QS SUBJECT FOCUS SUMMIT

MEDICINE

Translating Basic Medical Science into Evidence Based Medicine in The Medical Curriculum of The 21st Century

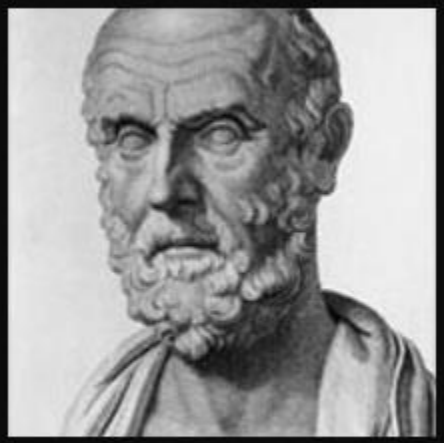
Tract 1 : Balancing Research, Training and Patient Care

Prof Dr Abdul Jalil Nordin

Dean Faculty Medicine Health Sciences

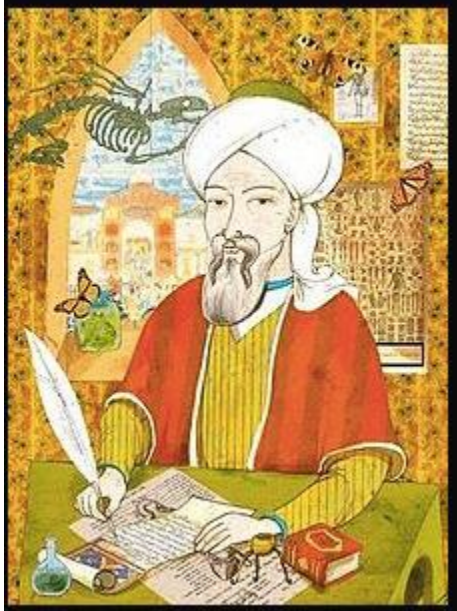
University Putra Malaysia

Hippocrates



Everyone has a doctor in him or her; we just have to help it in its work. The natural healing force within each one of us is the greatest force in getting well. Our food should be our medicine. Our medicine should be our food. But to eat when you are sick, is to feed your sickness.

AZ QUOTES



Therefore in medicine we ought to know the causes of sickness and health.

(Avicenna)

Medical Students today

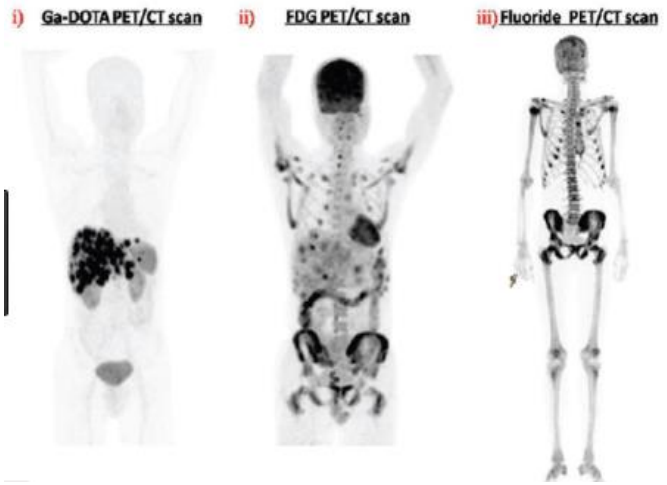
A World of Contrasts

-enter a profession defined by stark contrasts.

*Public health improvements have nearly doubled life expectancy in the last century, and sophisticated technology and innovative research hold the promise of longer and higher quality life.

*In developing countries, NCD is endemic, life-threatening emerging and reemerging infectious diseases such as tuberculosis and malaria continue to affect billions of people, and a rapidly escalating HIV/AIDS pandemic kills more people each day.

* Therapeutic medicine has evolved from new lines of antibiotics to new therapy targeting disease at molecular level supporting “Precision” medicine



*Despite these contrasts, clinicians in-training around the globe—in rich and poor countries—have a common goal: seeking the **skills** and **knowledge** to **improve the health** of individuals and populations.

