

Bibliography

Introduction

- Bhakta BB, Cozens JA, Chamberlain MA. Use of botulinum toxin in stroke patients with severe upper limb spasticity. *J Neurol Neurosurg Psychiatry* 1996; 61: 30–35.
- Gelber DA, Jozefczyk PB. Therapeutics in the management of spasticity. *Neurorehabil Neural Repair* 1999; 13: 5–14.
- Lagalla G, Danni M, Reiter F, Ceravolo MG, Provinciali L. Post-stroke spasticity management with repeated botulinum toxin injections in the upper limb. *Am J Phys Med Rehabil* 2000; 79: 377–384.
- Malterud K. Qualitative research: standards, challenges, and guidelines. *Lancet* 2001a; 358: 483–488.
- Malterud K. The art and science of clinical knowledge: evidence beyond measures and numbers. *Lancet* 2001b; 358: 397–400.
- Mant D. Can randomised controlled trials inform clinical decisions about individual patients? *Lancet* 1999; 353: 753–757.
- Rose DJ. A multilevel approach to the study of motor control and learning. Boston: Allyn and Bacon, 1997.
- Sampaio C, Ferreira JJ, Pinto AA, Crespo M, Ferro JM, Castro-Caldas A. Botulinum toxin A for the treatment of arm and hand spasticity after stroke. *Clin Rehabil* 1997; 11: 3–7.
- Schleichkorn J. The Bobaths. A biography of Berta and Karel Bobath. USA: Therapy Skill Builders, 1992.

Chapter 1 Applied Neurophysiology

1.1 Systems Control

The Neuromuscular System

- Academy of Medical Sciences. Report: Restoring Neurological Function: Putting the Neurosciences to work in neurorehabilitation, 2004. Available at: www.acmedsci.ac.uk (accessed 2005).
- Ada L, Canning C. Anticipating and Avoiding Muscle Shortening. In: Ada L, Canning C, editors. Key Issues in Neurological Physiotherapy. Physiotherapy: Foundations for Practise 1990: 219–224.
- Brodal P. The Central Nervous System. Structure and Function. Oxford: Oxford University Press, 1998.
- Brodal P. Sentralnervesystemet. 3rd ed. Universitetsforlaget, 2001.
- Brodal P. Det nevrobiologiske grunnlaget for balanse. *Fysioterapeuten* 2004; 8: 25–30.
- Burke RE, Levine DN, Salcman M, Tsairis P. Motor units in cat soleus muscle: physiological, histochemical and morphological characteristics. *J Physiol* 1973; 234: 723–748.
- Dietz V. Human neuronal control of automatic functional movements: interaction between central programs and afferent input. *Physiol Rev* 1992; 1: 33–69.
- Goldspink G, Williams P. Muscle fibre and connective tissue changes associated with use and disuse. In: Ada L and Canning C, editors. Key Issues in Neurological Physiotherapy. Physiotherapy: Foundations for Practise 1990: 197–215.
- Henneman E, Mendell LM. Functional organisation of motor neuron pool and its inputs. In: Brooks VB,

