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V-Discover

**THE STUDENTS
DIGITAL MAGAZINE**

Theme : MARINE DRUGS



SWAMY VIVEKANANDHA COLLEGE OF PHARMACY

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MEDICINES FROM OCEANS

INTRODUCTION

Marine medicine, also known as maritime medicine, is a field of medical practice that focuses on health care and encompasses a wide range of medical disciplines and practices due to the unique environment and conditions encountered at sea. **Marine drugs** refer to pharmaceuticals and bioactive compounds derived from marine organisms such as algae, bacteria, sponges, corals, and marine invertebrates. These substances have shown potential in treating a variety of diseases and conditions due to their unique chemical structures and biological activities. It represents a promising frontier in pharmaceutical development, offering novel solutions for a wide range of medical conditions. The ongoing exploration of the ocean's biodiversity is likely to yield new and valuable therapeutic agents in the future. Some of these organisms are antimicrobial, antiviral, antibiotic, anticancer /cytotoxic enzyme inhibitors, anti-inflammatory, prostaglandins, neurophysiological and cardiovascular agent. Many of species contain toxic compounds.



MARINE DERIVED DRUGS MARKET SIZE

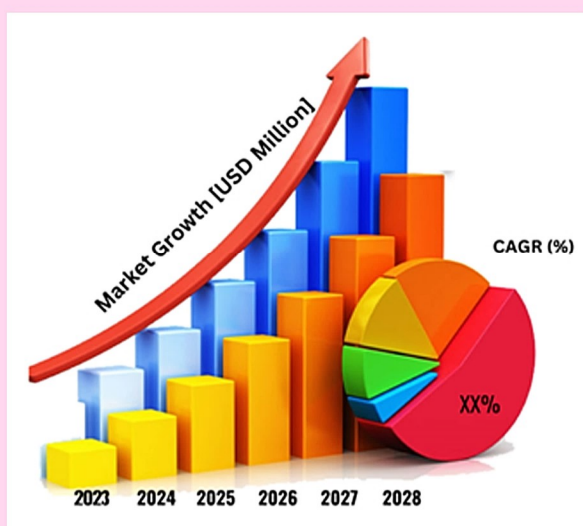


Marine Derived Drugs Market study describes how the Marine Derived Drugs industry is evolving and how major and emerging players in the industry are responding to long term opportunities and short-term challenges they face. One major attraction about Marine Derived Drugs Industry is its growth rate.

The Market Growth Report divides the worldwide Marine Derived Drugs market into categories based on type [Phenols, Steroids, Ethers, Strigolactones, Peptides, Marine Microorganisms, Marine Algae, Marine Invertebrates] and use [Antimicrobials, Antitumor Drugs, Anti-Cardiovascular Drugs, Antiviral Drugs, Digestive System Drugs, Anti-Inflammatory Analgesic Drugs, Urinary System Drugs, Functional Food].

KEY INDUSTRY PLAYERS IN MARINE DERIVED DRUGS MARKET

By Company: Marine Polymer Technologies, Takeda Oncology's Millennium, Genzyme, Abbott Laboratories, Bayer Innovation, Xenome Limited, Pharma Marine USA



The global Marine Derived Drugs market size was valued at USD 9749.46 Million in 2022 and will reach USD 17194.38 Million in 2028, with a CAGR of 9.92% during 2022-2028. The Marine Derived Drugs market report covers sufficient and comprehensive data on market introduction, segmentations, status and trends, opportunities and challenges, industry chain, competitive analysis, company profiles, and trade statistics, etc.

BRIEF HISTORY OF THE HUMAN USE OF MARINE MEDICINES

400 BCE Hippocrates noticed the antibiotic effects of certain sponges, which he recommends to dress soldier's wounds with (Riddle 1987)

In 41 CE, Scribonius Eboracensis, personal Doctor of Emperor Claudius, [recommended the discharge of electric fish to cure migraine and headache]

Discordus noted in his material medica, around 65CE, the benefits of applying brown Algae for treating inflammation.

Galen –Medicinal uses of algae –Mucilage surrounding the thallus had remarkable properties to dress wounds.

