Published in final edited form as:

Med Sci Educ. 2015 December ; 25(4): 473–477. doi:10.1007/s40670-015-0160-4.

Teaching Biochemistry to Students of Medicine, Pharmacy & Dentistry:

5th International Conference of the Association of Biochemistry Course Directors (ABCD) Santa Fe, NM, USA, May 3–7, 2015

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Further information about the ABCD

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Introduction

One hundred and one faculty educators representing 81 North American and Caribbean institutions met to discuss biochemistry education of students of medicine, pharmacy, and dentistry. Plenary and Breakout sessions are summarized.

Opening Session

- Dr. Neil Osheroff (Vanderbilt University School of Medicine, Nashville, TN) outlined the history, leadership structure, visibility, attendance trends, members' resources, and services of the ABCD, reported on ABCD finances, acknowledged sponsors (TopHat), and highlighted recent publications by ABCD authors.
- Dr. Susan Cline (Mercer University School of Medicine, Macon, GA) explained how candidates are nominated and elected to the ABCD Executive Committee.

Plenary Session IA – Horizontal and Vertical Integration of Basic and Clinical Sciences

- **Making Basic Science Visible**; Dr. Nicole Woods (Wilson Centre, University of Toronto, ON), a cognitive psychologist, presented research supporting the cognitive integration of basic and clinical sciences in the training of health professionals. The teaching of basic science concepts enhances diagnostic accuracy and the retention of information for later application. Furthermore, the introduction of basic science followed by an immediate connection to the clinical context enhanced diagnostic accuracy over learning conditions with only clinical science or with clinical science preceding basic science. The importance of basic science in medical teaching is not visualized easily in an integrated curriculum, but fundamental science concepts have a critical role in the cognitive integration needed for the development of diagnostic expertise.
- **Teaching of Biochemistry Fundamentals in the Critical Care Clerkship Using a Case-Based Approach**; Dr. Clive Slaughter (Georgia Regents University-University of Georgia Medical Partnership, Athens, GA) discussed the application of the Stewart model for determining patient acid-base status in the training of fourth year medical students in the critical care clerkship rotation. He used the model an example of teaching a fundamental science concept that is applicable throughout undergraduate medical education. His experience with this approach

suggests that it may be effective in clarifying and reinforcing the principles of acid-base balance in the context of patient care.

- **Integration of Basic Sciences into the Clerkship Years**; Dr. Neil Osheroff described a model for the incorporation of foundational sciences into the clerkship years of medical school through the use of integrated sciences courses that teach foundational knowledge during meaningful clinical engagement. Development of the integrated science courses requires close collaboration between clinicians and scientists. Dr. Osheroff discussed the novel use of "master science teachers," a group of scientists with leadership roles in the pre-clerkship curriculum, to review and offer assistance with the development of the integrated science courses.
- **Integration of Basic Sciences in Clinical Medicine**; Dr. Cheryl Dickson (Western Michigan University School of Medicine, Kalamazoo, MI) discussed the importance of integration throughout the medical school curriculum. She utilized a series of pre-recorded video interviews with a variety of stakeholders at her institution to emphasize the necessity for buy-in and the perception of a variety of active learning sessions.

Plenary Session IB – Integration of Biochemistry into Clinical Teaching

- **Biochemistry Concepts that Promote Better Medical Decision Making: The MedU Science Project**; Drs. Tracy Fulton (University of California-San Francisco School of Medicine, San Francisco, CA), Susan Cline, Janet Lindsley (University of Utah School of Medicine, Salt Lake City, UT), Peter Rubenstein (University of Iowa Carver College of Medicine, Iowa City, IA), Clive Slaughter, and Kathryn Thompson (University of New England College of Osteopathic Medicine, Biddeford, ME) discussed the MedU science project and its role in developing innovative virtual patient cases that can be used to incorporate foundational sciences into the clerkship years. The project is based on the concept that understanding the basic sciences helps to promote better decision making among physicians. The panel summarized the history of MedU and the current status of the biochemistry core concepts and related objectives.

Plenary Session II – Teaching Modalities Old and New (part I)

- **Novel Strategies for Teaching Basic Sciences to Digital Natives**; Sarah Farrell (Apple Education) presented numerous examples of applications and websites that can be used on any mobile device to engage and motivate students in an active learning format. She demonstrated how an iPad can become a smart board and can record mini-movies for student learning that can be exported to a variety of public sources. She demonstrated the use of iTunesU and Apple TV, where instructors and students can have access to courses and resources from other institutions and create their own resources.

