



INDEX

A

- Abdominals
 - exhalation and, 25
 - hypotonia, 47, 57
 - infants with typical development, 232–233, 234
 - spastic diplegia, 97, 134
 - spastic quadriplegia, 89
- Abnormal range of joints and muscle, 23
- Accompanying impairments classification, 2, 4
- Acetabulum, 119
- Activity
 - capacity, 17
 - defined, 7
 - examples, 8
 - individual and specific, 17
 - performance, 17
 - positive/negative aspects, 9
- Activity limitations
 - ataxic cerebral palsy, 202, 204–205, 207, 209
 - characteristics, 12
 - dyskinetic cerebral palsy, 164–165, 168, 172
 - hypotonia, 41, 45, 50–51
 - impairments, 13
 - postural control and movement, 12, 13
 - spastic diplegia, 93, 96, 99, 101–102
 - spastic hemiplegia, 103, 105, 106, 108
 - spastic quadriplegia, 89–90
- Alignment, hypotonia studies, 59–60
- Anatomical and neuroimaging classification, 2, 4
- Ankle, spastic cerebral palsy, 120, 121
- Anticipatory control
 - ataxic cerebral palsy, 199
 - diplegia and, 81
 - dyskinetic cerebral palsy, 184–185
 - hemiplegia and, 81
 - spastic cerebral palsy, 82–83
- Anticipatory postural adjustments, 10
- Antigravity postural control. *See* Infants with typical development
- Arms. *See* Upper extremities
- Arousal, defined, 25. *See also* Physiological arousal and attention
- Asymmetrical tonic neck reflex (ATNR), 161
- Ataxia
 - defined, 197
 - postures, 100
 - sensory processing impairments, 22
 - stiffness, 78
- Ataxic cerebral palsy, 197–223
 - activity limitations, 202, 204–205, 207, 209
 - body structures and functions, 210–215
 - joints, 212–213
 - musculoskeletal system, 213–214
 - neuromuscular system, 210–211
 - physiological arousal and attention, 214
 - respiratory system, 214
 - sensory/perceptual systems, 211–213
 - swallowing, digestion, elimination, 215
 - walking, 202, 203, 205, 209
 - causes, 197–198
 - eyes, 200–203, 211–212, 215–217, 220
 - feeding, 200, 202–203, 205, 213
 - intervention case studies, 219–223
 - intervention strategies, 215–218
 - motor learning, 209–210
 - pathophysiology, 197–198
 - postural control and movement, 198–209
 - characteristics, 198–199
 - drooling, 200, 202
 - eyes, 200–203
 - feeding, 200
 - head, neck, tongue, and eyes, 200–203
 - lower trunk, 205–207
 - muscle synergies, 199–200
 - neck, 200–203
 - participation restrictions, 202
 - pelvic girdle and lower extremities, 207–209
 - thoracic spine, ribcage, and upper extremities, 203–205
 - tongue, 200–203
 - sitting, 203, 206
 - speech–language, 203, 207, 214, 221–222
 - standing, 199, 208, 209, 219–220
 - symptoms, 3
 - synergies, 199–200, 204, 210, 211
 - vision, 211–212
- Athetosis
 - characteristics, 155
 - hip dislocation, 169

- kinesthetic sense, 175
 - lower trunk, 167
 - musculoskeletal system, 178, 179
 - neuromuscular system, 173, 174
 - reaching, 161, 162, 164, 173, 184
 - sitting, 170
 - standing, 171
 - symptoms, 3
 - Attention, defined, 25. *See also* Physiological arousal and attention
 - Audition, purpose of, 9
 - Auditory processing in ataxia, 213
- B**
- Balance
 - defined, 9
 - infants with typical development, 237
 - Ball. *See* Therapy ball
 - Basal ganglia, 153–154
 - Belly breathing
 - ataxic cerebral palsy, 204
 - defined, 24
 - hypotonia, 57
 - Bilateral spasticity, 92
 - Bimanual task using interlimb coordination, 68
 - Body structures and functions
 - ataxic cerebral palsy, 210–215
 - musculoskeletal system, 213–214
 - neuromuscular system, 210–211
 - physiological arousal and attention, 214
 - respiratory system, 214
 - sensory/perceptual systems, 211–213
 - swallowing, digestion, elimination, 215
 - defined, 7
 - dyskinetic cerebral palsy, 173–181
 - cardiorespiratory and muscle endurance, 180–181
 - musculoskeletal system, 177–180
 - neuromuscular system, 173–174
 - respiratory system, 180
 - sensory/perceptual systems, 174–177
 - swallowing, digestion, elimination, 181
 - examples, 8
 - hypotonia, 51–59
 - cardiorespiratory and muscle endurance, 58
 - elimination, 59
 - musculoskeletal system, 54–57
 - neuromuscular system, 51–53
 - physiological arousal and attention, 58
 - respiratory system, 57
 - sensory/perceptual systems, 53–54
 - swallowing and digestion, 58–59
 - impairments, 18–28
 - cardiorespiratory and muscle endurance, 26
 - musculoskeletal system, 22–24
 - neuromuscular system, 19
 - physiological arousal and attention, 25–26
 - primary vs. secondary, 18–19
 - respiratory system, 24–25
 - sensory/perceptual systems, 21–22
 - skin condition, 28
 - swallowing, digestion, elimination, 27–28
 - positive/negative aspects, 9
 - spastic cerebral palsy, 108–124
 - cardiorespiratory and muscle endurance, 123
 - musculoskeletal system, 114–122
 - neuromuscular system, 108–111
 - physiological arousal and attention, 123
 - respiratory system, 122–123
 - sensory/perceptual systems, 112–113
 - swallowing, digestion, elimination, 123–124
 - Body system impairments, 11–12
 - Bones, spastic cerebral palsy, 121
 - Breath holding
 - hypotonia, 47, 67
 - spastic cerebral palsy, 123
 - Breathing
 - spastic quadriplegia, 87
 - and swallowing coordination study, 11
 - Bronchopulmonary dysplasia, 26
- C**
- Capacity, defined, 17
 - Cardiorespiratory and muscle endurance
 - body function and structure impairments, 26
 - dyskinetic cerebral palsy, 180–181
 - hypotonia, 58
 - spastic cerebral palsy, 123
 - Case studies
 - ataxic cerebral palsy, 219–225
 - dyskinetic cerebral palsy, 188–192
 - hypotonia, 69–75
 - spastic diplegia, 137–139
 - spastic hemiplegia, 142–145
 - spastic quadriplegia, 131–133
 - Causation and timing classification, 2, 4. *See also* Pathophysiology
 - Causes of cerebral palsy, early theories, 1
 - Central nervous system
 - control of muscle activity, 20–21
 - impairments caused by lesions, 1
 - joint stiffness and, 19
 - lesions, impact of, 21
 - lesions causing spasticity, 78
 - Cerebellum
 - attention impairments, 214
 - damage during preterm birth, 197–198
 - functions, 210
 - motor learning, 218
 - proprioception perception, 212

