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Seema Sethi

# miRNAs and Target Genes in Breast Cancer Metastasis

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Seema Sethi  
Department of Pathology  
Wayne State University School of Medicine  
Karmanos Cancer Institute  
Detroit, MI, USA

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*To my parents, Sadanand and Tripta Bahri,  
who taught me the importance of sincere hard  
work in making a difference in this world.  
Losing my father to cancer and knowing the  
pain, anguish, and turmoil of this disease  
motivated me to work in this field.  
To my husband Anil and children Aisha,  
Prajit, and Sajiv who all make it worthwhile.*



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# Chapter 1

## Introduction: Role of miRNAs and Their Target Genes in Breast Cancer Metastasis

Seema Sethi, Shadan Ali, and Fazlul H. Sarkar

**Keywords** Breast cancer • miRNA • Brain metastasis • Bone metastasis

Breast cancer is the most common cancer among women in the United States and the second leading cause of cancer deaths among women of all ages [1]. In 2013, there have been approximately 232,340 new cases of invasive breast cancer and 39,620 breast cancer deaths among US women [2]. One out of 8 women in the United States will develop breast cancer in her lifetime [2].

Rapid advances in the fields of molecular biology and medicine have led to the development of novel therapeutic strategies for breast cancer. These have led to a significant improvement in the prognosis of this disease from the past few decades. Patients today have a wide range of therapeutic options including multimodality treatment protocols with surgery, chemotherapy, and molecular targeted therapies. Molecular-based therapies like trastuzumab, targeting against HER2/neu, have led to improved outcomes in these patients.

Although the prognosis has considerably improved for early stage cancers, unfortunately many patients die as a consequence of metastasis. It has been determined that approximately 25–40 % of patients develop metastatic disease which is generally incurable [3]. The metastasis could be at several body sites including the bone and brain. Once the metastasis develops, it heralds a rapid downhill course for these patients. Not only is the mortality increased but there is significant morbidity, impacting the quality of life of the patient.

Metastatic disease dramatically reduces the 5-year survival by 20 % when compared with patients with no metastasis [4]. Once breast cancer has

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S. Sethi (✉) • F.H. Sarkar

Department of Pathology, Karmanos Cancer Institute, Wayne State University, Detroit, MI, USA

e-mail: [drsethi7@gmail.com](mailto:drsethi7@gmail.com)

S. Ali

Department of Oncology, Karmanos Cancer Institute, Wayne State University, Detroit, MI, USA