



## Presence of Novel Chemical Diversity in Marine Environment

### KEYWORDS

marine molecular biology, anticancer drugs, marine virus

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**ABSTRACT** *The potential application of molecular biology in marine biology is growing. The technological advancement in the molecular technology had significantly advanced in biological research. Now a days marine organisms and ocean process will be providing the solution to many diseases. Marine biology, marine molecular biology will define the human health and welfare. There are various subjects which can help in human welfare that is marine microbiology, marine invertebrates, marine natural products etc. The reason being is that ocean plays an important role in human race. Marine scientist had discovered much about the ocean, its organisms and the technology development have been readily incorporated to the study of marine organisms as the model for understanding the biology. While the use of various microbiology molecular techniques will allow answering many question about global climate change, biodiversity, unanswered question about human health etc. Whereas the basic biology investigation will be key stone to develop techniques for assessing that physiological status in deciphering the biogeochemical cycle, oceanic process, toxin, discharge. Hence a wide fold increased in the research of marine science, biological science, the potential use of marine virus as vector for genetic manipulation can be understood an investigation can be done. Cancer has jeopardized many lives, and ocean has copious amount of anticancer drugs.*

### INTRODUCTION:

For centuries, human has been obtaining food and nourishment from the ocean, not only from fishes (as a source of protein) but also from the plants. Thus the society relies heavily on the ocean for their living. These oceans provide a wide range of services to the human. Coral reefs sea mounts, open – ocean each of these habitat contributes to the ocean ability to serve essential goods and services. The sea accommodates 32 of the 33 phyla known in biological taxonomy; 15 phyla are found in the marine habitat. Approximately there are 200500 marine species have been described. Whereas, mangrove flora and fauna plays an important role in the defence of the coastal region. These prevent the damage to the property and the lives. The biogenic structure reduces the erosion and decrease the impact of tidal waves. After any events the natural structure has the ability to recover and to regain full functionality at no cost.

### THE OCEANS ARE THE MOST PROMISING FRONTIER OF NEW DRUGS

There has been long before about various prophylactic substances that can be obtain from the ocean. As a result of this, there are more and more research is taking place into the possibilities of obtaining the possibility of the pharmaceutically active chemicals from the ocean. They are obtained from microorganism or bottom dwelling organism such as corals, sponges and tunicates. Thus by occupying more than 70 percent of the Earth's surface, the ocean is the virtually unexplored treasured chest of new and unidentified species. These natural products are of so special interest because of the dazzling diversity and uniqueness of the creature that makes the sea their home. One reason marines organism are so interesting to scientist is because in adapting to the various oceans environment, they have evolved fascinating repertoire of unique chemicals to help them survive. Sponges are in fact are among the most prolific sources of diverse chemical compounds. An estimate 30 percent of all potentially marine derived medication currently in the pipeline and about 75 percent of recently patented marine derived anticancer compound comes from the marine sponges. Recent advances in the molecular biology, high throughput cultivation of microorganism growing knowledge and exploration

of deep-sea environments and chemosynthesis ecologies and understanding of the ocean's incredible biodiversity, along with mounting problem of drug resistance pathogen strain and increased incidence of some kind of cancer have resulted in new interest in the oceans from a pharmaceutical point. The advent of new, extremely sensitive analytical capabilities including the nuclear magnetic resonance and mass spectral instruments had opened the fields to the discovery of highly active metabolites that exist in such low concentration that they were previously beyond reach. In addition the ability to mass culture toxin producing algae, bacteria and fungi under highly controlled and safe conditions allow for production of sufficient quantities of toxin for experimental and testing. The availability of approximately equipped bio safety laboratories in the discovery and development of therapeutic banned on materials from the sea. The major opportunities for advancement includes are a) examine genetic, species and molecular diversity within extreme habits b) to develop man cultured methods to allow large scale production of marine microbes c) the conduct the focus studies d) to investigate novel microbe and novel compound e) to make available methods and materials to rapidly and accurately screen newly isolated compounds.

