Biomedical Science Education & Practice.

M. Hamdi M., LIBMS, PhD (UK).
Outline of this presentation

- Introduction.
- MLS/BMS practices.
- MLS/BMS education.
- Summary & Conclusion.
• Medieval period, training system - apprentice (aka protégés) with on-the-job training & some classroom work and reading.

• Aim to gain a license to practice in a regulated profession by a Guild (ie kesatuan pekerja).

• Malaysian adopt more of family based traditional profession.  

• As systems evolved we have Universities adopting the concept of madrasa (teaching & learning infrastructure complex and capable of conferring academic degree such as bachelor (al-haqqu biriwayat) & doctorate ijāzah al-tadrīs wa al-iftā' (licentia docendi- "license to teach and issue legal opinions"- kebolehan berijtihad).

• There is also technical & vocational system

• How does this applies to Medical Laboratory Science?
• The National diagnostic laboratory Service, starts with IMR in the 1900 (117 years of experience).

• A Biomedical scientist/MLS is not a pathologist

• Will never replace the pathologist

• Thus betterment of this profession is up to its members (neither pathologist nor other allied health)
• Little post vacancy

• Is there a real need for Qualification upgrade?

• Let us look at the service system
Malaysia have 3 segregated strands of Biomedical Scientist

The three different strands of biomedical scientist in Malaysia are like three parallel lines which will never meet. This is due to ‘U’ grade and non-‘U’ grade division. The first strand stagnant at grade U40 (or U42). Diploma holders later pursuit appropriate degree are in the second strand. The third strand consist of those in research institute and learning institution. This is contrary to biomedical scientist in UK (and other developed countries) who play significant role in the National Health Service (NHS). Thus in Malaysia, MSc or PhD qualified biomedical scientists mostly go along the third strand (Non- ‘U’ grade) which thought to offer better carrier pathway suit their academic qualification.
U Scheme 29

Start/Min RM1,797

Revised (by?) & Need to Match MQR relevant Course

Also the Job description
**Pendahuluan**

**Need to Match**

**MQR relevant Course**

**Also the Job Description**

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**Course Information**

<table>
<thead>
<tr>
<th>Gaji Minimum</th>
<th>Gaji Maksimum</th>
<th>Kadar Kenaikan Gaji Tahunan</th>
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<tr>
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**Start/Min RM2,317**

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**C Scheme 41**
Kumpulan: Pengurusan dan Profesional

Kem./Jab.: Kementerian Kesihatan Malaysia

Jadual Gaji:

<table>
<thead>
<tr>
<th>Gaji Minimum</th>
<th>Gaji Maksimum</th>
<th>Kadar Kenaikan Gaji Tahunan</th>
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<tr>
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SYARAT LANTIKAN:
1. Calon bagi lantikan hendaklah memiliki kelayakan seperti berikut:
   (a) warganegara Malaysia;
   (b) berumur tidak kurang dari 18 tahun pada tarikh tutup iklan jawatan; dan
   (c) 
   (i) ijazah sarjana muda kepulauan dalam bidang berkaitan yang diktiraf oleh Kerajaan daripada institusi pengajian tinggi tempatan atau kelayakan yang diktiraf seluruhnya dengan ijazah sarjana muda;
   (ii) mempunyai seluruh kelayakan ianya (3) tahun pengalaman dalam bidang berkaitan; dan
   (iii) telah berdiri dalam Lembaga dalam bidang yang berkaitan (jika berkenaan).

   (Gaji permulaan ialah pada Gred U41, RM2,429.00)

Syarat Peningkatan Secara Lantikan (PSL):
Pegawai sedang berkhidmat dalam perkhidmatan Juruteknologi Makmal Perubatan adalah layak diperimbangkan untuk PSL ke jawatan Pengajar Juruteknologi Makmal Perubatan Gred U41 terutamanya kepada kecemasan jawatan, apabila telah disahkan dalam perkhidmatan dan:

- mempunyai kelayakan di atas; dan
- berumur kurang atau 54 tahun pada tarikh lantikan.