- editor. *Handbook of Physiology—the Nervous System*. Baltimore: Williams and Wilkins, 1981: 423–505.
- Hufschmidt A, Mauritz K-H. Chronic Transformation of muscle in spasticity: a peripheral contribution to increased tone. *J Neurol Neurosurg Psychiatry* 1985; 48:676–685.
- Kandel ER, Schwartz JH, Jessel TM. *Principles of neural science*. 4th ed. New York: McGraw-Hill, 2000.
- Karnath HO, Ferber S, Dichgans J. The neural representation of postural control in humans. *Proc Natl Acad Sci USA* 2000; 25:13031–13036.
- Kerty E. Synsrehabilitering etter hjerneskade. *Tidsskr Nor Lægeforen* 2005; 125:146–147.
- Kidd G. The myotatic reflex. In: Downie P, editor. *Cash's Textbook of Neurology for Physiotherapists*. London: Faber & Faber, 1986: 85–103.
- Kidd G, Lawes N, Musa I. *Understanding Neuromuscular Plasticity*. London: Edward Arnold, 1992.
- Langton P. What determines muscle fibre type? www.bris.ac.uk/Depts/Physiology/ugteach/ugindex/m1_index/nm_tut5/page4.htm, 1998 (accessed 2005).
- MacKay-Lyons M. Central pattern generation of locomotion: a review of the evidence. *Phys Ther* 2002; 82:69–83.
- Massion J. Movement, posture and equilibrium. *Prog Neurobiol* 1992; 38:35–56.
- Massion J. Postural control system. *Curr Opin Neurobiol* 1994; 4:877–887.
- Mosby's Medical, Nursing and Allied Health Dictionary. 4th ed, 1994.
- Mulder T, Nienhuis B, Pauwels J. The assessment of motor recovery: a new look at an old problem. *J Electromyogr Kinesiol* 1996; 2:137–145.
- Riise R, Gundersen B, Brodal S, Bjerke P. Synsproblemer ved hjerneslag. *Tidsskr Nor Lægeforen* 2005; 125:176–177.
- Rothwell J. *Control of Human Voluntary Movement*. London: Chapman & Hall, 1994.
- Sahrmann SA. Posture and Muscle Imbalance. *Physiotherapy* 1992; 78(1) Postgraduate Advances in Physical Therapy—APTA 1987: 1–19.
- Sahrmann SA. *Diagnosis and Treatment of Movement Impairment Syndromes*. St. Louis, MO: Mosby; 2002.
- Shumway-Cook A, Woollacott M. *Motor Control. Translating Research into Clinical Practice*. 3rd ed. Philadelphia: Lippincott Williams and Wilkins, 2006.
- Sieck GC. Plasticity in skeletal, cardiac, and smooth muscle [editorial]. *Highlighted Topics Series. J Appl Physiol* 2001; 90(1).
- Simons DG, Mense S. Understanding and measurement of muscle tone as related to clinical muscle pain. *Pain* 1998; 1:1–17.
- Stokes M. *Neurological Physiotherapy*. London: Mosby; 1998.
- Taber's Cyclopedic Medical Dictionary. Thomas CL: FA Davies Company, 1997.
- Tyldesley B, Grieve JI. *Muscles, Nerves and Movement. Kinesiology in Daily Living*. Oxford: Blackwell Science, 1996.
- van Ingen Schenau GJ, Bobbert MF, van Soest AJ. The unique action of bi-articular muscles in leg extensions. In: Winters JM, Woo SLY, editors. *Multiple Muscle Systems: Biomechanics and Movement Organization*. Berlin: Springer-Verlag 1990: 639–652.
- Ward NS, Cohen LG. Mechanisms underlying recovery of motor function after stroke. *Arch Neurol* 2004; 61:1844–1848.
- Wikipedia online encyclopedia. Wikimedia Foundation, Inc. <http://en.wikipedia.org/wiki/> (accessed 2006).
- Zackowski KM, Dromerick AW, Sahrmann SA, Thach WT, Beatian AJ. How do strength, spasticity and joint individuation relate to the reaching deficits of people with chronic hemiparesis? *Brain* 2004; 127:1035–1046.

The Somatosensory System, Vision, and Balance

- Ada L, Canning C. Anticipating and avoiding muscle shortening. In: Ada L, Canning C, editors. *Key Issues in Neurological Physiotherapy. Physiotherapy: Foundations for Practise* 1990: 219–224.
- Brodal P. *Sentralnervesystemet*. 2nd ed. Oslo: Tano, 1995.
- Davidoff RA. The pyramidal tract. *Neurology* 1990; 40: 332–339.
- Dietz V. Human neuronal control of automatic functional movements: interaction between central programs and afferent input. *Physiol Rev* 1992; 72: 33–69.
- Harkema SJ, Hurley SL, Patel UK, Requejo PS, Dobkin BH, Edgerton VR. Human lumbar sacral spinal cord interprets loading during stepping. *J Neurophysiol* 1997; 77: 797–911.
- Horak FB, Henry SM, Shumway-Cook A. Postural perturbations: new insights for treatment of balance disorders. *Phys Ther* 1997; 77: 517–533.
- Kandel ER, Schwartz JH, Jessel TM. *Principles of Neural Science*. 4th ed. Columbus, OH: McGraw-Hill; 2000.
- Kidd G, Lawes N, Musa I. *Understanding Neuromuscular Plasticity*. London: Edward Arnold, 1992.
- Massion J. Movement, posture and equilibrium. *Prog Neurobiol* 1992; 38: 35–56.
- Mudge S, Rochester L. Neurophysiological rationale of treadmill training: evaluating evidence for practice. *NZ J Physiother* 2001; 2: 6–15.

