



Advanced Molecular Pathology laboratory

&

In vitro toxicity testing laboratory







Performance | Reliability| Better results

What is Advanced Molecular Pathology Laboratory

The Advanced Molecular Pathology Laboratory (AMPL) is a joint effort between the Institute of Molecular and Cell Biology (IMCB) and Singapore Health Services (SingHealth). This world class facility provides a wide range of pathology-related services in basic as well as translational research, therapeutic target validation and drug safety evaluation in biomedical research community and industry. Translational Pathology Consortium platform is recently created and supported by NRF SIS grant for its operation. This platform includes AMPL,IMCB, *in vitro* toxicology lab and SingHealth, TTSH and NUH tissue repositories.

It provides high-quality and timely data using cutting-edge technology. Data generated from non-clinical safety studies of pharmaceuticals/chemicals are accepted by regulatory agencies in US and Europe through Mutual Acceptance of Data system. Histopathology services at AMPL are to support the researchers at A*STAR RIs, Universities, Pharmaceutical Companies and CROs. It also provides the support to veterinary clinics needing accurate diagnosis for clinical management, and regulatory bodies like National Parks Board (NParks) that require forensic veterinary pathology expertise for law enforcement.

The vision of this facility is as follows:

- To provide pathology services as a one-stop facility for pharmaceutical and biotechnology companies who engage in exploratory, preclinical and early clinical studies
- To provide veterinary clinical diagnosis to pet health sectors
- To provide *in vitro* toxicology services (alternate to animal testing) to pharmaceuticals, cosmetics and agrochemical companies
- To generate high quality tissue bio resources for the research community and biomedical industry, in collaboration with NUH tissue repository & SingHealth Tissue Repository (STR)

Core Strengths of the AMPL

The core strength of AMPL in animal research services includes GLP-grade animal necropsy, histology services, immunohistochemistry, *in situ* hybridization, image analysis, veterinary pathology evaluation and *in vitro* toxicology testing. At AMPL@SingHealth, researchers will have access to a CAP-compliant diagnostic facility with a variety of techniques necessary for human tissue-based research including histotechnology, histopathology consultation, immunodiagnostics and molecular assays. The AMPL is also closely linked to the SingHealth Tissue Repository (the largest human tissue research biobank in Singapore), researchers in

non-human primate research and research institutions with cutting-edge translational research capabilities.

Why Should Researchers and Industry Use Our Services

To ensure the highest professional standards, AMPL has a team of pathologists and scientists, supported by experienced medical and laboratory technologists. Our veterinary pathologists are either board certified by American College of Veterinary Pathologists (ACVP) or American Board of Toxicology (ABT) with decades of experience in the pharmaceutical industry. AMPL is headed by an experienced histopathologist with local license and international qualifications. As a research service provider, our charges are competitive and we constantly ensure our services are cost-efficient. The AMPL is a unique research service provider that brings together expertise across multiple disciplines to support researchers and industrial clients. We also provide consultation for project design, applications to IRB and tissue access committees. Clients can expect 100% quality control from AMPL, which also functions as a conduit for knowledge, experience and clinical resources from around Singapore.

Rodent Necropsy and Veterinary Pathology

Researchers will have access to the expertise of our board-certified veterinary pathologists and a team of well-trained laboratory technicians who can perform rodent necropsies at our GLP-accredited histopathology laboratory or in client facilities. At AMPL, photography of gross lesions is performed with the Milestone MacroPATH D Macro Digital Imaging System and the Olympus Stereo microscope.

We provide dissection, macroscopic examination and processing of a wide range of tissues originating from human, Zebrafish to animal (both rodents and non-rodents) sources for molecular research as well as regulatory toxicology studies. We offer various embedding techniques such as paraffin, MMA and OCT.



