

# PRESCRIPTION

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## FROM 'COMPOUND AND DISPENSE' TO 'COMPOUND, PRINT AND DISPENSE' – THE COMING OF THE 3D DRUG PRINTING

*A possible scenario in the near future - you have a prescription from the doctor which you receive via your smartphone. You then take it to a pharmacy where you will have your medications compounded, 3D printed and dispensed by the pharmacist, just like a print-on-demand service, currently offered for clothing and housewares. You may choose the colour, shape and size of your tablets, and perhaps to have several medications embedded within one single tablet so that it is convenient for you to swallow just one, instead of the usual handful of tablets. For refills, you simply return to the pharmacy and have them printed. Forget about the queue at the hospital. Even better, if you have enough funds, procure a drug 3D printer and print the medications at home. Then, simply e-consult the pharmacist on the proper use of the medication.*

Hitherto, the major part of a pharmacist's task is upon receiving a prescription from the doctor, to compound or prepare, and then dispense the medications to the patient. This practice may be somewhat modified in the coming years.

With the advent of Industrial Revolution 4.0 (IR4), there is an integration of smart technologies and production systems, and this includes with the pharmaceutical manufacturing practice. One major aspect of IR4 is additive manufacturing (AM). AM is 'the process that aggregates materials to create objects starting from their three-dimensional (3D) mathematical models, usually by overlapping layers and proceeding in the opposite way to what happens in the subtractive manufacturing, a process of chipping away or removing of excess materials' (ISO/ASTM52921-1).

The layering method is akin to the preparation of multilayer tablets long developed in pharmaceutical manufacturing. These tablets consist of an active core supplemented by one or more layers applied during tableting which act as barriers and regulate drug release. Multilayer tablets play a major role in the oral sustained drug delivery system.

In view of this, pharmaceutical compounding should be able to adopt additive manufacturing like a duck takes to water. The 3D printing of pharmaceuticals would be on the horizon sooner than we thought. A company set up in the United Kingdom, FabRx Ltd., states on its website as having produced the world's first pharmaceutical 3D printer for personalised medicines. "Using our propriety Printlets™ technology, we can create a range of personalised medicines, composed of specific dosages, API (Active Pharmaceutical Ingredients) combinations, shapes, sizes and release profiles", it says.

From the above claim, it seems that the phrase 'personalised medicines' is now being coined in another realm. With the plural 'medicines' it connotes medications meant for an individual, not necessarily based on his or her genomic profiles, but rather, any medicine prepared for the use of that specific individual as, when and where required. For this purpose, in the not too distant future, one can even print one's own paracetamol at home or in a neighbourhood pharmacy, provided the appropriate 3D printer, actives and raw materials required to compound the medicine are available. You only need to consult the pharmacist on the proper way of using the medicine.

Indeed FabRx boasts of 'M3DIMAKER, the world's first pharmaceutical 3D printer for personalised medicines'. Imagine, if this bioprinter became ubiquitous like the current 2-D printer, you might print your own medication without having to visit the pharmacy or clinic, especially for refills.

Overall, 3-D drug printing is expected to provide several benefits. For example, an option to select the shape and size of a tablet based on the patient's preference, the ability to replace a cocktail of drugs into a single tablet thus enhancing compliance, the flexibility of controlling drug release by either slowing it down or accelerating to achieve the optimum effect of the drug, and the possibility of printing drugs in small quantity for an orphan disease, i.e. a rare disease that affects a very small number of the population. The last point is crucial as the big pharma may find it unprofitable to produce drugs in small quantities to serve this sector.

In the big picture, 3-D drug printing may save cost in the production and testing of drugs, compared to the huge and complex pharmaceutical manufacturing facility required at the moment. In terms of the impact on the environment, the 3-D drug printing is considered eco-friendly production, although this point is debatable.

The challenges facing this additive manufacturing method for drug production are plenty, for instance the high cost, due to the lack of economies of scale. Inaccurate designs can also lead to misprinting of drugs.

Another hurdle is the regulatory quagmire. However, this is not unsurmountable. In 2015, Aprelia Pharmaceuticals successfully obtained the approval of the Food and Drug Administration, United States of America for its 3D-printed anti-epileptic, Spritam (levetiracetam). The drug which simply evaporates in the mouth with a sip, is very useful for children and older people who have trouble swallowing.



Hence, if one can prove that the drug, whether produced through subtractive or additive manufacturing, fulfils these conditions, namely quality, safety, efficacy, then it can meet the regulatory requirement. The successful registration of Spritam with FDA signals the completion of the proof of concept of 3D printed drugs.

As far as Universiti Teknologi MARA (UiTM) is concerned, 3D printing has been adopted in teaching and research activities for many years. According to Dr Siti Azma Jusoh, Senior Lecturer at the Faculty of Pharmacy, and Coordinator of MakerLab at UiTM Selangor, it would be better to start with 3D printing of nutraceuticals or supplements to test the water, before embarking on pharmaceuticals.

She added that bioprinting is the next challenge. Bioprinting is the printing of bioengineered structures using biochemicals, biological materials, and living cells based on computer-aided design. Hence, printing of body spare parts to replace defective organs, tissues and cells is becoming a reality, despite the tough challenges faced by 3D bio-prospectors.