Pliny – In 77CE, when he suggested stingray spines to alleviate toothaches

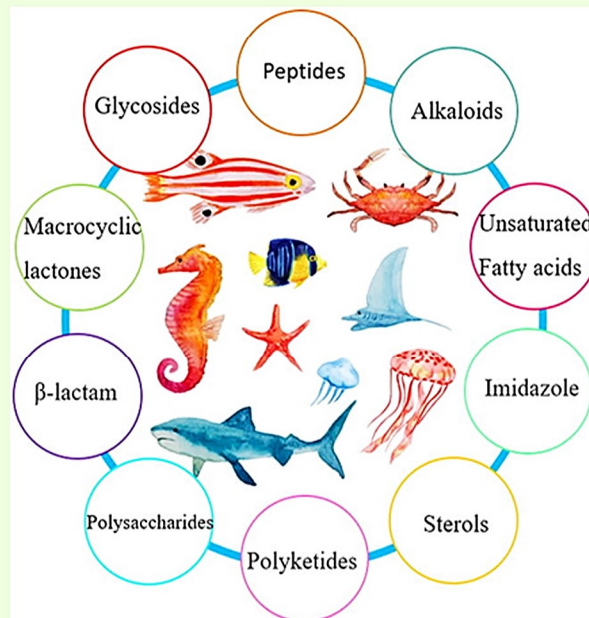
Common glass wort – Used as diuretic in the Netherlands (Price, 2007)

Shrimps –Asthma in Brazil (Costa –Neto 1999)

Red mangrove used against myriad ailments in rural Baja California Sur

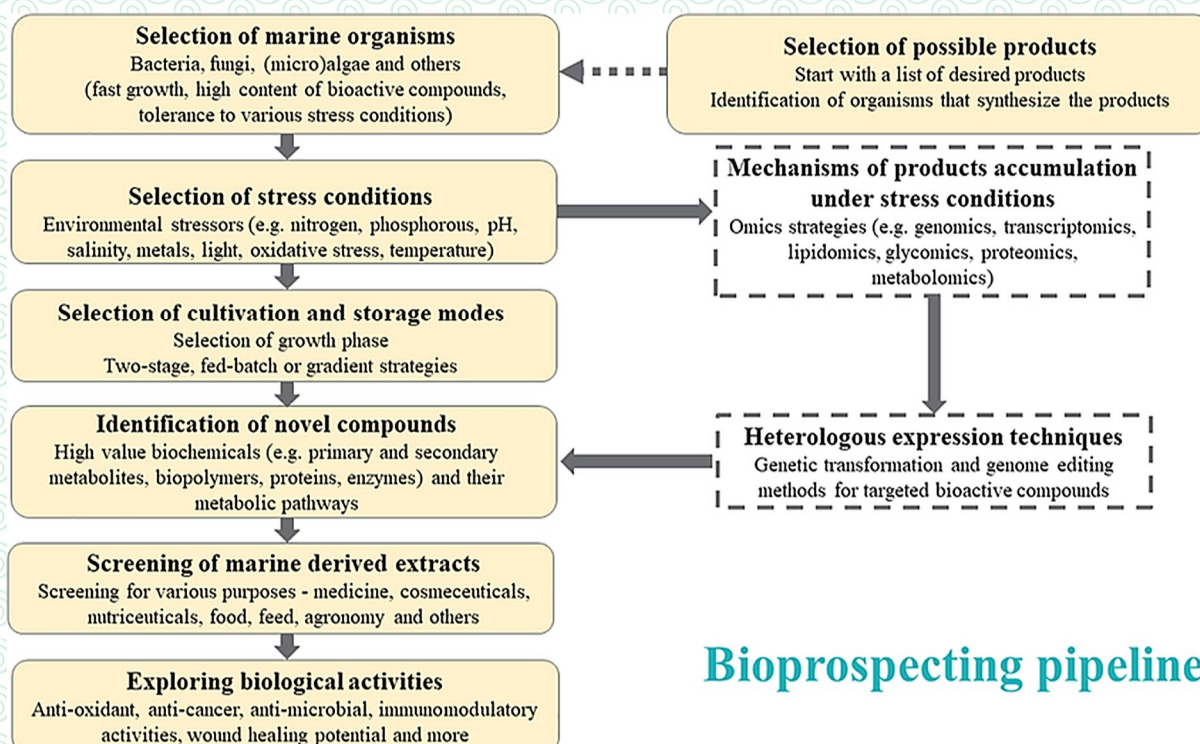
MARINE NATURAL PRODUCTS IN DRUG RESEARCH

More than 70% of the surface of our planet is covered by oceans, and life on earth originates from the oceans. The marine environment is full of about 500,000 species of animals and plants of about 28 phyla, in which mainly nine types of marine animals and plants, have been extensively studied to isolate natural products. Marine invertebrates, plants and bacteria have produced new bioactive compounds. There are phytoplankton (dinoflagellates), microorganisms (bacteria, fungi), sponges, algae (green, blue, red, brown, and green), mollusks (hares, sea cucumbers), coelenterates (soft corals, gorgonians, and sea anemones), and bryozoans.