*The transformative quest to become a competent clinician imbues the learner with insights from within and outside the profession of medicine.

Basic Medical Sciences (BS)

- **Definition** of **basic science** : any one of the **sciences** (such as anatomy, physiology, bacteriology, pathology, or biochemistry) fundamental to the study of **medicine**

Traditionally, undergraduate medical curriculum incorporated basic medical science as foundation during fundamental years creating two distinct study phases.

- In this framework a course in the first year or two of medical school is a preparation for what happens later.
- Another way of looking at this progress from the initial years of medical school to subsequent years is to characterize the students' task.
- In recent decades, early clinical training in medical interviewing, physical examination and diagnostic reasoning have been included in "introduction to clinical medicine" or "doctoring" courses.

A standard Curriculum

The first/second year

Anatomy, embryology, physiology, biochemistry, cell biology, histology, neurobiology

The second year

Pathology, pathophysiology, microbiology, immunology, pharmacology, physical diagnosis

Original Flexner Model of a 2 year BMS

- knowledge of mechanisms (normal structure/function/derangements)
- a knowledge of clinical medicine (the manifestations of disease)

clinicians do not "use" basic science in their decision-making
Rely rather on pattern recognition
'Thinking out loud' method

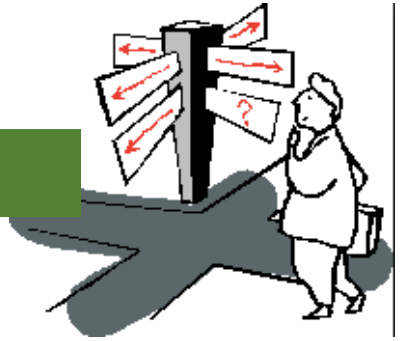
UNDERSTANDING

MISSING LINK

ACTION

