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**Science Research**  
**The University of Nottingham**  
**Malaysian Campus**

[www.nottingham.edu.my/science/research](http://www.nottingham.edu.my/science/research)



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Biosciences postgraduate researching the shelf life of fruit



The University of Nottingham has three international campuses; one in Malaysia, another in China, as well as our UK based campus. We are committed to producing world-leading research and having that research make an impact for the benefit of industry, as well as the wider community.

It states in the University's mission statement, *"By bold innovation and excellence in all that we do, we make both knowledge and discoveries matter"*. We believe that our campus in Malaysia has a team of dedicated, and skilled, scientists that enables us to deliver on this mission for the university and for the world beyond.

The Faculty of Science comprises six Schools – Biomedical Sciences, Biosciences, Computer Science, Geography, Pharmacy and Psychology. Its internationally recognised research is as wide as it is varied. For example, our research projects include tracking elephants using GPS for the purposes of relocation, tracking eye movements for hazard perception and cross cultural differences, the discovery of new drugs and how to deliver them, research into autism, how to prolong the shelf life of fruits and how we are able to introduce under-utilised crops into our diets, removing our reliance on the major foods group such as wheat and rice.

In this brochure, we have tried to illustrate the broad spectrum of research taking place within the Faculty of Science. We hope that you find it interesting, and we invite you to contact us to talk about our research and how we might be able to work together on some of these exciting initiatives.

**Professor Graham Kendall**  
Vice-Provost for Research and Knowledge Transfer

“By bold innovation and excellence in all that we do, we make both knowledge and discoveries matter”

In the most recent UK Research Assessment Exercise 90% of all research at Nottingham was classified of an 'international standard' and 60% as 'world-leading' or 'internationally excellent'. The University of Nottingham Malaysia Campus achieved 4\* rating (the maximum is 5\*) for research activities and publications in the 2011 Malaysian Research Assessment Exercise (MyRA).

## Introduction

**The University of Nottingham prides itself as a premier research-led university and this notion is upheld at all three campuses. UNMC's Faculty of Science Research Centres have evolved from the UNMC's Research Priority Groups rather than from School-based research.**

Each Priority Group maintains strong links with the University's Priority Groups. Individual Schools within the Faculty also have the opportunity of retaining research themes that are unique to them, enabling individual researchers to develop their own research dimensions. This approach has ensured a varied nature of research themes within each of the seven Centres and promotes high calibre interdisciplinary research which runs across Schools and the Faculty.

We are aware that the Faculty is relatively new and has a significant number of young researchers. Thus, we have in place a system of pump-priming research grants, especially for young researchers to help propel their research. Our system of peer-reviews for external grant applications ensures that the quality of proposals submitted from the Faculty is of the highest standard.

The Faculty has over 50 research-active academic staff and this number is expected to grow. Many of our researchers are recognised both nationally and internationally. The number and quantum of research grants awarded to UNMC is significant. This funding comes from national and international funding bodies including the Malaysian Ministry of Higher Education, the European Union, industry and charitable organisations.

Over the coming years, we expect to make significant contributions to global issues that have far-reaching consequences on major areas such as the environment, health and well-being.

**Dr Nashiru Billa**  
Director of Research, Faculty of Science

# Research and Knowledge Transfer Priority Groups

The University of Nottingham has established a number of Research and Knowledge Transfer Priority Groups. These are areas of key focus, which support the delivery of excellence in research and knowledge transfer.

- Advanced Manufacturing
- Aerospace
- Biomedical imaging
- Centre for Advanced Studies
- Clinical Translational Research
- Drug Discovery
- Energy
- Facilities
- Global Food Security
- Integrating Global Society
- International
- Operations in a Digital World
- Science, Technology and Society

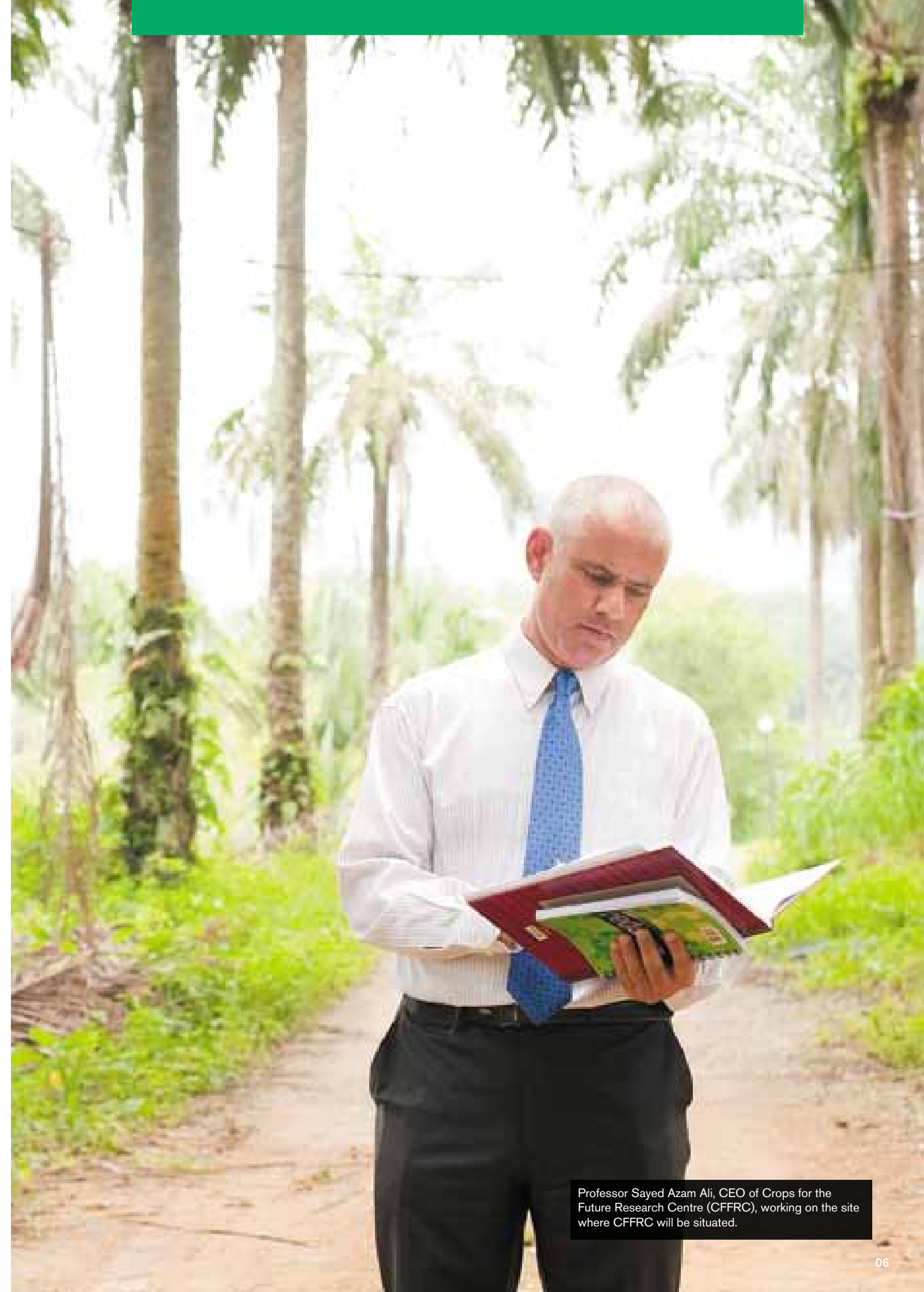
Nine Priority Groups are in key thematic areas with the potential to grow and deliver an influential amount of world-class research and knowledge transfer addressing global issues and challenges. Four Priority Groups underpin capabilities across the University with the objective of leveraging significant external funding.

