Index

Note: page numbers in italics refer to figures; those in bold to tables or boxes. Prefixes are ignored in the alphabetical sequence – thus S-adenosylhomocysteine will be found below adenosine triphosphate.

A-B-C model of behavior 1057–8

aging 654–68
carnitine supplements 399
ergy requirements and 64–5
nutritional epigenetics 20
nutritional status and 654–61
osteoarthritis pathophysiology 835–7
taste and food choices 1033
see also older adults
agouti gene, A* locus 16, 20
agouti viable yellow (A⁺) mouse 16, 20
agricultural biotechnology see biotechnology, agricultural
aguaje fruit 167
AIDS see HIV infection/AIDS
air-displacement plethysmography (ADP) 1000, 1003, 1003–4, 1008
alactasia 86
alanine
metabolic studies 50, 51–2
synthesis 72
beta-alanine supplements 681
albumin, serum 658
chronic kidney disease 878, 879
liver disease 890, 891
alcohol (ethanol) 912–38
energy metabolism and 915–17, disease risks 913
alcohol consumption
1270  Index
alcohol dehydrogenase (ADH) 913
genotypes 914
alcoholic liver disease (ALD) 927
S-adenosylmethionine (SAM)/betaine therapy 898–9
cytokine–nutrient interactions 893–4, 894
malnutrition 890–2, 891, 892, 915
methionine metabolism 898, 898
mortality risk 891, 892, 924
nutritional assessment 890, 891
nutritional support 895
zinc deficiency 899, 923
alcoholic myopathy 928
ald/redehydrogenase 2*2 allele (ALDH 2*2) 928
allergens, food see food allergens
allithiamin 272, 273
iso-alloazines 281
Alpha-Tocopherol Beta-Carotene (ATBC) study 995, 1257–8
aluminum
beneficial bioactivity 602
intellectual aging 503
Alzheimer’s disease 662–3
fat-soluble vitamins and 919–20
Alzheimer’s disease
alcoholism
manifestations 913–14
alcohol-related liver disease
akinesia
AICARFT 325
fulfills 313–14
α-amino acid oxime synthase 1242–3
American Dietetic Association (ADA)
ational food consumption surveys 779
American Heart Association (AHA)
American College of Physicians (ACP)
American Diabetes Association (ADA)
gestational diabetes diagnosis 814–15
American Dietetic Association (ADA)
classification of functional foods 783
American Heart Association (AHA)
2020 impact goals 777, 779
diet and lifestyle recommendations 777
Therapeutic Lifestyle Changes (TLC) diet 777
American Time Use Survey (ATUS) 1091, 1102
amiloride 273
amine oxidases, copper-dependent 541
2-amino-3-carboxymuconate-6-semialdehyde (ACMS) 298
amine acids 69–82
branched chain see branched-chain amino acids
conditionally indispensable 72, 72
dispensable (non-essential) 71–2, 72
excessive intake 78
functions 69–71, 70, 72
glucose metabolites involved in synthesis 90
immune function and 701–2
indispensable (essential) 71, 72
infant nutrition 626
requirements 77–8, 78
setting international standards 1141
intestinal synthesis 53, 76
nutritional corollaries 71–3
parenteral nutrition solutions 993, 993
peritoneal dialysis fluids 883
postprandial utilization 73, 74, 75
requirements 76, 76–7, 79
hospitalized patients 984–5
setting international standards 1141
splanchnic/gut utilization 75, 75–6
vitamin B₆-dependent reactions 311, 311–12
para-aminobenzoic acid (PABA) 1040
aminolevulinic acid ribonucleotide (AICARFT) 325
β-amino acid oxidase 313–14
α-amino acid nitrogen, need for preformed 72–3
Amish lethal microcephaly 267, 272
amprolium 273
α-amylase 86
amyloid precursor protein (APP) 545
amylopectin 84
amylose 84
anabolic interventions, chronic kidney disease 883
anabolic steroids, liver disease 895
anaphylactic shock, food allergy 1224–5
anaphylactoid reactions, food 1230
androsterone 1240
lycopene interactions 192
osteoporosis and 835
anemia
of chronic disease (ACD) 511–12
iron deficiency 515–17
hemoglobin thresholds 512
iron deficiency 515–17
megablastic see megaloblastic anemia
microcytic 314
pernicious see pernicious anemia
aneurin 263
angina pectoris, carnitine therapy 400
angiogenesis 1261
angiogenesis
angiogenesis-converting enzyme (ACE) 532
animal models, studying cancer risk 851–2
animal models, studying cancer risk
animal protein, vs plant protein 727, 765
animal source food changes 1153, 1155–6
anorexia
chronic kidney disease 876–7, 883
infection-related 693
liver disease 894
physiological, of aging 658–9
zinc deficiency 528
see also appetite
anorexia nervosa 646
ANTI gene 1243
anthocyanidins 1242
anthocyanidin synthase (ANS) 1242
anthocyanins 1240
absorption and metabolism 421, 423, 423
biofortification of crops 1242–3, 1243
biosynthesis 1242
health benefits 1237
Anthocyanosides, visual function and 970  
anticoagulants, coumarin 230, 233–4, 241  
see also warfarin  
anticluthins 273–4  
Antioxidants in the Prevention of Cataracts (APC)  
Antihistamines 1228  
Antiepileptics  
anticonvulsants 333, 369, 714  
Anticoagulants, coumarin 230, 233–4, 241  
Antibodies 691  
apoE 126  
apoC-II 126  
apoC 126  
apoB-100 (apoB-100) 125, 126  
apoB-48 (apoB-48) 125–6  
apoC-I (apoC-I) 126  
apoC-I (apoC-I) 126  
apoE (apoE) 126  
e4 genotype, dietary fat interaction 30–1  
nutrition interaction 301  
phyloquinone transport 232  
apoptosis 1260–1  
cancer cells 851  
tric entering 528, 529  
apetite  
bioavailability 1051–2  
chronic kidney disease 876–7, 883  
defined 1044  
neurobiology 1034–6  
see also anorexia  
Arabidopsis  
calcium exchanger (CAX) genes 1241–2, 1242  
folate biosynthetic genes 1239, 1240  
glucosinolate biosynthetic genes 1245  
tocopherol biosynthetic genes 1240–1, 1241  
tocopherol over-expressing transgenic 1241  
arachidonic acid (ARA) 119, 121, 133  
biosynthesis 136, 754, 755  
cardiovascular disease and 758–9  
dietary requirements 140  
eicosanoid synthesis 138–9, 700  
infant nutrition 632, 1143  
maternal nutrition 612  
visual function and 971–2  
arginine 72, 73  
blood pressure and 727  
cardiovascular disease and 765  
imune function 701  
ArrayExpress 8  
arsenic 595–6  
arthritis, fatty acid intake and 143  
aspartic acid 72, 76  
aspirin 72, 76  
aspiration pneumonia, enterally-fed patients 990, 991  
assessment, nutritional  
see nutritional assessment  
assisted reproductive technologies (ART),  
egenic changes 19, 21  
Association of Official Analytical Chemists  
(AOAC) method, total dietary fiber 101  
associate conditioning 1044  
astaxanthin 186, 186, 187  
asthma  
food additives inducing 1231  
magnesium supplements 469  
selenium status and 573  
vitamin C and 253  
ataxia with vitamin E deficiency (AVED) 223  
atherosclerosis 745–6  
odolent origins 645  
choline status and 413  
obsesity and 715  
patophysiology 746–8, 747  
preventive effects of carotenoids 193, 195  
risk factors 749, 749–70  
benefits of changes to 750, 751  
grading the evidence 750–1, 752  
micronutrient intakes 751–65  
micronutrient and antioxidant intakes 765–70  
see also cardiovascular disease  
atherosclerotic plaque  
development 746, 747, 748  
rupture 747, 748  
athletes 669–87  
odolent 649  
antioxidants 684  
carbohydrate intake 501, 673–7, 675–7, 679  
eating before/during events 673–9  
energy intake 669–70  
fluid guidelines 678, 678, 679–80, 680, 684  
 optimizing physique 670–2  
physiological limitations 673–9, 674–5  
recovery period 679–80, 680  
sports foods and supplements 681–3, 681, 682–3  
staying healthy/injury free 672–3  
training low 683–4  
vitamin C supplements 698  
athletic performance  
see exercise, performance  
Atkins diet 762, 764, 1061  
ATOX1 protein 543, 543, 544  
ATP (adenosine triphosphate) 58–60  
bationinylination of carboxylases 361  
generation pathways 58  
production from alcohol 916  
ATPases, copper-translocating (ATP7A, ATP7B) 543, 544–5  
ATP-binding cassette (ABC) transporters  
AI (ABCAL), vitamin E efflux 222  
G5 and G8, cholesterol transport 125, 127–8  
atitudes, nutrition, US surveys 1099–100  
Australia  
dietary guidelines 1125, 1126  
nutrient reference values 1112, 1121  
Australian Institute of Sport (AIS) sports supplement guidance 681, 682–3  
autoimmune disease  
niacin and 300, 301–2  
vitamin D status and 698  
avto-inducer AI-2 591  
antomized multiple-pass method (AMP M) 1097  
average nutrient requirement (ANR) 1112, 1114, 1117, 1145  
average requirement (AR) 1112, 1114  
avitin-binding assays, biotin 365  
avoidance diets, food allergies 1228  
Axin²оде locus 20–1  
Bacillus cereus 1208, 1210, 1212  
heral foodborne disease 1208  
edemiology 1212  
pathogenic mechanisms 1210, 1210–11  
bariatric surgery  
dolescents 645  
high alcohol intake after 915  
non-alcoholic steatohepatitis 903  
taste preferences after 1034  
type 2 diabetes 819  
basal ganglia disease, biotin-responsive 267, 272  
basal metabolic rate (BMR) 60, 61  
energy requirements and 1137  
factors affecting 61  
prediction from weight or height 61, 61  
 basal requirements 1118  
basophils, food allergy 1223–4  
Baysian statistics 11–12  
BCCAA branched-chain amino acids 1212  
Bcl-2-associated death promoter protein (BAD) 528, 529  
Bcl-2-associated X protein (BAX) 528, 529
Beaver Dam Eye Study (BDES)  
age-related macular degeneration 959–60, 961–2, 964  
cataracts 943–4, 947–8, 950–1, 953–4  
behavior  
functional analysis (A–B–C model) 1057–8  
nutrition-related, US surveys 1099–100  
see also eating behavior  
behavioral development, iron deficiency and 516  
Behavioral Risk Factor Surveillance System (BRFSS) 1089, 1099, 1102  
uses of data 1087  
behavioral weight-loss programs 1057–70  
adolescents 644–5  
changing eating behavior 1060–1  
changing exercise 1061–3  
history 1057–8, 1058  
maintenance of initial weight loss 1065–6  
media-based interventions 1064–5  
strategies used 1058–60  
support for healthy behavior 1064  
benfotiamine 272, 273  
benzoic acid, metabolomic studies 50, 51  
berberine bridge enzyme 282  
beriberi 261, 262–3, 270–1, 272  
berberine 327, 346, 407  
berinert 261, 262–3, 270–1, 272  
treatment 264–5  
wet 261, 270–1  
beryl 359–74  
beta-glucans 102, 104, 108  
betaine 327, 406  
dietary sources 408  
functions 405  
liver disease 898–9  
betaine aldehyde dehydrogenase 407  
betaine-homocysteine methyltransferase (BHMT) 16, 327, 346, 407  
gene polymorphisms 412  
beta-linked oligosaccharides 100  
beverages  
energy-containing 1046–7  
ports 501  
see also soft drinks; sugar-sweetened beverages  
bicarbonate 681  
biguaneides 820  
bilberries 970  
bile 123  
bilirubin excretion 365  
vitamin A excretion 156  
vitamin E excretion 222  
bile salts 123, 124  
absorption, short bowel syndrome 861  
binge eating, neurobiology 1035–6  
bioactive food components  
assessment of intake 1018  
health-promoting effects see health effects of bioactive components  
influencing cancer processes 844–52, 852  
molecular targets 1259–61, 1260  
plant-derived 1237–8  
biofortification of crops 1242–7  
blood pressure and 726  
trace elements 591–601  
see also specific components  
Bioconductor 11  
biosynthetic impedance analysis (BIA) 1000, 1002, 1008  
chronic kidney disease 879–80  
in disease states 1007  
biofortification, food 1236–54  
esential nutrients 1239–42  
phytonutrients 1242–7  
provitamin A 168–9  
strategies 1238, 1238–9  
see also transgenic plants  
bioinformatics 9–10  
biochemical mismatch concept 1155  
biomarkers  
alcohol abuse 915  
apprize 1051–2  
chronic kidney disease 878–9, 879  
dietary assessment 48–50  
long-term intervention studies 1261–2  
omics tools for identifying 2–3  
predictive, of response to bioactive compounds 1259, 1260  
US surveys 1102  
Biomarkers Consortium 1261–2  
Biomarkers of Nutrition for Development (BOND) 163–4, 166, 174  
biotechnology, agricultural  
effects on food allergenicity 1229  
food biofortification 1236–54, 1240  
bioterrorism 1214  
bioactivated peptides 361, 364  
bioactive components  
see also specific components  
B-lymphocytes 689, 691  
biotin 359–74  
absorption, transport and storage 364–5  
analogs 364  
analytical methods 363–4  
biological functions 361–2  
biosynthesis 360  
biological mismatch concept 1260  
bilirubin 359–74  
serum and urine 365, 366  
sic absorption 366  
urinary excretion 365, 366  
bilirubin-DL-sulfoxides 360, 360  
sodium and urine 365, 366  
biliverdin 361, 364  
deficiency 368  
bilirubin-responsive basal ganglia disease 267, 272  
bilirubin sulfone 360, 360, 366  
bilirubin transporter 364  
deficiency 369  
bilirubinyl peptides 361, 364  