- Mulder T, Nienhuis B, Pauwels J. The assessment of motor recovery: a new look at an old problem. *J Electromyogr Kinesiol* 1996; 6: 137–145.
- Nashner LM. Adaptation of human movement to altered environments. *TINS* 1982; 5: 358–361.
- Petersen H, Magnusson M, Johansson R, Åkesson M, Fransson PA. Acoustic cues and postural control. *Scand J Rehabil Med* 1995; 27: 99–104.
- Rothwell J. Control of Human Voluntary Movement. London: Chapman & Hall, 1994.
- Shumway-Cook A, Woollacott M. Motor Control. Translating Research into Clinical Practice. 3rd ed. Philadelphia: Lippincott Williams and Wilkins, 2006.
- Sunderland A, Tinson DJ, Bradley EL, et al. Enhanced physical therapy improves recovery of arm function after stroke. *J Neurol Neurosurg Psychiatry* 1992; 55: 530–535.
- Taber's Cyclopedic Medical Dictionary. 18th ed. Thomas CL, editor. Philadelphia: FA Davies, 1997.
- Trew M, Everett T. Human Movement: An Introductory Text. 3rd ed. London: Churchill Livingstone, 1998.
- Wade M, Jones G. The role of vision and spatial orientation in the maintenance of posture. *Phys Ther* 1997; 77: 619–628.
- Yekutiel M, Guttman E. A controlled trial of the re-training of the sensory function of the hand in stroke patients. *J Neurol Neurosurg Psychiatry* 1993; 56: 241–244.
- Chen PT, Liaw MY, Wong MK, Tang FT, Lee MY, Lin PS. The sit-to-stand movement in stroke patients and its correlation with falling. *Arch Phys Med Rehabil* 1998; 79: 1043–1046.
- Cornall C. Self propelling wheelchairs: the effect on spasticity in hemiplegic patients. *Physiother Theory Pract* 1991; 7: 13–21.
- Davidoff RA. The pyramidal tract. *Neurology* 1990; 40: 332–339.
- Dietz V. Human neuronal control of automatic functional movements: interaction between central programs and afferent input. *Physiol Rev* 1992; 72: 33–69.
- Dietz V, Duysens J. Modulation of reflex mechanisms by load receptors. *Gait Posture* 2000; 11: 102–110.
- Dietz V, Zijlstra W, Duysens J. Human interlimb coordination during split-belt locomotion. *Exp Brain Res* 1994; 101: 513–520.
- Gjerstad L, Kerty E, Nyberg-Hansen R. Behandling av focale dystonier med botulinumtoxin. *Tidsskr Nor Lægeforen* 1991; 21: 2637–2639.
- Guyton AC. Textbook of Medical Physiology. Physiotherapy Theory and Practice. 5th ed. Philadelphia: WB Saunders company, 1976.
- de Haart M, Guerts AC, Huidekoper SC, Fasotti L, Van Limbeek J. Recovery of standing balance in post-acute stroke patients: A rehabilitation cohort study. *Arch phys med rehabil* 2004; 85(6): 886–895.
- Harkema SJ, Hurley SL, Patel UK, Requejo PS, Dobkin BH, Edgerton VR. Human lumbosacral spinal cord interprets loading during stepping. *J Neurophysiol* 1997; 77: 797–911.
- Horak FB, Diener HC. Cerebellar control of postural scaling and central set in stance. *J Neurophysiol* 1994; 72: 2: 479–493.
- Jobst EE, Melnick ME, Byl NN, Dowling GA, Aminoff MJ. Sensory perception in Parkinson disease. *Arch Neurol* 1997; 54: 450–454.
- Karnath H-O, Ferber S, Dichgans J. The origin of contraversive pushing—Evidence for a second graviceptive system in humans. *Neurology* 2000; 55: 1298–1304.
- Kavounoudias A, Roll R, Roll JP. The plantar sole is a “dynamometric map” for human balance control. *Neuroreport* 1998; 9: 3247–52.
- Kerty E. Vision rehabilitation after brain injury [in Norwegian]. *Tidsskr Nor Laegeforen* 2005; 125: 146.
- Khemlani MN, Carr JH, Crosbie WJ. Muscle synergies and joint linkages in sit-to-stand under two initial foot positions. *Clin Biomech* 1998; 14: 236–238.
- Kidd G, Lawes N, Musa I. Understanding neuromuscular plasticity. London: Edward Arnold, 1992.
- Knapp HD, Taub E, Berman J. Movements in monkeys with deafferented forelimbs. *Exp Neurol* 1963; 7: 305–315.
- Lalonde R, Botez MI. The cerebellum and learning processes in animals. *Res Rev* 1990; 15: 325–332.

