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The Latest Developments in 3D Culture Models as they relate to Thyroid Cancer

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Introduction

Thyroid cancer is the most common endocrine malignancy, with a rising incidence worldwide. Traditional two-dimensional cell culture models have been the cornerstone of cancer research, including thyroid cancer, but they often fail to recapitulate the complex tumor microenvironment and drug responses seen in vivo. Three-dimensional culture models have emerged as a valuable tool to bridge this gap, offering a more physiologically relevant system to study thyroid cancer biology and test novel therapeutic strategies. This article provides an overview of the latest developments in 3D culture models as they relate to thyroid cancer, including their advantages, challenges, and future directions. One of the main advantages of 3D culture models is their ability to mimic the tumor microenvironment more accurately than 2D models. This includes factors such as cell-cell interactions, cell-matrix interactions, and gradients of nutrients and oxygen, which can influence tumor growth and drug responses. 3D models also allow for long-term culture, making them suitable for studying tumor progression and metastasis. Additionally, 3D models can be used to study the tumor immune microenvironment and test immunotherapies [1,2].

Description

Thyroid cancer arises from the cells of the thyroid gland and encompasses several histological subtypes, with papillary thyroid carcinoma being the most common. Despite a generally favorable prognosis, some thyroid cancers can be aggressive and resistant to conventional treatments. Traditional 2D cell culture models, while useful for basic research, often fail to replicate the complex 3D architecture and cellular interactions present in tumors. 3D culture models offer a more realistic representation of the tumor microenvironment and have the potential to improve our understanding of thyroid cancer biology and therapeutic responses. Several types of 3D culture models have been developed for studying thyroid cancer, each with its own advantages and limitations. Spheroid models, including multicellular tumor spheroids and thyroid spheroids, allow cells to grow in three dimensions, mimicking the spatial organization of tumors. Organoid models, derived from patient tissues or cell lines, recapitulate the heterogeneity and cellular interactions seen in vivo. Scaffold-based models, such as hydrogels or decellularized extracellular matrices, provide a more structured environment for cell growth and differentiation [3,4].

Conclusion

3D culture models have been used to study various aspects of thyroid cancer biology, including tumor growth, invasion, and metastasis. They have also been used to screen for novel therapeutic agents and study drug resistance mechanisms. For example, 3D models have been used to identify potential therapeutic targets in thyroid cancer, such as the BRAFV600E mutation, which is found in a subset of PTCs and is associated with a poor prognosis. Despite their advantages, 3D culture models also present several challenges, including reproducibility, scalability, and the complexity of the microenvironment. Future research directions include the development of more sophisticated 3D models that better mimic the in vivo tumor microenvironment, as well as the integration of these models with other technologies such as imaging and omics analyses. Overall, 3D culture models have the potential to revolutionize thyroid cancer research and lead to the development of more effective therapies for this disease [5].

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Conflict of Interest

None.

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