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POSTGRADUATE DEGREES@

CENTRE FOR DRUG RESEARCH UNIVERSITI SAINS MALAYSIA

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ABOUT US

Centre for Drug Research (CDR) has a long involvement in addiction research since its first establishment as national centre for addiction research known as Pusat Penyelidikan Dadah Kebangsaan in 1978. The work conducted at the centre was recognized by international organizations including the World Health Organization (WHO) and United Nations of which the centre was a collaborating partner for training and research in addiction. In 1985, the centre was acknowledged as a full-fledged centre of Universiti Sains Malaysia (USM) and since then known as Pusat Penyelidikan Dadah dan Ubat-ubatan or Centre for Drug Research. In 2009, CDR was awarded the status of Higher Institution Centre of Excellence (HICoE) under the Ministry of Higher Education Malaysia in the niche area Behavioral Research in Addiction.

Today, CDR is staying true to its strength in having a multidisciplinary team of which the disciplines include chemistry, pharmacology, neuroscience, and social sciences; working together to address research questions with the vision to lead in drug research, for the benefits of mankind. Research activities are enriched by the establishments of extensive research network with national and international collaborators.

At CDR, we offer postgraduate degree programme at Masters and PhD levels tailored to fit the expertise of our academics. We welcome students of all nationalities who are qualified to pursue their postgraduate degrees through research mode either on a full-time or a part-time basis. Please go through this booklet to discover more about what we can offer!

http://drug.usm.my

Centre for Drug Research, USM

ACADEMIC PROGRAMME

Programme Title	Programme Code	Field Code	Title (English)	*Tajuk (Malay)*
Pharmacology/ *Farmakologi*	DRU01	1	Pharmacology	*Farmakologi*
	DRU01	2	Metabolism	*Metabolisme*
	DRU01	3	Pharmacodynamics	*Farmakodinamik*
	DRU01	4	Toxicology	*Toksikologi*
	DRU01	5	Molecular Pharmacology	*Farmakologi Molekul*
	DRU01	6	Pharmacokinetics	*Farmakokinetik*
	DRU01	7	Protein Binding	*Pengikatan Protein*
	DRU01	8	Drug Interaction	*Interaksi Dadah*
	DRU01	9	Pharmacognosy	*Farmakognosi*
Clinical/*Klinikal*	DRU02	1	Clinical Trials	*Kajian Klinikal*
	DRU02	2	Pharmacogenomics	*Farmakogenomik*
	DRU02	3	Bioequivalence	*Bioekuivalens*
Chemistry/*Kimia*	DRU03	1	Extraction Technology	*Teknologi Pengekstrakan*
	DRU03	2	Analytical Chemistry	*Kimia Analisis*
	DRU03	3	Medicinal Chemistry	*Kimia Perubatan*
	DRU03	4	Natural Products Chemistry	*Kimia Hasil Semulajadi*
Drug Abuse & Addiction/*Penyalahgunaan & Penagihan Dadah*	DRU04	1	Epidemiology	*Epidemiologi*
	DRU04	2	Prevention	*Pencegahan*
	DRU04	3	Treatment and Rehabilitation	*Rawatan dan Pemulihan*
	DRU04	4	Social, Economic and Health Impact	*Impak ke atas Sosial, Ekonomi dan Kesihatan*
	DRU04	5	Drug Policy Studies	*Kajian Mengenai Dasar Dadah*

