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News Article Science in the House 2013

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1 Introduction

On Thursday September 26 at 4 pm the inauguration of Science in the House opened at the Grand Master's Palace, Valletta. A poster exhibition entitled "Science in the House" was inaugurated under the auspices of the Office of the Speaker at the House of Representatives in the Grand Master's Palace, Valletta. The exhibit was organised by Dr. David Magri (University of Malta) on behalf of the consortium "Researchers' Night - Science in the City"

The researchers were greeted by the Deputy Speaker the Hon. Censu Galea in the presence of Project Coordinator for Science in the City and Chair of the Malta Chamber of Scientists Prof. Alex Felice, University of Malta Pro-Rector for Research & Innovation Prof. Richard Muscat, Chief Executive of the Research Trust (RIDT) Wilfred Kenely, and Members of Parliament.



Figure 1: Scientists and researchers from the University of Malta, parliamentarians and journalists at the inauguration of the 2013 Science in the House at the Grand's Masters Palace in Valletta.

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Figure 2: (left to right) Chair of the Malta Chamber of Scientists Prof. Alex Felice, Chief Executive of the Research Trust (RIDT) Wilfred Kenely, Deputy Speaker The Hon Censu Galea and University of Malta's Pro-Rector of Research and Innovation Prof. Richard Muscat discussing and viewing the poster exhibition.

Following the opening speeches, the Deputy Speaker was taken for a tour of the posters. A set of 12 posters were consistent with the theme "Today's Science, Tomorrow's Jobs" and the slogan of the Research Trust "Brighter thinking, broader future". Each poster showcase a particular research study, the team involved in the research, and the societal contribution the research may make our lives. The exhibition aims to provide a unique opportunity for Members of Parliament and the public to meet scientists and learn how the research is contributing to a better quality of life.

The "Science in the House" exhibition will be open for public viewing tomorrow (today) during Science in the City from 6.00pm to 9.00pm and on the 5th October during Notte Bianca. During the week of the 30th September, the exhibition will be open for viewing by the parliamentarians.

Science in the House is a forum for networking and cause for celebration involving Maltese research scientists, Representatives of the House and Members of Parliament. It is also a poster exhibition highlighting



Figure 3: Sacha Dunlop (left) and Katrina Grech (second from left), research students under the supervision of Sandro Lanfranco, presenting their poster to the Deputy Speaker the Hon Censu Galea (second from right) and the Project Coordinator for Science in the City and Chair of the Malta Chamber of Scientists, Prof. Alex Felice (right).

some of the exciting scientific research currently conducted in Malta, particularly at the University of Malta. The event encourages and supports the achievements of Malta's early-stage research scientists, engineers and technologists - arguably the "creative engines" of future innovation and development in Malta. During the following week the exhibition is open for viewing by the parliamentarians and afterwards left on display in the Grand Master's Palace over the Notte Bianca festival, thus allowing the general public including students, parents and tourists to be more aware of local research endeavors. The event was sponsored by the Malta Chamber of Scientists, the Research, Innovation & Development Trust (RIDT) and the University of Malta.

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Dr. David C. Magri

Intelligent Molecules for Medical Diagnostic Applications

The Research

As "molecular engineers", chemists perform chemical transformations to build rationally designed molecules with useful functions. Research is currently being carried out to develop intelligent molecules that operate as logic gates for medical diagnostics applications. For example, molecules can be designed to report the presence of one or more chemical species in a vial by emitting bright fluorescent colours after irradiation with light from a lamp.

How it Makes Our Lives Better

With the continual rising cost of health care, the creation of intelligent molecules able to simultaneously detect many analytes at once for a specific disease could help doctors to diagnose patients more effectively, and reduce the waiting time for laboratory test results.

The Research Team

Research on intelligent luminescent sensors and molecular logic gates is being carried out by Dr. David C. Magri and postgraduate and undergraduate students of the Department of Chemistry in the Faculty of Science at the University of Malta.



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Osteoporotic bone is more porous and weaker, making it prone to fractures with deterioration of vertebral support and loss of weight.

