

Exercise and Sport Science

EDITED BY

WILLIAM E. GARRETT, JR.

AND DONALD T. KIRKENDALL



LIPPINCOTT WILLIAMS & WILKINS

Contents

Contributing Authors	xi
Preface	xix

Part One: Energy Metabolism

1	Carbohydrate Metabolism and Exercise	1
	<i>Mark Hargreaves</i>	
2	Fat Metabolism	9
	<i>Kevin Allen Jacobs, David Richard Paul, and W. Michael Sherman</i>	
3	Protein Metabolism During Exercise	19
	<i>Peter W. R. Lemon</i>	

Part Two: Physiology of Exercise

4	Measurement of Work and Power in Sport	31
	<i>Jay T. Kearney, Kenneth W. Rundell, and Randall L. Wilber</i>	
5	Physiology of Intermittent Exercise	53
	<i>Jens Bangsbo</i>	
6	Nature of Training Effects	67
	<i>Atko Viru and Mehis Viru</i>	
7	Fatigue from Voluntary Motor Activity	97
	<i>Donald T. Kirkendall</i>	

Part Three: Systemic Exercise

8	Cardiovascular Responses to Exercise and Training	107
	<i>Barry A. Franklin</i>	
9	Pulmonary Responses to Exercise and Training	117
	<i>Dale D. Brown</i>	
10	Endocrine Responses to Exercise and Training	135
	<i>Robert G. McMurray and Anthony C. Hackney</i>	
11	Muscular Responses to Exercise and Training	163
	<i>Robert S. Staron and Robert S. Hikida</i>	
12	Exercise, the Immune System, and Infectious Disease	177
	<i>David C. Nieman</i>	

13	Exercise and Gastrointestinal Function	191
	<i>Michiel A. van Nieuwenhoven, Fred Brouns, and Robert-Jan M. Brummer</i>	
14	Renal Responses to Exercise and Training	217
	<i>Gilbert W. Gleim</i>	
15	Skeletal Responses to Exercise and Training	227
	<i>Diane M. Cullen, Urszula T. Iwaniec, and M. Janet Barger-Lux</i>	
16	Skin Responses to Exercise and Training	239
	<i>Dean L. Kellogg, Jr., and Pablo Pérgola</i>	
17	Molecular Biology of Exercise	251
	<i>James A. Carson and Frank W. Booth</i>	

Part Four: Applied Topics

18	Individual Assessment of the Aerobic-Anaerobic Transition by Measurements of Blood Lactate	267
	<i>Axel Urhausen, Bernd Coen, and Wilfried Kindermann</i>	
19	Exercise for Successful Aging	277
	<i>William J. Evans</i>	
20	Effects of Air Pollutants on Exercise	285
	<i>Lawrence J. Folinsbee</i>	
21	Free Radicals and Antioxidants in Exercise and Sports	299
	<i>Li Li Ji</i>	
22	Body Composition in Sports: Measurement and Applications for Weight Loss and Gain	319
	<i>Richard A. Boileau and Craig A. Horswill</i>	
23	Exercise Science and the Child Athlete	339
	<i>Thomas W. Rowland</i>	
24	Chronobiology and Physical Performance	351
	<i>Thomas Reilly, Greg Atkinson, and Jim Waterhouse</i>	
25	Ergogenic Aids for Improved Performance	373
	<i>Melvin H. Williams and J. David Branch</i>	
26	Physical Exercise in Hot and Cold Climates	385
	<i>Michael N. Sawka and Andrew J. Young</i>	
27	Exercise-Induced Muscle Injury and Inflammation	401
	<i>Lucille L. Smith and Mary P. Miles</i>	
28	Fluids and Electrolytes During Exercise	413
	<i>Ronald J. Maughan, Susan M. Shirreffs, and John B. Leiper</i>	
29	Growth, Maturation, and Performance	425
	<i>Robert M. Malina</i>	
30	The Effects of Hypo- and Hyperbaria on Performance	447
	<i>Robert F. Chapman and Benjamin D. Levine</i>	
31	Effects of Microgravity on Exercise Performance	459
	<i>Victor A. Convertino</i>	

32	Enhancing Exercise Performance: Nutritional Implications	471
	<i>Jeff S. Volek</i>	
33	Overtraining and Overreaching: Causes, Effects, and Prevention	487
	<i>Laurel T. Mackinnon and Sue L. Hooper</i>	
34	Periodization of Training	499
	<i>David G. Rowbottom</i>	

Part Five: Sports Biomechanics

35	Biomechanics of Cycling	515
	<i>Robert J. Gregor</i>	
36	Biomechanics of Landing	539
	<i>Kathy J. Simpson, Teri Ciapponi, and He Wang</i>	
37	Biomechanics of Kicking	551
	<i>William R. Barfield</i>	
38	Biomechanics of Overhead Sports	563
	<i>Glenn S. Fleisig, Eugene G. Jameson, Charles J. Dillman, and James R. Andrews</i>	
39	Biomechanics of Powerlifting and Weightlifting Exercises	585
	<i>Rafael F. Escamilla, Jeffrey E. Lander, and John Garhammer</i>	
40	Biomechanics of Alpine and Nordic Skiing	617
	<i>Serge P. von Duillard, Kenneth W. Rundell, Bernard Bilodeau, and David W. Bacharach</i>	
41	Biomechanics of Swimming	639
	<i>Huib M. Toussaint, A. Peter de Hollander, Coen van den Berg, and Andrei R. Vorontsov</i>	
42	Biomechanics of Walking and Running	661
	<i>Philip E. Martin and David J. Sanderson</i>	
43	Biomechanics of Ice Hockey	675
	<i>David J. Pearsall, René A. Turcotte, and Stephen D. Murphy</i>	

Part Six: Applied Sports Physiology

44	Physiology of Alpine Skiing	695
	<i>Robert A. Hintermeister and Gene R. Hagerman</i>	
45	Physiology of Baseball	709
	<i>Kevin E. Wilk</i>	
46	Physiology of Basketball	733
	<i>Jay R. Hoffman and Carl M. Maresch</i>	
47	Physiology of Canoe Sport	745
	<i>Jay T. Kearney and Donald C. McKenzie</i>	
48	Physiology of Cycling	759
	<i>Edmund R. Burke</i>	
49	Physiology of Dance	771
	<i>Lynn A. Darby</i>	

50	Physiology of Figure Skating	785
	<i>Edward T. Mannix, Pieter Kollen, and Mark O. Farber</i>	
51	Physiology of American Football	795
	<i>William J. Kraemer and Lincoln A. Gotshalk</i>	
52	Physiology of Ice Hockey	815
	<i>David L. Montgomery</i>	
53	Physiology of Cross-Country Skiing	829
	<i>Martin D. Hoffman, Philip S. Clifford, and Steven E. Gaskill</i>	
54	Physiology of Competitive Rowing	843
	<i>Fredrick C. Hagerman</i>	
55	Physiology of Soccer	875
	<i>Donald T. Kirkendall</i>	
56	Physiology of Speed Skating	885
	<i>Carl Foster, Jos J. deKoning, Kenneth W. Rundell, and Ann C. Snyder</i>	
57	Physiology of Swimming	895
	<i>Rick L. Sharp</i>	
58	Physiology of Racquet Sports	905
	<i>T. Jeff Chandler</i>	
59	Physiology of Triathlon	919
	<i>David S. Rowlands and Brendon Downey</i>	
60	Physiology of Weight Lifting	941
	<i>Michael H. Stone and Kenton B. Kirksey</i>	
61	Physiology of Wrestling	955
	<i>Craig A. Horswill</i>	
	Subject Index	965