Subject Index

A
Abortion, spontaneous, vitamin A
toxicity and, 139, 150
Absorptiometry. See Dual beam X-ray
absorptiometry
Absorption, developmental changes in,
9–15, 19–21
carbohydrates, 10
corticosteroids and, 11–13
epidermal growth factor and, 13
fetal development and, 7
lipids, 10
proteins, 9–10
Acidosis
nutrient intake and, 81
parenteral nutrition and, 198
Active transport, placental transfer by,
116, 122, 123
Adiposity index, 52, 53–54
metabolism and, 52
skinfold thickness and, 51–53
AGA infants. See Appropriate-for-
gestational-age infants
Age
body composition and, 43
bone mineral content and, 131, 132
evaporative heat loss and, 48
thermoneutral zone and, 63, 68, 69
Air temperature, incubator control and,
64
Airway infection. See Respiratory
infection
Alanine, infection-injury response and,
107
Albumin, human serum
amino acid solutions vs., 210
composition of, 199, 203, 210
source of, 209
supplementation with, 198–200, 201
outcomes described, 202–205
outcomes discussed, 205–207
Alkaline phosphatase, glucocorticoids
and, 12
Allergies
early diet and, 29–30, 186–187
maternal diet and, 29
α-linolenic acid, DHA and, 103
Amino acids
See also Protein; Protein intake
in cow’s milk, 38
discovery of, 36, 38
human serum albumin vs., 210
immature systems and, 39
infection-injury response and, 106–108
parenteral nutrition and, 197–198, 199,
202, 203–205, 210
placental transport of, 116–117
postnatal weight loss and, 180, 181
protein intake and, 80
recycling of, 105–106, 107, 112–113
Amniotic fluid
intestinal maturation factors in, 20
transfer from blood to, placental
transfer vs., 122–123
Amylase activity
developmental changes in, 10, 21
glucocorticoids and, 12
Anatomical barrier, placental transfer
and, 117–118
Anatomical gut development. See Fetal
development
Anemia, 155, 159, 160
Anesthetic agents, placental transport of,
116, 117
Antibody absorption, glucocorticoids and,
12
Apnea, recurrent, partial parenteral
nutrition and, 200
Appropriate-for-gestational-age (AGA)
infants, growth patterns in, 52,
53
Arachidonic acid (20:4 n-6)
cholesterol and, 102
CNS development and, 93, 99
in placental vs. soya phospholipids, 95,
98, 99
Arginine, infection-injury response and,
109–110
Ascorbic acid. See Vitamin C
Atopy, preterm diet and, 30, 186–187
Atresia, duodenal, fetal development and,
8
B
B cells, fetal development and, 26, 27, 28
Basal metabolic rate (BMR), early research on, 41
Betamethasone, maternal, neonatal effects of, 11
Bile acid concentration, developmental changes in, 10
Bile-salt-stimulated lipase (BSSL)
  carboxylic ester hydrolase and, 86–87, 91
  in fat digestion, 85–86, 87, 88, 89
Biochemical maturation, in small intestine, 4–5
Biological programming, nutrition and, 183–186
Biotin requirements, 154
Blankets, thermal, 66, 68
Blood pressure
  dobutamine administration and, 58
  nutritional programming and, 194
BMR. See Basal metabolic rate
Body composition
  gestational age and, 43–44
  measurement methods, 45
  weight gain and, 175–177, 178–179
Body mass
  See also Lean body mass
  growth calculation and, 175–176
  measurement methods, 45
Body mass index. See Adiposity index
Body weight. See Weight gain; Weight loss
Bone(s)
  disease, outcomes and, 187–188
  fetal development of, vitamin A and, 139
  fetal vs. preterm, 134
  mineral content, 131–132, 133, 135
  human milk vs. formula and, 131, 133, 135, 194–195
  measurement method, 127
  mineral requirements for, 125
BPD. See Bronchopulmonary dysplasia
Brain development
  LCP fatty acids and, 93, 99
  nutrition and, 185, 188–191, 192–193, 196
Breast milk. See Human milk
Bronchopulmonary dysplasia (BPD)
  nutritional needs and, 193
  vitamin A and, 157, 159–160, 162
  vitamin E and, 159
  Brunner’s glands, epidermal growth factor and, 13
  Brush-border membrane, fetal vs. adult, 4–5
  Brush-border proteins, sucrase and, 21
  BSSL. See Bile-salt-stimulated lipase

