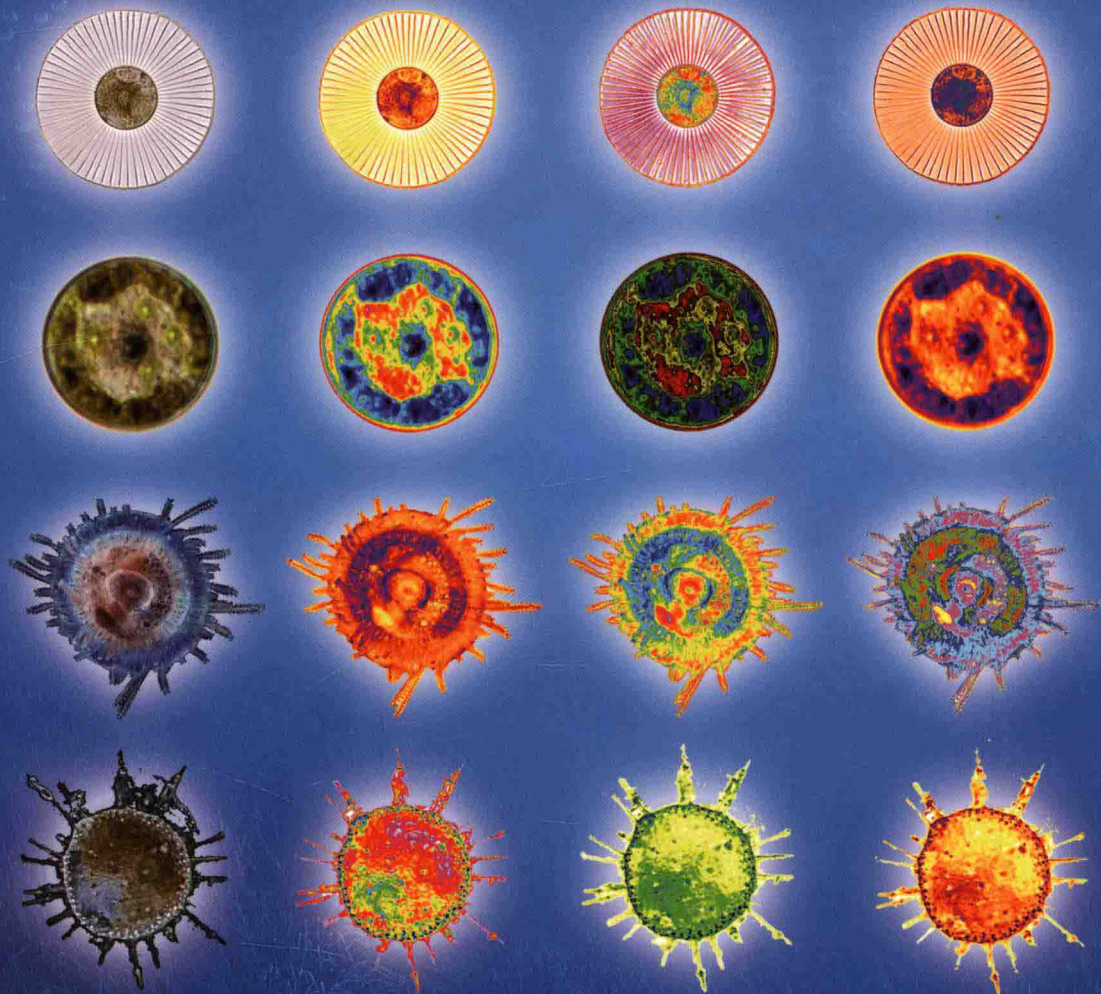


Imaging Marine Life

Macrophotography and Microscopy
Approaches for Marine Biology

Edited by Emmanuel G. Reynaud



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Macrophotography and Microscopy Approaches for
Marine Biology



WILEY Blackwell

The Editor

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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 Image]. 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.