Plenary Session III – Educational Methods

- **Scholarly Teaching and Scholarship of Teaching**; Dr. Georges Bordage (University of Illinois at Chicago College of Medicine, Chicago, IL) discussed

differences between “being scholarly” and “doing scholarship.” He went on to describe strategies that educators can use to transform their scholarly teaching into educational scholarship. Finally, Dr. Bordage defined scholarship, the essential characteristics of high quality scholarship, and how to select the appropriate journal in order to target the desired audience for the publication of your work.

- **Constructing an Effective Instructor Guide for MedEdPORTAL Publications**; Dr. Richard Sabina (Oakland University William Beaumont School of Medicine, Rochester, MI), the MedEdPORTAL Associate Editor for Biochemistry and Genetics, ran a workshop on best practices involved in writing instructor guides for MedEdPORTAL publications. The interactive session used high quality and poor examples to reinforce what constitutes an excellent MedEdPORTAL manuscript and what reviewers look for in submissions.

Plenary Session IV – Teaching Modalities Old and New (part II)

- **Maximizing Learning through Spacing Content, Mixed Practice, and Formative Testing with Feedback**; Dr. Georges Bordage reviewed a variety of evidence and made a strong case for the effectiveness of spacing, mixed practice, and formative testing to maximize learning. He explored the challenges and opportunities of each of these approaches. Finally, he encouraged individuals to participate in medical education reform by adopting evidence-based innovations and by contributing research that advances the fields of teaching and learning.
- **Spaced Education as a Modality for Review and Retention in Pre-clerkship Education: A Pilot Study that Includes Biochemistry and Genetics**; Dr. Tracy Fulton described how she used the instructional strategy of spaced education to improve student retention of material presented in previous courses. Qstream, a multiple-choice question-based platform was used to deliver questions with comprehensive explanations to students’ email boxes every three days. This method allowed students to revisit material previously covered in the curriculum without negatively impacting their performance in current courses. Preliminary data suggest that spaced education has great potential as a learning tool.

Plenary Session V – Biochemistry and Nutrition in Health Maintenance and Disease Treatment

- **Planning a Nutrition Curriculum: How to Decide What Skills Students Should Learn**; Drs. Clive Slaughter, Janet Lindsley, and Peter Rubenstein led a lively discussion on key questions related to the development of nutrition curricula for student. The discussion focused on criteria for choosing learning objectives, clinically applicable skills that students should learn, and life-long learning in the area of nutrition.
- **Using Metabolic Integration to Teach Medical Students how Diet can be Manipulated to Treat Obesity and Type II Diabetes**; Dr. Eileen Lafer (University of Texas Health Sciences Center at San Antonio, San Antonio, TX) described a new method of teaching nutrition in which the traditional starve-feed

paradigm is extended to include what happens during consumption of diets with varying macronutrient ratios.

Plenary Session VI –Teaching Modalities Old and New (part III)

- **Using Concept Mapping as a Tool for Integration**; Drs. Doug Spicer (University of New England College of Osteopathic Medicine, Biddeford, ME) and Kathryn Thompson led an interactive session that modeled how concept mapping is used in their curriculum. Using a clinical vignette of a Type I diabetic presenting with dehydration, hyperglycemia and elevated BUN, teams developed short lists of basic science and clinical concepts and generated concept maps to explain the biomedical mechanisms causing the patient's symptoms. A second case related to chest pain was distributed along with student-generated concept maps and a rubric to evaluate them. Teams used the rubric to rate each concept map.
- **Development of a Standardized Metabolic Map for Learning and Assessment**; Drs. Tina Cowan (Stanford University School of Medicine), Tracy Fulton, and Janet Lindsley distributed examples of metabolic maps and their experiences with them. At Stanford, the map is provided on day 1, excerpts are used during learning modules, and annotated copies can be brought to exams. At UCSF, the Stanford map is provided to medical and pharmacy students in separate courses. At Utah, "simplified" and "complex" metabolic maps are provided in separate courses to medical, graduate, and physician assistant students. Annotated versions of the maps are not allowed in exams at Utah. The facilitators recruited interested ABCD members to participate in a working group to develop a standardized metabolic map for NBME exams and wider dissemination.

AMGDB Session

- **Greetings from the AMGDB – A Chair's Perspective on Post-Baccalaureate Education and Educators**; Dr. Bruce Nicholson (University of Texas Health Sciences Center at San Antonio, San Antonio, TX), President of the Association of Medical and Graduate Departments of Biochemistry (AMGDB), presented his perspective on medical education. He provided a brief introduction to the AMGDB, its mission, structure, and he summarized its involvement in founding and supporting the ABCD. Using a series of white paper survey articles, he presented and stressed the need to influence the direction of medical, graduate, and post-graduate education.