- respiratory system disruptions after surgical resection, 214
 - sensory feedback loops, 211
 - Cerebral palsy
 - classifications, 2–4
 - accompanying impairments, 2, 4
 - anatomical and neuroimaging, 2, 4
 - causation and timing, 2, 4
 - functional, 2, 4
 - motor type, 2–3
 - defined, 1–2
 - Cervical spine
 - dyskinetic cerebral palsy, 157, 178
 - hypotonia, 38–39
 - spastic quadriplegia, 84
 - CFCS (Communication Function Classification System), 4
 - Chin tuck
 - dyskinetic cerebral palsy, 183
 - hypotonia, 40, 45, 60, 74
 - Chorea
 - characteristics, 155
 - symptoms, 3
 - Choreoathetosis
 - basketball, dribbling, 191–192
 - cardiorespiratory and muscle endurance, 180–181
 - defined, 155
 - lower extremities, 168
 - musculoskeletal system, 177
 - neuromuscular system, 173–174
 - postural control and movement, 157, 161
 - proprioception, 213
 - quieting themselves, 184
 - tactile discrimination, 176
 - timing and ordering of movements, 175
 - Classifications of cerebral palsy, 2–4
 - accompanying impairments, 2, 4
 - anatomical and neuroimaging, 2, 4
 - causation and timing, 2, 4
 - functional, 2, 4
 - motor type, 2–3
 - Cocontraction
 - ataxic cerebral palsy, 208–209, 210–211
 - compensatory, 109
 - defined, 19
 - graded activity, 20
 - hypotonia, 20, 51
 - limb or joint stiffness, 19–20
 - neuromuscular system control of, 19
 - new skills and, 20
 - purpose of, 19–20
 - spastic cerebral palsy, 108–109
 - spasticity, 20
 - Communication Function Classification System (CFCS), 4
 - Compensatory cocontraction, spastic cerebral palsy, 109
 - Compensatory lateral flexion, 103
 - Compensatory postural adjustments, 10
 - Compensatory responses in sitting, 80
 - Constipation. *See also* Elimination
 - hypotonia, 59
 - spastic quadriplegia, 124
 - tube-fed children and, 27
 - Cooling after birth, 154
 - Core sets, 8
- D**
- Definition of cerebral palsy, 1–2
 - Depth perception
 - hypotonia, 40
 - spastic diplegia, 138
 - spastic quadriplegia, 84
 - Development of children with cerebral palsy, 28–29
 - Development of infants. *See* Infants with typical development
 - Development predictability of children with cerebral palsy, 28–29
 - Diaphragm
 - functions, 24–25
 - hypotonia, 43
 - spastic diplegia, 97
 - spastic quadriplegia, 87
 - Digestion
 - ataxic cerebral palsy, 215
 - dyskinetic cerebral palsy, 181
 - esophagus, 27
 - hypotonia, 58–59
 - nutrition and oral motor skills, 28
 - spastic cerebral palsy, 123–124
 - Diplegia. *See also* Spastic diplegia
 - defined, 77
 - sitting, 170
 - Direction-specific activity
 - compensatory postural adjustments, 10
 - spastic diplegia and, 80
 - Domains in the ICF model, 7, 9
 - Down syndrome
 - excessive joint mobility, 56
 - similarities to hypotonia, 37
 - subluxation and dislocation, 55
 - Drug use causing hypotonia and lethargy, 58
 - Dyskinetic cerebral palsy, 153–192
 - athetosis, 155. *See also* Athetosis
 - basal ganglia injury, 153–154
 - body structures and functions, 173–181
 - cardiorespiratory and muscle endurance, 180–181
 - musculoskeletal system, 177–180
 - neuromuscular system, 173–174

- respiratory system, 180
 - sensory/perceptual systems, 174–177
 - swallowing and digestion, 180, 181
 - causes, 155–154
 - characteristics, 153, 156
 - chorea, 155
 - choreoathetosis, 155
 - defined, 153
 - dystonia, 155. *See also* Dystonia
 - eyes, 157, 167, 174–175
 - feeding, 159, 185–186
 - intervention case studies, 188–192
 - intervention strategies, 181–188
 - pathophysiology, 153–154
 - postural control and movement, 156–172
 - activity limitations, 164–165, 172
 - asymmetry, 156–159
 - eyes, 157, 167
 - head, 156–159, 161
 - hips, 157, 169–170, 177–178
 - jaw, 158
 - joints, 160, 162, 180
 - lower extremities, 168–172
 - lower trunk, 166–168
 - neck, 156–159, 161
 - overview, 156
 - participation restrictions, 168
 - pelvic girdle, 168–172
 - ribcage, 162, 165
 - scotting backward in supine, 163
 - sitting, 160, 163, 170, 172
 - thoracic spine, 160, 163
 - tongue, 158
 - trunk control, 187
 - upper extremities, 159–162, 164
 - walking, 171–172
 - reaching, 162, 185
 - simulating a function, 210
 - speech–language, 180, 187–188
 - standing, 159, 160, 166, 170–171, 172, 185
 - symptoms, 3
 - synergies, 174
 - vision, 163, 174–175
- Dysmetria, 198
- Dystonia
- as cause of hypertonia, 78
 - cervical spine instability, 178
 - characteristics, 155
 - hypotonia, 62, 155
 - intervention strategies, 183
 - lower extremities, 168
 - musculoskeletal system, 180
 - neuromuscular system, 173–174
 - postural control and movement, 157, 163, 166
 - reaching, 166, 173
 - standing, 172
 - symptoms, 3
- tactile discrimination, 176
 - trunk control, 187
 - vision, 175
- E**
- Eating. *See* Feeding
- Eating and Drinking Ability Classification System (EDACS), 4
- EDACS (Eating and Drinking Ability Classification System), 4
- Elimination
- ataxic cerebral palsy, 215
 - constipation
 - hypotonia, 59
 - spastic quadriplegia, 124
 - tube-fed children and, 27
 - hypotonia, 59
 - spastic cerebral palsy, 124
 - tube-fed children and, 27
- Endurance, cardiorespiratory and muscle. *See* Cardiorespiratory and muscle endurance
- Environmental factors
- characteristics, 12
 - defined, 7
 - hypotonia, 45
 - positive/negative aspects, 9
- Esophagus, 27
- Excessive range of joints and muscle, 23
- Extremities. *See* Lower extremities; Upper extremities
- Eye extension
- dyskinetic cerebral palsy, 157
 - postural control and movement, 21
 - spastic cerebral palsy, 112
 - spastic quadriplegia, 84
- Eyes. *See also* Vision
- ataxic cerebral palsy, 200–203, 211–212, 215–217, 220
 - downward gaze therapy, 74
 - dyskinetic cerebral palsy, 157, 167, 174–175
 - hypotonia, 40, 41, 53
 - infants with typical development, 227, 228
 - position, 9
 - spastic diplegia, 92–93, 137
 - spastic hemiplegia, 102–103
 - spastic quadriplegia, 84
 - strabismus, 92, 174
- F**
- Feeding. *See also* Swallowing
- ataxic cerebral palsy, 200, 202–203, 205, 213
 - breathing and swallowing coordination, 11
 - dyskinetic cerebral palsy, 159, 185–186
 - dyskinetic cerebral palsy intervention, 188–192
 - Eating and Drinking Ability Classification System, 4
 - food choices, hypotonia intervention, 69–71
 - hypotonia, 65, 69–71