The Faculty of Pharmacy UiTM is working with a couple of international partners to venture into 3D drug printing research and development. In the meantime, the curriculum content on pharmaceutical industry process is being updated to include this aspect of additive manufacturing to sensitise students of the realities of this aspect of IR4.0. They will also be alerted to the future role of a pharmacist as an expert in 3D drug printing. Thus from the current practice of 'compound and dispense', they will have to move to 'compound, print and dispense'.

# Neuroprotective effects of 7-tetrahydroxyflavone against Alzheimer's disease through Hypothalamic-Pituitary-Adrenal Axis and Nrf2 linked bidirectional pathways

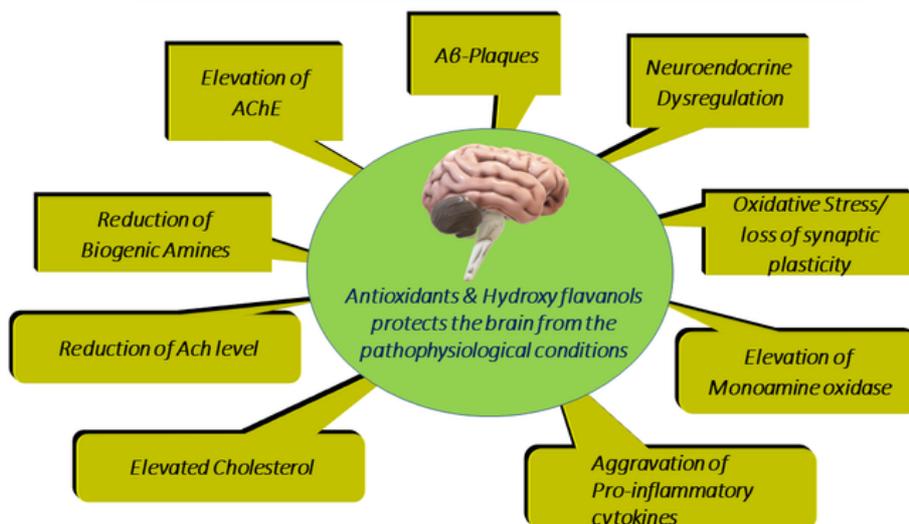
## Fundamental Research Grant Scheme

Alzheimer's disease is an age-related memory loss that affects cognitive function. In Alzheimer's type of dementia, stress escalates the acetylcholinesterase enzyme with accumulation of amyloid peptide which eventually causes declining cognition, emotion, and social health. Worldwide 46.8 million people are living with dementia and in Malaysia was 123,000 people in 2015 and projected to 261,000 by 2030 and to 590,000 in 2050. National health and morbidity survey-senior health of Malaysia, 2018 states the prevalence is 8.6%. In Malaysia, according to Alzheimer's disease International, the prevalence of dementia was 123,000 people during 2015. As per Alzheimer's disease foundation, the number was projected to be 261,000 by 2030 and will continue to increase to 590,000 people in 2050. It's also denoted that in Malaysia 8.6% of elderly population prevails with dementia with its rapid growth and morbidity, it ranks second on the burden of disease in Asia Pacific Region. Currently, there is a worldwide effort to find better ways to treat the disease, delay its onset, and prevent it from developing.

As a preventive measures' basic quality of life enhancements with nutritious food habits balanced with fruits and natural products value adds to neuroprotection. At present there is no cure for Alzheimer's disease. Despite symptomatic treatments, any drugs or any chemical entity which controls the disease progression value adds the therapeutic management of AD and makes life better for the millions of people living with Alzheimer's Disease. Current Alzheimer's treatment, acetylcholinesterase enzyme prevents Alzheimer's from progressing and it can temporarily reduce the dementia symptoms. Despite the low bioavailability profile, the currently available drugs such as AChE inhibitors (Donepezil, Tacrine & Rivastigmine) are only affording symptomatic control and effects. A new novel drug Aducanumab was recently approved. However, these drugs also alter the brain neurotransmitters and cause adverse effects such as insomnia, altered mental status, anorexia, visual disturbances, muscle cramps and asthenia.

Polyphenolic compounds and flavonoids have abundant neuroprotective and antioxidant potential to be elucidated and optimized as formulation delivery to the brain which renders neuroprotection through delaying and preventing the AD without adverse effect. The study was aimed to envisage the regulation of neuroimmune and neuroendocrine coordination through nuclear factor erythroid 2-related factor 2 (Nrf2) pathway for organic brain balance. The optimized formulation of polyphenolic drugs was predicted to exhibit the neuroprotective effect with enhanced bioavailability for treating early onset AD (EOAD), Late onset AD (LOAD) and benefits geriatric care for national action plan for dementia, promote mental health and wellness and expands new drug development.

## Neuroprotection by Hydroxy flavanols & antioxidants



Our team members, from the Faculty of Pharmacy, UiTM are investigating the neuroprotective molecular targets where polyphenolic 7-tetrahydroxyflavone interacts in the brain. This research explores the knowledge on novel theories of neuroimmune and neuroendocrine bidirectional pathways for treating AD.