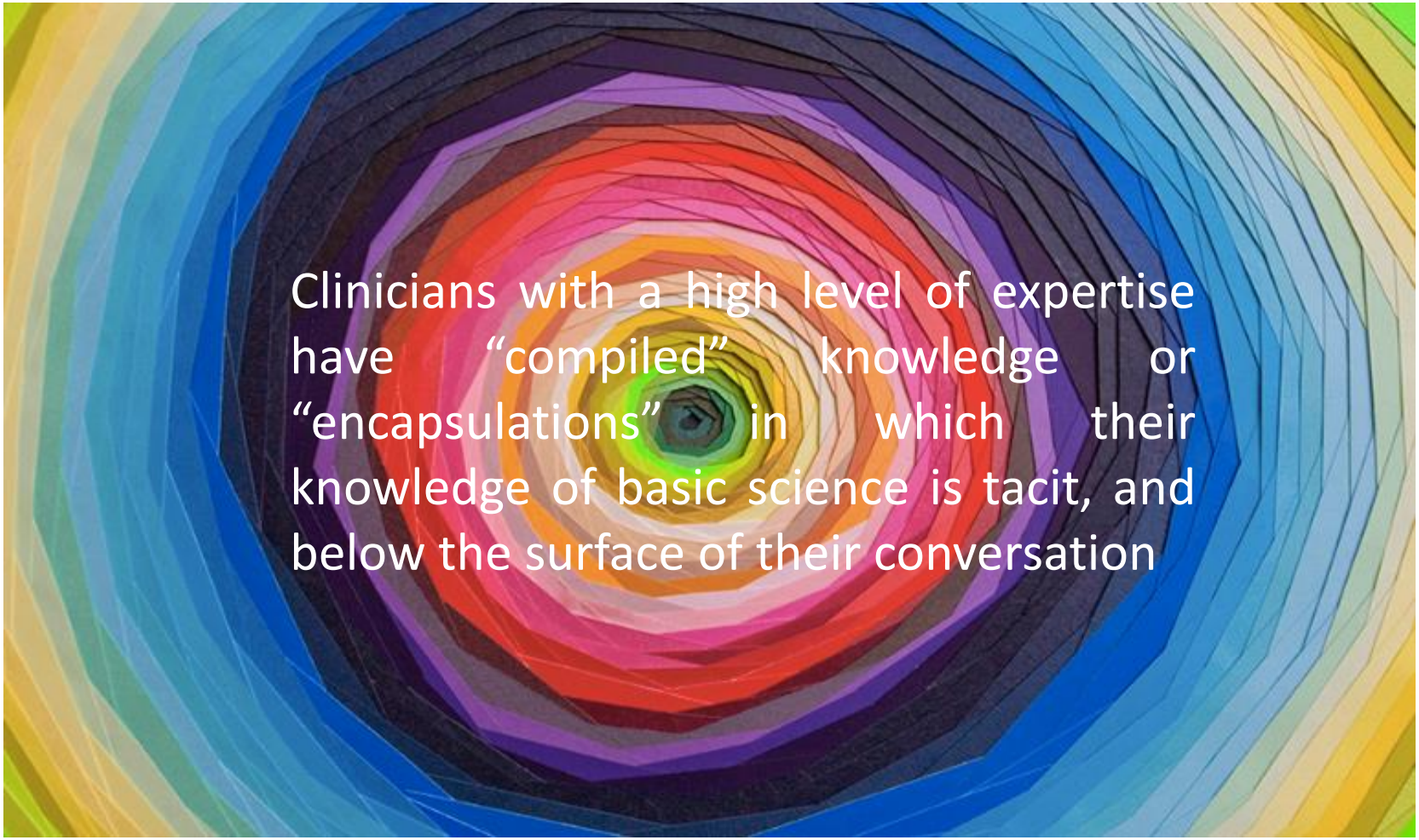
making a diagnosis – reasoning

clinical decision-making



There is global consensus that the highly discipline-specific, non-integrated and divisive curriculum of 20th century medical education is neither adequate nor appropriate for the educational preparation of today's medical students to become tomorrow's competent, caring and ethical doctors of the 21st century.

Patel VL, Evans DA, Groen GJ, Reconciling basic sciences and clinical reasoning,
Teach Learn Med, 1989, 1: 116-121.
Patel VL, Yoskowitz NA, Arocha JF, Shortliffe EH,
J Biomedical Informatics, 2009, 42, 176 – 197.
Woods NN, Medical Education, 2007, 41, 1173 – 1177.


Clinicians with a high level of expertise have “compiled” knowledge or “encapsulations” in which their knowledge of basic science is tacit, and below the surface of their conversation

Clinicians use a knowledge of basic science mechanism in solving more difficult problems

Bordage G. Elaborated knowledge: a key to successful diagnostic thinking.
Acad Med 1994;69:883–
Schmidt HG, Rikers RMJP,
Medical Education, 2007, 41, 1133-1139.
Patel VL, Groen GJ, Arocha JF,
Memory and Cognition, 1990, 18, 394 – 406

Challenges

Rapid expansion of the science that can support improved rational medical decision making

Medical schools are challenged to incorporate new biomedical knowledge into limited curricula time using an ever-increasing number of faculty for whom medical education is not the highest priority.

During preclinical courses students too often perceive biomedical sciences as not being "relevant" to clinical care