Bidang-Bidang Yang Dipertimbangkan:
- Medical Sciences (Hons)
- Biology or Chemistry
- Biomedical Science (Hons)
- Bio Perubatan
- Sains Kesihatan
- Teknologi Makmal

Start/Min RM2,429

http://www.spa.gov.my/web/guest/deskripsi-tugas/ijazah/1169
Summary: Must have some form of a clear “Professional Recognition” for the Biomedical Science Profession (not as separate clusters) for future career development.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Start/Min</th>
<th>Allowance</th>
<th>Trainee</th>
</tr>
</thead>
<tbody>
<tr>
<td>U Scheme 29</td>
<td>RM1,797</td>
<td></td>
<td>Standard Tasks &amp; “R &amp; D”</td>
</tr>
<tr>
<td>C Scheme 41</td>
<td>RM2,317</td>
<td></td>
<td>Educ. &amp; Stand. Task</td>
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<td>U Scheme 41</td>
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<td>Pengajar</td>
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MLT O-T-J  Allowance RM 835

C Scheme 19 (SPM) Start/Min RM 1,357

Q Scheme 19 (SPM) Start/Min RM 1,355

Adakah skim sedia ada dlm SPA berfungsi sebagai “Profession Regulator (aka Majlis Profession)?”

A structured academic program with a common identity indeed is a form of “Professional Recognition”

…It comes with “documentized” Responsibility…
The IBMS(UK) recognition was known for the first 6 batches of Biomed UKM (Graduate 94-99). This was followed by lapse period with no IBMS recognition. In 2013, after 22 years UKM was re-accredited. However whether IBMS accredited degree holder has any benefit or advantage in Malaysian academic, industry, healthcare or particularly clinical laboratory set up is not clear.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Year</th>
<th>IBMS Recognition</th>
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<tbody>
<tr>
<td>UKM</td>
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<tr>
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<td>1992</td>
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</tr>
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<td>UPM</td>
<td>1992</td>
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<tr>
<td>USM</td>
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<tr>
<td>UIAM</td>
<td>2002</td>
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</tr>
<tr>
<td>KUTPM</td>
<td>2003</td>
<td>-na-</td>
</tr>
<tr>
<td>UKM</td>
<td>2013</td>
<td>22nd batch</td>
</tr>
</tbody>
</table>

Biomedical Science program introduced to cater the both service & scientist
BHH (Biomedicine), USM: Total Credit Hours: **140**

**MQA Programme Standard for Medical and Health Sciences (Laboratory-Based Diagnostic Sciences)**

- MLT Society (Persatuan MLT)
- MLT Union (Kesatuan MLT)
- MIMLS
- Scientific Officers (Pegawai Sains (Pelbagai varian) – Uni / MOH)

Endless dispute about “territories” without looking into overall scenario.

*Includes Clinical or Professional Placement or supervised professional placement*
In general, **based on their gradual weightage curriculum input**; an undergraduate degree holder biomedical scientist can be divided as clinical proximal (variant A) and clinical distal (variant B). The **numbers of both variants in this country** are not known and the niche areas whether academic, industry, healthcare or clinical laboratory) which they concentrate on are also not known. Malaysian learning institutions has been producing variant B as early as in the 70s, they became medical researchers which focus on life sciences. It was 20 years later (ie 1994) Variant A graduates were initially produced. It was thought that Variant A would become important worker in medical laboratory ie MLTs capable to doing research.
Critical issues and problems that were identified:

- Lack of standardization of syllabi and the curricula.
- Different names used for the degrees, causing confusion at the employment level. Graduates with the wrong qualifications have wound up being employed in medical laboratories, leading to unnecessary complaints and problems.
- Over-production of Biomed.Sc. Graduates particularly by the private institutions, leading to serious employability issues!!!
- “Flawed” graduates
  Poor/No practical training provided by some of the institutions, resulting in graduates who are incompetent in practical skills.
- Lack of appropriately trained academic staff.
- Lack of appropriate infrastructure especially for practical training
- Absence of a council to vigilantly monitor the issues stated above

Will we work together for a sustainable profession?
(Manpower, Money, Admin, Politic)
Definition of “Professional Bodies”

- There is no legal definition of “professional bodies” in Malaysia.
- Black’s Law Dictionary defines a “professional” as “a person who belongs to a learned profession or whose occupation requires a high level of training and proficiency.”

“Professions” typically has 3 main characteristics:

a) Possession and use of expert and specialized knowledge;

b) Strict control of entry into profession; and

c) Existence of a professional code or conduct of ethics.

SHILA DORAI RAJ

Chief Executive Officer of the Malaysia Competition Commission
Majoriti penjawat awam (70.8) – tanpa kelayakan ijazah sarjanamuda.

Wanita, melayu – paling ramai terkesan.

