Research Excellence

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Research Excellence

Mahidol University has continuously developed and strived for educational excellence, outstanding research and leadership in healthcare services, and global outlook.
Thus Mahidol University is ranked top for research in Thailand and has been selected as 1 of 9 National Research Universities in 2010 – 2013 by the Thai Commission of Higher Education, Ministry of Education and is ranked number 4 in ASEAN and 42 in Asia by Quacquarelli Symonds Asian Ranking 2013.

	Institute	Country	ASEAN Rank 2013
1.	National University of Singapore	Singapore	2
2.	Nanyang Technology University	Singapore	10
3.	University of Malaya	Malaysia	33
4.	Mahidol University	Thailand	42
5.	Chulalongkorn University	Thailand	48
6.	University Kebangsaan Malaysia	Malaysia	57
7.	Univeritas Indonesia	Indonesia	64
8.	University of the Philippines	Philippines	67
9.	Universiti Technology Malaysia	Malaysia	68
10.	Universiti Putra Malaysia	Malaysia	72
11.	Chiangmai University	Thailand	98

In addition, Mahidol University has consistently been always ranked number 1 in Thailand by the QS Asian University Ranking 2013.

Institute	Thai Rank	ASEAN Rank				
		2013	2012	2011	2010	2009
MU	1	42	38	34	28	30
CU	2	48	43	47	44	35
CMU	3	98	91	67	79	81
TU	4	107	110	88	91	85
PSU	5	146	145	95	101	109
KKU	6	161-170	122	114	171-180	113
KMUTT	7	161-170	161-170	181-190	201	201
KU	8	171-180	191-200	120	126	108
BUU	9	191-200	191-200	181-190	201	151
KMUTL	10	251-300	251-300	201	201	201
SWU	11	251-300	251-300	201	201	201

In 2013, Mahidol University has continuously developed research infrastructures and has hosted a number of excellence centers.
Mahidol University supports 4 National Centers of Excellence in Science and Technology, and Postgraduate Education and Research Development Office (PERDO), under the Higher Education Commission, as follows:

1. Center of Excellence on Environmental Health, Toxicology and Management of Chemicals (ETM)

2. Center of Excellence for Innovation in Chemistry (PERCH-CIC)

3. Center of Excellence in Mathematics (CEM)

4. Center of Excellence in Medical Biotechnology (in a final stage of establishment)

The Centers of Excellence in Nanotechnology at Mahidol University have been jointly established by the National Nanotechnology Center (NANOTEC) of the National Science and Technology Development Agency (NSTDA) into 2 centers:

1. NANOTEC-MU Excellence Center of Intelligent Materials and Systems at the Faculty of Science.

2. NANOTEC-MU Excellence Center of Nanotechnology for Cancer Diagnosis and Treatment at the Faculty of Medicine Siriraj Hospital.

Since 2011, Mahidol University has been selected as one of the National Research Universities to foster research clusters and research centers as follows:

National Research University (NRU) Project
4 Research Clusters
1. Cluster of Cardiovascular Diseases and Metabolic Research
2. Cluster of Innovation in Social Science, Education and Environmental Management for Human-being
3. Cluster of Enhancing Competitive Advantage of Healthcare Service in Thailand
4. Cluster of Music Therapy
5 Research Centers
1. Center for Emerging and Neglected Infectious Diseases Research
2. Center for Research in Complex Systems Sciences
3. Center for Thalassemia Research
4. Center for Aquatic Animals Research
5. Center for Biopharmaceutical Development and Innovative Therapy

Mahidol University has many long-term research collaborations with various international institutes. Collaboration with University of Oslo, Norway has been continuously extended for the last 42 years. Cooperation with Oxford University, UK and Osaka University, Japan has lasted more than 30 years. Mahidol University and Osaka University have also established the Collaborative Research Center (MU-OU: CRC) for Bioscience and Biotechnology at the Faculty of Science to conduct highly advanced multidisciplinary research.

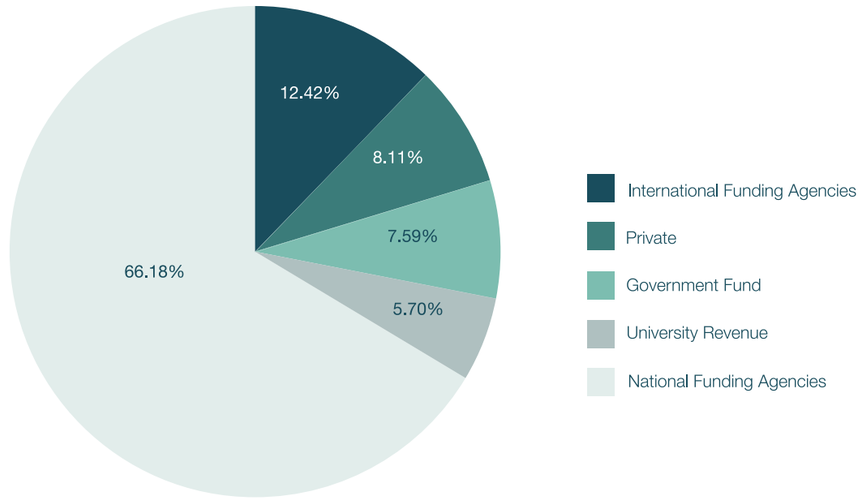
Furthermore, Mahidol-Osaka Center for Infectious Diseases (MOCID) and Mahidol-Oxford Tropical Medicine Research Unit have been established at Faculty of Tropical Medicine. In addition, Mahidol University has hosted 6 WHO Collaborating Centers (WHO-CCs) situated in Faculty of Medicine Siriraj Hospital, Faculty of Nursing, Faculty of Tropical Medicine, Institute of Nutrition, ASEAN Institute for Health Development and Institute for Population and Social Research.