Birth defects  
choline status and 411–12  
folate status and 311, 614  
see also neural tube defects; teratogenic effects  
bisnorbilirubin 360, 360, 365  
bisnorbilirubin methyl ketone (BNBMK) 360, 366  
bisphenol-A, epigenetic effects 21  
bisulfite modification 22, 23  
bitter taste 1028, 1030  
aversion by children 1029, 1033  
blackcurrants 970  
blood, vitamin K deficiency 241  
bleeding  
see also hypertension  
biocytin 361  
biotin sulfone 360, 360  
biotinidase 361, 364  
biotinyl peptides 361, 364  

Blue Mountain Eye Study (BMES)  
age-related macular degeneration 956, 957, 959, 960, 962–3, 963, 965  
cataracts 944, 952, 954, 955  
B-lymphocytes 689, 691  
Bod Pod plethysmograph 1003–4  
blood pressure  
alcohol intake and 725–6, 727, 926  
classification 721, 722  
dietary and lifestyle influences 723–7, 727  
epidemiological metabolomics 51–2  
flavonoids and 425, 726  
magnesium status and 466–7  
measurement 722  
potassium intake and 486, 726  
protein intake and 765  
sodium/salt intake and 51, 477, 725, 727  
target 749  
see also hypertension  
bloodstream infections, parenterally-fed patients 994–5  

Blue Mountain Eye Study (BMES)  
age-related macular degeneration 956, 957, 959, 960, 962–3, 963, 965  
cataracts 944, 952, 954, 955  
B-lymphocytes 689, 691  
Bod Pod plethysmograph 1003–4  
body circumference 1001, 1008  
see also waist circumference  
body composition  
assessment 1000–11  
chronic kidney disease 879–80  
in disease states 1007  
methods 1001–7, 1008  
obesity 710  
older adults 655  
older adults 659  
plasma carotenoid levels and 189  
total body water and 494  

body mass see weight, body  
body mass index (BMI) 59, 709–10  
adolescents 643  
body composition analysis 1001, 1008  
children 711  
dietary fiber intake and 108–9  
hypertension and 723–4, 727  
magnesium status and 468  
as malnutrition indicator 658, 1186  
older adults 655
Index