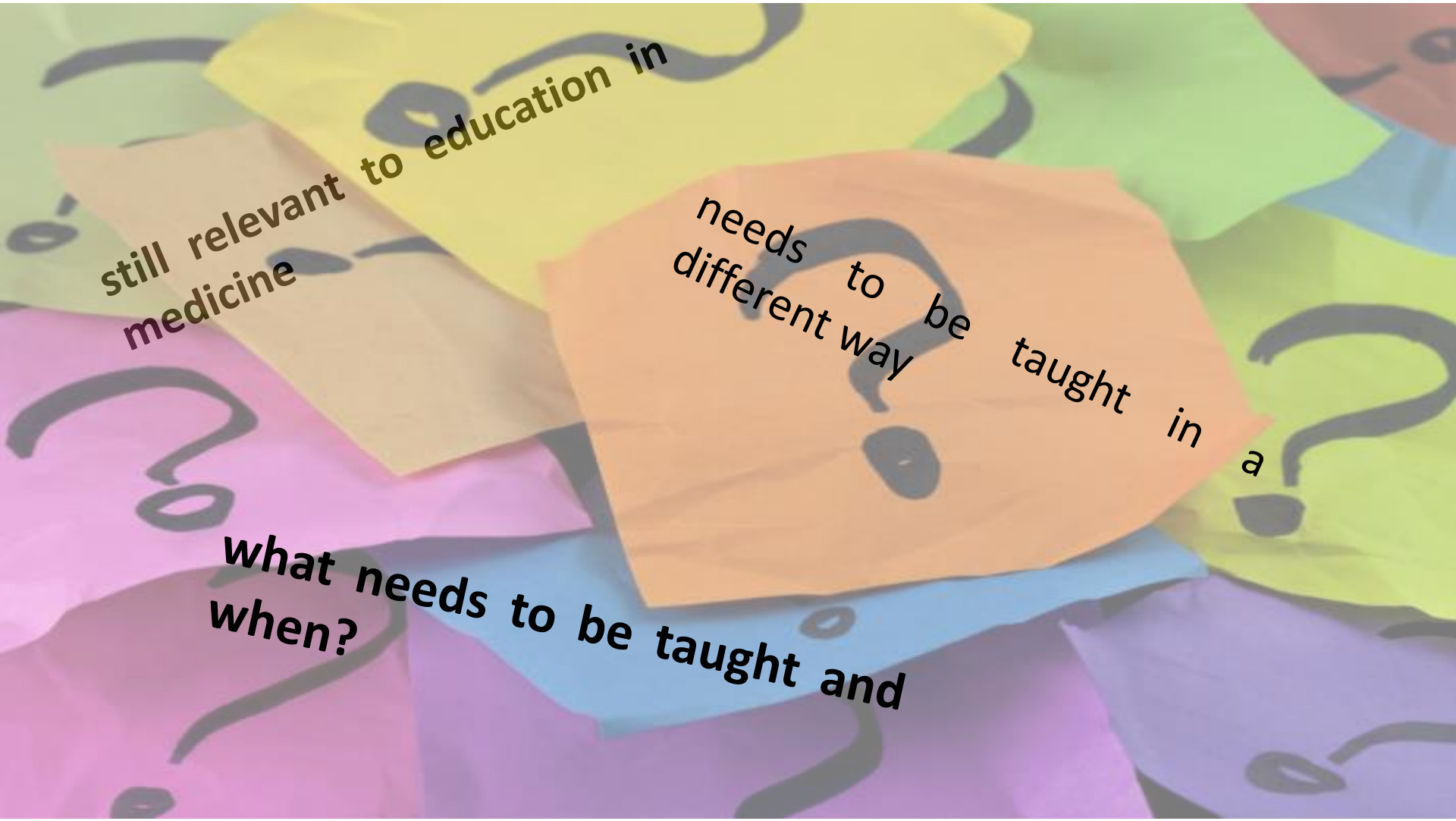
Much of basic science teaching focused on in-depth scientific facts rather than on the relevance of the discipline to and in the context of contemporary medical practice.

Clinical teachers also complained that students seemed to have a poor grasp and recall of and, therefore, the inability to apply basic science knowledge, concepts and principles acquired in the preclinical years to medical problems encountered in the clinics.

Approach to medical practice does not adequately role model the value of science in decision making, thereby implicitly sending the message that such knowledge is clinically irrelevant

Their lectures are accurate but sterile and insensitive to the legitimate needs and interests of medical students

Basic Biomedical Sciences and the Future of Medical Education: Implications for Internal Medicine
Eric P. Brass, MD, PhD
J Gen Intern Med 2009:24(11):1251–4


still relevant to education in medicine
needs to be taught in a different way
what needs to be taught and when?

"Basic sciences are important to the training of physicians, but that given the complexity of medical knowledge and practice, call on to reconsider what constitutes these foundational medical sciences and ensure that we teach them as they will be practiced, in the context of clinical problem solving"

Fincher ME, Wallach PM, Richardson WS. Basic science right, not basic science lite: medical education at a crossroad.
J Int Med. 2009. doi:10.1007/s11606–009–1109–3.