List of WHO Collaborating Centres (WHO-CCs) In Mahidol University

No.	Organization	Area of Expertise	Contact Person
1.	Institute for Population and Social Research (IPSR)	Research in Human Reproduction	Assist. Prof. Sureeporn Punpuing Ph.D. Sureeporn.pun@mahidol.ac.th
2.	Dept. of Oto-Rhino-Laryngology Faculty of Medicine Siriraj Hospital	Prevention of Deafness and Hearing Impairment	Prof. Emeritus Suchitra Prasansuk Suchitra.pra@mahidol.ac.th Dr. Samut Chongvisal samut.cho@mahidol.ac.th
3.	ASEAN Institute for Health Development	Primary Health Care Development	Dr. Jumroon Mikhanorn Jumroon.mik@mahidol.ac.th Assoc. Prof. Boonyong Keiwkarnka Boonyong.kei@mahidol.ac.th
4.	Institute of Nutrition	Community Nutrition and Food Safety	Prof. Visith Chavasit Visith.cha@mahidol.ac.th
5.	Faculty of Tropical Medicine	Clinical Management of Malaria	Prof. Polrat Wilairatana Polrat.wil@mahidol.ac.th
6.	Faculty of Nursing	Nursing & Midwifery Development	Prof. Fongcum Tilokskulchai Fongcum.til@mahidol.ac.th

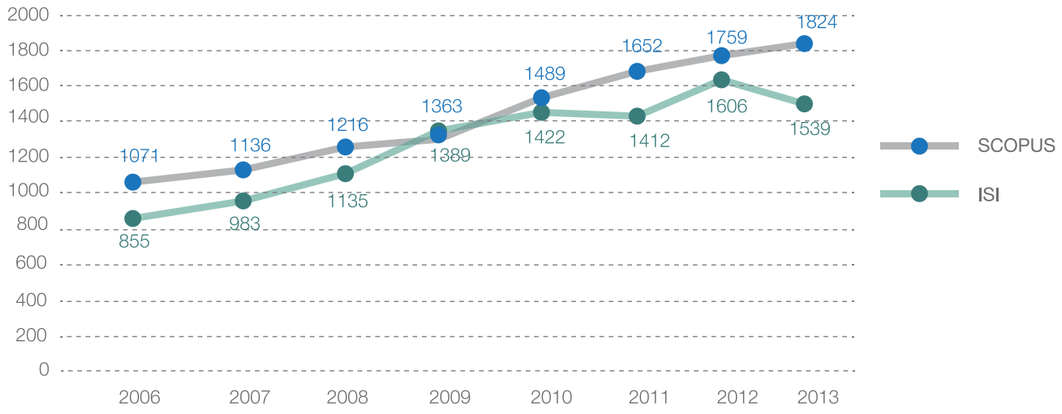
Research Funding In 2013

As of 30 May 2014



Number of Publications

All Document Types Indexed in ISI & SCOPUS
As of 31 May 2014



Number of Citations

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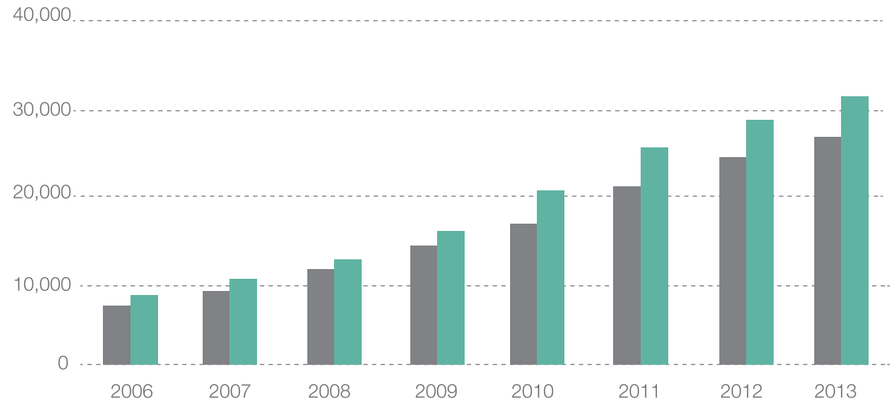
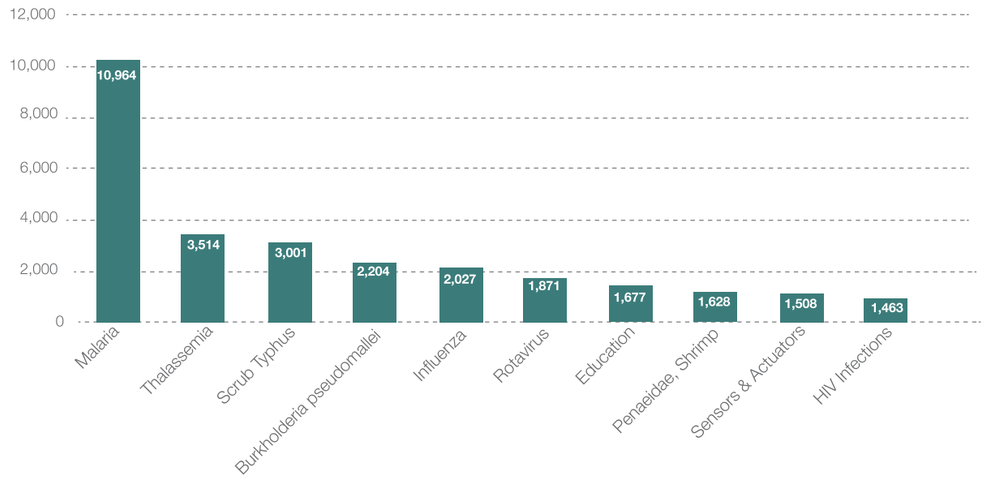
As of 31 May 2014