### TEAM MEMBERS

Assoc. Prof. Dr. Hanish Singh jayasingh Chellammal, Faculty of Pharmacy, UiTM.

Assoc. Prof. Dr. Mizaton Binti Hazizul Hasan, Faculty of Pharmacy, UiTM,

Prof. Sathesh Kumar. Sukumaran, School of Pharmacy, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai, India.

Dr. Yuslina Binti Zakaria, Faculty of Pharmacy, UiTM,

Dr. Noreen Binti Husain, Faculty of Pharmacy, UiTM,

**Assoc. Prof. Dr. Hanish Singh jayasingh Chellammal**

Department of Pharmacology & Pharmaceutical Chemistry,

Faculty of Pharmacy, UiTM.

# CERTIFICATE PRESENTATION CEREMONY: QUALIFYING EXAMINATION FOR REGISTRATION AS PRACTISING PHARMACISTS (*PEPERIKSAAN KELAYAKAN MENGAMAL FARMASI*)



Pharmacy Board of Malaysia has determined that in order to be registered and practice as a pharmacist, pharmacy students are required to pass the qualifying examination. The examination aimed to assess candidates' knowledge and ability to apply Malaysia laws regulating the sale and supply of medicinal products from pharmacies including Poisons Act 1952, Sale of Drugs Act 1952, Control of Drugs and Cosmetics Regulations 1984, Registration of Pharmacists Act 1951 and Medicines (Advertisement and Sale) Act 1956. It is held three times a year and the third and fourth year pharmacy students from the Faculty of Pharmacy UiTM have attended the exam session on 23rd November 2022.

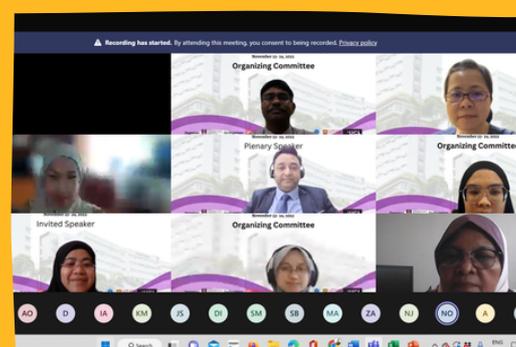
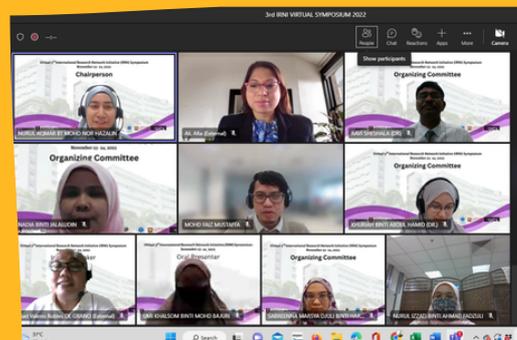
A certificate presentation event was organised on 6th January 2023 at DK10, FF4 Building, UiTM Puncak Alam Campus to celebrate the students who have successfully passed the exam. The event was attended by the Dean, lecturers, administration staff and final year pharmacy students. The event started with a welcoming speech from the Dean followed by presentation of certificate to 113 students.

The faculty hope that this event will increase students' confidence level, motivate them to continue to progress well in their studies and eventually become competitive pharmacists. Congratulations and well done to all students!

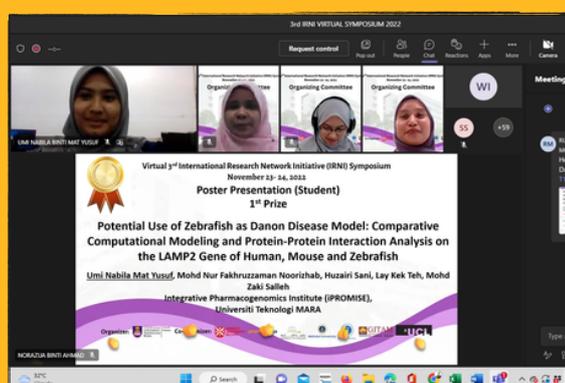
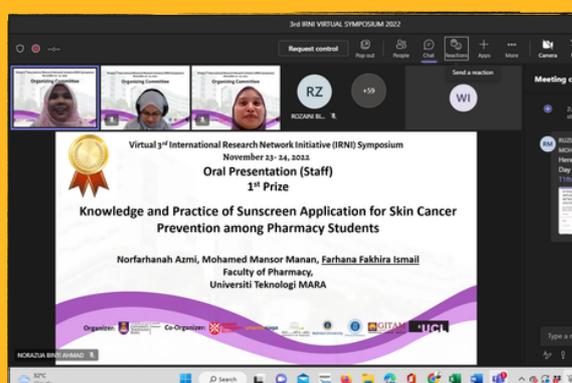
**Mdm. Syahida Fathiah Ahmad Kamal, Dr. Mahmathi Karuppattan, Ms. Zakiah Mohd Noordin**

# Virtual 3rd IRNI Symposium 2022: Exploring Recent Advancements in Drug Discovery and Development

The Virtual 3rd IRNI Symposium 2022, a two-day international scientific event (23-24 November 2022) centred around the theme “Shaping the Future of Medicine: Recent Advancements in Drug Discovery and Development” was organised by the Faculty of Pharmacy, UiTM, with the aim of sharing valuable knowledge and showcasing the latest inventions in drug discovery and development. This programme was conducted in collaboration with MoU partner universities, inviting plenary speakers from Queen’s University Belfast (QUB), United Kingdom; Gandhi Institute of Technology and Management (GITAM) University, India; Institut Teknologi Bandung, Indonesia; Mahidol University, Thailand; Pharmaniaga Berhad, Malaysia’s renowned pharmaceutical industry; and other prestigious universities such as University College London, United Kingdom and University of Sharjah, United Arab Emirates.



