CONTENTS

Contributors *xvi*
Preface *xxiv*
Foreword *xxvii*

Introduction **1**
Samantha J. Stear, Hans Braun and Kevin Currell

Nutritional Supplements in Sport, Exercise and Health: An A–Z Guide **41**

Amino acids 43
Arash Bandegan, Linda M. Castell and Peter W.R. Lemon

γ–aminobutyric acid (GABA) 46
Romain Meeusen and Bart Roelands

Androstenedione ('Andro' or 'DIONE') 47
Gregory A. Brown, Matthew D. Vukovich and Douglas S. King

Antioxidants 48
Andreas N. Kavazis and John C. Quindry

Arginine 53
Robert R. Wolfe and Eric A. Newsholme

Arnica 54
Edzard Ernst

Aspartame 55
Peter J. Rogers

Aspartate and asparagine 56
François Trudeau and Rui Curi

D-aspartic acid (D-AA) 57
Jason C. Siegler and Geoffrey W. Melville

Bee pollen 58
Stephen Gurr

β-alanine and carnosine 59
Craig Sale and Roger C. Harris

Boron 61
Nigel Mitchell and Joseph Lockey

Branched chain amino acids 62
Eva Blomstrand

Caffeine 64
Louise M. Burke and Lawrence L. Spriet

Calcium 68
Linda K. Houtkooper and Melinda M. Manore

Carbohydrates 72
Ronald J. Maughan and Louise M. Burke

L-carnitine 78
Francis B. Stephens and Paul L. Greenhaff

Chinese herbs 80
David S. Senchina

Chlorogenic acids 81
Adrian B. Hodgson

Choline bitartrate and acetylcholine 83
Jeni Pearce

Chondroitin and glucosamine 85
James R. Borchers and Christopher C. Kaeding

Chromium picolinate 87
Eric S. Rawson

Cissus quadrangularis 88
Greg Shaw

L-citrulline 89
Nikki A. Jeacocke, Stephen J. Bailey and Andrew M. Jones

Co-enzyme Q10 91
Björn Ekblom

Colostrum 93
Cecilia M. Shing

Conjugated linoleic acid 95
Philip C. Calder

Copper 97
Nathan A. Lewis

Cordyceps (*Ophiocordyceps*) 98
David S. Senchina

Creatine 99
Jacques R. Poortmans and Eric S. Rawson

Cysteine and cystine 102
Kevin Currell

Cytochrome C 103
Christine E. Dziedzic

Dehydroepiandrosterone (DHEA) 104
Douglas S. King

Dihydroxyacetone phosphate and pyruvate 105
Lawrence L. Spriet

1,3-Dimethylethylamine (DMAA) 107
Ano Lobb

Dimethylglycine 108
James Collins and Joseph Lockey

Echinacea 109
David S. Senchina

Electrolytes 110
Michael F. Bergeron

Ephedra 113
David S. Senchina

Fatty acids 114
Philip C. Calder

Ferulic acid and γ-oryzanol 117
Siobhan Crawshay

Fish oils 119
Philip C. Calder and Martin R. Lindley

Flavonoids 121
David C. Nieman

Folate 126
Melinda M. Manore

Garlic 128
Stéphane Bermon

Ginger 129
David S. Senchina

Ginkgo 130
David S. Senchina

Ginseng 131
David S. Senchina

Glandulars 132
Samantha J. Stear

Glucuronolactone 133
Stéphane Bermon

Glutamine 134
Linda M. Castell, Philip Newsholme and Eric A. Newsholme

Glutathione and glutamate 137
Philip Newsholme and Mauricio Krause

Glycerol 141
Louise M. Burke

Glycine 143
Kevin Currell

Green tea 144
David S. Senchina

Guarana 145
Samantha J. Stear

Histidine-containing dipeptides 147
Inge Everaert and Wim Derave

α-hydroxyisocaproic acid (HICA) 149
Antti A. Mero, Tuomo Ojala and Juha J. Hulmi

β-hydroxy β-methylbutyrate (HMB) 150
Gary Slater

γ-hydroxybutyrate (GHB) and γ-butyrolactone (GBL) 152
Alex D. Popple and Michael J. Naylor