MARINE NATURAL PRODUCTS IN DRUG RESEARCH

Bioprospecting involves the systematic search for bioactive compounds from natural sources, including aquatic fauna, which can be used for pharmaceutical, agricultural, and industrial applications. Aquatic environments, especially oceans, harbor a vast diversity of species with unique metabolic pathways, making them a rich source of novel bioactive chemicals.

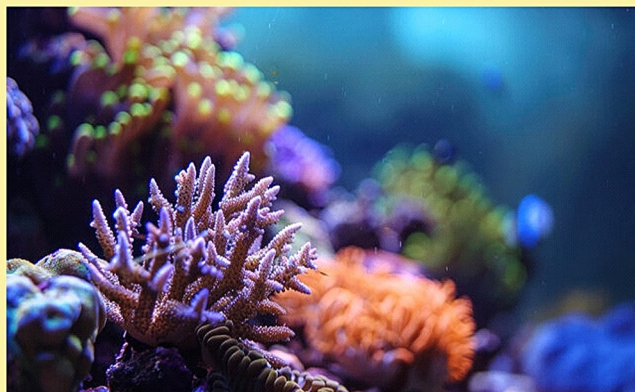


Bioprospecting pipeline

MARINE NATURAL PRODUCTS IN DRUG RESEARCH

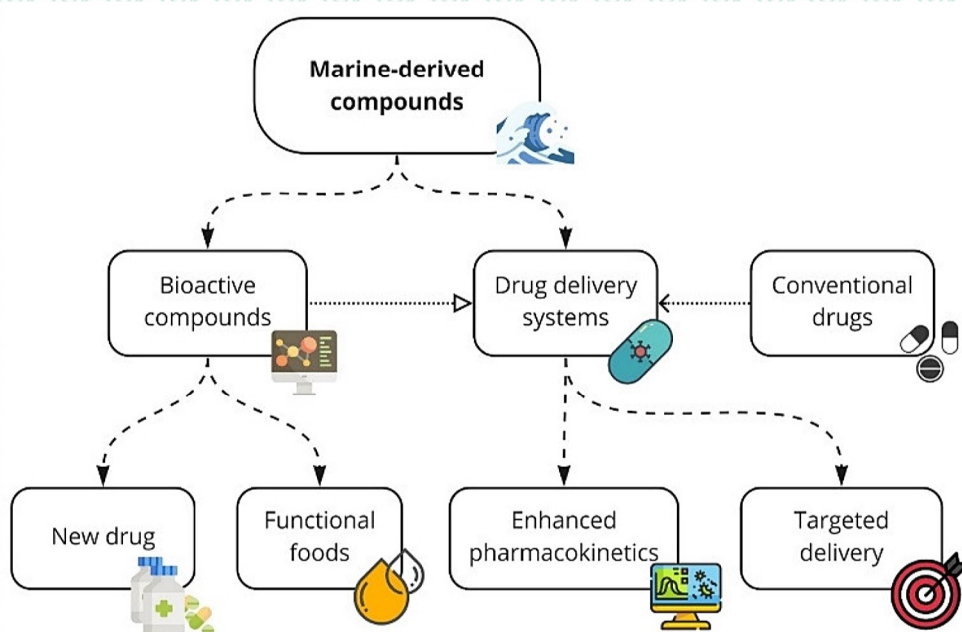
Coral reef: Major habitat of numerous Marine organism

Home to many species of algae, cyanobacteria, micro-organism and marine animals (such as-fish, crustaceans, corals, sponges, loryozoans, tunicates, mollusks and echinoderms). They produce nutritional substances as well as bio active metabolites to defend themselves against predators, tight disease and prevent the fouling and over growth of another organism. These natural products may also useful for the discovery of new drug. Cr- rich sources of bioactive natural products hence (useful medicines in future drug might be development)



VARIOUS STRATEGIES THAT CAN BE IMPLEMENTED TO TREAT THE DISEASES EFFECTIVELY

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RECENT ADVANCES IN MARINE DRUGS :

Innovation:

Marine natural drugs the name explains and itself are drug obtained from marine organisms. It has rich history and has been going since the ancient times.