A total of eight plenary speakers and eighteen invited speakers from Faculty of Pharmacy, UiTM, National Institute of Health, Hospital Pulau Penang and Malaysian Palm Oil Board from Malaysia, Kyoto Pharmaceutical University Japan, QUB, University of Santo Tomas Philippines, Perintis University Indonesia, Walailak University Thailand and Virchow Biotech India shared their invaluable knowledge and ideas. The highlights focused on recent innovations in drug discovery and development for the tailored treatment of chronic diseases. Academicians, researchers, healthcare professionals, and post-graduate students from Malaysia, United Kingdom, India, Indonesia, and the Philippines were among the 84 registered attendees that attended the event.



This successful event ultimately created a dynamic platform to bring together scientists from a wide range of research fields, establish new research collaborations, and share common experiences and best practices in an international environment. The participants appreciated that the topics covered were relevant to the symposium's theme, as well as the committee members' hard work in virtually ensuring the smooth running of this excellent programme. They were also enriched with new knowledge and gained insight into the latest trends and developments in drug discovery and development.

In conjunction with Virtual 3rd IRNI Symposium 2022, a face-to-face pre-symposium workshop on "HPLC Technique and Applications" was organised by Analytical Unit, Faculty of Pharmacy UiTM from 16 to 17 November 2022, involving an expert from AuRIns, UiTM and an application and product specialist from CX1 Services Sdn Bhd, Malaysia. A total of 25 registered participants, including staff and post-graduate, joined this event, which aimed to enhance the knowledge on high-performance liquid chromatography (HPLC), particularly on qualitative and quantitative analysis approaches and HPLC method development, specifically for natural products in drug discovery. A hands-on session on HPLC analysis was an added essence of this workshop, serving as the highlight of this event. This event received positive feedback with participants appreciating the speaker's expertise and topics that were covered.



**Dr. Ravi Sheshala, Dr. Gurmeet Kaur Surindar Singh**

# The *Scan, Sahih, Selamat* Roadshow: Educating the Public on the Dangers of Unregistered Medications and Health Supplements



The *Scan, Sahih, Selamat* programme was successfully conducted on January 18, 2023 jointly organised by the Bahagian Perkhidmatan Farmasi, Jabatan Kesihatan Negeri Selangor (BPF) and Faculty of Pharmacy, Universiti Teknologi MARA (UiTM). The roadshow was attended by YBrs. En. Dazafarullah bin Daud, Deputy Director General of Health (Pharmacy) Selangor, YBhg. Professor Dato' Dr. Abu Bakar Abdul Majeed, Dean, Faculty of Pharmacy UiTM, representative from Techno Secure Print Sdn. Bhd and the Pharmaceutical Services Program, Ministry of Health.

All medications and health supplements in Malaysia must be registered with the Drug Control Authority (DCA) before they can be marketed for the public, in order to ensure its safety, efficacy, and quality. Registered products will have the MAL registration number and hologram safety label attached to each packaging. Currently, the widely used hologram known as Farmatag™ is supplied by Techno Secure Print Sdn. Bhd. Additionally, the company has developed an application to increase public awareness on registration of products called FarmaChecker which can be downloaded from Google Play Store, Apple App Store or Huawei App Gallery.

This roadshow aimed to educate the public on the dangers of purchasing unregistered medications and health supplements that are available in the market. Pharmacists-in-training are the most appropriate ambassadors to educate their family members and relatives. Young adults nowadays are largely exposed to social media, which is currently the main platform for promoting medications and health supplements. Their interest in becoming founders or agents for these products are notably increasing too. It is important for them to understand the legal aspects of product registration to benefit both them and the public.

Final year pharmacists-in-training and faculty members attended this roadshow as participants, while 18 of the students volunteered to assist the organisers. This collaboration opens up opportunities for them to work with the enforcement pharmacists' officers and learn about different job scopes of a pharmacist. It is hoped that all participants gained new knowledge on the importance of product registration and will practically use the FarmaChecker application in the future. The Faculty of Pharmacy welcomes future collaborations with BPF for the next programme.

