

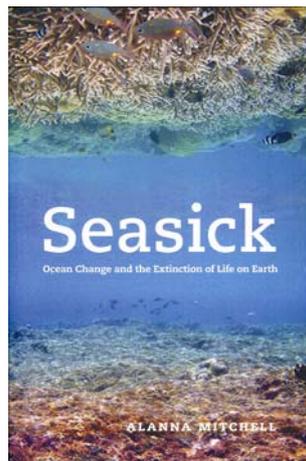
audience is the package – of scientific process, collaborations, authorship issues, politics, intellectual property rights and conflict of interest issues – that the book brings to light. These aspects were, by nature of the company, inherent to its functioning. The book points to the concerns (legal and others) that surrounded the ownership of research funded by a private company but conducted in university laboratories in the late 20th century.

The name ‘Genentech’ was coined by Boyer as an abbreviation for (Gen)etic (En)gineering (Tech)nology. Swanson had recommended a bizarre ‘HerBob’ (Herb from Herbert and Bob was Swanson’s nickname). Genentech survived the struggle that a company’s early years bring about. Not only that, it ventured into an area of science that established companies were hesitant to undertake, and in doing so left a trail for other biotech start-ups to follow. The genes for human insulin, human growth hormone and human interferon were cloned in three successive years. Genentech won the race for cloning these genes against leading academic research groups, and turned out to be a lucrative career option for young scientists. More so because Boyer emphasized that the company must encourage scientific publications, not just patents.

What stands out in the book is Swanson’s perseverance in establishing a start-up in the era of pharma giants. Nearly eight months after the company’s legal on-paper founding on 7 April 1976, when it laid a business plan, ‘It had no laboratories, no research equipment, no scientists of its own, no money for sustained development, no patents or licenses securely in hand, no certainty of the impact of the festering recombinant DNA debate.’ About two years down the line, ‘Genentech had made insulin, *human* insulin.... Two teams of unknowns [young postdocs and graduates] supported by an obscure company [Genentech]...managed to out-compete two elite academic teams [University of California–San Francisco and Harvard University] in making a form of a celebrated hormone.’

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Seasick: Ocean Change and the Extinction of Life on Earth. Alanna Mitchell. The University of Chicago Press, 1427 East 60th Street, Chicago, Illinois 60637-2954, USA. 2011. x + 161 pp. Price: US\$ 18.00.

That we are in the middle of a major environmental crisis is no longer in doubt. Governments, the public, the science community all largely agree that environmental conservation is one of the most significant challenges of the 21st century. However, much of this attention has been focused on terrestrial landscapes. Even climate change, now considered as one of the most pervasive threats, and recognized by even the most blinkered governments, is generally viewed through the lens of its impact on land. How, for example, will sea-level rise affect coasts and people living there? The fact that we live on a planet that is largely water does not enter the conservation consciousness of the public nearly enough. The book under review is an effort to bring to the forefront the human caused ills that are afflicting the world’s seas.

From the Great Barrier Reef in Australia to Panama and Puerto Rico and Zanzibar, Alanna Mitchell travels around the world, exploring a number of nearshore and oceanic habitats with scientific teams that are working on a variety of organisms and ecosystems. She follows their work on human-induced threats, ranging from coral bleaching to ocean acidification to the occurrence of dead zones. She writes with passion about the impacts that ocean change can have on ecosystems, such as the effect of warming on coral reefs which leads to the breakdown of the symbiotic association

between the coral and the algae, resulting in the death or expulsion of the algae, and consequently the death of the corals. Many severe bleaching episodes have now occurred in all major coral reefs across the world in the last few decades.

Mitchell travels with a group of scientists to study the dead zone, also called the blob, in the Gulf of Mexico. Dead zones are low-oxygen zones, that are probably caused by excessive nutrient pollution, from sources like, as in this case, fertilizers. An increase in nutrients causes an increase in cyanobacteria, which die and sink to the bottom and decompose, leading to a decrease in oxygen, and the near complete depletion of fish and other organisms. More than a 400 dead zones are known around the world today.