In recent years the scientific knowledge important to learning and practice of medicine has changed dramatically, while the approach to science education in the premedical and medical curricula has essentially remained unchanged"

Howard Hughes Medical Institute, Scientific Foundations for Future Physicians, AAMC, 2009

The BMS & Competency of a clinician

"the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, the values and reflection in daily practice for the benefit of the individual and community being served".

SIX general competencies" in The Accreditation Council for Graduate Medical Education (ACGME)

1. medical knowledge,
2. interpersonal and communication skills,
3. professionalism,
4. patient care,
5. system-based practice and
6. practice-based learning

Competence is seen as a multidimensional construct in which knowledge is given a prominent role, and a knowledge of basic sciences is explicit.

Epstein RM, Hundert EM, Defining and Assessing Professional Competence,
J Amer Med Assoc, 2002, 287, 226 -235.
Accreditation Council for Graduate Medical Education, http://www.acgme.org/outcome/comp/compmin.asp, accessed 11April 2010.xxix

The core of clinicians work rests on integrating **vast quantities** of clinical and other relevant **information**, finding patterns in that data, coming up with a plan of action, and problem solving.

Education in the 21st century will be to embrace the challenges posed by evolving technology, increasingly complex service structures and changing views of the clinician's role, whilst remaining true to our established commitment to teaching the learner the skills they need to thrive as clinicians.

From students receiving intensive instruction of in-depth scientific facts derived from disciplinary courses, to student acquisition of scientific competencies required for the development of the desired habits of mind, behavior and action for medical practice in the 21st century

A good medical curriculum

1. Learning is more efficient when the gaps between theory and practice disappear.
2. experience has meaning to the learner and the learner is able to construct their new knowledge.
3. able to identify their learning needs and turn their learning practices into an enjoyable experience.
4. receives constructive feedback that builds them up, enables them to deepen their understanding of new concepts,
5. actively involved in the learning process and is moti- vated to share knowledge with others.
6. learner is encouraged to master knowledge, use it and explore different aspects of new concepts, empowered to discover things and learn how to think in a creative way.
7. able to see the big picture and the fine details, ask open-ended questions, provide justification for their views, weigh the evidence for different hypotheses, use evidence-based approaches and use communication effectively to achieve their objectives.

special communication
Medical Education at the Crossroads: Which Way Forward?
Samy A. Azer
From the University of Toyama, School of Medicine, Gofuku 3190 Toyoma Japan
Ann Saudi Med 2007; 27(3): 153-157

Standard requirements

LCME Accreditation Standards

PREFACE

An essential goal of each program of medical education leading to the M.D. degree must be the meeting of standards for accreditation by the LCME. The accreditation process requires educational programs to provide assurances that their graduates exhibit general professional competencies that are appropriate for entry to the next stage of their training, and that serve as the foundation for life-long learning and proficient medical care. While recognizing the existence and appropriateness of diverse institutional missions and educational objectives, the LCME subscribes to the proposition that local circumstances do not justify accreditation of a substandard program of medical education leading to the M.D. degree.

Content

ED-10.
The curriculum must include behavioral and socioeconomic subjects, in addition to basic science and clinical disciplines.

> Lists of subjects widely recognized as important components of the general professional education of a physician are included in the medical education database completed in preparation for full accreditation surveys, and in the LCME Part II Annual Medical School Questionnaire. Depth of coverage of the individual topics will depend on the school's educational goals and objectives.

ED-11.
It must include the contemporary content of those disciplines that have been traditionally titled anatomy, biochemistry, genetics, physiology, microbiology and immunology, pathology, pharmacology and therapeutics, and preventive medicine.

ED-12.
Instruction within the basic sciences should include laboratory or other practical exercises that entail accurate observations of biomedical phenomena and critical analyses of data.

ED-13.
Clinical instruction must cover all organ systems, and include the important aspects of preventive, acute, chronic, continuing, rehabilitative, and end-of-life care.

ED-14.
Clinical experience in primary care must be included as part of the curriculum.