Penjawat awam (a person who works for the government in the civil service) – mula dilihat sebagai "liabiliti"?
The education system has evolved how to use it for professional development?
“pelbagai Dekan” Supaya wujud post JTMP U41, baru laksanakan program akademik

“kenapa tidak kaji long term effect”.......kpd Profession, Tenaga kerja (perlu perincian).
Clinician - KKM
(Biomed BUKAN clinician ie “Not-DU”, therefore different career path and different root (tidak perlu KKM).

biomedical & biotechnologist (this is clin distal)

Universiti hanya menjalankan program
(serve as education provider only).

Jika perlu dari penambahbaikan maka hanya dari KKM (what about the Profession itself ?).

Why are there Biomed, Biochem, Microbiologist?
Can we have ONE...?
European Union **Laboratory Medicine (LM)** Professional Organizations

- European Federation of Laboratory Medicine (EFLM)

- European Union of Medical Specialists (EUMS)- movements within EU.

**Types of laboratory specialists**

LM Physician dominant
Greece, Hungary, Austria

LM Pharmacy dominant
France (73%), Spain (61%) Portugal (57%)

LM Scientist dominant
UK, Netherlands.

Oosterhuis, 2015
Clinical chemistry in European Union (EU) countries comprises of clinical chemistry, blood-banking, haematology, microbiology and immunology, however in the UK and Ireland, clinical chemistry comprises of clinical biochemistry only. Note that in the UK, medically qualified chemical pathologist must register with general medical council, whereas for scientists registration with CPSM also known as Healthcare Profession Council (HCPC) is compulsory. Adapted from (Sanders et al. 2002, Oosterhuis, 2015)

<table>
<thead>
<tr>
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<th>Clinical (biological) chemistry</th>
<th>Hematology</th>
<th>Immunology</th>
<th>Microbiology</th>
<th>Blood-banking</th>
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<td>Yes</td>
<td>Yes</td>
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<table>
<thead>
<tr>
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<th>Duration of training (years)</th>
<th>Official register/legalisation</th>
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</table>

¹: MDs and scientists, respectively; B: biology, BC: biochemistry, C: chemistry, P: pharmacy, AH: analytical haematology, V: veterinary medicine

The designations for the speciality in the member states of the EU are:

- Austria: Medizinische Chemie, Laboratoriumsdiagnostik
- Belgium: Biologie Cliniale/Klinische Biologie
- Bulgaria: Clinica Laboratory
- Czech Republic: Klinická Biochemie
- Cyprus: Laboratory Medicine
- Denmark: Klinisk Biokemi
- Estonia: Laboratory Medicine
- Finland: Klininen Kemia
- France: Biologie Médicale
- Germany: Klinische Chemie, Laboratoriumsmmedizin
- Greece: Kliniké Chimie - Kliniké Biochimia
- Hungary: Orvosi Laboratorium Diagnostíka (Medical Laboratory Diagnostics/Laboratory Medicine)
- Ireland: Clinical Biochemistry
- Italy: Patologia Clinica/Laboratory Medicine
- Latvia: Laboratorij Medicīna
- Lithuania: Laboratorinė Medicina/Medicinos Biologija
- Luxembourg: Biologie Clinique/Biochimie
- Malta: Patologijs Kimika (Chemical Pathology)
- Netherlands: Klinische Chemie en Laboratorium Geneeskunde
- Poland: Diagnostyka Laboratoryjna
- Portugal: Análises Clinicas/Patologia Clinica
- Romania: Laboratory Medicine
- Slovakia: Klinická Biochemia
- Slovenia: Medicinska Biokemiija
- Spain: Bioquimica Clinica - monovalem
  Analisis Clinicos - polyvalent
- Sweden: Klinisk Kemia
- UK: Clinical Biochemistry/Chemical Pathology
Pathology Act 2007, not applicable to MOH Lab, according to test complexities.

CLIA (US) test categories
- Waived
- Provider Microscopy
- Complex Test

CLIA (US) for lab certification (+responsibility to those who run the lab).

Manpower credentialing & state licensure by granting bodies (e.g., ASCP, separate from CLIA)

CLIA (US) – to prevent unnecessary test order (lab director, record & insurance fee claim).

“Walk-in” (professionalism of those who run the business).
The Clinical Laboratory Improvement Amendments (CLIA) of 1988 is a United States federal statute and regulatory standards program that applies to all clinical laboratory testing performed on humans in the United States, except clinical trials and basic research.

The CLIA regulations contained minimum quality standards and placed the overall responsibility for laboratory quality on the laboratory director.