- infants with typical development, 228
 - respiratory system and, 25
 - spastic hemiplegia, 142
 - spastic quadriplegia, 84, 130
 - swallowing, digestion, elimination, 27–28
 - tube-fed children and elimination, 27
 - Femur, 119, 121
 - Food choices, hypotonia intervention, 69–71
 - Foot, spastic cerebral palsy, 120, 121
 - Forces, defined, 78
 - Freud, Sigmund, 1
 - Functional classification
 - Communication Function Classification System, 4
 - deterioration and worsening of skills, 18
 - Eating and Drinking Ability Classification System, 4
 - Gross Motor Functional Classification System, 4
 - hypotonia, 38
 - hypotonia intervention, 62–65
 - Manual Ability Classification System, 4
 - overview, 2, 4
 - postural control and movement, 21
 - Functional limitations
 - ataxic cerebral palsy, 204
 - dyskinetic cerebral palsy, 172
 - spastic hemiplegia, 104–105, 106
- G**
- Gait analysis, hypotonia, 47. *See also* Walking
 - GAS (goal attainment scaling), 8
 - Gastroesophageal reflux (GER)
 - cause of, 27
 - dyskinetic cerebral palsy, 181
 - spastic quadriplegia, 124
 - General Movement Assessment, 10
 - Generalized hypotonia. *See* Hypotonia
 - GMFCS (Gross Motor Functional Classification System), 4
 - Goal attainment scaling (GAS), 8
 - Graded activity, cocontraction, 20
 - Graded control, hypotonia, 52, 64–65
 - Grasp, dyskinetic cerebral palsy, 162, 165
 - Graviception, 9
 - Gross Motor Functional Classification System (GMFCS), 4
- H**
- Hamstrings, 180
 - Hand movement studies, 11
 - Head control
 - ataxic cerebral palsy, 200–203
 - dyskinetic cerebral palsy, 156–159, 161
 - hypotonia, 38–40, 41, 60–62
 - infants with typical development, 227–229
 - joint approximation, 61
 - lack of, 11
 - purpose of, 9
 - spastic diplegia, 92–93
 - spastic hemiplegia, 102–103
 - spastic quadriplegia, 83–84
 - thoracic extension therapy, 70
 - Health condition
 - defined, 7
 - ICF diagram, 8
 - pathophysiology, 17
 - positive/negative aspects, 9
 - Hemianopia, 102
 - Hemiplegia
 - causes, 79
 - defined, 77
 - postural synergies, 80
 - Hips. *See also* Pelvic girdle
 - athetosis, 169
 - dyskinetic cerebral palsy, 157, 169–170, 177–178
 - hypotonia, 47, 56
 - infants with typical development, 235
 - joint development, 23
 - spastic cerebral palsy, 118–120
 - spastic diplegia, 97, 100, 135–136
 - spastic hemiplegia, 107
 - spastic quadriplegia, 88, 90–91
 - subluxation and dislocation, 118–119
 - Holistic treatment, 1
 - Humerus, 121
 - Hydrocephalus, 37
 - Hyperbilirubinemia, 176–177
 - Hyperlordosis, 118
 - Hypermobility of joints and muscles, 23
 - Hypertonia
 - causes, 78
 - defined, 77–78, 155
 - dystonia and, 62, 155
 - postural control and movement, 165
 - reaching, 176
 - spastic quadriplegia and dystonia, 79
 - stiffness, 78
 - voicing, 187
 - wheelchair control, 184
 - Hypomobility of joints, 23
 - Hypotonia, 37–75
 - body structures and functions, 51–59
 - cardiorespiratory and muscle endurance, 58
 - elimination, 59
 - hips, 47, 56
 - musculoskeletal system, 54–57
 - neuromuscular system, 51–53
 - physiological arousal and attention, 58
 - respiratory system, 43, 45, 57
 - sensory/perceptual systems, 53–54
 - swallowing and digestion, 58–59
 - vision, 53–54
 - case studies, 69–75
 - cocontraction, 20
 - defined, 37