## Research Priority Groups will:

- maximise the visibility and impact of the University's research
- secure significant levels of external funding to support their research activities
- become an institutional champion for their topic
- incorporate interdisciplinary collaborations of international quality
- provide a first-class environment for career development and training
- attract high quality staff, postgraduates and strategic partnerships

It is envisaged that Priority Groups will have a maximum life-span of five years in order to allow for new thematic areas to emerge. These will be dependent on the University's evolving priorities and changing global challenges.

Find out more about our Global Research Priority Groups at [www.nottingham.ac.uk/research/priorities](http://www.nottingham.ac.uk/research/priorities)



Professor Sayed Azam Ali, CEO of Crops for the Future Research Centre (CFFRC), working on the site where CFFRC will be situated.



## UNMC Research Priority Groups in Science

The University of Nottingham Malaysia Campus has developed thirteen Research Priority Groups, which complement and overlap with the global priorities of the University. They also reflect priorities unique to Malaysia and Southeast Asia. Five of these groups are based in the Faculty of Science.

- Autism Research in Malaysia
- Drug Discovery and Delivery
- Intelligent Computation
- Post-Harvest Biotechnology
- Sustainable Crops

Our groups range from centres which have an established history of producing leading research to newly identified 'emerging areas' which represent new and exciting developments at the Malaysia Campus.

Through our links with higher education and research institutions in Malaysia, we are raising the profile of Malaysia as a key player in research that addresses global issues that transcend national and traditional disciplinary boundaries.

For further information about Research Priority Groups at The University of Nottingham Malaysia Campus visit [www.nottingham.edu.my/research/priority](http://www.nottingham.edu.my/research/priority)

# Autism Research in Malaysia

## Global Priority Group: Biomedical Imaging

The principal purpose of our research is to develop a system of early diagnosis of autism using eye-movement recording technology and electroencephalogram (EEG), using our state-of-art facility at The University of Nottingham Malaysia Campus neuroscience laboratories.

Another purpose will be to conduct an epidemiological project to establish a systematic approach to diagnosis of autism in Malaysia. To date, there is a serious lack of knowledge and expertise in diagnosis in Malaysia, and internationally recognised testing instruments are not widely available. Our epidemiological study will allow an estimate of the proportion of people who suffer with autism in a large scale programme of diagnosis. To our knowledge, this will be the first time that such work has been carried out in Malaysia. The work will provide a vital opportunity for clinicians and researchers in Malaysia to build up capacity in clinical testing and epidemiology.

## Areas of research

Our research is focused upon investigating aspects of developmental disorders, especially autism. One strand involves basic research to generate a new instrument for early diagnosis, using the tools of neuroscience, especially EEG and eye-movement recording technology. Another strand involves an epidemiological study which will have various benefits. It will raise awareness of developmental disorders, build capacity in diagnostic expertise and will identify children and families who are in need of help.

## Research impact and beneficiaries

The major beneficiaries will be the families in Malaysia who are coping with children who have developmental disorders. Our research will also benefit the health service of Malaysia as well as the educational establishment. The research could help the fledgling clinical psychology service get off the ground, and it could also help to establish an educational psychology service.

## Partnerships and collaborations

Our partner is the National Autism Society of Malaysia, a charitable organisation that has been doing excellent work in providing a basic diagnostic service and educational provision for children who have autism. Our partnership will enable better systems of diagnosis and better methods of intervention.

## Strategic objectives

The centre attracts major grants from the Malaysian ministry as well as from abroad – especially the USA. This funds cutting-edge research that will make a difference to our knowledge of autism such that diagnosis can be done more reliably and at an earlier point in development before 'autistic' behaviour becomes well established.