### CANCER DRUGS AND ITS SOURCES:

Cancer is one such catastrophic disease which has jeopardized many lives since ages. Researches on various anticancer drugs are incessant and marine environment has copious amount of anticancer drugs. Many marine organisms have been proved futile for various anticancer drugs. The discovery of Trabectedin, first ever marine anticancer drug provided a quantum jump in research and development of marine anticancer drugs. Since then many biologically active compounds have been extracted which have proved to be potent anticancer drug. The marine environment can be broadly classified into floral and faunal resources. 90% of oceanic biomass consists of marine floral like bacteria, actinobacteria, cyanobacteria, fungi, seaweeds and mangrooves making marine floral momentous. The chemicals extracted from these faunal resources have displayed an array of pharmacological properties like antioxidant, immunostimulatory, and antitumor properties. The secondary metabolites

produced by various bacteria and fungi have yielded many salubrious anticancer drugs. The contribution of probiotic bacteria such as lactobacilli and bifidobacteria is paramount in producing drugs against colon cancer. They produce a chemical named bacteriocin which is an antibacterial protein. Marine blue-green algae, Cyanobacteria are noxious and produce toxins. These toxins are effective in killing the cancer cells by inducing apoptotic death or affecting the cell signalling. Lyngbya majuscula, has antiproliferative agents which are useful in treating colon, renal and breast cancer. Seaweeds are important sources of protein, iodine, vitamins and minerals thus they have promising activities against cancer and due to this in past three decades, many researchers have worked on the antioxidant, antitumour and immunomodulating activities of seaweeds. Edible seaweed, *Palmaria palmata* is potent in inhibiting cancer cell proliferation. Various species of seaweeds like *Ulva reticulata*, *Acanthophora specifera* and *Padina boergesenii* of Gulf of Mannar region have shown cytotoxic activity in their alcoholic extract. Marine environment is more biologically diverse than the terrestrial environment. The marine environment is bloated with disparate phyla which exhibit sundry adaptations. There is discrepancy in the adaptations of the organisms surviving in the benthic and pelagic region of the ocean. The organisms have to brace themselves from extreme fluctuations in pH, temperature, salinity, wave current, etc and so they exhibit astounding adaptations. Thus the marine environment has ample of biologically active substances which may play a key role in unravelling cure for many diseases like cancer. Over the last few decades, significant efforts have been made by both pharmaceutical companies and academic institutions to isolate various chemical compounds from marine faunal species ensuing an array of potent anticancer drugs. Some of the successful contrivances of the anticancer drugs are listed in the later part.

Cytarabine a chemotherapy agent is isolated from Caribbean sea sponge *Cryptotheca crypta*. It kills cancer cells by interfering with DNA synthesis. Cytarabine is currently used in the routine treatment of patients with leukaemia and lymphoma. It is on the World Health Organisation (WHO) list of essential medicines. Psammaphin A is another compound isolated from the sea sponge which has been found to blotch several components that are involved in the growth and division of cancer cells. Scientists have unearthed several promising drugs from sea creatures called Tunicates, commonly known as Sea squirts. Tunicate namely *Ecteinascidia turbinata* found in West Indies coral reefs is a source of anticancer drug Trabectedin. It is potent in the treatment of advanced soft tissue sarcoma. Didemnin B is another compound isolated from tunicate *Trididemnum solidum*. Didemnin B is a strong antiviral agent against both RNA and DNA viruses. It is a strong immunosuppressant and is very cytotoxic. The compound has strong activity against leukaemia cells. *Dolabella auricularia*, algae eating Indian sea hare is a source of Dolastatin. Dolastatin is the basis of the drug Auristatin. This drug shows benefit for the treatment of lung cancer, ovarian cancer and myeloid leukaemia. Sea stars and Sea cucumbers have physiologically active saponins that have been extensively studied for anticancer properties. Impatienside A was isolated from sea cucumber, *Holothuria impatiens* and is a potent anticancer drug against seven different human tumour cells.