# UiTM SELANGOR INNOVATION CARNIVAL 2023



On 14th and 15th January 2023, the Faculty of Pharmacy, Universiti Teknologi MARA (UiTM) participated in the UiTM Selangor Branch (UCS) Innovation Carnival 2023 which was organised by UCS in collaboration with the Ministry of Science, Technology and Innovation (MOSTI). The innovation carnival which took place at the Diamond Hall of UCS Puncak Alam Campus was officiated by Chief Secretary of MOSTI, YBhg. Datuk Ts. Dr. Haji Aminuddin Hassim. Also present were UiTM Vice Chancellor, YBhg. Profesor Datuk Ts. Dr. Hajah Roziah Mohd Janor, UiTM officials, UCS Management, lecturers and staff of UCS, sponsors, industry partners, media and visitors.

During this two-day carnival, the Faculty of Pharmacy showcased some of the faculty's innovations that have been recognized at innovation competitions such as Malaysia Technology Expo (MTE), International Invention, Innovation & Technology Exhibition Malaysia (ITEX) and Invention, Innovation and Design Exposition (IIDEX). In addition, the Faculty of Pharmacy also conducted soap-making workshops and free health screenings for the visitors. The response received from researchers and the community around Kuala Selangor was very encouraging. This initiative will hopefully enliven a culture of creativity and innovation among students, academics, and local community.

**Dr. Aisyah Hasyila Jahidin**

# Strengthening Bonds Through Pharmily Day 2022



Pharmily Day, one of the most anticipated events of the semester, marked the end of 2022. This program was organised by the Sekretariat Mahasiswa Fakultas Farmasi (SMF) and Society of Pharmacy Students (SOPHYS) on December 21, 2022 at the FF4 corridor, Faculty of Pharmacy, Puncak Alam Campus, Universiti Teknologi MARA. Surprisingly, despite being held for the first time, this event garnered positive feedback from participants. With the slogan “Strive Together, Care For Each Other”, this programme achieved its purpose of further strengthening the relationship and bridging the gap among the faculty members.

Pharmily Day was carried out with the concept of *sukaneka*, where participants performed a variety of games in the groups to which they had been assigned. Each group was required to play games such as ‘field bowling’, ‘sponge squeeze’ and ‘flying balloon’ at the allocated checkpoints. Bonus points were awarded to the group that managed to answer the question correctly. At the end of the event, the top 3 groups with the highest scores were given the grand prizes which came in the form of a hamper. Group 1 led by Mohammad Asyif Ali Bin Akhtar Ali was crowned the grand prize winner, followed by Group 10 as the runner up and Group 6 in third place.

**Ms.Ili Rabiatul Adawiah binti Ismail, Mr. Muhammad 'Izzuddin Zamery,  
Dr. Gurmeet Kaur Surindar Singh**

# Hospital Pharmacy Attachment: A Structured Experiential Training For Future Pharmacists

From December 5th 2022 to January 11th 2023, a Hospital Pharmacy Attachment (HPA) was conducted at the Pharmacy Department of Hospital Al Sultan Abdullah, Universiti Teknologi MARA (UiTM). HPA was a structured experiential training conducted over a time frame of 10 working days, offered in the final year of the Bachelor of Pharmacy programme. HPA is a compulsory training aimed at providing an overview and introduction to pharmacy units, exposing students to the organisational structure, the pharmacist's role, its governing guidelines, and standard operating procedures. The attachment involved training at six main pharmacy units: the in-patient, out-patient, drug information centre, hospital pharmacy administration and store management, chemotherapy drug reconstitution, and total parenteral nutrition.

These future pharmacists were given the opportunity to practise their skills in dispensing medication, providing medication counselling, and answering drug queries under the supervision of a hospital pharmacist's preceptor. Generally, from a spectator's point of view, this exposure allowed students to apply their knowledge from a theoretical perspective to a real-based scenario. For instance, students gained an idea of how to resolve the issue that emerged based on their exposure to the Out-patient Pharmacy Department, such as initiating medication safety and ensuring effective medication distribution operations at the In-patient Pharmacy Department.

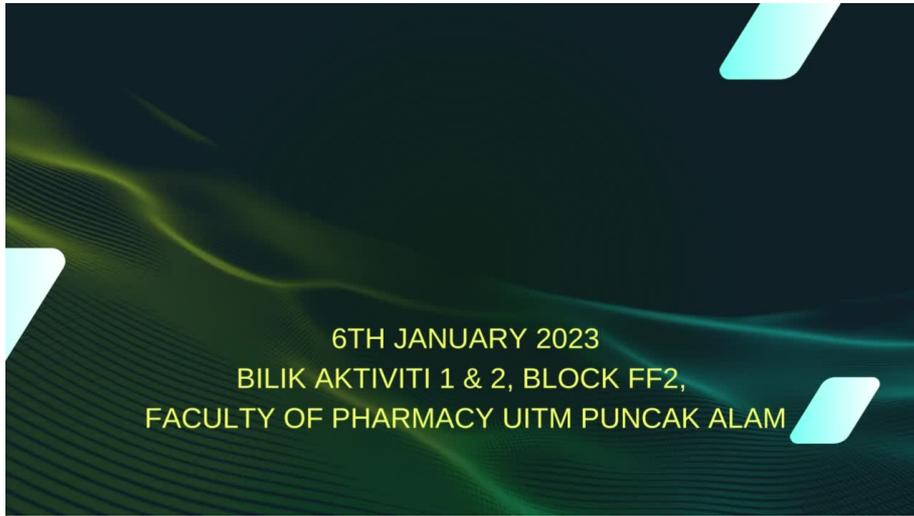


Additionally, a case scenario based on each pharmacy department was assigned to students for a small group discussion under the supervision of a lecturer. From this activity, students were encouraged to provide evidence-based references in justifying the decisions and actions taken to resolve pharmaceutical care issues in the given case. Upon completing the attachment, students reflected on their experiences and expressed satisfaction with the opportunity to do the HPA.

