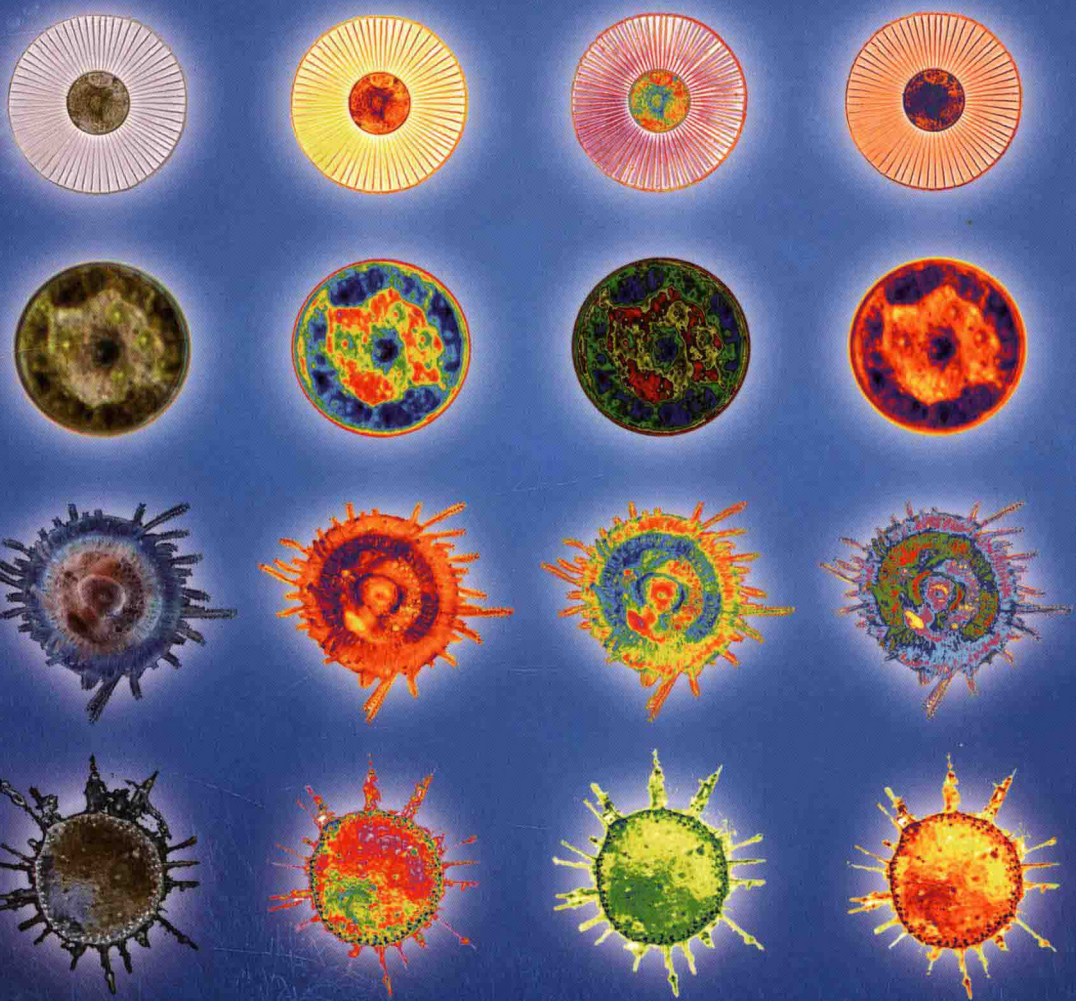
Imaging Marine Life

Macrophotography and Microscopy Approaches for Marine Biology

Edited by Emmanuel G. Reynaud



TARA OCEANS

KahiKai
CONNECT THE OCEANS

WILEY Blackwell

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Macrophotography and Microscopy Approaches for Marine Biology

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Cover

Plankton organisms (diatoms (rows 1–2), hydroid (row 3) and radiolarian (row 4) can be imaged using different techniques and different image processing schemes. The cover shows four different organisms: *Planktoniella sol* (Schütt, 1892; Marquesas Archipelago, Tara Oceans), *Coscinodiscus* sp. (Azores islands, Tara Oceans), *Porpita porpita* (Linnaeus, 1758; North Pacific Ocean; Luis Gutierrez-Heredia, Tara Oceans) and a radiolarian (*Actinomma* sp.; Mediterranean Sea, Tara Oceans). All original colour images were converted to 8-bit then processed using different Look up Tables (LUT) to highlight specific characteristics using NIH ImageJ. Background underwater scene © adimas, fotolia.com

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Preface

The Earth, the Blue planet, is so called because its larger biotope is a vast and deep intertwined blue expanse of salted oceans and seas. The water is filled with billions of organisms which are mainly invisible to the naked eye. These life forms have allowed us to breathe and to conquer the lands. They are our ancestors, our stones, our oils, our food or the food of our food . . . and they may hold the key to our future in these troubled times of climate change.

