

AN AQUATIC PHARMACY: THE BIOMEDICAL POTENTIAL OF THE DEEP SEA

BY SARA MAXWELL

DEEP-SEA ORGANISMS HAVE UNIQUE ADAPTATIONS *that enable them to survive in cold, dark, and highly pressurized environments. As a result of these unique environments, deep-sea species often produce chemical compounds not found in their shallow-water or tropical counterparts that aid in their defense and survival in the deep sea. Compounds that protect corals and sponges from predation can also protect humans from a variety of ailments such as cancer, Alzheimer's disease, and even pain (Newman and Cragg, 2004).*

Two compounds isolated from deep-sea sponges are in human clinical trials, and several other promising compounds and applications, resulting from research on deep-sea sponges and corals, are in early stages of development:

- **Discodermolide.** Scientists from Harbor Branch Oceanographic Institution isolated discodermolide from the sponge *Discodermia dissolute* found off the coast of the Bahamas in water over 460 feet (140 m) deep. Discodermolide recently completed the early stages of clinical trials and is one of the most exciting compounds to date because it may treat cancers which were resistant to other drugs (Ter Haar et al., 1996).
- **E7389.** This compound comes from the sponge *Lissodendoryx* sp., which lives in New Zealand waters at depths of 330 feet (100 m). E7389 is being tested for the treatment of lung cancer and other cancers and is currently undergoing the early stages of clinical trials (Newman and Cragg, 2004).
- **Dictyostatin-1.** Harbor Branch scientists collected a sponge from the order Lithistida (family Corallistadae) at 1,450 feet (442 m) off the northern coast of Jamaica. Dictyostatin-1 was isolated from this sponge and may be more effective than the very successful anti-cancer drug Taxol (Isbrucher et al., 2003). Harbor Branch researchers are continuing work on this promising substance.
- **Topsentin.** This is one of the only deep-sea compounds that researchers are currently investigating for non-cancer related treatments. Isolated from the sponge *Spongospirites ruetzleri*, which lives at depths of 990-1,980 feet (300-600 m), this compound shows promise as an anti-inflammatory agent to treat arthritis and skin irritations, as well as for the treatment of Alzheimer's disease and to prevent colon cancer (National Research Council, 2002).

- **Bone Grafts.** Doctors have used shallow tropical corals as bone grafts for more than 10 years, but deep-sea species have not been used. Ehrlich and colleagues, however, were recently able to successfully synthesize bone analogs from bamboo corals (family Isididae). Found at depths of more than 3,280 feet (1,000 m), these corals have a skeletal structure and dimensions that are almost identical to bone (Ehrlich et al., 2003).
- **Collagen.** Bamboo corals also contain gorgonin, which closely resembles collagen, an important component of bone. Collagen can be used for controlled release of medicines, as scaffolding for tissue rebuilding and for a variety of other applications. Scientists hope that by understanding how corals form gorgonin, they can create a synthetic collagen-like material under the low temperature and pressure environments that bamboo corals naturally inhabit (Swatschek et al., 2002).

The deep sea will continue to be a valuable resource for human medical applications. Destructive fishing practices such as bottom trawling, oil and gas exploration, and other threats to this aquatic pharmacy are endangering this resource before its full life-saving potential can be realized.

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The deep-water sponge *Discodermia* is now in clinical trials for the treatment of cancer.

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