

Genetics and Genomics Nursing Has Arrived!

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Welcome to the new Genetics & Genomics feature. Since the completion of the Human Genome Project in 2003 (Collins, Morgan, & Patrinos, 2003), information targeting genetics and genomics or their products has become a mainstay in cancer care. Genetics and genomics are beginning to show usefulness for risk assessment of multiple inherited cancers, direction for screening and surveillance guidelines, prevention needs for families at high risk for certain cancers, treatment guidelines (germline and tumor based), and prognosis for a growing group of cancers. In addition to single-gene heritable cancer syndromes, genomics and epigenetics have been found to play an important role in the development and phenotypic expression of cancer. Epigenetics is the study of changes in gene function that are heritable. However, no change occurs in the DNA sequence; epigenetics explains how the gene is expressed (National Human Genome Research Institute, n.d.).

The future of oncology care is embracing tools such as miRNA (microRNA) and siRNA (small interfering RNA), small RNA molecules involved in silencing genes, which have implications for disease development and treatment (Carthew & Sontheimer, 2009). Personalized medicine is being used with genetic testing of tumors and germline genes to direct treatment. Finally, genetics and genomics knowledge also leads to ethical, legal, and social issues still to be identified and addressed. The Genetic Information Nondiscrimination Act (GINA) was signed into law in 2008 and provides protection from genetic discrimination (Lea, 2010). GINA is just the beginning, revealing a new depth of areas that need to be addressed within genetics and genomics.

Genomics and Cancer Care

Many recent and exciting research findings may dramatically change cancer care. The goal of the Cancer Genome Atlas Network is to perform a comprehensive genomic analysis of each cancer type. The Cancer Genome Atlas Network (2012c) identified four distinct types of breast cancer, which may explain why treatment is not always effective. One has basal-type cells similar to serous ovarian cancer, which may indicate the need to treat those breast cancers with ovarian cancer drugs. Another comprehensive study (Cancer Genome Atlas Network, 2012a) examined the genetics of squamous cell lung cancer. A high mutation rate was reported, with potential targeted genes or pathways identified. The same type of genomic analysis was performed on colon and rectal cancer tumors (Cancer Genome Atlas Network, 2012b), again identifying potential targeted genes or pathways. As the Cancer Genome Atlas Network continues genomic analyses of breast, lung, and colorectal cancers and completes analyses on all other cancer types, cancer therapy will become more targeted and a cure may be identified. Oncology nurses need to stay up-to-date with these new findings, as they may dramatically change treatment.

Pharmacogenomics

Pharmacogenomics is another rapidly growing field of research. By identifying metabolic pathways specific to each drug and identifying mutations in the metabolic pathways of individual patients, appropriate drug selection and titration unique to patients' tumors can be provided. As targeted agents are developed, new side effects also will be identified. Oncology nurses need to understand the mechanism of these new drugs, identify

side effects, assess effectiveness, manage symptoms, and educate patients.

Nurse Competencies in Genetics and Genomics

The Institute of Medicine (2011) has stated that nurses should practice to the full extent of their education and training. Nursing curriculum is constantly in flux to reflect current health issues and technological advancements. The American Association of Colleges of Nursing ([AACN], 2008, 2011) guidelines have been revised at both the bachelor's and master's levels to reflect the relevance of genetics in patient care. The essential genetic and genomic competencies needed by nurses in all settings have been defined through consensus panel reports for generalist and graduate levels of education (American Nurses Association, 2009; Greco, Tinley, & Seibert, 2012).

The essential competencies (AACN, 2008) for all nurses include knowledge and understanding of genetics and genomics. The specific skills include (a) collect a patient health history that includes genetic, environmental, and genomic influences; (b) construct a three-generation pedigree; (c) identify patients at risk for heritable syndromes; (d) identify ethical, legal, and social issues related to genomics; (e) facilitate appropriate referrals; (f) educate patients regarding genetics and genomics; (g) identify credible information (e.g., helpful Web sites, evidence-based genetic testing); (h) understand implications of identified risk; (i) educate patients regarding appropriate screening; (j) be a resource for patients; and (k) advocate for patients. Oncology nurses now are challenged to learn about genetics and genomics, as well as integrate that knowledge into their specialty practice.