ACADEMIC PROGRAMME

Programme Title	Programme Code	Field Code	Title (English)	*Tajuk (Malay)*
Public Health/*Kesihatan Umum* (DRU)	DRU05	1	Social and Behavioural Aspects of Diseases	*Aspek Sosial dan Tingkahlaku yang Berhubungkait dengan Penyakit-Penyakit*
	DRU05	2	Health Education and Promotion	*Pendidikan dan Promosi Kesihatan*
	DRU05	3	Evaluation of Health Interventions	*Penilaian Intervensi Kesihatan*
	DRU05	4	Psychology	*Psikologi*
Neuroscience/ *Neurosains*	DRU06	1	Neurobehaviour	*Neurotingkahlaku*
	DRU06	2	Neuropharmacology	*Neurofarmakologi*
	DRU06	3	Neuroscience	*Neurosains*
Drug Discovery & Development/ *Penemuan & Pembangunan Ubat-Ubatan* (DRU)	DRU07	1	Computer-aided Drug Design	*Rekabentuk Ubat-Ubatan Berbantuan Komputer*
	DRU07	2	Lead Compound Optimization	*Pengoptimuman Sebatian Penunjuk*

Please visit Institute of Postgraduate Studies USM website at http://ips.usm.my/ for more information

PROSPECTIVE STUDENTS

Potential Supervisors

Postgraduate training by research is offered under a specific supervisor who is in the field of research which is going to be undertaken. To identify your potential supervisor, please go through the pages on CDR academics research expertise in this booklet. Alternatively, you can go to https://experts.usm.my/ to browse more.

Admission

Admission for postgraduate study at CDR is open throughout the year. However, students have to comply with the university's term dates for payment of fees. Application is through an online platform at http://onlineips.usm.my/admission/, and subject to approval by CDR Postgraduate Programme Committee.

For information regarding admission requirements and term dates, please visit https://admission.usm.my/index.php/en/postgraduate/postgraduate-programme

Financial Assistance

Information on financial assistance can be found at http://ips.usm.my/index.php/financial-assistances-v2

Accommodation

On accommodation, registered students are eligible to apply for student accommodation. Application can be made to USM Housing and Accommodation Centre at https://hac.usm.my/index.php/student-housing-accommodation. Private housing near the campus can be found through online searches.

MEET THE TEAM

PROFESSOR DR. MOHD NIZAM MORDI

BSc (Hons) (UKM), MSc (USM), PhD (Manchester)
mnizam@usm.my

Mohd Nizam is a Professor of Medicinal Chemistry. He started his research endeavor with natural product screening as a platform to find lead compounds for several diseases. A breakthrough materialized after his group successfully isolated mitragynine, an alkaloid from the kratom medicinal plant. Now his research horizon circulated in drug design and discovery, in which heterocyclic compounds become his particular interest. By integrating a computer-aided drug design and artificial intelligence, his group has successfully designed and synthesized various analogs of medicinal importance. These analogs were tested primarily for analgesia, addiction, anticancer, antidepressant and Parkinson's. Some analogs have shown a multiple-fold increase of bioactivity against their respective reference compounds from the current treatment. He consistently motivates undergraduate and postgraduate students to study medicinal chemistry and enjoy the challenge associated with the discovery of novel compounds. His research focus has opened more research opportunities and collaborations in drug discovery, development, and preclinical studies with national and international partners.

Current Research Projects:

- Design, synthesis, and mechanism of action of novel indole analogs for opioid-like activity.
- The design and synthesis of novel monofunctional and bifunctional intercalating anticancer compounds.
- Design and synthesis of chemical library focused on neurodegenerative disorder.

CHM DR. THIRUVENTHAN KARUNAKARAN
BSc (Hons) (UPM), PhD (UPM)
thiruventhan@usm.my

My key research area focusing on the field of natural product chemistry, medicinal chemistry, pharmaceutical chemistry and pharmacognosy. Natural products from flora and fauna have become the essential source for discovery of new drugs especially on new psychoactive substances (NPS) based on the new chemical compounds/entities found through the studies conducted by researchers around the globe. Throughout the ages, since ancient times, natural products have played a vital role in the daily life of human beings especially in traditional medicine. It is known as the source of active ingredients of medicine used to treat various diseases. Natural products or natural product derived compounds represent great structural diversity, which is not commonly seen in synthetic compounds and also contributes to the emergence of new psychoactive substances (NPS).Natural products offer great hope in the identification of bioactive compounds and their development into drugs for the treatment many types of diseases. Besides that, plants have been the source for many traditional medicine systems throughout the world for thousands of years and continue to provide mankind with new remedies. Phytochemical studies have enabled researchers to identify bioactive hit compounds responsible for medicinal properties with the aid of analytical and spectroscopic chemistry techniques. Through phytochemical studies, researchers can prove the effectiveness of plant-based medicines which have been used since ancient civilizations as well as the safety of plant-based medicines compared to available synthetic drugs.

