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Teaching Biochemistry and Genetics to Students of Dentistry, Medicine, and Pharmacy 6th International Conference of the Association of Biochemistry Educators (ABE) Clearwater Beach, FL, USA, May 7–11, 2017

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Introduction

Over 115 educators representing more than 86 North American and Caribbean institutions met to discuss biochemistry and genetics education of students of medicine, pharmacy, and dentistry. Plenary, Breakout, and Educational Discussion Group sessions in the ABE Conference agenda and sessions organized by the Course Directors Special Interest Group of the Association of Professors of Human and Medical Genetics (CD-SIG APHMG) as part of the ABE agenda are summarized.

Opening Session

- Dr. Eric Niederhoffer (Southern Illinois University School of Medicine, Carbondale, IL), President, acknowledged sponsors [National Board of Medical Examiners (NBME), and the Association of Medical and Graduate Departments of Biochemistry (AMGDB)], thanked the Board, announced the invited speakers and their topics, and awarded Emeritus Membership to Dr. Richard Sabina, retired, William Beaumont School of Medicine, Oakland University.

- Dr. Alan Diekman (University of Arkansas for Medical Sciences College of Medicine, Little Rock, AR), Treasurer, reported on ABE finances and explained how candidates are nominated and elected to the ABE Board of Directors.
- Dr. Susan Cline (Mercer University School of Medicine, Macon, GA), President-Elect, presented Distinguished Service Awards to the past Chairs/Presidents of the Association (Drs. Janet Lindsley, Peter Ronner, Richard Sabina, Neil Osheroff, and Eric Niederhoffer).

Plenary Session I—Future of Medical Education (Part I)

- ***The Master Adaptive Learner as a Model for Learning and Teaching***; Dr. Larry Gruppen (University of Michigan Medical School, Ann Arbor, MI) summarized *Master Adaptive Learner*, a product of the American Medical Association Accelerated Change in Medical Education Consortium, that describes the kind of learners we wish medical students and physicians to be. He demonstrated how four gears mesh in the mind of a Master Adaptive Learner: (1) the *planning* gear, which drives identification of gaps in understanding and selects opportunities to learn; (2) the *learning* gear, which drives acquisition and critical appraisal of knowledge; (3) the *assessment* gear, which drives deployment of learning in practice and self-assessment of efficacy; and (4) the *adjustment* gear, which drives incorporation of what has been learned into routine practice. This model can help identify where problem learners are having difficulty and help formulate external feedback to foster success.
- ***Using Competency-Based Assessments to Monitor and Coach Pre-Clerkship Medical Students***; Drs. Neil Osheroff (Vanderbilt University School of Medicine, Nashville, TN), Jana Simmons (Michigan State University College of Human Medicine, Grand Rapids, MI), Sage Arbor (Marian University College of Osteopathic Medicine, Indianapolis, IN), Joe Fontes (University of Kansas Medical Center, Kansas City, KS), and Eric Niederhoffer discussed how competencies are more than medical knowledge and include communication skills, professional behavior, teamwork, and the ability to self-assess to improve performance. Competencies are assessed on a developmental trajectory using milestones, which represent a roadmap for professional development. Panel members described how assessment methods at their institutions use a combination of *quantitative data* such as test scores, and *qualitative data* such as observed behaviors, to provide a richer picture of learner development. Challenges inherent to this approach were discussed.
- ***Assessments and the Metabolic Map: Constructing Questions for Higher-Order Thinking***; Drs. Tina Cowan (Stanford University School of Medicine, Palo Alto, CA), Tracy Fulton (University of California-San Francisco School of Medicine, San Francisco, CA), Janet Lindsley (University of Utah School of Medicine, Salt Lake City, UT), and Jana Simmons described a consensus metabolic map that is being adopted by the NBME for use as reference material for the United States Medical Licensing Examination Step exams. The map is

intended to focus learner attention on big concepts in biochemistry rather than minutiae. Discussion focused on what constitutes higher order questions, how to write them in the context of the map, and the usefulness of this approach.