AMPL has achieved a significant head start, being the only center in Singapore that offers diagnostic veterinary pathology and GLP-certified in vivo toxicologic pathology. To stay competitive, AMPL will invest in expanding the range of diagnostic assays on offer including but not limited to fine needle aspiration cytology and immunodiagnostics. The pathologists and toxicologist work cross-functionally to maximize the manpower utilization. These experts will in turn be supported by a team of lab technicians and officers, who will also be trained for cross-functionality.

Our pathologists can read the slides and provide descriptive pattern of lesions, semiquantitative grading/scoring, and description with consistent terminology and annotation and analysis using image software. The pathology report contains detailed individual animal data, representative photomicrographs, summary of findings and conclusion.

AMPL started offering diagnostic veterinary pathology services from 2014 to local and regional veterinary clinics, as well as for exotic and aquatic animal exhibits. It also offers ancillary immunohistochemistry assays for tumour diagnosis, further strengthening the capability and reputation of the laboratory.

Histochemistry

Certain tissue components can only be demonstrated using special techniques called histochemistry which are highly useful to support the data in biomedical research.



Mast cell tumour, Dog, Toluidine blue



Lungs, Dog, Gram's



Femur, Mouse, Masson's trichrome



Calvarium, Rat Safranin O



More than 15 types of special staining methods are available

Pathology and Histological Consultation

In terms of clinical histopathology, researchers will have access to the expertise of a UKqualified histopathologist and scientist, supported by a team of Pathology Associates, who can provide consultation for interpretation of histology, grading of immunostains and classification of human neoplasms according to standard or protocol-defined criteria. We can also assist with selection of material for downstream applications, such as comparative genomic hybridization (CGH) and SELDI-mass spectrometry.



Immunodiagnostics

The facility is able to provide a full range of immunodiagnostic techniques ranging from single-label immunostaining to multi-color immunolabelling to demonstrate co-expression of two or more molecules in a particular cellular subset.

TUNEL assays for apoptosis and *in situ* hybridization (ISH) assays for detection of viral RNA can also be performed, e.g. EBER for EBV infection, as well as detection of kappa and lambda mRNA for the determination of light chain restriction.



In addition, AMPL at IMCB also evaluates new antibodies for animal research and diagnostic purposes.

More than 80 biomarkers optimized in mouse, rat, rabbit, non-human primate and human tissues

Sample Types: Cell lines, organoids, skin constructs, tissues, TMA

Tissue Cross

Reactivity

Studies

tissues available

Non-Human

Primate

Cryo and

paraffin-

embedded

Mouse

Rat

IHC

- Bright-field and fluorescence staining
- Manual and Leica automated stainer
- TUNEL staining



- Quality assurance in place
- Performed by experienced technician and reviewed by pathologist



Tissue Microarray Construction

Tissue microarray (TMA) is a technique that places numerous tiny cores of tissue samples on a single microscope slide and is a useful tool for high-throughput analysis of protein expression across a large number of samples. TMA technology is also suitable for analysis of RNA and genetic alterations by the ISH, CISH and FISH techniques. It is also useful for high through put immunohistochemistry and antibody validation. The main advantages are economical, uniform conservation of materials and reduced use of reagents

The AMPL constructs and stocks tissue microarrays derived from a variety of tissue types and neoplasms. All tissue arrays are produced under the supervision of a pathologist, thereby ensuring their quality. In addition, dedicated tissue arrays can be custom-made for a particular study upon request by researchers. AMPL is also able to construct cellular arrays derived from malignant effusions and cell lines.



Working with other collaborating biobanks in SingHealth, TTSH and NUH; the Translational Pathology Consortium platform make available to both the research community and industry a wide range of validated and annotated tissue microarrays of different human neoplasms.