My current research focuses on drug discovery and preclinical studies of potential compounds especially those with psychoactive properties from natural, semi-synthetic as well as botanical drug development and herbal standardization for the treatment of addiction and pain. I also conduct research on assessing the toxicity of the compounds from natural, semi-synthetic as well as on plant extracts through in-vitro studies on selected normal and cancer cell lines. With our research strength in chemical and pharmaceutical analysis, chemical spectroscopy including advance spectroscopic techniques (NMR, qNMR, LCMS, GCMS, and FTIR,) and pharmacognosy, potential compounds from natural products, semi-synthetic and standardize extracts will be subjected to preclinical evaluation.

PROFESSOR DR. SURASH RAMANATHAN

BSc (Hons) Pharmacology (UKM), PhD (USM)
srama@usm.my

Under the drug development and discovery programme, two principal areas of research have been identified; addiction science and infectious diseases. With natural products being the most consistent and successful source of drugs, work is being undertaken to source for potential compounds for opiate substitution therapy and infectious diseases. With our research strength in analytical science, isolation chemistry and pharmacology, potential compounds from natural products will be first subjected to preclinical evaluation. In view of merging the strength of natural products with modern analytical techniques, scientific approaches as well as the establishment of their preclinical and clinical studies, the development of new functional compounds with high therapeutic value could be achieved within a short span of time.

PROFESSOR DR. VIKNESWARAN MURUGAIYAH

B Pharm (Hons) (USM), PhD (USM)
vicky@usm.my

My field of research is drug discovery from natural products and synthetic organic compounds. Since the use of morphine as the first commercial pure natural product in 1826 and the first semi-synthetic pure drug of natural product origin, aspirin in 1899, natural products have been the most consistent and successful source of drugs. In line with the national interest in herbal drug development, my research activities are geared toward unravelling scientific evidence on the ethnobotanical uses of local medicinal plants and natural products, mainly but not limited to the areas of metabolic and brain diseases. My research interest is in neurohormetic phytochemicals and cholinesterase inhibitors for neurodegenerative and metabolic disorders.

As I progressed through my research career, I built a repertoire of research related to kratom. Currently, I'm also involved in the pre-clinical research of kratom for the treatment of addiction and pain management.

My research expertise are as follows:

- Isolation and characterization of phytochemicals from medicinal plants.
- Phytochemical analysis/standardization of the medicinal plant extracts or products using the marker chemical constituents by various analytical techniques (HPLC, LCMS, NMR, UV, FTIR).
- Pharmacological investigations of compounds derived from medicinal plants or synthesized for potential bioactivity, focusing on enzyme inhibitory activities, neuroprotection, anti-ageing and metabolic disorders using animal models (rodents and *Caenorhabditis elegans*) and cell lines.
- Pharmacokinetics investigations of the potential bioactive natural products or synthetic compounds.
- Toxicological investigations (acute, sub-chronic and chronic) of plant extracts/ standardized herbal products/bioactive compounds in mice, rats and rabbits.

