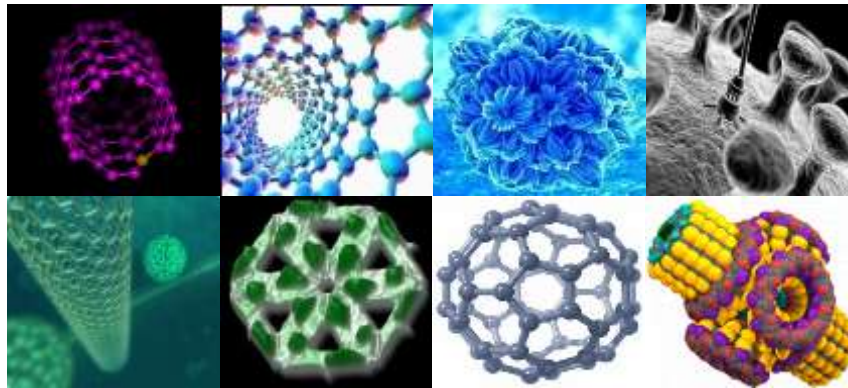


A Proposal for a World-Class Malaysia Institute for Innovative Nanotechnology (NanoMiTe)



**Malaysia Institute for Innovative Nanotechnology
(NanoMiTe)**



Knowledge Based Innovation-led Economy

“The challenge of establishing a scientific and progressive society, a society that is **innovative and forward looking**, one that is not only a consumer of technology but also a **contributor to the scientific and technological civilization**”

- NEM -



Pivoting Science & Technology to
Innovative Malaysia

- Knowledge Generation
 - Wealth Creation
 - Societal Well-Being

4 Reaching for Research Prominence



1. Positioning Malaysia to be the international educational hub
1. Enlarging the stock of useful knowledge
3. Propel research icons identified from each RU and country to greater prominence
4. Nurturing young talents and icons towards Nobel pathway and provide the competitive edge for Malaysia in blue sky economy

NanoMITE: Preamble

- NanoMITE was proposed by MoE under the GSIAC program
- Presented and approved by the GSIAC committee led by YAB PM on 26 September 2013 in New York, USA
- NanoMITE to initiate and host a global collaborative scientific research programmes at the upstream sector, crucial in the creation of ideas, knowledge and products that will benefit the society at large
- NanoMITE is the first global R&D consortium on high impact research in different domains of emerging/nanotechnology; to be conducted in Malaysia in collaboration with foreign scientists; that will provide solutions to local problems and contribute to the GNI of Malaysia

NanoMITE: Introduction

- A **Consortium of top scientists from world renown IHLs** forming under NanoMITE to provide a global platform for research, development and strengthening of nanotechnology-enabled solutions to address global issues such as:
 - Poverty
 - Lack of access to technology and information
 - Lack of clean water supply
 - Low agricultural efficiency
 - Expensive medical diagnostics and treatments
 - Lack of reliable local energy production



NanoMITe: Objectives

- 1:** Provide a global platform to research, develop and strengthen local capability and capacity on nanotechnology
- 2:** Drive nanotechnology-based industry for economic growth and societal well-being
- 3:** Support Government implementation on Distributive Economy by focusing on active local and global participation of world class nano-scientists
- 4:** Promote science, research culture and knowledge economy

NanoMiTe Consortium

NanoMiTe currently consists of **38 members**, and is **expected to grow** to include more in this network of collaboration for global sustainable development.

International members come from **highly-ranked institutes around the world** such as:

- Harvard University,
- Stanford University
- Massachusetts Institute of Technology
- Virginia Tech
- University of Cologne
- University of Pittsburgh
- University of Washington
- North Eastern University
- Xi'an Jiaotong University
- University of Alberta

Malaysia Centres of Excellence (CoEs):

- Institute of Micro Engineering and Nanoelectronics (IMEN), UKM
- Centre of Innovative Nanostructured Materials and Nanosystems (COINNS), UTP
- Ibnu Sina Institute for Fundamental Science Studies (IIS) and Razak School of Engineering and Advanced Technology, UTM
- Institute of Nanoelectronic and Engineering (INEE), UniMAP
- Institute of Advanced Materials (ITMA), UPM
- Wellness Research Cluster, UM
- Center for Research in Engineering, Science and Technology (CREST), USM