Ignoring iconic species such as whales and dolphins, sea turtles and sharks, Mitchell instead tells the more obscure stories, those that are in fact more important, more reflective of the health of the ocean, and with greater consequences for the future of the planet, and humanity. One of these is the study of plankton in Plymouth University, UK concerning the fate of coccolithophores, which have become less calcified with increased ocean acidity (though some studies have shown the opposite). Another concerns the rapidly declining trend in fish stocks, with dire predictions of the future of fisheries, made famous by studies from the University of Halifax, Canada.

In order to explore the past, Mitchell also visits the Pyrenees, formed when the Iberian peninsula pushed against Europe. Here, there are records of the Palaeocene–Eocene Thermal Maximum, a period when temperatures and carbon dioxide levels were much higher than they are now, which provides clues into how the earth’s biota responded.

Mitchell’s engagement with the scientists introduces us to their world, not just their passion about science or conservation, but also to their methods and instruments. Meet Scanfish, an instrument that moves through the water column collecting data. And Johnson-Sealink 1, the submersible that goes down to 3,000 ft. Mitchell attempts to make the technical seem fascinating and deconstruct the often arcane methods that we use to arrive at our inferences, and for the large part, succeeds.

Mitchell writes eloquently about her journey to the bottom of the sea, 900 m

BOOK REVIEWS

below the surface. For those of us who have snorkelled or dived using a SCUBA set, 30–40 m below the sea surface is remarkable enough. To go down several thousand metres boggles the mind. Earlier this year, I hitched a ride with Cindy Van Dover, Director of the Duke University Marine Lab in Beaufort, NC, USA. Van Dover is one of the few scientists who pilots her own submersible, and is also the only woman who does so. Van Dover works on hydrothermal vents, on the chemosynthetic ecosystems. On the journey from Durham to Beaufort, she told us about some of her trips to the bottom of the sea, down 4000 m below the surface, including one that lasted 18 h, and another one where they were snagged at the bottom. These scientists and their stories only serve to illustrate how little we know about much of oceanic life, and to affirm in the strongest possible manner that, at best, we are only skimming the surface.

But what is the upshot of all this? Mitchell sends the message for the most part that, due to a variety of human actions, the oceans are sick, or worse, dying. This is non-trivial. As she puts it in the beginning, 'if life on land were to perish, the ocean's creatures would survive'. But not the other way around. As her title suggests, not only have the seas been poisoned, we are on a perilous voyage across a metaphorical ocean that is

going to or has made us very ill. Combined with the fascinating science she describes, and the crusader's passion that the scientists bring to it, this has rather the effect of a horror movie. The content is horrifying, but one cannot take one's eyes off it. In fact, Mitchell's intention is to send the message that, while the global environmental crisis is more alarming than anyone believes, there is hope if public policy would heed the warning signs that are being sent and interpreted by a small band of science brothers.

On the whole, I found the book entertaining, but a bit apocalyptic in its outlook and hyperbolic in its portrayal of science and conservation. The science community in this book comes off looking rather one-dimensional; all her scientists are superheroes, a flattering dimension no doubt, but hardly reflective of the real world of science and its practitioners.

The larger problem is that science and policy are uncomfortable bedfellows. Precious few scientists bring themselves to engage with policy, and when they do, they find that it does not work quite the way their world does. When science does inform policy, it often has as much to do with politics as it does with pure objective knowledge. Indeed, a lot of conservation biologists are ideologues, firmly believing in one model of conservation or another, regardless of their actual

findings. Much of the difficulty and challenge in implementing conservation is reflected in the conflicts and controversies within this group.

Mitchell does poorly in engaging with the social consequences of implementing conservation, in particular responses to alarmist calls such as hers. In a way, this is best reflected in her chapter on China. While pointing out the tremendous environmental impact that China is likely to have, Mitchell also lauds the Chinese state policy towards environmental conservation. However, it is being pointed out increasingly that the cost of the green movement in China is borne mostly by poor economic and marginalized communities, a reflection of a broader global problem. Mitchell's token visit to a poor fishing community in Zanzibar notwithstanding, the social consequences of environmental movements are not addressed with any nuance.

Nevertheless, the book does an outstanding job of highlighting marine ecosystems and their champions, and ocean change that we should all be concerned about.

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