The idea for this book germinated during an oceanographic survey in the Mediterranean Sea where, as a cell biologist coming out of a high ranked institute of fundamental research, I realized that many imaging techniques including 3D microscopy techniques were not easily available to marine biologists. I came back eager to share my knowledge with this large and amazing scientific community. Many of my friends responded positively and shared the burden of tracking any application of advanced imaging methods in marine biology and I would like to thank them all, in particular Renaud Boistel, who managed a huge crowd of co-authors to give us a wonderful chapter on X-ray related imaging techniques, Stephan Jericho and his colleagues for their patience, Gustaaf Hallegraeff who shared his long-standing experience of Electron Microscopy techniques applied to planktonic species, and finally my students who took some of the burden of collecting information and writing.

This book is not an encyclopaedia of all imaging techniques applied in marine biology. We made a choice and two main factors influenced our choices: three-dimension and promises.

First, water is always a three-dimensional medium that governs marine organisms: their shapes and forms but also, surely, their physiology. And so there is a crucial need to obtain three-dimensional views as this opens ways to deeper approaches: taxonomy, cell biology and *in vivo* biochemistry, fields well established in the medical world. Secondly, because there are so many imaging techniques out there, we had to make choices for this first edition, so we decided to drop the well-established techniques: light microscopy, cytometry . . . and promote less appreciated techniques or emerging ones that often give us a better three-dimensional view of the creatures of the oceans (Optical Projection Tomography, Light Sheet Microscopy etc.) and we made a big effort to make them available.

We believe that these techniques can be highly beneficial to the marine biology community.

However, we provide some basic skills to enable the reader to photograph larger organisms (Chapter IX) and a historical perspective of ocean imagery (Chapter I) as a reminder of where we are coming from to enlighten the path of where we go . . .

This book is an introduction to marine biology imaging methods suitable not only for students wishing to pursue marine biology but also for established researchers eager to extend their knowledge of imaging methods that may improve their current or future research.

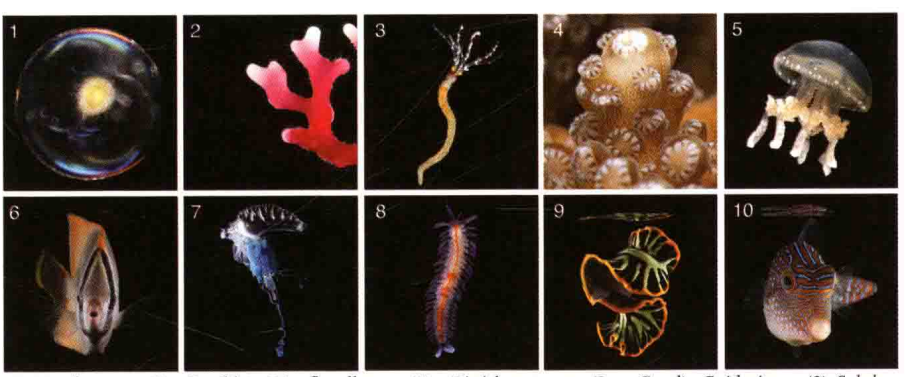
This first book, specifically-designed for the marine biology field, is work in progress. We hope you will find it informative and your feedback is welcome to improve our common knowledge.

Swim long and image well!
Emmanuel G. Reynaud

KahiKai
CONNECT THE OCEANS

Kahi Kai ('one sea' in Hawaiian) is a project born in Hawai'i. Kahi Kai stands for a unique ocean representing all oceans of our planet, which contain an amazing and mostly unknown biodiversity. The mission of Kahi Kai is to raise awareness about our ocean legacy and to appeal to our shared responsibility to preserve the fascinating, mysterious, and highly endangered marine world (www.kahikai.org).

Some of the sea creature portraits featured as chapter openers were taken during the Tara Oceans expedition and are currently part of an itinerant exhibition that can be seen in 2013/2014 in French cultural centers and embassies throughout the world.



(1) *Noctiluca sp.* (Sea Sparkle) - Dinoflagellate, (2) - *Distichopora sp.* (Lace Coral) - Cnidarian, (3) *Sabel - lastarte sp.* (Sabellid worm)- Annelid, (4) *Acropora sp.* (Staghorn coral) - Cnidarian, (5) - *Mastigias sp.* (Lagoon jellyfish) - Cnidarian, (6) *Chaetodon trifascialis* (Chevron butterflyfish) - Vertebrate, (7) *Physalia physalis* (Portugese man o' war) - Cnidarian, (8) *Myrianida sp.* - Annelid, (9) *Pseudoceros dimidiatus* (Divided flatworm) - Platyhelminth, (10) *Canthigaster papua* (Papuan toby) - Vertebrate.

Photo credits: Kahi Kai - (1) Noan le Bescot, (2, 5, 6, 7, 9, 10) Eric Röttinger, (3, 4, 8) Aldine Amiel, (1, 2, 4, 6, 10) Tara Oceans.

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