Breakout Session IA – Approaches to Teaching and Assessment

- **Channeling a Clinician: Design and Construction of Clinical Scenarios for Teaching and Assessment**; Dr. Eric Niederhoffer (Southern Illinois University School of Medicine, Carbondale, IL) ran a workshop on the design of clinical scenarios focused on a specific disease or basic science concept as a means to effectively connect foundational science and clinical concepts. Participants discussed appropriate on-line resources and worked in teams to construct clinically relevant interdisciplinary scenarios for teaching and assessment.

- **The Importance of Alignment: Developing Assessments that Reflect Course Goals**; Dr. Melinda Maris (Georgia Campus – Philadelphia College of Osteopathic Medicine, Suwanee, GA) led a workshop to help participants achieve a better alignment of their course goals and learning objectives with assessment practices. Participants shared their diverse perspectives on assessment and then explored how to align assessment with objectives and instructional strategies for effective facilitation and evaluation of student learning. Dr. Maris concluded by illustrating how to use scaffolded learning activities with frequent formative assessment and feedback to enable deeper student learning and mastery.

Breakout Session IB – Biochemistry in Pharmacy Education

- **What do Pharmacy Students Need to Know about Biochemistry? Biochemistry Learning Objectives in Pharmacy Education**; Drs. Kevin Kearney (MCPHS University, School of Pharmacy, Worcester, MA), Danielle Cruthirds (Samford University, McWhorter School of Pharmacy, Birmingham, AL), David Harrison (Rosalind Franklin University of Medicine and Science, College of Pharmacy, North Chicago, IL), and James Stoll (Texas Tech University Health Sciences Center, School of Pharmacy, Amarillo, TX) led an interactive session on biochemistry learning objectives in pharmacy education. Participants reviewed and commented on a draft document describing these learning objectives. Comments will be forwarded to a group of educators who are preparing a list of learning objectives for use in schools of pharmacy.
- **Usefulness of Laboratory Research in Pharmacy Education**; Dr. Arup Chakraborty (Roseman University of Health Sciences, College of Pharmacy, Las Vegas, NV) gave a presentation about the usefulness of laboratory research in pharmacy education. A student survey indicated a high level of interest in doing extracurricular research. Students who participated in research displayed an increased ability to critically analyze pharmacy-related scientific literature.
- **The Use of TBL in a Non-Traditional Laboratory Elective Course, A 3-Year Perspective**; Dr. David Pearson (California Northstate University, College of Pharmacy, Elk Grove, CA) presented findings on the use of team-based learning (TBL) in a second year pharmacy course in which students isolate and characterize natural products. Students have evaluated the course very positively over a 3-year period. Instructors have identified some problems with the use of TBL (e.g., unequal participation by members of teams) and are working to improve the course.

Breakout Session II – Concurrent Education Discussion Group Sessions

- **Best Practices/Challenges for Implementing a TBL Program**; Drs. Richard Sabina, Edward McKee (Central Michigan University College of Medicine), and David Franklin (Tulane University School of Medicine, New Orleans, LA) led a discussion with participants who shared an interest in employing TBL activities at their institutions. Considerable discussion was devoted to best practices for TBL program development and implementation, including how to overcome major

barriers and successfully create an institutional culture that supports the widespread implementation of TBL.

- **Educational Research: Do We Know What We Are Trying to Do?** Dr. Eric Niederhoffer provided a list of studies that we should be aspiring to perform in medical education research (groundwork, investigations, validation, observations and educational case reports) and the types of studies that should be avoided (student attitudes, intentions, beliefs in isolation of other measures, self-reported knowledge or growth, impact of learning styles, impact of technology, opinion pieces and "me-too" efforts). Discussion focused on the difficulty of finding valid methods to access outcomes. The need and value of reaching out to experts in statistics and cognitive psychology was discussed.
- **DIY Medical/Pharmacy/Dental Education? Effective Presentation of Self-Directed Learning Modules**; Dr. Alan Diekman (University of Arkansas for Medical Sciences College of Medicine, Little Rock, AR) led a discussion on the value of self-directed learning modules and the variety of tools that can be used to help develop on-line modules. He went on to describe authoring tools such as SoftChalk and the incorporation of embedded audio files in PowerPoint presentations. The latter methodology can produce student-friendly self-directed modules that are straightforward for faculty to revise.

