

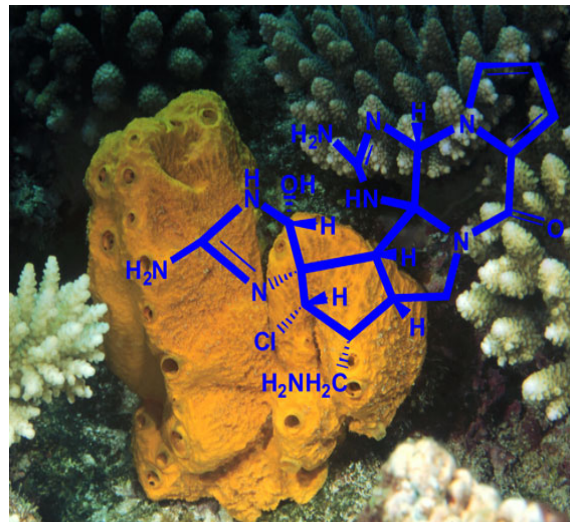


# The MarineQuest Explorer

University of North Carolina Wilmington

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"About 70% of our globe is covered by ocean. It is supposed that only 1% of the microorganisms living in the marine environment have yet been discovered. In the course of evolution, these organisms have adapted excellently to the extreme marine environmental conditions such as high salt concentration, extreme low or high temperature, high pressure and low nutrient concentrations. These extreme conditions require unique adaptation strategies leading to new natural products, which are different to known structures of terrestrial organisms. These new marine products have an enormous potential for different biotechnological applications in industry, medicine and environmental protection." *Extract from Marine Natural Products - Germany 2001. International Symposium of the European Society for Marine Biotechnology.*



[http://oceanexplorer.noaa.gov/explorations/07twilightzone/background/hires/styllissa\\_hires.jpg](http://oceanexplorer.noaa.gov/explorations/07twilightzone/background/hires/styllissa_hires.jpg)

**So, what is marine biotechnology?** Any technological application that uses marine biological organisms at the whole, cell, or molecular level to develop products or processes which serve as solutions to today's problems and advance the understanding and accessibility of marine biological material. Major areas of research focus on **health, food, energy, biosensors and forensics, industrial applications** and **biomimetics**.



exploration

collection

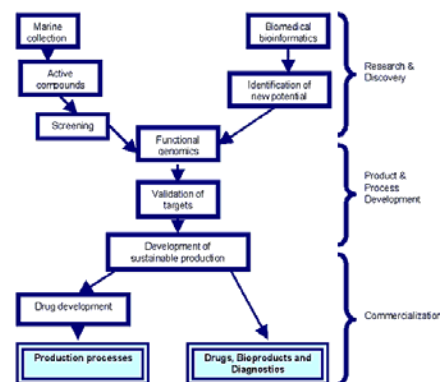
cultivation

isolation

identification

**Challenges to marine biotechnology** include cost and availability of exploratory equipment and collection tools, the natural supply of marine organisms and the ecological impact of harvesting them, the difficulties associated with culturing marine organisms in a sustainable manner, and the state of scientific methodologies used to isolate, identify and synthesize potentially active compounds. Each challenge is part of a **plan of action** that may ultimately lead to commercialization.

**The Business of Marine Biotechnology** involves a somewhat controversial partnership between academia, industry and business. Academic scientists are involved in the exploration and discovery phase, supported by an industrial research and product/ process development phase, finally leading to the commercialization phase with business partners.



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**Focus on Health:** a wide variety of marine invertebrate and microbial organisms produce compounds that are being developed into pharmaceuticals and nutraceuticals, including compounds that can be used in the treatment of tumors, cancers, skin and respiratory diseases. <http://www.newswise.com/articles/view/544930/?sc=rssn>

**Focus on Food:** the main thrust of food research involves mariculture and seafood by-product development. <http://www.ars.usda.gov/is/AR/archive/apr07/fish0407.pdf>

**Focus on Energy:** photosynthetic microalgae are being cultured to provide lipids for biodiesel fuel production. A new photobioreactor is being built in Southeastern North Carolina. [http://www.wwaytv3.com/video/students\\_working\\_to\\_produce\\_biodiesel\\_from\\_algae/06](http://www.wwaytv3.com/video/students_working_to_produce_biodiesel_from_algae/06)

**Focus on Biosensors & Forensics:** are being used to detect specific toxins, such as those produced by harmful algal blooms, and biomarkers, such as DNA from endangered species, used to prosecute poachers. <http://www.magazine.noaa.gov/stories/mag110.htm>

**Focus on Industrial Applications:** antifouling agents, extreme adhesives, oil eating bacteria, and fluorescent tracers are just a few products developed from marine organisms. <http://www.biotech.seagrant.org/achievmnts/agric.htm>

**Focus on Biomimetics:** The science of biomimetics can be described as the abstraction of good design from nature. Another way to define it would be the intentional imitation of nature. The goal of this scientific field is to identify specific desirable qualities and attributes in biological systems and then use them in the design of new products. The application of biomimetics to marine organisms has led to many amazing discoveries and product development:

<http://www.biomimicryinstitute.org/>

[http://www.time.com/time/specials/2007/article/0,28804,1663317\\_1663319\\_1669888,00.html](http://www.time.com/time/specials/2007/article/0,28804,1663317_1663319_1669888,00.html)

<http://edition.cnn.com/2008/TECH/science/07/04/janine.beyusbio/index.html>

[http://www.ted.com/index.php/talks/janine\\_benyus\\_shares\\_nature\\_s\\_designs.html](http://www.ted.com/index.php/talks/janine_benyus_shares_nature_s_designs.html)

<http://www.marinebiotech.org/biomimetics.html>

<http://ngm.nationalgeographic.com/video/player?titleID=1456277236>

<http://ngm.nationalgeographic.com/print/2008/04/biomimetics/tom-mueller-text>

<http://www.biomimicryinstitute.org/home-page-content/home-page-content/biomimicking-sharks.html>

<http://www.biopowersystems.com/>

[http://www.sciencedaily.com/videos/2005/0909-unbreakable\\_glass.htm](http://www.sciencedaily.com/videos/2005/0909-unbreakable_glass.htm)

**To learn more about marine biotechnology visit these informational websites:**

<http://www.marinebiotech.org/marinebiotech.html>

<http://www.biotechinstitute.org/>

<http://www.biotech.seagrant.org/reasons.html>

<http://www.umbi.umd.edu/comb/home.php>

[http://www.oar.noaa.gov/oceans/t\\_biotech.html](http://www.oar.noaa.gov/oceans/t_biotech.html)

<http://cmbb.ucsd.edu/>

**Lesson Plans and Reading Material:**

[http://www.biotechinstitute.org/resources/pdf/yw7\\_2.pdf](http://www.biotechinstitute.org/resources/pdf/yw7_2.pdf)

<http://www.marine.usf.edu/piocean/packets/sp01/sp01u7p2.pdf> (p7-8)

[http://oceanservice.noaa.gov/education/classroom/lessons/05\\_oe\\_molecular.pdf](http://oceanservice.noaa.gov/education/classroom/lessons/05_oe_molecular.pdf)



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