Plenary Session II–Nutrition/Metabolism Interactions

- ***Innovative Strategies for Nutrition Education***; Drs. Emine Abali, (Rutgers Robert Woods Johnson Medical School, New Brunswick, NJ), Janet Lindsley, and Chef Alyse Van Liew (Rutgers Robert Woods Johnson Medical School, New Brunswick, NJ) ran a workshop that presented the concept of *culinary medicine*. Participants witnessed a demonstration of knife skills, compared recipes from traditional American vs. Mediterranean diets, and discussed case-based exercise questions relevant to diet modification for improved health.
- ***Gleaning Teaching Pearls from the Nutrition Literature***; Drs. Clive Slaughter, (Augusta University/University of Georgia Medical Partnership, Athens, GA) and Robert Bateman (William Carey University College of Osteopathic Medicine, Hattiesburg, MS) presented a workshop on ways to approach the teaching of nutrition subjects. Participants were encouraged to start by assembling questions that they wanted their students to be able to answer, by approaching the subject from the perspective of both the teacher and the learner, and by using a patient's perspective to present the subject. Sources that could be used as starting points were presented. Participants applied these approaches to design novel nutritional teaching materials.

Concurrent Education Discussion Group Sessions (EDGrS)

- ***Does MCAT 2015 Facilitate Better Student Preparation for Medical Biochemistry?***; Dr. Susan Cline examined how the current Medical College Admission Test includes several topics traditionally taught in medical biochemistry courses and asked whether medical students actually arrive more prepared to apply biochemical concepts to clinical problems. Participants discussed potential multi-site research study designs to address this question.
- ***The AAMC Graduation Questionnaire: What to the Results Mean and How can They Inform our Educational Practices?***; Drs. Tracy Fulton and Esteban Dell' Angelica (University of California-Los Angeles David Geffen School of Medicine, Los Angeles, CA) led an interactive discussion on the information gained from the question "How well did your study of biochemistry prepare you for clinical clerkships and electives?" that appears on the AAMC graduation questionnaire. Discussion focused on the best way to present and interpret the data generated by the question and what the question instructs about how biochemistry affects the preparation of medical students for clerkships.
- ***How do We Cultivate Self-Directed Learning?***; Dr. Eric Niederhoffer led a rich discussion on how students can use the Master Adaptive Learner model to take ownership of their learning. Ideas included formulating goals, learning needs,

and getting students to learn to ask appropriate questions. Discussants provided specific examples of approaches to student learning and insight on how individuals think.

- ***Strategies to Increase Live Lecture Attendance and Engagement***; Dr. Raquel Ritchie (Michigan State University College of Osteopathic Medicine, Clinton Township, MI) led a discussion on strategies to increase live lecture attendance, focusing on the importance of engaging students during learning sessions. She discussed the use of multiple-choice clicker questions that award points to learners, think-pair-share teachable moments, student/faculty interactions, and peer-to-peer teaching.

AMGDB Session

- ***Greetings from the AMGDB – Building a Medical School from Scratch***; Dr. Susan Martinis (University of Illinois School of Medicine, Urbana, IL and President, AMGDB) acknowledged and congratulated the maturation of ABE into an independent organization. She then outlined the creative process associated with the development of a new medical school that will fuse traditional basic sciences with the computation and engineering technology strengths of the University of Illinois and systems-level thinking with the health care expertise of Carle Foundation Hospital.

Breakout Session A – Integration of Teaching and Learning (Part I)

- ***Coupling of Case-Based and Team-Based Learning in Teaching Biochemistry and Genetics in an Integrated Medical School Curriculum***; Drs. Daniel Griffin and Edward McKee (Central Michigan University College of Medicine, Mount Pleasant, MI) ran a workshop illustrating the use of case-based learning as a learning modality coupled with a team based learning (TBL) experience as the assessment. Participants worked through a sample case, stepped through the TBL process, discussed what made effective application questions for the TBL assessment, and considered logistics of maintaining learner engagement.
- ***Integrating Basic Biochemistry Content into Clinical Skills Labs***; Drs. Kristie Grove Bridges and Jill Cochran (West Virginia School of Osteopathic Medicine, Lewisburg WV) described a primary care pediatrics clinical skills lab that integrated basic sciences and the teaching of clinical medicine. Students are presented clinical information, conduct an interview with a simulated patient, and develop a diagnosis. During the process, a clinician guides clinical aspects and a basic scientist asks questions to help students see the relevance of basic science as they develop the diagnosis. Resource challenges of this approach were discussed.

