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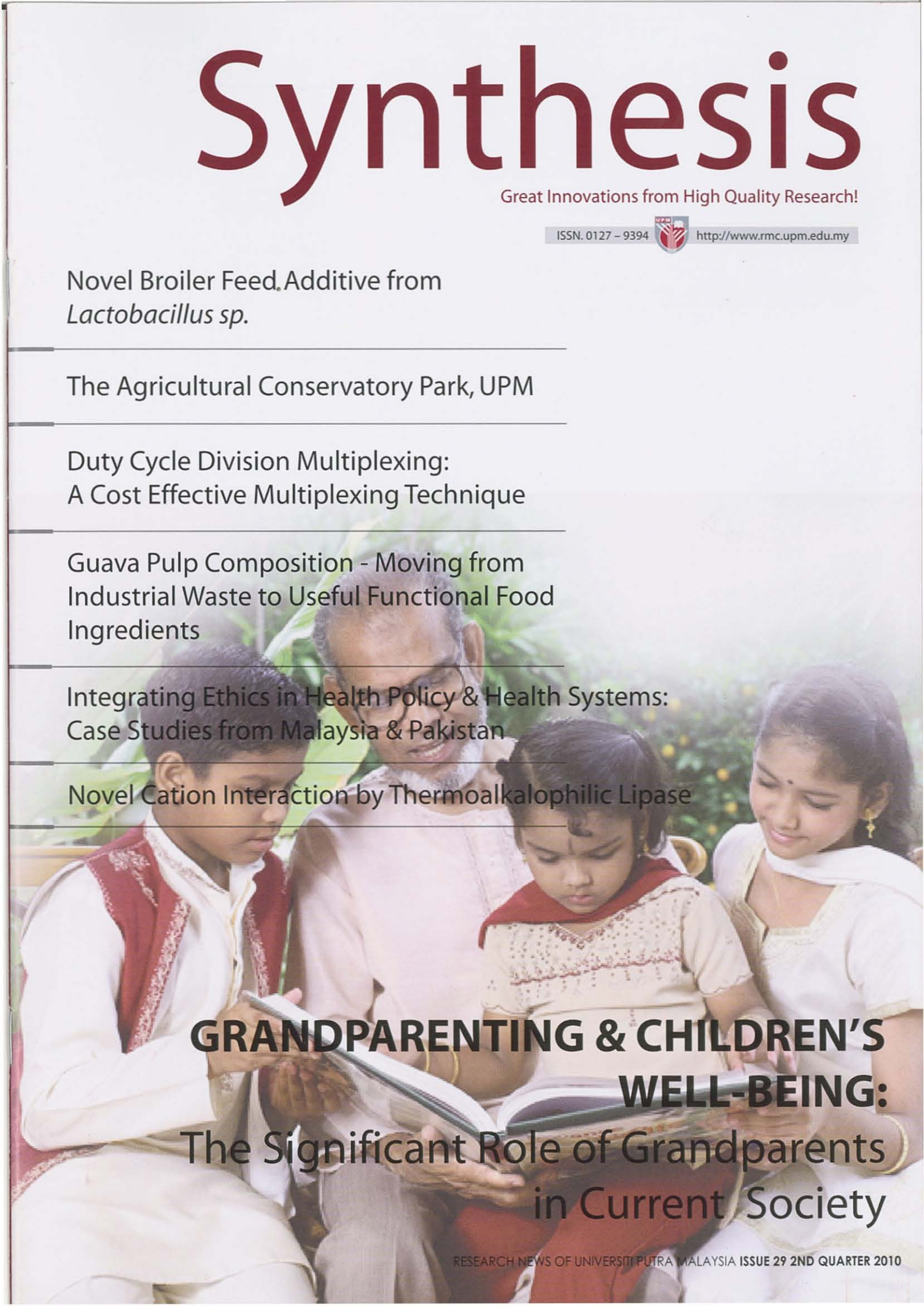
The Agricultural Conservatory Park, UPM

Duty Cycle Division Multiplexing: A Cost Effective Multiplexing Technique

Guava Pulp Composition - Moving from Industrial Waste to Useful Functional Food Ingredients

Integrating Ethics in Health Policy & Health Systems: Case Studies from Malaysia & Pakistan

Novel Cation Interaction by Thermoalkalophilic Lipase



GRANDPARENTING & CHILDREN'S WELL-BEING:

The Significant Role of Grandparents in Current Society

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- *Halal* Collagen from Freshwater Fish Skins
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Synthesis is the only quarterly R&D&C bulletin of Universiti Putra Malaysia published in March, June, September and December. It focusses on award-winning innovations and high impact publications. It covers research happenings that emerged from the various faculties and institutes across the university and provides a brief summary of some of the important research findings by UPM. It features special topics that are of national interest in various fields and disciplines.

Scientists must be made aware of the impact of their work and its possible applications to the society and public. It is hoped that this bulletin will provide the opportunity to interact, particularly through feedback or direct mail, with the scientists from either the private sector or other government research institutions.

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If you have any comments about the content of the publication or contributions for the forthcoming issues, please send them to: The Editors, *Synthesis*, Publication Division, Research Management Centre, Tower II, UPM-MTDC Technology Centre, 43400 UPM, Serdang, Selangor, Malaysia or e-mail to fatimah@rmc.upm.edu.my. The editors reserve the right to edit articles before publication.

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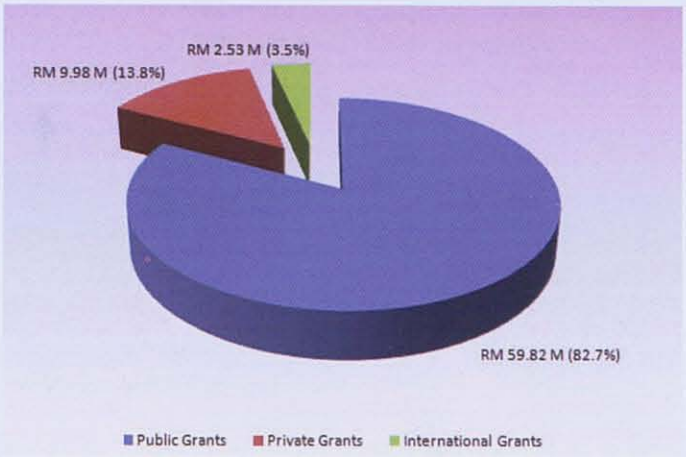
Facts & Figures 2010

RESEARCH FUNDING

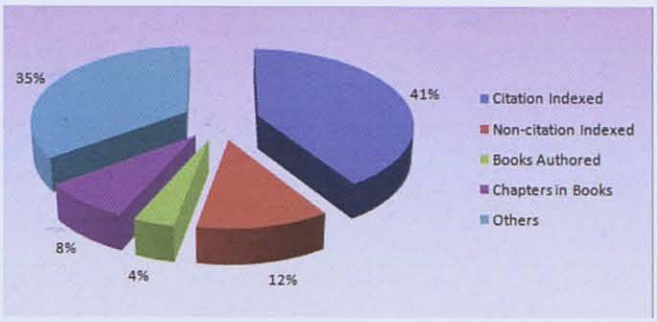
UPM has maintained its lead in research funding amongst other Malaysian universities. As of 2009, the available data indicated that the university had received research grants of various categories from the government, private as well as international sources amounting to almost RM 73 million.

Graph 1: Research Grants (RM million)



(Figures as of Dec. 2009, Source: Knowledge Management Division, RMC)

R&D PUBLICATIONS



Besides promoting research, UPM has emphasised the importance of publishing research findings in international journals. It is noteworthy that in 2009, UPM's scientists had published over 2,359 papers with 1,820 papers in citation indexed journals and 539 papers in non-citation indexed journals, and 1,560 papers in conferences and proceedings as in **Table 1**.

Table 1: R&D Publications

Category	Number of Publications
Journals	
Citation Indexed	1,820
Non-citation Indexed	539
Books Authored	166
Chapters in Books	368
Others	1,560
Total	**4,453**
Publication in Citation-indexed Journals (High Impact Journals)	**2009**
Cumulative Impact Factor (IF)	698.832
High Impact Journals with IF 3.0 and Above	35

(Figures as of Dec. 2009, Source: Knowledge Management Division, RMC)

RESEARCHERS' ACHIEVEMENTS AND AWARDS

Table 2: R&D&C Awards and Achievements

Category	Awards
International Exhibition Awards	26
National Exhibition Awards	70
International Special Awards	2
National Special Awards	4
UPM Invention & Research Awards	438
Total	**540**

(Figures as of Dec. 2009, Source: Promotion Division, RMC)

UPM scientists continue to win prizes and awards at the national and international exhibitions world-wide. The university's position as an outstanding research organisation is affirmed with its garnering of numerous international accolades. The many international and regional awards won in 2009, which only the prominent ones were featured, covered a broad range of research areas, enhancing the university's contribution to knowledge in science and technology (see **Table 2**).