Bone Health and Osteoporosis

Prof. Angela Xuereb • Ms. Melissa Formosa

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The Research

Osteoporosis is a bone disease that negatively affects the bone structure. As we grow older, deterioration of the bone structure affects our vertebrate such that we get shorter. Our bone mass starts deteriorating after we reach the age of 30. Although this affects both men and women, the rate of bone deterioration is faster for women after menopause. Although not all fractures are the result of loss of bone mass, the lifetime risk of a fracture resulting from such a condition is 40% for women and 13% for men. The most common fracture sites are the spine, hip, wrist and humerus. The bone mineral density (BMD) measurement test is used to diagnose osteoporosis and to predict fracture risk. Lifestyle factors (such as smoking and low Calcium intake), coexisting medical diseases

or prolonged use of glucocorticoids are major contributing factors in the development of osteoporosis and fractures, which are both highly hereditary.

How it Makes Our Lives Better

The results of this study will possibly aid in the early diagnosis of osteoporosis and fracture, as well as in the development of personalised medicine. Early detection is the key in preventing unnecessary suffering and escalation of health care costs.

The Research Team

The research is being conducted by Professor Angela Xuereb and research staff and students of the Department of Applied Biomedical Science in the Faculty of Health Sciences at the University of Malta.



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Measuring Acceleration

Mr. Ansel Briffa • Prof. Edward Gatt • Prof. Joseph Micallef

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The Research

Micro-electro-mechanical systems (MEMS) are very small devices on the micro scale (that is one millionth of a metre), although they range in size from a few micrometres to a few millimetres. These consist of two units: the central unit, which is used to process data and the mechanical sensor, which interacts with the surroundings. The current research focuses on a type of MEMS known as an accelerometer. A MEMS accelerometer is a device that measures. proper acceleration (or rate of change of velocity). There are two types of accelerometers: static due to gravity, and dynamic, which operates based on movement or vibration. Accelerometers are now a common component in most smart-phones and tablets.

How it Makes Our Lives Better

Demands for low-cost accelerometers have increased rapidly in recent years which augment our day to day life. Accelerometers are also used in navigation, transport, building and structural monitoring, medical applications and consumer electronics. The scope of this research was to design and fabricate novel three-axis accelerometers having separate masses using an industrial fabrication process.

The Research Team

This research was conducted by Mr. Ansel Briffa under the supervision of Professor Ing. Edward Gatt and Professor Ing. Joseph Micallef of the Department of Microelectronics & Nanoelectronics in the Faculty of Information and Communication Technology at the University of Malta.



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Newly Discovered Brain Area Offers Hope to Stopping Nicotine Addictions



The Research

Smoking is the leading preventable cause of disease, disability and death in the world with approximately 5 million deaths each year. So why do people smoke? It is a well known fact that nicotine is one of the most addictive substances known to mankind because it stimulates feelings of pleasure. Similarly to other addiction drugs, such as cocaine, heroin, and marijuana, nicotine increases the levels of the neurotransmitter dopamine, which affects the brain pathways that control reward and pleasure. It is for this reason that it is difficult for people to stop smoking as the brain wants to avoid feeling bad after such a pleasurable experience.



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How it Makes Our Lives Better

Are there effective treatments for tobacco addiction to help people stop smoking? One consideration is nicotine-replacement treatments such as bupropion and varenicline. An alternative is a vaccine called NicVax. Our research suggests that the brain area called the lateral habenula might be a new drug target for the treatment for nicotine cessation. We hope to find a new effective drug soon.

The Research Team

This research is being carried out under the supervision of Professor Giuseppe Di Giovanni at the Department of Physiology and Biochemistry in the Faculty of Medicine & Surgery at the University of Malta.







Plant Diversity and Natural Heritage

The Research

Endemic plants – There are approximately twenty species of plants which are unique to the Maltese islands and not found anywhere else on Earth. Such plants are therefore of considerable value on both a local and global scale. There are no detailed studies on the life-cycles and reproductive capacity of these so called endemic plants and these are vital for their effective conservation. One such plant is the Maltese Everlasting (Sempreviva ta' Ghawdex; Helichrysum melitense), a plant that is only found along the western coast of Gozo as species that has a very low fertility.

Shoreline algae – The gently sloping rocky shores of the Maltese Islands harbor a wide variety of algae. Why are these algae so important?

• They help reconstruct past ecosystems and monitoring sea-level changes

• They respond to changes in water chemistry to rapidly help assess the pollution load in seawater without resorting to chemical tests.