ED-15.
The curriculum should include clinical experiences in family medicine, internal medicine, obstetrics and gynecology, pediatrics, psychiatry, and surgery.

> Schools that do not require clinical experience in one or another of these disciplines must ensure that their students possess the knowledge and clinical abilities to enter any field of graduate medical education.

ED-16.
Students' clinical experiences must utilize both outpatient and inpatient

Evidence Based Medicine - integration of best research evidence with clinical expertise and patient values

"conscientious use of current best evidence in making decisions about patient care"

EBM is a process of life-long, problem-based learning.

The process involves:

- Converting information needs into focused questions.
- Efficiently tracking down the best evidence with which to answer the question.
- Critically appraising the evidence for validity and clinical usefulness.
- Applying the results in clinical practice.
- Evaluating performance of the evidence in clinical application.

Guyatt G, et al. Evidence-Based Medicine working Group. Evidence-based medicine. A new approach to teaching the practice of medicine. JAMA 1992; 268: 2420-5.

Fincher and colleagues outline a way forward in their manuscript stating that “Foundational science and clinical medicine must be integrated inextricably....”

Fincher ME, Wallach PM, Richardson WS. Basic science right, not basic science lite: medical education at a crossroad
J Int Med. 2009

New Curriculum for the 21st Century

From students receiving intensive instruction of in-depth scientific facts derived from disciplinary courses, to student acquisition of scientific competencies required for the development of the desired habits of mind, behavior and action for medical practice in the 21st century

Explosion of knowledge and new disciplines

- Molecular biology
- Nano-medicine
- Biomedical engineering
- Informatics- computer science
- Decision making systems
- Robotic
- New imaging technologies

- Culture Change - medical education will be clearly valued and explicitly supported
- More Integration-horizontal/vertical (across years)
- Early introduction to clinical medicine
- Flexibility
- Discovery (research) phase for creativity, curiosity

Basic Medical Science into pre-medical

Changing the pre-medical course requirements to knowledge requirements in order to broaden the depth of scientific teaching and knowledge pre-medical students have upon entering medical school.

The idea being that better prepared medical students will reduce the need to expand upon basic medical science teaching in medical school and allow the medical school focus to shift to applied scientific knowledge in clinical contexts,

Defining Medical Basic Science: General Internists' Special Role in the Reformation of Medical School Education
Elizabeth A. Jacobs, MD, MPP1 and Adina Kalet, MD, MPH 2
J Gen Intern Med 24(11):1261–2

Prerequisites for entering medical school

In the pre-medical school curriculum students should have demonstrated to themselves and faculty that they are familiar with the terminology, methods and content of science. It may be as important that they see "science" as a process of rigorous observation and hypothesis testing than as a fixed body of knowledge to be cherished. Among several recent discussions, Lambert and others proposed a revision of legacy pre-med requirements, including a shift from organic chemistry to biochemistry, from calculus to statistics and substituting no cell biology and physiology for physics. Additionally, they support a decrease in total contact hours in collegiate science, and a shift to more individualized learning of science during medical school.

Pre clinical period

- Basic biomedical science to be taught to support the development of encapsulating concepts; students to be supported by integrated teaching ;
- students should work with patients early in the curriculum;
- students should have exercises to reflect and elaborate on problems of patients (with a tutor/coach or in small groups) to develop knowledge structures.
- Reduced lecture time
  Increase use of patient simulators
- Excellent faculty mentoring
  Extended exposure to master clinicians