Grandparenting & Children's Well-being:

The Significant Role of Grandparents in Current Society

With diversifying families, increased life expectancy, growing numbers of dual-worker households and higher rates of family breakdown, grandparents are now playing an increasing role in their grandchildren's lives. Statistics show that men and women may spend longer time in life being grandparents (average 25 years) than being parents with children responsibilities (18 years). Grandparents have always been central to provide support for families, particularly in times of need or family crisis, and there is growing evidence that grandparents today are playing an increasing role in rearing and supporting young children. As a consequence, grandparenthood and its associate roles are achieving growing prominence. Although there is considerable research on kinship care and some from the parents' perspective, there are still limited findings from the children's perspective on their involvement with their grandparents (i.e.: what grandparents 'normally' do) and how this impacts on their well-being.

Expert's Snapshots

Dr. Tan Jo-Pei joined Universiti Putra Malaysia as a Senior Lecturer in 2008, having attained her MPhil in the Social and Developmental Psychology at University of Cambridge and DPhil in the Evidence-based Social Interventions at the University of Oxford. Her research interests focus on family studies and parenting, intergenerational relations and psychological outcome of mixed-parentage children. Her research efforts and international networking have led to several collaborative projects with local and overseas partners, including the Dept. of Social Policy and Social Work, University of Oxford, UK; Dept. of Psychology, University of Maryland, US; School of Social Work and Social Welfare, Hebrew University of Jeruselam, Israel; Social Welfare Dept. of Malaysia and local universities. She is also currently a member at the Centre for Parenting and Children, University of Oxford, United Kingdom.

This study surveyed 1,596 children between the age of 11 to 16 years in schools across England and Wales and undertook in-depth interviews with 40 children. These young people completed a questionnaire in their classrooms, including providing details of personal and family background information. The children reported on the characteristics of their grandparents and the role of the parents in supporting that relationship. Interviews were transcribed and coded using Nvivo. The study sought to answer some of the key questions: To what extent are grandparents involved in young people's lives and what factors are associated with this involvement? What impact does this involvement have on grandchildren's emotional and behavioural well-being? To what extent do grandparents help or hinder the grandchildren's adjustment at times of family breakdown? To what extent do grandparents reduce the impact on grandchildren's well-being of family adversity?

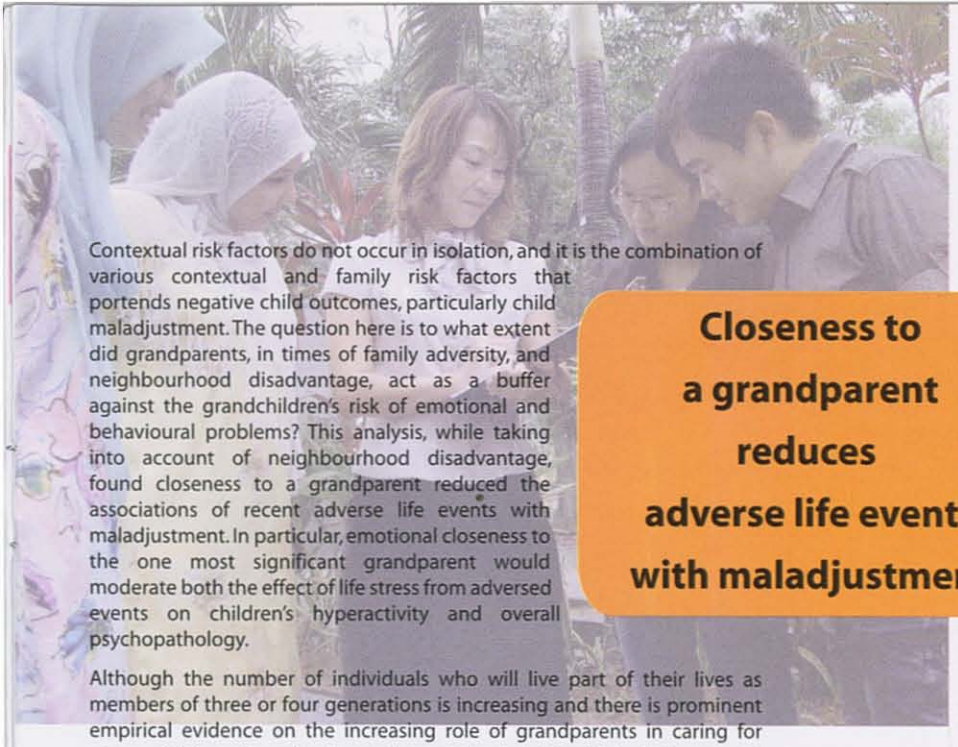
The extent of grandparental involvement was surprising. It was found that more than 80% of the children saw their grandparents on a regular basis. Almost a third of maternal grandmothers provided regular caretaking for their grandchildren while another 40% provided occasional caretaking. In other words, maternal grandparents were the most active grandparents in children's lives as compared to other grandparents. Most grandparents provided regular financial support or other assistances. In addition, there was considerable involvement from grandparents in sharing young people's interests and activities, and talking about future plans. They were also involved in helping to solve the young people's problems and taking part in school activities. A range of factors in the wider ecology of children predicted grandparents' involvement: the child's age, living in a less deprived area, frequent contact, good grandparents' health and grandparent-grandchild closeness. Interestingly, proximity is not necessarily important as young people nowadays use modern technology to communicate. Parents act as 'gatekeepers' to grandparental involvement. Grandchildren, nevertheless, feel grandparents became closer when they undertake some traditional parenting tasks (i.e.: caretaking).

Active grandparenting may enhance well-being

The second question considered whether the high level of grandparental involvement impacted on the grandchildren's well-being. To date, research has been ambivalent showing that grandparents with high level of grandchildren's commitments can experience severe depression, and this may affect the children, and that adolescents become less close to their grandparents as they get older. In this study, it was interesting that a grandparent's active involvement was significantly associated with better adjusted adolescents. In particular, taking part in various aspects of their grandchildren's lives (such as hobbies and interests, schooling or education, talking to grandparents about future plans) was significantly associated with fewer emotional and behaviour problems, and fewer peer problems. In-depth interviews showed that grandparents were often regular attendees at school events, providing emotional support and 'cheerleading' their grandchildren as well as sharing hobbies with their grandchildren. Helping with homework was also a key form of involvement where many grandparents played a role as educators, as homework assistants and as general supporters. A strong theme was the role grandparents played during time of difficulty or crisis. Some grandchildren also reported that it was easier to open-up to their grandparents than their parents.

Grandparents are becoming more significant in providing childcare

Under the law in England and Wales, grandparents have no legal rights over their grandchildren. A study in 2003 of 44 families involved in divorce proceedings concluded that grandparent-grandchild post-divorce contact did not have an 'essential purpose or fundamental importance' which would justify an enhanced legal status for grandparents. While, similar family law is practiced for non-Muslim families in Malaysia where grandparents are not listed as the legal guardian of their grandchildren; the Islamic Law, however, explicitly noted that grandparents, in particular maternal grandparents, have legal rights on their grandchildren when the mother loses or gives up her rights for custody. In this current study, it was found that there were no differences in the level of grandparental involvement across different family structures (i.e.: two-parent biological, lone-parent and step-families). However, grandparents' involvement was strongly associated with reduced adjustment difficulties in all family types but particularly so amongst adolescents from non-intact families.



Contextual risk factors do not occur in isolation, and it is the combination of various contextual and family risk factors that portends negative child outcomes, particularly child maladjustment. The question here is to what extent did grandparents, in times of family adversity, and neighbourhood disadvantage, act as a buffer against the grandchildren's risk of emotional and behavioural problems? This analysis, while taking into account of neighbourhood disadvantage, found closeness to a grandparent reduced the associations of recent adverse life events with maladjustment. In particular, emotional closeness to the one most significant grandparent would moderate both the effect of life stress from adversed events on children's hyperactivity and overall psychopathology.

Closeness to a grandparent reduces adverse life events with maladjustment

Although the number of individuals who will live part of their lives as members of three or four generations is increasing and there is prominent empirical evidence on the increasing role of grandparents in caring for young children, the role of grandparents is almost invisible in the current family policy. Individual families may have different relationships with grandparents. However, the overall findings from this study suggested that the implications of the policy regarding the important role that grandparents are playing need to be reconsidered and highlighted.

Tan, J-P., Buchanan, A., Flouri, E., Attar-Schwartz, S. and Griggs, J., 2010. Filling in the Parenting Gap? Grandparental Involvement with UK Adolescents. Journal of Family Issues (USA), Vol. 31, 992-1015.

Flouri, E., Buchanan, A., Tan, J-P., Griggs, J. and Attar-Schwartz, S., 2010. Adverse Life Events, Area Socio-Economic Disadvantage and Adolescent Psychopathology: The Role of Closeness to Grandparents in Moderating the Effect of Contextual Stress. Stress: The International Journal on the Biology of Stress (Netherland), Vol. 13(5), 402-412.