- feeding, 65, 69–71
 - graded control, 52, 64–65
 - intervention strategies, 59–68
 - alignment, 59–60
 - food choices, 69–71
 - gaining function, 62–65
 - graded control, 64–65
 - head and trunk control, 60–62
 - movements requiring change in direction, 66–67, 72–73
 - occupational therapy, 68
 - seating systems, 69, 184
 - speech–language, 65, 67
 - trunk control, 60–62, 63
 - walking, 66
 - writing, 68
 - pathophysiology, 37
 - postural control and movement, 38–51
 - abdominals, 47, 57
 - characteristics, 38
 - diaphragm, 43
 - environmental factors, 45
 - eyes, 40, 41, 53
 - head, 38–40, 41
 - lower extremities, 49–51
 - lower trunk, 45–49
 - neck, 38–39, 41
 - participation restrictions, 41, 45, 50–51
 - pelvic girdle, 49–51
 - ribcage, 41–45, 57
 - shoulders, 39, 42, 44, 55–56
 - sitting, 43, 49
 - standing, 42, 46, 50
 - thoracic spine, 39, 41–46
 - tongue, 40, 41
 - upper extremities, 41–45
 - spastic quadriplegia vs., 90–91
 - speech–language, 45, 63, 65, 67
 - synergies, 111
- Hypoxic–ischemic injury, 154
- I**
- ICD (International Classification of Diagnosis), 7
 - ICF. *See* International Classification of Functioning, Disability and Health (ICF)
 - ICF–CY (International Classification of Functioning, Disability and Health, children and youth version), 8
 - ICHI (International Classification of Health Intervention), 7
 - Impairments of body functions and structures, 18–28
 - activity limitations, 13
 - body system, 11–12
 - cardiorespiratory and muscle endurance, 26
 - deterioration and worsening of skills, 18
 - dyskinetic cerebral palsy, 174
 - hypotonia, 56
 - musculoskeletal system, 22–24
 - neuromuscular system, 19
 - physiological arousal and attention, 25–26
 - primary vs. secondary, 18–19
 - respiratory system, 24–25
 - sensory/perceptual systems, 21–22
 - skin condition, 28
 - spastic cerebral palsy, 109–111
 - swallowing, digestion, elimination, 27–28
 - Implants, 28
 - In vivo* ultrasound technology, 114
 - Infants with typical development, 227–257
 - abdominals, 232–253, 234
 - carrying with front pack carrier, 230
 - eyes, 227, 228
 - feeding, 228
 - head control, 227–229
 - hips, 235
 - lower extremities, 234–257
 - lower trunk, 232–234
 - neck, 227–228
 - pelvic girdle, 234–237
 - ribcage, 229–231
 - shoulders, 229, 230
 - sitting, 231
 - speech–language, 233
 - standing, 231, 236, 257
 - thoracic spine, 229–231, 233
 - tongue, 228
 - trunk control, 235
 - walking, 237
 - Intercostal muscles
 - dyskinetic cerebral palsy, 163
 - exhalation and, 25
 - hypotonia, 62
 - Interlimb coordination, 68, 74
 - Internal intercostals, 25
 - International Classification of Diagnosis (ICD), 7
 - International Classification of Functioning, Disability and Health (ICF)
 - children and youth version, 8
 - core sets, 8
 - domains, 7, 9
 - health condition diagram, 8
 - postural control and movement in children
 - developing typically, 9–11
 - postural control and movement in children with cerebral palsy, 11–13
 - activity limitations, 12. *See also* Activity limitations
 - body system impairments, 11–12
 - environmental barriers, 12. *See also* Environmental factors
 - ineffective postural control and movement, 12. *See also* Postural control and movement
 - participation restrictions, 12. *See also* Participation restrictions
 - personal barriers, 12

- purpose of, 7
 - terms, 7, 9
 - uses for, 7
 - International Classification of Health Intervention (ICHI), 7
 - Intervention
 - ataxic cerebral palsy, 215–218
 - ataxic cerebral palsy case studies, 219–223
 - attentional costs of, 26
 - basketball, dribbling, 191–192
 - benefits of, 1
 - cardiorespiratory and muscle endurance, 26
 - central nervous system lesions, 1
 - dyskinetic cerebral palsy, 181–188
 - dyskinetic cerebral palsy case studies, 188–192
 - dystonia, 183
 - early treatments, 1
 - feeding impairments, 27
 - holistic, 1
 - hypotonia, 59–68
 - alignment, 59–60
 - food choices, 69–71
 - gaining function, 62–65
 - graded control, 64–65
 - head and trunk control, 60–62
 - movements requiring change in direction, 66–67, 72–73
 - occupational therapy, 68
 - seating systems, 69, 184
 - speech–language, 63, 65, 67
 - trunk control, 63
 - walking, 66
 - writing, 68
 - International Classification of Health Intervention, 7
 - occupational therapy
 - cutting with scissors, 73–75
 - dyskinetic cerebral palsy feeding, 188–190
 - hand therapy, 142–145
 - writing, 68
 - organized plan to teach new functions, 29
 - orthopedic treatment approach, 1
 - pulse oximetry during, 26
 - reassessment of the child, 29
 - spastic diplegia, 133–139
 - spastic hemiplegia, 140–145
 - spastic quadriplegia, 124–130, 131–133
 - therapist skills needed, 29
 - with therapy ball. *See* Therapy ball
 - visual intervention and motor performance, 22
- Intracranial hemorrhages, 78
- J**
- Jaw
- dyskinetic cerebral palsy, 158
 - oral motor skills, 27
- Joints. *See also* Hips
- abnormal range, 23
 - ankle and foot, 120, 121
 - ataxic cerebral palsy, 212–215
 - dyskinetic cerebral palsy, 160, 162, 180
 - equinus, 120
 - full flexion, 56
 - hyperextension, 56
 - joint approximation
 - ataxic cerebral palsy, 212–215
 - repetitive, 61
 - spastic quadriplegia, 126
 - knee, spastic cerebral palsy, 120
 - spastic cerebral palsy, 118–121
 - stiffness, 19. *See also* Stiffness
 - temporomandibular joints, 158
- Jumping, spastic diplegia, 136
- K**
- Kernicterus, 176–177
- Kinesthesia, 113
- Knee, spastic cerebral palsy, 120
- Kyphosis
- defined, 116
 - hypotonia, 54
 - spastic cerebral palsy, 116, 118
- L**
- Language. *See* Speech–language
- Legs. *See* Lower extremities
- Lesions
- central nervous system lesions
 - causing spasticity, 78
 - impact of, 21
 - impairments caused by, 1
 - cerebrum, and spastic diplegia, 78
 - dyskinetic cerebral palsy, 153, 154
 - motor performance dysfunction caused by brain lesions, 2
- Little, William, 1
- Little’s disease, 1
- Lordosis
- infants with typical development, 232, 233
 - spastic cerebral palsy, 118
 - spastic quadriplegia, 88, 89
- Lower extremities
- ataxic cerebral palsy, 207–209
 - dyskinetic cerebral palsy, 168–172
 - dystonia, 168
 - femur, 119, 121
 - foot, spastic cerebral palsy, 120, 121
 - functions, 234, 236
 - hamstrings, 180
 - hypotonia, 49–51
 - infants with typical development, 234–237
 - spastic diplegia, 99–102
 - spastic hemiplegia, 106–108
 - spastic quadriplegia, 90–92