	2006	2007	2008	2009	2010	2011	2012	2013
ISI	7,467	9,864	12,139	14,669	18,173	21,522	24,221	27,148
SCOPUS	8,930	11,193	14,146	17,002	20,932	25,602	29,193	32,335

Articles Published Internationally 2008-2012

In Major Competency Areas
Data from : www.spotlight.scival.com



Mahidol University Publication 2013 with High Impact

No.	Authors	Title	Source
1.	Jain V.K., Rivera L., Zaman K., Espos Jr. R.A., Sirivichayakul C., Quiambao B.P., Rivera-Medina D.M., Kerdpanich P., Ceyhan M., Dinleyici E.C., Cravioto A., Yunus M., Chanthavanich P., Limkittikul K., (...), Dbaibo G., Innis B.L	Vaccine for prevention of mild and moderate-to-severe influenza in children	(2013) New England Journal of Medicine. 369(26) pp. 2481-2491.
2.	Llanos-Cuentas A., Lacerda M.V., Rueangweerayut R., Krudsood S., Gupta S.K., Kochar S.K., Arthur P., Chuenchom N., Mohrle J.J., Duparc S., Ugwuegbulam C., Kleim J.-P., Carter N., Green J.A., Kellam Ms	Tafenoquine plus chloroquine for the treatment and relapse prevention of Plasmodium vivax malaria (DETECTIVE): a multicentre, double-blind, randomised, phase 2b dose-selection study	(2013) The Lancet. Article in Press
3.	Katz J., Lee A.C.C., Kozuki N., Lawn J.E., Cousens S., Blencowe H., Ezzati M., Bhutta Z.A., Marchant T., Willey B.A., Adair L., Barros F., Baqui A.H., Christian P., Fawzi W., Gonzalez R., Humphrey J., Huybregts L., Kolsteren P., Mongkolchati A., (...), Watson-Jones D., Black R.E.	Mortality risk in preterm and small-for-gestational-age infants in low-income and middle-income countries: A pooled country analysis	(2013) The Lancet. Volume 382(9890) pp. 417-425.
4.	Shanks G.D., White N.J.	The activation of vivax malaria hypnozoites by infectious diseases	(2013) The Lancet Infectious Diseases. 13(10) pp. 900-906.
5.	White N.J.	Primaquine to prevent transmission of falciparum malaria	(2013) The Lancet infectious diseases. 13(2) pp. 175-181.
6.	Day N.P.J.	Panton-Valentine leucocidin and staphylococcal disease	(2013) The Lancet Infectious Diseases. 13(1) pp. 5-6.
7.	Hemachudha T., Ugolini G., Wacharapluesadee S., Sungkarat W., Shuangshoti S., Laothamatas J.	Human rabies: Neuropathogenesis, diagnosis, and management	(2013)The Lancet Neurology. 12(5) pp. 498-513.
8.	Lertkhachonsuk A.-A., Yip C.H., Khuhaprema T., Chen D.-S., Plummer M., Jee S.H., Toi M., Wilailak S.	Cancer prevention in asia: Resource-stratified guidelines from the asian oncology summit 2013	(2013) The Lancet Oncology. 14(12) pp. e497-e507.
9.	Lorthongpanich C., Cheow L., Balu S., Quake S.R., Knowles B.B., Burkholder W.F., Solter D., Messerschmidt D.M.	Single-cell DNA-methylation analysis reveals epigenetic chimerism in preimplantation	(2013) Science. 341(6150) pp. 1110-1112.
10.	McNamara C.W., Lee M.C.S., Lim C.S., (...), Renia L., Nosten F., Tully D.C., Kocken C.H.M., Glynne R.J., Bodenreider C., Fidock D.A., Diagana T.T., Winzeler E.A.	Targeting Plasmodium PI(4)K to eliminate malaria	(2013) Nature. 504(7479) pp. 248-253.
11.	Miotto O., Almagro-Garcia J., Manske M., MacInnis B., Campino S., Rockett K.A., Amaratunga C., Lim P., Suon S., Sreng S., Anderson J.M., Duong S., Nguon C., Chuor C.M., Saunders D., Se Y., Lon C., Fukuda M.M., Amenga-Etego L., Hodgson A.V.O., Asoala V., Imwong M., Takala-Harrison S., Nosten F., (...), Day N.P., White N.J., Bethell D., Dondorp A.M., Plowe C.V., Fairhurst R.M., Kwiatkowski D.P.	Multiple populations of artemisinin-resistant Plasmodium falciparum in Cambodia	(2013) Nature Genetics. 45(6) pp. 648-655.
12.	Horikoshi M., Yaghootkar H., Mook-Kanamori D.O., Sovio U., Taal H.R., Hennig B.J., Bradfield J.P., St Pourcain B., Evans D.M., Charoen P., (...), Timpson N.J., Prokopenko I., Freathy R.M.	New loci associated with birth weight identify genetic links between intrauterine growth and adult height and metabolism	(2013) Nature Genetics. 45(1) pp. 76-82.
13.	Tachibana M., Amato P., Sparman M., Gutierrez N.M., Tippner-Hedges R., Ma H., Kang E., Fulati A., Lee H.-S., Sritanaudomchai H., Masterson K., Larson J., Eaton D., Sadler-Fredd K., Battaglia D., Lee D., Wu D., Jensen J., Patton P., Gokhale S., Stouffer R.L., Wolf D., Mitalipov S.	Human embryonic stem cells derived by somatic cell nuclear transfer	(2013) Cell. 153(6) pp. 1228-1238.
14.	Malakit, K., Shay, M.A., Cassak, P.A., Ruffolo, D.	Human embryonic stem cells derived by somatic cell nuclear transfer	(2013) Physical Review Letters. 111(13) Art.no.135001.