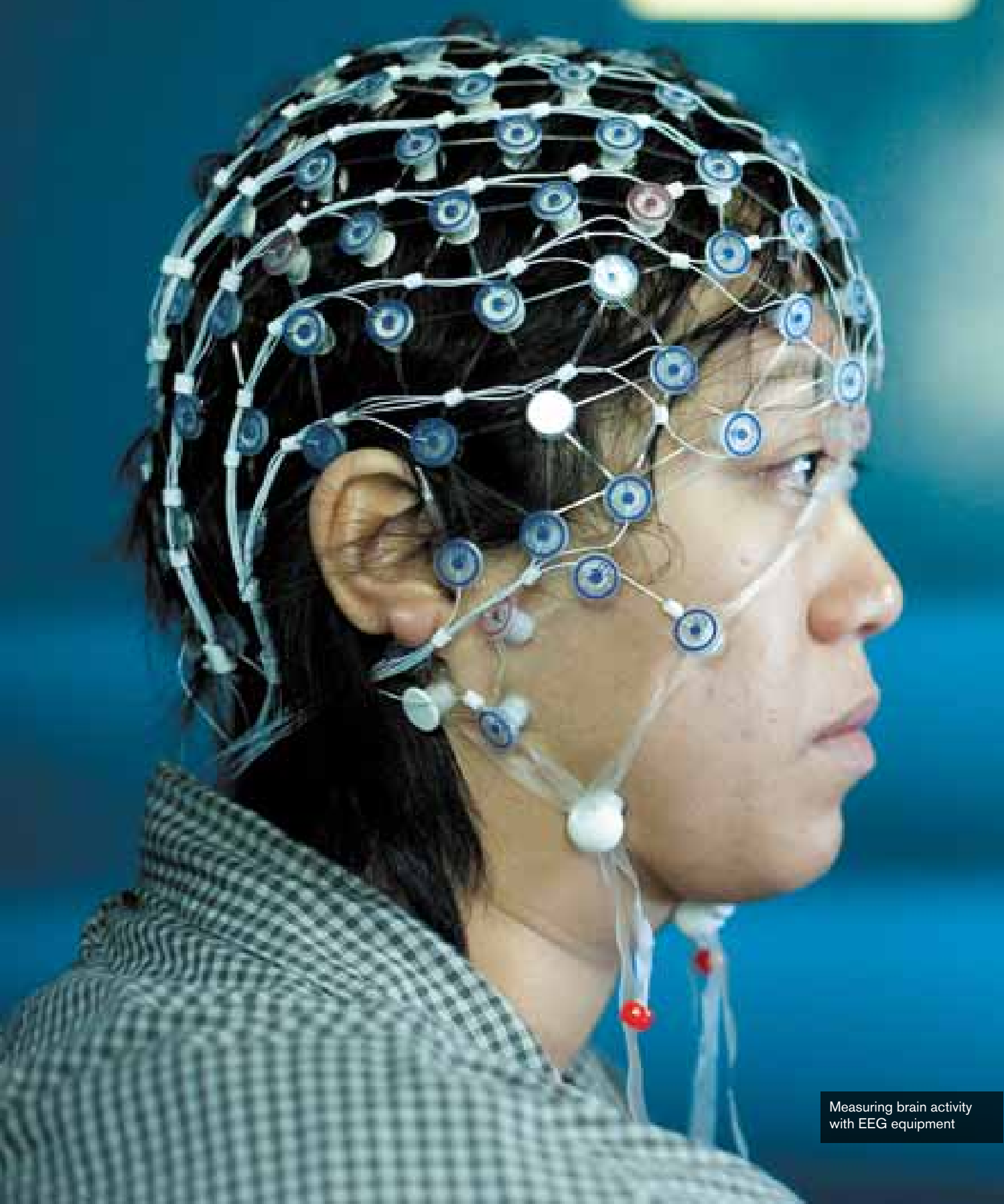
## Contact us

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## Fact

Approximately 1% of the population have autism, meaning approximately 330,000 people in Malaysia may have this disorder.

The tools of neuroscience will allow us to identify autism before abnormal behaviours become established. It is better to prevent these behaviours from developing in the first place than it is to extinguish abnormal behaviours that are already established.”



Measuring brain activity  
with EEG equipment



# Drug Discovery and Delivery

## Global Priority Group: Drug Discovery

At the Centre for Drug Discovery and Delivery (CDDD) we engage in scientific research that covers a spectrum of interrelated disciplines. These include: the identification of plants; isolation and pharmacological testing of plant constituents with relevant therapeutic properties; the delivery of these actives using novel approaches; and therapeutic monitoring.

Researchers within the CDDD come from different schools within the Faculty of Science at the Malaysia Campus and work closely with colleagues in the UK on a number of projects. The CDDD has a very successful track record in attracting a significant number of externally-funded research projects including a recent EU funded FP7 Biodesign grant, aimed at developing scaffolds for bone implants in regenerative medicine. Other external grants include: Ministry of Higher Education (FRGS, MOSTI); National Cancer Council of Malaysia (MAKNA); Ministry of Agric; Nottingham University Grants (MIDAS, MNDP, ECRKT). The centre works in collaboration with industries and internationally renowned researchers to develop its work.

## Areas of research

Key areas of focus for our research include:

- Organometallic drug synthesis of antibacterial and anticancer agents
- Pro-drug modelling and activation in anti-cancer treatment and novel enzyme-directed pro-drug therapies
- Ethnopharmacology of medicinal plants in the Asia Pacific, especially plants with anti-cancer, anti-bacterial, anti-fungal, anti-diabetic and antioxidant properties
- Enhancement of bio-availability of therapeutic agents through novel delivery approaches including nanoparticulate, transdermal and rectal delivery
- Fabrication of scaffolds for use in tissue engineering and regenerative medicine
- Adverse drug reactions (ADR) and pharmacovigilance, risk management and clinical governance

## Key research themes

Specialist key research themes include drug synthesis, drug delivery, tissue engineering, ethnopharmacology, and natural product chemistry.