C
C20 and C22 (n-6) and (n-3) fatty acids, in human milk, 93
Calcidiol, 141. See also Vitamin D
Calcitriol, 20, 141. See also Vitamin D
Calcium
  absorption of
    fat absorption and, 134
    milk types and, 127–129, 134
    retention vs., 134
    vitamin D and, 127, 128–129
    magnesium and, 130
    phosphorus and, 133, 134–135
    placental transfer of, 115, 119–120, 123
    requirements for, 125, 127, 133, 135, 212
  supplementation with, 133, 134, 165
Calcium-binding protein
  placental vs. gut transfer and, 123
  vitamin D supplementation and, 158
Calorimetry
  direct, described, 46
  indirect
    described, 46
    for energy balance calculation, 71–72
    research on, 33–35
Carbohydrates
  digestion and absorption of,
    developmental changes in, 10
  in milk vs. solid food, 9
Carboxylic ester hydrolase (CEH)
  BSSL and, 86–87, 91
  in fat digestion, 86–87, 88, 89
Caregiving, outcomes and, 195, 196
Carotene, placental transfer of, 150–151.
  See also Vitamin A
Casein, nitrogen retention and, 38
Catecholamine excretion, energy expenditure and, 58
Caveolated (tuft) cells, 4
CEH. See Carboxylic ester hydrolase
Cellular differentiation, in gut development, 2–4
Central nervous system (CNS), LCP fatty acids and, 93, 99, 103
CF. See Cystic fibrosis
Childhood obesity, preterm feeding and, 82
Chloride, placental transfer of, 115, 118
Cholecalciferol (vitamin D₃), 141. See also Vitamin D
Cholera toxin binding, fetal development and, 5
Cholesterol, placental phospholipids and, 103
Cholic acid/chenodeoxycholic acid ratio, developmental changes in, 10
Cholic acid synthesis, prenatal steroids and, 20
Clothing, thermoregulation and, 69
CNS. See Central nervous system
Coagulation disorders, vitamin K and, 146, 147
Cold stress, transepidermal water loss and, 51
Colipase-dependent lipase, in fat digestion, 84–85, 87, 88
Columnar epithelium, development of, 23
Conductive heat loss, 62, 68
Congenital microvillus atrophy, epidermal growth factor and, 14
Convective heat loss, 62, 63–64
Cow's milk digestion and absorption of, 10
epidermal growth factor and, 15
protein composition of, 38
research on, 37
Crohn's disease, epidermal growth factor and, 13
Crypt cells, development of, 2–3, 23, 26
Cystic fibrosis (CF), gastric lipase and, 91
Disaccharidase activity, developmental changes in, 10
Disease
See also specific diseases
long-term, early nutrient deficiency and, 185
protein metabolism and, 105–110, 112–114
vitamin therapy and, 157–161
Diuresis, protein intake and, 80
DNA synthesis, epidermal growth factor and, 14, 15
Dobutamine, thermogenic effect and, 58
Docosahexaenoic acid (22:6 n-3) (DHA) cholesterol and, 102
CNS development and, 93, 99
in human milk vs. formula, 103, 194
in placental vs. soya phospholipids, 98, 99, 100
visual function and, 94
Docosatetraenoic acid (22:4 n-6), CNS development and, 93
Dopamine, thermogenic effect and, 58
Double-walled incubators, 65–66
Drug abuse, maternal, gastrointestinal development and, 20
Dual beam X-ray absorptiometry for fat deposition studies, 82
for mineral balance studies, 127
research directions for, 212
Duodenal atresia, 8

