Predictive biomarkers are revolutionizing decisions about colon cancer treatment. Knowing which biomarkers are altered provides valuable information about which treatment may be more effective. DNA mismatch repair and microsatellite instability testing may also identify families that could benefit from further genetic evaluation to determine if there is hereditary risk for colon cancer. Nurses need to be able to explain what these biomarkers mean and how they affect treatment decisions, as well as recommend genetic counseling and testing for hereditary risk when appropriate.

AT A GLANCE

- Oncology nurses must keep up to date with changing information concerning predictive biomarkers.
- Nurses should educate patients about the results of their colon cancer biomarker tests and how they affect treatment decisions.
- Nurses can help identify patients with potential hereditary risk for colon cancer based on their family history and make appropriate referrals for further genetic testing.

KEYWORDS
biomarkers; colon cancer; genetic testing; genetics counselor; signaling pathways

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Predictive Biomarkers

Understanding their use in treatment decision making

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Biomarkers are biologic molecules found in tissue, blood, or body fluids that can be measured and provide diagnostic, prognostic, or predictive information about diseases, including malignancy. They are produced by cells or tissues in response to a tumor. Biomarkers can include hormones, enzymes, glycoproteins, oncofetal antigens, and receptors, as well as changes in tumors, such as genetic mutations, amplifications, or translocations (Duffy, 2017; Lech, Słotwiński, Słodkowski, & Krasnodębski, 2016).

In many cancers, biomarkers can give an indication of the presence of a tumor, the prognosis associated with a certain tumor, and/or predictive information about a patient's response to a certain treatment (Davis, 2018; Duffy, 2017; Lech et al., 2016; Sepulveda et al., 2017). Prognostic biomarkers are those that provide information about the potential outcome of a patient with a certain tumor type. Although prognostic biomarkers offer interesting and helpful information, they do not facilitate decision making about what treatment might be most beneficial to a patient (Davis, 2018; Saltz, 2017).

This article focuses on predictive biomarkers that assist in making treatment recommendations. Predictive biomarkers recommended for colon cancer by the National Comprehensive Cancer Network (NCCN) guidelines and the joint American Society for Clinical Pathology (ASCP), College of American Pathologists (CAP), Association for Molecular Pathology (AMP), and American Society of Clinical Oncology (ASCO) guidelines for use in clinical practice include DNA mismatch repair (MMR)/microsatellite instability (MSI), *KRAS*, *NRAS*, and *BRAF* (NCCN, 2019; Saltz, 2017; Sepulveda et al., 2017).

Signaling Pathways in Colon Cancer

The growth of colon cancer is driven by molecular changes and mutations in several genes and signaling pathways. These can promote tumor growth, angiogenesis, cell motility, altered cellular metabolism, and evasion of apoptosis (Hauptman & Glavač, 2017; Simon, 2016; Yamagishi, Kuroda, Imai, & Hiraishi, 2016). A critical pathway involved in the development of colon cancer is the epidermal growth factor receptor (EGFR) signaling pathway. Activation of the EGFR pathway stimulates the signaling of the RAS/RAF (rapidly accelerated fibrosarcoma) and phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha (PIK3CA) pathways and is required to promote tumorigenesis. *KRAS*, *NRAS*, and *BRAF* are all part of these signaling pathways (Meriggi, Vermi, Bertocchi, & Zaniboni, 2014; Queralt et al., 2016). DNA MMR genes are responsible for the correction of mistakes in DNA replication. Mutations in these genes lead to the accumulation of errors in DNA coding and result in MSI. Multiple DNA mutations encode for abnormal proteins that can promote tumor cell growth (Davis, 2018;