Lower trunk

- ataxic cerebral palsy, 205–207
- dyskinetic cerebral palsy, 166–168
- hypotonia, 45–49
- infants with typical development, 232–234
- spastic diplegia, 96–99, 133–139
- spastic hemiplegia, 105–106
- spastic quadriplegia, 87–90

Lumbar extension. *See* Lordosis

Lumbar flexion, spastic quadriplegia, 89

Lyra splinting use in dyskinetic cerebral palsy, 176

M

MACS (Manual Ability Classification System), 4

Manual Ability Classification System (MACS), 4

Manual vibration

- ataxic cerebral palsy, 221–222
- spastic cerebral palsy, 110
- spastic diplegia, 135
- spastic quadriplegia, 125

Motor control, selective

- defined, 21
- spastic cerebral palsy, 111

Motor performance dysfunction, 2

Motor type classification

- hypotonia, 37, 52
- learning differences, 209–210
- overview, 2–5

Motor units, fast- and slow-twitch, 121

Movement

- defined, 10
- postural activity, 10
- postural control and movement in children with cerebral palsy, 11–15. *See also* Postural control and movement
- spontaneous general movements, 10
- studies, 10–11

Muscle biopsies, 114

Muscle tone, 19

Muscles. *See also* Neuromuscular system

- controlled by central nervous system, 20–21
- endurance. *See* Cardiorespiratory and muscle endurance
- postural activity, 9
- shortened, 114–115
- synergies, 21

Musculoskeletal system, 22–24

- acetabulum, 119
- ataxic cerebral palsy, 215–214
- athetosis, 178, 179
- dyskinetic cerebral palsy, 177–180
- dystonia, 180
- endurance. *See* Cardiorespiratory and muscle endurance
- extensibility of muscles, 23
- femur, 119
- growth factors, 22

hip joint. *See* Hips; Pelvic girdle

- hypermobility, 23
- hypomobility, 23
- hypotonia, 54–57
- impairments, 22–23
- for mobility functions, 48
- spastic cerebral palsy, 114–122
- for stability functions, 48
- strength
 - force production, 23–24
 - hypotonia, 57

N

NDT (Neuro-Development Treatment), 28–29

Neck

- asymmetrical tonic neck reflex, 161
- ataxic cerebral palsy, 200–205
- dyskinetic cerebral palsy, 156–159, 161
- hypotonia, 38–39, 41
- infants with typical development, 227–228
- spastic diplegia, 92–93
- spastic hemiplegia, 102–103
- spastic quadriplegia, 83–84
- symmetrical tonic neck reflex, 161

Neural activity, 19

Neuro-Developmental Treatment (NDT), 28–29

Neuroimaging classification, 2, 4. *See also*

Pathophysiology

Neuromuscular synergies, 21

Neuromuscular system

- ataxic cerebral palsy, 210–211
- athetosis, 173, 174
- cocontraction, 19–20. *See also* Cocontraction
- dyskinetic cerebral palsy, 173–174
- dystonia, 173–174
- functional postural control and movement, 21
- hypotonia, 51–53
- impairments, 19
- muscle activity control, 20–21
- reciprocal activation, 19
- reflexive (muscle) tone, 19
- selective motor control, 21
- spastic cerebral palsy, 108–111
- voluntary motor control, 19

O

Occupational therapy

- cutting with scissors, 73–75
- dyskinetic cerebral palsy feeding, 188–190
- hand therapy, 142–145
- writing, 68

Oral motor skills, 27–28

Orthopedic treatment approach, 1

P

Participation

- defined, 7

- examples, 8, 17–18
 - positive/negative aspects, 9
- Participation restrictions
 - ataxic cerebral palsy, 202
 - characteristics, 12
 - dyskinetic cerebral palsy, 168
 - hypotonia, 41, 45, 50–51
- Patent ductus arteriosus, 26
- Pathophysiology
 - ataxic cerebral palsy, 197–198
 - dyskinetic cerebral palsy, 153–154
 - health condition, 17
 - hypotonia, 37
 - spastic cerebral palsy, 78–79
- PEDI (Pediatric Evaluation of Disability Inventory), 8
- Pediatric Evaluation of Disability Inventory (PEDI), 8
- Pelvic girdle. *See also* Hips
 - ataxic cerebral palsy, 207–209
 - dyskinetic cerebral palsy, 168–172
 - functions, 234, 236
 - hypotonia, 49–51
 - infants with typical development, 234–237
 - spastic diplegia, 99–102
 - spastic hemiplegia, 106–108
 - spastic quadriplegia, 90–92
- Perceptual systems. *See* Sensory/perceptual systems
- Performance, defined, 17
- Perinatal hypoxia-ischemia, 153
- Periventricular hemorrhagic infarction, 78
- Periventricular leukomalacia, 78, 154
- Personal barriers, 12
- Phelps, Winthrop, 1
- Physiological arousal and attention
 - arousal, defined, 25
 - ataxic cerebral palsy, 214
 - attention, defined, 25
 - classifications, 25–26
 - hypotonia, 58
 - spastic cerebral palsy, 123
- Plantar flexors
 - spastic cerebral palsy, 120
 - spastic diplegia, 100–101
- Postural activity
 - anticipatory postural adjustments, 10
 - defined, 9
 - direction-specific compensatory postural adjustments, 10
 - movement, 10
 - purpose of, 9
- Postural control and movement
 - activity limitations, 12, 13
 - ataxic cerebral palsy, 198–209
 - characteristics, 198–199
 - drooling, 200, 202
 - eyes, 201–202
 - feeding, 200
 - head, 201
 - head, neck, tongue, and eyes, 200–205
 - lower trunk, 205–207
 - muscle synergies, 199–200
 - pelvic girdle and lower extremities, 207–209
 - thoracic spine, ribcage, and upper extremities, 205–205
 - body system impairments, 11–12
 - dyskinetic cerebral palsy, 156–172
 - activity limitations, 164–165, 172
 - asymmetry, 156–159
 - eyes, 157
 - head, 156–159, 161
 - jaw, 158
 - lower extremities, 168–172
 - lower trunk, 166–168
 - neck, 156–159, 161
 - overview, 156
 - pelvic girdle, 168–172
 - ribcage, 162, 163
 - thoracic spine, 160, 163
 - tongue, 158
 - upper extremities, 159–162, 164
 - dystonia, 157, 163, 166
 - environmental barriers, 12
 - functional classification, 21
 - head control, lack of, 11
 - hypertonia, 165
 - hypotonia, 38–51
 - characteristics, 38
 - eyes, 40, 41
 - head, 38–40, 41
 - lower extremities, 49–51
 - lower trunk, 45–49
 - neck, 38–39, 41
 - pelvic girdle, 49–51
 - ribcage, 41–45
 - thoracic spine, 41–45
 - tongue, 40, 41
 - upper extremities, 41–45
 - ineffective postural control and movement, 12, 13
 - infants with typical development
 - eyes, 227, 228
 - head control, 227–229
 - lower extremities, 234–237
 - lower trunk, 232–234
 - neck, 227–228
 - pelvic girdle, 234–237
 - ribcage, 229–231
 - thoracic spine, 229–231
 - tongue, 228
 - participation restrictions, 12
 - personal barriers, 12
 - postural control, defined, 9
 - spastic cerebral palsy, 79–108
 - anticipatory control, 82–85
 - characteristics, 79–80
 - compensatory responses in sitting, 80

