# References

Abbas, P. J. and Miller, C. A. (2004). Biophysics and physiology, *in* F. G. Zeng, A. N. Popper and R. R. Fay (eds), *Cochlear Implants: Auditory prostheses and electric hearing*, Vol. 20 of *Springer handbook of audiory research*, Springer-Verlag, New York, chapter 5, pp. 149–212.

Abbas, P. J., Brown, C. J., Shallop, J. K., Firszt, J. B., Hughes, M. L., Hong, S. H. and Staller, S. J. (1999). Summary of results using the Nucleus CI24M implant to record the electrically evoked compound action potential, *Ear & Hearing* **20**(1): 45–59.

Abbas, P. J., Hughes, M. L., Brown, C. J., Miller, C. A. and South, H. (2004). Channel interaction in cochlear implant users evaluated using the electrically evoked compound action potential, *Audiology & Neuro-Otology* **9**(4): 203–213.

Arts, H. A., Jones, D. A. and Anderson, D. J. (2003). Prosthetic stimulation of the auditory system with intraneural electrodes, *The Annals of Otology, Rhinology & Laryngology. Supplement* **191**: 20–25.

Atkins, P. W. (1995). *Physical Chemistry*, Fifth edn, Oxford University Press, Oxford.

Baker, M. D. (2002). Electrophysiology of mammalian Schwann cells, *Progress in Biophysics and Molecular Biology* **78**(2-3): 83–103.

Bakondi, G., Pór, A., Kovács, I., Szucs, G. and Rusznák, Z. (2008). Voltage-gated $K^+$ channel (Kv) subunit expression of the guinea pig spiral ganglion cells studied in a newly developed cochlear free-floating preparation, *Brain Research* **1210**(C): 148–162.

Behse, F. (1990). Morphometric studies on the human sural nerve, *Acta Neurologica Scandinavica. Supplementum* **82**(132): 1–38.

Black, R. C. and Clark, G. M. (1980). Differential electrical excitation of the auditory nerve, *Journal of the Acoustical Society of America* **67**(3): 868–874.

Black, R. C., Clark, G. M., Tong, Y. C. and Patrick, J. F. (1983). Current distributions in cochlear stimulation, *Annals of the New York Academy of Sciences* **405**: 137–145.

Blight, A. R. (1985). Computer simulation of action potentials and afterpotentials in mammalian myelinated axons: The case for a lower resistance myelin sheath, *Neuroscience* **15**(1): 13–31.

Boiko, T., Rasband, M. N., Levinson, S. R., Caldwell, J. H., Mandel, G., Trimmer, J. S. and Matthews, G. (2001). Compact myelin dictates the differential targeting of two sodium channel isoforms in the same axon, *Neuron* **30**(1): 91–104.

Bostock, H. (1983). The strength-duration relationship for excitation of myelinated nerve: Computed dependence on membrane parameters, *Journal of Physiology* **341**: 59–74.

Bostock, H. and Rothwell, J. C. (1997). Latent addition in motor and sensory fibres of human peripheral nerve, *Journal of Physiology* **498**(1): 277–294.

Bostock, H., Sears, T. A. and Sherratt, R. M. (1983). The spatial distribution of excitability and membrane current in normal and demyelinated mammalian nerve fibres, *Journal of Physiology* **341**: 41–58.

Briaire, J. J. and Frijns, J. H. M. (2000). Fields patterns in a 3D tapered spiral model of the electrically stimulated cochlea, *Hearing Research* **148**: 18–30.

Briaire, J. J. and Frijns, J. H. M. (2005). Unraveling the electrically evoked compound action potential, *Hearing Research* **205**: 143–156.

Briaire, J. J. and Frijns, J. H. M. (2006). The consequences of neural degeneration regarding optimal cochlear implant position in scala tympani: a model approach, *Hearing Research* **214**: 17–27.

Brown, C. J., Abbas, P. J. and Gantz, B. (1990). Electrically evoked whole-nerve action potentials: Data from human cochlear implant users, *Journal of the Acoustical Society of America* **88**(3): 1385–1391.

Brown, C. J. and Abbas, P. J. (1990). Electrically evoked whole-nerve action potentials: parametric data from the cat, *Journal of the Acoustical Society of America* **88**(5): 2205–2210.

Bruce, I. C. (2007). Implementation issues in approximate methods for stochastic Hodgkin-Huxley models, *Annals of Biomedical Engineering* **35**(2): 315–318.