E
EGF. See Epidermal growth factor
Eicosapentaenoic acid (EPA), 94
18:2 n-6. See Linoleic acid
18:3 n-3. See Linolenic acid
ELBW infants. See Extremely low birthweight infants
Electrolyte balance, protein intake and, 80
Endocrine cells, differentiation of, 3–4
Endocrine system. See Hormonal regulation
Endocytosis, receptor-mediated, placental transfer by, 116, 117
Energy, metabolizable, 71
energy intake and, 81
Energy balance
See also Energy expenditure; Energy intake
computation methods, 35–36
Energy balance (contd.)
concept of, 71
in early postnatal period, 50–51
methods of calculating, 72
milk type and, 198
nutrient intake and, 72–76, 77, 81,
170–179, 180–183
transepidermal water loss and, 51
Energy expenditure
See also Energy balance
catecholamine excretion and, 58
energy cost of growth, 50–51
heat loss and, 55
human milk vs. formula and, 198
methods of calculating, 41, 71–72
nutrient intake and, 72–76
postnatal changes in, 44–45
skin water loss and, 48
thermoregulation and, 68–69
water loss and, 47–48, 55
Energy intake
See also Energy balance
ergy expenditure and, 40–41
fat accretion and, 170–179, 180–181
optimal amount of, 211
Energy quotient, calculation of, 34–35
Energy sources, dietary fats as, 93
Energy storage
See also Energy balance
methods of calculating, 72
nutrient intake and, 72–76
Energy-supplemented human milk, in
energy expenditure/storage
studies, 72–79
Enteral nutrition
calcium retention and, 134
parenteral nutrition vs., for vitamin
administration, 161
Enterocolitis. See Necrotizing
enterocolitis
Environment
insensible water loss and, 55
thermoregulation and, 61–66, 67–69
modes of heat loss, 62–63
thermoneutral zone, 63
Enzyme maturation, foodstuff
introduction and, 8
EPA. See Eicosapentaenoic acid
Epidermal growth factor (EGF),
gastrointestinal function and,
13–15
Epithelial absorptive cells, differentiation
of, 3
Epithelium, development of, 23–25
Escherichia coli, fetal development and, 5
ETG (external temperature gradient), 63–64
Evaporative heat loss, 62–63
humidity variation and, 65
limitation of, 64–65
devices for, 55, 57, 65–66, 68
transepidermal water loss and, 47–48,
55. See also Water loss
Exit mechanisms, in placental transfer, 116
External temperature gradient (ETG), 63–64
Extremely low birthweight (ELBW) infants, partial parenteral nutrition
for, 197–207, 209–210
F
Fat absorption
calcium retention and, 134
magnesium absorption and, 130–131
vitamin D and, 141
Fat deposition
energy vs. protein intake and, 170–179,
180–181
nutrient intake and, 77, 79
research methods, 82, 171–173,
174–177
weight gain and, 72, 77, 79, 82,
169–170, 173–174
Fat digestion, 83–89, 91
adult vs. newborn, 87–88
bile-salt-stimulated lipase in, 85–86, 87,
88, 89, 91
carboxylic ester hydrolase in, 86–87,
88, 89
colipase-dependent lipase in, 84–85, 87,
88
gastric lipase in, 83–84, 87, 88
pancreatic insufficiency and, 91
Fat mass, measurement methods, 45
Fat tissue, development of, 43, 44. See
also Fat deposition
Fatty acids
deficiency of, long-term consequences
of, 185
eyear feeding of, 180–181
long-chain polyunsaturated (LCP)
requirements for, 93–100, 102–103
synthesis of, 93, 94
solution problems, 181
vitamin A and, 137
vitamin E and, 155
Feeding, introduction of, enzyme maturation and, 8. See also Formulas; Human milk; Milk
Female vs. male outcomes, 193, 195–196
Fetal death, vitamin A toxicity and, 139, 150
Fetal development
of anatomical gut, 1–8
absorption functions, 7
biochemical maturation, 4–5
cellular differentiation, 2–4
digestive capacity vs. motility, 8
duodenal atresia and, 8
digestive maturation factor and, 14
genetic programming, 5–6
maternal steroids and, 7
organogenesis, 1
villi and crypts, 1–2
body composition and, 43–44
of endocrine system, 123
of immune system, 23–28, 29–30
epithelium, 23–25, 27
HLA-DR expression, 25–26
hormonal factors and, 20
lamina propria, 26, 27
Peyer’s patches, 26–27
salivary glands, 27–28
secretory component, 26
placental transport
mechanisms for, 116–117
of minerals, 115–120, 122–123
of vitamin A, 139–141
of vitamin D, 141–145
of vitamin K, 145–147
vitamin A and, 138–139
Fever, protein metabolism in, 106–108
FFA. See Free fatty acids
Fish oil, as fat source
fatty acid status and, 94, 99–100
infection–injury response and, 108
Fluid balance, 43–55, 57–59
See also Total body water
assessment methods, 46–47
growth patterns and, 54, 55
protein intake and, 80
types of water loss, 48
Fluid intake, postnatal weight loss and, 58
Folic acid
in human milk, vs. formulas, 154
requirements for, 154, 156
supplementation with, 156, 157, 158
Formulas
allergies and, 30, 186–187
brain development and, 188–189, 190
calcium absorption and, 128–129
childhood obesity and, 82
ergy expenditure/storage and, 73–79, 81, 198
hormone additives in, 19–20
LCP fatty acid problems in, 93–94
fish oils and, 94, 99–100
placental phospholipids and, 94–99, 100, 102
magnesium absorption and, 131
mineral balances and, 126–127
nutritional programming with, 184
outcome studies, 186–191
vitamin requirements and, 154, 155, 156, 157
degradation problems, 166
Forskolin, placental calcium transfer and, 119
Free fatty acids (FFA), as fat digestion product, 87
Full-term infants. See Term infants