HIGHLIGHTS RESEARCHES EXCELLENCE

Production of therapeutic antibodies for hepatitis C virus infection and construction of a minibody/nanobody phage display library

"2013 Outstanding Research Award from the Thailand Research Fund (TRF)"

Prof. Dr. Wanpen Chaicumpa, D.V.M. (Hons.), Ph. D. (Microbiology) Faculty of Medicine Siriraj Hospital

Over 180 million people are chronically infected with hepatitis C virus (HCV) with an additional 3-4 million new cases each year. The infection is a major cause of end-stage liver diseases including liver fibrosis and hepatocellular carcinoma with exceptionally high fatality. Presently, there is no effective vaccine against the HCV infection. The current treatment is weekly injected pegylated interferon alpha in combination with daily oral ribavirin to relieve the clinical symptoms and control the viral load. Only ~50% of the patients respond to the therapy. Recently, HCV protease inhibitors (telaprevir and boceprevir) have been approved by US FDA. Telaprevir/boceprevir in combination with the dual therapy (triple therapy) is indicated for chronic hepatitis C patients with both drug naïve and dual therapy resistant infections. About two-thirds of the treated patients develop sustained viral response. However, the treatment causes adverse side effects and is contraindicated for pregnant women as birth defect and fetal death may result. There is an urgent need of more effective and safe therapeutic agents for HCV treatment.

Among the 10 HCV proteins, NS3 protease, NS3 helicase and NS5B polymerase are key players in the HCV replication cycle and thus they are the main targets of therapeutic antibodies invented in this study.

Recombinant HCV protease, helicase and polymerase with inherent enzymatic activities of the native counterparts were produced and used as antigens in bio-panning for selection of phage clones that bound to the antigens from the previously constructed human single chain antibody (VH-linker-VL; HuScFv) and humanized-single domain antibody (nanobody/VH/VHH) phage display libraries. After introducing the phages into E. coli bacteria, soluble HuScFv and VH/VHH specific to the three enzymes were successfully produced. The small antibodies could inhibit the respective HCV enzymatic activities. They were then made into non-toxic cell penetrable format by molecularly linking the antibody coding genes with a DNA coding for a cell penetrating peptide, called penetratin (PEN). The PEN-HuScFv and PEN-VH/VHH were tested for their ability to interfere with the HCV replication cycle in human hepatic cells infected with heterologous HCV replicon. There were 2 NS3 protease specific-PEN-HuScFv, 3 NS5B polymerase specific-PEN-HuScFv, 3 protease specific-PEN-VHH, 4 NS3 helicase specific-PEN-VH/VHH and 3 NS5B polymerase specific-PEN-VH/VHH that could inhibit replication and/or assembly of the heterologous HCV.

These transbodies have high potential for developing into novel anti-HCV remedies. Moreover, new VHH phage display library with high antibody diversity was constructed. Humanized, cell penetrable nanobodies that bound specifically to HCV viroporin (p7) and interfered with HCV replication were also produced.

Center of Excellence for Antibody Research (CEAR)

"2013 NRCT Outstanding Research Award from National Research Council of Thailand"

Associate Professor Dr. Pongrama Ramasoota

On January 9th, 2014, The National Research Council of Thailand awarded the NRCT Outstanding Research Award 2013 to Associate Professor Dr. Pongrama Ramasoota, Director of the Center of Excellence for Antibody Research (CEAR), Faculty of Tropical Medicine and his team; Dr. Pannamthip Pitaksajjakul, Dr. Ladawan Sariya, Dr. Chonlatip Pipattanaboon, Dr. Chayanee Setthapramote, Miss. Sujittra Keadsanti and Mr. Surachet Benchatummaruk together with Collaborators from Osaka University, Japan; Professor Dr. Kazuyoshi Ikuta, Assoc. Prof. Dr. Tadahiro Sasaki, Assoc. Prof. Dr. Tamaki Okabayashi, for their Research work entitled "Therapeutic and Diagnostic Monoclonal Antibodies Against Tropical Diseases".

This research focused on "Therapeutic human monoclonal antibodies against 4 serotypes of Dengue virus (DENV)" that was funded by Science and Technology research partnership for sustainable development, Japan Science Technology Agency, Japan International Cooperation Agency and Faculty of Tropical Medicine, Mahidol University. Since DENV infection is a world public health problem and until now there be have been no specific and effective treatment for DENV, so Dr. Pongrama and his team developed "Neutralizing Human Monoclonal antibody (NhuMAb)" that can block DENV infection in a host cells. The NhuMAb was developed using Thai DENV patients Peripheral Blood Mononuclear cell (PBMC) that fused with novel myeloma cell namely "SPYMEG". The fused Hybridoma cells would have functions of human antibody productions from B cells and fast growing functions from Myeloma cell. Then, NhuMAb produced from each cultured hybridoma cell, was screened with 4 serotypes of DENV.

Finally, 3 candidate NhuMAbs with more than 90% NT were obtained. Each candidate NhuMAbs could completely neutralize 4 serotypes of DENV clinical isolates in vitro. Moreover, the vivo experiment in DENV challenged monkeys, showed that candidate NhuMAbs completely eliminated DENV infection within 2 days.