This column will include in-depth information beyond the baseline competencies. Oncology nurses who are

- ▶ Genetics/Genomics Competency Center for Education
www.g-2-c-2.org
- ▶ Oncology Nursing Society Cancer Genetics Special Interest Group
<http://cancergenetics.vc.ons.org>
- ▶ Oncology Nursing Society Cancer Genetics 101 Web course
www.ons.org/CourseDetail.aspx?course_id=98

Figure 1. Online Resources on Genetics and Genomics

new to genetics and genomics may find several resources helpful to prepare them for this advanced column. Basic and generalist information for nurses is available online (see Figure 1). Other resources include *Cancer Basics* (Eggert, 2010) and *Genetics and Genomics in Oncology Nursing Practice: The Evolution of Oncology Nursing* (Calzone, Masny, & Jenkins, 2010).

Future Directions

The Oncology Nursing Society (ONS) is committed to advancing oncology nursing practice and endorses the essential genetic and genomic competencies (for more information, see the ONS position statement on genetics and genomics on p. 10). The goal of this column is to open new territory for exploring and learning with application to clinical practice by providing advanced, in-depth education. This column will apply the molecular aspects of genetics and genomics to promote quality patient care, offer case studies to challenge old ideas, and report and suggest uses for research findings. Future columns may include information regarding BART (BRACAnalysis Large Rearrangement Testing), molecular signaling, PARP (poly [adenosine diphosphate-ribose] polymerase) inhibitors, epidermal growth factor receptor and anaplastic lymphoma kinase mutations, and cytochrome P450 enzymes.

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References

- American Association of Colleges of Nursing. (2008). *The essentials of baccalaureate education for professional nursing practice*. Retrieved from <http://www.aacn.nche.edu/education-resources/BaccEssentials08.pdf>
- American Association of Colleges of Nursing. (2011). *The essentials of master's education in nursing*. Retrieved from <http://www.aacn.nche.edu/education-resources/MastersEssentials11.pdf>
- American Nurses Association. (2009). *Essentials of genetic and genomic nursing: Competencies, curricula guidelines, and outcome indicators* (2nd ed.). Silver Spring, MD: Author.
- Calzone, K., Masny, A., & Jenkins, J. (2010). *Genetics and genomics in oncology nursing practice: The evolution of oncology nursing*. Pittsburgh, PA: Oncology Nursing Society.
- Cancer Genome Atlas Network. (2012a). Comprehensive genomic characterization of squamous cell lung cancers. *Nature*, 489, 519–525. doi:10.1038/nature11404
- Cancer Genome Atlas Network. (2012b). Comprehensive molecular characterization of human colon and rectal cancer. *Nature*, 487, 330–337. doi:10.1038/nature11252
- Cancer Genome Atlas Network. (2012c). Comprehensive molecular portraits of human breast tumours. *Nature*, 490, 61–70. doi:10.1038/nature11412
- Carthew, R.W., & Sontheimer, E.J. (2009). Origins and mechanisms of miRNAs and siRNAs. *Cell*, 136, 642–655.
- Collins, F.S., Morgan, M., & Patrinos, A. (2003). The human genome project: Lessons from large-scale biology. *Science*, 300, 286–290. doi:10.1126/science.1084564
- Eggert, J. (Ed.). (2010). *Cancer basics*. Pittsburgh, PA: Oncology Nursing Society.
- Greco, K.E., Tinley, S., & Seibert, D. (2012). *Essential genetic and genomic competencies for nurses with graduate degrees*. Silver Spring, MD: American Nurses Association and International Society of Nurses in Genetics.
- Institute of Medicine. (2011). *The future of nursing: Leading change, advancing health*. Washington, DC: National Academies Press.
- Lea, D.H. (2010). Handling genetics and genomic information responsibly. In K.A. Calzone, A. Masny, & J. Jenkins (Eds.), *Genetics and genomics in oncology nursing practice* (pp. 255–256). Pittsburgh, PA: Oncology Nursing Society.
- National Human Genome Research Institute. (n.d.). Epigenetics. Retrieved from <http://www.genome.gov/Glossary/index.cfm?id=528>

Genetics & Genomics

This feature aims to educate oncology nurses about the emerging role of genetics and genomics in cancer care. Possible submissions include, but are not limited to, application of genetics and genomics in clinical practice, screening and surveillance, case studies to present new ideas or challenge current notions, and ethical issues. Manuscripts should

clearly link the content to the impact on cancer care. Manuscripts should be six to eight double-spaced pages, exclusive of references and tables, and accompanied by a cover letter requesting consideration for this feature. For more information, contact Associate Editor Lisa B. Aiello-Laws, RN, MSN, AOCNS®, APN-C, at llaws@eviti.com.