Campylobacter (jejuni) 1209, 1210, 1212
pathogenesis of disease 1211
temporal trends 1213, 1213
Canada
Guidelines for Healthy Eating 1124–5, 1125
nutrient reference values 1112, 1115–17, 1119
cancer 843–56
alcohol consumption and 927–8
boron status and 592
calcium intake and 441–2
carbohydrate intake and 94
carotenoid intake and 190–2
chemotherapy, carnitine therapy with 400
choline status and 412
developing countries 1159–60
dietary fiber intake and 111–12
fatty acid intake and 143
flavonoid intake and 427
fate status and 332, 847
gene–diet interactions 31, 34, 1258
niacin and 301
obesity and 716
prevention recommendations 846, 852–3
retinoid therapy 172
selenium status and 574–5
selenoprotein genotypes and 579
stem cells 848
studying dietary influences 844–52,
sites of action 851–2,
diversity of foods and constituents 844
assessing exposure 844–5
interindividual variability 845–50
physiological vs pathological 850–1
sites of action 851–2, 852
timing of exposure 845
vitamin B6 status and 316
vitamin C status and 253
vitamin K status and 240–1
see also specific types
Cancer Biomedical Informatics Grid (caBIG) 8
candidate gene approach 28–9
cannabinoids 1035
canthaxanthin 186
chemistry 187
high-dose supplements 194
Ca × P ion product, serum 449–50
capric acid 119
caproic acid 119
caprylic acid 119
carbohydrate-deficient transferrin (CDT) 915
carbohydrates (CHO) 83–96
absorption 87
classification 83–6
definition 1138
digestion 86–7
disease risk and intake 92–4
age-related macular degeneration 967
cardiovascular disease 93, 761–4
energy value 63, 88, 105
fermentation in colon 105
glycemic 85–6
infant formulas 628, 629, 630
loading 673–7, 676
low-availability, sports training 680–3
metabolism 80–90
alcohol-related changes 918–19
effects of dietary fiber 103–4
inborn errors 90
net or impact values 813–14
non-glycemic 85–6
oxidation parameters 59, 60
requirements and recommendations 90–2
athletes 501, 673–8, 675–7, 679
chronic kidney disease 881
Crohn's disease 860
current intakes 92, 92
diabetes mellitus 812–14, 822
establishing international 1138, 1138–9
gestational diabetes 815
infants 625, 626
metabolic syndrome 739–40
weight loss programs 762, 1061
resistant and available 764
safety effects 93, 1045–6
substitutions, in diabetes 813
carbon dioxide production (VCO2) 59, 60
doubly labeled water method 63
α-carboxyethyl hydroxychroman (α-CEHC) 222
γ-carboxyethyl hydroxychroman (γ-CEHC) 222, 223
γ-carboxyglutamic acid (Gla) 230–1, 233, 234
containing bone proteins 236
containing coagulation proteins 234–5
carboxylase activation index 366
carboxylases, biotin-dependent 361, 362
deficiencies 368–9
carboxylyser lipase (CEL) 152
carcinogens, metabolism 851
cardiovascular disease (CVD) 745–805
adolescent origins 645
alcohol consumption and 919, 924–5, 925
calcium intake and 441, 443
carbohydrate intake and 94, 761–4
carnitine therapy 400
carotenoid intake and 194–5
choline status and 412–13
chromium status and 594
copper deficiency 547
definition 748–9
developing countries 1159–60
dietary prevention and treatment 770–89
diabetic patients 821–2
dietary patterns 777–82
drug therapy and 788–9
functional foods 783
guidelines 770–7, 771–80
health claims 783, 784
healthy lifestyle behaviors 786–7
omega-3 fatty acids 141–2, 755–8, 1263
population-based approaches 790
targeting major co-morbidities 783–5
WHO/FAO summary of evidence 783, 785
fatty acid intake and 141–2, 751–61, 1263
fiber intake and 109–10, 763–4
flavonoid intake and 425–6
gene–diet interactions 31, 33–4, 1258
homocysteine hypothesis 331–2, 768
hypertension and 721–2
insulin resistance and 736, 736–7
magnesium status and 465–6, 767
niacin therapy and 301, 769
pathophysiology 746–8, 747
risk factors 749, 749–70
benefits of changes to 750, 751
grading the evidence 750–1, 752
macronutrient intakes 751–65
micronutrient and antioxidant intakes 765–70
obesity-related 714–16, 783–5
vitamin B6 status and 315–16, 768
vitamin C and 253, 769–70
vitamin E intake and 224, 769–70
vitamin K status and 239–40
see also coronary heart disease; peripheral vascular disease; stroke
L-carnitine 391–404
biosynthesis 251, 392, 392–3
chemistry 391, 392
deficiency 395
dietary intake and absorption 391–2
mechanisms of action/biological activity 379, 395, 395–7
metabolism 393, 393–4
requirements 394
supplements 397–9
therapeutic use 399, 400
transport 394
carnitine-acylcarnitine translocase (CACT) 395, 395
γ-carotene monooxygenase 1 (CMO1) 152, 153
β-carotene 186, 187
alcohol interactions 919
analytical methods 151
cataracts and 949, 950–1
chemistry 150, 151, 187
cleavage enzymes 190
gene technology engineered plants 169, 195
high intakes 190
intestinal absorption 152–3
lung cancer and 190–2, 193, 1076
protection against sunburn 194
vitamin A equivalence 188
see also provitamin A
beta-carotene 15,15'-dioxygenase 153–4
carotene monoxygenase 1 (CMO1) 152, 190, 195
gene polymorphisms 153, 190
tissue expression 191
metabolism 406–8
as methyl donor 16, 17, 406–7, 407
overnutrition 412–13
status assessment 409
synthesis 406
toxicity 409, 413
choline acetyltransferase (ChAT) 407
choline dehydrogenase (CHDH) 407, 410
choline kinase 407
choline phosphotransferase (CPT) 407
chromatin 15, 361
chromatin immunoprecipitation (ChIP) assay 4, 22
chromium 593–5
diabetes and 594, 823
dietary guidance 589, 595
esSENTiality status 586–7, 593
infant nutrition 625
insulin sensitivity and 739
chromodulin 593–4
chronic disease
anemia of (ACD) 511–12
carbohydrate intake and 92–4
developing countries 1159–61
fatty acid intake and 141–3, 144
fiber hypothesis 98, 106–12
interventions in humanitarian crises 1193
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
taste perception/food choices and 1028,
fatty acids
absorption 123
β-oxidation 137–8
biosynthesis 135–6, 136
cellular roles 135
chemistry 118–21, 119, 120
conjugated 760–1
dietary requirements 139–41
dietary sources 133–5
fatty acid synthase complex 380, 381
fatty acid synthase 135–6, 136
fatty acid synthase 135–6
fatty acids
fatty streaks
fatty liver
ferric (Fe³⁺) iron 507
ferric reducing ability of plasma (FRA P) 424
ferrin 507
ferroportin (FPN) 509, 510, 511
ferrous (Fe²⁺) iron 507
fetal alcohol spectrum disorders (FASD) 531, 616–17, 929
fetal alcohol syndrome (FAS) 929
fetus
choline supply to 408–9
growth 609, 610
growth restriction epigenetic effects 18–19
folate status and 331
see also low birth weight
macromozia 616
undernutrition epigenetic effects 18–19
impact on adult health 612, 633
fiber
dietary 97–117
adolescent nutrition 642–3
adverse effects 112
analysis in foods 100–2
calcium bioavailability and 439
cardiovascular disease and 109–10, 763–4
composition 85, 98–100
content of foods 92, 101
current intakes 112–13
definition 98, 99–100
disease and 93, 94, 106–12
enteral formula feeds 987
epigenetic influences 19
food sources 99
global trends 1156
insulin sensitivity and 738
obesity, energy intake and 1047
physiologic effects 102–6
recommended intakes 90–1
total 100
type 2 diabetes and 107–8, 817
functional 100
hypothesis, chronic disease 98, 106–12
soluble 101, 101
flavilin, tomato 1246
fibroblast growth factor 23 (FGF23)
foam cells
flush response, nicotinic acid 300
flavonoids
flavonoids 419–33
absorption, metabolism and excretion 421–3, 422, 423
biological effects 423–7
blood pressure and 425, 726
classification and distribution in foods 420, 420–1
see also anthocyanins
flavonols 420
biological effects 425, 427
flavor enhancers 1033
flavorings, allergenicity 1227
Flexible Consumer Behavior Survey 1088, 1099
fluid
compartments 480–1, 481, 494, 494
intake
enterally-fed patients 990
during exercise 678, 678, 684
during exercise 678–90, 680
overload 495, 498
athlete 675, 684
replacement 501–2
see also water
fluoride 596–7
bone health and 596–7, 835
dietary guidance 589, 597
pregnancy and lactation 611
infant nutrition 625
fluorosis, dental 596
flush response, nicotinic acid 300
foam cells 747, 748
folate 321–42
absorption 323
adolescent nutrition 642
alcohol consumption and 330, 333
analytical methods 335
antagonists 332–3
bioavailability 324–5
biochemical functions 325, 325–7
biofortification of crops 1237, 1239
biosynthesis 1239
chemistry 322, 322
choline interactions 406–7, 407
cytoplasmic metabolism 325, 325–7, 326
regulation 327–9
deficiency
alexithymia 922
Croc's disease 860
severe clinical 330
diabetes 823
disease risk and 330–2
age-related macular degeneration 960, 963
cancer 332, 847
cardiovascular disease 331–2, 768
cataracts 952
colorectal cancer 332, 1077–8
pregnancy complications 330–1
DNA methylation and 16, 16–17, 335
drug interactions 332–3
hypercalcemia 442
hypercalciuria 442
hypercholesterolemia, adolescents 645, 645–6
hyperglycemia, parenteral nutrition-associated 995
Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) study 814, 815
hyperhomocysteinemia see homocysteine, elevated levels
hyperinsulinemia 732–3
adverse effects on health 736, 736–7
cardiovascular disease risk 763
hypercalcemia 442
hyperphosphatemia 455–7
hyperphagia, intestinal failure/short bowel syndrome 865
hypernatremia 482
hyperkalemia 488
hyperglycemia, parenteral nutrition-associated 483–4
hypoglycemia 509
hypocalcemia, liver disease 901
hypomagnesemia 465–8, 469
hypokalemia 487, 488
hypophosphatemia 455
hypothyroidism 559–60
congenital (cretinism) 559–60, 560
obesity 713
subclinical 564
transient newborn 563
hypovolaemia 497–8
hypertonic 494, 495
isotonic 494, 495
see also dehydration
hypoxia-inducible factor (HIF) 510, 511, 597–8
IDEAL imaging technique 1005
ido see indoleamine-2,3-dioxygenase
lgE-mediated food allergy see food allergies, IgE-mediated
IGF2 gene, epigenetic regulation 18
immediate hypersensitivity reactions, food see food allergies, IgE-mediated
immune function 688–708, 1261
assessing effect of nutrition on 695, 696
athletes 672
biotin deficiency 366–7
borage seed oil and 592
breastfeeding and 702–3
B vitamins and 697–8
copper deficiency 547–8
dietary amino acids and 701–2
dietary fat and 700–1
factors influencing 693
iron deficiency 515, 699–700
micronutrient status and 696–700
obesity and 695–6
optimal 703–4
probiotics, prebiotics and 702
protein–energy malnutrition 696
role of nutrients 694–5
selenium status and 573, 700
selenium status and 573, 700
vitamin A and 159, 696–7
vitamin C and 252–3, 698
vitamin D and 207, 698–9
vitamin E and 223, 699
zinc deficiency 528–30, 530, 699
immune system 689–93, 690
acquired 689–91, 690, 690
acquired 689–91, 690, 690
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
n-3 fatty acid requirements 76
Index 1287

proteomic studies 849–50
vitamin B6 status and 316
vitamin K status and 240
zinc deficiency and 530
inflammatory bowel disease (IBD) 859–61, 870
dietary fat composition and 142–3
influenza, selenium status and 574
information bias 1074
injuries, athletes 672–3
inpatients see hospitalized patients
insulin 90, 1052
actions 734–5
chromodulin interaction 594
food reward and 1055
mimetic actions of vanadium 601
preparations 810
sarcopenia of aging and 660
secretion, fiber intake and 103–4
sensitivity 732
assessment 735–6
carbohydrate intake and 93–4, 738–9
determinants 733–4, 734
dietary interventions maximizing 737–9
therapy
 type 1 diabetes 809–11
 weight gain 714
insulin receptors 735
insulin receptor substrate-1 (IRS-1) 735
insulin resistance 732–44
assessment 735–6
chronic kidney disease 878
dietary interventions 737–9
magnesium deficiency 467, 739
management 740
mechanisms of health effects 736, 736–7, 737, 741
metabolomic approach 7, 53
molecular mechanisms 735
pregnancy 610
prevalence and risk factors 733–4
syndrome see metabolic syndrome
vitamin K and 240
Integrated Food Security Phase Classification (IPC) 1187

-intensive care unit (ICU) patients
malnutrition 982–5
nutrient intake goals 984–5
parenteral nutrition 992, 993–5, 996
see also hospitalized patients

Inter-Agency Standing Committee (IASC) Nutrition Cluster 1198, 1199

interferon-γ (IFN-γ) 691
INTERHEART study 789
interleukin-1 (IL-1), liver disease 894
interleukin-1 receptor-associated kinase-4 (IRAK-4) 460
interleukin-2 (IL-2) 691
copper deficiency 548
interleukin-4 (IL-4) 691
interleukin-12 (IL-12) 691
INTERMAP study 51–2, 483, 724
intermediate-density lipoprotein (IDL) 125, 126–7
internally displaced persons (IDPs) 1183
food security interventions 1189
International Association of Diabetes and Pregnancy Study Groups (IADPSG) 814
International Committee of the Red Cross (ICRC) 1191
International Conference on Nutrition (ICN) 1146
international correlation studies 1072–3
International HapMap Project 29, 1258
internet-based diaries, weight loss programs 1059
internet-based interventions, weight loss programs 1064–5
INTERSALT study 51, 483, 487, 723
interstitial fluid (ISF) 480, 494, 496
interviews, dietary
observation of dietary intake 1022–3
training 1013
interviews, dietary
24-hour food recall 1014–15
dietary history 1015
food frequency questionnaires 1016
modes of administration 1023
practical aspects 1013
time taken 1018
intestinal failure 861–6
causes 861, 861, 862
management 861–6, 863
nutrient losses 862
intestinal infection 829–31
inborn disorders 511
interoceptive feedback 77–8
intracellular fluid (ICF) 480, 481, 494, 494
interracial parenteral nutrition (IDPN) 883
interventions
bioelectrical impedance analysis 1002
intradialytic parenteral nutrition (IDPN) 883
intravenous glucose tolerance test, frequently sampled (FSIGTT) 736
intrinsic factor (IF) 351
insulin 84, 100
calcium absorption and 439
in vitro fertilization, epigenetic changes after 19
iodide 555
iodine 554–67
absorption 555–6, 557
deficiency 556
goiters causing, 556
iodine clearance 556, 557
prevalence 560, 560–1
prophylaxis and treatment 563–4
selenium deficiency and 556, 572
deficiency disorders (IDD) 558–61, 559, 560
dietary sources 555
effect 555
excess and toxicity 564–5
excretion 556, 557, 558
infant nutrition 625
metabolism 556–8, 558
physiologic function 558–61, 559
requirements 561, 561
status assessment 561–3, 562
urinary (UI) 561, 562–3
selenoprotein P 578
ionomics
definition 2
methods 7
regulatory space 6
iron 506–20
absorption 509–10
calcium intake and 443
homeostasis 510–11
pregnancy 516
vitamin A actions 158
vitamin C and 254, 256
African iron overload 517
bioavailability 513–14
biological functions 507–8
deficiency 515–17
adolescence 637–8, 641–2
celiac disease 859
in early life 516
features 515
immune function 515, 699–700
iodine deficiency and 556
liver disease 902
pregnancy 516–17, 615
prevention 517, 518
zinc–iron interaction 517
dietary sources 513
distribution 508–9
fortification of foods 517
homeostasis 510–11
infant nutrition 512, 516, 625, 631
intracellular homeostasis 510
manganese interaction 588
maternal nutrition 516–17, 615, 619
metabolism 508, 509
forward genetics approach 5
homeostasis 510–11
inborn disorders 511
influence of inflammation 511–12
overload 517–18, 902
oxidation states 507
requirements 514, 514–15
pregnancy and lactation 611, 615
serum 512–13
status assessment 512, 512–13
supplements 516–17, 615
women of reproductive age 512
zinc interaction 524
iron-responsive elements (IREs) 510
iron-responsive proteins (IRP1 and IRP2) 510
iron–sulfur clusters (ISCs) 507, 508
aconitase 519
irritable bowel syndrome (IBS), dietary fiber intake 110–11
isoflavones 420
blood pressure and 726
see also soy isoflavones
isoleucine