The invention of these NhuMAbs against DENV was filed for patents in USA and 8 more countries. Since these NhuMAbs will be further applied as therapeutic reagent in human, so NhuMAb production as recombinant IgG expressed in mammalian CHO cell, which is accepted by FDA for human used, were prepared from each Hybridoma cell.

Characterizations and relationships of gonadotropin-releasing hormone (GnRHs) and gonadotropin hormones (GTHs) in crustaceans, and their possible applications in aquaculture

"2013 Outstanding Research Award from Thailand Research Fund"

Professor Dr. Prasert Sophon

Prawns and marine crabs are important economic aquatic animals of Thailand. Because of high demands from both export and local consumption attempts have been made to culture these animals. However, stress in captivity prevent the broodstocks from breeding properly, resulting in very low production of gametes and larvae. The aims of these research are to help rectify these short comings, which is composed of two-step approaches: first, to investigate the structures of the central nervous system (CNS), the reproductive organs and to identify key hormones, pheromones and factors that control the reproductive process; and second, to apply these factors in stimulating gonadal maturation to increase gametes and larval productions that may be applied in aquaculture system.

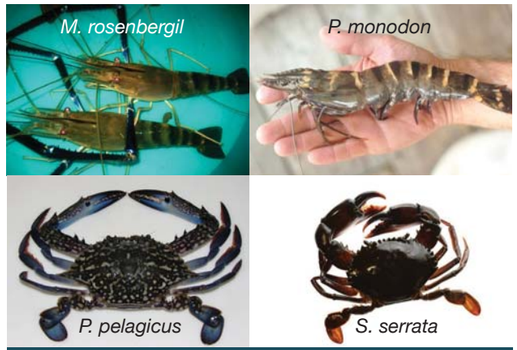
The CNS is composed of eyestalk, brain, thoracic and abdominal ganglia linked by ventral nerve cord. The eyestalks contain X-organ Sinus gland complexes (XSO) that produces hormones inhibiting gonadal development and molting.The brain and thoracic ganglia are the seats where gonadal stimulating factors (GSFs) are produced. The GSFs are composed of serotonin (5HT), members of gonadotropin-stimulating hormone family (GnRHs, RPCH, AKHs), and gonadotropins including egg laying hormone (ELH) in females, and insulin-liked androgenic gland hormone (IAGH) in males. In females, administration of 5HT, GnRHs, ELH could stimulate ovarian maturation and egg production in order of increasing effectiveness, while the administration of dopamine (DA) had an opposite effect. Thus, it was hypothesized that there is a heirachical control of ovarian maturation with 5HT and its associate neurons being the first order that perceive appropriate environmental conditions, such as photoperiod, temperature, food availability, etc. 5HT may exercises control over GnRH, a neuromodulator produced mainly by CNS, which in turn controls the local production of ELH in the ovary.

This endocrine axis may control ovarian maturation and oocytes differentiation through 5 stages to form mature eggs. Under unfavorable environmental conditions DA may inhibit the activity of this axis, and also promotes the production and secretion of gonad-inhibiting hormone (GIH) from the XOS which suppresses the ovarian maturation.

In males, the reproductive organs comprise of testes that produce sperm, and spermatic ducts that produce substances promoting sperm maturation such as male-related reproduction factor (Mrr), and ejaculatory bulb for sperm storage and spermiation. Androgenic glands are male-specific endocrine glands that produce insulin-like androgenic gland hormone (IAGH) which controls testicular maturation, sperm production and male sex differentiation. IAGH has two chains linked by two disulfide bonds.

IAGHs of blue and mud crabs share 96% similarity with IAGHs of crayfish (C.destructor and C.quadricarinatus), while that of fresh water prawn shares only 23% similarity. Eyestalk ablation as well as administrations of 5HT or GnRHs stimulated hypertrophy of the AG and increased production of IAGH, which in turn stimulated testicular maturation and sperm production; while DA showed the opposite effect. These data suggest that testicular maturation, sperm production and expression of male sex characteristic are also under the heirachical control of 5HT-GnRH-IAGH axis; while DA may suppress the activity of this axis as well as promoting the production and release of GIH which directly suppressed testicular maturation.

The knowledge obtained above may be applied in aquaculture. For example, the treatments with GnRH or ELH may obviate the need to perform eyestalk ablation in female broodstocks in captivity, especially in marine prawns including P.monodon and L.vannamei. The primings with these hormones may also help to promote the fecundity and egg production in underperformed broodstocks of fresh water prawn and crabs in captivity. By the same token, fecundity, testicular maturation and sperm production could be increased in male broodstock by treatment with GnRH and IAGH. The latter could also be used as a biomarker for postlarval males because it is expressed early during the first week.



Economic decapod crustaceans

Using IAGH marker it was noticed that postlarvae of the giant fresh water prawn that supine during the first two days are predominantly males. This simple technique could be used for male sex selection for monoculture. At a more sophisticated level IAGH or extract of hypertrophic AG may be used for induction of males if given early in postlarval stage. Alternatively, the IAGH gene or gene product may be suppressed by treatment with siRNA or antibody that should be given to male postlarvae or juveniles to induce pseudofemales that can be mated with males to produce all male offsprings. Such manipulative technologies should be investigated further and if proven to be practical should be optimized in future studies, so that the full benefit of the basic knowledge obtained can be utilized.

