Review Article

Undergraduate Medical Research - The Essential Domain

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ABSTRACT

Research is an essential component of any branch of Science and particularly in the field of medicine. While in the West, research has become an essential component of medical curriculum, India still faces the dearth of physician scientists which poses a challenge to secure its place in the global arena of research. Early research exposure is an easy solution to overcome this problem. The history of medicine has witnessed path breaking discoveries in the past by medical students. Indian funding bodies are opening up new funding schemes. However, the role of each medical college in improving the research potential at undergraduate level is unquestionable. Many novel initiatives can be begun at the Institutional level to promote undergraduate research and translate it to productive patient care.

Keywords: Kishore Vaigyanik Protsahan Yojana, ICMR, IJMR

Introduction:

Research is an essential component of any branch of Science and particularly in the field of medicine. While in the West, research has become an essential component of medical curriculum, India still faces the dearth of physician scientists which poses a challenge to secure its place in the global arena of research. Early research exposure is an easy solution to overcome this problem. The history of medicine has witnessed path breaking discoveries in the past by medical students. Indian funding bodies are opening up new funding schemes.

However, the role of each medical college in improving the research potential in undergraduate level is unquestionable. Many novel initiatives can be begun at the Institutional level to promote undergraduate research and translate it to productive patient care.

Why is Research Important?

Efficient and informed health care delivery requires knowledge and skills of research in addition to technical expertise in the chosen field of specialization. Therefore research is and should be an essential component of medical education. Also, the ability to carry out research...
is an important skill for the academic advancement of an individual. Individuals who effectively acquire this skill are in a position to make an impact on the body of knowledge through exploration and scientific communication. It is for this reason that research is now a required competency for any well trained health professional. The survival and recognition of any health training institution depends on how effectively it promotes research. Unfortunately, health research has a low priority in the developing world. A recent UNESCO report says in all disciplines of Science and Technology, India has about 137 researchers per million citizens as compared to 4,526 researchers per million in the United States\textsuperscript{1}. One long-term strategy for promoting health research is to target medical students early in their careers. Student research has also shown to increase the publication output of the Institution. Even if the experience of doing research as a student does not lead to a later career in academic medicine, research experience can help improve students’ skills in searching and critically appraising the medical literature, independent learning, and writing research papers\textsuperscript{2}. In one Indian study, 91\% of interns reported no research experience in medical school\textsuperscript{3}. Thus, students in India rarely get exposed to research at this crucial stage in their academic development when such exposure could encourage further research after qualification. The apex accrediting and regulatory agency of medical education in India, namely the Medical Council of India, lays down research aptitude as an Institutional goal for an undergraduate student. In addition, MCI recommends completion of a research project as one of the criteria for award of internal assessment marks\textsuperscript{4}. The global minimum requirements for medical education include research as one of the essential requirements for medical students to promote critical thinking and problem solving, thereby improving patient care\textsuperscript{5}.

**Famous Discoveries by Medical Students**\textsuperscript{5}

In medical history, research has always been part of medical education. The discovery of heparin, a natural anticoagulant, revolutionized the management of thromboembolic disorders and cardiac surgery after its introduction into clinical practice in the 1940s. Jay Mclean (1890–1957) in 1916, as a second-year medical student at Johns Hopkins University in Baltimore began his work with William Henry Howell. Along with another medical student discovered Heparin (Greek: Hepar means liver)

Dr Thomas J Fogarty is best known for his invention of the balloon embolectomy catheter. During his teenage years he was working as a surgical scrub technician when he witnessed long and difficult operations undertaken to remove blood clots from arteries. This inspired him to think of a new approach that he perfected as a medical student at the University of Cincinnati. He took a latex glove, cut off the fingertip and attached it to a plastic catheter, using fly-tying techniques he learned as a fisherman. However, his discovery was considered too complicated and
dangerous and was widely criticized by the surgical community. The balloon catheter was finally patented in 1963, the same year that he published an account of its use in nine patients. Subsequently the findings were published by Fogarty and his colleagues their experience of its use in treating 50 patients with femoral or aortoiliac emboli; 80% of the patients survived and only two required an amputation. Today, more than half a million Fogarty catheters are sold annually (Edwards Life sciences CA, USA, pers. comm., 2008).

Another path breaking discovery in Medicine was done by a medical student Auguste-Maurice Raynaud (1834–1881) when he reported 25 women with episodic vasoconstriction of the digits causing classical color changes associated with pain and loss of sensation. This was his doctoral work. He also observed that this occurs due to exposure to cold. Today Reynaud’s phenomenon is a widely diagnosed condition associated with many diseases.