isotope tracer studies, protein and amino acid metabolism 74–5, 75, 76
ishatura huuk 110–11
ISX transcription factor 152–3

Japanese Americans 1073
jaudice 1209–10
jejuno-colic anastomosis 862
jejunostomy 985

Joint FAO/WHO Food Standards Programme see
Codex Alimentarius Commission
joule 59
Jovanovic diet 815
junk food 639

Kashin-Beck disease 572
Kempner rice diet 482
Kenya 1184
Keshan disease 572, 574
Keutel syndrome 239

kidney
magnesium homeostasis 461–2, 462
physiology 874–6, 875
regulation of ions and fluid 476
sodium regulation 479–80
vitamin D metabolism 202, 202–4

kidney stones

calcium intake and 442
high-dose vitamin C and 256
magnesium status and 468

kidney transplantation 880

knowledge, nutrition, US surveys 1099–100
Korsakoff’s psychosis 271, 920–1
kwashiorkor 1173

labeling, nutrition see nutrition labeling
lactase deficiency 86, 1230–1
lactation 617–20
biotin requirements 369, 369–70
calcium requirements 437, 438
humanitarian crises 1192, 1195
iron and 516–17
maternal nutrient requirements 611, 618–20
panthethic acid requirements 382
physiology 617
protein requirements 1140
see also breast milk; milk
lactoferrin 509–10, 700
lacto-ovo-vegetarian 648
lactose 84
in breast milk 617
intolerance 28, 86–7, 1230–1
lacto-vegetarian 648
lauric acid 119
laxative effect, dietary fiber 105–6
LCYB gene 1245, 1246
LDL see low-density lipoprotein lead 602
lean body mass see fat-free mass
lecithin 408
allergenicity 1227
see also phosphatidylcholine
lecithin cholesterol acyltransferase (LCAT) 121, 128
lecithin retinol acyltransferase (LRAT) 152, 155
leghumous seeds 99, 99–100, 103, 106
Leigh’s disease 269
Lens Opacities Case-Control Study (LOCCS) 943, 952, 953
leptin 1052
deficiency 713
food reward and 1035
sweet taste and 1030

lettuce 1237
calcium biofortification 1242
folate biofortification 1239, 1240
vitamin E biofortification 1241
leucine
functions 70
postprandial utilization 74, 75, 76
requirements 77–8, 78
leucoanthocyanidin dioxygenase/anthocyanidin synthase (LDOX/ANS) 1242
leucovorin 333
leukemia, retinoic acid therapy 172
leukotrienes
biosynthesis 138, 139
food allergy 1224
licorice extract, liver disease 899
life, origin of 475–6
lifestyle factors/modifications
behavioral approaches in obesity 1057–70
cardiovascular disease 786–9, 788
hypertension 723–7, 727, 788, 788–9
type 2 diabetes prevention 815–17
see also alcohol; physical activity; smoking
lignin 98
liking foods, vs wanting foods 1047
linamarin 556
LINE-1 methylation, nutritional influences 17
linkage analysis 4
linoleic acid (LA) 754
chemistry 119, 120
conjugated (CLA) 760–1
deficiency 139
dietary intake
age-related macular degeneration 965, 966
cardiovascular disease and 754–5, 756, 758–9
dry eye syndrome 970
immune function and 700
dietary sources 133
essential nature 132, 133
infant nutrition 631, 632
maternal intake 612
metabolism 136, 136, 755, 755
linoleic acid:α-linolenic acid ratio, dietary 133, 140
cardiovascular disease and 754–5, 756, 759–60
disease risk and 143

lipase
gastric 122
hepatic 126
lingual 122
pancreatic (triglyceride) 123, 152
lipids 118–31
absorption 122, 123–5
biosynthesis 135–8
blood
alcohol-related changes 918
carbohydrate intake and 94, 761–2
cardiovascular disease risk 749–50
carotenoid levels and 189
fatty acid intake and 141–2, 751–4
nicotinic acid/niacin and 300, 301
pantothenic acid and 384–5
trans fatty acids and 760–1
see also dyslipidemia

cellular roles 135
chemistry 118–22
dietary intake see fat (dietary), intake
dietary sources 133–5
digestion 122, 122–3
diabetes, parental nutrition 993–4, 996
mediators, novel 143–4
metabolism 125–8, 132–48
alcohol effects 916, 917–18
biotin deficiency 367
choline function 411
effects of dietary fiber 104
flavonoids and 425–6
gene–diet interactions 29–31
liver disease 893
transcriptome analysis 5
peroxidation, vitamin E actions 215, 216
transport 124, 125–8
see also fat (dietary); fatty acids; phospholipids;
triacylglycerols
lipid-based nutrient supplements (LNS) 1190, 1195, 1196
lipoic acid 369
lipoprotein(a) (Lp(a)) 127
lipoprotein lipase 126
lipoproteins 125, 125–8
atherogenesis 746, 747
carotenoid transport 189
vitamin E transport 220–1, 221
vitamin K transport 232
lipoxigenase (LOX) 138
Index 1289

liquid chromatography–mass spectrometry (LC–MS), metabolomics 44, 45

Listeria (monocytogenes) 1210, 1211

surveillance 1214

temporal trends 1213, 1213–14

lithium 602

livelihood

assessment, humanitarian crises 1187

protection, humanitarian crises 1188–9, 1189

security 1171

liver 889–90

biopsy, vitamin A assessment 164–5, 165

bistin uptake 364–5

carbohydrate metabolism 88

choline function 411

fatty see non-alcoholic fatty liver disease

glycogen 90

vitamin A storage 154

vitamin B, metabolism 310

vitamin D metabolism 202, 202–4

liver cancer 851

liver disease 889–911

alcoholic see alcoholic liver disease

causes of malnutrition 892, 892–3, 893

choline deficiency 410, 412

complementary and alternative medicine 896–900

cytokine–nutrient interactions 893–4, 894

nutritional assessment 890–2, 891

parenteral nutrition-associated 995

potential nutritional toxicities 900–2

prevalence of malnutrition 890–2, 891

liver transplantation 904–5

livestock interventions, complex emergencies 1188, 1188, 1189

long-chain fatty acids (polyenes)

beta-oxidation 138

biosynthesis 135–6, 136

insulin resistance and 737

transport into mitochondria 395, 395–6

see also polyunsaturated fatty acids; specific fatty acids

long-chain polyunsaturated fatty acids (LCPUFA) 754

blood pressure and 724–5

cognitive decline in elderly and 663

dietary sources 133

infant nutrition 632–3, 971–2

maternal intake 612

visual function and 971–2

see also omega-3 fatty acids; omega-6 fatty acids

Look-AHEAD study 819, 821

loss-adjusted food availability (LAFA) data 1087–97

low birth weight

adult blood pressure and 723

impact on adult health 612, 633

insulin sensitivity and 734

see also fetus

low-calorie diets 1060–1

see also weight-losing diets

low-carbohydrate diets 762, 1061

low-density lipoprotein (LDL) 125, 127

modification, atherosclerosis 746, 747

oxidized (OxLDL) 746, 747, 748

small dense particles 753

low-density lipoprotein cholesterol (LDL-C)

alcohol effects 918

cardiovascular disease risk 749–50

cholesterol intake and 761

dietary and lifestyle modifications and 788–9, 788

fatty acid intake and 141, 751–4

goals 749

trans fatty acids and 760–1

low-density lipoprotein (LDL) receptors 121, 126, 127

gene polymorphism 1258

lower reference nutrient intake (LRNL; LRNI) 1112, 1114, 1120

lower threshold intake (LTI; LTI) 1113, 1114

low-fat diets 762, 1061

metabolic syndrome 739–40

low-protein diet, maternal, fetal epigenetic effects

macrophages, atherogenesis 746, 747, 748

macrosomia, fetal 616

macular degeneration, age-related see age-related macular degeneration

macular pigment (MP) 959, 971

magnesium (Mg) 459–74

absorption 461, 467, 462–3

cardiovascular disease and 465–6, 767

chemistry and functions 460–1

concentration in body 459–60, 460

deficiency 459, 465–8, 469

alcohol-related 922–3

diabetes and 467, 469, 823

excess 469

food sources 464, 464–5

homeostasis 461–2, 462

insulin sensitivity and 467, 739

osteoporosis and 468, 835

requirements 463, 463–4

infants 625

pregnancy and lactation 611

serum concentrations 460, 469

status assessment 469–70

supplementation 468–9

alcohols 923

sweat 500

therapy 461

tolerance test 470

transport 463

magnetic resonance imaging (MRI), body composition analysis 1001, 1005–7, 1006, 1008