Clinical Postings

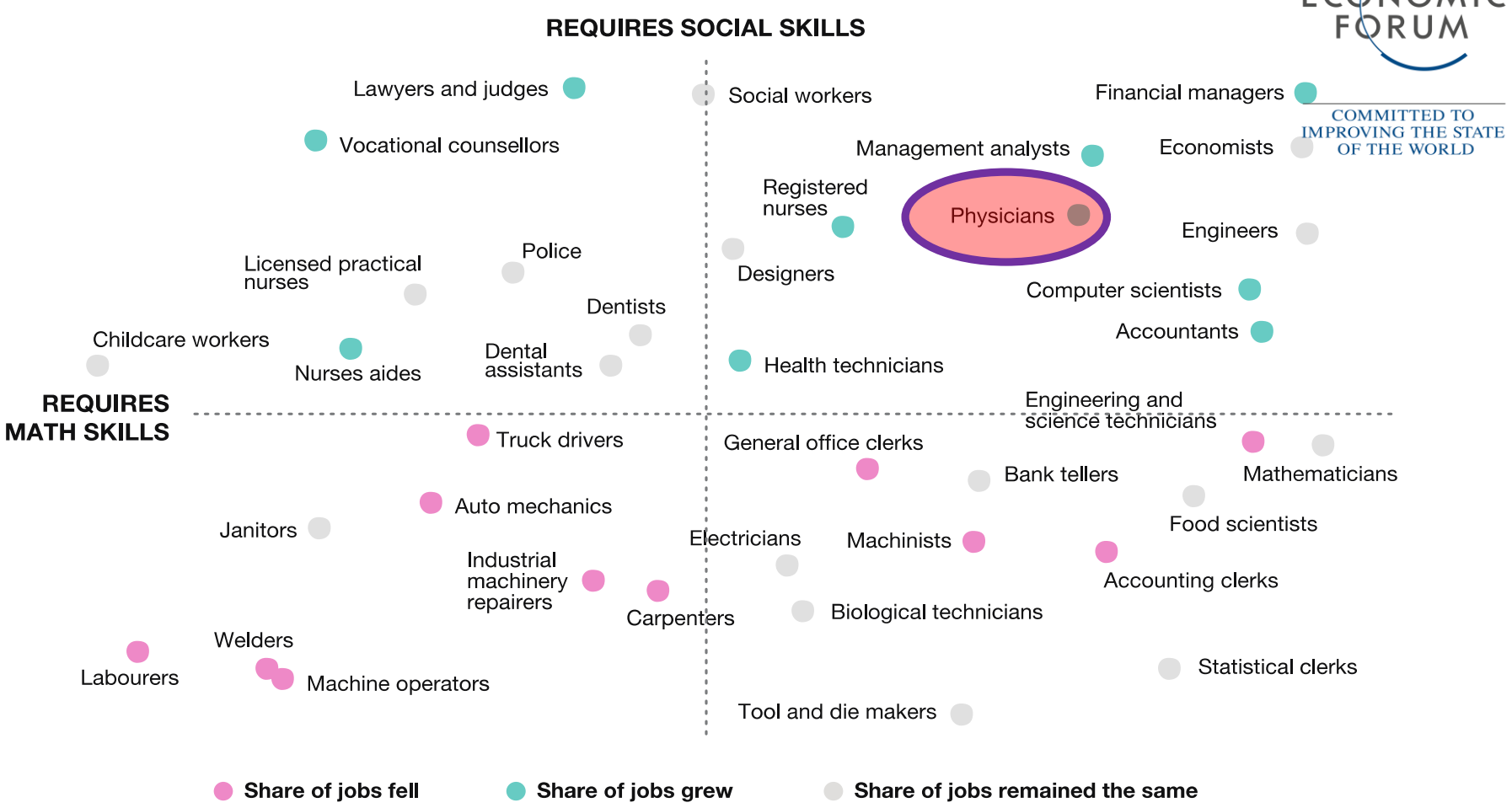
Incorporating basic science training into the clinical years
Faculty development for teachers to link between science and the clinical decisions
“made explicit, concise and clear”

Incorporating early clinical contact with patients in the first year of medical school,
A formal return to science during the clinical years.
A formal return to science may now be considered a “best practice”.