Attar-Schwartz, S., Tan, J-P. and Buchanan, A., 2009. Adolescents' Perspectives on Relationships with Grandparents: The Contribution of Adolescent, Grandparent and Parent-grandparent Relationship Variables. Children and Youth Services Review (USA), Vol. 31, 1057-1066.

Griggs, J., Tan, J-P., Buchanan, A., Attar-Schwartz, S. and Flouri, E., 2009. 'They've Always Been There For Me': Grandparental Involvement and Child Well-being. Children & Society (UK), Vol. 24, 200-214.

Attar-Schwartz, S., Tan, J-P., Buchanan, A., Flouri, E. and Griggs, J., 2009. Grandparenting and Adolescent Adjustment in Two-parent Biological, Lone-parent and Step-families. Journal of Family Psychology (USA), 23 (1), 67-75.

Five papers have been published in ISI Impact Factor journals based on the findings from the current research. The research project was funded by the Economic and Social Research Council (ESRC), UK and led by Professor Ann Buchanan from the University of Oxford and Dr. Eirini Flouri from the Institute of Education, UK.

Young Researcher Award UPM *(Social Sciences and Humanities - API 2009)*
GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2005)*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2005)*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2005)*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2005)*

Picture on the cover:
"Reading to Grandchildren" Seniors @ eCitizen. Retrieved October 26, 2010 from http://seniors.gov.sg/LeisureNVolunteerism/

Picture on the fifth page:
"Chinese Grandparents with their Grandchildren" VHamster's Profile. Retrieved October 26, 2010 from http://vhamster.glogster.com/

Reader Enquiry
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Integrating Ethics in Health Policy & Health Systems:
Case Studies from Malaysia & Pakistan

Title : Integrating Ethics, Health Policy and Health Systems in Low- and Middle-income Countries: Case Studies from Malaysia and Pakistan
Author : Hyder A. A., Merrit M., Ali J., Tran N. T., **Subramaniam K.** and Akhtar, T.
Journal : Bulletin of the World Health Organisation
Volume : 86
Issue : 8
Page : 606 - 611
Impact Factor: 5.029

Scientific progress is a significant basis for change in public-health policy and practice, but the field also invests in value-laden concepts and responds daily to sociopolitical, cultural and evaluative concerns. The concepts that drive much of public-health practice are shaped by the collective and individual mores that define social systems. This study seeks to describe the ethics processes in play when public-health mechanisms are established in low- and middle-income countries (LMICs), by focussing on two cases where ethics played a crucial role in producing positive institutional change in public-health policy.

Impact Factor: 5.029

Health systems are all the activities which have a primary purpose in promoting, restoring or maintaining health. Health policy-making and public-health practice in LMICs involve complex processes where a mix of experiences, politics, evidence, finance, values and ethics all interweave; the failure of any of the components can be fatal to any policy. Drawing from previous works, we propose that ethics can also be viewed and studied more broadly as an integral component of the health systems development. In this form, ethics is an organisational and development-oriented force that provides both methodological and motivational support to public-health practitioners and policy-makers. Crucial to this conceptualisation of ethics, through the lens of public-health and health systems, is the knowledge of society and social institutions, which differs from the knowledge of diseases or nature-society interactions.

Three core concerns in public-health ethics frequently arise at the formative stages of public-health policy development: prevention, accountability and social justice. By emphasising these three concerns, we seek to extend, not to replace, leading conceptual frameworks to better reflect the experiences of public-health professionals working in LMICs. The main professional role assigned to public-health policy-makers and practitioners is to decide how to use and direct the suite of available public-health institutions. Ethics is typically viewed as a tool to inform and constrain such decisions. By contrast, public-health professionals in LMICs often need to make decisions about which public-health institutions ought to be constructed or reformed, and in what form, while at the same time attempting to use those institutions.

Thus, researchers and policy-makers have negotiated a mutually beneficial research direction. This can be seen in an analysis of a programme to enhance road safety in Malaysia and an initiative to establish a national ethics committee in Pakistan. A cardinal achievement of the Malaysia road safety initiative was to engage the joint efforts of policy-makers and researchers around a shared public health goal: reducing motorcycle crashes, injuries and fatalities through preventive practices. In particular, policy-makers and researchers negotiated a shared approach to collect and interpret relevant evidence. This approach supported accountability in (i) the allocation of limited public resources, and (ii) the formation and use of an evidence base. In the other case study, the two salient concerns of public-health ethics in our Pakistan case are social justice as a background motivation and accountability as the primary operational objective. The formation of Pakistan's National Bioethics Committee (NBC) resulted from the Pakistan Medical Research Council's active involvement in documenting the under-distribution of global health research benefits to populations in LMICs. While this disparity might be seen as a failure of social justice on a global scale, redressing the 10/90 gap, a term given to the disparity that approximately only 10% of the world's expenditure on health research and development seems to be devoted to problems relevant to the poorest 90% of the world's population, is actually a matter of domestic social justice, i.e. of how the benefits and burdens of social cooperation are distributed within each sovereign state. Closing the gap would require governments of LMICs, such as Pakistan, to participate dramatically in increasing the amount of health research undertaken for the benefit of their own populations.

We conclude that while ethics are gradually being integrated into public-health policy decisions in many developing health systems, ethical analysis is often implicit and undervalued. The rapidly evolving nature of public-health systems in LMICs necessitates substantial use of novel approaches to study and improve existing processes. This study highlights the need to analyse public-health decision-making from an ethical perspective.

Figure 1: The Alarming Rate of Road Traffic Fatalities and Injuries Lead to Road Safety Initiative

N. T. Tran, A. A. Hyder, S. Kulanthayan, S. Singh and R. S. R. Umar, 2009. Engaging Policy Makers in Road Safety Research in Malaysia: A Theoretical and Contextual Analysis. Health Policy, 90 (1), 58-65.

S. Kulanthayan, A. R. Raha, T. H. Law and R. S. R. Umar, 2004. Seat Belt among Car Users in Malaysia. IATSS Research, 28 (1), 19-25.

S. Kulanthayan, A. Razak and E. Schenk, 2010. Driver Characteristics Associated with Child Safety Seat Usage in Malaysia: A Cross-sectional Study. Accident Analysis & Prevention, 42, 509-514.

T. H. Law, R. S. R. Umar, S. Zulkaurnain and S. Kulanthayan, 2005. Impact of the Effect of Economic Crisis and the Targeted Motorcycle Safety Programme on Motorcycle-related Accidents, Injuries and Fatalities in Malaysia. International Journal of Injury Control and Safety Promotion, 12 (1), 9-21.

S. Kulanthayan, Phang W. K. and Hayati K, 2007. Traffic Light Violation among Motorists in Malaysia. Journal of International Association of Traffic and Safety Sciences Research, Japan, 31(2), 67-73.

Reader Enquiry
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Title : Novel Cation Interaction Revealed by Crystal Structure of Thermoalkalophilic Lipase
Author : Hiroyoshi M., Takahiko Y., Leow T. C., Salleh A. B., Mahiran B., Tsuyoshi I., Yasushi K. and **Rahman R. N. Z. R. A.**
Journal : Proteins: Structure, Function and Bioinformatics
Volume : 70
Issue : 2
Page : 592 - 598

Impact Factor: 3.73

Novel Cation Interaction by Thermoalkalophilic Lipase

An extracellular lipase (T1 lipase) from *Geobacillus zalihae* strain T1 is a thermoalkalophilic enzyme that is isolated from palm oil mill effluent (POME) in Malaysia. T1 lipase conserves the classical Ser-His-Asp catalytic triad, which is very common in lipase families. This enzyme is a secreted protein that catalysed the hydrolysis of long-chain triglycerides into fatty acids and glycerol at the interface between water and insoluble substrate at high temperature (~70°C). Since the POME contains a high concentration of alkali metals (e.g.: more than 50 mM of K^+), the T1 lipase has the potential to catalyse the hydrolysis under distinctive conditions (e.g.: in organic solvent, at high temperatures and at high concentrations of alkali metals). Herein, we have crystallised wild-type and mutant F16L T1 lipase in the presence of alkali metal cations (both Na^+ and K^+), and have determined both crystal structures at 1.5 and 1.8 Å resolution, respectively. The resolved structures revealed that a unique Na^+-π interaction with Phe16 was only observed in the wild type T1 lipase. Therefore, in addition to the electrostatic and induction interaction between cation and lone-pair electrons of nitrogen and oxygen, the cation-π interaction is vital for the coordination of metal ions in the T1 lipase.