mailed questionnaires 1023

malabsorption

alcohol-related 915, 916

infection-related 693

malaria

iron status and 518, 700

pantothenic acid inhibitors 386

vitamin A supplements 171–2

male reproductive dysfunction, carnitine therapy 400

malic semialdehyde 393

malnutrition

alcohol-associated 914–15, 916

alcoholic liver disease 890–2, 891, 892, 915

chronic kidney disease 876

coupled with overnutrition 1159, 1176

definition 59

global acute (GAM) 1185

hospitalized patients 982–3, 983

liver disease 890–3

liver transplantation and 904

moderate acute (MAM) 1185

preventing and treating 1195–6

older adults 658–9

diagnosis 657, 658

risk assessment 655–8, 657

protein 78

severe acute (SAM) 1185

treating 1196–7, 1197

Index 1289
UNICEF conceptual framework 1173, 1174, 1185
see also humanitarian crises; protein–energy malnutrition; undernutrition
malonyl-CoA 361
malonyl transferase 381
maltose 84
malvidin 420, 1242
MAM genes 1245
mammary cancer, genistein exposure and 845
meal plans, structured, weight-loss programs 1061
McDonald’s 1154–5
Mauritia vinifera 823–4
maturity-onset diabetes of the young (MODY) 820
matrix Gla protein (MGP) 236, 237
matriptase 511
mass spectrometry (MS), metabolomics 41, 42
mass media, globalization 1154
MAP-kinase, insulin signaling 736, 737
mannitol, in sugar-free products 813
manganese 587–8
mammary cancer, genistein exposure and 845
MAM 589
mean cell volume (MCV) 512–13
mean cell hemoglobin (MCH) 512–13
meal plans, structured, weight-loss programs 1061
McDonald’s 1154–5
Mauritia vinifera 167
McDonald’s 1154–5
meal plans, structured, weight-loss programs 1061
mean cell hemoglobin (MCH) 512–13
mean cell volume (MCV) 512–13
measles, vitamin A supplements 171
measurement error, dietary assessment 1020–1, 1021
MEDE (METabolomics to characterize Dietary Exposure) study 49
media
mass, globalization 1154
weight loss interventions 1064–5
medical nutrition therapy (MNT) 810, 825, 826
gestational diabetes 815
prevention of type 2 diabetes 815–17
to reduce diabetic complications 821–2
type 1 diabetes 809–11
type 2 diabetes 819–21
Mediterranean diet
Alzheimer’s disease and 663
cardiovascular disease prevention 779–81
megablastic anemia
diagnosis of cause 352–3
folate deficiency 330
thiamin-responsive 266, 267, 272
vitamin B12 deficiency 347, 349
megestrol acetate, chronic kidney disease 877, 883
meglitinides 820
meibomian gland dysfunction 970
membranes, role of choline 410
mendadione (vitamin K3) 231, 231
toxicity 242
menaquinone-4 (MK-4) 231, 231
bone health and 238–9
emerging functions 240
tissue stores and biosynthesis 233
menaquinones (MKs) (vitamin K1) 231, 231
absorption/bioavailability 232
bone health and 237–8
cardiovascular health and 239–40
catabolism and turnover 233
ermalfunctioning 240–1
food sources 242
tissue stores 233
transport and cellular uptake 232
menarche, age at 638
Mendelian randomization 31
Menkes’ disease 546
menstrual blood loss 512
meta-analyses 1076–7
metabolic fingerprinting 39
metabolic food disorders 1230–1
metabolic syndrome 732–44
alcohol consumption and 917
definition 715, 733, 734, 749, 750
dietary fiber intake and 107–8
dietary interventions 739–40
magnesium status and 467
management 740
non-alcoholic steatohepatitis 902
obesity 715, 733
prevalence and risk factors 733–4
see also insulin resistance
metabolism
effects of dietary fiber 103–4
phase I/II enzymes 851
metabolites
definition 38–9
removal by kidney 875
metabolizable energy intake 63
metabolome 38–9, 39
investigation process 39–40, 41
normalization with diet 47–8
stability of human 47–8
metabolomics (metabonomics) 38–57
analytical technologies 7, 40–4
response to nutritional challenges 52–3
statistical analyses 44–5, 46
targeted 40
untargeted (global) 40
metabolomics see metabolomics
metal-binding transcription factor 1 (MTF-1) 525, 526
metal fume fever 533
metallothionein (MT) 526
concentrations 532
copper interaction 544, 545
zinc binding 523, 525, 526, 530
metastable epialleles 20–1, 22
metformin 816, 820
5,10-methylenetetrahydrofolate cyclohydrodase (MTHFC) 325, 326
methionine 72, 78
choline interactions 406–7, 407
immune function 701
load test 313
metabolism 325, 326–7, 345–7, 346
liver disease 898, 898
methionine adenosyltransferase 16
methionine synthase 16, 407
cobalamin dependence 344, 345–7
folate dependence 324, 326–7
gene defects 351
methionine synthase reductase (MTRR) 330, 346
methotrexate (MTX) 333
methy1ated DNA immunoprecipitation (MeDIP) 22–3
methylation reactions 16, 325, 326–7
choline-mediated 406–7
regulation 327–9
2-methylcitric acid 345, 347
urinary 366
methyl-CpG binding protein 2 (MeCP2) 22
3-methylkynurenin-CoA carboxylase (MCC) 361, 362, 366
MethylC-seq 23
methyl donors
dietary, epigenetic influences 16–18, 20–1
transmethylation pathway 16
5,10-methylenetetrahydrofolate (5,10-methyleneTHF) 326, 327
5,10-methylenetetrahydrofolate dehydrogenase (MTHFD)
folate metabolism 325, 326, 327, 329
gene polymorphisms, choline status and 32, 410
methyltetrahydrofolate reductase (MTHFR) 326
gene polymorphisms see MTHFR gene
regulation 327–9
N-methylglycine 349
N’-methylhistidine 70
methy1malonic acid (MAA) 345, 345
serum 347, 348, 349
methy1malonicaciduria 345, 351
methy1malonyl-CoA 344–5, 345
L-methylmalonyl-CoA mutase 344–5, 345
methyl-nicotinamide (MN) 301
N-methyltetrahydrofolate 51
0-methylpantothenate 383
5-methyltetrahydrofolate (5-methylTHF, MTHF) 326
B12 deficiency 347, 348–9
choline interactions 406–7, 407
epiphenic regulation 16, 17
SAM-mediated regulation 327–9
transport 323
methylthioalkylmate synthase (MAM) 1245
methyltransferase reactions 16
micelles 123–4
microarrays 9, 22, 848
microbiomes 850
see also gut microbiome
micronutrients
adolescent requirements 641–3
binding by dietary fiber 103
cardiovascular disease and 765–70
deficiencies
chronic kidney disease 877, 881–2
chronic pancreatitis 869
Crohn’s disease 860
deficiencies, chronic kidney disease 1302
Crohn’s disease 860
deficiencies, liver disease 894
deficiencies, multiple sclerosis (MS) 301
milk
migrant studies 1073
MTHF see 5-methyltetrahydrofolate
MTHFD1 gene 325
polymorphisms, choline status and 32, 410
MTHFR gene polymorphisms 31–2, 329–30
birth defects and 331
cancer risk and 332, 1077, 1078, 1258
cardiovascular disease risk and 1258
choline status and 410
DNA methylation and 17
MTRR gene polymorphism 330, 331
MUFA see monounsaturated fatty acids
multiple carboxylase deficiency (MCD) 368
multiple sclerosis (MS) 301
multivitamin supplements
age-related macular degeneration and 966
assessment of intake 1018–19
castrate prevention 955
liver disease 901
muscle, skeletal
acid–base disturbances, athletes 674
alcohol and 928
glycogen 90, 673, 674
vitamin B, content 310
mushrooms, poisonous 1208
mustard, golden 169
myocardial infarction (MI)
fatty acid intake after 756–8
gene–caffeine interaction 33–4
magnesium therapy 461
pathogenesis 748
see also coronary heart disease
myoglobin 507, 508–9
MyPyramid 1123–4
MyPyramid Equivalents Database (MPED) 1087, 1095
myristic acid 119
n-3 fatty acids see omega-3 fatty acids
n-6 fatty acids see omega-6 fatty acids
NAD (nicotinamide adenine dinucleotide) 294
boron binding 591
disease and 300–3
metabolism 296, 297–8
physiological functions 296, 297–300
reduced (NADH) 299
salvage pathway 296, 297–8
tissue and blood levels 294–5
utilizing proteins 298–300
NAD-dependent deacetylases (sirtuins) 299
NADP(H) 299
NASYN1 gene 33
naringenin 420, 421
naringin 421, 423
nasaloidonal (ND) tube feeding 986
nasoenteral (NE) tubes 985, 986
nasogastric (NG) feeding 986
nasojejunal (NJ) tube feeding 986, 987
nateglinide 820
National Academy of Sciences (NAS), symposium on nutrition monitoring 1085
National Cancer Institute (NCI) 1085, 1101
National Center for Health Statistics (NCHS) 1094, 1100, 1101
National Diabetes Education Program (NDEP) 324–5
National Health and Nutrition Examination Survey (NHANES) 1085, 1088, 1097
automated data collection 1102
biomarkers 1102
data linkages 1098
expert support 1103
Flexible Consumer Behavior Survey 1088, 1099
health status monitoring 1100
nutrition-related behaviors 1099, 1100
statistical analysis tools 1101
uses of data 1086, 1087
National Health Interview Survey (NHIS) 1088, 1100
National Household Food Acquisition and Purchase Survey (FoodAPS) 1093, 1097, 1099
National Human Genome Research Institute (NHGRI) 29
National Immunization Survey (NIS) 1089, 1100
National Nutrient Database for Standard Reference (NNDSR) 1095, 1098
National Nutrition Monitoring and Related Research Program (NNMRRP) 1082–5, 1088
National Nutrition Monitoring and Related Research Act 1990 1083–4
National Nutrition Monitoring and Related Research Program 1082–5, 1109
National Weight Control Registry 1063, 1065, 1065–6
natural disasters 1183
natural killer (NK) cells, zinc deficiency 528–9
neonates
iron status 512
transient hypothyroidism 563
vitamin A supplements 170
vitamin K deficiency bleeding 241
see also infants; preterm infants
network analysis 9–10
defined 2
neural tube defects (NTDs)
choline status and 411–12
folate status and 331, 334–5, 336, 614
neurocytosis 1210
neurodegeneration with brain-iron accumulation-1 384
neurodegenerative disease
flavonoid intake and 427
niacin and 301–2
vitamin E and 224
neurodevelopment
iron deficiency and 516
long-chain polyunsaturated fatty acids and 632–3
see also brain development
neurological disorders
B6 deficiency 349–50
biotin imbalances 367–8
choline supplements 412
copper deficiency 548
foodborne infections 1209, 1210
neurotoxic shellfish poisoning 1212
neutral detergent fiber technique 100
New York City Health and Nutrition Examination Survey (NYC HANES) 1101–2
New Zealand (NZ)
dietary guidelines 1125, 1126
nutrient reference values 1114, 1121
next-generation sequencing (shotgun sequencing) 1211
NFkB1 gene polymorphism, dietary fat interaction 30
NHANES see National Health and Nutrition Examination Survey
niacin 293–306
age-related macular degeneration and 960
assessment of status 294–5
cataracts and 952, 953–4
deficiency 293–4, 297
alcoholism 921–2
disease and 300–3
food sources 295
requirements 295, 295–7
infants 625
pregnancy and lactation 611
responsive genetic disorders 297
structure and nomenclature 294, 294
therapeutic use 294, 300, 768–9
serum levels 300
nicotinamide adenine dinucleotide see NAD
nicotinamide adenine dinucleotide phosphate (NADP) 299
nicotinamide adenine mononucleotide adenyl transferases (NMNAT) 301
nicotinamide mononucleotide phosphoribosyltransferase (NMNAT) 296, 296–7
nicotinamide phosphoribosyltransferase (NAMPT) 296, 297–8
nicotinamide riboside see NAD biosynthesis from 296, 298
serum levels 300
therapeutic use 294, 300, 768–9
nicotinic acid G-protein coupled receptors (GPR109a and GPR109b) 300, 301
nicotinic acid phosphoribosyltransferase (NPT) 298
A.C. Nielsen Company 1097
Niemann-Pick C1-like 1 (NPC1L1) 125, 220
night blindness 158
liver disease 900
during pregnancy 150, 169
see also vitamin A, deficiency
nitrate
blood pressure and 727
as ergogenic aid 681
nitric oxide (NO)
amino acid contribution 72
hypertension and 727
nitrogen
balance, protein requirements 77, 1139
postprandial utilization 73–6, 74, 75
preformed amino acid, need for 72–3
requirements 76, 76–7
urinary metabolomics studies 48
nutrient ratio calculations 60
NMMRRP see National Nutrition Monitoring and Related Research Program
non-alcoholic fatty liver disease (NAFLD; fatty liver) 902
choline deficiency 412
mechanisms of development 903
non-alcoholic steatohepatitis (NASH) obesity and 902–3
vitamin E therapy 897, 903
non-communicable diseases, nutrition-related see chronic disease
non-starch polysaccharides (NSP) 85, 98–9
distribution in grain 98, 99
food sources 99
isolated and purified 99–100
method, dietary fiber analysis 100–2, 101
values in foods 101
see also fiber, dietary
Nordic Nutrition Recommendations 1120
normative requirements 1118
norovirus (Norwalk-like agent) infections 1209, 1212, 1213
Nrf2 (nuclear factor E2 p45-related factor 2) 848, 849, 851–2
nuclear magnetic resonance (NMR) spectroscopy, metabolomics 41–2, 42, 43
nucleosomes 15, 361
nucleotide biosynthesis 325, 325–6
Nurses’ Health Study (NHS)
age-related macular degeneration 957, 958, 963–4, 965, 967
calcium intake 441
cardiovascular disease risk 755–6, 763, 781
cataracts 943–4, 947, 949, 950–1, 953, 955
whole-grain consumption 107, 108, 109
Nutrient Data Laboratory (NDL) 1099
Index

