Whenever we focus our attention towards malignancies caused by cancer, usually our mind gets preoccupied with many conflicting thoughts. When we look at cancer statistics, our heart starts sinking more and more as we drill down to details about incidence rate, mortality rate, trends etc. In spite of tremendous technological advancements over several decades, cancer is second only to cardiovascular disease as a cause of death. When we see so many people dying from cancer, sometimes we wonder if this is a nature’s answer to keep population under control. But when we bring together data from different sources like epidemiological studies, cancer molecular biology, molecular epidemiological studies; we are more than convinced that cancer is a man-made malignancy akin global warming.

In fact when we review source of drugs available for cancer treatment, it’s inevitable to miss fact that majority of anticancer drugs are sourced either directly from natural bioactive compounds or after structural optimization of natural compound. We can say that nature holds bounty of medicinal compounds, and onus is on us to discover and explore their possible medicinal applications. Usage of compounds from natural sources especially plant based can be dated back to possibly even before dawn of civilization. Most of the chemotherapeutic drugs are also derived from natural bioactive compounds. Research effort during past several decades has been dedicated on screening of bioactive compounds from natural sources, with more focus on easily available resources like terrestrial fauna and flora. However, big pharmaceutical companies have diverted their focus from natural bioactive compounds based discovery most probably to avoid possible patent conflicts.

‘Sea holds many secrets’ is a line of poem Iron Coffins by David Harris, which aptly applies for unexplored marine biodiversity and novel medicinal compounds spread across marine flora and fauna. To start this exploration, scientist can just surf over aquatic sources to discover therapeutically important entities, and then start deep diving in pursuit of unexplored biological treasures with endless possibilities. Cynobacteria is one of such marine microbe which is ubiquitously found in fresh water and marine ecosystem.

Cynobacteria are one of the richest sources of known and novel bioactives. Spirulina genus of cyanobacteria group is well known for its nutritional and therapeutic value [1,2]. Some of the potential lead compounds with anticancer activities include curacin A, symplastatin 3, belamide A, dolastatin 10, halichondrin B, Nostoc linckia and Nostoc spongiaeforme are marine strains of cyanobacteria, which is source of borophycin a boron containing metabolite. Borophycin has demonstrated cytotoxicity against human colorectal adenocarcinoma cell lines and human epidermoid carcinoma [3,4]. Cryptophycin isolated from Nostoc sp. has also demonstrated potent cytotoxicity against human tumor cell lines [5,6]. Antiproliferative action of cryptophycin is due to its interaction with tubulin [7-9]. C-Phycocyanin is yet another potential anti-cancer compound present abundantly in cyanobacteria. C-Phycocyanin has been demonstrated to inhibit proliferation of human hepatoma cell line (HePG2) [10], and induces apoptosis by selective activation of caspase-3, inhibition of bcl-2 and generation of reactive oxygen species [11]. C-Phycocyanin is known to selectively inhibit COX-2 [12]. COX-2 is significantly expressed in various cancers including breast cancer, therefore c-phycoerythrin holds potential to become anti-cancer compound. Cyanobacterial cyclopeptides like microystins have potential to induce apoptosis and their propensity to be taken up via organic Anion Transporting Polypeptides (OATP) which are expressed more in metastatic cancer cells compared with normal cells can make them potential anti-cancer drug candidates [13-15]. Some of potent compounds from cyanobacteria with anti-cancer activities which have garnered interest in recent years are largazole [16] and apratoxin [17].

In this write-up I have briefly discussed just one group from the rich marine biodiversity, with lot other still waiting to be explored. Drug discovery efforts centered on marine microbes, also makes good business sense for big pharmaceutical companies, they can look this as an opportunity to enrich their pipeline which of late is drying soon. Fight against cancer has been unnerving like a long and dark night, but we should hope Mother Nature will guide us through this difficult phase, as it has done time and again. Mesmerized with great biodiversity in nature, I conclude this write-up with a sense of optimism that our scientific endeavors would make world better place for generations to come.

References

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