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Bioprospecting Research Efforts: An Overview of New Anti-cancer Phytochemicals Discovered in the Past Ten Years

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Introduction

The ongoing battle against cancer has driven extensive scientific research, with bioprospecting—exploring nature for bioactive compounds—emerging as a promising approach. Plants, with their diverse biochemical arsenal, have been a cornerstone of drug discovery, yielding many anticancer agents. Over the past decade, significant progress has been made in identifying new phytochemicals with potent anticancer properties. These discoveries underline the importance of preserving biodiversity and investing in natural product research to develop novel therapeutic options. Bioprospecting involves the systematic search for bioactive compounds from natural sources, including plants, microorganisms, and marine organisms. For millennia, traditional medicine systems have relied on plants for treating ailments, providing a foundation for modern drug discovery. This approach has been particularly fruitful in oncology, with several landmark anticancer drugs, such as paclitaxel (Taxol) and vinblastine, derived from plant sources [1].

The past ten years have seen the discovery of numerous novel phytochemicals, reflecting advances in extraction techniques, analytical tools, and high-throughput screening methods. One remarkable class of phytochemicals identified in recent years is alkaloids, known for their complex structures and biological activities. Research on the plant *Catharanthus roseus* has yielded new derivatives of vincristine and vinblastine with enhanced efficacy against various cancers. Similarly, investigations into *Camptotheca acuminata* have led to the discovery of novel camptothecin analogs, which exhibit improved stability and reduced toxicity. These advancements demonstrate the ongoing potential of plant alkaloids in oncological therapeutics [2].

Description

Another significant group of anticancer phytochemicals is flavonoids, polyphenolic compounds found in fruits, vegetables, and medicinal plants. Flavonoids such as quercetin, luteolin, and apigenin have been extensively studied for their anticancer properties, including their ability to induce apoptosis, inhibit angiogenesis, and modulate signaling pathways. In the last decade, novel flavonoid derivatives have been isolated from plants like *Scutellaria baicalensis* and *Sophora flavescens*. These compounds have shown potent activity against breast, lung, and liver cancers in preclinical studies. Terpenoids, another diverse class of phytochemicals, have also contributed significantly to anticancer drug discovery [3].

Diterpenes from plants like *Andrographis paniculata* and *Salvia miltiorrhiza* have demonstrated potent anticancer effects, particularly against aggressive cancers such as triple-negative breast cancer and melanoma. Advances in synthetic biology have enabled the production of terpenoid derivatives with enhanced pharmacological profiles, paving the way for their clinical development. In addition to these well-known classes, other unique phytochemicals have garnered attention for their anticancer potential. Betulinic acid, a pentacyclic triterpenoid found in birch bark, has shown promise in targeting glioblastoma and melanoma cells through apoptosis induction and immune modulation. Similarly, withanolides from *Withania somnifera* (ashwagandha) have demonstrated dual anticancer and anti-inflammatory properties, making them attractive candidates for combinatorial therapies [4].

Marine-derived phytochemicals have also emerged as a fascinating area of research. The discovery of halichondrin B derivatives from marine sponges and their synthetic analog, eribulin, highlights the potential of marine bioprospecting. While eribulin is already an approved drug, ongoing studies on marine algae and seaweeds have identified several novel polysaccharides and polyphenols with potent anticancer properties. These findings underscore the untapped potential of marine biodiversity in anticancer research. The use of advanced technologies has been instrumental in accelerating phytochemical discoveries. Techniques such as Nuclear Magnetic Resonance (NMR) spectroscopy, mass spectrometry, and next-generation sequencing have enhanced the identification and characterization of bioactive compounds [5].

Conclusion

The discoveries of the past decade underscore the immense potential of bioprospecting in oncology. Phytochemicals such as flavonoids, terpenoids, alkaloids, and marine-derived compounds offer a diverse array of mechanisms to combat cancer, ranging from inducing cell death to inhibiting metastasis. As research progresses, the integration of traditional knowledge, modern technology, and sustainable practices will be key to unlocking the full potential of nature's pharmacy. In conclusion, bioprospecting has proven to be an invaluable strategy for discovering new anticancer phytochemicals. Over the last ten years, significant advancements in technology and interdisciplinary collaboration have paved the way for the identification of novel compounds with transformative therapeutic potential. By addressing the challenges associated with drug development and prioritizing sustainability, bioprospecting efforts can continue to contribute to the fight against cancer, offering hope for more effective and accessible treatments in the future.

Acknowledgement

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Conflict of Interest

None.

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