Bruce, I. C., Irlicht, L. S., White, M. W., O'Leary, S. J., Dynes, S., Javel, E. and Clark, G. M. (1999a). A stochastic model of the electrically stimulated auditory nerve: pulse-train response, *IEEE Transactions on Biomedical Engineering* **46**(6): 630–637.

Bruce, I. C., White, M. W., Irlicht, L. S., O'Leary, S. J. and Clark, G. M. (1999b). The effects of stochastic neural activity in a model predicting intensity perception with cochlear implants: low-rate stimulation, *IEEE Transactions on Biomedical Engineering* **46**(12): 1393–1404.

Bruce, I. C., White, M. W., Irlicht, L. S., O'Leary, S. J., Dynes, S., Javel, E. and Clark, G. M. (1999c). A stochastic model of the electrically stimulated auditory nerve: single-pulse response, *IEEE Transactions on Biomedical Engineering* **46**(6): 617–629.

Buchthal, F. and Rosenfalck, A. (1966). Evoked action potentials and conduction velocity in human sensory nerves, *Brain Research* **3**(1): 1–122.

Burke, D., Kiernan, M. C. and Bostock, H. (2001). Excitability of human axons, *Clinical Neurophysiology* **112**(9): 1575–1585.

Burke, D., Mogyoros, I., Vagg, R. and Kiernan, M. C. (1999). Temperature dependence of excitability indices of human cutaneous afferents, *Muscle and Nerve* **22**(1): 51–60.

Caldwell, J. H., Schaller, K. L., Lasher, R. S., Peles, E. and Levinson, S. R. (2000). Sodium channel $Na_v1.6$ is localized at nodes of Ranvier, dendrites, and synapses, *Proceedings of the National Academy of Sciences of the United States of America* **97**(10): 5616–5620.

Carlyon, R. P., van Wieringen, A., Deeks, J. M., Long, C. J., Lyzenga, J. and Wouters, J. (2005). Effect of interphase-gap on the sensitivity of cochlear implant users to electrical stimulation, *Hearing Research* **205**: 210–224.

Cartee, L. A., van den Honert, C., Finley, C. C. and Miller, R. L. (2000). Evaluation of a model of the cochlear neural membrane. I. Physiological measurement of membrane characteristics in response to intrameatal electrical stimulation, *Hearing Research* **146**: 143–152.

Catterall, W. A., Goldin, A. L. and Waxman, S. G. (2005). International Union of Pharmacology. XLVII. Nomenclature and structure-function relationships of voltage-gated sodium channels, *Pharmacological Reviews* **57**(4): 397–409.

Chatterjee, M. and Shannon, R. V. (1998). Forward masked excitation patterns in multielectrode electrical stimulation, *Journal of the Acoustical Society of America* **103**(5I): 2565–2572.

Chen, C. (1997). Hyperpolarization-activated current ($I_h$) in primary auditory neurons, *Hearing Research* **110**: 179–190.

Chen, W. C. and Davis, R. L. (2006). Voltage-gated and two-pore-domain potassium channels in murine spiral ganglion neurons, *Hearing Research* **222**: 89–99.

Chiu, S. Y., Ritchie, J. M., Rogart, R. B. and Stagg, D. (1979). A quantitative description of membrane currents in rabbit myelinated nerve, *Journal of Physiology* **292**: 149–166.

Chiu, S. Y., Zhou, L., Zhang, C. L. and Messing, A. (1999). Analysis of potassium channel functions in mammalian axons by gene knockouts, *Journal of Neurocytology* **28**(4-5): 349–364.

Cohen, L. T., Richardson, L. M., Saunders, E. and Cowan, R. S. C. (2003). Spatial spread of neural excitation in cochlear implant recipients: comparison of improved ECAP method and psychophysical forward masking, *Hearing Research* **179**: 72–87.

Cohen, L. T., Saunders, E. and Clark, G. M. (2001). Psychophysics of a prototype peri-modiolar cochlear implant electrode array, *Hearing Research* **155**: 63–81.

Cohen, L. T., Saunders, E. and Richardson, L. M. (2004). Spatial spread of neural excitation: comparison of compound action potential and forward-masking data in cochlear implant recipients, *International Journal of Audiology* **43**(6): 346–355.