G
Gastric acid secretion, epidermal growth factor and, 13, 13–14
Gastric lipase, in fat digestion, 83–84, 87, 88
pancreatic insufficiency and, 91
Gastric peptidase, 9
Gastrointestinal system
anatomical development of, 1–8
functional development of, 9–15, 19–21
Genetic potential, nutrition and, 82, 183
Genetic programming, in gut development, 5–6
Gestational age
See also Small for gestational age infants
body composition and, 43–44
protein/energy requirements and, 181
vitamin requirements and, 153–154
Glucocorticoids
See also Steroids
in amniotic fluid, 20
gastrointestinal tract maturation and, 10–13
infection–injury response and, 107
Glucose, placental transport of, 116
Glucose absorption, developmental changes in, 10
Glucose intolerance, protein intake and, 81–82
Glutamine
  infection-injury response and, 107, 109
  lymphocyte function and, 105
  surgery and, 109
  total parenteral nutrition and, 113
Glycerol, as fat digestion product, 87–88
Glycosylation, fetal development and, 5
Goblet cells, 4, 23
Growth, 169–179, 180–182
  See also Weight gain
  body composition and, 175–177
  early bone disease and, 187–188
  early postnatal, 49, 50
  energy intake and, 82, 173–174
  preterm feeding goal, 41
  in preterm vs. term infants, 53–54
  protein intake and, 173, 174
Growth factors
  See also Epidermal growth factor
  adding to formulas, 19–20
  somatostatin and, 20
Gut hormone, protein metabolism and, 110
Gut development. See Fetal development

H
Heat loss
  energy expenditure and, 55
  limitation of
    devices used for, 65–66, 67
    incubator air temperature and, 63–64
    incubator humidity and, 64–65
    “kangaroo” method for, 67, 68
  measurement methods, 47
  modes of, 62–63. See also specific modes
Heat shields, 55, 65
Hemorrhagic disorders, vitamin K and, 146, 147, 151, 158
HIV, in placentas, 103
HLA-DR molecules, fetal development and, 25–26, 27
Hologic 1000 densitometer, 127
Hormonal regulation
  of calcium transport, 119–120, 123
  protein metabolism and, 110
Hormones
  as formula additives, 19–20
  gastrointestinal maturation and, 10–15, 20
  epidermal growth factor (EGF), 13–15
  glucocorticoids, 10–13
Human immunodeficiency virus (HIV), in placentas, 103
Human milk
  advantages of, 191, 193, 198, 212
  allergy prevention with, 29–30, 186–187
  brain development and, 189, 191, 192–193
  calcium absorption and, 127–128, 129
  calcium retention and, 134–135
  calcium supplements for, 133
  childhood obesity and, 82
  energy content of, 34–35
  energy balance and, 72–79, 198
  epidermal growth factor and, 15
  LCP fatty acids in, 93
  lipolysis and, 83–89, 91
  magnesium absorption and, 130–131
  magnesium supplements for, 133
  mineral balances and, 126, 135
  mineral supplements for, 133, 134, 135
  necrotizing enterocolitis and, 191
  nucleotides in, 20
  nutritional outcome studies with, 186–191
  nutritional programming and, 184
  partial parenteral nutrition vs., 202, 203, 204
  phosphorus absorption and, 128
  phosphorus supplements for, 133, 134
  protein composition of, 37, 38
  protein-supplemented, in energy balance studies, 72–78, 81
  somatostatin in, 20
  supplementation of, 30, 196. See also specific supplements
  vitamin requirements and, 154, 155, 156, 157
Humidity
  insensible water loss and, 55
  thermoregulation and, 64–65
Hydration. See Total body water
Hydrocortisone, lactase activity and, 11
Hyperbilirubinemia
  albumin retention and, 199
  vitamin E and, 159, 160
Hypercalciuria, protein supplementation and, 134–135
Hypertyrosinemia, vitamin C and, 155
Hypocalcemia, vitamin D
    supplementation and, 158

I
IEL. See Intraepithelial lymphocytes
IgA cells, 26, 28
IgM cells, 28
Immune system, development of, 23–28, 29–30
    epithelium, 23–25, 27
    HLA-DR expression, 25–26
    hormonal factors and, 20
    lamina propria, 26, 27
    maternal antigens and, 29
    Peyer’s patches, 26–27
    salivary glands, 27–28
    secretory component, 26
Immunoglobulin G, placental transport of, 117
Intraventricular hemorrhage
    partial parenteral nutrition and, 200
    vitamin K and, 146, 147, 158
Intraventricular hemorrhage. See Peri-
    intraventricular hemorrhage (PIVH)
Iron, placental transport of, 117
Iron deficiency, long-term consequences
    of, 185
IUGR. See Intrauterine growth
    retardation