The Porifera are more commonly known as the sea sponges are multicellular marines animals usually occurring in complex sessile colonies. They are the homes to huge amount of bacteria, cyanobacteria and fungi and because a single sponge can be populated by dozens of different symbiotic bacteria that produces an extra ordinary range of chemicals. These chemicals are those that have been collected from the sponges of the Lithistid family discovered at depth of 300 to 600 meters off the coast of Florida. Drug extracted from them had been used to treat myelocytic leukemia and non-Hodgkin's Lymphoma. The other family of Sponges which has high number of microorganism population which is ex-

ceptionally bioactive in the *Halichondria okadai* Sponges, this contain halichondrin B, a chemical which has been described as 'exquisitely potent' in killing cancer. The deep sea sea sponge *Lissodendoryse*, contain the compound called halichondrins in greater concentration; it interfere with dividing cells against solid tumours, especially multi drug resistant tumours. Tunicates, commonly called as sea squirts are marines animals that spend most of their lives attached to rock. The photosynthetic microbes *Prochloron didemni* live as an endosymbiont inside the sea squirt *Lissoclinum patella*. It produces two compound called Patellamide A and C which is anticancer. The bacteria *Salinispora*, a new class of marines Grams Positive bacteria, have been isolated in large number from many different ecosystem. A substance, *Salinosporamide A*, has been isolated from these bacteria which shows strong anti-cancer properties against melanoma, colon-, breast-, and lung - cancer.

#### CONCLUSIONS:

We can thus infer that the marine environment is an eternal source for various biologically active compounds. The marine environment is taxonomically diverse and consists of various chemically unique compounds which is valuable in cancer treatment. The past few decades has witnessed an immense increase in the research of marine anticancer drugs. The improved outcome of various clinically approved anticancer drugs has ameliorated the treatment of cancer drugs across the globe. The screening strategies are continuing to evolve and the sea sampling techniques are rapidly developing and this in turn has lead to increase in the desire to develop novel and less toxic cancer therapies. This advancement suggest that in near future, the oceans will become an important source of novel chemicals.

**TABLE:1 STATUS OF MARINE DERIVED NATURAL PRODUCTS IN CLINICAL AND PRECLINICAL TRIALS**

COMPOUND	SOURCE	DISEASE	COMMENT
Bryostatin1	Bugla neritina	Cancer	In trial
TZT-1027	Sea slug	Cancer	In trial
Cematodin	Sea Hare	Cancer	In trial
ILX651, Synthetodin	Sea Slug	Cancer	For myelanoma breast and non small cell lung cancer
Ecteinascidin 743	Mangrove tunicate	Cancer	In trial
Aplidine	Mediterranean tunicate	Cancer	In trial
E7389	Marine Sponge <i>Lissodendoryx</i> sp.	Cancer	Breast and lung cancer
Discodermolide	Marine Sponge <i>Discodermia dissolute</i>	Cancer	In trial

Kahalalide F	Mollusk, Bryopsis sp.	Cancer	In trial
Zalypsis	Marine Bac- teria,	Cancer	In trial
ES-285	Spisula pol- ynyma	Cancer	In trial
KRN-7000	Sea Sponge Agelas mauri- tianus	Cancer	In trial
Squalamini	Spiny dog fish Squalus acanthias	Cancer	In trial
AE-941	Shark	Cancer	In trial
NVP- LAQ824	Marine Sponge	Cancer	In trial
E-7974	Marine Sponge	Cancer	In trial
Saliosporamide A	Marine bacte- ria Salinispora tropica	Cancer	In trial
Dolostatin 10	Sea Slug	Cancer	In trial
HTI286	Sponge	Cancer	In trial
Yondelis	Sea squirt	Cancer	In trial

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