



Medical Laboratory Disciplines: Time for Academic Reform and Structural Organization

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Laboratory medicine means differently in different countries. Supposing pathology as the generic name for all laboratory-related medical disciplines, laboratory medicine is synonymous to clinical pathology, which also includes chemical pathology, laboratory hematology, and microbial pathology. Laboratory medicine is an example of “smart lab” that encompasses robotic automation, quality assurance and microscopy, oriented more towards patient’s service, dealing with investigations of immediate relevance with shortest possible turn-around-time (TAT). The expertise serves as “medical detective”, and “consultant” of the clinical consultants.

With the shift of generic name for medical laboratory disciplines from pathology to laboratory medicine, the latter becomes inclusive of all laboratory-related medical disciplines; even pathology, microbiology and biochemistry. This shift of focus has thrown open the opportunity for academic and organizational reforms of different laboratory-related medical disciplines.

Any medical discipline has three objectives: service to patients, service to students (academics), and service to science (research and publications). Laboratory medicine is not an exception to this. Laboratories are the “backbones” of evidence-based medicine, the “jugular vein” of a hospital. With service to students, it develops expert re-sources at the postgraduate and post-doctoral super-specialty levels.

The disciplines of pathology, microbiology and biochemistry have a great role in concept building for the medical undergraduates. However, none has any significant role even for sensitization with what is being done in a hospital’s clinical laboratory for moment-to-moment management of patients. Postgraduate course in pathology offers knowledge and experience in anatomic pathology, histochemistry/cytochemistry and molecular diagnosis. Postgraduate training in bio-chemistry has embraced metabolomics, proteomics, genomics and epigenomics, while postgraduate training syllabus for medical micro-biology ranges from bacteria to parasites, fungus to virus and bacteriophage, and their diagnosis in human conditions at cultural, biochemical, serological and molecular level. Pathology, microbiology and biochemistry all teach immunology and molecular biology in the context of their respective subject. Strikingly, there is no postgraduate course, which exclusively deals with holistic diagnostic patient care with equal training in automation, microscopy, accreditation, equipment and reagent procurement, and total quality management including safety, ethics and legal practice. Here, there is a felt need of laboratory medicine as a basic postgraduate medical discipline.

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Laboratory medicine has emerged as an independent postgraduate medical discipline in India and Bangladesh. India’s premier medical institute at Delhi, AIIMS, founded this discipline in 1988 and started a post-graduate course with three-year residency program since 1997. Bangladesh took a cue from India and established this discipline in 2014. In 2017, by Government order, the two-year diploma course in clinical pathology (DCP) in Bangladesh has been replaced by a three-year post-graduate course in laboratory medicine. This is the consequence of country’s service-need. Laboratory medicine for countries such as India, Bangladesh and even Canada (where it is called “general pathology”) is a bottom-line diagnostic service facility managed by laboratory physicians, who are postgraduates in laboratory medicine. The arrangement is useful to deliver integrated diagnostic service in the area of clinical pathology, laboratory hematology, microbiology, clinical biochemistry and rapid molecular tests, ensuring quality with minimum turn-around-time in their respective vast rural and semi urban areas. The palpable gains are in space economy, time economy, manpower economy, knowledge economy and budget economy. This arrangement opens up a new option for students as well as for teachers. At a higher level, this also opens up the opportunity for the basic departments of pathology, microbiology and biochemistry to develop their respective super-specialty or post-doctoral fellowship courses; for example in neuro-, renal, dermato- and gastrointestinal pathology, hematology, virology, parasitology, nanomedicine, genetics, immuno-, molecular medicine, etc.

Having recognized this need of new academic orientation in laboratory-related disciplines, organizational reform of the laboratories in a teaching medical institution hospital automatically falls into its natural place. In a defined diagnostic block, it consists of three tiers. Tier I includes the central hospital laboratory (laboratory medicine) with central phlebotomy facility, and blood bank services (transfusion medicine). Both laboratories are poly-disciplinary in nature and cater to all outpatients and in-patients in general. Transplantation medicine and reproductive medicine laboratories could be the specialized divisions of laboratory medicine. Tier II consists of the laboratories in three basic disciplines: anatomic pathology, microbiology and biochemistry. Tier III laboratory of a hospital in any medical institution is constituted by the common research facility with all high-end equipment (for example, mass spectroscopy, LC-MS, GC-MS ICP-MS, confocal microscopy, cell sorters, molecular tracer, image analyzer, stem cell and organoid research facility, etc.).

TAT in tier I is a few minutes (in case of point of care) to a few hours; in tier II, 12-72 hours; and in tier III, usually a week. Tier I laboratories work round-the-clock; tier II laboratories, from 9 AM to 5 PM; while tier III laboratory, although always accessible, mostly works as and when needed. Tier I laboratory is run by laboratory physician, tier II by respective postgraduates and consultants, and tier III by laboratory scientists with Ph.D. degree. Laboratory scientists (Ph.Ds) have a greater role in tier III laboratories on which super-specialty training mostly depends. The scope in tier III is unlimited and includes basic cell biology, cybersemiotics, synthetic biology, biologically inspired systems science (BISS), bio-robotics, and personalized medicine.

Integrated laboratory information system and integral situation of all laboratories in one block serve one-window solution for patients and holistic training of the residents, leaving sufficient numbers of doors open

for inter-laboratory and laboratory-clinician dialogues. This corridor generates revenues for the hospital, research papers for the institution, and experts for the nation.

Last, but not the least, the medical laboratories cannot be run without trained technologists. Therefore, their training course should be organized accordingly in undergraduate (B.Sc.), postgraduate (M.Sc.) and super-specialty level (Ph.D.) with corresponding appointment in tier I to

tier III.

Let us comprehend the Idea. Let us not re-fight the last war. Let us declare this decade as the decade for the lab. Let the discipline of medical laboratory science be structurally and academically organized; attain its natural deserving height with laboratory physicians in Tier I and II, laboratory scientists in tier III, and appropriate technologists all over. Let the *Journal of Laboratory Medicine* beckon this future.