NanoMITE: Principal Members



Professor Dr. Halimaton Hamdan
Universiti Teknologi Malaysia (UTM)
Nanostructured materials and
catalysis



Professor Dr. Burhanuddin Yeop Majlis
University Kebangsaan Malaysia (UKM)
Micro-electro-mechanical system sensors



Professor Dr. Norani Muti Mohamed
Universiti Teknologi Petronas (UTP)
Thin film and solar cells



Professor Dr. Noor Hayaty Abu Kasim
Wellness Research Center
University Malaya (UM)
Dentistry, wellness



Professor Dr. Nor Azah Yusof
ITMA (UPM)
Nanosensors, Molecular Imprinted Polymer,
DNA Based Sensor



Professor Dr. Abdul Rahman Mohamed
Universiti Sains Malaysia
Environmental Science



Dr Nagarjun Konduru
Harvard University
Nano-materials/technologies on human and
environmental health



Professor Roop Mahajan
Virginia Tech
Micro- and nano-electronics devices



Professor Joseph Brain
Harvard University
Nanotherapeutics



Professor Klein-Seetharaman
University of Pittsburgh
Structural biology



Professor Rohit Karnik
Massachusetts Institute of
Technology (MIT)
Nanofluidics



Professor S Ramanathan
Harvard University
Solid Oxide Fuel Cells

NanoMiTe: Principal Members



Professor Dinos Mavroidis
Northeastern University
Nanorobotics



Dr. Feng Xu
Xi'an Jiaotong University
Biothermal mechanics



Dr. Ansuman Chattopadhyay
University of Pittsburgh
Molecular bioinformatics



Dr. Ajay K Ray
Western University
Modelling and simulation



Professor Fu Kuo Chang
Stanford University
Composite nanomaterials



Dr. Zubin Jacob
University of Alberta
Nanophotonics and metamaterials



Dr. Madhumita Ray
Western University
Environment technology



Dr. Rezal Khairi Ahmad
NanoMalaysia
NanoMiTe Management

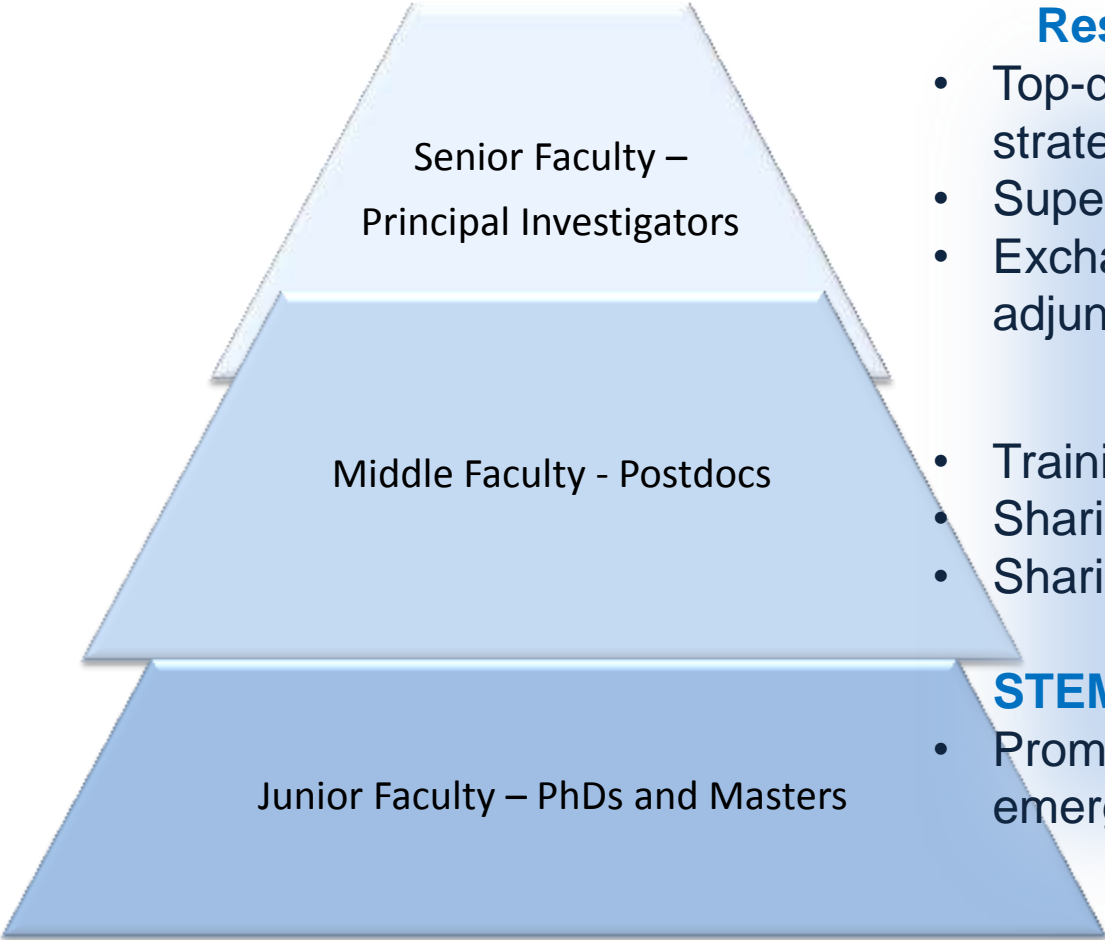


Professor Dr. Uda Hashim
University Malaysia Perlis (UniMAP)
Semiconductor nanodevices



Professor Sanjay Mathur