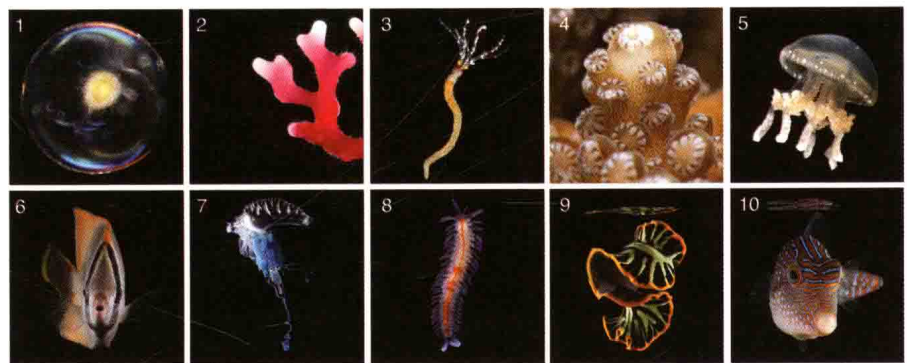
This first book, specifically-designed for the marine biology field, is work in progress. We hope you will find it informative and your feedback is welcome to improve our common knowledge.

Swim long and image well!
Emmanuel G. Reynaud



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) *Sabellastarte* 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* (Portuguese 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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Contents

Preface XIII

List of Contributors XVII

1	Under the Eye of Neptune: An Historical Perspective of Marine Creature Imagery	3
	<i>Emmanuel G. Reynaud</i>	
1.1	Introduction	3
1.2	Ancient Uses of the Oceans	5
1.2.1	Seafarers	5
1.2.2	The Mediterranean Sea: the cradle of marine biology	6
1.2.2.1	Aristotle and Pliny the Elder, the Founding Fathers	6
1.2.2.2	Understanding the Oceans	7
1.3	From Neptune to Animalcules	8
1.3.1	Age of European Discovery and Exploration	8
1.3.2	Voyages of Exploration and finally Science	9
1.3.3	A Glimpse at the Invisible	9
1.4	The Birth of Oceanography (The Nineteenth Century)	10
1.4.1	Drawing the Jellyfish	10
1.4.2	The H.M.S. Challenger Expedition	11
1.4.3	Stations and Institutions	14
1.5	The Twentieth Century: Institutions and moving images	15
1.5.1	New tools – new images:	15
1.5.2	Jean Painleve	16
1.5.3	The Writers and the Explorers	16
1.5.4	The Future	18
1.6	Time Line of Ocean Imagery	18
	Further Reading	20
	Basic Texts	20
	Source Books	20
	Ships and Expeditions	21
	Institutions	21

2	New Solutions in Underwater Imaging and Vision Systems	23
	<i>Francisco Bonin-Font, Antoni Burguera, and Gabriel Oliver</i>	
2.1	Introduction	23
2.2	Underwater Optical Image Formation	25
2.3	Illumination Techniques	27
2.3.1	Illumination Sources	27
2.3.2	Selection of the Light Source Position	28
2.3.3	Illuminating Systems	30
2.4	Laser-Based Techniques	32
2.4.1	Laser Range-Gating (LRG) Methods	32
2.4.2	Laser Line Scan (LLS) Methods	33
2.4.3	Scattered Light Rejection Using Modulation/Demodulation Techniques	33
2.5	Underwater Imaging Infrastructures	34
2.6	Image Improvement via Polarization	35
2.6.1	Extended Range Using Polarization	36
2.6.2	Housing	36
2.6.3	Experimental Evaluation	37
2.7	A Vision System for Underwater Applications	39
2.7.1	The Fugu Vision System	40
2.8	Conclusion	42
	Acknowledgements	44
	References	44
3	Holographic Microscopy of Marine Organisms	49
	<i>Stefan K. Jericho, Manfred H. Jericho, and Hans J. Kreuzer</i>	
3.1	Introduction	49
3.2	Advantages of Holographic Microscopy	50
3.3	Past Attempts to Image Microplankton	51
3.4	Point Source Digital In-Line Holographic Microscopy	54
3.4.1	Instruments	55
3.4.2	Image Reconstruction	56
3.4.3	Image Examples	58
3.4.4	Resolution	60
3.4.5	Volume Imaging Challenges	63
3.5	Future Outlook	64
	References	65
4	Confocal Laser Scanning Microscopy – Detailed Three-Dimensional Morphological Imaging of Marine Organisms	69
	<i>Jan Michels</i>	
4.1	Introduction	69
4.2	Technical and Methodological Aspects of Confocal Laser Scanning Microscopy	69