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How it Makes Our Lives Better

Plants are indicators of the 'state of health' of our natural ecosystem. Unfortunately much of the natural environment in the Maltese Islands has been degraded by human activity, so monitoring the 'state of health' of natural ecosystems is of prime importance for one to be able to assess

- the value of habitats,
- the impact of damage caused by human activity and
- the effectiveness of conservation measures

The Research Team

This research is being conducted by the Plants and Algae Research Group composed of Dr Sandro Lanfranco, Mr Edwin Lanfranco and a number of postgraduate and undergraduate research students at the Department of Biology in the Faculty of Science at the University of Malta.







Increasing Mobile Phone Efficiency

The Research

Wireless communication devices, such as mobile phones, need a particular type of circuit that generates a high number of electrical signals per second in order to send and receive information. The problem with traditional electronic circuits is that they are inefficient resulting in unnecessary battery-power consumption. In order to make this circuit more efficient, Micro-Electromechanical Systems or MEMS (these are small devices on the scale of a human hair) are employed as a key component. Our research has resulted in a significant improvement over traditional circuit implementations.

How it Makes Our Lives Better

Power consumption is a very important parameter in any mobile device. With MEMS technology, our batteries would last longer and apart from extending the operational time of the device, the amount of charging cycles required would also be reduced.

The Research Team

This research was carried out by Daniel Zammit at the Department of Microelectronics & Nanoelectronics in the Faculty of Information and Communications Technology, under the supervision of Dr. Owen Casha, through a scholarship scheme offered by STMicroelectronics, Malta.



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Better Quality of Life for Cancer Patients

The Research

Understanding the cause of disease requires systematic methodology, interrogating cellular communication. Interference in normal communication within cells and between cells is the source of irregular cellular growth and multiplication, hence the initiation of a new cancerous growth. Recent research has identified novel mechanisms of cancer initiation with potential new therapeutic targets. Directing specific therapies and deriving knowledge on response to the therapy in cancer patient groups is the key for cure.

How it Makes Our Lives Better

Our research uses research-derived knowledge to design methods to classify patients into therapeutic groups and predict therapy outcome within such groups. These platforms enhance the quality of life of cancer patients, promoting personalised medicine.

The Research Team

Cellular Biology and Genetics Research using cellular models and patient material is headed by Dr. Godfrey Grech, Department of Pathology at the University of Malta. Clinical Information and patient material are coordinated by Professor Christian Scerri (Consultant, Genetics Clinic, Mater Dei Hospital) and Dr. James DeGaetano (Consultant Pathologist, Mater Dei Hospital).



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The Structure of **Protein Molecules**

The Research

Proteins are the workforce of the body. There are many different types of proteins in our body: they digest our food, give us energy, make up our muscles, protect us from infection. Our cells synthesize proteins all the time and when something goes wrong with the way they function it may have fatal consequences. A protein is made up of thousands of atoms and is in itself as complex as the solar system. In the Department of Physiology and Biochemistry, a team of scientists is working on the purification, biochemical characterisation, and determination of the molecular structure of proteins.

How it Makes our Lives Better

Determining the structure and mechanism of function of a protein enables researchers to understand the basis of disease and to design drugs that will improve our quality of life.

The Research Team

A team of enthusiastic scientists supervised by Professor Gary J. Hunter and Dr. Thérèse Hunter is working together in the Laboratory of Biochemistry and Protein Science at the University of Malta. Collaborations have been established with colleagues at leading laboratories including the Astbury Centre for Structural Molecular Biology, UK, the CEA, France and the University of Tokyo, Japan.



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Hereditary Blood Disorders and Gene Control

The Research

The Laboratory of Molecular Genetics conducts basic research on important themes in molecular biology and genetics. These include the blood profiling for rare and other genetic disorders in the Maltese population and the molecular characterization of mechanisms and pathways leading to the developmental switching of haemoglobin in humans. Important discoveries from our lab have led us to speculate on a small set of genes and proteins that seem to be essential in regulating the development and maturation of red blood cells. This is all coded in our DNA. and variations in the DNA can lead to disorders, which we consistently scan and look out for with our laboratory equipment and instrumentation. A field better known as Bioinformatics, handles large datasets of generated numbers and results to make sense and analyze scientifically the effects.

How it Makes Our Lives Better

The impact of this research is felt by those who essentially are inflicted with a genetic disorder, such as beta thalassaemia and sickle cell disease since it can potentially cure their illness. Moreover, this research serves as a model for other analogous research being carried out elsewhere as it principally demonstrates how different life science themes can merge and cooperate together for a successful outcome.