oleic acid 119, 120, 136
oleoyl ethanolamide 128
oligosaccharides 84, 100
omega-3 (n-3) fatty acids 754
chemistry 119
dietary requirements 139–40
dietary sources 133, 134
eicosanoid synthesis from 138–9, 139, 754, 755
ternal formulas 987
essential nature 132–3
gene interactions 30–1, 1263
health benefits 141–3, 144
age-related macular degeneration 964–6, 965
blood pressure 724–5
cardiocvascular disease 141–2, 755–8, 1263
cataracts 952–5
cognitive decline in elderly 663
diabetes melitus 822, 1263
dry eye syndrome 969–70
immune function 701
inflammatory bowel disease 861
retinitis pigmentosa 968–9
strength of evidence 1262–4
infant nutrition 626, 632–3
health benefits 141–2, 758–9
interconversions 136,
infant nutrition 626, 632–3
recommended dietary intakes 1142, 1143
soybeans enriched with 1248
see also docosahexaenoic acid; eicosapentaenoic acid; α-linolenic acid
omega-3 index 758
omega-3:omega-6 (n-3:n-6) ratio
omega-9 (n-9) fatty acids
acids 755
metabolism 136, 136, 754, 755
polyenolic 142
recommended dietary intakes 1142, 1143
soybeans enriched with 1248
see also docosahexaenoic acid; eicosapentaenoic acid; α-linolenic acid
omega-3 index 758
omega-3:omega-6 (n-3:n-6) ratio
age-related macular degeneration and 966
cardiocvascular disease and 759–60
dry eye syndrome 970
recommended dietary intakes 133, 134
eicosanoid synthesis from 138–9, 139, 754, 755
essential nature 132–3
effect of 138–9
effects of 134
cholesterol-lowering effect 384–5
human studies 838–40
magnesium status and 468, 835
nutritional risk factors 835, 835
pathophysiology 835–7
strontium therapy 600
vitamin A intake and 174, 835
vitamin K status and 237–9,
plasma 495, 498, 499
urine 499
osteoarthritis, obesity and 716
osteocalcin (OC) 236,
osteopenia, definition 834,
osteomalacia 207–8, 455
osteoporosis 663–4, 833–42
plasmalogen 440–1,
definition 834,
celiac disease 859
definition 834, 834
epidemiology 834–5
experimental studies 837–8
human studies 838–40
magnesium status and 468, 835
nutritional risk factors 835, 835
pathophysiology 835–7
strontium therapy 600
vitamin A intake and 174, 835
vitamin D and 207–8, 835, 835, 838, 839
vitamin K status and 237–9, 835
overweight
adolescents 646
with concurrent undernutrition 1159, 1176
definition 59, 710
P2Y receptors 300
P/G Observatory 29
p53 signaling, zinc deficiency 528, 529
palm fruit derivatives 167
palm oil (palmitate)
biosynthesis 135
chemistry 119
stalkometry of oxidation 59
palmitoleic acid 119
palmityl-L-carnitine 392
pancreatic disorders 866–70
pancreatitis
acute 866–9, 867, 868
chronic 869–70
PanX2 gene mutations 384
panethelins 376
pantherins 376
cholesterol-lowering effect 384–5
panthanol 386
pantothenate kinase-associated neurodegenerative disease 384
pantothenic acid 375–90
absorption 376
cellular regulation and functions 378–81
cellular uptake and efflux 376–8
chemistry and nomenclature 376, 377
Pantolactone dosing requirements 1156–9, 1157, 1158
pantostatin 29
hypertension risk 715, 723–4, 727
insulin resistance and 733
older adults 659
pregnancy weight gain 610, 610
prevalence and time trends 710–11
see also body mass index (BMI); obesity
oxalic acid/oxalate
calcium interaction 439, 442
dietary restriction, Crohn’s disease 860
vitamin C catabolism 251
oxalodrone, liver disease 891, 895
oxidative burst 695
oxidative stress
carnitine actions 397
dementia pathogenesis 662
liver disease 893
vitamin E and 215–16, 224
zinc deficiency 528, 529
see also antioxidants
oxoacyl reductase 381
3-oxoacyl synthetase 381
oxoglutarate dehydrogenase complex 268, 269
oxygen consumption (VO2) 59, 60
oxygen radical absorbance capacity (ORAC) assay 424
oxysterol 273
P2Y receptors 300
P/G Observatory 29
p53 signaling, zinc deficiency 528, 529
palm fruit derivatives 167
palm oil (palmitate)
biosynthesis 135
chemistry 119
stalkometry of oxidation 59
palmitoleic acid 119
palmityl-L-carnitine 392
pancreatic disorders 866–70
pancreatitis
acute 866–9, 867, 868
chronic 869–70
PanX2 gene mutations 384
panethelins 376
pantherins 376
cholesterol-lowering effect 384–5
panthanol 386
pantothenate kinase-associated neurodegenerative disease 384
pantothenic acid 375–90
absorption 376
cellular regulation and functions 378–81
cellular uptake and efflux 376–8
chemistry and nomenclature 376, 377
physique, athletes 670–2
phytanic acid 269
phytate (phytic acid) 103, 439
iron bioavailability and 513–14
magnesium absorption and 462
phosphorus bioavailability and 448
zinc bioavailability and 522–3
phytoene 1244
phytoene desaturase 1246
polyunsaturated fatty acids (PUFA)
phytate (phytic acid) 103, 439
phytamic acid 269
physique, athletes 670–2
phytoene 1244
polyunsaturated fatty acids (PUFA)
sensory-specific 1048
understanding mechanisms of 1053
saturated fatty acids (SFA) 119, 119, 120
blood pressure and 724
cardiovascular disease and 751–3
foods and oils 134
insulin resistance and 737–8
recommended dietary intakes 1142, 1143
savoriness of foods 1031
scales, food weighing 1024
scavenger receptor (SR)-B1 127
carotenoid absorption 152, 189
vitamin E uptake 222
scavenger receptors 127
atherogenesis 748
Schiff-base formation 310–11
scavenger receptor (SR)-B1 127
scales, food weighing 1024
savoriness of foods 1031
selenium-binding protein 1 (SBP1) 577–8
deficiency 568
diseases 572
iodine deficiency and 556, 572
dietary intake 567, 570
ecology 569
human health and 573–6
immune function and 573, 700
infant nutrition 625
maternal nutrition 611, 619
metabolism 572–4, 573
requirements 571
status assessment 569–71
tissue distribution 569
toxicity 568, 571–2
Selenium and Vitamin E Cancer Prevention Trial (SELECT) 575, 576
selenium-binding protein 1 (SBP1) 577–8
selenocysteine (Sec; Se-Cys) 70, 569
absorption 572
- containing proteins see selenoproteins
deficiency 568
diseases 572
iodine deficiency and 556, 572
dietary intake 569, 570
ecology 569
human health and 573–6
immune function and 573, 700
infant nutrition 625
maternal nutrition 611, 619
metabolism 572–4, 573
requirements 571
status assessment 569–71
tissue distribution 569
toxicity 568, 571–2
Selenium and Vitamin E Cancer Prevention Trial (SELECT) 575, 576
selenium-binding protein 1 (SBP1) 577–8
selenocysteine (Sec; Se-Cys) 70, 569
absorption 572
- containing proteins 576–7
selenomethionine 70, 569, 572
selenoprotein 15 (Sep15) 577, 579
selenoprotein N (SepN; SelN) 577, 578
selenoprotein P (SEPP1; SepP) 571, 572–3, 577
selenoproteins 576–9
implicated in disease 577
thyroid hormone function and 578
selenoprotein S (SepS; SelS) 577, 579
sclerosis 571–2
self-monitoring, behavioral treatment of obesity 1059
sensory-specific satiety 1048
sensory variety, energy intake and 1048
sentinel acute pancreatitis event (SAPE) hypothesis 866
selenium, foodborne disease 1209
serial transverse enteroplasty (STEP) 864, 864
serine, synthesis 72
serine hydroxymethyltransferase (SHMT) 312, 312
cyttoplasmic (cSHMT) 325, 329
mitochondrial 328
serotonin, food cravings and 1034
serum/plasma metabolome monitoring 1083,
distribution in body 478, 478–9
homeostasis 479–80
SILAC (stable isotope labeling with amino acids in cell culture) 849
silicon 598–600
silymarin, liver disease 899
Simplified Nutrition Assessment Questionnaire (SNAQ) 655
single nucleotide polymorphisms (SNPs) 28–9,
infant nutrition 625, 631
liver disease 901
perturbations, clinical 481–2
renal excretion 476, 479–80, 480
sweat 500–1
sodium and Ca”/Mg”+- dependent vitamin C transporter (SVCT2) 250–1
sodium chloride see salt
sodium-dependent boron transporter (NaBC1) 591, 593
sodium-dependent multivitamin transporter (SMVT) 364–5, 376
sodium-dependent vitamin C transporter (SVCT1) 250
sodium/glucose co-transporter (SGLT1) 87
sodium/sulfate symporter (NIS) 555, 556, 558, 558
sodium molybdate 590
soft drinks
added sugars 85, 86, 92–3
energy density and intake 1046–7
global trends 1154, 1155, 1156
see also sugar-sweetened beverages
hedonic responses see hedonic responses
intensity scalings 1029
measuring responses 1028–9
neurobiology 1034–6
sensations 1027–8, 1029–32
taurine 50–1,
thiamin 261–79
THF
thermogenesis
thermic effect of feeding (TEF) 60, 61–2
thermogenic
facultative 62
obligatory 61–2
THF see tetrahydrofolate
thiamin 261–79
alcohol and 920–1
analysis 264
antagonists 273–4
assessment of status 270
cataracts and 953–4
chemistry 262, 263–4
deficiency 263, 270–2
alcoholism 920–1
chronic kidney disease 882
distinct types 272
subclinical 271
derivatives 261–2, 262
discovery 262–3
excretion 266
homeostasis 265–7
infant nutrition 625
intestinal absorption 265
maternal nutrition 611, 619
NAD biosynthesis 296
precursors and lipid-soluble compounds 272,
requirements 264–5
subclinical thiamin deficiency 271
supplements 264–5
alcoholism 921
tissue distribution/content 265–6, 267–8
toxicity 265
transport 265–7
transport proteins 266–7
thiaminases 273–4
thiamin diphosphates 267
thiamin diphosphate (ThDP; thiamin pyrophosphate) 261–2
analysis 270
chemistry 262, 263–4
cofactor role 268, 268–70
mechanism of action 263, 269–70
non-cofactor roles 270
synthesis 267
tissue content and metabolism 267
transport 266, 267
thiamin monophosphate (ThMP) 262,
thiamin diphosphatases 267
thiamin diphosphatases 267
thiamin triphosphate (ThTP) 262, 266, 267–4
thiamin-responsive megaloblastic anemia 266, 267, 272
thiamin transporter 1 (ThTR1) 266, 272
thiamin transporter 2 (ThTR2) 266–7, 272
thiamin triphosphatase 267–8
thiamin triphosphate (ThTP) 262, 262
functions 270
tissue content and metabolism 267–8
thiazolidinediones 820
thiorhodamine 262, 263
thiocic acid 369
thioester hydrolase 381
thioesters 381
thirst
guiding fluid intake of athletes 684
older adults 661
three-factor eating inventory (TFEI) 1050
threonine 78
intestinal synthesis 76
postprandial utilization 75, 76
thirty genotype 612, 818
thirty phenotype 612, 818
thrombin 235, 236
thromboxanes, biosynthesis 138, 139
thymidylate biosynthesis 325, 326
regulation 329
thymidylate synthase (TS) 326
thyroglobulin (Tg) 556, 558
serum 561, 563
thyroid gland
iodine metabolism 556, 558
iodine uptake 556, 557
size assessment 561
thyroid hormones 556–8, 559
biosynthesis 556, 558
functions 558–61
selenoproteins and 578
serum 563
thyroid-stimulating hormone (TSH) 558, 563, 564
thyroperoxidase (TPO) 556, 558
thyrotropin releasing hormone 713
thyroxine (T4) 556–8, 558, 559
tin
beneficial bioactivity 602
zinc interaction 524
tissue factor, atherosclerosis 747, 748
T-lymphocytes 689, 691–2
α-tocopherol 215, 1239–40
antioxidant activity 215–17, 218, 1240
chemistry 215
food sources 217, 217
metabolism 222–3
plasma kinetics 222
recommended intakes 217–19, 218
safety and upper limits 219–20
transport 220–1
see also vitamin E
α-tocopherol transfer protein (α-TTP) 221, 221–2
beneficial activity 223
tocopherol cyclase (VTE1) 1240, 1241
γ-tocopherol 217
metabolism 222, 223
plasma kinetics 222
transport 221
γ-tocopherol methyltransferase (γ-TMT; VTE4) 1240, 1241, 1241
tocopherols 215, 1239–40
biosynthesis 1240
tocotrienols 215, 222–3
Tolerable Upper Intake Level (UL) 625
tomato
anthocyanin biofortification 1242–3, 1243
calcium biofortification 1242
carotenoid biofortification 1246
carotenoid biosynthesis 1244–5
consumption, prostate cancer and 192
folate biofortification 1239, 1240
tooth development, fluoride and 596
total body water 480, 481, 494, 499
total cholesterol:high-density lipoprotein-cholesterol (TC:HDL-C) ratio, fatty acid intake and 751
total dietary fiber (TDF)
definition 100
method of dietary fiber analysis 101, 101–2
Total Diet Study 1096, 1098
total energy expenditure (TEE) 1117
components 60–2
energy requirements and 62–3, 1137
measurement 63
throughout life cycle 63, 63–5, 64
toxins, foodborne 1208, 1210, 1210–11, 1212
Toxoplasma (gondii) 1210, 1213
trace elements 586–607
beneficial bioactive 591–5
chronic kidney disease 877, 882
essential 587–91
infant formulas 629, 630
liver disease 902
vascular disease see cardiovascular disease