Key research units include in the CDDD include the Rainforest Group and the Drug Delivery Group

## Research expertise

Main areas of expertise include:

- Drug delivery and bioavailability
- Synthetic and analytical chemistry
- Computational modelling
- Pharmacognosy
- Pharmacology
- Adverse drug reaction

## Partnerships and collaborations

The centre works in collaboration with a range of research institutions, universities and industries to increase the quality and effectiveness of our research. Researchers within CDDD also work particularly closely with our University of Nottingham colleagues in the UK, specifically those within the School of Biomedical Sciences and the School of Pharmacy's Laboratory of Biophysics Surface Analysis and Division of Drug Delivery and Tissue Engineering. Key partnerships include:

### Universities

Monash University, Sunway Campus, Malaysia  
School of Pharmaceutical Sciences,  
University of Science, Malaysia  
School of Pharmacy, University of Kebangsaan  
Malaysia, Malaysia  
Faculty of Medicine and Health Sciences,  
University Putra, Malaysia  
Faculty of Science, Universiti Putra Malaysia, Malaysia  
Department of Chemistry, University Malaya, Malaysia  
Human Immunology Unit, University of Oxford, UK

### Industry

Pharmaniaga Berhad, Malaysia  
Carotech Berhad Sdn Bhd, Malaysia  
Hoe Pharmaceuticals Sdn Bhd, Malaysia  
Imeks Pharmaceuticals Sdn Bhd, Malaysia  
National Cancer Council, Malaysia

## Vision

Our vision is to realise effective therapies through novel approaches. The centre aims to strengthen strategic partnerships with the industry with the hope of evolving into a centre of excellence in the near future.

## Contact us

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## Fact

With the recently captured EU FP7 Biodesign research project, the DDDC becomes the first RPG at UNMC to be a part of a major EU grant scheme. This €11m funded research project involves 21 research teams from across Europe made up of leading experts in degenerative disease and regenerative medicine.

# Intelligent Computation

## Global Priority Group: Operations in a Digital World

The Centre for Intelligent Computation focuses on the development of various computational methodologies and their application to a wide range of real-world problems. Our focus is on the use of computational methodologies to solve problems in an intelligent manner, often drawing inspiration from the natural world.

The group is multidisciplinary, with members from several different faculties and schools. The main areas of research include operational research, optimisation, meta- and hyper-heuristics, evolutionary computation, machine learning and support vector machines, computational neuroscience, agent-based modelling, and hyper-structures for information retrieval.

### Areas of research

#### Operational research

We are interested in modelling the complexity and uncertainty inherent in complex, real-world problems across a wide range of application areas including cutting and packing, educational timetabling, network routing, portfolio optimisation, transportation, logistics and vehicle routing, sports scheduling, transportation logistics and vehicle routing. The intelligent decision support systems that we investigate are able to automatically aid the design and implementation of more efficient and reusable search methodologies that can be used across a wide range of real-world problems. Our work is underpinned by the development of mathematical models that capture the complexities inherent in the real-world.

#### Machine learning and support vector machines

The creation of computer behaviour that is derived from real world data makes use of statistical techniques that analyse data and recognise patterns. The systems are trained with pairs of inputs and predictions and models are built by mapping these pairs onto multi-dimensional space allowing inferences to be made.

#### Computational neuroscience

This is the study of biological nervous system function in terms of information processing, and how they solve computational problems. In particular these approaches are used to study computer vision and image processing. Nervous systems, and in particular the retina, are modelled – the short term aim being to provide data that helps to understand the retina. The long-term aim of this work is to design retinal prostheses that will enable new forms of treatment for blind people.

#### Hyperstructures for intelligent information retrieval

This research is concerned with the study of the 'shape' of data structures, and how they may be used to facilitate the retrieval of information from large corpuses – such as the world wide web. This has many applications from digital libraries and electronic publishing to education.

#### Context-aware software agents

This research focuses on the modelling and verifying of complex systems using ontology-driven agents that have logical reasoning abilities.

#### Key research themes

The main focus of this research is in the practical applications of intelligent computation to problems that are of significant economic or social concern to Malaysia. These include, but are not limited to, the manufacturing industry, education, renewable energy, food safety, water quality, healthcare, and agriculture.

#### Research expertise

The research priority group contains world-class experts in optimisation, hyperheuristics, scheduling and timetabling, support vector machines and machine learning. There is also outstanding expertise in evolutionary computing, artificial nervous systems, neural networks, computer vision, hypermedia, educational technology, fuzzy logic and neural networks.

#### Contact us

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Many of the problems we study are so large that we cannot simply look at every possible solution and return the best one as that would take millions, if not billions, of years, even on the fastest computers. A game such as Go, for example, has more possible game states than there are atoms in the known universe.



Areas of research in intelligent computation at UNMC include transportation, logistics and vehicle routing.



It is hoped that the reduction of postharvest losses will increase food availability and improve nutritional quality dually through minimising actual losses and increasing income from improved market opportunities.

#### Fact

Between 49 % and 80% of produced food actually reaches the consumers in developing countries, the remainder falling as postharvest losses.

Researchers in the Centre of Excellence for Post-Harvest Biotechnology

## Post-Harvest Biotechnology

### Global Priority Group: Global Food Security

It is a widely known fact that the world population is estimated to reach 9.1 billion by the year 2050. In the current age, where food security is already a pressing issue, how will we feed this growing population? The Centre of Excellence for Post-Harvest Biotechnology (CEPB) is striving to find answers to this challenging question. At the CEPB, the issue of food security is re-addressed as 'where does all the produced food go?' In tropical countries an estimate of 49–80 per cent of produced food is lost during post-harvest. This large-scale wastage impacts on global nutrition as well as the economy, and is especially pertinent for small-scale farmers.

Research into post-harvest technologies to extend shelf life and maintain quality is conducted at CEPB to minimise post-harvest losses. The centre makes use of natural chemicals, such as gum arabic and chitosan, as well as innovative technologies that include nanotechnology and Cerafusion™ ion technology. These studies are conducted by a dedicated research team of postgraduate and undergraduate students, operating within a truly global environment. The extensive research conducted by CEPB is carried out in collaboration with academic, industrial and governmental bodies worldwide.