Breakout Session III – Concurrent Education Discussion Group Sessions

- **Integrated Centralized Curricula: Impact of Departments and Course Directors**; Dr. Neil Osheroff led a group discussion on the increasing trend toward integrated curricula with centralized administrative oversight. Participants shared the different models of curriculum administration employed at their institutions and reflected on the institutional challenges posed by major curriculum restructuring efforts. Discussion focused on the specific ramifications of integrated centralized curricula on basic science departments, institutional administrators, course directors, and their evolving roles and relationships.
- **Small Group Facilitation: Biochemist or Sociologist?** Dr. Susan Cline engaged the audience in a discussion of small group sessions with attention to the role of tutors, the preparation tutors need and the methods used to influence group dynamics to optimize learning environments. The quiet student was used as an example.
- **Lessons Learned from "Flipping" Biochemistry Lectures**; Drs. Emine Abali (Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ), David Franklin and Richard Sabina led an interactive session on "flipping" the classroom, which requires students to learn assigned material before coming to class and use class time to interactively apply the learned information to problems or cases. Panelists discussed the extensive preparations required for flipping, various types of in-class activities, resources available for educators interested in the method, and improved learning outcomes resulting from flipping.

Breakout Session IVA – Biochemistry Competency and Assessment

- **What is Biochemistry? NBME Subject and USMLE Step Exam Observations from Writers and Reviewers**; Drs. Eric Niederhoffer and Janet Lindsley described the NBME question writing and review process for the USMLE Step and biochemistry subject exams. They engaged attendees in an activity to identify biochemistry-focused NBME questions and generated discussion about the 'tagging' of questions used to test biochemistry concepts in NBME examinations.
- **Performance Data for Basic Sciences on USMLE Steps 2 and 3**; Dr. Steve Haist (Test Development Services, NBME, Philadelphia, PA) presented an update on the comprehensive review of the step exams, the changes in the USMLE 3 testing process, and the expansion of foundational sciences on USMLE 3. He discussed the changes in test committees involved in the writing, review, and approval of questions for all USMLE exams. He also described new initiatives in the testing process, such as test taker evaluation of pharmaceutical ads and scientific abstracts, and the utilization of resources in demonstrating clinical reasoning.

Breakout Session IVB – Selected Talks from Submitted Abstracts

- **A Flipped Classroom Approach to Teaching Biochemistry Leads to Greater Learning Gains;** Dr. Melinda Maris described the use of a flipped classroom to teach laboratory techniques. Data from paired t-tests indicate that students performed better using flipped classroom as compared to a traditional approach.
- **A Curriculum Exercise: Training Medical Students to Answer Layman's Questions;** Dr. Jana Simmons (Michigan State University College of Human Medicine, Grand Rapids, MI) described a module on gene regulation that students use to answer patient questions in layman's terms in a short answer format. Students who participated in this active learning modality were less likely to forget the desired information as compared to those who used a more passive approach.
- **Faculty Development, Logistics and Positive Student Outcomes Associated with Implementing Small Group Active Learning at a Large, Multi-Site Medical Campus;** Dr. Raquel Ritchie (Michigan State University College of Osteopathic Medicine, Clinton Township, MI) described the use of evidence-based small group active learning at a large multiple campus institution. Students identify appropriate journal article learning resources and present the material to their classmates. Student teams summarize the information with regard to clinical presentation, etiology, diagnosis, and case management.
- **Developing an Integrated Organ System Curriculum using Student-Led Case-Based Learning Complemented with Team-Based Learning;** Dr. Daniel Griffin (Central Michigan University College of Medicine, Mount Pleasant, MI) described how his institution developed an integrated organ-based curriculum that is interactive and student centered, but does not require enormous faculty time.
- **Strategies to Incorporate Inborn Errors of Metabolism into an Integrated Medical Curriculum;** Dr. Deborah Louda (Florida Atlantic University Charles E.

Schmidt College of Medicine, Boca Raton, FL) discussed how her institution has incorporated inborn errors of metabolism into its integrated curriculum. She also described the development of a summary booklet on inborn errors of metabolism that is provided to second year students to help them prepare for the USMLE Step 1.

- **Use of Simple, Factual Recall Questions to Assist in Learning Medical Biochemistry;** Dr. Joseph Fontes (University of Kansas Medical Center, Kansas City, KS) presented a method of improving student retention of information using simple, voluntary recall quizzes. Outcomes indicate that students who utilized the recall quizzes achieved significantly higher final exam scores.