Omics in Nursing Science

Janet D. Pierce ▼ Susan J. Henly

In his State of the Union Address in 2015, President Barak Obama launched a new initiative—precision medicine—designed to enable a new era of healthcare through research, technology, and policies that empower patients, researchers, and providers to work together toward development of individualized care (The White House, n.d.). The advance of precision health depends on the ability to examine omics. “Omics” is a collective term that integrates important features of disparate disciplines including genomics, proteomics, metabolomics, exposomics, epigenomics, microbiome, and transcriptomics. The key feature of omics is that it seamlessly blends together features of biological knowledge that reflect the complexity and diversity of living systems in context over time. Findings from omics-based studies can assist clinicians to more precisely identify molecular characteristics of health, diseases, illnesses, and illness responses and identify which patients are best suited for specific medications or treatments. Furthermore, a new wave of diagnostic information actually incorporates itself into treatments by suggesting very specific molecular endpoints of personalized treatments in nursing, medicine, and the other health professions. Nurse scientists hold a unique and important role in advancing omics sciences, as they hold a longstanding value for person-centered approaches (Henly, 2016) and possess the clinical acumen needed to integrate practice-based and molecular information to understand the biological basis of disease. Consequently, nurse scientists are posed to improve patient outcomes and quality of life by developing new personalized nursing interventions.

In the late 1990s, a few nurse scientists began to examine genomes and sequencing of DNA (Funkhouser, Concannon, Charmley, Vredevoe, & Hood, 1992; McLeskey et al., 1998). Currently, nurse scientists have expanded this work to patients, members of the community, diverse populations and underserved communities utilizing whole genome sequencing and other techniques to identify risks and promote health (Conley, 2016; e.g., see Taylor, Wright, Hickey, & Housman, 2017; Taylor, Wright, & Housman, 2016; Wright, Housman, & Taylor, 2016). Genetic nurse experts have identified opportunities for action to increase advanced practice nursing and research contributions toward improving genomic health for all individuals and populations (Williams et al., 2016).

However, with new omics technologies, copious amounts of data at multiple levels of biology can be produced to better understand underlying cellular networks and organ function (e.g., Schallom, Thimmesch, & Pierce, 2011). In the past, scientists mainly performed experiments to obtain data in order to test specific hypotheses. Now using multi-omics approaches, developing a hypothesis first is not always required. Instead, a wide array of data can be collected in an omics experiment without an existing hypothesis, which is then later used to test a specific hypothesis. This reversal of procedures for hypothesis testing presents an opportunity to discover new pathophysiological disease mechanisms and potential precision treatments for patients.

Most nurses have long believed that nursing research provides the scientific basis for the practice of the profession (e.g., Bixler, 1950; Melnyk & Fineout-Overholt, 2015). Nursing research has been focused on using various philosophical and theory-based approaches as well as diverse methodologies to assist in understanding symptoms of acute and chronic illness—also the prevention of disease to achieve and sustain optimal health (American Association of Colleges of Nursing, 2006). In order to meet these goals, the next generation of nurse scientists need to understand, use, and implement omics for nursing science. In order to accomplish this, omics must be an essential element of doctoral nursing programs, particularly the PhD curriculum. Focusing only on genetics has passed, and nursing should embrace the big data approach of omics in order to understand the complex and dynamic components of biological processes of patients (Conley, 2016). Unfortunately, few schools of nursing have incorporated any omics into their curriculum plans for the research-focused doctorate (Wyman & Henly, 2015). Perhaps this is due to the lack of education in the basic sciences such as molecular biology and biochemistry. More than the complexity of omics, its diversity and dynamic features suggest a new biological language that actually does not belong to any single professional discipline but is, in fact, translated and shared across professional borders. To begin this educational process, the National Institute for Nursing Research has been dedicated in training the next generation of nurse scientists in genetics. The ongoing intensive Summer Genetics Institute program held annually on the National Institutes of Health (NIH) campus has provided over 300 nurses with a foundation in molecular genetics and allowed them to develop and integrate genetic applications into their research, clinical and education, and scholarship endeavors. The 2016 summer boot camp was titled “Precision Health: From Omics to Data Science.” This 1-week intensive research
training course was administered by the Foundation for Advanced Education in the Sciences. During this course, scientists, clinicians, graduate students, and faculty learned more about the latest advances in genomics, pharmacogenomics, nutrigenomics, metabolomics, microbiomics, and data science, as well as the associated ethical, legal, and social implications of precision health.

For over 25 years, the International Society of Nursing in Genetics (www.isong.org) has also served as global nursing leader that is dedicated to genomic healthcare, education, research, and scholarship. In fact, long before the discovery of the human genome, the International Society of Nursing in Genetics nurses were fostering and advocating for the scientific and professional development of its members and the nursing community in the discovery, interpretation, application, and management of genomic information for the promotion of the public’s health and well-being.

This issue of Nursing Research highlights the work of nurse scientists and investigators from related fields who have successfully conducted omics research. The papers include investigations, reviews, methods, and commentary related to genomics, pharmacogenomics, and microbiomics. We are hoping that these articles will provide readers the opportunity to learn about new omics techniques as well as the usefulness of this type of research to support precision healthcare initiatives for nursing.

Janet D. Pierce, PhD, APRN, CCRN, FAAN, is Christine A. Hartley Centennial Professor, School of Nursing, University of Kansas Medical Center, Kansas City, and Editorial Board Member, Nursing Research.

Susan J. Henly, PhD, RN, FAAN, is Editor of Nursing Research.

The authors have no conflicts of interest to declare.

Accepted for publication November 29, 2016.

Corresponding author. Janet D. Pierce, PhD, APRN, CCRN, FAAN, School of Nursing, University of Kansas, Mail Stop 2029, 3901 Rainbow Blvd., Kansas City, KS 66160 (e-mail: jpierce@kumc.edu).

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DOI: 10.1097/NNR.0000000000000205

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