Aging
  caloric restriction mechanisms of longevity effects 46, 52
  insulin signaling pathways 46
  oxidative stress theory 47, 48
  telomere shortening 47, 48
Agouti-related peptide (AgRP), appetite regulation 26, 27
Arachidonic acid (AA), infant supplementation studies 124–126, 133, 134
Arcuate nucleus of the hypothalamus (ARH), appetite and energy balance regulation 26
Attention deficit hyperactivity disorder (ADHD), white matter defects 144, 145

Behavioral problems
  low birthweight effects 104
  stunting effect studies 112

Body composition
  body mass index relationship in early infancy 217–221
determination 214–217, 223
  fat-free mass 214, 215
  fetal programming 10, 11

Body mass index (BMI)
  body composition relationship in early infancy 217–221

Centers for Disease Control and Prevention growth chart 190, 191
Brain, see also Cognition; Hypothalamus
docosahexaenoic acid levels 123, 134
  fat content in infants 221
  glucocorticoid effects in fetus and neonate 149–151
iron supplementation and development 155, 156
magnetic resonance imaging development studies 138–140
diffusion tensor imaging microstructural brain development study overview 141, 142
  neurodevelopmental disorders 144–147
  white matter connectivity 142–144
  metabolism studies 151
  white matter 138–140
preterm infants and development 86
Breastfeeding
  cardiovascular disease risk modification 3
  exclusively-fed infants growth patterns 167, 168
  maternal dropout analysis data sources 169, 177, 178
growth chart types 175, 176, 179
Breastfeeding (continued)
  growth pattern as reason 171–174
  mean weight trajectory by dropout pattern 170, 171
  prospects for study 174
  statistical analysis 169, 170
  leptin in breast milk 22
  obesity prevention 21, 23
  preterm infants 97, 98

Caloric restriction, mechanisms of longevity effects 46, 52

Cardiovascular disease
  animal models of early growth and long-term effects 56
  fetal programming and risk
    breastfeeding 3
    mechanisms 8
    overview 2–4
  infant growth effects on risk factors
    dyslipidemia 60, 61
    hypertension 59, 60
    insulin resistance 60
    mechanisms 61, 62
    obesity 57–59
    overview 21, 56, 57
    public health implications 62

Centers for Disease Control and Prevention (CDC) growth chart
  body mass index and extreme percentiles 190, 191
  comparison with other growth charts
    birth to two years 200–204
    methodology 198–200
    two to five years 204–208
  development of 2000 chart 181–183
  infants 184–190
  lambda, mu, and sigma pattern analysis 183, 190, 193, 195
  race differences 193, 194

Childhood growth
  cognition and nutrition effects 5, 6
  growth charts, see Centers for Disease Control and Prevention growth chart; Euro-Growth chart; National Centers for Health Statistics growth chart; NL97 growth chart; UK90 growth chart; World Health Organization growth chart
  iron supplementation studies 156, 157

Dyslipidemia, infant growth effects and cardiovascular disease risks
  behavioral problem studies 112
  catch-up growth benefits 76, 81, 82
  cognitive development studies 110, 111
  comparison with low birthweight in outcome studies 113–115
  confounding factors in studies 100, 112, 113, 119
  developing country morbidity and mortality 74
  epidemiologic evidence
    diarrheal disease 75, 76
    morbidity 75
    mortality 74, 75
    respiratory infection 75
    infectious disease morbidity 73, 74
  mechanisms of developmental defects 115, 116
  overview of studies 105–109
  prospects for study 77
  schooling trajectory 111, 112, 118, 119

Cognition
  low birthweight effects 101
  nutrition effects in early life
    brain growth 6, 7
    infants and children 5, 6
    intrauterine growth retardation 6
    preterm infants 6
  supplement studies 7
  stunting effects 110, 111

Copper, iron interactions 159, 160

Diffusion tensor imaging, see Magnetic resonance imaging

Docosahexaenoic acid (DHA)
  brain levels 123, 134
  dosing in infancy 129, 130
  neuroprotection mechanisms 130, 131
  prenatal supplementation trials 129, 133
  preterm infant use 135