The objectives of HPA have been successfully achieved. Additionally, it is also hoped that the students will value this precious experience and put their newly acquired knowledge to use in the future. Nevertheless, the duration of HPA can be considered to be extended to ensure that future pharmacists can gain more experience and training in pharmacy practice.

**Mdm. Nor Elyzatul Akma Hamdan, Dr. Gurmeet Kaur Surindar Singh**

# PHARMACOEPIDEMOLOGY DAY 2023: A FUN AND INTERACTIVE WAY TO UNDERSTAND PHARMACOEPIDEMOLOGY



Pharmacoepidemiology and Public Health course is offered to second year pharmacy students in their 2nd semester. The course introduces students to different types of pharmacoepidemiology study designs. Pertaining to that, Pharmacoepidemiology day was organised as one of the assessments.. The assessment aims to enhance student's ability to describe the main concepts ,

in pharmacoepidemiology demonstrate problem solving skills in social and cultural aspects of pharmacy practice and display information management skills in drug information and literature evaluation. All Faculty of Pharmacy staff and students were invited to participate in the program.

Working in a group, the second-year students were required to prepare a creative and engaging presentation to explain a pharmacoepidemiology concept given to them prior and describe its application in research articles. Students are also encouraged to decorate their assigned booths and utilise appropriate tools to facilitate audiences' understanding. Several groups organised games and quizzes using questions related to their concepts while a number of groups prepared pamphlets and digital booklets to provide further information to the audience. Some of the pharmacoepidemiology concepts covered were pharmacoconomics, pharmacovigilance, study designs, health-related quality of life and sampling techniques such as snowball sampling and stratified sampling.

Upon completion of the program, students expressed that the program provided them with an opportunity to share their knowledge with the audiences. In addition, they were able to transform the information gathered during literature review into creative materials which enhanced their understanding on various pharmacoepidemiology concepts. The program also served as an ideas exchanging platform as students were required to reflect and write on what they have learnt from other groups.

On behalf of the program committees, we would like to thank all the participants for their support and valuable feedback for the students. It is hoped that through this program, students will be able to enhance their understanding of pharmacoepidemiology concepts and be able to effectively apply the concepts in their future works. It is also hoped that the program will be able to engage a wider audience including members of allied health sciences in future.

**Ms. Zakiah Mohd Noordin, Dr. Mahmathi Karuppanan**

# Exploring Cadamba Forest: A Refreshing Hiking Activity



The Sport and Recreation Bureau of the Society of Pharmacy Students (SOPHYS) organised an activity to explore the Cadamba Forest in UiTM on December 17th, 2022 and January 14th, 2023. This activity involved the participation of 55 students and 5 staff from the Faculty of Pharmacy. The purpose of this activity was to provide an opportunity for the students to explore the natural environment and to gain knowledge about the flora and fauna of the forest.

The students were introduced to the basics of hiking activities, provided safe climbing skills, and introduced to the diversity of plants and animals found in the forest. Furthermore, this kind of activity enables them to feel refreshed and has a number of merits associated with it. While walking, our legs, arms, and other parts of our body move, providing good physical exercise that keeps you fit and healthy. Spending quality time in nature can boost mood, improve mental health and social life, reduce stress, calm anxiety, and lead to a lower risk of depression.

Cadamba Forest offers an easy to moderate hiking trail suitable for people of all ages, with a relatively low hill offering one of the best views around. The starting point of Cadamba Forest, located at Tasik Lima, is a 3.5 km or 2-hour hike, depending on your fitness level. The activity began at 7.45 am with a warm-up session, which is important to increase blood flow to the muscles, prepare for the activity and reduce the risk of injury. The participants then began trekking up the trail, which is pretty straightforward with only moderate slopes and a clear pathway for hikers, so following it will ensure a safe journey.

We encountered a few checkpoints, using them as an opportunity to sip some water before arriving at an open-air space area to rest. At the end of this hiking activity at 12.00 pm, students reflected on their experiences finding this easy breezy hike to be the best experience of their lives!

**Mdm. Maziana Mahamood, Dr. Gurmeet Kaur Surindar Singh**

# ALUMNI SERIES : PHARMACOECONOMICS AND ITS IMPORTANT IN PHARMACY

Pharmacoeconomics refers to the scientific discipline that compares the value of one pharmaceutical drug or drug therapy to another and it is a sub-discipline of health economics. Pharmacoeconomic research assesses the financial value, efficacy, or effects on quality of life of a pharmaceutical medication as well as its costs (represented in monetary terms). Pharmacoeconomic studies help to determine the most efficient and scientifically sound way to allocate healthcare resources.