The CLIA standards are based on the complexity, not the location, of the laboratory; i.e., the more complicated the test is to perform, the more stringent are the CLIA standards for quality and oversight.
The allied health workforce includes hundreds of professionals employed in different professions with different job duties and different levels of preparation, but there is no single definition of allied health or list of allied health occupations. All formulations exclude physicians and dentists, and most exclude nurses. Others exclude pharmacists, physician assistants, and more.

According to Title 42 of the U.S. Code, an allied health professional is a health professional (other than a registered nurse or physician assistant) who has a certificate, associate’s degree, bachelor’s degree, master’s degree, doctoral degree, or postbaccalaureate training in a science relating to health care and who shares in the responsibility for the delivery of health care services or related services, including

- services related to the identification, evaluation, and prevention of diseases and disorders;
- dietary and nutrition services;
- health promotion services;
- rehabilitation services; or
- health system management services.

The definition excludes those with a degree in medicine, osteopathy, dentistry, veterinary medicine, optometry, pediatric medicine, pharmacy, public health, chiropractic, health administration, clinical psychology, social work, or counseling.

\[1\text{Title 42 of the United States Code is the United States Code dealing with public health, social welfare, and civil rights.}\]
The scope of basic biomedical research is broad (see classification - not included behave & Soc Sci).

The goal of basic biomedical research is to provide comprehensive & detailed understanding of the mechanism that underlie the development and normal function of humans and other living organisms and thereby gain insights into the pathological and pathophysiological mechanisms that cause disease (the committee 2011).

NIH is the primary agency of the DHHS (US Govt) responsible for biomedical and health-related research. It has its own scientific research facility also it provides research funding to non-NIH research facilities.

The 51 states department of health are commonly responsible for public health, including preventive medicine, vaccinations, environmental health & inspections, and the licensing of health care professionals; collection and archiving of records such as birth and death certs; occupational safety disease notification etc.

In the US, since late 1800's, medical laboratory education occurred within hospital laboratories, under the direct tutelage of a pathologist usually young women were taught how to perform basic laboratory tests.

In 1922 American Society for Clinical Pathology (ASCP) encompassing pathologists and laboratory professionals was established. As it becomes more active, in 1928 they set the Board of Registry to award certificates to laboratory technicians. The ASCP relinquished their oversight of laboratory education programs; in the 70s, American Society for Medical Technologists (ASMT, formerly ASCLTechnologist), oversee laboratory education & licensure. However ASCP, still involve in independent, professional certification (requires passing of exam).
Certification. Require passing of exam. Note the level of test complexities taught in:

- High School Diploma,
- Associate degree,
- Baccalaureate degree—include PhD & Professional doctorate DSc.

For Licensure certification, note the various names which relates to particular specialisations.

http://www.ifcc.org/media/224735/01_walz.pdf
United Kingdom

Modernising Scientific Careers: Scientist Training Programme (STP):
Diagrammatic representation of employment-based, pre-registration 3 year
NHS commissioned education and training programme

Work Based Rotational and Specialist Training Programme

Single Specialism Work Based Programme to include a 4 – 6 week period of Elective Training

P/T MSc Clinical Science
Blended learning (incl problem based learning)

Year 3
Specialist including Research Project

Year 2
Specialist including Research Project

Year 1
Research Methods

Integrated Professional Practice

Work Based Themed Rotational Programme
4 x 12 weeks

Specialism One
Specialism Two
Specialism Three
Specialism Four

Induction

Generic Education and Training
Themed Education and Training
Specialist Education and Training

1.1 What is a biomedical scientist?

Biomedical scientists are scientifically qualified, registered practitioners who work in clinical pathology departments. They play a vital role in patient care, by carrying out diagnostic tests on samples such as blood, tissue and urine. As healthcare professionals, biomedical scientists work with a range of staff in hospitals and in primary care, to provide clinical laboratory services. About

To qualify as a biomedical scientist, both academic and vocational training are required. The academic part of the qualification in the UK is usually a BSc in Biomedical Science which has been accredited by the Institute of Biomedical Science (see below); the vocational training must be undertaken in a approved training laboratory and is designed to show that the trainee has met the Standards of Proficiency set by the Health Professions Council (see below). It is possible to gain an accredited BSc and then take a post as a trainee Biomedical Scientist to complete the vocational training. However, a number of universities across the UK now offer courses which incorporate the vocational training – the so-called "coterminal" or "integrated" Applied Biomedical Science degree programmes.