The Research Team

The research team is headed by Professor Alexander E. Felice in the Laboratory of Molecular Genetics with participation from many departments at the University of Malta. Dr. Joseph Borg and Mr. Clint Mizzi are involved in genome sequence analysis of a selection of the Maltese population. The team headed by Professor Christian A. Scerri of the Thalassaemia and Molecular Genetics Clinic at Mater Dei Hospital is involved in clinical diagnostic testing.



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Metamaterials

The Research

Typically materials which we encounter in our everyday life get their properties as a result of their chemical composition alone. However, our quest for having new materials with previously unachievable properties has led to the development of a new class of materials, now referred to as 'metamaterials', i.e. engineered systems that exhibit macroscopic properties that emerge due to the structure of their subunits rather than their materials composition. Our team works with materials and metamaterials which get fatter when stretched (auxetics), shrink when heated or expand when under pressure.

How it Makes Our Lives Better

By designing tailor made materials having unusual properties, we can design superior products. For instance auxetics may be used in the design of highly efficient stents, cushions, filters, skin grafts, etc.

The Research Team

The metamaterials research team is lead by Professor Joseph N. Grima, Dr. Ruben Gatt and Dr. Daphne Attard from the Metamaterials Unit of the Faculty of Science in collaboration with Dr. Aaron Casha from the Faculty of Medicine and Surgery at the University of Malta.



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Novel Approaches to Cancer Treatment

The Research

Healthy blood cells mature through a process called differentiation, a process by which cells divide and become more specialized in what they do. After a period of time normal cells stop dividing and die. Leukaemia is an example of a blood cancer where cells do not differentiate, and rather remain immature and immortal. Consequently, the cells keep dividing and growing faster than normal healthy bone marrow and blood cells eventually causing sickness and death. The team is focused on finding new molecules that will encourage leukaemia and cancer cells to differentiate and die off naturally. We have already discovered extracts from insects and plants that are successful in causing differentiation in a range of leukaemia cells. We collaborate with the European COST action STEMCHEM in screening more such compounds.

Dr. Pierre Schembri-Wismayer • Ms. Analisse Cassa

How it Makes Our Lives Better

Some cancers, including certain blood cancers called Acute Myeloid Leukaemia, are difficult to treat. The current treatment is chemotherapy, which is only partially effective as it kills the cancer cells, but also poisons normal healthy cells causing many side effects including hair loss, vomiting and bleeding. Finding therapies that could make cancer cells mature and die normally would help to treat leukaemia without many of these side effects.

The Research Team

This research is being carried out by a number of undergraduate and postgraduate students, following on the initial work of Ms. Analisse Cassar, under the supervision of Dr. Pierre Schembri-Wismayer from the Department of Anatomy in the Faculty of Medicine and Surgery.



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rof. Ray Fabri • Dr. Albert Gatt • Prof. Gordon Pace • Mr. Michael Rosner

Language and Communication Technologies

The Research

Language is the point of intersection between imagination, reasoning, knowledge and expression. It constitutes the essence of humanity and a building block of civilisation. Yet in an era dominated by increasing globalisation, mechanisation and exposure to information, we are confronted by problems whose root causes are the barriers imposed by language itself: human languages with which we are not familiar; machine languages we find unnatural, awkward and inexpressive; above all, the bombardment of information that overloads our capacities. These problems are being addressed by technology, and our research explores technological solutions to language processing, studying language itself and experimenting with intelligent computer systems that use language. The research area is highly interdisciplinary, lying on the frontier of linguistics, computer science and artificial intelligence.

Solutions being developed address many different aspects of these problems: low-cost high-quality machine-translation of human languages; dialogue systems for spoken and written interaction so that we can communicate with machines naturally; computational models of languages like Maltese that are needed for spelling and style correction; tools for understanding semi-formal documents like contracts; automated interpretation of complex databases in linguistic terms understandable to humans.

The Research Team

The research team consists of Mr. Michael Rosner of the Department of Intelligent Computer Systems, Professor Ray Fabri and Dr. Albert Gatt of the Institute of Linguistics and Professor Gordon Pace of the Department of Computer Science of the University of Malta.

How it Makes Our Lives Better



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