K
“Kangaroo” warming method, 67, 68

L
Lactalbumin, nitrogen retention and, 38
Lactase activity
    developmental changes in, 10
    epidermal growth factor and, 14, 15
    glucocorticoids and, 12
    hydrocortisone and, 11
    sucrase activity and, 21
Lactoglobulin, in cow’s milk, 38
Lactose digestion, developmental changes
    in, 10
Lamina propria, development of, 26, 27
LCP fatty acids. See Fatty acids
Lean body mass
    development of, 43, 44
    measurement methods, 45
    nutrient intake and, 77, 79
Linoleic acid (18:2 n-6)
    LCP fatty acids and, 93, 97, 98, 99, 100
    vitamin E requirements and, 155
Linolenic acid (18:3 n-3), LCP fatty acids
    and, 93, 94, 97, 98, 100, 103
Lipase activity
    colipase-dependent, 84–85
    developmental changes in, 10, 21
    in fat digestion, 84–85, 86–87
    glucocorticoids and, 12
    low birth weight and, 21
Lipids, digestion and absorption of,
    83–89, 91
    age and, 180–181
    BSSL in, 85–86, 87, 88, 89
    carboxylic ester hydrolase (CEH) in,
    86–87, 88, 89
    colipase-dependent lipase in, 84–85, 87, 88
Lipids, digestion and absorption of, (contd.)
  developmental changes in, 10
  gastric lipase in, 83–84, 87, 88
  vitamin requirements and, 167
Long-chain polyenoic (LCP) fatty acids
  requirements for, 93–100, 102–103
  synthesis of, 93, 94
Lymphocytes, intraepithelial (IEL),
  development of, 24–25

M
M cells, 4, 30
Magnesium
  absorption and retention of, 130–131, 133
  placental transfer of, 120
  requirements for, 125
  supplementation with, 133
Male vs. female outcomes, 193, 195–196
Malformations, vitamin A excess and, 139
Mattresses, heated, 67
Medium-chain triglycerides (MCTs),
  metabolizable energy and, 81
Mental development. See Brain development
Metabolic acidosis
  nutrient intake and, 81
  parenteral nutrition and, 198
Metabolic cost of growth, 50–51
Metabolic rate
  early research on, 41
  thermoregulation and, 65, 66
Metabolism
  adiposity index and, 51–52
  assessment methods, 45–46
  fluid requirements and, 43–55, 57–59
Metabolizable energy, 71
  energy intake and, 81
Microvillus atrophy, congenital, EGF and, 14
Milk
  See also Formulas; Human milk
  composition of solid foods vs., 9
  vitamin requirements and, 154–155
Minerals
  See also specific minerals
  absorption of, milk type and, 131, 133, 135, 194–195
  bone measurement methods, 127
  placental transfer of, 115–120, 122–123
  requirements for, 125, 126–133, 134–135
Miscarriage, vitamin A toxicity and, 139, 150
Monoglycerides, sn-2, as fat digestion product, 87
Morbidity
  fetal, vitamin A toxicity and, 139, 150
  vitamin E and, 159
Motility
  digestive capacity vs., 8
  epidermal growth factor and, 13
Multivitamin preparations, 157
  parenteral nutrition and, 163, 165, 201
Muscle protein degradation, role of, 105–106

N
Nature vs. nurture, nutrition and, 183
Necrotizing enterocolitis (NEC)
  breast milk and, 191
  epidermal growth factor and, 13
  fetal development and, 8
  glucocorticoids and, 11
  vitamin E and, 159
Neural tube defects, vitamin A excess and, 139
Niacin requirements, 154, 155
Nitric oxide, in infection-injury response, 110
Nitrogen, discovery of, 35
Nitrogen balance
  amino acid administration and, 180
  computation methods, 35–36
  energy storage and, 72
  illness or injury and, 106–107
  phosphorus retention and, 135
  research on, 37–39
Nitrogen intake
  See also Protein intake
  energy storage and, 81
  nitrogen retention and, 170, 171, 180
Nucleotides, 20
Nursing care, outcomes and, 195
Nutrient balance
  in energy storage calculation, 72
  examples of, 74–75
Nutrient intake
  energy balance and, 72–76, 77, 81
  metabolic acidosis and, 81
  prediction of, 173–174
  protein deposition and, 170–171
  weight gain and, 76–77, 78–79
Nutritional programming, 183–186. See also Outcome studies
Nutritional research, history of, 31–39