Laser Capture Micro-dissection

Laser micro-dissection (LCM) is a high-resolution method used to isolate cells from their surrounding tissues, with the aid of a laser beam (UV/ IR rays) under direct microscopic visualization. Specific cells can be isolated directly by cutting target cells away from unwanted cells, to obtain enriched cell populations. Thus, it enables gentle, selective isolation of specific cells from heterogeneous tissue, protecting biomolecular integrity and preserving profiles of complex samples for more accurate downstream applications in molecular biology (e.g. gene expression profiling, proteomics discovery, signal-pathway profiling, comparative genomic hybridization, MALDI/SELDI-TOF). Researchers can have access to qualified staff trained in the use of laser micro-dissection with Leica LMD and Carl Zeiss' PALM Microbeam systems.



Laser capture microdissection is also a powerful technique that enables oncology researchers to compare molecular profiles of tumor tissue to surrounding non-tumor cells. It is also useful in obtaining cell-specific transcriptomic signatures of toxicity and for the identification of the mechanisms of toxicity.

Antibody Evaluation and Probe-Making Services

The AMPL provides services for researchers in the healthcare clusters and commercial companies to screen antibodies and evaluate their staining characteristics in normal and neoplastic tissues of human and animal origins. In addition, we will be able to design, construct and validate for researchers, locus-specific FISH probes against genes of interests or region-specific probes to verify regions of amplifications/deletions as identified by CGH.







BAC Nucleotide Mapping clones position **RP11-**19p13.2 12587922-1115 12782977 CTD-19p13.2 12627174-2659N19 12774845 CTD-19p13.2 12736891-2265021 12856237

JUNB

Histology Imaging, Digital Pathology and Image Analysis

AMPL has Olympus BX51 fitted with DP71 Camera and Nikon Eclipse 90i with DS Fi3 camera to capture the bright field as well as fluorescent images. Leica SCN400 whole slide scanner is another platform that provides a perfect pathology workstation for the assessment of biomarker expression by fluorescent and bright-field microscopy. It can scan the slides at 20X and 40 X magnification. This capability supports the researcher to store, manage, analyze, and report on digital images in preclinical and clinical research.



Scanned images are viewed through Slidepath Digital Imaging Hub (Leica Microsystems). This service allows secure data sharing, tele-pathology and conferencing through a secure web browser from anywhere in the world. It also facilitates the archiving and sharing of slides and capturing of images for publication. Predefined image analysis protocols using Slidepath Tissue IA Software (Leica Microsystem) measure the various parameters such as whole cell quantification that includes nuclear, membrane, and cytoplasmic analysis.



Ki-67 positive nuclei to quantify cell proliferation in small intestine: Rat small intestine stained with hematoxylin and anti-Ki-67 antibody (DAB) is analyzed with nuclear analysis tool. Red nuclei are positive for DAB; blue nuclei are negative in digitalized image.

Resultname	Value
Measurement Units	μm
Total Tissue Area (in measurement units squared)	110,777.26
Total Number of Cells	1,239
Cellular H-Score For Nuclear Staining	39
Total Number Of Accepted Nuclei	1,239
Number Of Negative Nuclei	1,079
% Of Negative Nuclei	87.09
Number Of Positive Nuclei	160
% Of Positive Nuclei	12.91
Number Of Weak Intensity Nuclei	0
% Of Weak Intensity Nuclei	0.00
Number Of Moderate Intensity Nuclei	0
% Of Moderate Intensity Nuclei	0.00
Number Of Strong Intensity Nuclei	160
% Of Strong Intensity Nuclei	12.91
Average Nuclear Staining Intensity (Positive Area Only)	155.73
Average Nuclear Staining Absorbance (Positive Area Only)	37
% Of Positive Nuclear Area In Tissue	8.24





In addition, with available NIS Elements Imaging software, Version-5.02, Nikon, can support the following in captured images

- Intensity measurement
- Annotation and analysis
- Mean linear measurement in lung tissues (COPD model)
- Length of colon mucosal folds (IBD model)
- Point counting
- Customized image analysis support for researcher's need

Training Researchers, Clinicians and Pathologists at AMPL @SingHealth

Training is an important aspect of the AMPL. The facility conducts lectures and workshops for researchers, medical students, clinicians and pathologists who wish to acquire the technical expertise for tissue-based research.

