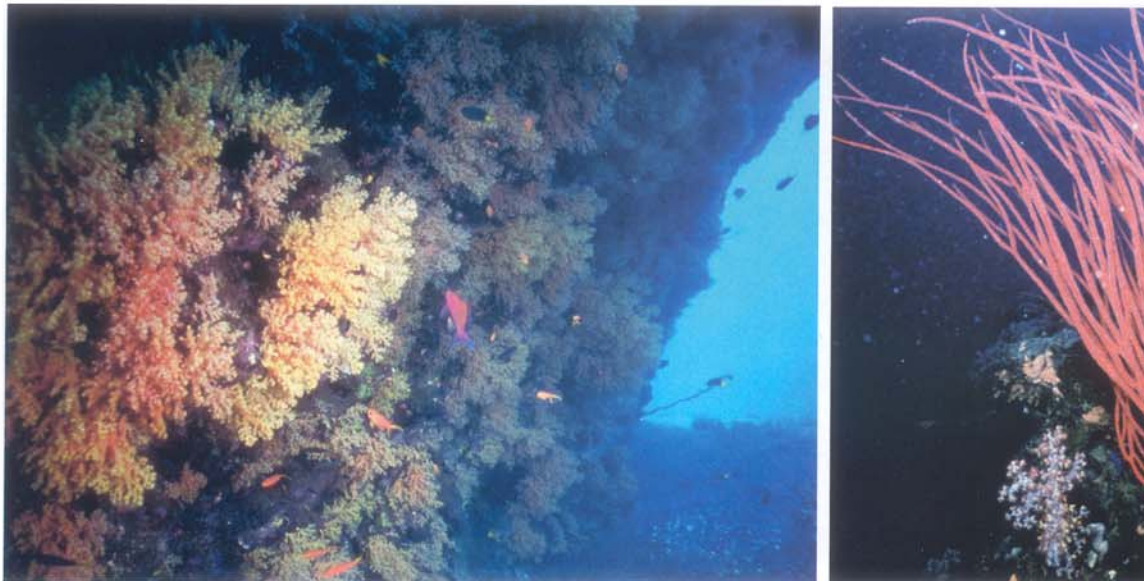


# 3: BEYOND THE SEA



"Discovery," observed the Nobel Prize winning chemist, Albert Szent-Gyorgi, "consists in seeing what everyone else has seen and thinking what no one else has thought." For a handful of highly adventurous scientists seeking to unlock the treasure chest of new chemical substances hidden in the world's oceans, these words are their daily bread. Where most of us view seaweeds on beaches as sea garbage, algae on rocks as just slime, or muck at the bottom of the ocean as, well, just muck, these dedicated biological and chemical oceanographers know better. For it is here, in the dark, watery places most of us instinctively shun, that the next generation of cancer cures, immune system boosters, antibiotics and anti-inflammatories are likely to be found. And the cosmetic industry, with its relatively low barriers to entry—compared to the time, money and patience needed for developing drugs—is among the first to reap the rewards of their labor.

"The average person thinks of the bottom of the ocean as a dark, cold and nasty place that is irrelevant, but we've shown that this environment may be a huge resource for new antibiotics and drugs for the treatment of cancer," said William Fenical, director of the Center for Marine Biotechnology and Biomedicine at Scripps Institution in La Jolla, California. It was Fenical's research in the 1990s with Robert Jacobs, a professor of pharmacology at UC Santa Barbara, that led to the development

of Sea Whip (*pseudopterogorgia elisabethae*) extract, a potent anti-inflammatory and probable wound healing agent from a feathery Caribbean coral that resembles shrubbery resting on the ocean floor. Sea Whip packs more anti-inflammatory clout than hydrocortisone; a mere 0.06 percent of the extract neutralizes 90 percent of phospholipase A2 (PLA2), a naturally-occurring enzyme in the body that leads to the pain and swelling seen with acne, skin sensitivity, chemical-induced irritation, sunburn and aging. First brought to market by Estée Lauder, the ingredient from Lipo Chemical in Paterson, New Jersey, is now widely used in skin care. Pseudopterrosin, Sea Whip's active compound, is currently under review as a new drug for the treatment of arthritis, burns, psoriasis and contact dermatitis.

## Exploring the Ocean's Diversity

With so much diversity in the oceans, how do scientists know which organisms are the likely candidates with cosmetic benefits? The key is observing how different species survive their environments. "The nature of algae allows them to adapt to changes in temperature, dehydration and intense exposure to UV-radiation," explained Romauld Vallee, technical manager for Codif Laboratories, manufacturers of bioactive algae extracts, located in Saint-Malo, France, and represented in the U.S. by Biosil Technologies in Paterson, New Jersey.

Once relegated to thickening lotions or thinning dimpled thighs, seaweeds and other fruits of the sea are among the newest entries in the war on aging skin, among other things. **BY REBECCA JAMES GADBERRY**



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Seaweeds live in especially hostile surroundings, part of the time immersed in water, and part exposed to air and sun, with drastic changes in temperature, salinity and mechanical stress caused by standing up to waves and tides. At Codif, researchers explore more than 800 species of seaweed found near the facility, drawing parallels between human skin tissue and the cellular structure of various algae. Chemists select those algae showing the greatest resistance to their environment in hopes they will overcome similar challenges in skin and hair, then subject the seaweed to a patented extraction process that ensures the active ingredients in the seaweed are transferred to the extract. "In vitro and clinical tests have demonstrated the activity of these extracts enabling confirmation of their full scientific dimension and guaranteeing their reliability," said Vallee.