Hydroxycut 154
Ano Lobb and Mark Ellison

Inosine 156
Lars R. McNaughton and David Bentley

Inositol 157
Shelly Meltzer

Iron 158
Peter Peeling and Carmel Goodman

Jack3D 162
Ano Lobb

α-ketoglutarate (AKG) 163
Mayur K. Ranchordas

α-ketoisocaproate (KIC) 165
Mayur K. Ranchordas

Ketone bodies 166
Pete J. Cox and Kieran Clarke

Lecithin 170
Mayur K. Ranchordas

Leptin 171
José A.L. Calbet

Leucine 173
Eva Blomstrand

Linoleic acid 175
Philip C. Calder

γ-linolenic acid 176
Philip C. Calder

α-lipoic acid 177
Karlien Smit and Shelly Meltzer

Magnesium 178
Frank C. Mooren

Medium-chain triglycerides (MCT) 180
Louise M. Burke

Melamine 182
David S. Senchina

Melatonin 183
James C. Miller

Methionine 185
Nicholas A. Burd

Methylsulphonylmethane (MSM) 186
Kate Jackson

Multiple transportable carbohydrates (MTC) 188
Asker Jeukendrup

N-acetylcysteine (NAC) 190
Michael B. Reid

Nitrate 191
Andrew M. Jones

Nootkatone 193
Satoshi Haramizu

Octacosanol and policosanol 194
Mayur K. Ranchordas

Ornithine 196
Kevin Currell

OxyElite Pro 197
Ano Lobb

Pangamic acid 198
Louise M. Burke

Papain 199
Sarah Chantler

Peptides 200
Nicholas A. Burd

Phenylalanine 202
Daniel R. Moore

Phlogenzym and wobenzym 203
Mayur K. Ranchordas

Phosphate 205
Peter Peeling

Phosphatidylserine 207
Nicholas A. Burd

Pinitol 208
Sarah Chantler and Karlien Smit

Plant sterols 209
David S. Senchina

Potassium 210
Nancy M. DiMarco

Prebiotics 212
Nicholas P. West

Probiotics 214
Michael Gleeson

Prohormones 217
Richard Baskerville and Douglas S. King

Proline 219
Malcolm Watford and Linda M. Castell

Protein 220
Stephan van Vliet and Nicholas A. Burd

Pycnogenol 225
Jason C. Siegler

Resveratrol 226
Markus Laupheimer

Rhodiola rosea 227
Mayur K. Ranchordas and David S. Senchina

Ribose 229
Ylva Hellsten

Royal jelly 230
Joseph Lockey

Selenium 231
Nathan A. Lewis

Serine 233
Mhairi Keil

Smilax (Sarsaparilla) 234
David S. Senchina

Sodium 235
Susan M. Shirreffs

Sodium bicarbonate and sodium citrate 237
Lars R. McNaughton and Adrian W. Midgley