Dual-energy X-ray absorptiometry (DXA), body composition
  analysis 215, 221–223

Dyslipidemia, infant growth effects and cardiovascular disease risks 60, 61
Growth charts, see also Preterm infants
body composition effects in later life, see Body composition
cardiovascular risk factor effects
dyslipidemia 60, 61
hypertension 59, 60
insulin resistance 60
mechanisms 61, 62
obesity 57–59
overview 56, 57
public health implications 62
growth charts, see also Centers for Disease Control and Prevention growth chart; Euro-Growth chart; National Centers for Health Statistics growth chart; NL97 growth chart; UK90 growth chart; World Health Organization growth chart
analysis 66, 67
ideal weight gain 64, 65, 67, 68
obesity effects in later life
animal studies 22
breastfeeding in obesity prevention 21, 23
cardiovascular disease 21
cohort studies 15, 16
growth standards 22, 23
overview 42, 43
research needs 17–19
weight versus length 69
Infection
iron supplementation benefits 157, 158, 163
stunting
morbidity 73, 74
epidemiologic evidence
diarrheal disease 75, 76
respiratory infection 75
Insulin
leptin interactions 38
signaling in aging 46, 47
Insulin-like growth factor-I (IGF-I)
deficiency 231, 232
disruption effects on growth 228–230, 236
Hyperalumus
appetite and energy balance regulation 26, 27
feeding circuit development
critical periods 36, 37
Hypertension, infant growth and cardiovascular disease risks 59, 60
Fat-free mass (FFM),
determination 214, 215
Fetal programming
body composition and outcomes 10, 11
cardiovascular disease risk
breastfeeding 3
mechanisms 8
overview 2–4
epidemiological data 42
growth, critical period 86
hypothalamic feeding circuit
development, role of maternal nutrition 30, 31
maternal iron restriction studies in animals 44
obesity 2, 4
prospects for study 8
windows 7, 8
Ghrelin, leptin interactions 38
Glucocorticoids
fetal and neonatal effects 149–151
overexposure models in animals 44, 45
Growth charts, see Centers for Disease Control and Prevention growth chart;
Euro-Growth chart; National Centers for Health Statistics growth chart;
NL97 growth chart; UK90 growth chart; World Health Organization growth chart
Growth hormone (GH)
growth regulation 227
prenatal role 235
receptor gene and regulation 230, 231, 236
signaling 235
therapy 232
Infants, growth
subject index
Insulin-like growth factor-I (IGF-I) (continued)
epigenetics 234, 235
infant versus adolescent levels 237
preterm infants 235
regulation of expression 228
signaling in aging 46, 47
structure 227, 228
therapy 233
Insulin-like growth factor-II (IGF-II)
disruption effects on growth 229, 230
prenatal role 235
regulation of expression 228
structure 227, 228
Insulin resistance, infant growth effects and cardiovascular disease risks 60
Intrauterine growth retardation
animal models
global calorie restriction 43
hypoxic model 44
intrauterine artery ligation 44
cognitive development effects 6
Iron
absorption and interactions with other minerals
copper 159, 160
lead 159
transporter 158
zinc 159
childhood requirements 154
cognitive development role 7
deficiency
anemia 153–155, 164
girls 163
stages 163
maternal restriction in animal models 44
supplementation studies
administration modes 160, 164
brain development 155, 156
childhood growth 156, 157
infection 157, 158, 163
preterm infants 162, 163–165
prospects for study 160, 161
side effects 164
Lambda, mu, and sigma pattern, see
Centers for Disease Control and Prevention growth chart
Lead, iron interactions 159
Leptin
breast milk content 22
Subject Index

Obesity
Bangladesh children 80
epidemiology in children 14, 15
fetal programming 2, 4
infant growth effects in later life
animal studies 22
breastfeeding in obesity
prevention 21, 23
cardiovascular disease 21
cohort studies 15, 16
growth standards 22, 23
overview 57–59
research needs 17–19
prevention in childhood 13
Oxidative stress, aging theory 47, 48

PEA POD, body composition
analysis 223
Potassium, body cell mass
measurement 222
Preterm infants
brain and organ development 86
breastfeeding advantages 97, 98
cardiovascular disease risk 2–4
catch-up growth
advantages and disadvantages 87, 91–93
sex differences 97
docosahexaenoic acid
supplementation 135
growth characteristics 87, 88
insulin-like growth factor-1 levels 235
iron supplementation 162, 163–165
Mental and Developmental Index
88, 89
nutritional intervention studies
89, 90, 96
Psychomotor Developmental Index 88, 89
white matter injury 139, 140
Programming, see Fetal programming
Protein restriction
aging studies 50, 51
maternal effects in animals 45
neurological effects 53
Psychomotor Developmental Index (PDI), preterm infants 88, 89
Resolvins, docosahexaenoic acid
response 130
SIRT1, caloric restriction effect
modulation 46
Skinfold thickness, subcutaneous fat
analysis 222
Stunting, see Childhood growth

Telomere shortening
aging 47, 48
sex differences 52
Thrift phenotype hypothesis,
overview 42

UK90 growth chart, comparison with
other growth charts
birth to two years 200–204
methodology 198–200
two to five years 204–208

White matter, see Brain
World Health Organization (WHO)
growth chart
comparison with other growth charts
birth to two years 200–204
methodology 198–200
two to five years 204–208
data sources 198, 207, 210
discrepancies in stunted growth 208
exclusively breastfed infant growth,
see Breastfeeding
subgroup analysis 211, 212

Zinc
cognitive development role 7
iron interactions 159