Training attachments are regularly conducted in various areas:

- Basic histo-technology: microtomy, hematoxylin/eosin staining, making cryostat sections
- Basic immunohistochemistry: immunostaining of frozen sections, paraffin embedded tissues and cytological specimens
- Multi-label immunohistochemistry: double and triple immunofluorescence labeling, combining immune-peroxidase with immunofluorescence staining
- Tissue microarray technology: constructing tissue microarrays from archival paraffin embedded material
- Laser microdissection

Services and Charges

There are two components to the charge: (1) reagent charge and (2) service charge. The service charge will be determined after discussion with the researcher and will depend on the nature of the protocol, the possibility of batching the tests, complexity of the procedure and the number of specimens. Please contact us for details.

Invitro toxicology (alternate to animal testing):

As an alternative to animal testing, our *In vitro* toxicity facility at IMCB is a OECD GLP certified laboratory and is capable of providing an array of cell-based and analytical techniques to assess the potential health and safety hazards of pharmaceutic drugs, cosmetics, healthcare products and agrochemicals. All the *in vitro* assays are approved by international regulatory agencies such as United Nations (UN) GHS, EU/OECD, DOT, OSHA, IATA, EPA etc. Before providing these assays to the clients, each assay is thoroughly validated with at least ten proficiency chemicals using regulatory guidelines and accurately audited for quality purpose. Our facility is equipped with necessary infrastructures and expertise (board certified



toxicologist and industrial experienced professionals) to support these assays. This facility was GLP certified by Singapore Accreditation Council (now called as Enterprises) and it undergoes due-diligence for recertification in subsequent years.

Sensitization assay:

• **Direct Peptide Reactivity Assay (DPRA)** is an in chemico test method which addresses peptide reactivity, postulated to be the molecular initiating event (the first key event) of the skin sensitization Adverse Outcome Pathway. Reactivity is measured by quantifying how much of the substance being tested does not bind to the synthetic heptapeptides containing either cysteine or lysine.



 ARE-Nrf2 Luciferase Test Method (KeratinoSensTM) addresses keratinocyte induction of a cyto-protective gene pathways linked to skin sensitisation, i.e. second key event of the skin sensitisation AOP. The test method uses luminescence detection to measure gene expression of antioxidant/electrophile response element (ARE)-dependent pathway.



 Human Cell Line Activation Test (h-CLAT) is an in vitro method which addresses the third key event of the skin sensitisation AOP i.e. activation of the dendritic cells. The assay measures quantitatively change in the expression of cell surface markers, associated with the activation of dendritic cells i.e. CD86 and CD54, in a human monocytic leukemia cell line by flow cytometry analysis.

Above assays are used for discriminating the chemicals between skin sensitizers and non-sensitizers in accordance with GHS labelling. These tests also replace the murine

test, local lymph node assay (LLNA) and Magnusson Kligman Guinea Pig Maximisation Test (GMPT) and the Buehler Test.

• In vitro Skin irritation/ Corrosion: Re-constructed human epidermis (RHE) test method:

The reversible/irreversible damage to the skin is assessed through Reconstructed Human Epidermis (RhE) method. In this test, the test chemical is applied topically to a three-dimensional RhE model, which have been cultured to form a multi-layered, highly differentiated model of the human epidermis and cell viability is measured by MTT method. Irritant chemicals are identified as either irritant (Cat.2) or non-irritant based on cell viability. This test also categories the chemicals as non-corrosive and corrosive substances and supports the sub-categorisation into 1A, 1B and 1C in accordance with the UN GHS.