Pharmaceutical economic evaluation is the focus of pharmacoeconomic, which may employ cost-minimization, cost-benefit, cost-effectiveness, or cost-utility analysis. The primary outcome of interest in pharmacoeconomic analyses is quality-adjusted life years (QALY), and much research uses cost-per-QALY analysis. Randomised controlled trials and decision-analytic modelling techniques are used in economic evaluations.

Pharmacoeconomics is a practical tool for assessing the cost-effectiveness of various treatment choices. It has become essential, especially in the context of developing nations where resources are limited, to apply the principles of pharmacoeconomic for various drugs and treatment options so that the greatest improvement in quality of life can be achieved at the lowest cost. This is because more expensive drugs are being developed and licensed [1].

## Impact on pharmaceutical innovations

A comparison of several initiatives or tactics, taking into account both costs and effects, is known as an economic evaluation. Therefore, identifying, measuring, valuing, and comparing the costs and effects of the interventions under discussion are the fundamental tasks in conducting an economic evaluation. The study will be regarded as undertaking a partial economic assessment rather than a full economic evaluation in circumstances where any of the components of the reference case are absent, for instance, in an analysis where there is no comparator being compared against or missing cost/outcome data.

In Table 1 below, examples of both partial and complete economic analyses are provided. The partial economic evaluation may be a crucial transitional phase in comprehending the expense and effects of a treatment. Partial economic evaluations, however, are unable to address problems about efficiency, in contrast to comprehensive economic evaluations [2].

Table 1: Types of economic evaluation (partial and full) and their examples

Partial	Full
Cost minimisation analysis Cost analysis Cost description Cost-outcome description	Cost effectiveness analysis Cost utility analysis Cost benefit analysis

## Types of pharmacoeconomic evaluations:

### 1) Cost-Minimisation Analysis (CMA)

When two interventions have comparable health effects but differing prices, a CMA may be performed. A CMA would analyse all costs among treatments after evidence of the similarity of the health effects had been established in order to choose the option with the lowest cost.

### 2) Cost-Effectiveness Analysis (CEA)

CEA is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action. CEA is distinct from cost-benefit analysis, which assigns a monetary value to the measure of effect [3]. When it comes to health services, where it might not be suitable to monetize health effects, cost-effectiveness analysis is frequently applied. The CEA is typically represented as a ratio, where the numerator represents the cost of the health gain and the denominator represents the gain in health from a measure (years of life, premature births avoided, sight-years gained) [4]. Years of quality-adjusted life (QALY) are the most often utilised outcome measure [3].

### 3) Cost-Utility Analysis (CUA)

CUA and CEA are extremely similar in concept, with the exception that the outcome is assessed using utility-based measures of health-related quality of life. When various patient-related outcome parameters recorded in various units are present for the treatment being evaluated, it is also employed in those cases. For the purpose of evaluating changes in both quantity and quality of life brought on by interventions, this analytical method is advised. A measure of outcome that incorporates both the quantity and quality of life is called "Quality Adjusted Life Years" (QALYs). As a result of its ability to compare incremental cost and results for various health conditions, CUA has therefore grown to become the norm for economic evaluation in the healthcare industry.

### 4) Cost-Benefit Analysis (CBA)

When the costs and benefits of a treatment are both expressed in monetary terms, CBA evaluates the two possibilities. CBA presents a number of methodological difficulties, including the ethical and practical difficulties related to putting monetary values on health outcomes.

Table 2: Summary of different types of pharmacoeconomic analysis

Type of analysis	Measurement of costs	Measurement of outcomes	Example of outcomes
CEA	Monetary	Natural/physical units (final,intermediate or surrogate outcomes)	Milimetres mercury to express blood pressure, events free survival or life years gained
CUA	Monetary	Multidimensional	QALYs/DALYs
CBA	Monetary	Monetary	Monetary

## Budget Impact Analysis (BIA)

BIA calculates the financial effects of implementing a novel health intervention in a predetermined environment. It aids in educating budget holders about the entire financial implications of a new health intervention. In some ways, it supports pharmacoeconomic analyses by illuminating the viability and affordability of a health intervention in a specific context. The projected size of the eligible population, perspective, time horizon, current and future treatment mix, drug-related and disease-related cost of the treatment mix, and uncertainty analysis are the main components of a BIA [5].

In summary, pharmacoeconomic analysis looks at the efficacy and effectiveness of new health interventions as well as their costs and advantages in relation to one another. Pharmacoeconomic analysis aids healthcare decision-makers in making the best use of the sector's finite resources.

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## KEJOHANAN SUKAN ANTARA FAKULTI (SAF) 2023



Heartiest congratulations to the Faculty of Pharmacy contingent for winning 1 gold, 2 silver and 3 bronze medals and finishing in the Top 10 SAF 2023 overall ranking. Well done!