Enzyme Catalysis and Engineering

"2012 Outstanding Researcher Award from National Research Council of Thailand"

Professor Dr. Pimchai Chaiyen

The main goal of Dr. Chaiyen research is to gain an in-depth understanding of the reaction mechanisms of many redox and aldolase enzymes. A thorough understanding of enzyme catalysis is useful for engineering enzymes to be suitable for applications in biocatalytic and biorefinery processes. The knowledge about enzyme mechanisms and kinetics is also useful for devising enzymes and their reactions to be used as bioreporters and in drug discovery. Currently, they are investigating about 20 enzymatic reactions in which their applications can be classified into 4 groups.

1. Enzymes that are useful for biocatalysis: Flavin-dependent enzymes such as p-hydroxyphenylacetate hydroxylase (HPAH) can perform regio-specific hydroxylation of phenolic compounds. They are currently exploring HPAH potential in synthesizing catecholic drugs or anti-oxidants. Pyranose 2-oxidase (P2O) can catalyze regio-specific oxidation at C2-position of pyranoses. P2O reaction is useful for synthesis of sweetener and rare sugars. A few more enzymatic systems are being developed for potential use in pharmaceutical industry.

2. Enzymes that are useful for biorefinery process: In order to support sustainable development of Thailand, a few enzymatic systems that can convert waste or by-products from biomass to useful compounds such as bioplastics or biogas are being studied.

3. Enzymes that are useful as bioreporters: Bacterial luciferase is a flavin-dependent enzyme that catalyzes light-emitting reactions. They are currently developing gene reporter systems to be used in bacterial and mammalian cells.

4. Enzymes that can be potential drug-targets: The enzyme serine hydroxymethyl transferase (SHMT) is an indispensible anti-malarial target. They are studying its reaction mechanisms so that any difference between host and parasite enzymes can be delineated and used for designing specific inhibitors against malaria. The human SHMT is also a good target for cancer therapy.

CFTR choloride channel as a drug target for cholera

"2013 Young Scientist Award From The Foundation for the Promotion of Science and Technology under the Patronage of H.M. the King"

Cholera is a severe diarrhea caused by intestinal infection with a gram-negative bacterium Vibrio cholerae. Annually, numbers of cholera cases were estimated to be approximately 3-5 million and tended to increase recently as a result of global warming. Mainstay therapy of cholera is the use of oral rehydration solution (ORS) to replace intestinal fluid loss. However, ORS is ineffective in 20% of cholera cases, in which diarrheal fluid loss is too severe to be replaced by ORS and therefore accounts for most of the dead cases (~100,000 cases/year). Dr. Muanprasat's research effort is to develop novel therapeutic approaches that can effectively reduce diarrheal fluid loss and save life of cholera patients. It has long been known that severe diarrhea in cholera results from the stimulation of chloride secretion by cholera toxin, an enterotoxin produced by V. cholerae, which in turn drives massive intestinal fluid secretion and fluid loss.

Since cystic fibrosis transmembrane conductance regulator (CFTR), a cAMP-activated chloride channel, provides a principal route for chloride exit across the luminal membrane of intestinal epithelial cells under cholera toxin-stimulated conditions, CFTR represents a promising target for anti-secretory therapy of cholera. Dr. Muanprasat and his team have discovered several types of natural plant-derived bioactive compounds that hold great promise to be developed as cholera therapy. His team initially demonstrated that dihydroisosteviol, a derivative of a natural sweetener stevioside isolated from Stevia rebaudiana, inhibits CFTR-mediated chloride secretion in human intestinal epithelial cells and reduces cholera toxin-induced diarrhea in mice through a mechanism involving activation of an energy sensor AMP-activated protein kinase.

Assistant Professor Dr.Chatchai Muanprasat

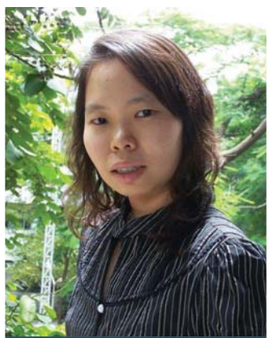
Subsequently, Dr. Muanprasat's research team discovered series of phenol-containing CFTR inhibitors from Thai indigenous plants and fruits including hydrolysable tannin from gallnuts, chalcone from Butea monosperma and hydroxyxanthones from shells of mangosteens. Mechanistic studies revealed that all these three classes of natural phenolic compounds directly inhibit CFTR and demonstrate in vivo efficacy in mouse models of cholera toxin-induced diarrhea. Interestingly, these phenol-containing CFTR inhibitors exhibit differential specificity toward apical chloride channels in human intestinal epithelial cells: hydroxyxanthones inhibit both CFTR and calcium-activated chloride channels (CaCC) expressed in the apical membrane of intestinal epithelial cells, while hydrolysable tannin and chalcone inhibit only CFTR. These data suggest that hydroxyxanthones have board ranges of application in the treatment of diarrheas resulting from overstimulation of either CFTR or CaCC-mediated chloride secretion.

Of particular importance, Dr. Muanprasat and his team have developed a novel mouse model of cholera, in which V. cholera inoculated into ileal loops of adult mice consistently produced massive intestinal fluid secretion. Using this mouse model of cholera, Dr. Muanprasat's research team showed that V. cholerae-induced diarrhea is completely inhibited by a specific CFTR inhibitor (CFTRinh-172), confirming CFTR as a highly promising drug target for cholera, as shown in figure below. This study is the first to identify CFTR as a major host factor determining the severity of diarrhea induced by V. cholerae infection.