Impact Factor: 3.73

The final models of wild-type and F16L mutant enzymes both include 776 amino acid residues (for two molecules), two Zn^{2+}, two Ca^{2+}, two Cl^- ions (for two molecules). Although the wild-type T1 lipase contains 1148 water molecules in addition to two alkali metal cations (probably Na^+, vide infra), the mutant F16L contains smaller number of water molecules (686 H_2O) and more notably no metal ions. It was unexpected that Cl^- ions were observed in both structures **[Figure 1 (B)]**, which have never been reported in the structures of lipases. The asymmetric unit of the crystal contains two copies of the T1 lipase. The overall structure is globular in shape, with a central β-sheet consisting of seven strands surrounded by 13 α-helices and 10 3_{10}helices and loops, which results in an overall topology of a typical α/β hydrolase canonical fold **[Figure 1 (A)]**. Lipases are generally known to adopt a closed or open conformation. The structure of the current T1 lipase shows a closed conformation and the active site is buried inside the molecule.

R. N. Rahman, T. C. Leow, M. Basri and A. B. Salleh, 2007. *Geobacillus zalihae sp. nov.* Strain T1T, A Thermophilic Lipolytic Bacterium Isolated from Palm Oil Mill Effluent in Malaysia. BMC Microbiology, 7, 77.

T. C. Leow, R. N. Rahman, M. Basri and A. B. Salleh, 2007. A Thermoalkaliphilic Lipase of *Geobacillus sp.* T1. Extremophiles 11, 527-535.

T. C. Leow, R. N. Rahman, M. Basri and A. B. Salleh, 2007. High Temperature Crystallisation of Thermostable T1 Lipase. Crystal Growth and Design, 7, 2, 406-410.

R. N. Rahman, T. C. Leow, M. Basri and A. B. Salleh, 2005. Secretory Expression of Thermostable T1 Lipase through Bacteriocin Release Protein (BRP). Protein Expression and Purification, 40, 2, 411-416.

T. C. Leow, R. N. Rahman, M. Basri and A. B. Salleh, 2004. High Level Expression of Thermostable Lipase from *Geobacillus sp.* Strain T1. Bioscience Biotechnology and Biochemistry, 68, 1, 96-103.

GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2008)*
GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
GOLD *Malaysia Technology Expo (MTE 2006)*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2007)*
SILVER *Expo of Science, Technology and Innovation 2004*
SILVER *UPM Invention, Research & Innovation Exhibition (PRPI 2003)*
BRONZE *UPM Invention, Research & Innovation Exhibition (PRPI 2002)*

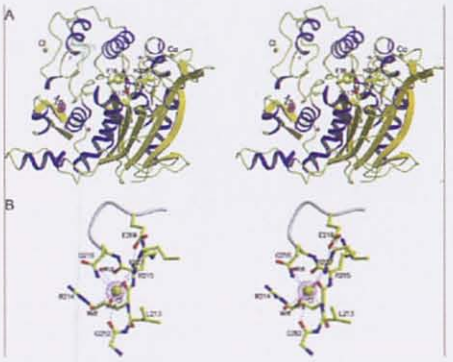

Figure 1: (A) Stereo Diagramme of the Wild-type T1 Lipase Structure;

and

(B) Close-up View of Cl^2.

During crystallographic refinement of the wild-type T1 lipase, the metal-free model phased ($2F_{obs}$-F_{calc}) map indicated an existence of an additional atom near the aromatic ring of Phe16 **[Figure 2 (A)]**. The electron density looks spherical, and an aromatic ring of Phe16 faces toward the peak of the electron density. The 1.5 Å resolution map revealed that a specific atom tightly interacts with the aromatic π-system of Phe16. Since the crystallisation buffer contains a high concentration of alkali metal cations (600 mM of Na^1 and 100 mM of K^+, respectively) but with no divalent cations, this atom is likely either alkali metal cation or water molecules.

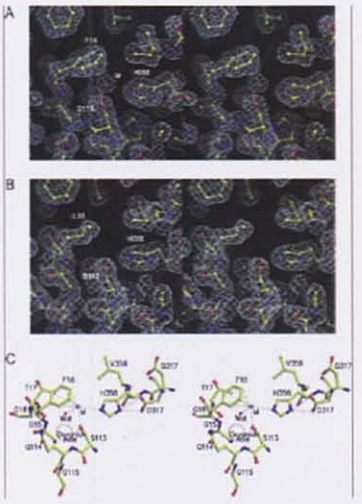

Figure 2: (A) Close-up View of Electron Density Map of the Wild-type T1 Lipase;

and

(B) the Mutant Enzyme F16L

while

(C) is the Alkali Metal Cation Binding Site.

To the best of our knowledge, this is the first direct observation of the Na^+ ion coordinated with the π-system of phenylalanine ring in protein structures, while the Na^+ ion coordinated with the π-system of tryptophan ring has been observed in HEW lysozyme and thermophilic triosephosphate isomerase mutant. To further confirm the positive contribution of the side chain of Phe16 for the present cation-π interaction, we have also solved the crystal structure of mutant F16L T1 lipase at 1.8Å, which were prepared and crystallised similarly to the wild-type enzyme. Although the resolution was slightly lower (1.8Å), we found almost zero electron density in mutant F16L enzyme at the position corresponding to the metal ions in the wild-type enzyme **[Figure 2 (B)]**. Since the site was located inside the molecule, a possible artifact by the crystal appreciably packing could be excluded. Therefore, this observation confirms that the side chain of Phe16 contributes to the binding of the alkali metal ion in the protein structure.

Reader Enquiry
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Duty Cycle Division Multiplexing: A Cost Effective Multiplexing Technique

Demands for data increase exponentially every year. To satisfy these demands, scientists need to find ways to increase the transmission speed while maintaining the operation expenditure (OPEX) at a reasonably acceptable value. Since 1990, Wavelength Division Multiplexing (WDM) has been the technology of choice to increase the bandwidth due to its simplicity. Today, the WDM is a mature technology, which is used in backbone networks across the globe. As the technology grows, scientists start to realise that the capacity of the WDM channels is not optimally utilised, which gives birth to the ideas of locating more data in every single channel by taking advantage on the characteristics of polarisation, phase and code. These proposals seem to show some promises but limited to the additional transmitter and receiver cost, beside the transmission line impairments. With polarisation, only two users can be carried per WDM channel, which also applies to phase. With code, on the other hand, large spectrum bandwidth is needed that leads towards less tolerance to fibre impairments.

Considering all issues, we have come out with a system which is based on duty cycle namely the Duty Cycle Division Multiplexing (DCDM). By allocating different duty-cycle values to represent different users, this technique is able to multiplex and carry more than two users over a single WDM channel. This achievement has opened up a new paradigm in the telecommunication industry and made the technique one of the competing alternatives. At the same time, the multiplexing and demultiplexing processes are fully electronics, which make the technique economic, and can be realised by using off-the-shelves component. This helps to put the product very close to the market.

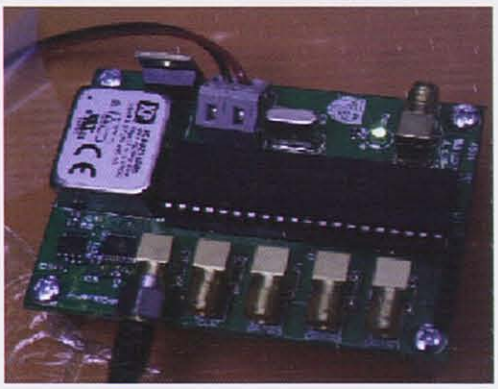

Figure 1: The DCDM Transmitter Prototype

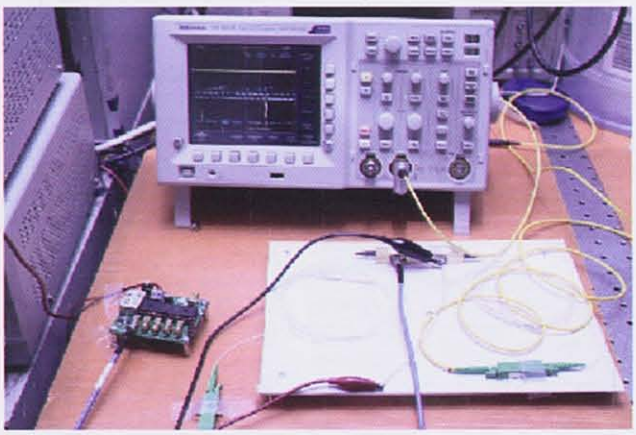

Figure 2: A Laboratory Setup

The targeted end users are the telecommunication providers. In Malaysia, companies like Telekom Malaysia, Celcom, Maxis, Time and Fiberail can be potential candidates to adopt this technique. As for now, the Photonics and Fibre Optics Laboratory, Universiti Putra Malaysia, has developed a prototype for both the transmitter and receiver of the technique. This invention is also a Patent Pending product with the file number PI 20095256. This shows our commitment to push this product to the market, which is not far from reality. The DCDM is hoped to become the 'Serdang child' that can bring great revenue to the country.