The Brain and Spinal Cord

- Borgmann R. Behandling av spastisk torticollis med botulinumtoxin A. *Tidsskr Nor Lægeforen* 1997; 13: 1889–1891.
- Bridgewater KJ, Sharpe MH. Trunk muscle performance in early Parkinson's disease. *Phys Ther* 1998; 78: 566–576.
- Brodal P. Sentralnervesystemet. 2nd ed. Oslo: Tano, 1995.
- Brodal P. The central nervous system [in Norwegian]. 3rd ed. Oslo: Universitetsforlaget; 2001.
- Brodal P. The Central Nervous System. Structure and Function. Oxford: Oxford University Press, 1998.
- Brodal P. Det nevrobiologiske grunnlaget for balanse. *Fysioterapeuten* 2004; 8: 25–30.
- Bussel B, Roby-Brami A, Neris OR, Yakoleff A. Evidence for a spinal stepping generator in man. Electrophysiological study. *Acta Neurobiol Exp* 1996; 56: 465–468.
- Byl NN, Merzenich MM, Cheung S, Bedenbaugh, Nagarajan SS, Jenkins WM. A primate model for studying focal dystonia and repetitive strain injury: effects on the primary somatosensory cortex. *Phys Ther* 1997; 77: 269–284.

- MacKay-Lyons M. Central pattern generation of locomotion: a review of the evidence. *Phys Ther* 2002; 82: 69–83.
- Maki EB, McIlroy WE. The role of limb movements in maintaining upright stance: the 'change-in-support' strategy. *Phys Ther* 1997; 77: 488–507.
- Markham C. Vestibular control of muscle tone and posture. *Can J Neurol Sci* 1987; 14: 493–496.
- Marque Ph, Felez A, Puel M, et al. Impairment and recovery of left motor function in patients with right hemiplegia. *J Neurol Neurosurg Psychiatry* 1997; 62: 77–81.
- Marsden CD, Quinn NP. The dystonias. *BMJ* 1990; 300: 139–144.
- Marsden CD, Rothwell JC, Day BL. The use of proprioceptive feedback in the control of movement. *Trends Neurosci* 1984; 7: 253–258.
- Mulder T. A process-oriented model of human behavior. *Phys Ther* 1991; 71: 157–164.
- Mulder T, Nienhuis B, Pauwels J. The assessment of motor recovery: A new look, at an old problem. *Journal of Electromyography and Kinesiology* 1996; 6(2): 137–145.
- Musa I. The role of afferent input in the reduction of spasticity; an hypothesis. *Physiotherapy* 1986; 72: 179–182.
- Nashner LM. Adaptation of human movement to altered environments. *TINS* 1982; 358–361.
- Paillard J. Basic neurophysiological structures of eye-hand coordination. In: Williams HG, editor. *Growth, Motor Development and Physical Activity Across The Life-Span*. Columbia: University of South Carolina Press, 1990: 26–74.
- Patten C, Lexell J, Brown HE. Weakness and strength training in persons with poststroke hemiplegia. Rationale, method and efficacy. *J Rehabil Res Dev* 2004; 41: 293–312.
- Pearson KG. Common principles of motor control in vertebrates and invertebrates. *Annu Rev Neurosci* 1993; 16: 256–297.
- Riise R, Gundersen B, Brodal S, Bjerke P. Visual problems in Cerebral stroke [in Norwegian]. *Tidsskr Nor Laegeforen* 2005; 125(2): 176–177.
