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Editorial: Diagnosis and Treatment of Breast Cancer in 2022: The Rise of Novel Molecular Biomarkers

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Editorial on the Research Topic

Diagnosis and Treatment of Breast Cancer in 2022: The Rise of Novel Molecular Biomarkers

We are experiencing an amazing era of advances in the diagnosis and treatment of breast cancer, with the discovery of novel actionable biomarkers (e.g., programmed death-ligand 1 (PD-L1), phosphatidylinositol-4,5-bisphosphate 3-kinase, catalytic subunit alpha (PIK3CA), mismatch repair) and the re-discovery of traditional and established ones, particularly for HER2 (low expression/mutations) (Tarantino et al., 2020; Fusco et al., 2021a; Sajjadi et al., 2021; Criscitiello et al., 2022). These biomarkers are strongly impacting pathology and treatment decision-making in oncology, with the introduction of ultra-personalized therapeutic options (Punturi et al., 2021; Venetis et al., 2022a; Henry et al., 2022; Tarantino et al., 2022). In this evolving scenario, predictive molecular pathology is called to face new challenges in breast cancer (Fusco et al., 2021b; Dileep and Gianchandani Gyani, 2022). Our improved diagnostic resolution, together with the combination of clinicopathologic data and massive molecular and digital data, is allowing targeted therapies to become more and more selective (Pisapia et al., 2022). The multi-dimension of this approach requires extremely precise testing methods and guidelines.

We edited the present Research Topic of Frontiers in Molecular Biosciences on The Rise of Novel Molecular Biomarkers in Breast cancer (2022 edition) to provide a snapshot of novel significant advances in the evolving field of breast cancer biomarkers. We selected two original research articles and two comprehensive reviews covering different aspects of biomarkers in breast cancer. Among these, an original research article by Elham Sajjadi and collaborators provides previously unavailable evidence on the biology underpinning invasive breast carcinomas with osteoclast-like stromal giant cells (OSGC) (Sajjadi et al.,

2022). Through a comprehensive characterization of the different cellular compartments of this exceedingly rare type of tumor, the Authors investigated the similarities of OSGC with tumor and tumor immune microenvironment in terms of morphology, protein, and monocytic miRNA signatures. This comprehensive approach unveiled shared epigenetic events during the ontogenesis of breast cancer cells and OSGC, with the latter belonging to the spectrum of M2 tumor-associated macrophages. Another mRNA study by [Chen et al.](#) Depicts the prognostic value and biological role of protein tyrosine kinase 2 (PTK2) in breast cancer [Chen et al.](#) This elegant work has been particularly welcomed by the Editorial Board, given the integration of multiple publicly available databases. The Authors found that PTK2 mRNA is upregulated in breast cancer cells compared to the normal breast tissue and that it may give significant prognostic information, being associated with high-stage, mutations in well-known cancer genes, and poor survival. Quality of life Research Topic is a crucial burden in breast cancer survivors and there is accumulating evidence on the role of biomarkers in this spectrum of conditions ([Maurer et al., 2021](#); [Sunilkumar et al., 2021](#); [Invernizzi et al.](#)). In this respect, a multicentric Italian effort led by Prof. Marco Invernizzi clarifies the current state of knowledge on biomarkers that might be potentially integrated into rehabilitation practice to promote a precision medicine approach to breast cancer-specific survivorship Research Topic [Invernizzi et al.](#) This systematic review, which includes 22 randomized controlled trials assessing rehabilitation interventions in patients with breast cancer, reveals that physical exercise in patients with a diagnosis of breast cancer induce the presence of recurrent molecular alterations in key molecules, thus corroborating the need for translational research focused on the role of biomarkers in tailored rehabilitative treatments in these women. Finally, we are delighted to offer to the readership of this Research Topic some real-world data by [Di Cosimo S. et al.](#) On the prevalence, treatment response, and outcome of patients with HER2-low breast cancer [Di Cosimo et al.](#) This study is of particular relevance given that the introduction of novel anti-HER2 compounds is determining a paradigm shift in breast cancer treatment, as tumors with low levels of HER2 expression (i.e., score 1+/2+ with no gene amplification) benefit from HER2 antibody-drug conjugates (ADC) ([Venetis et al., 2022b](#)). In this article, patients with HER2-low breast cancer account for ~50% of the cases treated with neoadjuvant therapy and have poor treatment responses. In the absence of pathologic complete response (pCR), these patients, particularly those with a triple-negative neoplasm, have a dismal prognosis. Studies are needed not only to better define the biology of HER2-low breast cancer but also to investigate the possible role of new therapeutic approaches in the early stage.

Our understanding of the molecular landscape of breast cancer is expanding day by day. We believe that a biomarker-based approach being able to identify specific subgroups of patients is now mandatory in breast cancer precision oncology. Hence, precision medicine should ideally start in the pathology lab and expand to the clinic, keeping the patients at the center of their management.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

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