- Alternate Test to Acute Dermal Irritation/Corrosion
- Test system : Three-dimensional RhE model
- Design
 - Irritation
 - 3 replicates
 - exposure time 15-60 min and post treatment incubation for 42hrs
 - Positive control-5% SDS and negative control: PBS
 - Read out: Cell Viability by MTT

Corrosion

- Minimum of 70µl/cm & exposure time 1hr
- Positive control- glacial acetic acid or 8N KOH
- Negative control: NaCl

Viability	Category
< 50% after 3 min exposure	Corrosive: Optional Sub-category 1A*
≥ 50% after 3 min exposure and < 15% after	Corrosive: A combination of optional Sub-
60 min exposure	categories 1B-and-1C
≥ 50% after 3 min exposure AND ≥ 15% after	
60 min exposure	Non-corrosive



- Limitation: Not allow the classification of test substances to the optional UN GHS Category 3 (mild irritants) and not suitable for highly volatile test substances
- Short Time Exposure In Vitro Test Method for Eye Damage/Eye Irritation:

This test method evaluates the cytotoxic effects of chemicals on a rabbit corneal epithelial cell line (SIRC cells) leading to corneal epithelium damage and eye irritation. Cell viability is assessed by MTT assay and the test chemicals are classified based on the

relative cell viability values. This test is used for identifying i) Chemicals inducing Serious Eye Damage (UN GHS Category 1) and ii) Chemicals Not Requiring Classification for Eye Irritation or Serious Eye Damage (UN GHS No Category).

Corrosion assays:

Corrositex[®] test method:

The assignment of classification to chemicals is based on the time taken for the chemical to penetrate through the membrane barrier in to the CDS eliciting the colour changes in Corrositex kit. This test allows the sub-categorisation of corrosive test chemicals according to UN packing group (I/II/III) or EU risk Phrases (R35/R34/no label). It also permits assignment of Packing Group classification for Class 8 corrosives. This test replaces the rabbit test of dermal corrosivity (Draize test) by providing a reliable means of mimicking the *in vivo* test. Our lab is recognized as SEA lab for this assay by invitro international, USA

- Alternative to Acute Dermal Irritation/Corrosion (OECD 404): Draize test
- Regulatory approval:
- · EPA, FDA, OSHA, US DoT & consumer product of safety commission, IATA.
- Design

Corrositex assay^R:

Test Substance Compatibility Test : CDS

Test Substance Timescale Category Test : Distinguish between strong or weak Membrane Barrier Test Method

- Negative control: citric acid or propionic acid
- Positive control- sodium hydroxide (GHS Corrosive subcategory 1B)

Read out UN packaging group:	Corrosivity	Category 1(high acidity/alkalinity)	Category 2 (low acidity/alkalinity)
	Corrosive I	0-3	0-3
	Corrosive II	>3min-1hr	>3min-30mim
	Corrosive III	>1hr- 4hr	>30min-60mim
	Non		
	Corrosive	> 4hr	> 60min

Photo- toxicity assay:

• In Vitro 3T3 NRU photo-toxicity test:

This test identifies the phototoxic potential of a chemical by relative reduction in viability of Balb/c 3T3 cells in the presence or absence of light (UV- simulator) using Neutral Red uptake method. Substances identified by this test are likely to be



phototoxic in vivo, following systemic application and distribution to the skin, or after topical application.

- **Regulatory approval**
 - In all EU Member and OECD Member States
- Design:
 - Balb/c 3T3 cells,
 - 8 dose levels, Dose of 5 J/cm2 (as measured in UVA range)
 - · Positive control: Chlorpromazine; Negative control: Solvent
 - · Neutral red uptake method
- Read out- By Calorimetry ٠
 - Photo-irritation factor (PIF)
 - < 2 predicts: "no phototoxicity". PIF > 2 and < 5 : "probable phototoxicity" and PIF > 5 : "phototoxicity
- Limitation:
 - · May not be appropriate for the evaluation of some water-insoluble substances
 - or photocarcinogenicity

· Cannot predict adverse effects such as photogenotoxicity, photoallergy Above assays are either at different stages of validation or not validated. Limitation of these assays can be discussed if required. In addition to these assays, our in vitro facility is also designed to develop new assays but it is subjected to volume of works and cost

price involved in developing new assays.