- Rothwell J. Control of Human Voluntary Movement. London: Chapman & Hall, 1994.
- Rothwell JC, Taub MM, Day BL, et al. Manual motor performance in deafferented man. *Brain* 1982; 105: 515–542.
- Shepherd RB, Koh HP. Some biomechanical consequences of varying foot placements in sit-to-stand in young women. *Scand J Rehabil Med* 1996; 28: 79–88.
- Shumway-Cook A, Woollacott M. Motor Control. Translating Research into Clinical Practice. 3rd ed. Philadelphia: Lippincott Williams and Wilkins, 2006.
- Smidt GL. Gait in Rehabilitation. Clinics in Physical Therapy. New York: Churchill Livingstone, 1990.
- Thach WT, Goodkin HP, Keating JG. The cerebellum and the adaptive coordination of movement. *Annu Rev Neurosci* 1992; 15: 403–442.
- Thilmann AF, Fellows SJ, Garms E. Pathological stretch reflexes on the 'good' side of hemiparetic patients. *J Neurol Neurosurg Psychiatry* 1990; 53: 208–214.
- Trew M, Everett T. Human Movement: An Introductory Text. 3rd ed. New York: Churchill Livingstone, 1998.
- Wade M, Jones G. The role of vision and spatial orientation in the maintenance of posture. *Phys Ther* 1997; 77: 619–628.
- Whittle MW. Gait analysis, an introduction. 2nd ed. Oxford: Butterworth-Heinemann, 1996.
- ## 1.2 Plasticity
- Aboderin I, Venables G, for the Pan European Consensus Meeting on Stroke Management. Stroke Management in Europe. *J Intern Med* 1996; 240: 173–170.
- Academy of Medical Sciences. Report: Restoring Neurological Function: Putting the Neurosciences to work in neurorehabilitation, 2004 (available at: www.acmedsci.ac.uk) (accessed 2005).
- Agnati LF, Zoli M, Biagini G, Fuxe K. Neuronal plasticity and the ageing processes in the frame of the 'Red Queen Theory'. *Acta Physiol Scand* 1992; 145: 301–309.
- Ashburn A. Physical recovery following stroke. *Physiotherapy* 1997; 83: 480–490.
- Bailey CH, Kandel ER. Structural changes accompanying memory storage. *Annu Rev Physiol* 1993; 55: 397–426.
- Benowitz LI, Routtenberg A. GAP-43: an intrinsic determinant of neuronal development and plasticity. *Trends Neurosci* 1997; 20: 84–98.
- Bishop B. Neural plasticity IV. *Phys Ther* 1982; 62: 1442–1451.
- Bobath B. Adult Hemiplegia: Evaluation and Treatment. 2nd ed. London: William Heinemann, 1978.
- Bobath B. Hemiplegia, Evaluation and Treatment. 3rd ed. Oxford: Heinemann, 1990.
- Brodal P. Sentralnervesystemet. 2nd ed. Oslo: Tano, 1995.
- Brodal P. The Central Nervous System. Structure and Function. Oxford: Oxford University Press, 1998.
- Brodal P. Sentralnervesystemet. Oslo: Universitetsforlaget, 2001.
- Craik RL. Recovery processes: maximizing function. in: contemporary management of motor control problems. Proceedings of the II Step Conference 1991: 165–173.