vegetarians 648

cardiovascular disease and 782

carnitine intake 392, 394

n-3; n-6 fatty acid ratio 759

vegetable oils (edible)

allergenicity 1227

fatty acid composition 133, 134

genetically modified 128, 1247

global trends 1153, 1155

partially hydrogenated (PHVOS) 1142, 1144

vitamin K-rich 242

vegetables see fruit and vegetables

vegetarians

adolescents 648

cardiovascular disease risk 765, 781–2

categories 648, 781

dietary pattern 781–2

very-low-calorie diets (VLCDs) 1060–1

very-low-density lipoprotein (VLDL) 125, 126–7

Veterans Health Administration (VA) studies of alcoholic hepatitis 890–2, 892

Vibrio cholerae 1212, 1217

Vibrio infections 1213, 1214

Vibrio para-haemolyticus 1209, 1212

Vibrio vulnificus 1209

carbohydrate metabolism 1212

infections

foodborne 1208, 1209–10, 1212

selenium status and 573

vitamin C function 252

visceral fat see abdominal fat

visual function 940, 940, 970–2

docosahexaenoic acid (DHA) and 971–2

essential fatty acids and 140–1, 142, 632

lutein and 971

phytonutrients and 970

vitamin A 157

see also eye disease

vitamin(s)

adolescent nutrition 642

B group see B vitamins

cardiovascular disease and 767–70

deficiencies

chronic kidney disease 877, 881–2

chronic pancreatitis 869

Crohn’s disease 860

liver disease 900–1

diabetes 822

food labeling 1147

infant formulas 629, 630

infant nutrition 625, 626–7

insulin sensitivity and 739

parenteral nutrition 993, 994

requirements

chronic kidney disease 881–2

setting international standards 1144–5

short bowel syndrome 862

see also multivitamin supplements; specific vitamins

vitamin A 149–84

adverse and toxic effects 172–4

alcohol interactions 919

analytical methods 151

bone health and 174, 835

breast milk 156, 618

chemistry 150, 150–1

deficiency 150, 158–60

causes 159

diagnosis 163–7, 164

epidemiology 160

iodine deficiency and 556

liver disease 900

manifestations 158–9, 697

preventive interventions 167–70

dietary intakes 162–3

dietary requirements 160–1, 161

excretion 156

food fortification 168–9, 174–5

food sources 161, 162–3

functions and actions 156–8

immune function and 159, 696–7

infant nutrition 625

international units (IU) 160

intestinal absorption 151–4, 152

maternal nutrition 611, 613, 619

metabolism 154–6

nomenclature 150–1

nutriture (status)