O
Obesity, genetics vs. nutrition and, 82
Open-field systems. See Radiant warmers
Osteomalacia, 135
Osteopenia, 132, 133, 134, 158
Osteoporosis, 135, 195
Outcome studies, 82, 186–191, 192–196
Oxygen, placental transport of, 116, 117
Oxygen toxicity, vitamin E and, 166
Oxygen uptake, energy expenditure and, 44–45

P
Pancreatic amylase activity. See Amylase activity
Pancreatic function
developmental changes in, 10, 21
glucocorticoids and, 12
Pancreatic lipase activity. See Lipase activity
Pancreatic protease activity, glucocorticoids and, 12
Pancreatic trypsin activity. See Trypsin activity
Paneth cells
development of, 23
fat digestion and, 88–89
Pantothenic acid requirements, 154
Paracellular mineral transport, 116, 117–118
Parathyroid hormone, placental calcium transfer and, 119
Parathyroid hormone-related peptide (PTHrP), placental calcium transfer and, 119–120
Parenteral nutrition
See also Total parenteral nutrition
calcium retention and, 134
dermal growth factor and, 15
artial, 197–207, 209–210
mino acids and, 197–200
clinical study described, 200–202
outcomes described, 202–205
outcomes discussed, 205–207
for vitamin administration, 161
recombinant growth hormone and, 110
Partial parenteral nutrition. See Parenteral nutrition
Patent ductus arteriosus (PDA)
as fluid excess risk, 55
vitamin E and, 159, 160
Pepsinogen secretion, EGF and, 13
Peri-intraventricular hemorrhage (PIVH)
vitamin E and, 159
vitamin K and, 146, 147, 158
Permeability, placental, 115–116
Peyer’s patches, development of, 26–27
pH of gastric contents, developmental changes in, 9
Phagocyte activation, prematurity and, 30
Phenobarbitone, maternal, gastrointestinal development and, 20
Phosphate
placental transfer of, 115
supplementation with, 130, 134
Phospholipids
placental, as LCP fatty acid source, 94–100, 102–103
red blood cell, human milk vs. formula and, 93–94
Phosphorus
absorption of, milk type and, 128, 130
calcium and, 133, 134–135
nitrogen retention and, 135
requirements for, 125, 130, 212
supplementation with, 133
vitamin D and, 158
Phototherapy
transepidermal water loss and, 58
vitamin B1 supplementation with, 156
vitamin requirements and, 165–166
PIVH. See Peri-intraventricular hemorrhage
Placental transfer
blood-to-amniotic fluid transfer vs., 122–123
of LCP fatty acids, 94–100, 102–103
mechanisms of, 116–117
of minerals, 115–120, 122–123
paracellular, 116, 117–118
of vitamin A, 137–141, 150–151, 152
of vitamin D, 141–145
of vitamin E, 151
of vitamin K, 145–147
Placentas, sources of, 94
Plastic bag, for heat retention, 68
Polyamines, as formula additives, 20
Polyethylene blanket, 66
Polymer heat shields. See Heat shields
Polyunsaturated fatty acids. See Fatty acids
Pooled human milk. See Human milk
Potassium
in growth analysis, 177
nutritional programming and, 194
placental transfer of, 115, 119
Preterm infants
See also Extremely low birthweight (ELBW) infants; Very low birthweight (VLBW) preterm infants
enzyme maturation in, 8
mineral requirements of, 125, 126–133, 134–135
nutritional programming and, 183–191
nutritional research and, 31–39, 40–41
sociocultural factors and, 193–194
vitamin D requirements of, 125–126
Protease (trypsin) activity, glucocorticoids and, 12
Protein
See also Amino acids; Nitrogen balance; Protein intake; Protein metabolism
calcium-binding, placental vs. gut transfer and, 123
defined, 35
digestion and absorption of, developmental changes in, 9–10
requirements for, 35–39
supplementation with, phosphorus and, 134–135
Protein intake
amino acid patterns and, 80
amino acid recycling and, 105
diuretic effects of, 80
energy balances and, 72–76, 77
fat storage and, 77, 79
glucose intolerance and, 81–82
optimal amount of, 81, 181–182, 211
phosphate excretion and, 135
protein deposition and, 170–179, 180, 181–182
research methods, 171–173, 174–177
vitamin B₆ requirement and, 155
Protein metabolism
amino acid recycling and, 112–113
disease or trauma and, 105–110, 112–114
functional role of, 105, 106
monitoring of, 112
regulating factors, 110, 113
in surgery, 108–110
Protein-supplemented human milk, in energy balance studies, 72–78, 81
PTHrP. See Parathyroid hormone-related peptide
PUFA (polyunsaturated fatty acids). See Fatty acids
Pyridoxine. See Vitamin B₆

