, and a finish with a vast range of possibilities of what you fit in between. Routes can be short or long, hard or easy, random or defined. All dependant on the order of strips of land that lock together. The result is a fascinating, light, visually gorgeous adventure that does not overstay its welcome—unlike Talisman. Most importantly, it’s different. It explores a new realm, it allows you to feel real minerals (yes, the bits are actual amber), and it has stellar graphic design. Amber Route stands out for breaking the mould. Call it indie, call it experimental, whatever it is: I like it.

The designers of the game seem to have gone out of their way to make the game as language independent as possible. All text within the game is, in fact, replaced with iconography which is a pleasure to interact with. You will need to get used to the symbols till they sink in, and that’s fine. The rules, however, are slightly problematic with a confusing layout and poor translation. I had to make too much effort to find the relevant paragraphs every time I turned a page. A couple of other problems are that the game is a little too easy and the gameplay itself is nothing special, but neither of them is a deal breaker.

Overall, Amber Route struck me as a surprisingly fresh take on an overused formula. It was an enjoyable product to explore not only as a game but as a physical object within itself. Whatever you do Bomba, do not fire your art director. 🌟
Move over Minority Report

In 1964 a very clever engineer, called Douglas Engelbart, invented a tiny device that changed the whole concept of how we interact with machines. By moving the device, a pointer on a screen moved, while tapping a button with your finger would cause an action. I’m talking about the mouse—a device now taken for granted—but back in its inception it had revolutionised the way we instructed machines. Instead of giving commands through a keyboard, the mouse made it possible to work in 2D.

The mouse kept evolving. So did the monitor, with new variations emerging. Nevertheless, despite all of these advancements we are still using the same concepts from the 60s. Our technology is still limited to 2D. We still construct 3D models on a 2D monitor, play 3D games on our flat screens, and input our instructions by moving a pointer in 2D space. Thankfully, science fiction has inspired new innovations. I remember the first time I saw Tom Cruise use a glove to control a futuristic UI (User Interface) in Minority Report by swiping his hands back and forth. It seemed like a hologram controlled by the movement of a finger. How cool would it be to have these types of devices? What if we could go beyond the screen and blend the digital and real world? Well, now we can.

Microsoft invests a lot of research in augmented reality and virtual space. In 2010, the Kinect was introduced, with cameras and an infrared sensor capable of capturing body and skeletal movements. Initially this let people play games through body motion, then others soon started using its APIs (Application Programme Interface) in creative ways like scrolling through the windows on the monitor, or to apply sound effects by combining different hand gestures. This new way to interact was strikingly similar to Minority Report.

The next leap forward was by Oculus VR™ that made virtual reality possible. Their device, called the Oculus Rift, consists of a head-mounted display that is sensitive to head movements. In a nutshell, what you see on the display is related to the way you move your head.

Microsoft retaliated. They pushed the boundaries by showing the world a demo of the real deal: HoloLens (available in January 2016 with Windows 10). The HoloLens is yet another head-mounted display—similar to Oculus Rift—that ‘inserts’ holograms or virtual objects in your display, while still showing the real surrounding environment. Imagine wearing a pair of clear glasses while looking at a table. Now imagine that you put a small sticker of a little teacup on your glasses. If you now position yourself in the right spot you will get the impression that the cup is sitting on the table. The HoloLens works in the same way.

So what’s the big deal about HoloLens? Their demo shows that for the first time we can work in a real 3D environment. Microsoft also combined hand-gesture technology with voice recognition technology into one device. Apart from easily visualising your work in 3D, the applications of this device are endless, with immersive games and intelligent systems entering your life.

The University of Malta is central to our knowledge economy, and yet it is chronically underfunded. The University performs well despite underfunding, so imagine the heights that could be scaled with more adequate support.

My idea? Scrap the scandalously outmoded stipends system. Instead, make student financial support entirely elective (students decide whether they want support); money is then given to students as an interest-free loan, which they only start to repay once they have graduated and are earning more than a minimum threshold salary. The money saved would be directed into research, postgraduate and postdoctoral initiatives, and infrastructure and technology.