causes of variation 159

diagnostic assessment 163–7, 164

effects of variations 158–9

recommended intakes 160–1

storage 154

supplementation 169–72, 174

humanitarian crises 1195

preventive 169–70, 170

retinitis pigmentosa 171, 968

therapeutic 170–2, 171

tolerable upper levels 173, 173

usage 162–3

toxicity 173–4

assessment 166–7

liver disease 900

transplacental transport 156

transport 154–6

see also provitamin A; retinol

vitamin B1 294

vitamin B2

vitamin B3 294, 296

see also niacin

vitamin B6 307–20

age-related macular degeneration and 960, 963

assessment of status 312–13

bioavailability 309

cardiovascular disease and 315–16, 768

chemistry 307–8, 308

deficiency 313–14, 922

disposition 309, 309–10

food sources 308–9

in health and disease 315–16

immune function and 697–8

infant nutrition 625

margin status 314

maternal nutrition 611, 613, 619

metabolism and coenzyme function 310–12, 311, 312

NAD biosynthesis 296, 298

requirements 314–15, 315

chronic kidney disease 882

toxicity 314

vitamin B12 (cobalamin, Cbl) 343–58

absorption 350–1

age-related macular degeneration and 960, 963

cardiovascular disease and 768

cataracts and 952, 954

chemical structure 344, 347

deficiency 31, 347–54

causes 350–2, 351

clinical manifestations 349–50

clinical spectrum 350

Crohn’s disease 860

diagnosis 352–3

metabolic abnormalities 347, 347–9, 348

treatment 353

dependent enzyme reactions 344–7

diabetes 823

generic interactions 31

immune function and 697

infant nutrition 625

intracellular metabolism 351

maternal nutrition 611, 618, 619

nickel interaction 598

serum levels 352

vegetarianism and 782

vitamin C 248–60

age-related macular degeneration and 956, 957, 959, 966

biochemical functions 251–2

cataracts and 942–6, 943–5

chemistry 249, 249–50

deficiency 254

dietary requirements 254–6, 255

genetic interactions 32–3

infant nutrition 625

marginal status 254

maternal nutrition 611, 619

metabolism 250–1, 251

NAD biosynthesis 296, 298

physiological functions 252–4

species comparisons 248–9

supplements 252–4

cardiovascular disease prevention 253, 769–70

chronic kidney disease 882

immune function and 252–3, 698

liver disease 901

vitamin E interaction 215–16, 216, 254

vitamin D 199–213

adolescent nutrition 642

alcohol and 920

athletes 673

blood pressure and 727

bone health and 207–8, 835, 835, 838, 839

cardiovascular disease and 767–8

chemistry 200–1, 201

Index 1303
deficiency 200, 208
Alzheimer’s disease 663
Crohn’s disease 860
diseases 207, 207–8
liver disease 900
serum 25(OH)D levels 209
treatment 209
endocrine system 201–2
newly recognized functions 206, 207
regulation 202, 204
see also 1α,25-dihydroxyvitamin D3
food fortification 210
genetic interactions 33
historical review 200
human disease related to 206–8
immune function and 207, 698–9
infant nutrition 208–9, 625, 627
insulin sensitivity and 739
maternal nutrition 611, 613, 619
metabolism 202–3
nutritional aspects 208–9
phosphorus absorption and 452
recommended intakes 208–9, 210
safety 209
sarcopenia of aging and 660
sufficiency 209, 210
supplementation 208
chronic kidney disease 882
liver disease 900
maternal 613, 618
older adults 664
toxicity 209
type 1 diabetes and 808
vitamin D3 200
supplementation 208
vitamin D3 (cholecalciferol) 200
metabolites 201–2, 202
supplementation 208
ultraviolet-induced synthesis 201, 201
vitamin D3, 25-hydroxylase 202, 202–4
vitamin D binding protein (DBP) 202
vitamin D-dependent rickets type II (VDDR-II) 205
vitamin D receptor (VDR) 204–6
gene polymorphisms, health effects 846, 1258
ligand interaction 202, 203, 204
mechanisms of action 204–6, 205
vitamin E 214–29
age-related macular degeneration and 223–4,
956–9, 958, 966
alcohol interactions 919–20
antioxidant activity 215–17, 216
biliary excretion 222
biofortification of crops 1237, 1239–41, 1241, 1249
biological activities 220–3
cataracts and 946, 947–8
content of foods 217, 217
deficiency 223
immunity and 223
intestine and 220
metabolism 223–3
plasma kinetics 222
recommended intakes 217–19, 218
infants 625
pregnancy and lactation 611
safety and upper limits 219–20
supplements
alcoholism 919–20
cardiovascular protection 224, 769–70
chronic disease protection 223–4
chronic kidney disease 882
dliver disease 896–7, 900, 903
retnitis pigmentosa 968
transport 220–1, 221
vitamin C interaction 215–16, 216, 254
vitamin K interaction 241
vitamin K 230–47
absorption/bioavailability 232
alcohol and 920
antagonists 230
bone health and 237–9, 835
catabolism and turnover 232–3
chemistry and nomenclature 231, 231–2
cycle 233–4, 234
deficiency 241
Crohn’s disease 860
dliver disease 900–1
dependent carboxylation 233–4
dietary intakes 242
emerging functions 240–1
functions 233–7
human health and 237–40
infant nutrition 242, 625, 627
requirements 241–2
supplements
chronic kidney disease 882
dliver disease 900–1
toxicity 242
transport and cellular uptake 232
vitamin K, see phyloquinone
vitamin K, see menaquinones
vitamin K 2,3-epoxide 233, 234
vitamin K, see menadione
vitamin K deficiency bleeding (VKDB) 241
vitamin K-dependent blood coagulation proteins
234–6, 235, 238
vitamin K-dependent proteins (VKDP) 234–7, 238
vitamin K hydroquinone 233–4, 234
vitamin K oxidoreductase (VKOR) 233, 234
vitamin K quinone 233
vomiting
enterally-fed patients 991
fluid replacement 501–2
foodborne illness 1208–9, 1209
voucher schemes, humanitarian crises 1191, 1194
vulnerable groups, nutritionally see nutritionally
vulnerable groups
waist circumference (WC)
body composition analysis 1001
chronic kidney disease 880
metabolic syndrome 715, 733, 750
waist-hip ratio 1001
Wallerian degeneration (Wdr) mouse 301
wanting foods
neurobiology 1034–5
vs liking foods 1047
warfarin 230
bone health and 239
cardiovascular health and 240
mechanism of action 233–4, 234
vitamin K intake and 241
warm environments
fluid imbalances 495–6, 497
water and electrolyte needs 500, 500–1
wars and conflicts 1183
wasting, definition 59
water
biological functions 494
infant requirements 627
intake values 1117
intoxication see fluid, overload
needs 500, 500–1
total body 480, 481, 494, 499
see also fluid; hypovolemia
water balance 493–505
disturbances
illness and disease 497–8
physiological effects 495–7, 497
during exercise 678, 678
following exercise 679–80, 680
kidney function 875, 875
normal variations 494
physiology 494–5, 495
see also hydration status
watermelon, lycopene b-cyclase (LCTB) gene 1245
weaning 627
WebQTL 8
weighed dietary records see dietary records,
weighed
weight, body
athletes, optimizing 670–2
basal metabolic rate prediction 61, 61
blood pressure and 723–4
measurement, older adults 655
weight-for-height, children 1185
weight gain
food insecurity and 1168
infant 630
medical conditions causing 713–14
pregnancy 610, 610
adolescents 647, 647
gestational diabetes 815
weight-losing diets 718
behavioral programs 1060–1
diabetes prevention 825–6
high-protein 764
low-carbohydrate vs low-fat 762, 1061
non-alcoholic steatohepatitis 903
weight loss
Alzheimer’s disease 662
athletes 671–2
behavioral programs see behavioral weight-loss programs
cardioprotective effects 762
carnitine supplements for 398
goal setting 1059
health benefits 1058
metabolic syndrome 740
obese older adults 659
type 2 diabetes prevention 714, 816, 825–6
therapy 714, 819
unintentional, older adults 655, 658
Weight Loss Maintenance Trial 1066
weight maintenance
behavioral programs 1065, 1065–6
amount of exercise 1063, 1063–4
history 1058, 1058
relapse prevention 1060
cardiovascular disease prevention 762
obesity prevention 718
weight-making sports 671, 672
Weight Watchers diet 1061
Wernicke–Korsakoff syndrome 261, 271, 272, 920–1
   genetic factors 269, 271
   rodent model 273
Wernicke’s encephalopathy 271, 921
Western diet, modern 476–7
wheat allergy 1226
wheat grain, non-starch polysaccharides 99
WHO see World Health Organization
   whole grains 91, 94
   cardiovascular disease and 763–4
   consumption 92
disease risk and 93, 94, 107, 108
   insulin sensitivity and 738
   metabolomic study 49
   recommended intake 91–2, 92
Wilson disease 534, 546, 549, 902
   women
calcium requirements 437, 438
   humanitarian crises 1192
   iron status 512
   maternal nutrition 608–23
   nutrient requirements 611
   see also lactation; pregnancy
Women Infants and Children, Special Supplemental Nutrition Program for (WIC) 1091, 1097, 1100
Women’s Antioxidant and Folic Acid Cardiovascular Study 960
Women’s Health Study (WHS)
   alcohol consumption 917
eye disease 947, 951, 958
   vitamin E 220, 958
Women’s Intervention Nutrition Study (WINS) 845
workplace, obesity and 1052
World Food Programme (WFP) 1190, 1190, 1194, 1198
World Health Organization (WHO) 1135–50
   cardiovascular disease prevention 770, 776, 783, 785
   child growth standards 1185
diabetes prevention 785, 786
   Diabetes Programme 825
dietary guidelines 1122, 1125
   Global Strategy on Diet, Physical Activity and Health 1147–8
   nutrient intake goals for populations 1118, 1119
   nutrition reference values 1114, 1117–18
   nutrition monitoring activities 1103
   public health applications of nutrient recommendations 1145–8
   recommended nutrient intakes 1136–45
   wound healing, pantothenic acid and 385–6
xanthophylls 185, 186
   bioavailability and bioconversion 187–8
   xerophthalmia 158, 170–1
   X-linked inhibitor of apoptosis (XIAP) 543, 543
Yersinia enterocolitica 1210, 1211
   at-risk populations 1215
   epidemiology 1212
   surveillance 1213–14
Yersinia pseudotuberculosis 1210
   youth behaviors, US surveys 1099–100
   Youth Risk Behavior Surveillance System (YRBSS) 1089, 1099
ySANd1e gene 1246
Zambia, refugee camp 1194
zeaxanthin 186, 186
   age-related macular degeneration and 192–4, 959–60, 961–2, 966
cataracts and 194, 946–52, 950–1
   chemistry 187
   cleavage 190
   uptake in tissues 189, 189
   meso-zeaxanthin 187, 194
   zinc (Zn) 521–39
   absorption 522–4
   adolescent nutrition 642
   age-related macular degeneration and 960–4
cataracts and 952
   chemistry 521–2
copper interaction 524, 534, 545
   deficiency 526–31, 529, 530
   alcoholic liver disease 899, 923
   chronic kidney disease 882
   Crohn’s disease 860
   immune function 528–30, 530, 699
   liver disease 894, 899, 902
dietary sources 532–3
   excess and toxicity 533–5
   excretion 524
   homeostasis 524–5
infant nutrition 625
   maternal nutrition 611, 615–16, 619
   metabolism 522–5
   physiological function 525–6
   plasma 522, 532
   requirements 531, 531–2
   status assessment 532
   supplements, liver disease 899
   tissue 522
   zinc finger domains 526
   zinc importer proteins (ZIPs) 523
   zinc oxide nanoparticles 534
   zinc protoporphyrin, red-cell 512–13
   zinc transporters (ZnTs) 523, 525, 532
   Zone diet 765, 1061
   Zrt/ltl-like proteins (Zips) 523, 525, 532
   zyklopen 542