A/Prof Tan Soo Yong MBBS, DipRCPath, FRCPath, DMJ, DPhil (Oxon)

Head, AMPL & Senior Principal Investigator (Histopathology Laboratory and *In vitro* Toxicity Facility), IMCB, A*STAR Senior Consultant and Head, Dept of Pathology, NUHS Head and Chief, Department of Pathology, NUS Senior Consultant, Manpower Standards and Professional Development, Ministry of Health International Advisor (West Pacific), Royal College of Pathologists

Prof Tan Soo Yong obtained his medical qualifications from the National University of Singapore and thereafter underwent postgraduate training in Forensic Pathology under the late Prof Chao Tzee Cheng in Singapore and Prof Michael Green in the University of Sheffield, United Kingdom. Qualifying in both forensic and histopathology, he is a Fellow of the Royal College of Pathologists (UK) and a Diplomate of the Society of Apothecaries of London. Dr Tan obtained his PhD from Oxford University, working in the field of haematopathology. He is currently Associate Professor in Duke-NUS Graduate Medical School, a Senior Consultant and Clinician Investigator in the Department of Pathology, Singapore General Hospital and Senior Consultant to the Ministry of Health, Singapore. Apart from heading the Advanced Molecular Pathology Laboratory (AMPL), he also holds concurrent appointments as Director of the Singhealth Tissue Repository, Senior Principal Investigator at the Institute of Cell and Molecular Biology (IMCB), Chief Examiner in Pathology, Chairman of the Residency Advisory Committee for Pathology and Visiting Professor to University Malaya. He also sits on the Editorial Board of two pathology journals (Journal of Clinical Pathology, Biobanking and Biopreservation). Dr Tan has multiple administrative and advisory roles including Consultant to Johnson & Johnson, Inc., member of the Diagnostic Hotspot Advisory Panel, Exploit Technologies, Singapore's representative to the Advisory Board of the IAEA, Member of Advisory Board, Roche Ventana, Chairman of the Biobanking Subcommittee, Asian Network of Research Resource Centres (ANRRC) and International Advisor (West Pacific) of the Royal College of Pathologists (UK). His current research interest is in the pathology of NK/T cell lymphoma [Cancer Discov. 2012 Jul;2(7):591-597] and Type II Enteropathy-associated T-cell lymphoma. [Leukemia. 2011 Mar;25(3):555-7; Leukemia. 2013 Feb 12. doi:10.1038/leu.2013.41.]



Dr Ravisankar Rajarethinam, BVSc, MVSc (Vet Path), PhD (Vet Path), Diplomate ABT

Project Leader and Research Veterinary Pathologist/Toxicologist, AMPL, IMCB, A*Star

Dr Ravi has extensive industrial working experience in drug discovery and development of new chemical entities as well as biologicals in India. He collaboratively worked as a scientist with multidisciplinary departments in animal studies to support the investigation of efficacy and toxicity of new drug entities in Glenmark Pharmaceuticals. Subsequently, as a Senior Scientist, he was involved in preclinical research of new chemical entities in different animal models of inflammation, metabolic disorders, immune mediated diseases oncology etc at Ranbaxy Research Laboratories. Later, he served as a Lead Investigator, heading the Pathology Department at a GLP-certified CRO Company, Syngene International Ltd, and focused mainly on non-clinical studies for the safety evaluation of drugs, chemicals and biologicals for regulatory submission.

At present, Dr. Ravi oversees the laboratory management & activities and performs as research veterinary pathologist for basic as well as translational research. He is also involved as a study director in *in vitro* toxicology (alternate to animal testing)/ *in vivo* toxicology studies under GLP environment. He obtained training in Descriptive Veterinary Pathology at University of Queensland, Australia and *in vitro* toxicology at Institute for In Vitro Sciences, Inc., USA. His research interest is mainly focused on non-clinical toxicity studies, toxicologic pathology, biomarker discovery and animal models of human diseases. His professional contribution is published in reputed peer-reviewed journals.