Cohen, L. T., Saunders, E., Knight, M. R. and Cowan, R. S. C. (2006). Psychophysical measures in patients fitted with Contour™ and straight Nucleus electrode arrays, *Hearing Research* **212**: 160–175.

Colombo, J. and Parkins, C. W. (1987). A model of electrical excitation of the mammalian auditory-nerve neruon, *Hearing Research* **31**: 287–312.

Conning, M. (2006). *Acoustic modelling of cochlear implants*, Master's thesis, University of Pretoria, Pretoria, South Africa.

Deurloo, K. E. I., Holsheimer, J. and Bergveld, P. (2001). The effect of subthreshold prepulses on the recruitment order in a nerve trunk analyzed in a simple and a realistic volume conductor model, *Biological Cybernetics* **85**(4): 281–291.

Devaux, J. J., Kleopa, K. A., Cooper, E. C. and Scherer, S. S. (2004). KCNQ2 is a nodal $K^+$ channel, *Journal of Neuroscience* **24**(5): 1236–1244.

Dillier, N., Lai, W. K., Almqvist, B., Frohne, C., Müller-Deile, J., Stecker, M. and van Wallenberg, E. (2002). Measurement of the electrically evoked compound action potential via a neural response telemetry system, *Annals of Otology, Rhinology and Laryngology* **111**(5): 407–414.

Dimitrov, A. G. (2005). Internodal sodium channels ensure active processes under myelin manifesting in depolarizing afterpotentials, *Journal of Theoretical Biology* **235**(4): 451–462.

Dynes, S. C. B. and Delgutte, B. (1992). Phase-locking of auditory-nerve discharges to sinusoidal electric stimulation of the cochlea, *Hearing Research* **58**: 79–90.

Etler, C. P., Abbas, P. J., Hughes, M. L., Brown, C. J., Dunn, S. M., Zubrod, L. J. and van Voorst, T. L. (2004). Comparison of psychophysical and electrophysiologic measures of channel interaction, *in* R. T. Miyamoto (ed.), *International Congress Series*, Vol. 1273 of *Cochlear Implants. Proceedings of the VIII International Cochlear Implant Conference, 10-13 May 2004*, Indianapolis, IN, USA, pp. 44–47.

Fayad, J. N. and Linthicum Jr, F. H. (2006). Multichannel cochlear implants: Relation of histopathology to performance, *Laryngoscope* **116**(8): 1310–1320.

Felder, E., Kanonier, G., Scholtz, A., Rask-Andersen, H. and Schrott-Fischer, A. (1997). Quantitative evaluation of cochlear neuronal and computer-aided three-

dimensional reconstruction of spiral ganglion cells in humans with a peripheral loss of nerve fibres, *Hearing Research* **105**: 183–190.

Franck, K. H. and Norton, S. J. (2001). Estimation of psychophysical levels using the electrically evoked compound action potential measured with the neural response telemetry capabilities of Cochlear Corporation's CI24M device, *Ear & Hearing* **22**(4): 289–299.

Frankenhaeuser, B. and Huxley, A. F. (1964). The action potential in the myelinated nerve fibre of *Xenopus laevis* as computed on the basis of voltage clamp data, *Journal of Physiology* **171**: 302–315.

Frijns, J. H. M. and ten Kate, J. H. (1994). A model of myelinated nerve fibres for electrical prosthesis design, *Medical and Biological Engineering and Computing* **32**(4): 391–398.

Frijns, J. H. M., Briaire, J. J. and Grote, J. J. (2001). The importance of human cochlear anatomy for the results of modiolus-hugging multichannel cochlear implants, *Otology & Neurotology* **22**: 340–349.

Frijns, J. H. M., Briaire, J. J. and Schoonhoven, R. (2000). Integrated use of volume conduction and neural models to simulate the response to cochlear implants, *Simulation Practice and Theory* **8**: 75–97.

Frijns, J. H. M., de Snoo, S. L. and Schoonhoven, R. (1995). Potential distributions and neural excitation patterns in a rotationally symmetric model of the electrically stimulated cochlea, *Hearing Research* **87**: 170–186.

Frijns, J. H. M., de Snoo, S. L. and ten Kate, J. H. (1996). Spatial selectivity in a rotationally symmetric model of the electrically stimulated cochlea, *Hearing Research* **95**: 33–48.

Frijns, J. H. M., Mooij, J. and ten Kate, J. H. (1994). A quantitative approach to modeling mammalian myelinated nerve fibers for electrical prosthesis design, *IEEE Transactions on Biomedical Engineering* **41**(6): 556–566.

