



Educating future nursing scientists: Recommendations for integrating omics content in PhD programs

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ABSTRACT

Preparing the next generation of nursing scientists to conduct high-impact, competitive, sustainable, innovative, and interdisciplinary programs of research requires that the curricula for PhD programs keep pace with emerging areas of knowledge and health care/biomedical science. A field of inquiry that holds great potential to influence our understanding of the underlying biology and mechanisms of health and disease is omics. For the purpose of this article, omics refers to genomics, transcriptomics, proteomics, epigenomics, exposomics, microbiomics, and metabolomics. Traditionally, most PhD programs in schools of nursing do not incorporate this content into their core curricula. As part of the Council for the Advancement of Nursing Science's Idea Festival for Nursing Science Education, a work group charged with addressing omics preparation for the next generation of nursing scientists was convened. The purpose of this article is to describe key findings and recommendations from the work group that unanimously and enthusiastically support the incorporation of omics

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content into the curricula of PhD programs in nursing. The work group also calls to action faculty in schools of nursing to develop strategies to enable students needing immersion in omics science and methods to execute their research goals.

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Introduction

“The 21st century is the century of biology” according to Dr. Francis Collins, the director of the National Institutes of Health (NIH; [Collins, 2015](#)). Current opportunities for the development of the biological branch of nursing science, from molecules to holistic humans, are unprecedented. Are nursing scientists prepared for this challenge or will they be bystanders in the research endeavors of the 21st century that will incorporate biological approaches to impact clinical practice? Educating and training the next generation of nursing scientists require that the curriculum for PhD programs keeps pace with emerging knowledge in the life sciences. A field of inquiry that holds great potential to move nursing and other health sciences, including interdisciplinary efforts, forward is in the area of omics. Broadly defined omics includes genomics, transcriptomics, proteomics, epigenomics, exposomics, microbiomics, and metabolomics. Descriptions of these approaches can be found in [Table 1](#). Taken together, the omics sciences link understanding of health, illness, and the environment across scales from molecules to cells to organisms to populations. Omics perspectives are applicable to the breadth of nursing science across populations from newborns to elders, from critical care to population health, and from prevention to treatment.

To address the incorporation of omics content in PhD programs in nursing, a work group of faculty experts from schools of nursing across the United States was convened to discuss opportunities and challenges of incorporating omics content into curricula. This work group was brought together as part of the Council for the Advancement of Nursing Science’s Idea Festival for Nursing Science Education. The Idea Festival Advisory Committee was charged with inspiring dialogue about emerging areas of science ([Henley et al., 2015b](#)) and education of the next generation of nursing scientists ([Henley et al., 2015a](#)). The coauthors of this article represent the members of the omics work group and the Idea Festival Advisory Committee chair (SJH). Members were selected by the three cochairs of the working group (YPC, MH, DM) based on their incorporation of omics-based approaches into their research. Efforts were made to include scientists from across the United States who teach in PhD programs in nursing. The work group met over an 18-month period using web-based technology and phone conferences, conducted data collection from work group members

using a survey of open-ended questions (results presented within this article), and conducted follow-up discussions about conclusions and recommendations via e-mail.

The authors of this article endorse the idea that all students in PhD programs in nursing should be able to demonstrate knowledge and an appreciation for how omics approaches could inform nursing science and their future program of research. Without this foundational exposure, some students will miss opportunities to move their area of inquiry in new directions, increase their competitiveness to lead interdisciplinary teams as an independent investigator, and compete successfully for limited research resources. Additionally, we endorse the development of strategies to support students requiring immersion in omics science and methods to accomplish their dissertation and research goals.

Omics-based research approaches are being supported by federal and private funding agencies and are encouraged through the development of major resources that facilitate using these approaches in research projects and training initiatives. The National Institute of Nursing Research’s Strategic Plan ([National Institute of Nursing Research \[NINR\], 2011](#)), Implementing NINR’s Strategic Plan: Key Themes ([NINR 2014](#)), and the Blueprint for Genomic Nursing Science ([Genomic Nursing State of the Science Advisory et al., 2013](#)) all support increased attention to omics-based approaches to research impacting nursing practice. Requests for applications (RFAs) and program announcements (PAs and PARs) issued through the National Institutes of Health increasingly mention that omics-based approaches are encouraged. Recent examples with the NINR as the sole participating institute are “Synergizing Omic and Symptom Science” (PA-13-264 and PA-13-265), “Genomic Underpinnings of Response to Rehabilitation Interventions” (PAR-14-0111 and PAR14-012), “Application of Genomic Advances to Wound Repair” (RFA-NR-12-002 and RFA-NR-12-003), and “Personalized Genomics for Symptom Management: Bridging the Gaps from Genomic Discovery to Improved Health Outcomes” (RFA-NR-11-003 and RFA-NR-004). Scientists across disciplines are encouraged to use publicly available omics-based resources such as those provided in [Table 1](#). These funding opportunities and publicly available resources are relevant to nursing science research. The capacity for current and future nursing scientists to be responsive to funding opportunities, communicate in the language of their interdisciplinary colleagues, and

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