University of Cologne
Materials chemistry

NanoMITe: Activities



Senior Faculty –
Principal Investigators

Middle Faculty - Postdocs

Junior Faculty – PhDs and Masters

Research Program Supervision

- Top-down long term collaborative strategic research programmes
- Supervision and training of postdocs
- Exchange of research fellows e.g. as adjunct professors

Mentoring and R&D

- Training of young scientists
- Sharing of world-class R&D facilities
- Sharing of IPR

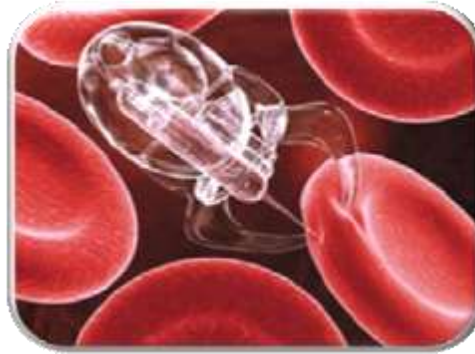
STEM Education and Enculturation

- Promotion of STEM education and emerging science

NanoMITE: Flagship Programmes



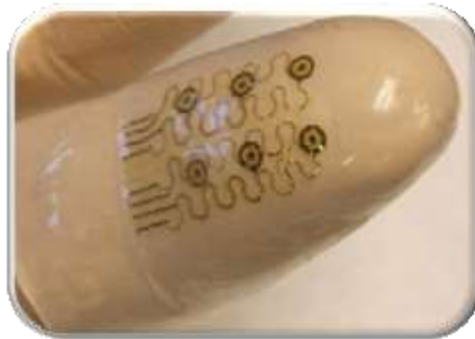
Programme 1:
Energy



Programme 2:
**Wellness, Medical and
Healthcare**



Programme 3:
Food and Agriculture



Programme 4:
**Electronics, Devices and
Systems**



Programme 5:
Environment

NanoMITe: Research Programmes

PROGRAMME	1: ENERGY	2: WELLNESS, MEDICAL & HEALTHCARE	3: FOOD & AGRICULTURE	4: ELECTRONICS, DEVICES & SYSTEMS	5: ENVIRONMENT
LEAD	UTM:	UM:	UPM:	UKM:	USM:
TITLE	Nanotechnology Enabled Efficient Generation of Renewable Energy	NanoRobots for MRI Guided Theranostics	Nanotechnology in Detection and Control of Ganoderma Boninense (GB)	Development of Graphene-based Nanoelectro-mechanical Systems (NEMS) Sensors and Devices	Green Technology and Nanomaterial Applications for the Mitigation of Greenhouse Gases (GHGs)
PROGRAMME LEADER	Prof. Datuk Halimaton Hamdan	Prof. Noor Hayaty Abu Kassim	Prof. Nor Azah Yusof	Prof. Dato Burhanuddin Yeop Majlis	Prof. Abdul Rahman Mohamed
MEMBERS	MJIIT, UTP, HARVARD, UPSI, STANFORD, UM, UKM, UiTM, UPM, USM,	HARVARD, North Eastern Univ. MIT, UKM, UPM	Univ. of Pittsburg, Univ. of Warwick, UNIMAP, UKM, MARDI, MPOB, MIMOS	HARVARD, UNIMAP	Harvard, Western University, UKM, UPM, Monash University,