In addition, this mouse model of cholera resembles cholera in human in many aspects, especially the observation of excessive intestinal fluid secretion and mucus secretion from goblet cells despite intact intestinal epithelial barrier and vascular integrity. This mouse model of cholera could be very useful for investigating pathogenesis of cholera diarrhea and for evaluating therapeutics/cholera vaccines. Altogether, studies of Dr. Muanprasat's research team validate CFTR as a drug target for cholera and uncover the therapeutic promise of several classes of CFTR inhibitors derived from Thai bioresources. Further development of these compounds may provide effective and inexpensive therapy to alleviate morbidity and mortality associated with cholera and other types of secretory diarrheas.

Mathematical Modeling in Nanotechnology

"2013 Young Scientist Award from the Foundation for the Promotion of Science and Technology under the Patronage of H.M. the King"



Assistant Professor Dr. Duangkamon Baowan

Nanomaterials have inspired much progress in nanomedicine, especially for their use as carriers for targeted drug delivery. Being able to deliver drugs to a targeted cell in the body would certainly enhance the future treatment of patients, especially those suffering from cancer. Nanomaterials, such as silica nanospheres and liposomes are being developed as nanocarriers. In such complex physical areas there is often a lack of well-formed conceptual ideas and sophisticated mathematical modeling in the analysis of the fundamental issues involved in the process. Progress in many of these areas will be accelerated by means of accurate applied mathematical modeling which embodies the correct physical and chemical principles.

This project aims to develop a classical mathematical description for the molecular interaction of silica nanoparticles with liposomes, enabling the understanding of the mechanisms for transportation of nanoparticles through cell membranes.

The electrostatic and the van der Waals energies are evaluated using the Coulombic and the Lennard-Jones functions, respectively. To allow a mathematical treatment, the continuum approach assumes that atoms in a molecule are uniformly distributed over a surface or throughout the volume of the molecule, and then an integration approach is applied to evaluate the total energy of the system. We assume that silica nanoparticles can be modeled as perfect spheres consisting of SiO2 beads, and the liposome is composed of a dipalmitoylphosphatidylcholine (DPPC) lipid bilayer. For this we derive analytical expressions to describe how the various energies depend on the particle sizes and the distances between particles. We consider two systems that are (i) one liposome containing two silica nanoparticles and (ii) two liposomes each encapsulating a silica nanoparticle. The total surface areas of the liposomes in the two systems are assumed to be equal where the silica radius is fixed to be 16 nm. The latter system has a lower energy level because the lipid shells fit more snugly around the nanoparticle.

Therefore the encapsulation of single silica molecule entity in small liposomes may be found in experiments. We find that the mutual compensation of the electrostatic dipoles on the lipid head groups and on the nanoparticle surface make the overall electrostatic contribution negligibly small. The balance of the van der Waals interactions does not consider the compensating interactions of solvent molecules. Hence, the touching configurations of nanoparticles with liposomes and among each other are preferred. The findings of this project are a primary innovation for the worldwide community in considering the safety matter of nanotechnology.

Neuroprotective role of melatonin against methamphetamine-induced neurotoxicity and neuron cells degeneration

"2013 TRF-CHE Scopus Researcher Awards: Health Science from Thailand Research Fund, Commission of Higher Education and Scopus."

Assoc.Prof. Dr.Banthit Chetsawang

Banthit Chetsawang, Wilasinee Suwanjang, Arisa Parameyong, Nipawan Pirompul, Piyarat Govitrapong Research Center for Neuroscience, Institute of Molecular Biosciences Recent evidence has indicated that half of the world's aging populations are living in Asia including Thailand. One of the health problems that impact the quality of life in elderly people is cognitive impairment leading to dementia disorders. It has been emphasized that the main pathophysiological symptom of dementia is the progressively loss of neuron cells in several areas in the brain. In several regions of the world, drug abuse is becoming a serious problem. This problem impacts people of several age groups and socio-economics. Various lines of evidence have shown that repeated or long term exposure to drug abuse, methamphetamine (METH), a derivative of amphetamine can cause damage to the brain.

Therefore, we studied effector molecules involved in METH-induced neuron cells death. The results of our study implicated an important role of intracellular Ras-dependent death signaling cascade activation, caspase- and calpain-dependent death pathway, and disturbances in mitochondrial dynamics in the process of METH-induced toxicity in dopaminergic cell cultures. In parallel line of the studying in intracellular death signaling process responds in METH-induced neurodegeneration, we also demonstrated the neuroprotective properties of melatonin against neuron cell degeneration. Our studies point to the contribution of melatonin as a potential protective agent for caspase- and calpain-dependent death processes, and mitochondrial dysfunction. Better understanding of cellular and molecular mechanisms involved in neurotoxic and neuroprotective effects should help to generate potential therapeutic approaches to prevent or attenuate the METH-induced related neurodegenerative disorders such as Alzheimer's and Parkinson's diseases in human.

An evaluation of SN-38 encapsulated in PLEC depots distribution in Glioblastoma multiforme model

Asst. Prof. Dr. Norased Nasongkla

SN-38 loaded injectable polymer depot was developed for malignant gliomas treatment. This drug delivery system was designed so that it can solidify in situ upon intracranial injection allowing the formation of small or irregular shapes after solidification. An anticancer drug, SN-38, was encapsulated in the polymer depots. These injectable polymer depots were injected intratumorally and tumor sections were placed and observed under fluorescence imager. Depots were administered intratumorally as double injection (low dose), double injection (high dose) and 2X double injection. he in vivo distribution study of SN-38 was evaluated with difference variety of factors. The method to determine SN-38 distribution from polymeric depots in brain tumor model was successfully developed.

The distance of distribution was determined. In summary, these depots will definitely be a useful approach to develop drug delivery systems that can bypass the blood brain barrier (BBB) such as implantable controlled release systems.