Breakout Session B—Objectives and Assessment

- ***What Biochemistry do Pharmacy Students use in Clinical Practice, and What is Important for Them to Know?***; Drs. Kevin Kearney (Massachusetts College of Pharmacy and Health Sciences, Worcester, MA) and Melany Puglisi (Chicago State University College of Pharmacy, Chicago, IL) described a study examining the core biochemistry knowledge that pharmacy students from four institutions used during advanced clinical rotations. Students were surveyed on how often they used previously taught biochemistry topics during clinical rotations. Students remembered only a fraction of the topics.
- ***Working to Create a Secure Biochemistry Question Bank: Student Objectives and Competencies in Biochemistry***; Drs. Emine Abali, Zeynep Gromley (Lincoln Memorial University DeBusk College of Osteopathic Medicine, Harrogate, TN), Douglas Spicer (University of New England College of Osteopathic Medicine, Biddeford, ME), Sankhavaram Pāini (Touro College of Osteopathic Medicine, Middletown, NY), Judith Binstock (Touro College of Osteopathic Medicine, New York, NY), Joe Deweese (Lipscomb University College of Pharmacy, Nashville, TN), Danielle Cruthirds (Samford University McWhorter School of Pharmacy, Birmingham, AL), Pasquale Manzerra (University of South Dakota Sanford School of Medicine, Vermillion, SD), and Sage Arbor described the creation of a secure, multiple-choice question bank covering nine themes within biochemistry. A two-year effort, initiated at the 2015 ABE meeting, resulted in a database of over 300 questions that can be imported into ExamSoft. A checklist rubric was provided to assess each of the submitted questions and to ensure quality and adherence to NBME standards. Attendees reviewed and edited questions in the database.

Plenary Session III—Integration of Teaching and Learning (Part II)

- ***Integrating Foundational Sciences into the Clerkship Curriculum***; Drs. Neil Osherooff, Lourdes Estrada, and Kimberly Dahlman (Vanderbilt University School of Medicine, Nashville, TN) discussed how Vanderbilt has successfully bridged the chasm between foundational and clinical sciences. With clerkships in year 2, their students now have time during years 3&4 to flexibly complete a minimum of three months of research and four Integrated Sciences Courses (ISCs). Each ISC is an intense month-long immersion that integrates explicit foundational science and clinical experiences. Participants proposed new ISCs with enticing names (*Too Much Around the Middle*, *The Fountain of Youth*) and rigorous science.

ABE/APHMG Poster Session—Selected Poster Talks

Eight submissions were selected from forty-two poster abstracts for three-minute overviews.

Plenary Session IV–Integration of Teaching and Learning (Part III)

- ***Lost in Translation: Collaborating to Bring the Basic Sciences Back to Entrust Everyday Medical Practice***; Dr. Leslie Fall (MedU and Dartmouth Geisel School of Medicine, Hanover NH) summarized the MedU program and its focus on integrating basic and clinical sciences to produce cost effective high quality clinical care. MedU identified top core concepts associated with individual disciplines whose understanding is needed by medical students in their progress toward independent practice. The ultimate goal of cognitive entrustment can be appreciated by coupling the Master Adaptive Learner model with diagnostic reasoning and clinical decision-making and using information processing theory to better optimize transfer and embedding of encapsulated knowledge in everyday clinical problems.
- ***Re-envisioning Themes and Threads in the Pre-Clerkship Curriculum***; Dr. Clive Slaughter presented a workshop on using clinical cases, themes, and recurring concepts encountered in diverse contexts throughout the curriculum to promote integration and provide a framework that helps students organize information. He described a case-based learning module focusing on *heritability of disease susceptibility* and its unifying approach to integrate genetics, biochemistry, cell biology/histology, fluid physiology, immunology, and neuroscience. Attendees discussed alternative cases, themes, and associated threads for introduction into the pre-clerkship curriculum.
- ***Developing Cases and Assessments for Integrated Biochemistry and Genetics/ Genomics Curricula***; Drs. Jon Bernstein (Stanford University School of Medicine, Stanford, CA), Shoumita Dasgupta (Boston University School of Medicine, Boston, MA), Vicki Park (University of Tennessee Health Science Center College of Medicine, Memphis, TN), Tracey Weiler (Florida International University College of Medicine, Miami, FL), Andrew Sobering (St. George's University School of Medicine, Grenada, W.I.), Katherine Hyland (University of California-San Francisco School of Medicine, San Francisco, CA), Tracy Fulton, and Tina Cowan led a workshop to develop integrated teaching cases and assessment questions. Attendees were provided with a template for case development, a list of clinical disorders, and the learning goals and objectives developed by the CD-SIG APHMG and the ABE for genetics/genomics and biochemistry, respectively. Groups reported case titles and scenarios, learning goals, teaching and assessment methods, and challenges.
- ***Instructional Design Approaches for Creating Effective e-Learning and Video-Based Medical Education***; Dr. Kadriye Lewis (Children's Mercy Hospital and University of Missouri Kansas City School of Medicine, Kansas City, MO) presented an overview of instructional design models and pedagogical principles for applying instructional design models to an e-learning environment. She discussed cognitive load and provided strategies for e-learning to help learners retain crucial information by managing working memory load and constructing schemas. She also introduced the *Instructional Design and Interactivity Scale*

that consists of six instructional design domains (content design, assessment items, feedback mechanism, media design, visual design, and navigation), and four levels of interactivity.