DOES THE KRAKEN EXIST?
Alexander Hili

‘Release the Kraken’ is a very famous quote from Clash of the Titans. In the movie scene, a monstrous being, with characteristics of both squid and octopus, is summoned from the sea to smash a city to the ground.

The Kraken is clearly a mythological creature, but the colossal squid (Mesonychoteuthis hamiltoni) is very real. The monstrously large squid grows to an estimated 12–14 m in length and has sharp swivelling or three-pointed hooks on its limbs. The bloated carcasses of this organism could have inspired the ancients. Large adults have never been caught since it is thought to live around 2.2 km beneath the water’s surface when it develops. Like the Kraken it is a very elusive creature that is rarely seen.

Don't THINK
by Ġorġ Mallia
KRISTA: I am tired of coming across things I like and forced to feel excluded. This film is so obviously ‘for the boys’. All-male group and female victim waiting to be rescued. All ‘pop culture’ symptoms are there—the ‘woman in refrigerator’, the ‘smurfette’, the ‘damsel in distress’. She does rescue herself in the end, but that’s two-thirds into the film and too late to participate in the ‘fun bits’. I’d have preferred to feel included in the intended audience for armoured vehicles and zombie petrol!

NOEL: At first I thought that Brooke (Bianca Bradley) would have a more prominent role. The photoshoot scene was promising, she sported the resourcefulness of Alice from the Resident Evil film franchise. But then it all went downhill. During the lab scenes she was totally upstaged by The Doctor (Berryn Schwerdt). She had a comeback of sorts towards the end but it was simply too little too late.

K: ‘Purer’ torture porn that has women as vulnerable victims, but focuses throughout on their struggle for survival, is perhaps less sexist than something that organizes women to the periphery.

N: The parodic nod towards torture porn is one of the things I liked most about Wyrmwood. The Doctor is a great character, a cross between Mr Blonde, Walter White and Dr Heiter. It also exposes what’s wrong with bad torture porn. The lab scenes are rather disturbing without being too graphic whereas usually it works the other way round.

K: Agreed. I also liked the ‘magic zombie’ touch. Brooke’s unexplained powers nod towards magic necromantic control over the undead, something we don’t often see in zombie films. I also liked the little visual nods to Romero, the unflagging pace (which it sustains throughout), the humour, the violence, and the action. What distinguished it was the pace. We were thrown into the thick of it, so to speak, and it didn’t let up. No pause in the relentless action.

N: Is there a zombie film that doesn’t reference Romero? I liked Wyrmwood for the same reasons as you however I found it too earnest in trying to be a cult movie. The handheld camera, the fast zooming in on close-ups, the breakneck editing, the ‘iconic’ shots. It’s obviously trying to ride on the crest of Mad Max by setting the story in a post-apocalyptic landscape with lots of vehicles and scarce fuel. It bothered me.

K: I liked the heightened artificiality of the blue-red colour (well, blue and blood) scheme inside the ‘mad scientist’ truck. That too was a case of style within a low-budget framework. It contrasted with the grit-and-grime greyyness of the outdoor sequences.

N: Nobody takes zombies seriously anymore so trying to build a sense of dread is too trite. Even metaphorically, zombie films are at a dead end at the moment. So Wyrmwood is the antithesis of a film that has something to say. It just plays it for laughs. However this doesn’t mean that the film is ‘silent’. For instance, I found its politics a bit dubious. We already mentioned the ‘boys only’ stance. What about the only indigenous person being the foolish sidekick who sacrifices himself for the greater good of the ‘white man’? I didn’t like that.
Indie games have allowed a new generation of creative developers to experiment. Nostalgia is a leading trope: defunct genres are being resurrected, and the 8-bit aesthetic is a stylistic trademark. Adhering to this practice, the first episode of Hotline Miami chewed-up old-school arcade games and nineties ultraviolence, mixing it up with a contemporary, psychedelic audiovisual blend.

Hotline Miami 2 keeps all of that with a set of new mechanics: players can now shoot sideways, roll under enemy fire, and brandish katanas. The game’s greatest merit is to carefully balance unabashed mayhem with careful strategy. You will need to memorise patterns and act quickly at the right time. And then, do it again and again.