### Areas of research

Key areas of focus for our research include:

- Post-harvest physiology and biochemistry of horticultural produce
- Microbiology and pathology of horticultural produce
- Phytochemicals from fresh fruits and vegetables to improve nutrition and human health
- Use of nanotechnology in post-harvest activities
- Modified atmosphere packaging technology
- Post-harvest quality and shelf life of horticultural produce
- Bio-active compounds from herbs
- Developing edible coatings for fruits
- Developing technology for storage of fresh fruits, vegetables and herbs

### Research projects

To date, the centre has undertaken the following key research projects:

- Novel edible coatings from natural products for enhancing the storage life of banana (*Musa acuminata* L) fruit
- Chitosan-based nanoemulsion biofungicides for the control of colletotrichum gloeosporioides, causal agent of anthracnose in dragon fruit plants
- Cerafusion technology to control decay and physico-chemical responses of papaya (*marica papaya* L) fruit
- Decay development and physico-chemical responses of selected vegetables using cerafusion technology
- The antifungal effects of chitosan against fusarium wilt of organically grown tomatoes
- Antifungal activity of chitosan on anthracnose disease in postharvest banana
- Effects of chitosan in controlling colletotrichum gloeosporioides and enhancing the quality of dragon fruit (*hylocereus polyrhizus* L)
- Potential of chitosan to induce resistance in bell pepper (*capsicum annum* L) against colletotrichum capsici

- Evaluation of novel technology (MedKlinn) for sterilisation of surfaces and biological materials
- Application of Cerafusion™ Technology in postharvest studies

### Research expertise

Extensive expertise in the post-harvest handling of tropical fruits and vegetables is available at CEPB. Novel edible coatings based on natural products have been successfully developed at CEPB to enhance shelf life and maintain the quality of tropical fruits and vegetables. Articles published by researchers in CEPB on edible coatings were recently recognised as part of the 'Top 25 Hottest Articles' in their respective fields at ScienceDirect.

### Partnerships and collaborations

The centre works in collaboration with a range of research institutions, universities and industries across the globe to increase the quality and effectiveness of our research. These include collaborations with: Universities in Malaysia, the UK, Australia, New Zealand, Belgium, Germany, Italy and the USA; governmental institutes in Malaysia, Canada and Tanzania; and partnerships with key industrial figures in Malaysia, Thailand and the UK. Key partnerships include:

#### Academic

Universiti Putra Malaysia (UPM), Malaysia  
Massey University, New Zealand  
Michigan State University, USA  
Universita Politecnica de Marche, Italy  
The University of Western Australia, Australia  
Royal Holloway, University of London, UK  
Albert-Ludwigs Universität Freiburg, Germany  
University of Kuleuven, Belgium  
Atlantic Food and Horticultural Research Centre, Canada

#### Industry

Malaysian Agrifood Corporation Sdn Bhd, Malaysia  
MedKlinn International Sdn Bhd, Malaysia  
Jumbo Acacia Co Ltd BKK, Thailand  
Syngenta Ltd, Bracknell, UK  
Government  
Horticulture Research Centre (HRC), MARDI  
Serdang, Malaysia  
International Institute of Tropical Agriculture, Tanzania

### Vision

The centre was established to carry out research into post-harvest handling of perishable fruits and vegetables to overcome problems frequently encountered by the fresh produce market. At CEPB, researchers are constantly striving to develop technologies that support the reduction of post-harvest losses and prolong shelf life. The centre also aims to enhance the quality and phytochemical content of fruits and vegetables to enhance the value of fresh produce.

### Contact us

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# Sustainable Crops

## Global Priority Group: Global Food Security

The Centre for Sustainable Crops conducts high-quality basic and strategic applied research to improve crop productivity, promote agricultural diversity and reduce agriculture's environmental impact. Our research is focused in both major and underutilised food crops to generate knowledge that will contribute to improving the sustainability of food crop production.

With global population continuing to grow and food demand on the rise, strategic approaches to agricultural production are needed. Alongside plant and crop physiology, a great deal of our research is committed to crop and molecular genetics and breeding.

## Areas of research

Our research is focused on the following key areas.

- Biotechnology and breeding – focusing on molecular genetics and the use of molecular markers in crop improvement, genetic fidelity, embryogenesis, tissue culture and genetic transformation.
- Crop physiology and biotic stress – including drought resistance, plant-pathogen interactions, molecular pathology, plant diseases and pests.
- Bio-pharming and natural products – investigating gene expression in various systems including plants, bacteria and yeast and development of plant-based vaccines.
- Nutritional sciences – including probiotic and prebiotic, antioxidant capacities and nutrigenetics.
- Underutilised crops - focusing on research for development of underutilised crop plants.

## Research impact and beneficiaries

The key beneficiaries of our research will be commercial and subsistence farmers as they continue to feed the ever expanding global population while remaining mindful of environmental degradation and pollution. The work we do will help to encourage sustainability of agricultural systems and diversify our food sources, which will also benefit consumers of agricultural produce.

## Partnerships and collaborations

The Centre has strong collaborations nationally and internationally; including with Applied Agricultural Resources Sdn. Bhd (AAR), an internationally recognised centre in oil palm plantation research. This collaboration has resulted in a state-of-the-art Biotechnology Research Centre that provides facilities for high-profile biotechnology research. Centre for Sustainable Crops works very closely with the newly established Crops For the Future Research Centre, a premier international centre for research and development of underutilised crops. Other collaborators include:

- FELDA Biotechnology Centre
- Malaysian Palm Oil Board
- Universiti Putra Malaysia
- Malaysian Agricultural Research and Development Institute
- International Institute of Tropical Agriculture
- Fraunhofer's Centre for Molecular Biotechnology USA

## Strategic objectives

We enjoy close links with The University of Nottingham School of Biosciences in the UK, enabling researchers to tap into the combined expertise and facilities that exist between the two sites. The Centre aims to address challenges of global food security through research that leads to improved efficiency of crop production and increased agricultural diversity that would encourage the use of crops resilient to adverse conditions.

## Contact us

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## Fact

Food demand will rise by approximately 50% by 2030 and the global population will approach 9 billion by 2050. The need for more food must be met with the same amount of land, but using less agricultural inputs.

The centre aims to increase crop productivity, promote agricultural diversity and improve agricultures' image through the use of sustainable strategies.