Dermachlorella® (INCI: Water (and) *Chlorella vulgaris* extract) is a protein-rich extract taken from the *Chlorella microalga* that grows on rocks near Codif's coastal laboratory. With a molecular weight low enough to penetrate the skin, a concentration of less than one percent of the extract, which features high doses of the amino acids alanine, glycine and proline, crucial for the production of collagen, is said to stimulate collagen synthesis by two and a half times the normal amount. Dermachlorella also inhibits enzyme destruction of collagen and elastin, a problem that worsens with age, sun exposure and inflammation and contributes to skin sagging, wrinkling and stretch marks.

Phycosaccharides® are produced by Codif from *Laminaria digitata*, a brown seaweed made up of large molecules called polysaccharides. By reducing the size of the polysaccharide and attaching minerals to the shortened molecules, Codif chemists

found they could improve skin penetration. Phycosaccharide anti-acne is combined with zinc to diminish 5-alpha reductase, an enzyme that converts testosterone into dihydrotestosterone, the chemical that worsens acne and male pattern baldness by causing sebum to clog pores and hair follicles. Phycosaccharide anti-age is joined with manganese and magnesium to provide total inhibition of the superoxide anion, the first free radical in the cascade of destructive oxygen radicals that underlay virtually all aging processes and inflammation. Phycosaccharide anti-inflammation reduces stinging from lactic acid and other irritants, and protects epidermal Langerhans cells—skin cells that trigger the immune response, and are destroyed by exposure to UVB rays. By leaving the polysaccharides large enough to remain on the skin's surface, a 2.5 percent level of Phycosaccharide anti-pollution offers total protection from tobacco smoke, 77 percent protection against the pesticide DDT, and 80 percent protection against heavy metals lead and cadmium.

Phillip Rockley, Ltd., a Collaborative Group Company in East Setauket, New York, is also known for its high quality, marine-derived extracts. Sea Parsley™, an extract of the red seaweed, *Rhodophyta*, is grown via a saltwater hydroponic process called "mariphonics." The extract, which is reported to feature a balance of minerals similar to those found in blood plasma, giving it a high affinity to skin, contains "more vitamin C than apples, more zinc than oysters, considerably more iron and potassium than spinach and more vitamin A than tomatoes," according to the company. Studies show the material provides 16 percent better protection from skin redness and 64 percent better skin barrier protection than Sea Whip extract, against which it was measured.



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### Heat Activated Anti-Aging

Not to be ignored is a new area of oceanographic exploration: hydrothermal vents. Discovered in 1979, these geysers form along mid-ocean ridges rife with volcanic activity. Organisms that grow in the rarified ecosystems of hydrothermal vents flourish without the sun's energy. Instead, basking in temperatures that can reach 400°C, they produce energy not from oxygen, as other life forms do, but from hydrogen sulfide that spews from the vent itself.

Sederma Inc., a member of the Croda International Group in Parsippany, New Jersey, produces Venuceane™ (INCI: *Thermus* Ferment (and) glycerin), a heat-activated broad spectrum antioxidant derived from cultures of *Thermus thermophilus*, a hydrothermal organism. Recommended for daily-wear sunscreens, Venuceane displays free radical scavenging abilities similar to native skin enzymes, neutralizing inflammatory superoxides and cell-destructive hydrogen peroxide when exposed to the high temperatures of summer sunlight. Another hydrothermal vent material, Abyssine 657 (INCI: *Alteromonas* Ferment Extract (and) butylene glycol), is offered by Lanatech France via its U.S. representatives, Tri-K Industries in Northvale, New Jersey. Clinical studies show the molecule relieves stinging from lactic acid and other irritants, reduces redness from sunburn and inflammation, and decreases skin irritation in patients taking oral Roaccutane®.

Perhaps the most remarkable of all marine-derived ingredients is photolyase, a DNA-repair enzyme from *Anacystis nidulans* plankton found floating in seas under ozone-depleted skies. Tucked into liposomal microbubbles called Photosomes®, the enzyme is delivered past the skin's surface into sun exposed cells, where it seeks out and repairs damaged DNA before the cell has a chance to replicate and pass on genetic mutations caused by sunlight. While cells can make these repairs on their own within 24 hours, studies conducted by a team of researchers in Germany and the Netherlands showed 40 to 45 percent of

DNA was repaired in 30 minutes with Photosomes. Redness and sunburn cell formation were also prevented.

Photolyase only works when exposed to visible sunlight, making it a valuable addition to sunscreens where photoprotection and repair can occur at the same time. However, it's unsuitable for "morning after" products, since the maximum repair effect is achieved within 30 minutes of light exposure.

Photosomes are made by AGI Dermatics and are represented to the cosmetic industry by Barnet Products in Englewood Cliffs, New Jersey. Besides being offered in sunscreens and daily wear moisturizers, the DNA-repair liposome is going through clinical trials with xeroderma pigmentosum patients, a rare genetic disorder rendering patients extremely sensitive to sunlight and prone to multiple skin cancers. AGI Dermatics is also conducting additional clinical tests for reduction of skin cancer in organ transplant patients and in patients with a history of skin cancer and pre-malignant skin cancer.

### More to Come

Although it seems like the oceans are already offering a medicine chest of cosmeceutical-grade answers for a variety of skin conditions, researchers vow there's much more to come. "There are one million cells in one milliliter of seawater and they are all different, yet we know something about only one or two percent," Scripps' Bill Fenical told *The Scientist* in September, 1999.<sup>1</sup> "The oceans are a huge resource for drugs and other products in agrichemicals and skin care, and we are discovering new things all the time." ■ GCI

<sup>1</sup>Oceans: Medicine Chests of the Future? A.J.S. Rayl, *The Scientist* 13[19]:1, Sep. 27, 1999

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