As a sequel, Hotline Miami 2 feels rather conventional. As expected, every part of the game has been expanded and the game mechanics have been completely exploited. Its narrative has been exhausted and lost sequential logic. It now serves as a backdrop for yet another suicide assault.

Hotline Miami 2 is undoubtedly a joy: a well-crafted, ultrafast ride, with a fantastic, inspired soundtrack. The game is designed to satisfy its fanbase. The struggle continues between innovation and conservatism.
Prof. Nikolai Attard was on the other end of the phone and was passionately describing what he had in mind. ‘A mobile dental clinic will be able to reach out to the community, schools, old people’s homes, village squares and we’ll be collecting epidemiological data on oral health which can then be fed into existing health data. At the same time we’ll be providing a free dental examination and advice to thousands of people, which they will then follow up with their personal dentist. This could be a first for Malta.’ Nikolai, Dean of the Faculty of Dental Surgery (University of Malta), is determined to expand the Faculty’s teaching activities and promote oral health.

That was August 2012 and we (the University’s Research Trust; RIDT) immediately set the ball rolling. We looked at a number of possibilities, including importing a ready-made mobile dental clinic from the UK, but the costs were prohibitive. The most plausible option was to purchase a truck and find someone who could convert it into a high quality dental clinic. This would give us enough breathing space for the RIDT to raise the necessary funds while the project was in progress. Having obtained the necessary quotations it became clear that the project needed a hefty €120,000.

In hand we had a clean sheet and zero funds. So we embarked on a fund-raising initiative. In the meantime, Attard and Dr Gabriella Gatt roped in engineer Albert Bonnici, who had experience setting up dental clinics.

The first donations started coming in around January 2013. We bought a DAF truck and,
around March, Bonnici started the conversion work. He laid out all the designs and plans for services, including water, electricity, air conditioning, drains, radiation protection, and so on, while ensuring that the structure of the truck was strengthened where needed. The works were carried out in one of the mega-garages which form part of the Xpress Group Yard in Ħal Farrug, which Albert converted into a workshop. In the meantime, donations continued flowing in from a number of sources.

Today, almost three years later, we are proud to announce that the University of Malta Mobile Dental Clinic will be on Malta’s roads by the end of July this year. The clinic is one of a kind: a fully equipped dental clinic on wheels on a par with other dental clinics. The clinic will bring oral health to everyone on the Island despite mobility impairments thus contributing to the socio-economic wellbeing of our country. It will have a direct impact on the quality of life of the Maltese population, whilst providing vital information with regard to the current oral health status of the nation.

The Mobile Dental Clinic has been made possible through the generous contributions of GSK (Malta) Ltd, Cherubino Ltd, Bart Enterprises Ltd, Suratek Ltd, ProHealth Ltd, Rahuma International Ltd, the Good Causes Fund, and Xpress Group Ltd. The Research Trust and Faculty of Dental Surgery are deeply grateful to these companies and individuals who made this project possible.
MEME
CULTURE GENES

IN CLASS: 1+1=2
EXAM: JOHN HAS FOUR APPLES AND GIVES ONE AWAY. CALCULATE THE MASS OF THE SUN.

IF FE = IRON
THEN DOES FEMALE = IRON MAN?

DROP
THE BASE

I WANNA BE
FOREVER JUNG

"About your cat, Mr. Schrödinger—I have good news and bad news."

Alcohol and calculus don’t mix. Never drink and derive.
EVENINGS ON CAMPUS
2015
31 JULY-13 AUGUST
UNIVERSITY OF MALTA

TNEMMIS/theatre16+ - FRI 31 JUL & SAT 1 AUG // TWISTED TALES/children - SUN 2 AUG
SCIENCE OF HONEY - SUN 2 AUG // THE NOTEBOOK/film12+ (with Maltese Subtitles) - TUE 4 AUG
THE AUDITION/theatre18+ - WED 5 & THU 6 AUG // MISTURA/concert - FRI 7 & SUN 9 AUG
THE TATTOO CULTURE/infotainment - SAT 8 AUG // FROZEN/filmU (with Maltese Subtitles) - MON 10 AUG
COMEDY ON CAMPUS/stand-upcomedy18+ - WED 12 & THU 13 AUG

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