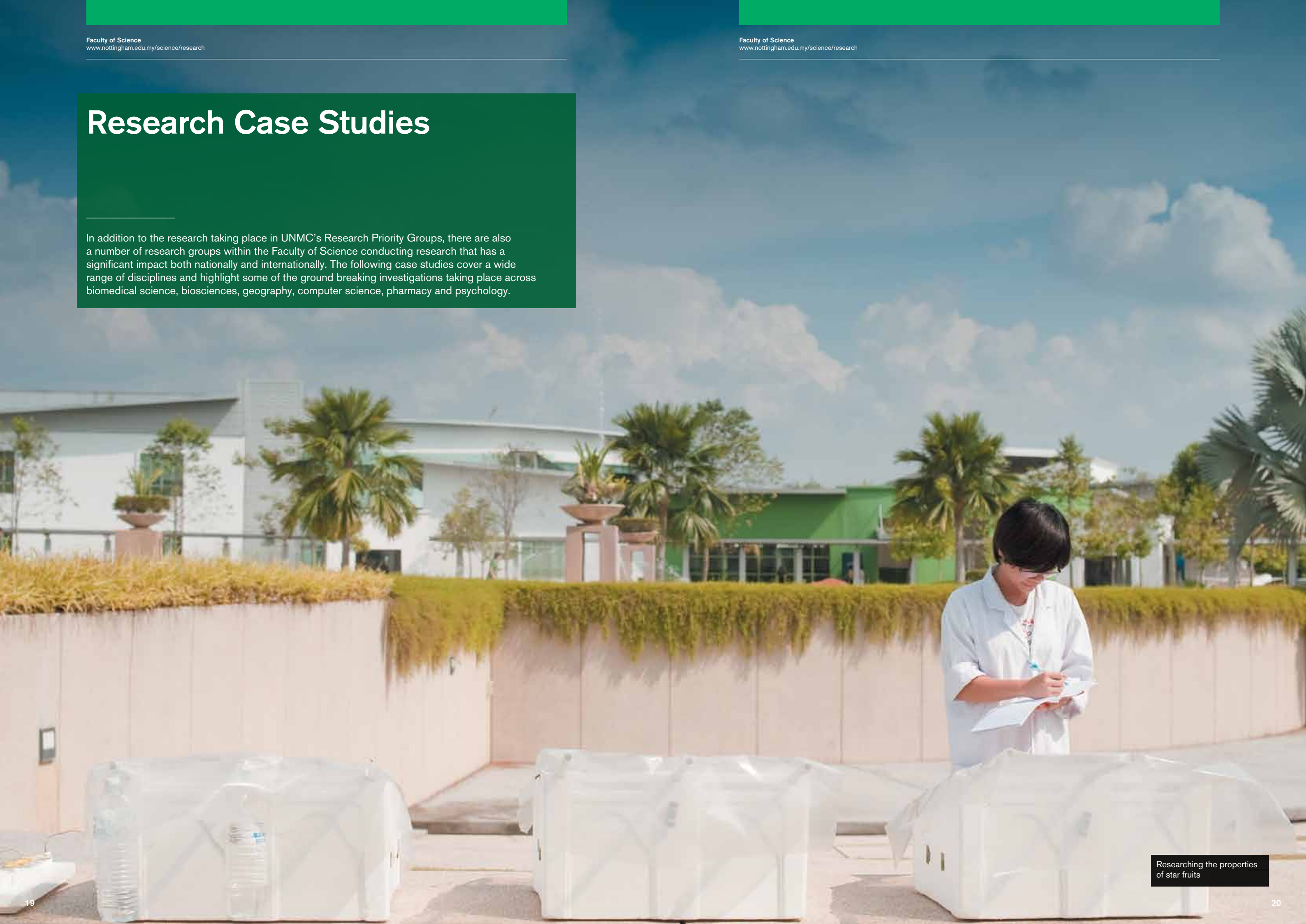


Research in the Centre for Sustainable Crops includes the development of more efficient crops.



# Research Case Studies

In addition to the research taking place in UNMC's Research Priority Groups, there are also a number of research groups within the Faculty of Science conducting research that has a significant impact both nationally and internationally. The following case studies cover a wide range of disciplines and highlight some of the ground breaking investigations taking place across biomedical science, biosciences, geography, computer science, pharmacy and psychology.



Researching the properties  
of star fruits



# Biodesign

Creating smarter and more effective medicines

The demand for organ transplants is great, but there are few donors and transplant rejection remains an ever present concern. This has led to the development of an interdisciplinary research field called regenerative medicine.

The Biodesign Research Group brings together academics from the School of Pharmacy in Malaysia and the UK. Research expertise includes drug delivery, nanoparticle formulation and computational modelling. We also work closely with The University of Nottingham UK's Advance Drug Delivery and Tissue Engineering Research Group and the Laboratory of Biophysics and Surface Analysis (LBSA). Our research is part of the €11m EU funded research project in Rational Bioactive Materials Design for Tissue Generation where 21 research teams from across Europe and Asia are working together to make medicines smarter and more effective with optimal therapeutic benefits. Smart medicines ensure safety and more effective therapy, especially in chronic illness such as cancer or tissue degeneration.

Current biomaterials are poorly suited to the needs of tissue engineering and regenerative medicine. The aim of the Biodesign research project is to develop new materials and medicines that will stimulate tissue regeneration rather than wait for the body to start the process itself. This, we plan to achieve by fabricating advanced biomaterials that match the basic structure of each tissue so the cells can take over the recovery process themselves.

Here in Malaysia we are looking at synthesising microparticles which can potentially be injected directly into a patient at the site of injury to promote tissue re-growth. These microparticles would act as a scaffold to encourage regrowth in bone tissue, skeletal muscle and potentially even cardiac muscle.

This research heralds a step-change in approaches to tissue regeneration and has potential benefits for patients requiring organ transplants, as well as those with severe burns, muscle injuries, cardiovascular problems, or broken bones that are not healing.