### Q1 ARTICLE PUBLICATION

**New biologically dynamic hybrid pharmacophore triazinoindole-...**

Triazinoindole bearing thiadiazole derivatives (1-25) have been synthesiz...

scimedirect.com

Full article:

[https://www.sciencedirect.com/science/article/abs/pii/S014181302102777X?fbclid=IwAR1D38YRjwd1p-FvYwoZcpUvAOEjKkbVcCL9-\\_EQot3QYADIQO0FdchCsXk](https://www.sciencedirect.com/science/article/abs/pii/S014181302102777X?fbclid=IwAR1D38YRjwd1p-FvYwoZcpUvAOEjKkbVcCL9-_EQot3QYADIQO0FdchCsXk)

Correspondence: Assoc. Prof. Dr Syed Adnan Ali Shah

### Q1 ARTICLE PUBLICATION



Article  
**Identification of Cyclic Sulfonamides with an *N*-Arylacetamide Group as  $\alpha$ -Glucosidase and  $\alpha$ -Amylase Inhibitors: Biological Evaluation and Molecular Modeling**

Full article: <https://www.mdpi.com/1424-8247/15/1/106?fbclid=IwAR3cnnS6eHMNQ-wBr470aPgQVJnX5DuvsyEKsth rVzerVQhjeQzbQtLRJI8>

Correspondence: Associate Prof. Dr Sadia Sultan

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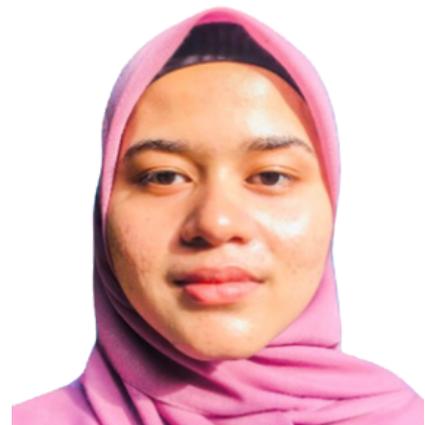
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# UPCOMING EVENTS

## 17TH WORKSHOP ON LABORATORY RODENTS, RATS AND MICE CARE AND USE

Laboratory Animal Facility & Management (LAFAM), Faculty of Pharmacy, UiTM Puncak Alam cordially invites you to participate in our upcoming 17th Rodent Workshop in March 2023!

Date : 7th - 8th March 2023

Time : 8.00 am – 5.00 pm

Venue : Faculty of Pharmacy, UiTM Puncak Alam

For any further information, please do not hesitate to contact the person-in-charge (PIC):

1. Assoc. Prof. Dato' Dr. S. Vellayan (03-3258 4701 / 013-6246918)
2. Dr. Nursakinah Latifi (03-3258 4689 / 013-3141553)
3. Mr. Mohamad Bashir Yaacob (03-3258 4677 / 4722 / 4633)

17TH WORKSHOP ON LABORATORY RODENTS (RATS AND MICE) CARE AND USE 2023

Prof. Dr. Goh Yong Meng  
Faculty of Veterinary Medicine, UPM Serdang

Dr. Raymond Leong Lek Mun  
(Prima Nexus Sdn. Bhd.)

Assoc. Prof. Dato' Dr. S. Vellayan  
Faculty of Pharmacy, UiTM Selangor

Dr. John Shia Kwong Siew  
Faculty of Pharmacy, UiTM Selangor

Assoc. Prof. Dr. Mizaton Hazizul Hasan  
Faculty of Pharmacy, UiTM Selangor

Date: 7th - 8th March 2023  
Time: 8.00 am - 5.00 pm  
Venue: Faculty of Pharmacy, UiTM Puncak Alam Campus.

REGISTER HERE

Designed by: LabMedia Pharmacy

## HANDS-ON WORKSHOP: BIOINFORMATICS FOR LIFE SCIENCES & DRUG DESIGN 2023

Faculty of Pharmacy, UiTM Puncak Alam cordially invites you to our upcoming Hands-on Workshop: Bioinformatics for Life Sciences and Drug Design. The objective is to provide a learning platform for interested researchers in the structural biology field. The 5-Days workshop consist of 3 main modules, which are protein structure modelling, receptor-ligand docking and molecular dynamics simulation. Participants may choose the workshop package based on their interest. Details of the workshop are as follows:

Date : 13th -17th March 2023

Venue : Faculty of Pharmacy, UiTM Puncak Alam

For more information and inquiry, please contact Dr Siti Azma Jusoh via email [sitiazma@uitm.edu.my](mailto:sitiazma@uitm.edu.my)

HANDS-ON WORKSHOP

**BIOINFORMATICS FOR LIFE SCIENCES & DRUG DESIGN 2023**  
13-17 March 2023

Venue:  
Faculty of Pharmacy  
Universiti Teknologi MARA  
Kampus Puncak Alam  
Selangor, MALAYSIA

REGISTER NOW

Dr. Firdaus Samsudin  
A\*Star Institute  
Singapore

Dr. Siti Azma Yusof  
Faculty of Pharmacy  
Universiti Teknologi MARA

Dr. Shirley Siu  
University of Saint Joseph  
Macau

Package	Fee
Protein Modeling & Docking (2 Days)	RM 600 (USD 150)
All-atom MD Simulations (2 Days)	RM 800 (USD 190)
Coarse-grained MD Simulations (1 Day)	RM 400 (USD 95)
Full Package (5 Days)	RM 1700 (USD 400)

\*The fee does not include accommodation.

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## NEWSLETTER EDITORIAL TEAM

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