

Decompression Sickness

Volume 1

The Biophysical Basis of Prevention and Treatment

B. A. Hills

*Professor of Physiology and Chief
Hyperbaric Physiology Section of the Marine Biomedical Institute
University of Texas Medical Branch, Galveston*

A Wiley-Interscience Publication

0112008



Albrecht Salm
Master Scuba Diver Trainer
PADI MSDT # 33913

A large, stylized handwritten signature in black ink, appearing to be 'AS'.

JOHN WILEY & SONS

Chichester • New York • Brisbane • Toronto

Contents

Preface	vii
List of Symbols	ix
1 Introduction	1
Diving	1
Caisson and Tunnel Work	10
Hyperbaric Therapy	12
Altitude Ascent	15
Elements of Physiological Transport	18
The Gas Tension	23
2 The Decompression Syndrome	29
Symptomatology of Inadequate Decompression	30
Environmental Parameters	34
Individual Factors and Susceptibility	41
Exercise	45
3 The Mechanism	48
The Primary Event	48
The Critical Insult	52
Limb Bends	54
Type II Decompression Sickness	60
Other Symptoms	68
Recommendations for Prevention	74
4 Gas Separation	76
Nucleation	76
Bubble Inception	81
Bubble Growth	90
Coalescence	95
Phase Equilibrium	100
5 Prevention	105
Natural Inhabitants of the Ocean	105
Decompression Methods and the Diving Tables	107
The 'Haldane' Method	110
Models	122
Decompression Meters	127
Pharmacological Approaches to Prevention	134

6	Supersaturation versus Phase Equilibration	136
	The Vital Issue	137
	Direct Detection of Sub-symptomatic Bubbles	139
	Indirect Methods	151
	Practical Experience	161
7	Other Vital Issues	167
	Diffusion versus Blood Perfusion	167
	Diffusion Times	181
	Decompression Studies	187
	The Critical Tissue(s)	190
8	Treatment and General Hyperbaric Limitations	195
	Dysbaric Osteonecrosis	195
	Other Diving Limitations	204
	Hyperbaric Phenomena	208
	Oxygen Toxicity	217
	Treatment of Decompression Sickness	228
9	Thermodynamic Decompression	235
	The Model	235
	The Inherent Unsaturation	239
	Quantitative Description	243
	Qualitative Assessment of the Model	248
	Quantitative Assessment	251
	Decompression Optimization	253
	References	263
	Appendix	291
	Index	309