## Find out more

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Find out more about research in The School of Pharmacy at [www.nottingham.edu.my/pharmacy/research](http://www.nottingham.edu.my/pharmacy/research)

This research will have significant impact on patients with degenerative tissue disorders and/or cancer, with an added dimension of the possibility of incorporating anti-cancer drugs within the prototype so that tissue regeneration and anti-cancer properties can be achieved simultaneously



Watch our video to find out more about Biodesign:  
[www.nottingham.edu.my/biodesign](http://www.nottingham.edu.my/biodesign)



Scan the code to watch this video on your smartphone.



Associate Professor Andrew Morris with postgraduate research students in the School of Pharmacy.



Watch our video to find out more  
about Cognitive and Sensory Systems:  
[www.nottingham.edu.my/css](http://www.nottingham.edu.my/css)



Scan the code to watch  
this video on your  
smartphone.

Dr Neil Mennie with seven-year-old Orangutan,  
Tsunami, and zoo keeper, Sharul, at Zoo Negara

# Cognitive and Sensory Systems

Investigating the neural mechanisms underlying behaviour

The Cognitive and Sensory Systems Group (CSS) was formed in 2011 to bring together the expertise of neuroscientists from the Schools of Psychology and Computer Science at The University of Nottingham Malaysia Campus. Neuroscience addresses the questions of how psychological/cognitive functions are produced by the brain. The purpose of our research is to investigate the neural mechanisms underlying behaviour while at the same time tackling some of the current problems that exist in neuroscience.

We use a wide variety of modern techniques, including computational neuroscience, pattern recognition and image processing, the use of functional and structural MRI, EEG and eye tracking, as well as neurological case studies, psychophysics and signal detection theory. Our current areas of research interest include visuo-tactile integration and somatic misperception, psycholinguistics and neurodegenerative diseases and cognitive function in elderly people, visual attention and working memory, visual perception, active vision and neuroethology. We are also interested in computational neuroscience and how different biological neural systems solve different types of computational problems.

Our research in neuroethology endeavours to understand how the central nervous system translates biologically relevant stimuli into natural behaviour. In collaboration with the National Zoo of Malaysia, we are looking at the visuo-spatial abilities and orienting behaviour of Orangutans in free behaviour. This is a novel project that investigates these animals use of vision in conjunction with everyday actions such as tool-use and visual search with an overall goal of shedding light on the visual strategies that these critically endangered primates use to help predict changes in their surroundings.

Current PhD research projects include investigations into cross-modal integration and tactile illusions to examine the temporal dynamics of illusory tactile and bodily sensations in neurologically healthy individuals, using eye trackers to explore the role and function of anticipatory eye movements to parts of the environment that will be useful for upcoming actions, and research on the effects of mental attention on subsequent visual perception of items held in short-term memory.

The CSS collaborates with Nottingham colleagues in the UK and have active links with a number of institutions, including the Faculty of Allied Health Sciences at the National University of Malaysia (UKM), the Department of Psychology at Sunway University, The National Zoo (Zoo Negara), CercalInsights (a Contract Research Organisation), the Brain and Body Centre at the University of Nottingham (UK), and researchers at the Universities of Yale, Princeton, Ohio State, Manchester, Swansea, Glasgow and Birmingham. We aim to increase research collaborations with Malaysian Research Institutes and Universities, expanding our research portfolio in Asia while continuing to collaborate on the international stage.

## Find out more

Key project lead: Dr Neil Mennie  
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Find out more about research in The School of Psychology at  
[www.nottingham.edu.my/psychology/research](http://www.nottingham.edu.my/psychology/research)

Neuroscience is the scientific study of the nervous system, especially the brain. Using different tools, neuroscience helps us understand the senses, thought, emotion, and behaviour of many animals, including humans.



# The Management and Ecology of Malaysian Elephants (MEME)

Endangered elephants equipped with GPS and satellite phone technology

A hundred years ago wild elephants on the Malay Peninsula could be counted in their thousands – now there are less than 1500.

Using the very latest GPS and satellite phone technology, the Management and Ecology of Malaysian Elephants research project (MEME) aims to track 50 of the remaining elephants to help the Malaysian Government assess the effectiveness of their elephant conservation and management practices. Stripped of their natural habitat to make way for crops, roads and new building developments and facing wide-spread persecution for the so-called human-elephant conflict, Asian elephants are endangered due to the rapid decline and fragmentation of their populations.

Researchers will produce information on why elephants move from one location to another, how they use landscapes, where they find nutrients and how they behave in natural conditions. The project is also looking at techniques to extract information from elephant DNA and hormones.

Understanding elephant ecology and behaviour will help the Malaysian Department of Wildlife and National Parks to manage wild elephant populations in a way that maximises their well-being and long-term conservation.

The project has received a donation of RM3.36 from Sime Darby which will fund hi-tech equipment and three PhD students.

## Find out more

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Find out more about research in The School of Geography at [www.nottingham.edu.my/geography/research](http://www.nottingham.edu.my/geography/research)

If we lose many elephants, basically we will lose a unique element of the tropical ecosystems. When an elephant walks in the forest, he walks in a way that no other animal does. When they eat, they are modifying the structure of vegetation. They are releasing plant parts that will be consumed by other animals. They are dispersing seeds. They are promoting and maintaining future generations of many plant species. All this will be lost. In the end we will have a much more simplified ecosystem that is less resilient and has lost a lot of its diversity.



Watch our video to find out more about the Management and Ecology of Malaysian Elephants:  
[www.nottingham.edu.my/meme](http://www.nottingham.edu.my/meme)



Scan the code to watch this video on your smartphone.



Elephant numbers on the Malay peninsula have diminished in the last 100 years



# Face perception

How do people use the information in faces to make judgements about people? And are those judgements correct?

The human face contains a wealth of important information, such as the person's identity, age, gender, ethnic group, emotional state and health status. In the Face Perception Group we are using the latest digital imaging, health assessment and eye tracking techniques to investigate the ways in which different groups of people access this information, and the accuracy of their perceptions. This includes looking at whether individuals from different cultures and ethnic groups use facial cues differently in assessing health or recognising faces, if a person's parenting style affects their children's perception of emotion in faces, how healthy behaviours affect the appearance of our faces and bodies and if this knowledge can be used to encourage healthy behaviour, and whether autistic and neurotypical individuals use different cues to identify people and emotional facial expressions.