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GOLD *World Exhibition on Innovation, Research and New Technologies (EUREKA - INNOVA 2009)*

SILVER *Malaysia Technology Expo (MTE 2009)*

Patent Pending: PI 20095256

Reader Enquiry
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Novel Broiler Feed Additive from *Lactobacillus sp.*

In modern animal farming, various methods have been explored to improve animal health and growth performance, such as better husbandry management, nutrition and utilisation of feed additives. Growth promoting antibiotics are the commonly used feed additives due to their positive effects on growth and the reduction of incidence of certain diseases. However, the extensive use of antibiotics may cause resistance or cross resistance to a number of pathogenic bacteria species. Therefore, there is a great urgency to reduce the usage of antibiotics as growth promoters where alternative compounds that are environmentally friendly and ease in farm application need to be explored.

It has been reported that metabolites produced by lactic acid bacteria containing bacteriocin and organic acids, which are commonly used as food preservatives, can be used as feed additives to replace the growth promoting antibiotics. In this project, the effects of probiotic metabolites produced by six strains of *Lactobacillus sp.* isolated from local food were investigated. These probiotic metabolites were mixed and formulated to be targeted to specific pathogens and applied in animal feeding as feed additives in order to replace in-feed antibiotics in livestock industry, particularly in the production of meat producing livestock, such as poultry. The growth performance and feed conversion efficiency of broiler chickens were enhanced substantially when the mixture of the probiotic metabolites was fed compared to a single strain of the probiotic metabolites. Besides that, the probiotic metabolites also improved intestinal health and environment which subsequently would increase the population of beneficial bacteria, vice-versa for the pathogen population in the gut of broiler chickens.

Furthermore, other benefits have also been reported including effects of antibacterial properties, immune-stimulation and production of bioactive materials. Research on the effects of probiotic metabolites on growth performances and value added products are important to warrant successful application in the animal feed industry. The success of the usage of these locally produced probiotic metabolites as animal feed additives will not only give a significant impact on reducing the importation bills of feed supplements, but most importantly will reduce the usage of growth promoting antibiotics as feed additives in our venture to promote the concept of "Green Agriculture".

Figure 2: Antimicrobial Activity of Probiotic Metabolites

Figure 3: Feed Mixed with Probiotic Metabolites

Picture 1: Liquid Probiotic Metabolites

N. T. Thanh, T. C. Loh, H. L. Foo, Bejo, M. H. and A. Kasim, 2009. Effects of Feeding Metabolite Combinations produced by *Lactobacillus plantarum* on Growth Performance, Faecal Microbial Population, Small Intestine Villus Height and Faecal Volatile Fatty Acids in Broilers. British Poultry Science. 50,298-306.

T. C. Loh, F. L. Law, H. L. Foo, Y. M. Goh and I. Zulkifli, 2009. Effects of Feeding Fermented Fish on Egg Cholesterol Content in Hens. Animal Science Journal. 80, 27-33.

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GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2009)*
GOLD *International Exposition of Research and Inventions of Institutions of Higher Learning (PECIPTA 2009)*
Patent Pending: *PCT/MY2009/000050*

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Malaysia Green Forum Imposes New Impact on the Quality Issue of Landscape

1. Tun Jeanne Abdullah delivering her speech during the Malaysia Green Forum 2010.
2. Tun Jeanne Abdullah (second from right) with Prof. Datin Paduka Dr. Aini Ideris, Deputy Vice Chancellor (Academic and International) (third from left) watching the Malaysia Green Forum 2010 gimmick.

Natural Gas Vehicle (NGV) Front Platform

1. Prof. Dr. Barkawi clarifying the functions of each component in the Natural Gas Vehicle (NGV).
2. A close-up view of the components in the engine area.

UPM Inks MoU with University of Queensland

1. The Dean from the Faculty of Biotechnology and Biomolecular Sciences, Prof. Dr. Mohd. Ali Hassan (first from left) is present to witness the signing of the MoU.
2. A firm handshake to seal the MoU.
3. The Vice Chancellor of UPM (second from left) exchanging MoU documents with the Vice Chancellor of University of Queensland (second from right).

3. Prof. Dr. Barkawi (left) explaining the NGV to the Deputy Vice Chancellor (Research and Innovation), Prof. Dato' Dr. Abu Bakar Salleh.
4. The front platform to place two cylindrical natural gas tanks to save bonnet space.

R&D&C HAPPENINGS

UPM Collaborates with RISDA for an Agricultural Expansion Deal

1. Among the dignitaries present.

2. The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah (second from left) exchanging documents with the Head Director of Rubber Industry Smallholders Development Authority (RISDA), Dato' Mohammad Izat Hassan, witnessed by the Chairman of RISDA, Tan Sri Rahim Tamby Chik (centre).

UPM Develops Agricultural Technology for Farmers

1. Agriculture and Agro-based Industry Minister, Datuk Seri Noh Omar eying the exhibited agriculture products.

2. Dr. Rosnah Shamsudin explaining about the Pineapple Multi-peeler Plus to Datuk Seri Noh Omar and the Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah (far left).

3. Datuk Seri Noh Omar (centre) trying out one of the exhibited products.

4. An interested participant listening attentively to the explanation given by a representative of UPM.

World Engineering Congress 2010 (WEC 2010)

1. The press conference on the 4th World Engineering Congress 2010 (WEC 2010) themed "Engineering and Technology for Global Stability and Security".

2. Prof. Dato' Abang Abdullah Abang Ali (second from left), Datuk Ir. Daud Abdul Rahman (second from right) and Assoc. Prof. Ir. Megat Johari Megat Mohd. Noor (far right) answering questions by the media.

3. mSET President, Prof. Dato' Ir. Abang Abdullah Abang Ali elaborating on his points.

NewsBriefs

Putra Science Park Enhances UPM's Reputation as a Research University

Ministry of Higher Education (MoHE) regarded the establishment of Putra Science Park by Universiti Putra Malaysia as the university's serious effort to increase its reputation as a Research University (RU) as noted by the Higher Education Minister, Dato' Seri Khaled Nordin.

He said with its strategic location, which is surrounded by the Multimedia Super Corridor, Putrajaya, Cyberjaya and KLIA, Putra Science Park is seen as the best catalyst to ensure UPM's continuous achievement as a research university. "I believe UPM has shown remarkable potential in research, development and commercialisation (R, D & C) activities which is something to be proud of. Hence the Putra Science Park reflects the knowledge-based society aspiration in our R, D & C activities," he said during the launching of the park held here.

Dato' Seri Khaled said the major challenge for Putra Science Park is to increase the commercialisation effort in R&D and place emphasis on the technology development commercialisation, coordinate the placement of amenities and research facilities, monitor technology transfers and also the placement of incubators. He added further that the establishment of Putra Science Park is aimed to increase UPM's research products and innovation competitiveness in order to explore foreign market opportunities as well as to broaden potential networking interactively through knowledge dispersion for the development of industry and entrepreneurship.

A representative from Xenolab Sdn. Bhd. (right) explaining the company's product to Dato' Seri Khaled while the Vice Chancellor of UPM (left) looks on.

In addition, the Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah said Putra Science Park is also a rebranding concept to acknowledge the R&D identity that has long existed in UPM where no apparent substantial restructuring is involved. "The rebranding is set to focus on UPM researchers' commercialisation efforts through a well mapped-out supervision. Besides that, Putra Science Park is known as a knowledge-based community that links the academia group, business entities and the public. The park also accelerates the government's effort in producing entrepreneurs of agricultural through programmes such as agriculture incubators," he said at the event also attended by the Chairman of the University Board of Directors, Tan Sri Dr. Syed Jalaluddin Syed Salim.

IBS Receives RM3 Million A Year

The Vice Chancellor of UPM (right) receiving a mock cheque from the Prime Minister as the Higher Education Minister (left) looks on.

Institute of Bioscience (IBS), UPM has done us proud again with the Higher Institution Centre of Excellence (HICoE) recognition bestowed by the government, beating 166 centres from various public higher learning institutions (IPTA) that have applied for the status since 2008. The proclamation of HICoE was presented by Prime Minister, Dato' Seri Mohd Najib Tun Abdul Razak to the Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah, awarding an allocation of RM3mil annually for IBS. Besides IBS, five more HICoE recognitions were awarded to Universiti Sains Malaysia (2 HICoE recognitions), Universiti Kebangsaan Malaysia, Universiti Malaya and Universiti Teknologi MARA.

Dato' Seri Mohd Najib said the recognition of HICoE is aimed to foster the activity of research and development (R&D) as well as IPTA's innovation to generate sufficient resources to support the National Innovation System hence increase the country's innovation endeavor. He also expressed his hopes for more IPTAs with the HICoE status in order to stay competitive and relevant in various fields of research and expertise.