Integrative Computational BioScience Center (ICBS)

Today, scientists commonly use state-of-the-art devices and technologies to conduct research. The devices and technologies produce a large amount of data which have to be properly analyzed systematically and efficiently in order to yield information and knowledge that can lead to innovation.

Realizing this data intensive research trend, Mahidol University executives granted an opportunity to researchers from six different faculties and institutes including Faculty of Engineering, Faculty of Information and Communication Technology, Faculty of Medicine Siriraj Hospital, Faculty of Medicine Ramathibodi Hospital, Faculty of Science, and Institute of Molecular Biosciences to establish the Integrative Computational BioScience Center (ICBS) in 2011 in order to build data-intensive research capability of the university including the high performance data processing and storing of scientific data. This capability will help drive Mahidol University to be the best research university in the country by producing high quality research, students, and academic services through integrative research combining the expertise in different areas of science and computing together. ICBS has achieved its goal set for 2013 by producing seven high quality research publications with average impact factor of 7.0.

Notable publications include the work of Charoensawan V. et al on "DNA sequence preferences of transcriptional activators correlate more strongly than repressors with nucleosomes" in Molecular Cell 2012 (impact factor 14.194), Yap KL et al on "NAC1 is an actin-binding protein that is essential for effective cytokinesis in cancer cells" in Cancer Research 2012 (impact factor 8.65), and Tanramluk, D. et al on "Toward mobile 3D visualization for structural biologists" in Molecular BioSystems 2013 (impact factor 3.35).

Currently, ICBS focuses on research projects mostly related to health and bioscience such as Genetic Epidemiology and Population Genetic Study of Copy Number Variation in Thailand, Development of Next Generation Sequencing (NGS) Laboratory Information Management Systems (LIMS) for Personalized Cancer Medicine in Thailand, Genetic Prognosis Support System, Development of Cloud Computing System for Structure Based Design of Kinase Inhibitors, and Fall Monitoring System for Impaired and Elderly People. All of these research projects will have a large impact on the understanding and treatments of genetic diseases and the well being of Thai people especially the elderly.
In addition, ICBS is actively collaborating with quality researchers around the world such as, but not limited to, Prof. Sir Tom Blundell, President of the Science Council UK, Director of Research at University of Cambridge, Dr. Madan Babu, Group Leader, Investigator, MRC-Laboratory of Molecular Biology, University of Cambridge, Dr. Sarah Teichmann, European Bioinformatics Institute, Prof. Yusuke Nakamura, Deputy Director, Center for Personalized Therapeutics, University of Chicago, and Dr. Asif Javed, Research Associate, Genome Institute of Singapore. These collaborations will help drive the development of world class research comparable to the research conducted by the world's leading research institutions.

Mother Tongue-Based Multilingual Education (MTB MLE) in Thailand's Deep-South : Research Institute for Languages and Cultures of Asia

The pilot project 'Mother Tongue-Based Multilingual Education (MTB MLE) in Thailand's Deep-South' was implemented by the Center for Documentation and Revitalization of Endangered Languages and Cultures, Research Institute for Languages and Cultures of Asia, Mahidol University. This project is supported by Mahidol University, Unicef (Thailand) and the Thailand Research Fund (TRF). The aim of the project is to integrate linguistic and cultural knowledge to solve the problems of education in deep south of Thailand. This project is designed the curriculum for the pupil and the primary level by using the local language as a medium of instruction at first and then link from the local language into Thai, is a second language for children in southern border area.

The MTB MLE curriculum was designed to be taught to children at the primary school level, using the local Patani Malay language as the medium of instruction. The curriculum builds a link from the local language to Thai, the national language, which is the second language of children in the southern border area. The MTB MLE process focuses on building a strong foundation for children in mother tongue first, including all 4 skills (listening, speaking, reading and writing) before bridging to Thai. Additional links are then built to the English and Standard Malay languages, including study of the Rumi and Jawi scripts.

The result of the MTB MLE project in the 4 pilot schools in Pattani, Yala, Narathiwat and Satun provinces showed that this method improves children's academic performance and literacy ability. An independent evaluation found that most students in the experimental MTB MLE schools achieved high scores (70-100%), while most students in the comparative (Thai only) schools posted low scores (20-40%). The MTB-MLE does not only benefit the learning of language, but also impacts cognitive development and educational achievement especially in fostering creativity, communicative fluency, confidence and a sense of value for the local culture.

The MTB-MLE approach is significantly better than the traditional educational system. Educational administrators, teachers and parents are all very satisfied with MTB-MLE. Because of these results, 12 additional schools have begun to use the MTB-MLE model for children at the kindergarten level. This expansion has been supported by the Southern Border Provinces Administrative Centre. In addition, the Faculty of Education, Yala Rajabhat University has recognized the value of MTB MLE model, and has begun to prepare their undergraduate students to become MTB MLE teachers. Mahidol University and Yala Rajabhat University initiated a Memorandum of Agreement (MOU) to cooperate in a research project entitled, 'Institutionalizing Mother Tongue Based Multilingual Education (MTB MLE) in Thailand's Deep South'.

This project is supported by the European Union (EU) and the Thailand Research Fund (TRF). The goal of this project is transfer knowledge of MTB MLE to YRU staff, as YRU is a major center for teacher training in the Deep South. The project will eventually offer MTB MLE related classes for undergraduate and graduate education students, as well as continuing education for teachers and administrators. YRU has also established a MTB MLE Center to disseminate technical knowledge to students, teachers, administrators, academics and others in the southern part of Thailand.

The expansion of the MTB MLE approach has the important goal of improving the quality of education—and thus the quality of life—for children in the southern border provinces of Thailand.