The potential benefits of our research are far-reaching. Our investigations into the effects of healthy behaviours on appearance and perceptions of health are being used to encourage healthy behaviours by appealing to vanity. We can use computer graphics techniques to show people the improvement in appearance that they could expect to see by making achievable changes to their diet, lifestyle choices and exercise habits. This appeal to vanity has already been adopted by at least one healthy eating company in the UK. In addition, our collaboration with the Cognitive Development Group which looks at the different face recognition strategies used by individuals with autism spectrum disorders may lead to new methods of helping people overcome their difficulties with recognising people in their everyday lives.

We also have a number of other collaborative research projects. With the School of Biosciences at UNMC we are working to identify ways in which antioxidant carotenoids from underutilised fruits get deposited in the skin and affect our skin colour. Our work with the University of St Andrews is focused on establishing how perception of aspects of faces – such as skin colour and masculinity – are perceived in different cultures. Collaborations with researchers at the University of Bristol and the University of Pretoria have established that skin colour is a more important determinant of men's attractiveness than masculinity and that the amount of disgust people feel at imagery associated with disease affects their ratings of unattractive faces, but not attractive faces. We are also examining how consumption of alcohol affects the appearance of faces.

## Find out more

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Growing up in a multicultural society gives Malaysian Chinese an advantage when recognising faces. We have found that, where most people find it harder to recognise other-ethnicity individuals, Malaysian Chinese are just as good at recognising Western faces as Asian faces.

Dr Ian Stephen conducting research on face perception

# Lung immunoregulation in influenza A virus infection

Unveiling the role of iNKT cells in fighting flu

Influenza A virus (IAV) infection is a recurring threat to the human population, and can result in severe lung injury. Much has now been characterised of the T cell response during IAV infection. T cells belong to a group of white blood cells known as lymphocytes and play a key role in cell-mediated immunity. Relatively little is known of the size, kinetics and type of innate immune response in the lungs, particularly in high-pathogenicity infections. It is also unclear how this arm of the immune response is controlled to minimise immune-pathology.

Immunoregulation is concerned with how the immune system is being regulated or modulates. Research in immunoregulation at The University of Nottingham Malaysia Campus draws together experts from a variety of disciplines, namely microbiology, molecular biology, immunology, cell culture, and genomics. It also involves collaboration with the University of Putra Malaysia, the Australian Organic Honey's Group and a close link with the Human Immunology Unit, University of Oxford. Our main research focus is on immunoregulation in the lungs and the immunomodulatory properties of natural products such as honey and plant extracts. Immunomodulators are agents that can either enhance or suppress our immune system.

Recent work done in Oxford has identified a role of iNKT cells in controlling inflammatory monocytes in the lungs and decrease immune-pathology during severe IAV infection. Invariant natural killer T cells (iNKT), a unique population of T cells that share some characteristics with natural killer (NK) cells – natural killer cells are crucial part of the immune system, providing rapid responses to virally infected cells. iNKT cells are CD1d restricted and produce a wide range of cytokines upon stimulation which affect immune cells. This research will have a huge impact on advancing the therapeutic manipulation of treatment to infectious or deadly disease.

## Find out more

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Find out more about research in the School of Pharmacy at [www.nottingham.edu.my/pharmacy/research](http://www.nottingham.edu.my/pharmacy/research)

Centre for Disease Control and Prevention (CDC) estimated that about 36,000 people died of seasonal flu-related cases each year. During the severe 1918 Spanish flu pandemic, at least 50 million people died.



Postgraduate student in the microbiology laboratory





Separation of crude extract using Sephadex LH20 to obtain active compounds.

# Pharmacognosy, Natural Products and Asian Medicine and Dietary Herbs

Securing human's supply of safe and efficacious medicines derived of plants

Pharmacognosy is the discipline covering all areas of medicinal plant research, a field of study which relies on diverse methods, but is unified by an interest in securing human's supply of safe and efficacious medicines derived of plants. Such medicines may be used as a pure compound or as a complex extract. The Pharmacology, Natural Products and Asian Medicine and Dietary Herbal Research Group combines classical ethnopharmacological methods with modern biology and pharmacology and draws on expertise in botany, ethnopharmacology, natural products, pharmacology, pharmacokinetics, toxicology, herbalism, pharmacognosy, nutrition, biological assays and agriculture.

The uses of plants in indigenous cultures are multiple and very diverse. For many people plants still form the economic basis, and are used as medicine. Over the last 16 years, we have conducted ethnobotanical studies in Asia with the aim of contributing to the development of under-utilised Asian medicinal or dietary plants into pharmaceutical, cosmetological and food products. This research enables a fuller evaluation and development of Asian medicinal or dietary plants and addresses the demand of the EU and US herbal and health food market for new high quality health supplements.

Some of our research has been undertaken in collaboration with colleagues at The University of Nottingham UK, Universiti Kebangsaan Malaysia, Songkla University and local and international businesses. Key areas of interest include the herbal potential of dietary plants, the herbal, pharmaceutical, cosmetological and nutraceutical potentials of medicinal plants, toxicological evaluation and marketing assessment of herbs, natural products and dietary products, and the domestication of wild herbs as crops. We are also engaged in phytochemical analysis, in vitro and in vivo substantiation of medicinal or dietary herbs, and pharmacokinetics of natural products, in addition to consultancy and public engagement.

## Find out more

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[www.nottingham.edu.my/biomedicalsciences/research](http://www.nottingham.edu.my/biomedicalsciences/research)

Billion USD are spent each year in a growing medicinal plant market.



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# MPhil and PhD opportunities

There are a number of MPhil and PhD opportunities within all Schools in The Faculty of Science. If you are interested in doing an MPhil or PhD at The University of Nottingham Malaysia Campus we recommend that you contact the relevant research supervisor to discuss your research project proposal in the first instance. You will find a list of academic staff members on each School's website. Visit our applications page to find out how to apply at [www.nottingham.edu.my/applications](http://www.nottingham.edu.my/applications)