SALARY

The following information is from the NHS Agenda for Change.

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Band</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical Scientist</td>
<td>Band 5</td>
<td>£19,683 - £25,424</td>
</tr>
<tr>
<td>Biomedical Scientist Team Leader</td>
<td>Band 6</td>
<td>£23,458 - £31,779</td>
</tr>
<tr>
<td>Biomedical Scientist Specialist</td>
<td>Band 6</td>
<td>£23,458 - £31,779</td>
</tr>
<tr>
<td>Biomedical Scientist Advanced</td>
<td>Band 7</td>
<td>£28,313 - £37,326</td>
</tr>
<tr>
<td>Biomedical Scientist Team Manager</td>
<td>Band 7</td>
<td>£28,313 - £37,326</td>
</tr>
</tbody>
</table>
Biomedical Education providers

- MOH-Allied health colleges (KSKB) offering diploma MLT program (not BSc/MScPhD).

- MOHE, there are six public universities (excluding private higher learning institutions*) which train biomedical scientists (clinical proximal) at degree level (undergraduate and post-graduate).

- The red dots • indicate a number of 38 private education institutions offering Diploma MLT (MQF lvl4 program

There are no mechanism encouraging collaborative work unifying educators from both institutions.
Typical thinking on career pathway for biomedical scientists; as above, the KKM Diploma will be much improved with a ‘bridging program’.

Collaborations between ministries, unions, learned societies stakeholders enable:

- Proper Biomedical Science course selection

- “Justice to this profession” leading to clear career pathway
ENGINER AND ENGINEERING TECHNOLOGIST SPECTRUM

<table>
<thead>
<tr>
<th>Research</th>
<th>Product Design</th>
<th>Product Development</th>
<th>Manufacturing</th>
<th>Production Testing</th>
<th>Technical Sale</th>
<th>Field Service</th>
</tr>
</thead>
</table>

**ENGINEER**

In order to distinguish between engineering and engineering technology, a technological spectrum is used to illustrate the differences. Generally, in an organization, engineers would most likely work in the design and development fields while technologists, technicians and craftsmen would be more inclined to work in manufacturing and production line. The engineers role are more towards the left of the spectrum while the technologists are more towards the right of the spectrum although the main activities of both engineers and technologist are in the center of the spectrum.

Source: Cheshier, 1998
2. In this Act, unless the context otherwise requires —

- “technologist” means a person who involves in the application and adaptation of technology that requires principles, methods and techniques appropriate to the field of technology with the exception of those who are already registered under any other Acts as in appendix; (BEM, BOA, BQSM,..)

- “Professional Technologist” means a person registered under subsection 19(4);

- “Graduate Technologist” means a person registered under subsection 19(2);
Malaysian Biomedical Science credentialing system – together with Act 774

MALAYSIAN QUALIFICATIONS FRAMEWORK: PROPOSED MINIMUM CREDIT

<table>
<thead>
<tr>
<th>MQF Levels</th>
<th>Qualifications</th>
<th>Minimum Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Doctoral</td>
<td>No given credit value</td>
</tr>
<tr>
<td>7</td>
<td>Research Masters</td>
<td>No given credit value</td>
</tr>
<tr>
<td>6</td>
<td>Fully or Partly Taught Masters</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>Postgraduate Diploma</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Postgraduate Certificate</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Bachelor</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>Graduate Diploma</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>Graduate Certificate</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>Advanced Diploma</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>Diploma</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Certificate</td>
<td>60</td>
</tr>
<tr>
<td>1-3</td>
<td>Skills Certificate</td>
<td>According to skills and levels</td>
</tr>
</tbody>
</table>
In Malaysia, “Administrator” and “Paper Qualification” affect career development. Within the profession, no niche is superior to the other. Respective niches are responsible for its own progress (run by its own members & welcome constructive contributions from other niches). Note that progress in one niche, do affect the others and thus the Biomedical Science profession (as a whole). This makes the united biomedical scientist (which covers clinical, academic, health & industry) is more versatile & resilient to face future challenges.
Summary & Conclusion

• 1- Decide to focus on biomedical science [ & biomedical sciences] play safe on issues pointed in the “Future direction of biomedical science program, 2011”

    OR

• 2- Decide to enhance biomedical science & have collaborative work with KKM

  • Bridging course for Diploma selected IPTA/S
  • Enhancing teaching & Learning eg KKM & UA/I mechanism

• If choose 1 or 2 (1 and 2) then how do we execute the plan?.