MARINE DRUGS WITH ANTI - DIABETES PROPERTIES

In the last 15 years, several marine microorganisms (Microalgae, seagrasses, sponges, corals, sea anemones, fishes, salmon skin, a shark fusion protein as well as fish and shellfish wastes) have also been screened for possible anti- diabetes properties. Several red brown and green macro algae have shown anti-diabetes properties (e.g. rhodomela confer voids, euchronia cava, palmaris, malaria and Ascophyllum

MARINE DRUGS IN CANCER THERAPY

Marine organism such as algae, sponges and invertebrates that have shown potential in cancer therapy and it often possess unique chemical structures and Bio- activities that make them promising candidates for drug development

Some examples of marine – derived drugs in cancer therapy include:

- **Eribulin (Halaven):** derived from a sea sponge, Eribulin is used to treat metastatic breast cancer and Ziposarcoma.
- **Ziconotide (Prialt):** derived from the cone snail. it is used to treating severe chronic pain, including pain associated with cancer.
- **Trabectedin (yondelis):** originally isolated from a sea squirt, it is used to treat soft tissue sarcoma and ovarian cancer.

MARINE PEPTIDES AS ANTI-AGING DRUG

Aging is an irreversible physiological process in the human body and the aging characteristics of the body that accompany this process also led to many other chronic diseases such as neurodegenerative disease represented by Alzheimer's disease and Parkinson's diseases, Cardiovascular disease, Hypertension, Obesity, Cancer

E.g.: Atlantic cod (Anti-oxidant, Anti-aging), Grass carp (Anti-oxidation), Jellyfish collagen oyster (Anti-oxidation, Anti-fatigue)

SEA INGREDIENTS THAT ARE BOON FOR HAIR:

Sea Kelp: Is the superstar nutrient rich profile ingredient that transform hair health from root

Sea weed: The seaweeds shampoo and conditioners are available in markets.

Sea Water: Salt water can exfoliate the scalp and encourage blood flow

Fish Oil: Increase hair density, Improve shine

NEW MARINE DRUGS UNDER CLINICAL TRIAL

Marine Drugs under Clinical trials subdivided into three Phases of Clinical Investigation

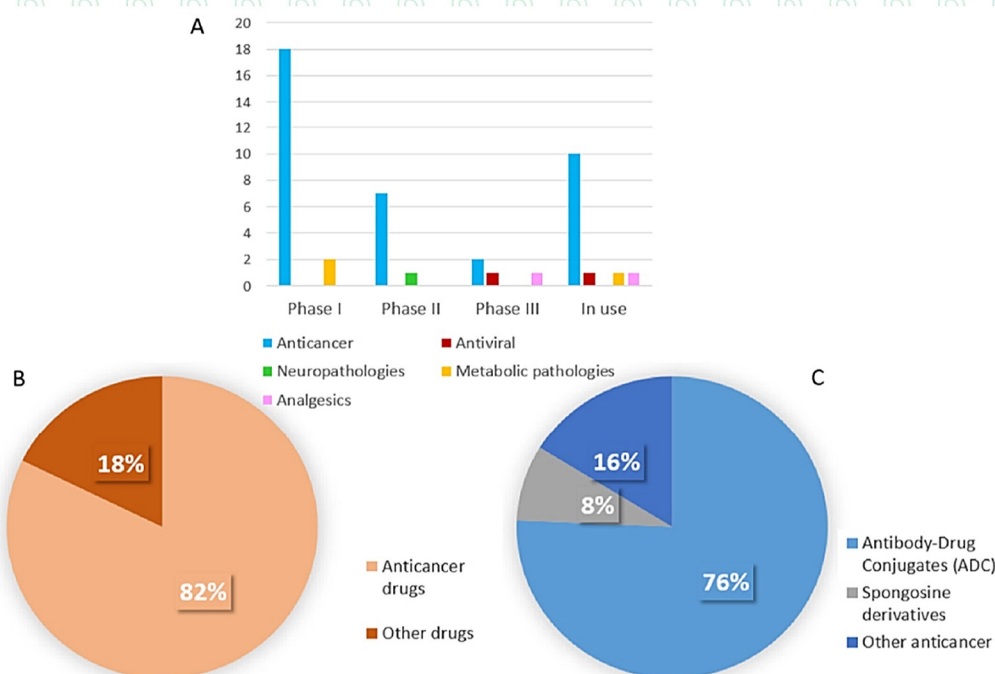
Generic Name	Natural Source	Chemical Class	Clinical Use
PHASE I			
GTS-21 (DMXBA)	Worm	Alkaloid	Obesity
Samrotamab vedotin	Mollusk/cyanobacterium	ADC	Cancer
Sirtratumab vedotin (ASG-15ME)	Mollusk/cyanobacterium	ADC	Cancer
SGN-CD48A	Mollusk/cyanobacterium	ADC	Cancer
ALT-P7	Mollusk/cyanobacterium	ADC	Cancer
ARX788	Mollusk/cyanobacterium	ADC	Cancer
Upifitamab rilsodotin (XMT-1536)	Mollusk/cyanobacterium	ADC	Cancer
AGS62P1	Mollusk/cyanobacterium	ADC	Cancer
PF-06804103	Mollusk/cyanobacterium	ADC	Cancer
Cofetuzumab pelidotin (ABBV-647)	Mollusk/cyanobacterium	ADC	Cancer
ZW-49	Mollusk/cyanobacterium	ADC	Cancer
MRG003	Mollusk/cyanobacterium	ADC	Cancer
STRO-002	Sponge	ADC	Cancer
MORAb-202	Sponge	ADC	Cancer
RC-88	Mollusk/cyanobacterium	ADC	Cancer
SGN-B6A	Mollusk/cyanobacterium	ADC	Cancer
SGN-CD228A	Mollusk/cyanobacterium	ADC	Cancer
FOR-46	Mollusk/cyanobacterium	ADC	Cancer
A-166	Mollusk/cyanobacterium	ADC	Cancer
PHASE II			
Bryostatin	Bryozoan	Macrolide lactone	Alzheimer
Plocabulin (PM060184)	Sponge	Polyketide	Cancer
Tisotumab vedotin	Mollusk/cyanobacterium	ADC	Cancer
Ladiratumab vedotin (SGN-LIV1A)	Mollusk/cyanobacterium	ADC	Cancer
Telisotuzumab vedotin	Mollusk/cyanobacterium	ADC	Cancer
CAB-ROR2 (BA-3021)	Mollusk/cyanobacterium	ADC	Cancer
CX-2029	Mollusk/cyanobacterium	PDC	Cancer
W0101	Mollusk/cyanobacterium	ADC	Cancer