4.3	Prerequisites for Generating High-Quality Confocal Laser Scanning Micrographs	73
4.4	Using Autofluorescences for Detailed Three-Dimensional Morphological Imaging	76
4.5	Application of Fluorescence Dyes	80
4.6	Surface Topography Analyses	85
4.7	Future Perspectives	88
	Acknowledgements	89
	References	89

5	Optical Projection Tomography	93
	<i>Karl Gaff, Luke McCormac Parker, Dee Lawlor, and Emmanuel G. Reynaud</i>	
5.1	Introduction	93
5.2	What Is Optical Projection Tomography?	94
5.2.1	Assembly of an OPT System	98
5.2.1.1	Detection Unit	98
5.2.1.2	Illumination Units	98
5.2.1.3	Sample Manipulation Unit	98
5.2.2	Illumination Sources	99
5.2.3	System Capabilities and Limitations	99
5.3	Comparison with Other 3D Microscopy Techniques	100
5.3.1	Confocal Microscopy	101
5.3.2	Two-Photon Microscopy	102
5.4	Sample Preparation	102
5.5	Image Processing and Analysis	104
5.6	Marine Biology Applications	104
	Acknowledgments	108
	References	108

6	Electron Microscopy Techniques for Imaging Marine Phytoplankton	111
	<i>Gustaaf Hallegraeff</i>	
6.1	Introduction	111
6.2	Collecting and Processing Specimens	112
6.3	Light Microscopy	113
6.4	Sediment Cyst Surveys	113
6.5	Transmission Electron Microscopy	114
6.6	Scanning Electron Microscopy	116
	Acknowledgements	121
	References	121

7	Looking Inside Marine Organisms with Magnetic Resonance and X-ray Imaging 123
	<i>Irene Zanette, Gheyleen Daghfous, Timm Weitkamp, Brigitte Gillet, Dominique Adriaens, Max Langer, Peter Cloetens, Lukas Helfen, Alberto Bravin, Françoise Peyrin, Tilo Baumbach, Jean-Michel Dischler, Denis Van Loo, Tomas Praet, Marie Poirier-Quinot, and Renaud Boistel</i>
7.1	Introduction 123
7.2	Magnetic Resonance Imaging 124
7.2.1	Experimental Setup 124
7.2.2	Hardware Improvements 128
7.2.3	Contrast 128
7.2.4	Applications 129
7.2.4.1	Anatomical MRI 129
7.2.4.2	Functional MRI 129
7.2.4.3	Diffusion Tensor Imaging or Diffusion MRI (DTI) 129
7.2.4.4	MEMRI or Manganese-Enhanced Magnetic Resonance Imaging 131
7.3	X-Ray Microtomography 132
7.3.1	Sources 133
7.3.1.1	Laboratory-Based Setups 133
7.3.1.2	Synchrotron-Based Setups 135
7.3.2	Sample Stage 138
7.3.3	Detector 138
7.3.4	Forward Problem (Contrast Formation) 140
7.3.5	Tomographic Reconstruction 142
7.3.5.1	2D Filtered Back-Projection 142
7.3.5.2	Image Quality and Artifacts 144
7.3.5.3	3D Image Reconstruction 145
7.4	Synchrotron laminography 146
7.4.1	Introduction 146
7.4.2	Image Reconstruction 149
7.4.3	Example Applications 151
7.5	Absorption Imaging 151
7.5.1	Natural Contrast 151
7.5.2	Staining Contrast 152
7.6	Phase-Contrast Imaging 155
7.6.1	Introduction 155
7.6.2	Free-Space Propagation Methods (Holotomography) 157
7.6.3	Analyzer-Based Imaging 160
7.6.3.1	Applications 161
7.6.4	X-Ray Grating Interferometry 162
7.6.4.1	Introduction 162
7.6.4.2	Performance Characteristics and Applications 165
7.7	Applications (Post-treatment) 166
7.7.1	Segmentation – Visualization Methods 166