"The allocation is specifically aimed to boost HICoE's achievements at the international level particularly in terms of research quality, extension of network with local and international industries as well as the accreditation of infrastructures," he said during the launching of the National Professors Council (NPA) and Higher Education Centre of Excellence (HICoE) held at the Putrajaya International Convention Centre (PICC). He added that the 'best of the best CoE' recognition as HICoE at the national level is deemed essential before it reaches the international level. The National Professors Council (NPA) was also launched at the event, which gathered the expertise and knowledge of 1,426 professors from all IPTAs in the country where they were assigned into 14 clusters. The council will assist in establishing government policies and handling public issues particularly in enforcing policy enactment as well as working on the New Economic Model (NEM).

The former Dean of Faculty of Agriculture, Prof. Dr. Ghizan Saleh was appointed to lead the agriculture and food safety cluster. At the moment, the Ministry of Higher Education (MoHE) is the secretariat for the National Professors Council (NPA) and the council will expand its membership to the private higher learning institutions (IPTS) once it has gained support from the professorial community.

UPM Wins 2 Special Awards and 5 Gold Medals at ITEX

Universiti Putra Malaysia researchers had successfully won 2 special awards, 5 gold medals, 6 silver medals and 1 bronze medal at the International Invention Innovation and Technology Exhibition (ITEX) 2010 at the Kuala Lumpur Convention Centre (KLCC).

Prof. Dr. Jinap Selamat, from the Faculty of Science and Food Technology, won a gold medal and a special award which was the Best Women Inventor from the International Federation Inventor Association (IFIA) Cup for her product "Efficient Mercury Removal Solution" (EMRS).

Meanwhile, Mr. Bakri Bakar@Ismail from the Faculty of Design and Architectural earned a gold medal and a special award awarded by the Korean Invention Promotion Association (KIPA) for his product - Self Retaining Anal Speculum (SRAS).

Apart from that, Prof. Dr. Raja Noor Zaliha Raja Abdul Rahman from the Faculty of Biotechnology and Biomolecular Sciences, won two gold medals for her products "PI12 Protease" and "Psychrozim".

The fifth gold medal went to Assoc. Prof. Dr. Osumanu Haruna Ahmed from the Faculty of Agriculture and Food Sciences at the university's Bintulu Sarawak campus with his product "Breakthough in Isolation of Humic Substances".

UPM also earned 6 silver medals which were won by Assoc. Prof. Dr. Jayakaran Mukundan from the Faculty of Educational Studies with his product "VOPACT-RETROTEXT", Assoc. Prof. Dr. Noor Akma Ibrahim from the Mathematical Research Institute (DGRSS: Dynamic Geometric Risk Space Software), Prof. Dr. Abdul Halim Shaari from the Faculty of Science (High Capacitance Ceramic Material novel), Assoc. Prof. Dr. Jamaloddin Noorzaei from the Faculty of Engineering (Structural Control System), Dr. Mohd. Nizar Hamidon from the Faculty of Engineering (433.92 MHz Single Port SAW Resonator for High Temperature Applications) and Dr. Nashiren Farzilah Mailah also from the Faculty of Engineering (Neutral Point Clamped Multilevel Inverter using Space Vector Modulation). Besides that, 1 bronze medal was won by Prof. Dr. Anuar Kassim from the Faculty of Science for his product "Novel Electromagnetic Shielding Material from Composite Organic Conductor".

The ITEX 2010, with its Green Invention theme, was officiated by the Minister of Science, Technology and Innovation, Datuk Seri Dr. Maximus Johnity Ongkili.

Prof. Dato' Dr. Abu Bakar Salleh (third from right) posing with UPM gold medalists, from right, Assoc. Prof. Dr. Osumanu Haruna Ahmed, Prof. Dr. Jinap Selamat, Mr. Bakri Bakar@Ismail and Dr. Mohd. Shukuri Mohamad Ali.

KPPK-UPM Bilateral Cooperation Aims to Strengthen R&D

Plantation Industries and Commodities Ministry (KPPK) and Universiti Putra Malaysia (UPM) established a cooperation to increase research and development (R&D) as well as human capital development. The cooperation in keeping with the government's aspirations, established research culture and innovation development for the nation by using research, development and commercialisation approach (R, D&C) in all research projects.

The Minister of KPPK, Tan Sri Bernard Dompok, said the bilateral cooperation between KPPK and UPM is held for the fifth time following feedback received from researchers who were involved during the previous bilateral cooperation. "This dialogue session discusses issues which arise as a result of researches which are carried out or will be carried out including existing problems, unsatisfactory achievement and the efficiency of research projects," he said to reporters after the Fifth Bilateral Cooperation Dialogue between KPPK and UPM held here. He added that many potential research products would be commercialised such as papers for writing and printing from *kenaf*, plywood from the trunk of the oil palm trees, *kenaf* stem harvesting machine, bio-oil from *kenaf* and others.

The Director of INTROP, Assoc. Prof. Dr. Faridah Tahir (left) explaining some of the institute's research outputs to Tan Sri Bernard Dompok.

Apart from that, Tan Sri Bernard hopes that the private sector would promote research products by local researchers especially new products. He also mentioned that the private sector should play a role with regard to products which are taking ages to be commercialised in local or international market. He noted that UPM's potential as a Research University will help commercialisation efforts due to the establishment of the university in agriculture besides always moving forward in commercialising agricultural-based research products.

UPM Researchers Receive MAKNA Cancer Research Award

Two researchers from Universiti Putra Malaysia (UPM) received the MAKNA Cancer Research Award 2009 for their contribution in cancer research.

The first recipient, Dr. Abhimanyu Veerakumarasivam from the Faculty of Medicine and Health Sciences was awarded for his research entitled 'Isolation, Immortalisation and Characterisation of Malaysian Primary Breast Cancer Cell Lines'. The next recipient, Prof. Dr. Chong Pei Pei from the same faculty, was chosen for her research entitled 'Investigation on Polymorphism of p53 and p21 Cell Circle Regulatory Genes and the Association with Human Papilomavirus (HPV) – Positive Cervical Cancer among the Female Population in Malaysia'. Each walked away with RM30,000 to fund their projects and the funds were also a form of appreciation from MAKNA, which has ceaselessly supported their efforts.

Dato' Farid is highly impressed with UPM winning researchers.

President of MAKNA, Dato' Mohd. Farid Ariffin said MAKNA will continuously monitor research conducted by the winning researchers based on determined regulations prior to public presentation of the research findings.

"I'm utterly proud of the fact that two recipients are from UPM and that they have succeeded in outdoing their equally competitive adversaries. It is therefore hoped that the grants will be utilised wisely for cancer research to benefit the public particularly in search of the ultimate cure," he mentioned in his speech during the official event held at the Faculty of Medicine and Health Sciences.

Meanwhile, the Deputy Vice Chancellor (Research and Innovation) of UPM, Prof. Dato' Dr. Abu Bakar Salleh reminded all researchers not to focus on commercial-oriented research only but to give priority to the research beneficial outcomes as well.

UPM-MAFC Cooperation to Boost the Food Production Sector

Universiti Putra Malaysia (UPM) and Malaysian Agrifood Corporation Berhad (MAFC) established an academic and research cooperation to contribute to the country's food production sector. The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah said UPM will help MAFC in terms of agricultural and socio-economic development of the country through graduates from UPM.

According to the Vice Chancellor during the memorandum of understanding (MoU) signing ceremony, the cooperation scope of both parties consists of sharing teaching and research information, expertise in the field of agricultural food production, negotiation and research services. He added that UPM takes initiatives to establish this cooperation with MAFC as one of the university's efforts to strengthen yet again the country's food production sector with a more productive food production and research.

Prof. Datuk Dr Nik Mustapha also mentioned that the cooperation is due to the reliance of Malaysia on imported food to accommodate the country's needs which rise each year.

Meanwhile, Chief Executive Officer of MAFC, Mr. Azizi Meor Ngah said that the cooperation focusses to establish cooperation relationship in teaching process as well as learning and research. UPM will channel information through negotiation and diagnostic services to MAFC in agronomy and other fields.

The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha (second from right) exchanging MoU documents with the Chief Executive Officer of MAFC, Mr. Azizi (second from left).

only. "This disposable bio-composite plastic will be inserted into a patient's external anus until the rectum to ease examination and surgery for the patient besides reducing infection," he added.

The product, which is also yet to be commercialised, is a result of UPM collaboration with researchers from Sheffield namely Saiful Hasley Ramli and Paul Chamberlain. The cost of fabrication of the product is estimated to be around RM25 while the selling price is around RM48.

UPM-MVP Produces Local Domestic Animal Vaccines

The Innovation & Commercialisation Centre (ICC), UPM inked a memorandum of understanding (MoU) with the Malaysian Vaccines & Pharmaceuticals Sdn. Bhd. (MVP) for research projects to produce local domestic animal vaccines.

The MoU was sealed in conjunction with MVP 1st Convention 2010 in collaboration with UPM and the Department of Veterinary Services (DVS) under the Ministry of Agriculture and Agro-based Industry to encourage commercialisation effort of local research products to be promoted at international level.