Paul Langerhans (1847–1888) was a son of a physician. He made two significant discoveries as a medical student. One was the dendritic cells of the skin (Langerhans cells) and the second was the pancreatic islets. Though the pancreas has been widely studied from the 16th century, it was initially classified as a type of salivary gland. In 1868, Langerhans reported the presence of clusters of small ‘irregularly polygonal’ cells with clear cytoplasm diffusely scattered throughout the gland, each measuring 0.1–0.24 mm in diameter. The functional roles of these cells were unraveled 25 years later.

Insulin was discovered by Charles Herbert Best (1899–1978) and Frederick Grant Banting (1891–1941) in Toronto. Banting and Best first tested their pancreatic extract in a diabetic dog in July 1921. Within months they had confirmed its efficacy in treating diabetes.

Martin William Flack (1882–1931) a medical student at the London hospital excitedly showed his teacher Dr Arthur keith the ‘wonderful structure he had discovered in the right auricle of the mole’. Keith had persuaded Flack to spend the summer holidays studying the hearts of trapped moles, mice and frogs. Keith quickly recognized that Flack’s findings closely resembled the atroventricular node. This was the sinoatrial node which was subsequently characterized to be the origin of the heart rhythm.

Augusta Klumpke (1859–1927) is best known for her description of inferior brachial plexus injuries as a medical student in 1885.

As a 23-year-old, fourth-year medical student at the University of Perugia, Ruggero Oddi (1864–1913) studied the actions of the sphincter at the distal end of the common bile duct. He concluded that the sphincter controlled the intermittent flow of bile from the liver to the duodenum. He also suggested that dysfunction of the sphincter might cause biliary tract disease.

Spermatozoa were first discovered in 1677 by Johan Ham (1651–1723), a medical student from Leiden.

All these discoveries only reiterate the fact that medical students, if actively pursue research and ignite their critical thinking could
contribute significantly to the history of medicine

**Current Scenario**

While research has grown exponentially in the West while India is still struggling to find its place in the global arena. With newer technologies in the field of molecular medicine to newer drugs and therapeutic modalities for various diseases being discovered, there is immense potential for the medical undergraduates to explore the world of research. The global minimum standards for medical education puts forward the essential components of medical education. (Fig 1) which lists critical thinking and research as an important component. It defines critical thinking and research as

“The ability to critically evaluate existing knowledge, technology and information is necessary for solving problems, since physicians must continually acquire new scientific information and new skills if they are to remain competent. Good medical practice requires the ability to think scientifically and use scientific methods. The medical graduate should therefore be able to formulate hypotheses, collect and critically evaluate data, for the solution of problems.”

Thanks to the medical council of India which has brought out the recent “Vision 2015” document which is envisioning a “Competency” based curriculum for the undergraduate medical students .In this document it has included research as an elective component.(MCI VISION 2015)

Few medical colleges have realized the potential of research and have introduced the “problem Solving for Better Health” funded by the Dreyfus foundation (http://www.dreyfus.org) which involves the students gaining exposure in carrying out community based research projects. Many colleges began this initiative as early as the early 1990’s.

The funding for undergraduate research by the Indian Council of Medical Research (ICMR-STS) is another successful and novel initiative. Many students gain a fruitful research experience when they are granted these projects. (icmr.nic.in/shortr.htm)
Another novel step towards research by the Department of Science and Technology is the Kishore Vaigyanik Protsahan Yojana (KVPY). This novel initiative is to encourage students from basic sciences, engineering and Medicine to take up research as their career. On a competitive basis scholarships are provided up to the PhD level for those who are selected.10

Future Directions
The day is not far off when India will excel in the research arena too. Early exposure of the medical students to research would open up new potentials for novel discoveries. In addition to these funding bodies, each medical college should take their own Institution based steps to promote research 10 . Forming of Research groups, introduction of research grants and awards are some of the steps. In addition, translating the research work to a publication would motivate more students to come forward to do research. A number of premier journals like BMJ, IJMR have dedicated sections for publishing student research. A list of journals which encourage exclusively the undergraduate student research are given in Box 1.

Addition of Research methodology into the curriculum, identifying the core research competencies for undergraduate research and more funding bodies to fund undergraduate research are the directions which we need to work together. Once this dream turns to a reality, the field of medicine is poised to become a very different ballgame altogether. The current paradigms of understanding the disease will undergo a thorough revision, with newer technologies for delivering innovative and path-breaking preventative and curative medicine to humans.

References

Box 1: Student Research Journals
Student BMJ (student.bmj.com)
Student IJMR (www.ijmr.org.in/)
The Lancet Student (www.thelancetstudent.com)
International Journal of Students Research (http://www.ijsronline.com)
Asian Students Research Journal (www.asmj.info)
Journal of Young Investigators (www.jyi.org)
International medical Journal of Students Research (http://www.imjsr.com)


6. Vision2015


8. ICMR Short term Research Studentships icmr.nic.in/shortr.htm [accessed on Dec 20th 2011]

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