Dr Chee Bing ONG, BVSc (Hons), MS, DACVP

Veterinary Pathologist, AMPL, IMCB, A*Star

Deputy Director, BRC, A*Star

Dr Chee Bing Ong was awarded the National Science Scholarship by Agency for Science, Technology and Research (A*STAR) in 2002 and obtained his Bachelor of Veterinary Science (with first-class honours) from The University of Melbourne, Australia. He worked as a laboratory animal veterinarian in Biological Resource Centre (A*STAR) after graduation. Thereafter, he pursued a residency in Veterinary Anatomic Pathology in the Diagnostic Center for Population and Animal Health, Michigan State University, United States. During his residency, he gained extensive experience in veterinary pathology, necropsies, surgical histopathology of various animal species and also completed a Master of Science in Pathobiology involving the study of respiratory toxicology in laboratory mice. Dr Ong is board certified in Anatomic Pathology by the American College of Veterinary Pathologists (ACVP), and is currently Deputy Director of Biological Resource Centre, with

joint appointment as Veterinary Pathologist in The Institute of Molecular and Cell Biology (IMCB), A*STAR, Singapore



Dr Susan Hue Swee San, FRCPA, MBBS, PhD Medical pathologist (joint appointment), AMPL, IMCB, A*Star Associate Consultant , Department of Pathology, NUH

Dr Susan Hue Swee Shan was awarded with MBBS-PhD Scholarship by Agency for Science, Technology and Research (A*STAR) in 2000. She obtained her medical qualifications from National University of Singapore and her PhD from Imperial College London, under the Department of Immunology. She underwent further postgraduate specialty training and qualified as a histopathologist in 2015. She is a Fellow of The Royal College of Pathologists of Australasia (FRCPA).

Dr Susan currently holds dual appointments, serving her clinical role as Associate Consultant in the Department of Pathology, National University Hospital (NUH) and as a Research Clinician in Advanced Molecular Pathology Laboratory (AMPL)/Institute of Molecular and Cell Biology (IMCB). Her research interests are lymphoma pathology and tumour immunology. At AMPL, IMCB, she over sees the pathology evaluation of human samples.



Ms. Poh Suat Fang, BBus

Assistant QA Manager, AMPL, IMCB, A*Star

Miss Poh Suat Fang received her diploma in Biomedical Science (2008) and graduate degree in Business (2012). She has been working at Institute of Molecular and Cell Biology, Advance Molecular Pathology Laboratory since 2008. She worked as a senior laboratory officer for the first 4 years in the laboratory before taking up the role in the Quality Assurance (QA) Unit. She is involved in the routine work from rodent necropsy to tissue processing, sectioning and staining to quality control. As an Assistant QA Manager, she is responsible in assuring the GLP compliance of laboratory activities in both the histopathology laboratory and *In-Vitro* Toxicity Facility, reviewing document for GLP compliance and involved in verification of documents. She also conducts audits that include process-based, study-based and facility-based audits and hosts the client and regulatory inspection and prepares responses to the inspection reports.



Dr. Lakshmanan Manikandan, B Pharm, M Pharm, PhD

Group Leader, MMHCU, IMCB, A*Star

Dr. Lakshmanan Manikandan is a Pharmacologist by training and has more than 15 years of Drug Discovery experience in various pharmaceutical companies such as Forma Therapeutics, Syngene International Limited, Ranbaxy Research Laboratories (acquired by Daiichi Sankyo). He has been awarded 5 patents with two of the molecules currently in Phase I/II clinical trials. In his current role he is actively involved in establishing industry collaborations and setting up translational platforms that supports Pharma/Biotech companies. Prior to joining IMCB he was working as Senior Scientist with Forma (S) Therapeutics Pvt Ltd., where he was a part of a team that out-licensed a tumor metabolism program to Genentech. He has published more than 40 research articles in journals of international repute.

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