R
Radiant heat loss, 62
limitation of, 63–64
preventive devices, 66, 68
Radiant warmers, 66, 67, 69
RBP. See Retinol-binding protein
RDA. See Recommended daily allowance
Receptor-mediated endocytosis, placental transfer by, 116, 117
Recombinant growth hormone, protein metabolism and, 110
Recommended daily allowance (RDA), of vitamins, 154, 155
Research, historical background, 21–29.
See also specific subjects
Respiratory distress, partial parenteral nutrition and, 200
Respiratory gases, placental transport of, 116, 117
Respiratory infection, vitamin A and, 159, 160
Respiratory insufficiency
partial parenteral nutrition and, 200, 209
vitamin A deficiency and, 157
Respiratory water loss, 48, 57
Retinal development, fatty acid deficiency and, 185
Retinoids, placental transfer of, 137–141
Retinol-binding protein (RBP), 137, 138
circulating vs. stored vitamin A and, 139, 151–152, 167
placental transport and, 140, 141
VLBW infants and, 157
Retinopathy of prematurity (ROP), 159, 160
Riboflavin. See Vitamin B₂
Rickets, 132, 143, 155, 158
ROP. See Retinopathy of prematurity

S
Salivary glands
as epidermal growth factor source, 13
immune system and, 27–28
Secretory component, development of, 26
Sepsis, vitamins and, 159, 160
Set point temperature, decreasing, 68
SGA infants. See Small-for-gestational age infants
Skeletal system. See Bones
Skin, heat loss through. See Evaporative heat loss; Water loss, transepidermal
Skin temperature
  humidity variation and, 65
  in incubator servo-control system, 64
set point, age and, 68
Skinfold calipers, use of, 46, 58-59
Skinfold thickness
  adiposity index and, 51-53
  in AGA infants, 52
  as assessment tool, 46
measurement methods, 46, 58-59
TBW changes and, 49, 50, 51
Small-for-gestational-age (SGA) infants
diet and brain development in, 188-189, 190
growth patterns and, 177-178
gut maturation in, 8
nutritional management for, 182, 193
vitamin A status and, 138
Small intestine, development of, 1-8
  glucocorticoids and, 12
  HLA-DR expression in, 25-26
  immunology and, 23-28, 29-30
  sn-2 monoglycerides, as fat digestion product, 87
Sucrase activity
  developmental changes in, 10
  epidermal growth factor and, 14, 15
  glucocorticoids and, 11
  lactase activity and, 21
Sucrase-isomaltase activity,
  glucocorticoids and, 11, 12, 13
Sudden infant death syndrome,
  phospholipids and, 102, 103
Surgery
  hormonal regulation and, 110
  protein metabolism and, 108-110

T
T cells, 25, 26, 27, 28
TBW. See Total body water
TCR (T-cell receptor) expression. See T cells
Teratogen, vitamin A as, 138-139, 150
Term infants
  bone mineral content in, 131, 132
  calcium/phosphorus ratio and, 135
  mother’s milk volume and energy quotient of, 35, 36
  nitrogen balance in, 37
  thermoregulation and, 61
  vitamin D requirements of, 126
  weight gain in, fat deposition and, 169-170
Thermal blankets, 66, 68
Thermogenesis, dobutamine/dopamine and, 58
Thermoneutral zone, 63, 211
Thermoplastic polymer heat shield. See Heat shields
Thermoregulation, 61-66, 67-69
  age and, 68, 69
  control methods, 65-66, 67-69
  humidity and, 64-65
  skin vs. air temperature and, 63-64
  modes of heat loss, 62-63
  thermoneutral zone, 63, 68, 211
Thiamine. See Vitamin B1
TNF. See Tumor necrosis factor
Total body water (TBW)
  early postnatal growth and, 49, 50
  growth calculation and, 175-176
  normal percentage of, 54
  skinfold thickness and, 51
  water requirements and, 54
Total parenteral nutrition (TPN)
  epidermal growth factor and, 15
  lipids in, 181
  protein metabolism and, 113-114
  recombinant growth hormone and, 110
  vitamins and, 161-162, 163, 165
SUBJECT INDEX

Transcellular mineral transport, 117, 118, 120
chloride, 118
potassium, 119
sodium, 118–119, 120
Transport mechanisms, in placenta, 116–117
placenta type and, 137
for vitamin A, 140–141
Transporter molecules, 116
Transthyretin (TTR), 137–138, 140, 141
Trauma, protein metabolism in, 105–106, 108–110
Tricyglycerides
dietary, percentage of, 84
medium-chain (MCTs), metabolizable energy and, 81
Trypsin activity
developmental changes in, 9, 21
glucocorticoids and, 12
low birth weight and, 21
Tryptophan intake, niacin requirement and, 155
TTR. See Transthyretin
Tuft (caveolated) cells, 4
Tumor necrosis factor (TNF), inflammatory response and, 107, 112
20:4 n-6. See Arachidonic acid
20:5 n-3, in fish oils, 94
22:4 n-6. See Docosatetraenoic acid
22:6 n-3. See Docosahexaenoic acid