Spirulina 240
Adam J. Zemski

Succinate 242
Martin J. Gibala

Sucrose 243
Ros Quinlivan

Taurine 244
Lawrence L. Spriet

Theobromine and theophylline 246
David S. Senchina

Threonine 248
Nicholas A. Burd and Naomi Cermak

Tribulus terrestris 249
David S. Senchina

Tryptophan 250
Takanobu Yamamoto and Linda M. Castell

Tyrosine 252
Romain Meeusen and Bart Roelands

Valine 253
Adrian B. Hodgson

Vanadium 254
Richard Baskerville

Vitamins A, C and E 255
David S. Senchina and Samantha J. Stear

Vitamin B 259
Mayur K. Ranchordas and Shelly Meltzer

Vitamin D 261
D. Enette Larson-Meyer

Vitamin K 266
Sarah L. Booth and Bronwen Lundy

Water (oxygenated) 268
Louise M. Burke

Weight loss supplements: general 269
Samantha J. Stear

Weight loss supplements: herbal 272
David S. Senchina

Wheat germ oil 277
Mayur K. Ranchordas and Samantha J. Stear

Whey protein 279
Nicholas A. Burd

Wolfberry (goji berry) 281
Richard J. Godfrey and David S. Senchina

Yerba maté 282
Samantha J. Stear

Yohimbine 283
Richard J. Godfrey

Yucca 284
Markus Laupheimer

Zinc 285
Patricia A. Deuster

ZMA – zinc magnesium aspartate 288
Adrian B. Hodgson

In practice 290
Louise M. Burke, Samantha J. Stear and Linda M. Castell

Conclusion 304
Samantha J. Stear, Linda M. Castell and Louise M. Burke

References *345*
Index *420*

FIGURES

1	Tag cloud of popular sports nutrition supplements	5
2	An example of popular dietary supplements bought in the UK	6
3	Nutritional supplements containing prohormones, in relation to the total number of supplements purchased in different countries	14
4	Levels of evidence	21 and 306
5	Factors to consider when assessing research on supplements	22
6	Supplement bioavailability	22
7	Evaluating sports performance research	23
8	Factors to control when measuring performance	24
9	Additional factors regarding supplement use	25
10	Latin-square design to investigate the placebo effect of supplements	26
11	Topics covered in BJSM series: A–Z of supplements	30
12	The amino acid composition of myosin	44
13	Caffeine content of common foods, drinks and non-prescription preparations	66
14	Recommended dietary reference intakes for calcium	69
15	Maximal rates of ATP resynthesis from different energy pathways	73
16	Summary of current guidelines for carbohydrate intake by athletes	74
17	Sports supplements containing carbohydrate	77
18	Flavonoid subgroups and food sources	121
19	Influence of flavonoids and flavonoid-rich extracts and products on exercise performance	124
20	ROS/RNS synthesis and the role of endogenous antioxidants	138
21	Glutathione synthesis	139
22	The main chemicals found in guarana seeds	145

23	Characteristics of vitamin groups	255
24	Properties of vitamins A, C and E	256
25	Vitamin D: recommended dietary allowance, dietary sources and signs and symptoms of deficiency and toxicity	262
27	Herbs commonly used as weight loss aids	274
28	Summary of nutrition and training interventions to achieve physiological adaptations underpinning marathon performance	292
29	Summary of race day physiological and nutritional determinates of marathon performance	293
30	Individual responses to caffeine intake	295
31	Individual responses to creatine loading	296
32	Individual response to caffeine supplementation	296
33	40 km time trial performance in 36 cyclists after caffeine intake	297
34	Examples of performance supplement protocols where different interactions between substances have been identified	300
35	Supplements with a 'strongly positive' effect on sports performance at evidence level IV	309
36	Supplements with a 'fairly positive' effect on sports performance at evidence levels IV and III	312
37	Supplements with a 'strongly or fairly positive' effect on health/clinical situations only at evidence level IV	314
38	Supplements with a 'strongly or fairly positive' effect on health/clinical situations only at evidence level III	317
39	Supplements with a 'mixed or no' effect on sports performance and health at evidence level IV	322
40	Supplements with a 'mixed or no' effect on health only at evidence level IV	324
41	Supplements with a 'mixed or no' effect on sports performance and health at evidence level III	325
42	Supplements with a 'mixed or no' effect on sports performance only at evidence level III	327
43	Supplements with a 'mixed or no' effect on health only at evidence level III	329
44	Supplements with a 'mostly no' effect on sports performance and/or health at evidence levels IV and III	333
45	Supplements with a 'strong absence of effect/possible negative effect' on sports performance and/or health at evidence levels IV and III	335
46	Supplements with only the lowest level of evidence at levels II and I	336
47	Supplements with no studies or credible evidence for sports performance or health at evidence levels IV–I	338
48	Supplements assigned to the 'Caution' category	340