- reaching, 82–83
 - spastic diplegia, 81, 92–102
 - spastic hemiplegia, 80–81, 102–108
 - spastic quadriplegia, 85–92
 - walking, 82, 83
 - voluntary motor control, 19–20
 - Postural extension used first in new skills, 20
 - Prader–Willi, 37
 - Premature birth
 - ataxia, 197–198
 - basal ganglia injury, 154
 - cardiorespiratory and muscle endurance, 26
 - diagnosis of cerebral palsy, 29
 - hemiplegia and, 79
 - hypotonia and lethargy, 58
 - intervention strategies, 29
 - intracranial hemorrhages, 78
 - periventricular leukomalacia, 78, 154
 - respiratory impairments, 25
 - skin condition, 28
 - spastic diplegia and, 78–79
 - Primary impairments
 - dyskinetic cerebral palsy, 174
 - hypotonia, 51, 52
 - secondary impairments vs., 18–19
 - spastic cerebral palsy, 112
 - spastic diplegia, 101
 - Primitive reflexes, 161
 - Proprioception
 - ataxic cerebral palsy, 212–213
 - dyskinetic cerebral palsy, 186
 - hypotonia, 54
 - purpose of, 9
 - for sensory feedback, 22
 - spastic cerebral palsy, 113
 - Pulse oximetry, 26
- Q**
- Quadriplegia
 - defined, 77
 - spastic. *See* Spastic quadriplegia
- R**
- Reaching
 - athetosis, 161, 164, 173, 184
 - dyskinetic cerebral palsy, 162, 183
 - dystonia, 166, 173
 - hypertonia, 176
 - spastic cerebral palsy, 82–83
 - spastic hemiplegia, 142
 - spastic quadriplegia, 128
 - Reading, spastic quadriplegia, 84
 - Reciprocal activation, 19
 - Reflexive (muscle) tone, 19
 - Respiratory system, 24–25
 - abdominals, 25. *See also* Abdominals
 - ataxic cerebral palsy, 214
 - belly breathing
 - ataxic cerebral palsy, 204
 - defined, 24
 - hypotonia, 57
 - breath holding, 47, 67, 123
 - breathing and swallowing coordination study, 11
 - diaphragm
 - functions, 24–25
 - hypotonia, 43
 - spastic diplegia, 97
 - spastic quadriplegia, 87
 - dyskinetic cerebral palsy, 180
 - easy respirations, 24
 - feeding and, 25
 - hypotonia, 43, 45, 57
 - internal intercostals, 25
 - premature birth, 25
 - ribcage, 24–25. *See also* Ribcage
 - spastic cerebral palsy, 122–123
 - spastic quadriplegia, 89
 - vocalization and speech, 25
- Ribcage**
- adult skeletal anatomy, 230
 - ataxic cerebral palsy, 203–205
 - development, 24–25
 - dyskinetic cerebral palsy, 162, 163
 - hypotonia, 41–45, 57
 - infants with typical development, 229–231
 - spastic cerebral palsy, 115–116
 - spastic diplegia, 95
 - spastic quadriplegia, 86
- S**
- Sagittal plane flexion
 - dyskinetic cerebral palsy, 158
 - spastic diplegia, 97
 - spastic quadriplegia, 88
 - Scar tissue, 28
 - School Function Assessment (SFA), 8
 - Scoliosis
 - dyskinetic cerebral palsy, 166, 178–179
 - spastic cerebral palsy, 116–118
 - SCPE (Surveillance of Cerebral Palsy in Europe), 2–3
 - Seating systems, hypotonia intervention, 69, 184. *See also* Wheelchair
 - Secondary impairments
 - dyskinetic cerebral palsy, 174, 177, 178
 - hypotonia, 40, 46, 53, 54
 - musculoskeletal system, 23, 24
 - primary impairments vs., 18–19
 - spastic cerebral palsy, 112
 - spastic diplegia, 99–100
 - Selective motor control
 - defined, 21
 - spastic cerebral palsy, 111
 - Sensory feedback, 22