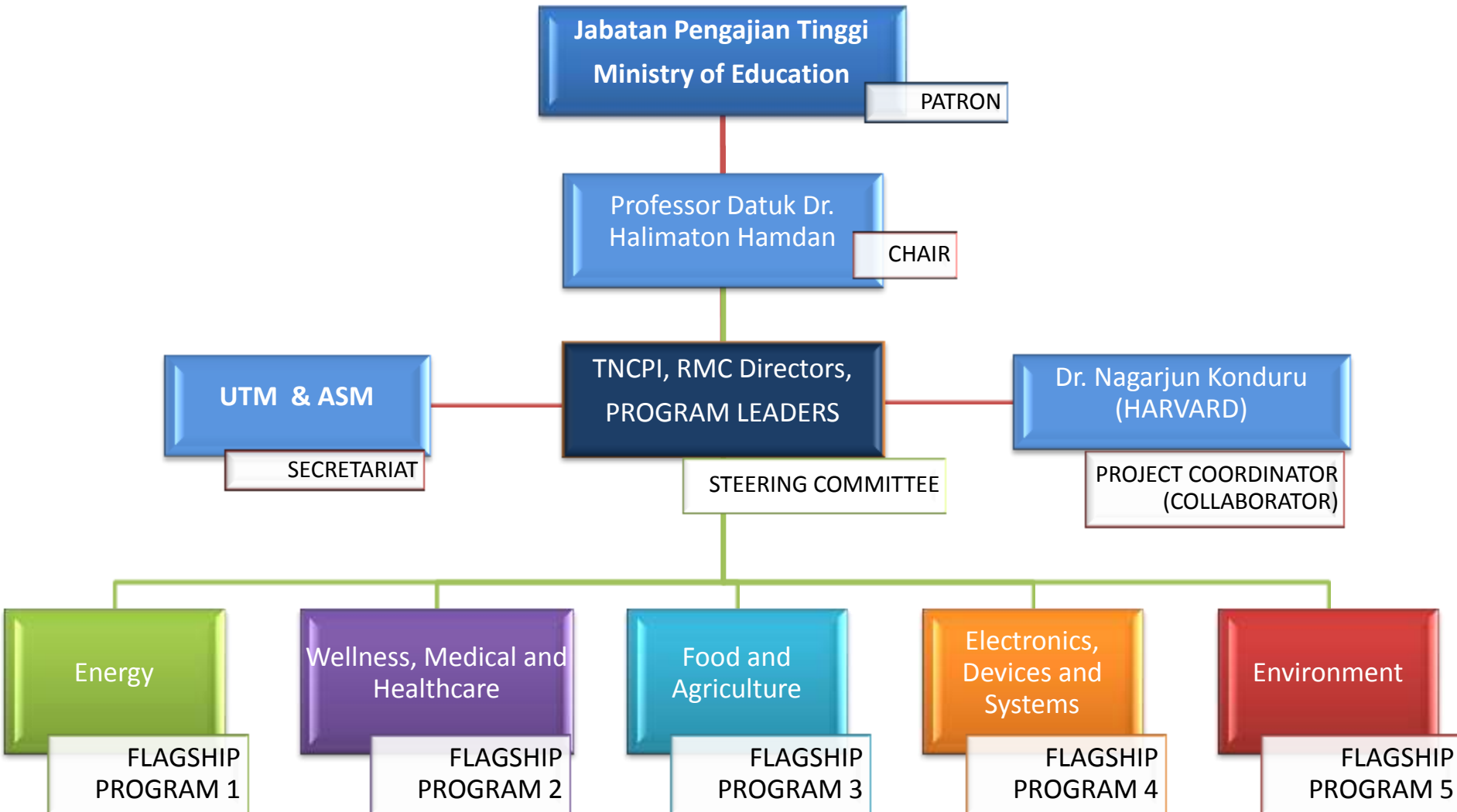
NanoMITE: Research Projects

UTM: Nanotechnology Enabled Efficient Generation of Renewable Energy	UM: NanoRobots for MRI Guided Theranostics	UPM: Nanotechnology in Detection and Control of Ganoderma Boninense (GB)	UKM: Development of Graphene-based Nanoelectromechanical Systems (NEMS) Sensors and Devices	USM: Green Technology and Nanomaterial Applications for the Mitigation of Greenhouse Gases (GHGs)
<ol style="list-style-type: none"> 1. Solid-Oxide Fuel Cells for Power Industry 2. Flexible Dye-Sensitized Solar Cells (DSSCs): Printed solar Cells for Renewable Energy 3. Second generation catalytic pyrolysis of palm oil EFB biomass to jet fuel 	<ol style="list-style-type: none"> 1. The Design and Manufacturing of NanoRobotic Systems for Medical Applications 2. The MRI-Based Tracking and Propulsion of NanoRobots 3. The Guidance and Control of NanoRobotic Systems Inside Clinical MRI Scanners 	<ol style="list-style-type: none"> 1. Controlled release formulation based on graphene for NDS in controlling GB related disease in oil palm 2. Nanosensor for early detection of GB and soil quality 3. Application of the NDS and nano sensor in smart farming for actual detection and control of GB 4. Nanofabrication of devices for nanosensing and control of GB 	<ol style="list-style-type: none"> 1. High capacitance vertical aligned graphene interdigital supercapacitor for powering implanted biomedical devices 2. Graphene membrane for ultra-sensitive NEMS pressure sensor and nanophone 3. Graphene-based photonic crystal biosensor for pathogen detection 4. Efficient and bright light-emitting diodes on single-layer graphene electrodes 5. Graphene Based pressure sensor platform for continuous health-care monitoring application. 	<ol style="list-style-type: none"> 1. Advanced photoresponsive nanomaterials for photoreduction of CO₂ to renewable hydrocarbon fuels 2. Syngas production via CO₂ reforming of methane using nanocatalysts 3. Electrocatalytic conversion of CO₂ and CH₄ to fuels using nanomaterials based electrode 4. Hydrogenation of CO₂ to value added products over nanomaterials

Outcomes

1. **Five Collaborative Research Programmes:** Innovative Solutions to problems
2. **Skilled scientists:** 75 leading scientists
3. **Shared facilities:** save time and cost, access to state-of-the-art scientific equipment and conducive research environment