ASSOCIATE PROFESSOR DR. ZURINA HASSAN

BSc (Hons) (UK), MSc (USM), PhD (USM)
zurina_hassan@usm.my

I am electrophysiologist and behavioural neuroscientist motivated to work toward a deeper understanding of how the brain's cells are born, grow, connect and organise themselves into efficient functional circuits. Communication between neurons is not constant; rather, cells can change their connectivity and communication, a phenomenon known as "plasticity". It is thought that the ability of neurons to rearrange their connections is enables the brain to grow, adapt to experience and encode long-term memories. An extensive amount of study is being done to determine the elements that either encourage or restrict neural changes (and hence memory encoding). Understanding brain principles of motivation, learning and memory, particularly in drug addiction and neurodegenerative disease, has long been a focus of my research. Currently, we are using animal model of chronic cerebral ischemia and investigating its behaviour, particularly regarding cognition, brain activity, neural circuit and neurotransmitter systems. The discovery of therapeutic drugs that can interfere with the hemodynamic and molecular effects of the disease, along with an understanding of the pathophysiology of the brain, have raised high hopes for the effective treatment of stroke and dementia. This animal model has been used as a benchmark for Alzheimer's illness. Our goal is to identify any prospective plants that may have memory-enhancing and neuroprotective characteristics to be developed as "Smart Drug".

DR. FARAH WAHIDA SUHAIMI
BSc (Hons) (Malaya), MSc, PhD (USM)
sfarahwahida@usm.my

My field of research is neurobehaviour and cognition. I am particularly interested in the cognitive changes accompanying drug addiction since brain areas and processes that underlie drug addiction overlap extensively with those that underlie cognition. Cognitive functions such as learning, memory and attention following drug addiction are evaluated using various behavioural paradigms in animal models. The underlying changes in neural mechanisms can be further determined by looking at the neurochemical release in specific brain regions using brain microdialysis in freely moving animals. I am also interested in investigating new plant-based medications for addiction/cognition in different age populations by looking at their effects on physical, physiological and psychological development.

DR. NORSYIFA HARUN

BSc (Hons) (Adelaide), PhD (USM)
norsyifaharun@usm.my

My research interests are focused in the field of psychopharmacology/behavioural pharmacology. The studies extensively involve drug discovery and development from pre-clinical modelling and pharmacological perspectives. My research utilizes a variety of animal models to examine how various drugs affect behaviour and to identify the mechanisms underlying the therapeutic or adverse effects of a range of drug classes. The research goal is to maximise the therapeutic potential of pharmacological drug classes that are associated with liabilities which incorporating the abuse and dependence potential assessments. A number of significant models such as drug self-administration, drug discrimination, conditioned place preference and etc. are being developed to assess the effects of drugs that parallel the subjective effects experienced in humans. In addition, some of the laboratory models may also be used to evaluate newly developed alternative pharmacotherapeutics for neuropsychiatric disorder symptoms such as depression, anxiety, and anhedonia. Using a variety of these models, I am looking forward to explore more on the pharmacology of various pharmacological classes of drugs.

DR. SITI RAFIDAH YUSOF

BSc (Hons), MSc (USM), PhD (King's College London)

sryusof@usm.my

I am interested to understand the structure and function of the blood-brain barrier (BBB), particularly passage of molecules across the BBB and changes to the BBB in pathological conditions. The BBB is formed by cerebral microvessel endothelium and plays an important role to regulate molecular traffic between the circulating blood and the brain. The regulation involves different levels of barriers including the tight junction that seals inter-endothelial space, and the polarized expressions of membrane transporters that are either facilitating or impeding transport of molecules. Though the regulation of passage of molecules by the BBB protects the microenvironment of the brain, the BBB also imposes a significant challenge in the central nervous system (CNS) drug development as delivery of therapeutic molecules are hampered.

At CDR, we have established a cell-based BBB model using primary brain endothelial cells. The model allows us to investigate BBB permeation of CNS lead compounds and different formulations or constructs to improve delivery. Improvements of the cell-based model to better resembles the BBB, and development of a pathological cell-based model are always of interests to me. As the BBB is dynamic in nature, we also used animal models that mimic pathological state e.g. in cerebral hypoperfusion, to explore potential changes to the BBB in such state. The knowledge gained may lead to better therapeutic strategies for CNS disorders.