- Sensory/perceptual systems
 - ataxic cerebral palsy, 211–213
 - audition, 9
 - dyskinetic cerebral palsy, 174–177
 - graviception, 9
 - head and eye position, 9
 - hypotonia, 53–54
 - perceptual systems, 21–22
 - proprioception, 9
 - purpose of, 9
 - sensory feedback, 22
 - spastic cerebral palsy, 112–115
 - spastic hemiplegia, 104
 - tactile pressure, 9
 - vision. *See* Vision
 - visual system, 21–22
- SFA (School Function Assessment), 8
- Shoulders
 - hypotonia, 39, 42, 44
 - infants with typical development, 229, 230
 - spastic diplegia, 94–95
 - spastic quadriplegia, 86–87
 - subluxation and dislocation in hypotonia, 55–56
- Sitting
 - ataxic cerebral palsy, 205, 206
 - athetosis, 170
 - dyskinetic cerebral palsy, 160, 163, 170, 172
 - hypotonia, 43, 49
 - infants with typical development, 231
 - spastic cerebral palsy, 80
 - spastic diplegia, 99, 170
 - spastic hemiplegia, 106
 - spastic quadriplegia, 86–87, 88, 90
 - W-sitting
 - dyskinetic cerebral palsy, 165, 170
 - spastic diplegia, 95, 101
- Skin condition, 28
- Sleep
 - respiratory compromise during, 25
 - sleep apnea and hypotonia, 58
- Sound sensitivity, spastic cerebral palsy, 113
- Spastic cerebral palsy, 77–145
 - body structures and functions, 108–124
 - cardiorespiratory and muscle endurance, 123
 - hips, 118–120
 - joints, 118–121
 - musculoskeletal system, 114–122
 - neuromuscular system, 108–111
 - physiological arousal and attention, 123
 - respiratory system, 122–123
 - ribcage, 115–116
 - sensory/perceptual systems, 112–113
 - swallowing, digestion, elimination, 123–124
 - tongue, 122
 - upper extremities, 122
 - case studies
 - spastic diplegia, 137–139
 - spastic hemiplegia, 142–145
 - spastic quadriplegia, 131–133
 - defined, 77–78
 - frequency of occurrence, 77
 - hypertonia, defined, 77–78
 - impairments, 109–111
 - intervention strategies
 - spastic diplegia, 135–139
 - spastic hemiplegia, 140–145
 - spastic quadriplegia, 124–133
 - lordosis, 118
 - pathophysiology, 78–79
 - postural control and movement, 79–108
 - anticipatory control, 82–85
 - characteristics, 79–80
 - compensatory responses in sitting, 80
 - reaching, 82–83
 - sitting, 80
 - spastic diplegia, 81, 92–102
 - spastic hemiplegia, 80–81, 102–108
 - spastic quadriplegia, 83–92
 - walking, 82, 83
 - quadriplegia, defined, 77
 - spasticity, defined, 77
 - speech-language, 122–123
 - stiffness, defined, 78
 - symptoms, 3
 - synergies, 111
 - vision, 112
- Spastic diplegia
 - abdominals, 97, 134
 - activity limitations, 93, 96, 99, 101–102
 - anticipatory responses, 81
 - causes, 78–79
 - defined, 77
 - diaphragm, 97
 - direction-specific activity, 80
 - eyes, 92–93, 137
 - head control, 92–93
 - hips, 97, 100, 135–136
 - intervention case study, 137–139
 - intervention strategies, 135–139
 - lower extremities, 99–102
 - lower trunk, 96–99, 133–139
 - neck control, 92–93
 - pelvic girdle, 99–102
 - postural control and movement, 81, 92–102
 - ribcage, 95
 - shoulders, 94–95
 - sitting, 99, 170
 - speech-language, 135
 - standing, 93, 95, 100–101
 - standing with altered alignment, 81
 - stepping up, 210
 - synergies, 101
 - thoracic spine, 94–96
 - tongue, 92

- upper extremities, 94–96
- walking, 100
- Spastic hemiplegia
 - activity limitations, 105, 105, 106, 108
 - anterior postural sway, 81
 - anticipatory responses, 81
 - asymmetry, 102
 - defined, 77
 - eyes, 102–103
 - feeding, 142
 - functional limitations, 104–105, 106
 - head control, 102–103
 - hips, 107
 - intervention case study, 140–145
 - lower extremities, 106–108
 - lower trunk, 105–106
 - neck, 102–103
 - pelvic girdle, 106–108
 - postural control and movement, 80–81, 102–108
 - reaching, 142
 - sensory/perceptual systems, 104
 - sitting, 106
 - speech-language, 103
 - thoracic spine, 103–105
 - tongue, 103
 - upper extremities, 104
 - walking, 108, 140–141
- Spastic infantile paralysis, 1
- Spastic quadriplegia
 - abdominals, 89
 - activity limitations, 89–90
 - causes, 78
 - defined, 77
 - diaphragm, 87
 - digestion, 124
 - eyes, 84
 - feeding, 84, 130
 - head, 83–84
 - hips, 88, 90–91
 - hypotonia vs., 90–91
 - intervention case study, 131–133
 - intervention strategies, 124–130
 - lordosis, 88, 89
 - lower extremities, 90–92
 - lower trunk, 87–90
 - neck, 83–84
 - pelvic girdle, 90–92
 - postural control and movement, 83–92
 - reading, 128
 - respiratory system, 87, 89
 - ribcage, 86
 - shoulders, 86–87
 - sitting, 86–87, 88, 90
 - speech-language, 84, 131–133
 - standing, 128, 129
 - swallowing, 123–124
 - synergies, 88–89
 - thoracic spine, 86
 - tongue, 84
 - upper extremities, 85–87
 - walking, 91
- Spasticity
 - cocontraction, 20. *See also* Cocontraction
 - defined, 77
 - more spastic, 91, 95
 - musculoskeletal system, 23
 - visual intervention and motor performance, 22
- Speech-language
 - ataxic cerebral palsy, 203, 207, 214, 221–222
 - dyskinetic cerebral palsy, 180, 187–188
 - hypertonia, 187
 - hypotonia, limitations of, 45
 - hypotonia intervention, 63, 65, 67
 - infants with typical development, 235
 - oral motor skills, 27–28
 - respiratory system and exhalation, 25
 - spastic cerebral palsy, 122–123
 - spastic diplegia, 135
 - spastic hemiplegia, 103
 - spastic quadriplegia, 84, 131–133
 - vocalization and respiratory system, 25
- Spine
 - cervical spine
 - dyskinetic cerebral palsy, 157, 178
 - hypotonia, 38–39
 - spastic quadriplegia, 84
 - scoliosis
 - dyskinetic cerebral palsy, 166, 178–179
 - spastic cerebral palsy, 116–118
 - spastic cerebral palsy, 116–118
- Spontaneous general movements, 10
- Stability, defined, 9
- Stair climbing
 - ataxic cerebral palsy, 209, 210, 217
 - hypotonia, 66
- Standing. *See also* Walking
 - ataxic cerebral palsy, 199, 208, 209, 219–220
 - athetosis, 171
 - diplegia and, 81
 - dyskinetic cerebral palsy, 159, 160, 166, 170–171, 172, 185
 - dystonia, 172
 - hypotonia, 42, 46, 50
 - infants with typical development, 231, 236, 237
 - spastic diplegia, 93, 95, 100–101
 - spastic quadriplegia, 128, 129
- Stiffness
 - defined, 78
 - of joints, 19
 - to learn motor skills, 20
- Strabismus, 92, 174
- Strength of musculoskeletal system. *See also*

