

# Rules of Tumor Cell Development and Their Application to Biomarkers for Ovarian Cancer

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**Purpose/Objectives:** To apply the Hanahan and Weinberg conceptual framework for tumor development to the specific biomarkers observed or expressed in ovarian cancer.

**Data Sources:** Data-based publications, topical reviews, and book chapters.

**Data Synthesis:** Articles specific to ovarian cancer were reviewed to examine whether the six rules from the Hanahan and Weinberg conceptual framework were applicable to biomarkers of ovarian cancer. This approach allows for the application of a general framework for the development of solid tumors to the development of ovarian cancer.

**Conclusions:** The six rules for tumor cell development outlined in the Hanahan and Weinberg conceptual framework are applicable to biomarkers expressed or observed in patients with ovarian cancer.

**Implications for Nursing:** Oncology nurses can enhance their clinical teaching by integrating this information into their practice. Nurses who conduct research on ovarian cancer can use this framework to guide the selection of biomarker(s) for these studies. Finally, nurse educators can use this framework when teaching students key concepts in the care of patients with cancer.

Inherent biologic differences exist among and within various types of human cancer. Although tumors arise and proliferate from a single abnormal cell, they quickly become heterogeneous in their cellular composition, with some more differentiated than others. Historically, experimental work in histology (the microscopic structure of tissues), cytology (structure and function of cells), morphology (form and structure of living organisms), and epidemiology (incidence and prevalence of disease) has provided diverse phenotypes for various cancers. However, as molecular methods improve, synthesizing experimental evidence and thinking conceptually about the underlying rules that govern tumor development have become possible (Hanahan & Weinberg, 2000).

The purpose of this article is to apply the Hanahan and Weinberg (2000) conceptual framework for the development of cancer cells to biomarkers observed or expressed in ovarian cancer. Ovarian cancer was chosen as the tumor type because this framework has not been applied to it and knowledge of biomarkers for ovarian cancer has increased in recent years.

## The Rules for Making Tumor Cells and Biomarkers of Ovarian Cancer

The Hanahan and Weinberg conceptual framework attempts to synthesize existing knowledge about tumors and the rules

## Key Points . . .

- The Hanahan and Weinberg conceptual framework is applicable to biomarkers of ovarian cancer.
- The hallmarks of cancer can be distilled to six rules that also apply to biomarkers of ovarian cancer.
- Information about biomarkers of ovarian cancer has increased during recent years, and nurses should integrate this knowledge into their clinical practice.

required for malignant transformation. After a review of years of literature in cell biology, biochemistry, genetics, and clinical oncology, six rules were distilled regarding the development of tumor cells (Hahn & Weinberg, 2002; Hanahan & Weinberg, 2000). Hanahan and Weinberg stated that “we foresee cancer research developing into a logical science, where the complexities of the disease, described in the laboratory and clinic, will become understandable in terms of a small number of underlying principles” (p. 57). The six rules are: (a) self-sufficiency in growth signals, (b) insensitivity to growth-inhibitory signals, (c) evasion of programmed cell death (apoptosis), (d) limitless replicative potential, (e) sustained angiogenesis, and (f) tissue invasion and metastasis (Hanahan & Weinberg). Detailed information about each rule

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