DR. JUZAILI AZIZI

BSc (Hons) (Malaya), MSc (USM),
PhD (King's College London)
juzaili.azizi@usm.my

My research interests are divided into two related fields namely blood-brain barrier (BBB) and the discovery of neuroprotective agent for the treatment of Parkinson's disease (PD).

Blood-brain barrier (BBB) is a vascular barrier formed at the level of brain capillary endothelial cells (BCEC). Expression of complex tight junctions impede the paracellular permeability of small charged molecules including nutrients and physiological ions such as glucose, amino acids and sodium. Expression of various carrier-mediated transporters and ion channels assist in two-way transport of these molecules (blood-to-brain vs brain-to-blood). Lipophilic compounds can easily permeate through the BCEC lipid bilayer, however, high expressions of efflux pumps at the BBB essentially extrude most of the lipophilic compounds en-route to the brain. The formation of BBB is the evolutionary strategy to maintain the optimum ionic concentration of brain interstitial fluid (ISF) for neuronal communications and signalling. Despite the importance of BBB in maintaining the optimum environment by avoiding rapid fluctuations of solutes content in brain ISF, it also impedes delivery of drug target for central nervous system (CNS) such as drugs for the treatment of Parkinson's disease, brain tumour, pain and drug addiction. My research interest is therefore to manipulate various transport mechanisms at the BBB through chemical modification of drug or using nanocarrier to enhance brain penetration of potential CNS drug candidates. Brain permeability parameters like rate and extent of brain permeation of potential CNS drugs are obtained by *in situ* brain perfusion experiment in rodents which can also be used to obtain information on the mechanisms of brain uptake.

Parkinson's disease (PD) is the second most frequent neurodegenerative disease in the world. As the population of older people increase due to improvement of living standard, so does the population of PD. Current primary treatment with levodopa (L-DOPA) focuses on improvement of symptomatic PD without delaying dopaminergic neuron cell death in the basal ganglia. Treatment with L-DOPA comes with side effects with the most prominent one is L-DOPA induced dyskinesia (LID). L-DOPA will also not be effective when most of dopaminergic neurons have loss. Currently, there are no single effective neuroprotective agent for PD in the clinic to delay or stop dopaminergic neurons death in the basal ganglia. Therefore, my research interest is to screen the potential neuroprotective compounds in *in vitro* and *in vivo* models of PD. Currently available are chemically synthesised β-carboline derivatives and isolated flavonoids from Pteridophytes (edible fern).

PROFESSOR DR. VICKNASINGAM B. KASINATHER

BSoc. Sc. (Hons), MA, PhD (USM)

vickna@usm.my

My research interest is to understand and develop behavioral interventions for people who use drugs. Behavioral surveys are conducted to identify treatment gaps for people who use drugs. Surveys to identify treatment barriers for people who use drugs and integration of substance abuse treatment with other medical services is also an area of my research. I am also working with my colleagues to conduct several clinical trials among people who use opiates and amphetamines. In these trials, medications and behavioral interventions are provided and measured for its efficacy. An interesting emerging area of research is on recreational drug use (New Psychoactive Substances).

DR. DARSHAN SINGH MAHINDER SINGH

Bachelor of Commerce (Deakin University, Australia),
Master of Public Administration (USM), PhD (USM)
darshan@usm.my

My key research focus includes studying the emergence and abuse of psychotropic substances, identifying addiction treatment and harm-reduction prevention challenges among people who use drugs (PWUDs). In addition, I also study ketum (Mitragyna speciosa) use motives, health risks and effects among PWUDs, methadone treatment barriers, HIV risk behaviours of amphetamine-type stimulant (ATS) users, treatment barriers and needs of females who use drugs (FWUDs) and adolescents who use drugs, as well as determine the effectiveness of harm-reduction programs designed for PWUDs. I also analyse the strengths and weaknesses of drug policies like the death penalty and corporal punishment. I work closely with out-of-treatment PWUDs and people who use New Psychoactive Substances (NPS). I am also proactively engaged in University-Community-based engagement programs targeting communities plagued with drug abuse issues. My research aims to help improve drug policies and laws for the betterment of PWUDs and to meet UN's Sustainable Development Goals.