- Cramer SC, Bastings EP. Mapping clinically relevant plasticity after stroke. *Neuropharmacology* 2000; 39: 842–851.
- Dietrichs E, Gjerstad L. *Vår fantastiske hjerne*. Oslo: Universitetsforlaget, 1995.
- Dietz V, Wirz M, Jensen L. Locomotion in patients with spinal cord injuries. *Phys Ther* 1997; 5: 508–516.
- Eccles JC. Evolution of the brain: creation of self. London: Routledge, 1989.
- Eriksson PS, Perfilieva E, Björk-Eriksson T, et al. Neurogenesis in the adult human hippocampus. *Nat Med* 1998; 4: 1313–1317.
- Feys H, De Weerd W, Verbeke G, et al. Early and repetitive stimulation of the arm can substantially improve the long-term outcome after stroke. A 5-year follow-up study of a randomized trial. *Stroke* 2004; 35: 924–929.
- Goldberger ME, Murray M. Patterns of sprouting and implications for recovery of function. In: Waxman SG, editor. *Advances in Neurology: Functional recovery in neurological disease*. New York: Raven Press, 1988; 361–385.
- Hallett M. The plastic brain. *Ann Neurol* 1995; 38: 4–5.
- Hori J, Ng TF, Shatos M, Klassen H, Streilein JW, Young MJ. Neural progenitor wells lack immunogenicity and resist destruction of allografts. *Stem Cells* 2003; 21: 405–416.
- Indredavik B, Bakke F, Solberg R, Rokseth R, Lund Haheim L, Holme I. Benefit of a stroke unit. A randomized controlled trial. *Stroke* 1991; 22: 1026–1031.
- Kempermann G, Kuhn HG, Winkler J, Gage FH. Neue Nervenzellen für das erwachsene Gehirn. *Der Nervenarzt* 1998; 10: 851–857.
- Kidd G, Lawes N, Musa I. *Understanding Neuromuscular Plasticity*. London: Edward Arnold, 1992.
- Kwakkel G, Kollen B, Lindeman E. Understanding the pattern of functional recovery after stroke: facts and theories. *Restor Neurol Neurosci* 2004a; 22: 281–299.
- Kwakkel G, van Peppen R, Wagenaar RC, et al. Effects of augmented exercise therapy time after stroke. A meta-analysis. *Stroke* 2004b; 35: 2529–2536.
- Lee RG, van Donkelaar P. Mechanisms underlying functional recovery following stroke. *Can J Neurol Sci* 1995; 22: 257–263.
- Liepert J, Bauder H, Miltner WHR, Taub E, Weiller C. Treatment-induced cortical reorganization after stroke in humans. *Stroke* 2000; 31: 1210–1216.
- Martin J-L, Magistretti PJ. Regulation of gene expression by neurotransmitters in the central nervous system. *Eur Neurol* 1998; 39: 129–134.
- Mosby's Medical, Nursing and Allied Health Dictionary. 4th ed. New York: Mosby-Year Book Inc., 1994.
- Muir GD, Steeves JD. Sensorimotor stimulation to improve locomotor recovery after spinal cord injury. *Trends Neurosci* 1997; 20: 72–77.
- Nudo RJ. Adaptive plasticity in motor cortex: implications for rehabilitation after brain injury. *J Rehabil Med* 2003; Suppl. 41: 7–10.
- Nudo RJ, Wise BM, SiFuentes F, Milliken GW. Neural substrates for the effects of rehabilitative training on motor recovery after ischemic infarct. *Science* 1996; 272: 1791–1794.
- Olson L. Neurotrofa faktorar i CNS. Allt fler proteiner med klinisk potensial. *Nordisk Medicin* 1996; 111: 3–6.
- Seil FJ. Recovery and repair issues after stroke from the scientific perspective. *Curr Opin Neurol* 1997; 10: 49–51.
- Shumway-Cook A, Woollacott M. *Motor Control. Translating Research into Clinical Practice*. 3rd ed. Philadelphia: Lippincott Williams and Wilkins, 2006.
- Small SL, Hlustik P, Noll DC, Genovese C, Solodkin A. Cerebellar hemispheric activation ipsilateral to the paretic hand correlates with functional recovery after stroke. *Brain* 2002; 125: 1544–1557.
- Solheim BG, Stamceller fra navlestreng gav bedring hos paraplegiker. *Tidsskr Nor Lægeforen* 2005; 125: 32–38.
- Squire LR, Knowlton B, Musen G. The structure and organization of memory. *Annu Rev Psychol* 1993; 44: 453–495.
- Stein DG, Brailowsky S, Will B. *Brain Repair*. Oxford: Oxford University Press, 1995.
- Stephenson RA. Review of neuroplasticity: some implications for physiotherapy in the treatment of lesions of the brain. *Physiotherapy* 1993; 79: 699–704.
- Stroke Units Trialists' Collaboration. Collaborative systematic review of the randomised trials of organised inpatient (stroke unit) care after stroke. *BMJ* 1997; 314: 1151–1159.
- Sundar T. Nytt liv for neuroner. *Tidsskrift Norska Lægeforening* 1999; 1: 100.
- Taub E, Uswatte G, Pidikiti R. Constraint-Induced Movement Therapy: A new family of techniques with broad application to physical rehabilitation—a clinical review. *J Rehabil Res Devel* 1999; 36: 237–251.
- Troen H, Edgar H. The regulation of neuronal gene expression. *TINS* 1982; 7: 311–313.
- Turton A, Pomeroy V. When should upper limb function be trained after stroke? Evidence for and against early intervention. *Neurorehabilitation* 2002; 17: 215–224.
- Ullian EM, Christopherson KS, Barres BH. Role for glia in synaptogenesis. *Glia* 2004; 47: 209–216.
- Umphred D. Merging neurophysiologic approaches with contemporary theories. I: *Contemporary Management of Motor Control Problems. Proceedings of the II Step Conference* 1991: 127–130.
- Ward NS, Cohen LG. Mechanisms underlying recovery of motor function after stroke. *Arch Neurol* 2004; 61: 1844–1848.