4. **Human capital:** 25 post-docs, 50 PhD and MSc
5. **Linkages:** Establish scientific R&D linkages with more than 10 top universities in the world
6. **STEM Education:** Knowledge advancement, information and expertise sharing, scientific and research culture
7. **Improved competitiveness:** High-end, cutting-edge scientific research, 75 high impact journal publications, patents and create jobs to scientists and researchers
8. **Global Mobility:** Exchange of researchers, professors, science teachers and students that will benefit thousands of Malaysian students and scientists.

NanoMITe: Operational Structure



NanoMITe: Management

- MOE (JPT) owns the grant mechanism named as **Long-Term Research Grant Scheme - LRGS** (Programme - **NanoMITe**)
- RUs, Nano CoEs and other institutions are invited to be members of NanoMITe
- Member institutions contribute an agreed amount of grant per year
- Grant contributed by member institutions is matched by MOE – Programme based
- Top-down regional/global R&D collaborations on focus area
- Sharing of IPR, facilities and human resources; coordinated by Programme Chair (UTM)
- Funds to be disbursed from Programme Chair Institution (eg UTM) as the Secretariat and Programme Manager

Financial Investment

- R&D grant for 5 programmes at RM 5 million a year amounting to **RM25 million for 2014-2018**:
 - RM12.5 million contributed by 5 RUs
 - RM12.5 million matched by JPT
- Human capital development expenditure for training of 50 post-docs, Masters and PhD students is estimated at RM5 million (2014-2018)
- Facilities to be provided by RUs and collaborators to be shared among researchers

Investing in the Future Technology: “Nanotechnology”

nanoschematic

Small structures and systems are the building blocks of nanotechnology. They are the smallest units of matter that can be manipulated and controlled at the atomic and molecular level. Nanotechnology is a multidisciplinary field that combines physics, chemistry, biology, and engineering to create new materials and devices with unique properties and functions. The potential applications of nanotechnology are vast and include medicine, energy, electronics, and environmental science. This technology is revolutionizing the way we live and work, and it is essential for our future generations.

For our present and future generations