TESTIMONIALS

"CDR is a great place for critical-minded students to study and explore science. As a postgraduate, I am given the opportunity and freedom to work on my research project in the pursuit of finding answers to the endless questions encapsulating the brain mechanisms. With access to research facilities, helpful academicians and friendly staff, I am able to work on my research endeavours with ease"

Dr. Hema Sekaran

"I love it here in CDR! Doing research surrounded by talented, committed, helpful and friendly staff and students just makes research here more interesting and exciting. All the awesome moments and the valuable experiences will be cherished forever"

Dr. Nur Azzalia Kamaruzaman

"Here, I have worked with and established relationships with colleagues from different cultural backgrounds. Exchange of ideas among us is definitely an eye-opener which allows new perspectives to be developed and pondered upon. This is extremely helpful when one is facing bottleneck in research. Advice and support from colleagues are of great comfort and propel me to persevere against all odds. Apart from budding friendships, regular Journal Club activities are a great platform for me to improve presentation and communication skills which are vital for boosting employability. Last but not least, I would like to extend my appreciation to lab officers for their assistance in my research. It is indeed an unforgettable memory I have had in CDR. I hope CDR will continue to strive to become the crème de la crème locally and achieve global recognition"

Jimmy Wong

"I spent almost 7 years in CDR, so called super senior. My journey began with MSc (2008) and continues with PhD (2015). CDR is a package with great experiences, interesting research, information box, fun activities and good people. This place has given me a wealth of information and trained me to be a good as well as an independent researcher. I personally enjoyed all my years here"

Dr. Sutha Devaraj

LAB FACILITIES

Contact:
nur_sabrina@usm.my

Quantitative & quantitative analyses of samples

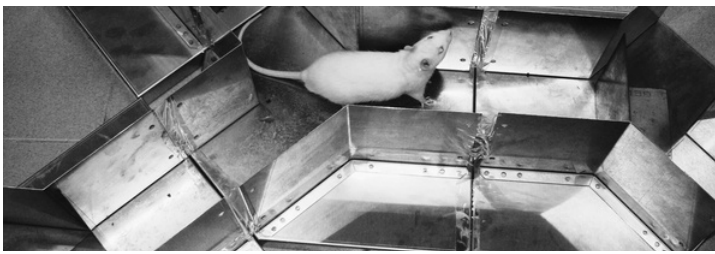
- LC-MS/MS
- GC-MS
- HPLC-UV/PDA
- Fourier-transform infrared spectroscopy (FTIR)
- UV-Vis/microplate reader
- Liquid scintillation counter for quantitation of low energy radioisotopes
- Dissolution apparatus

Sample extraction

- Soxhlet apparatus
- Rotary evaporator
- Freeze dryer
- Microcentrifuge
- Ultracentrifuge

Neurobehavioural & animal research equipment

- Operant-conditioning chamber
- Conditioned place-preference chamber
- Automated open field
- Passive/active avoidance test apparatus
- Novel object recognition apparatus
- Morris water maze
- Elevated plus maze
- SMART behaviour tracking system
- Microdialysis apparatus
- Tail flick test apparatus
- Hot plate test apparatus
- Forced swim test apparatus
- Social motivation test apparatus
- Zebrafish facility
- Motorized stereotaxic micromanipulator
- Long-term potentiation apparatus
- Microsurgery microscope
- Light microscope/image analyzer
- Telemetric EEG



Cell culture facility

- Autoclave
- Biosafety cabinet class II
- CO2 incubator
- Plate shaker incubator
- Inverted microscope
- Refrigerated centrifuge
- Chopstick electrode (STX-2) and voltohmmeter (EVOM2)
- Liquid nitrogen tanks
- Fridge (4°C) & freezers (-20°C, -80°C)

Western Blot apparatus

RT-qPCR apparatus

COME AND JOIN US!

http://drug.usm.my

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