- Cardiorespiratory and muscle endurance
 - defined, 25
 - force production, 23–24
 - hypotonia, 57
 - lack of, in children with cerebral palsy, 24
 - spastic cerebral palsy, 121–122
 - Surgery as treatment, 1
 - Surveillance of Cerebral Palsy in Europe (SCPE), 2–3
 - Swallowing. *See also* Feeding
 - ataxic cerebral palsy, 215
 - and breathing coordination, 11
 - development of mechanism, 27
 - dyskinetic cerebral palsy, 180, 181
 - esophagus, 27
 - hypotonia, 58–59
 - nutrition and oral motor skills, 28
 - spastic cerebral palsy, 123–124
 - Symmetrical tonic neck reflex (STNR), 161
 - Synergies
 - ataxic cerebral palsy, 199–200, 204, 210, 211
 - defined, 21
 - dyskinetic cerebral palsy, 174
 - hemiplegia and, 80
 - hypotonia, 52–53
 - spastic cerebral palsy, 111
 - spastic diplegia, 101
 - spastic quadriplegia, 88–89
- T**
- Tactile awareness, 22
 - Tactile pressure, 9
 - Tactile stimuli in dyskinetic cerebral palsy, 176
 - Talking. *See* Speech–language
 - Task-specific anticipatory postural adjustments, 10
 - Temporomandibular joints (TMJs), dyskinetic cerebral palsy, 158
 - Therapeutic cooling, 154
 - Therapeutic intervention. *See* Intervention
 - Therapy ball
 - dyskinetic cerebral palsy, 175, 182
 - hypotonia intervention, 64, 69, 70
 - spastic cerebral palsy, 110
 - spastic diplegia, 135, 136
 - spastic quadriplegia, 124, 126
 - Thoracic extension
 - dyskinetic cerebral palsy, 186–187
 - hypotonia, 70
 - spastic quadriplegia, 89, 126, 127, 130
 - Thoracic flexion
 - hypotonia, 44
 - spastic diplegia, 93
 - Thoracic kyphosis in dyskinetic cerebral palsy, 178
 - Thoracic spine
 - ataxic cerebral palsy, 205–205
 - dyskinetic cerebral palsy, 160, 163
 - hypotonia, 39, 41–46
 - infants with typical development, 229–231, 233
 - spastic diplegia, 94–96
 - spastic hemiplegia, 103–105
 - spastic quadriplegia, 86
 - Tibia, 121
 - Tongue
 - ataxic cerebral palsy, 200–205
 - dyskinetic cerebral palsy, 158
 - hypotonia, 40, 41
 - infants with typical development, 228
 - oral motor skills, 27
 - spastic cerebral palsy, 122
 - spastic diplegia, 92
 - spastic hemiplegia, 103
 - spastic quadriplegia, 84
 - Treatments for cerebral palsy. *See* Intervention
 - Trunk control. *See also* Lower trunk
 - dyskinetic cerebral palsy, 187
 - dystonia, 187
 - hypotonia intervention, 60–62, 65
 - infants with typical development, 235
 - Trunk rotation in infants with typical development, 234
- U**
- Upper extremities
 - adult skeletal anatomy, 230
 - ataxic cerebral palsy, 203–205
 - dissociation, 74
 - dyskinetic cerebral palsy, 159–162, 164
 - hand control studies, 11
 - hypotonia, 41–45
 - spastic cerebral palsy, 122
 - spastic diplegia, 94–96
 - spastic hemiplegia, 104
 - spastic hemiplegia intervention case study, 142–145
 - spastic quadriplegia, 85–87
 - Upper lumbar extension position, hypotonia, 46–47
- V**
- Vestibular information feedback to movement performance, 22
 - Vestibular system, affect of ataxia, 213
 - Vision. *See also* Eyes
 - ataxic cerebral palsy, 211–212
 - depth perception
 - hypotonia, 40
 - spastic diplegia, 138
 - spastic quadriplegia, 84
 - dyskinetic cerebral palsy, 163, 174–175
 - dystonia, 175
 - eyes, copy from main
 - hemianopia, 102
 - hypotonia, 53–54
 - infants with typical development, 228

- purpose of, 9
 - spastic cerebral palsy, 112
 - spastic diplegia, 92–93, 137
 - spastic hemiplegia, 102–105
 - Visual systems, 21–22
 - eye extension, 21
 - impairments in cerebral palsy, 21–22
 - in infants, 21
 - sensory feedback, 22
 - Vocalization. *See* Speech-language
 - Voluntary motor control of posture and movement, 19–20
- W**
- Walking. *See also* Standing
 - ataxic cerebral palsy, 202, 203, 205, 209
 - dyskinetic cerebral palsy, 171–172
 - gait analysis in hypotonia, 47
 - hypotonia, 37, 47, 66
 - infants with typical development, 237
 - spastic cerebral palsy, 82, 83
 - spastic diplegia, 100
 - spastic diplegia case study, 137–139
 - spastic hemiplegia, 108, 140–141
 - spastic quadriplegia, 91
 - stair climbing. *See* Stair climbing
 - Wheelchair
 - dyskinetic cerebral palsy, 165, 168–169
 - for hypertonia, 184
 - hypotonia seating systems, 69, 184
 - World Health Organization, ICF approval, 7
 - Writing
 - children with typical development, 231
 - hypotonia intervention, 68
 - W-sitting
 - dyskinetic cerebral palsy, 165, 170
 - spastic diplegia, 95, 101