The Deputy Vice Chancellor (Research & Innovation), UPM, Prof. Dato' Dr. Abu Bakar Salleh (right) exchanging MoU documents with the Managing Director of MVP, Mr. Ishan Paman Ahmad.

The MoU was signed by the Deputy Vice Chancellor (Research and Innovation), UPM, Prof. Dato' Dr. Abu Bakar Salleh and the Managing Director of MVP, Ishan Pawan Ahmad, which was witnessed by the Deputy Minister of Agriculture and Agro-Based Industry, Dato' Mohd. Johari Baharum. Dato' Mohd. Johari said cooperation among the government agencies, universities, research institutes and the private sector is vital to develop the vaccine industry for the livestock health industry. "Malaysia is able to save millions of ringgit a year by using expertise from local research institutions to produce animal vaccines compared to the current practice of depending on imported expertise," he said during the MoU signing ceremony.

Dato' Mohd Johari hopes the Veterinary Research Institute (VRI), under the Department of Veterinary Services (DVS), will share knowledge with UPM to further develop the local livestock vaccine industry in the country.

Prof. Dato' Dr. Abu Bakar Salleh (left) explaining one of UPM's commercialised products to Dato' Mohd. Johari Baharum.

UPM Invents Solution to Remove Mercury from Fish and Surgery Aid Instrument for the Anal

Two Universiti Putra Malaysia researchers managed to produce a slurry acidic solution to remove mercury from fish as well as a surgery instrument for the anal.

Prof. Dr Jinap Selamat, a researcher from the Faculty of Food Science and Technology, UPM, invented "Efficient Mercury Removal Solution" where the solution is capable of absorbing mercury effectively compared to other available products. According to Prof. Jinap, mercury is hazardous to humans because of its high toxicity. Hence, the solution will remove mercury from the fish simply by applying the solution on the body of the fish and rinsing it with water. "This solution removes 90% of mercury from the body of the fish and at the same time it preserves the original colour, taste and texture of the fish," she said during a press conference of UPM New Products organised by the Research Management Centre (RMC) and the Corporate Communication Division (BKK) at the Banquet Hall, UPM.

The product, which is yet to be commercialised, is estimated to cost up to RM200 for a 4-liter solution to be used on 100 kg of fish. The other group members involved in this research are Dr. Parvaneh Hajeb, Assoc. Prof. Dr. Fatimah Bakar and Prof. Dr. Jamilah Bakar.

Prof. Dr. Jinap posing with her new product.

Mr. Bakri showing his invention.

Another product namely Self Retaining Anal Speculum, by Mr. Bakri Bakar from the Faculty of Design and Architecture which functions as a surgery aid instrument for surgeon during examination at the anal. He noted that a doctor normally uses expensive stainless steel conventional instrument where the instrument makes work easier for a surgeon

Guidelines for Pollution in Drinking Water

Mohammad Reza Mohammad Shafiee, Mohamad Pauzi Zakaria, Nayan Deep S. Kanwal, Mahyar Sakari, Pourya Shahpoury Bahry and Alireza Riyahi Bakhtiari

Water pollution is one of the major and serious problems to the human. There are several pollutants which pose as threats to drinking water. They are categorised in six categories as follows:

- Microorganisms; • Disinfectants; • Disinfection Byproducts; • Inorganic Chemicals; • **Organic Chemicals**; and • Radionuclides.

As mentioned above, these are potential pollutants to human drinking water worldwide. This guideline provides a short yet necessary information on these drinking water pollutants. In this volume, you will receive information focussing on Organic Chemicals:

Organic Chemicals

Contaminant	1MCLG	2MCL	Potential Health Effects from Ingestion of Water	Sources of Contaminants in Drinking Water
Styrene	0.1	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills
Tetrachloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
Toluene	1	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories
Toxaphene	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
2,4,5,-TP (Silvex)	0.05	0.05	Liver problems	Residue of banned herbicide
1,2,4-Trichlorobenzene	0.07	0.07	Changes in adrenal glands	Discharge from textile finishing factories
1,1,1-Trichloroethane	0.20	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
1,1,2-Trichloroethane	0.003	0.005	Liver, kidney or immune system problems	Discharge from industrial chemical factories
Trichloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories
Vinyl chloride	zero	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
Xylenes	10	10	Nervous system damage	Discharge from petroleum and chemical factories

Definitions:

1. Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals. 2. Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

*Units are in milligrammes per litre (mg/L) unless otherwise noted. Milligrammes per litre are equivalent to parts per million.

....to be continued in Synthesis Issue 30, Sept. 2010.

The Agricultural Conservatory Park, UPM

The Agricultural Conservatory Park is an *ex situ* conservation area of ethnobotanically important plants. This is where it stores a collection of Malaysian indigenous and exotic plants collected from different parts of the country. The Park is under the responsibility of the Biodiversity Unit, Institute of Bioscience (IBS), UPM for its research and commercial purposes. The Unit's mission is to inculcate the appreciation for biodiversity of plants through exposure, education, workshops, publications, and products based on essential oils. With these valuable and unique collections of plants, it is vital to take steps to conserve them in the Park for the coming generations.

The Park is actively used by both local and international plant researchers, students and visitors. The first phase occupies 2 hectares under the canopy of rubber trees. It is divided into 10 zones of more than 500 plants [**Aromatics** (35 spp. e.g.: *Cananga odorata*, *Wrightia religiosa*); **Gingers** (130 spp. e.g.: *Alpinia purpurata*, *Etlingera elatior*); **Orchids** (40 spp. e.g.: *Paphiopedilum barbatum*, *Aerides odorata*); **Ferns** (30 spp. e.g.: *Angiopteris evecta*, *Psilotum nudum*); **Aroids** (20 spp. e.g.: *Colocasia gigantea*, *Homalomena sagittifolia*); **Pitcher Plants** (3 spp.); **Aquatics** (15 spp. e.g.: *Acorus calamus*, *Hydrocotyle sibthorpioides*); **Medicinal** (220 spp. e.g.: *Eurycoma longifolia*, *Molineria latifolia*); **Spices** (15 spp. e.g.: *Cinnamomum iners*, *Aleuritus moluccana*); and ***Ulam* (Traditional Salads)** (50 spp. e.g.: *Melicope lunu-ankenda*, *Parkia speciosa*)]. The *Zingiberaceae* (gingers and turmerics) collection is one of the largest collections in Malaysia boasting 130 identified species.

In May 2009, the Biodiversity Unit, IBS organised a workshop on Medicinal Plants and in December 2009, it organised a workshop on Tissue Culture of Medicinal Plants. Three books have been published: *Taman Konservatori Pertanian* (Agricultural Conservatory Park), Therapeutic Herbal Baths and *Tumbuhan Ubatan Tradisional* Malaysia (Malaysian Traditional Medicinal Plants). Apart from that, the Taxonomy Team goes on regular scientific expeditions to add to the living collections in the Park and also for the Unit's herbarium which specialises in medicinal plants. In addition, there is a database established regarding the living collections detailing the provenance and a self-exploratory guide system using the PDA has been launched early this year.

Figure 1: *Taman Konservatori Pertanian* Book

The Tissue Culture Unit is developing protocols for novel aromatics and medicinal plants such as *Kantan* (*Etlingera elatior*) and *Cempaka* (*Michelia champaca*). The axillary bud explants of both species were cultured on Murashige and Skoog's (MS) basal medium supplemented with various concentrations of cytokinin (BAP) for shoot growth and auxin (IAA) for root growth. It was observed that callus of *M. champaca* could be induced on media containing 0-2.0 mg/L IAA, 0-0.2 mg/L 2,4-D, and 0-0.2 mg/L BAP. 0.1 mg/L IAA and 0.1 mg/L 2,4-D were found most suitable for the induction of callus. 81 % of explants survival rate was observed in the media that contained IAA. Different concentrations of BAP combined with IAA and 2,4-D were tested on the media for callus proliferation. The combination of 3.0 mg/L BAP with 0.5 mg/L IAA initially showed a very good response in terms of morphological difference with the cream-coloured appearance of callus growth after three months.

In addition, the Essential Oil Team also extracted oils from 14 species from the Park: *Serai Wangi* (*Cymbopogon nardus*), *Ulam Raja* (*Cosmos caudatus*), *Kaduk* (*Piper sarmentosum*), *Sireh* (*Piper betle*), *Lempoyang* (*Zingiber zerumbet*), *Lengkuas Padi* (*Alpinia conchigera*), *Kayu Putih* (*Melaleuca leucadendron*), *Nilam* (*Pogostemon cablin*), *Kayu Manis* (*Cinnamomum verum*), Tea Tree (*Melaleuca alternifolia*), *Selasih* (*Ocimum basilicum*), *Kesum* (*Persicaria hydropiper*), *Kenanga* (*Cananga odorata*) and *Kemangi* (*Ocimum gratissimum*).