The Role and Value of the Basic Sciences in Medical Education: The Perspective of Clinical Education - Students’ Progress from Understanding to Action
Louis Pangaro (http://www.iamse.org)

- Developments in genetics, artificial intelligence, robotics, nanotechnology, 3D printing and biotechnology,
to name just a few, are all building on and amplifying one another.
- Smart systems—homes, factories, farms, grids or cities—will help tackle problems ranging from supply chain management to climate change.
- As entire industries adjust, most occupations are undergoing a fundamental transformation.
- While some jobs are threatened by redundancy and others grow rapidly, existing jobs are also going through a change in the skill sets required to do them.
- Technological change accompanied by talent shortages, mass unemployment and growing inequality—reskilling and upskilling of today's workers will be critical.
- First step taken – reform education

Exhibit 2: Since 1980, jobs requiring social skills have surged



WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD

Challenges

Impact felt already

- Rising geopolitical volatility
- Mobile internet and cloud technology
- Advances in computing power and Big Data
- Crowdsourcing, the sharing economy and peer-to-peer platforms
- Rise of the middle class in emerging markets
- Young demographics in emerging markets
- Rapid urbanization
- Changing work environments and flexible working arrangements
- Climate change, natural resource constraints and the transition to a greener economy

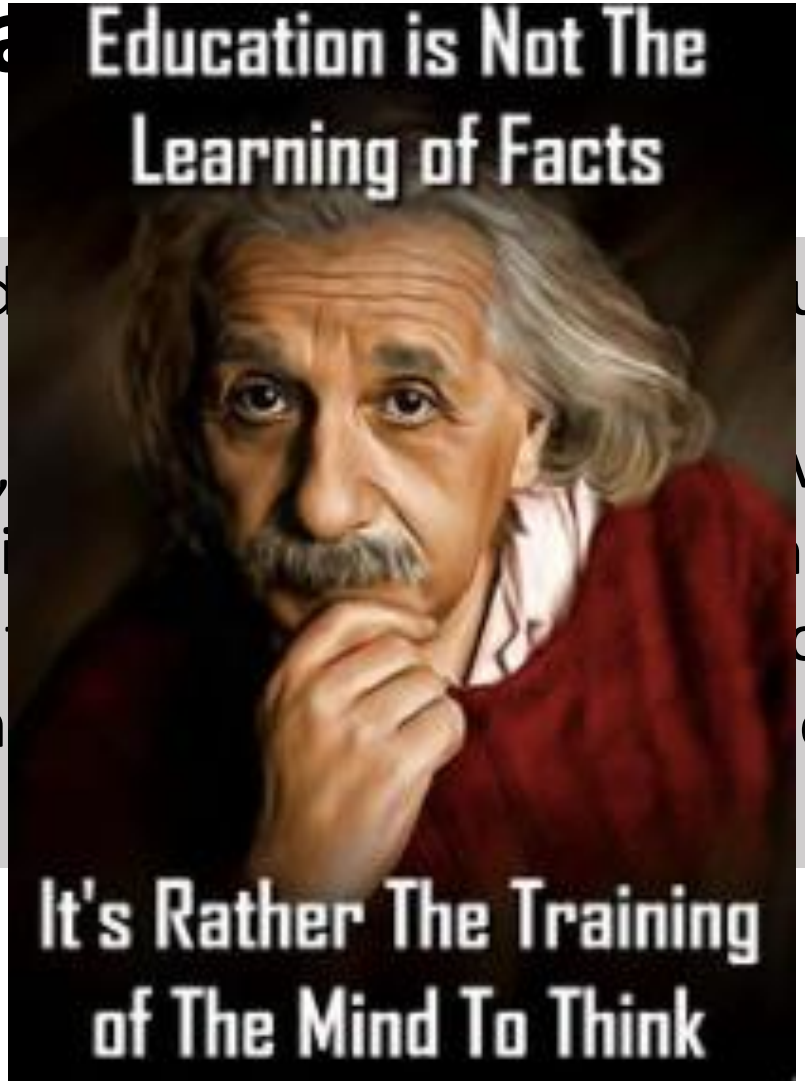
2015–2017

- New energy supplies and technologies
- The Internet of Things
- Advanced manufacturing and 3D printing
- Longevity and ageing societies
- New consumer concerns about ethical and privacy issues
- Women's rising aspirations and economic power

2018–2020

- Advanced robotics and autonomous transport
- Artificial intelligence and machine learning
- Advanced materials, biotechnology and genomics

Summa



Medical Ed ury will be to embrace by evolving technology, vice structures and changi 's role, whilst remaining ommitment to teaching th ed to thrive as clinicians.

Thank you