NEW MARINE DRUGS UNDER CLINICAL TRIAL

Generic Name	Natural Source	Chemical Class	Clinical Use
PHASE III			
Tetrodotoxin	Pufferfish	Alkaloid	Chronic pain
Plinabulin	Fungus	Diketopiperazine	Cancer
Marizomib (salinosporamide A)	Actinomycetes	γ -lactam- β -lactone	Cancer
Plitidepsin	Tunicate	Depsipeptide	COVID-19

Most of the marine molecules both in clinical use and under trial are for the anticancer therapy and most of them are marine molecules conjugated to an antibody

- Number of marine drugs under clinical trials and already marketed (in use), distributed for therapeutic class;
- % distribution of all marine drugs (under clinical trials and already marketed) for their use (cancer vs. non cancer);
- % distribution of marine anticancer agents (under clinical trials and already marketed) in different typology.



SOURCE : Cappello, Emiliano & Nieri, Paola. (2021). From Life in the Sea to the Clinic: The Marine Drugs Approved and under Clinical Trial. Life. 11. 1390. 10.3390/life11121390.

MICRO PLASTICS POLLUTION IMPACT ON MARINE ORGANISMS



Micro plastics are a form of pollution containing aquatic and marine habitats, including estuaries, the breeding grounds for many fish species. Over 690 marine species have been impacted by plastic debris and microplastic, which are adversely affecting increasing number of marine organisms. Shellfish and other aquatic animals that are consumed whole pose particular concern for human exposure.

INSTITUTIONS / UNIVERSITIES OFFERING TRAINING/RESEARCH ON MARINE DRUGS IN INDIA

Research Institute in India	Courses In Marine Pharmacology/ Marine Biotechnology in India
National Institute of Oceanology, Goa with Regional Center at Kochi, Mumbai, Vishakhapatnam.	M.Sc. Marine Pharmacology at Chettinad University, Kanchipuram, Tamil Nadu
Central Salt and Marine Chemicals Research Institutes, Bhavnagar, Gujarat.	M.Sc. Marine pharmacology, Annamalai University, Tamil Nadu
Central Drug Research Institutes, Lucknow	M.Sc. Marine Studies and Coastal Resources Management, Madras Christian College Chennai, Tamil Nadu. M.Sc. Marine Biotechnology Goa University.
Research Institutes Outside India	Marine Pharmacology and Related Courses
The Roche Research Institutes of Marine Pharmacology, New South Wales, Australia.	Post Graduates Courses in Marine Biology Ocean College Zhejiang University, China
Marine Biotechnology Center, University of California, Santa Barbara, USA	Bachelor, Master and Doctoral Programs in Marine Pharmacy, China Pharmaceutical Universities, Nanjing, China
Bachelor Lab University of Connecticut, USA	M.Sc. / Diploma Marine Biotechnology and Biodiversity, Heriot Watt University, Edinburgh, Scotland Bachelor Program in Marine Biology, Heriot Watt University, Edinburgh, Scotland.

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