U
Urea, in infection-injury response, 110
Urinary water losses, 48

V
Vegetable oil, as fat source, 93–94
Ventilation
partial parenteral nutrition and, 200
respiratory water loss and, 57–58
Very low birthweight (VLBW) preterm infants
energy balance in, 71–79, 80–82
factors affecting, 153–157
mineral requirements of, 125, 132, 133
partial parenteral nutrition for, 197–207, 209–210

Vitamin A
requirements of, 153–163, 165–167
factors affecting, 153–157
vitamin D, 125–126
Villi, development of, 1–2, 3
Visual dysfunction
DHA and, 94
diet and, 194
fatty acid deficiency and, 185
vitamin A and, 159–160
Vitamin A
circulating vs. stored, 139, 151–152, 167
in human milk vs. formulas, 154
maternal supplementation with, 139–140, 151, 162
parenteral nutrition and, 165
phototherapy and, 165–166
placental transfer of, 137–141, 150–151, 152
requirements for, 154, 156, 157
supplementation with, 156, 157, 159–160, 162
as teratogen, 138–139, 150
Vitamin B1 (thiamine)
in human milk vs. formula, 154
requirements for, 154, 156
supplementation with, 156
Vitamin B2 (riboflavin)
in human milk vs. formulas, 154
requirements for, 154, 156
supplementation with, 156
Vitamin B6 (pyridoxine)
in human milk vs. formulas, 154
requirements for, 154, 155, 156
supplementation with, 156
Vitamin B12 absorption of, glucocorticoids and, 12
in human milk vs. formulas, 154
requirements for, 154
Vitamin C
in human milk vs. formulas, 154
requirements for, 154, 155, 156, 157
supplementation with, 39, 156, 157
Vitamin D
calcium absorption and, 127, 128–129
disease prevention with, 132, 133, 134, 158
free levels of, 151
gut development and, 20
in human milk vs. formula, 154
maternal supplementation with, 143
mineral absorption and, 131
in partial parenteral nutrition, 201
placental transfer of, 141–145
requirements for, 125–126, 154, 155, 156
supplementation with, 155–156, 158
Vitamin E
in human milk vs. formulas, 154
oxygen toxicity and, 166
parenteral nutrition and, 165
placental transfer of, 151
requirements for, 154, 155, 156, 166
supplementation with, 156, 159, 160
toxicity of, 160
Vitamin K
cancer risk and, 166
deficiency prevention, 155
delivery route for, 166–167
in human milk vs. formula, 154
maternal supplementation with, 146–147, 151, 162
molecular structures of, 145
parenteral nutrition and, 165
placental transfer of, 145–147
requirements for, 154, 155, 156, 166, 167
supplementation with, 155, 156, 158
Vitamin requirements, 212
See also specific vitamins
formula degradation and, 166
intravenous feeding and, 161–162
monitoring methods and, 167
multivitamin preparations, 157, 163, 165
parenteral nutrition and
partial, 201
total, 161–162, 163
phototherapy and, 156, 165–166
for VLBW infants, 153–163, 165–167
disease prevention and, 157–161
factors affecting, 153–157
VLBW preterm infants. See Very low birthweight (VLBW) preterm infants

W
Water balance. See Fluid balance: Total body water
Water loss
energy expenditure and, 47–48, 55
insensible, 46
evaporimetric assessment of, 46–47
preventing, 55
respiratory, 48, 57–58
stool, 48
transepidermal, 47–48
energy balance and, 51
measurement of, 46–47
phototherapy and, 58
reducing, 55, 57
urinary, 48
Weaning practices, outcomes and, 193, 194
Weight gain, 43, 44
See also Growth
body composition and, 175–177, 178–179
energy intake and, research problems, 82
energy storage calculation and, 72
fat deposition and, 72, 77, 79, 82, 169–170, 173–174
nutrient intake and, 76–77, 78–79, 170–171
model for studying, 171–173, 174–177
nutritional programming and, 184
optimum rate of, 169
partial parenteral nutrition and, 202
patterns of, 181
postnatal, causes of, 50
protein intake and, 173, 174
Weight loss, postnatal, 169, 173, 180
causes of, 50
composition of, 181
fluid intake and, 58
IUGR and, 209