- ***Strategies for Including Ethics in Integrated Medical Curricula***; Drs. Jon Bernstein and Shoumita Dasgupta described the current state of genetics ethics education in medical schools, noting that related topics can be found in basic science and ethics courses. They demonstrated how autonomy, beneficence, non-maleficence, and justice inform elements of patient care. They further described approaches to incorporate these topics into medical student genetics education. Participants discussed how to maintain continuity across disciplines and overcome implementation barriers, and illustrated approaches to introduce and assess these complex concepts.
- ***Integration of Genetics Content into Clinical Education Settings/Clerkships***; Drs. Vicki Park and Tracey Weiler led a workshop on strategies to incorporate genetics into clinical training. They provided an overview of curricular expectations, including institutional program objectives and the AAMC Entrustable Professional Activities (EPAs) for entering residency, and asked participants to consider how their teaching fits into larger curricular goals. In spite of weak representation of genetics in EPAs, evidence supports the addition of genetics to clinical content. SOAR (Strengths, Opportunities, Aspirations, and Results) analysis was presented as a strategic planning approach that builds on curriculum strengths and considers stakeholders and their motives. Groups used a SOAR worksheet to identify opportunities for integrating genetics into 3rd and 4th year medical curricula.

Plenary Session V–Future of Medical Education (Part II)

- ***Teaching Millennial Learners: Top Tips***; Dr. Hope Ricciotti (Beth Israel Deaconess Medical Center, Boston, MA) presented tips for teaching millennial learners, including goal setting, providing effective feedback, and not leaving errors uncorrected. Millennials want flattened hierarchies but still need good mentors to help them achieve their goals. Millennials were contrasted with other demographic generations and were characterized as confident, hard working, tech-savvy individuals who believe in work-life integration rather than work-life balance and seek to make a difference in their community and workplace.
- ***Rethinking Adult Learning Principles in Medical Education: Five Teaching Perspectives***; Dr. Kadriye Lewis described the characteristics of adult learning and the kinds of teaching that best foster it. She illustrated five different teaching perspectives: (1) *transmission* of information; (2) *apprenticeship*, in which the teacher models behavior; (3) *developmental*, in which the teacher cultivates ways of thinking; (4) *nurturing*, in which the teacher facilitates self-efficacy; and (5) *social reform*, in which the teacher seeks to develop a better society. She invited educators to assess which represents their own dominant perspective

(teachingperspectives.com) and to use this recognition as a pathway toward developing a personal teaching philosophy.

Plenary Session VI–Short Talks

- ***Mapping Curriculum across Disciplines and Time – Easy Generic ad hoc Databases***; Dr. Sage Arbor described how to use Google Sheets with equations to enter lectures, objectives, and content to map curriculum across years and disciplines. He also discussed the ReadMe file, which provides instructions on building a curriculum and provides a link to the databases of medical learning objectives from more than twenty national societies (<http://data.medobjectives.marian.edu/about.html>).
- ***SoftChalk as an Interactive Learning Alternative to Traditional Lectures***; Dr. Steven Ellis and Catherine Colb (University of Louisville School of Medicine, Louisville, KY) provided an overview of SoftChalk as an interactive learning modality. They presented data on the variability of SoftChalk modules among faculty and on student perceptions and performance with different SoftChalk formats. Some of the parameters that correlated with overall effectiveness were clarity, organization, and engagement of students with formative feedback, videos, and activities.
- ***All Lectures Complete... but the Course is Not!***; Dr. Martha Faner (Michigan State University College of Osteopathic Medicine, Detroit, MI) discussed how the use of spaced learning improves retention and integration of student knowledge. An interactive session follows traditional lectures after a few weeks. During the interactive session, students are divided into small groups and are assigned specific problems. This is followed by *docendo discimus*, allowing students to teach each other. Students felt these sessions helped them learn content better, gave them a sense of social support, and helped them recognize the utility of basic science in digesting clinically-centered articles.
- ***Curating Content through iBook Development***; Drs. Renee LeClair and Andrew Binks (Virginia Tech Carilion School of Medicine, Roanoke, VA) discussed *Do's and Don'ts* for preparing effective iBooks as course resources tailored to an integrated teaching format. Conversational text and usage instruction, complimenting static material with video and other dynamic material, realistic reading assignments, and immediate feedback were important components of a successful iBook. Conversely, excessive use of media formats, external links, popovers, and supplementary sidebars were distractions.