One of the completed research investigated essential oils produced by hydrodistillation from leaves and rhizomes of *A. conchigera*, which were dried at different day lengths (fresh, one, two, three and seven). The chemical composition of oils was investigated using GC and GC-MS analyses. The findings showed that the post-harvest drying period had a positive effect on the oil yield of both leaves and rhizomes where the highest oil yields were obtained from seven drying days of leaf (0.300 v/w) and three drying days of rhizome (0.162 v/w).

The Product Development Team has commercialised herbal soaps named Putra AromatiQ (15 body soaps, 5 facial soaps) from some of these oils and will continue to develop other beneficial and health-enhancing products.

Figure 2: *Tacca integrifolia* (*Keladi Murai*)

Figure 3: Herbal Soaps from Extracted Essential Oils

BRONZE BioMalaysia 2009

Tnah L. H., Lee S. L., Kevin N. K. S., Faridah Q. Z. and Faridah H. I., 2010. Forensic DNA Profiling of Tropical Timber Species in Peninsular Malaysia. Forest Ecology and Management, 259, 1436-1446.

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Reader Enquiry
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Guava Pulp Composition - Moving from Industrial Waste to Useful Functional Food Ingredients

Malaysia is practicing the agricultural-based industries; hence the growing numbers of manufacturing annually. As a consequence, a great amount of by-products are produced each year. Due to the increase in production, by-products of plant food processing represent a major disposal problem for the industry concerned, but they are also the promising sources of compounds which may be useful because of their favourable technological or nutritional properties. Considerably, high ratios of by-products arise from tropical and subtropical fruit processing. The use of by-products by the food industry is a great interest because of its economic profitability, since these by-products are available in large quantities and may be costly to dispose. By-products derived from food processing are attractive sources of valuable components. The primary wastes and by-products fractions, which are peel, flesh and seed residues, contain high amount of bioactive compounds that can be exploited as functional food ingredients and nutraceuticals. Since synthetic additives are progressively being rejected by consumers; functional ingredients should preferably originate from natural sources.

Pink guava is a delicious fruit which is very nutritious and famous due to its high content of dietary fibre, vitamin C, polyphenols (ellagic acid and anthocyanin) and lycopene. Malaysia is one of the largest pink guava puree exporters which supplies about 20% of the world's pink guava puree market. During the production of pink guava puree, by-products that are created make up 25% of the total loading weight. Three types of by-products are discarded from three different processing stages; namely refiner, siever and decanter. Our study found that decanted portion is the last fraction of the by-products, which consists of pink flesh pulp and has the highest lycopene content and antioxidant capacity among the by-products. The by-products of pink guava puree industry can be a potential source of lycopene and antioxidant compounds. As shown in **Figure 1**, our work showed that the presence of lycopene in decanted by-product could be a major contributor to the antioxidant capacity, and further exploitation and utilisation for food application of this by-product is warranted.

Investigation of appropriate thermal processes for the drying of decanted pink guava by-product will provide an opportunity for the food industry to produce a dried decanted product with high lycopene content. We utilised a response surface methodology to optimise the drying conditions for the lycopene content and antioxidant capacity in decanted by-product. It was found that drying at certain conditions were the most efficient way in producing the decanted by-product powder with high lycopene content and antioxidant capacity. Nowadays, there is a growing interest in "green technology" to produce high quality products that are safe and environmentally friendly. Supercritical fluid extraction (SFE) is an alternative to conventional solvent extraction that has gained importance in various industries by isolating desirable compounds for pharmaceutical and nutraceutical uses. Thus, in our work, an attempt was made to extract lycopene from the decanted by-product using the SFE. This extraction is more preferable due to its higher extract yield and also the total lycopene obtained. **Figure 2** shows that a significant protective effect of lycopene-rich fraction against hydrogen peroxide (H_2O_2)-induced cytotoxicity and DNA damage in a human liver cell line. Lycopene-rich fraction from pink guava by-products may have a potential use as functional food ingredients in preventing the promotion of oxidative stress.

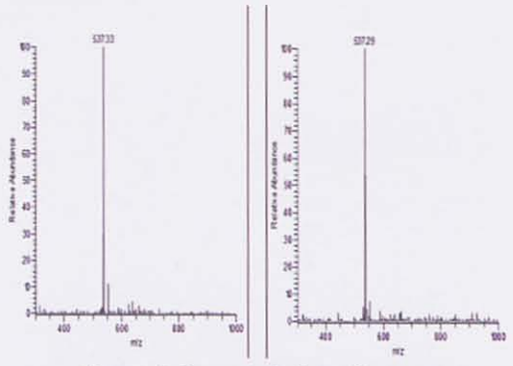

Figure 1: Representation of Lycopene in a Guava Pulp Composition

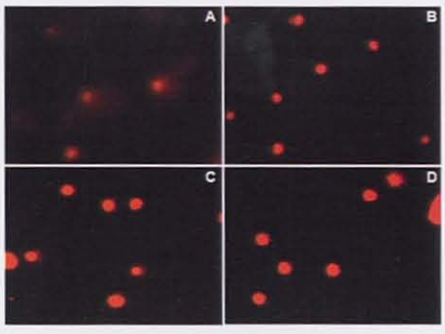

Figure 2: Appearance of Cells Following Different Treatments

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K. W. Kong and A. Ismail, 2010. Lycopene Content and Lipophilic Antioxidant Capacity of By-products from *Psidium guajava* Fruits Produced during Puree Production Industry. Food Bioproducts and Processing. (Article in press: doi:10.1016/j.fbp.2010.02.004)

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GOLD *UPM Invention, Research & Innovation Exhibition (PRPI 2009)*
SILVER *International Exposition of Research and Inventions of Institutions of Higher Learning (PECIPTA 2009)*
BRONZE *Biotechnology Asia 2006*

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ICC Meets the Farmers at an Open Day with UPM Agriculture Experts

"Universiti Putra Malaysia (UPM) is entrusted with an important role in developing agricultural technology for farmers or *usahawantani* in the country," said Minister of Agriculture and Agro-based Industry, Datuk Seri Noh Omar during the opening ceremony of an Open Day with UPM Agriculture Experts in Kuala Selangor on the 8th and 9th May 2010. He said that UPM's strength in the field of agriculture which focusses on biotechnology innovation is able to educate farmers in transforming the agricultural system through modern agricultural technology. He added that the Open Day is part of the university's corporate social responsibility (CSR) to incorporate agricultural development in order to approach the community especially the farmers, breeders and local entrepreneurs directly.

The Vice Chancellor of UPM, Prof. Datuk Dr. Nik Mustapha R. Abdullah said the programme held in Tanjong Karang is the fifth of a series of programmes conducted in Temerloh-Pahang, Jeli-Kelantan, Batu Pahat-Johore and Pekan-Pahang. The aim of the programme, which was organised by the Centre for Extension, Entrepreneurship and Professional Development (APEEC), UPM, in collaboration with the Ministry of Agriculture and Agro-based Industry, is to bring experts from various faculties in UPM, including the Innovation and Commercialisation Centre (ICC), directly to the community of Tanjong Karang, Selangor could benefit from UPM. Datuk emphasised that the programme will allow UPM to introduce research findings and technologies available for the farmers and *usahawantani* to enhance the overall agricultural development programme.

As a centre that promotes innovation and commercialisation, the ICC also displayed commercialised technologies based on agricultural research and several potential technologies for commercialisation during the open day. The exhibition booth received good response from visitors who were not only interested at the displayed products but also participated in an interactive quiz which was professionally conducted by the staff of ICC. The main function of the ICC is as a one-stop centre assisting other faculties and institutes to match-make UPM's technologies with potential industrial partners.

The Minister, Y. B. Datuk Seri Noh Omar dropped by at the ICC booth and was impressed with the interactive quiz. As a memento, Y. B. Minister was presented with a bottle of Lactonic, one of UPM`s research products that has been commercialised.

A staff of ICC explaining to visitors about some of UPM's commercialised products and technologies.

Feed for Monogastric Animals

ADDEX - Anti-oil Absorption Additive

Two recent additions of UPM's commercialised products and technologies which make a total of twenty two commercialised products and technologies.

Cattle Breeding

High Quality Orchid

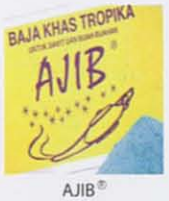
Edu-Enzyme Assay

Newcastle Disease Vaccine: V4-UPM

Fibre Duplexer Module

Stone Mastic

StellarLac™



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Twenty UPM's Commercialised Products and Technologies

Reader Enquiry
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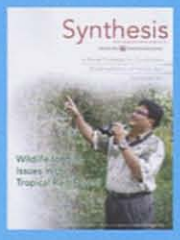

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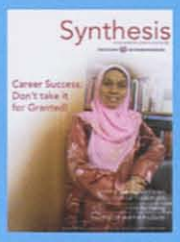

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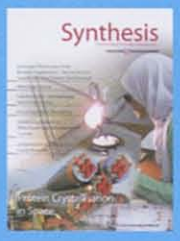

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