Geuna, S., Tos, P., Guglielmone, R., Battiston, B. and Giacobini-Robecchi, M. G. (2001). Methodological issues in size estimation of myelinated nerve fibers in peripheral nerves, *Anatomy and Embryology* **203**(6): 1–10.

Glueckert, R., Pfaller, K., Kinnefors, A., Rask-Andersen, H. and Schrott-Fischer, A. (2005a). The human spiral ganglion: New insights into ultrastructure, survival rate and implications for cochlear implants, *Audiology & Neurotology* **10**(5): 258–273.

Glueckert, R., Pfaller, K., Kinnefors, A., Rask-Andersen, H. and Schrott-Fischer, A. (2005b). Ultrastructure of the normal human organ of Corti. New anatomical findings in surgical specimens, *Acta Oto-Laryngologica* **125**(5): 534–539.

Glueckert, R., Pfaller, K., Kinnefors, A., Schrott-Fischer, A. and Rask-Andersen, H. (2005c). High resolution scanning electron microscopy of the human organ of Corti. A study using freshly fixed surgical specimens, *Hearing Research* **199**: 40–56.

Grill, W. M. and Mortimer, J. T. (1995). Stimulus waveforms for selective neural stimulation, *IEEE Engineering in Medicine and Biology Magazine* **14**(4): 375–385.

Grill, W. M. and Mortimer, J. T. (1997). Inversion of the current-distance relationship by transient depolarization, *IEEE Transactions on Biomedical Engineering* **44**(1): 1–9.

Hanekom, T. (2001a). *Modelling of the electrode-auditory nerve fibre interface in cochlear prostheses*, PhD thesis, University of Pretoria, Pretoria, South Africa.

Hanekom, T. (2001b). Three-dimensional spiraling finite element model of the electrically stimulated cochlea, *Ear & Hearing* **22**(4): 300–315.

Hanekom, T. (2005). Modelling encapsulation tissue around cochlear implant electrodes, *Medical and Biological Engineering and Computing* **43**(1): 47–55.

Hartmann, R. and Klinke, R. (1990). Response characteristics of nerve fibers to patterned electrical stimulation, *in* J. M. Miller and F. A. Spelman (eds), *Cochlear implants. Models of the electrically stimulated ear*, Springer-Verlag Inc., New York, chapter 10, pp. 135–160.

Hartmann, R., Topp, G. and Klinke, R. (1982). Comparison of auditory single fiber responses during acoustic and electric stimulation of the intact cat cochlea, *Archives of Oto-Rhino-Laryngology* **234**(2): 187–188.

Hartmann, R., Topp, G. and Klinke, R. (1984). Discharge patterns of cat primary auditory nerve fibers with elecrical stimulation of the cochlea, *Hearing Research* **13**: 47–62.

Hille, B. (2001). *Ionic Channels of Excitable Membrane*, Third edn, Sinauer Associates Inc., Sunderland, Massachusetts.

Hodgkin, A. L. and Huxley, A. F. (1952). A quantitative description of membrane current and its application to conduction and excitation in nerve, *Journal of Physiology* **117**(4): 500–544.

Hong, R. S., Rubinstein, J. T., Wehner, D. and Horn, D. (2003). Dynamic range enhancement for cochlear implants, *Otology and Neurotology* **24**(4): 590–595.

Hossain, W. A., Antic, S. D., Yang, Y., Rasband, M. N. and Morest, D. K. (2005). Where is the spike generator of the cochlear nerve? Voltage-gated sodium channels in the mouse cochlea, *Journal of Neuroscience* **25**(29): 6857–6868.

Huxley, A. F. (1959). Ion movements during nerve activity, *Annals of the New York Academy of Sciences* **81**: 221–246.

Huys, Q. J. M., Ahrens, M. B. and Paninski, L. (2006). Efficient estimation of detailed single-neuron models, *Journal of Neurophysiology* **96**(2): 872–890.

Izhikevich, M. E. (2007). *Dynamical systems in neuroscience: the geometry of excitability and bursting*, First edn, The MIT Press, Cambridge, Massachusetts.

Javel, E. (1990). Acoustic and electrical encoding of temporal information, *in* J. M. Miller and F. A. Spelman (eds), *Cochlear implants. Models of the electrically stimulated ear*, Springer-Verlag Inc., New York, chapter 17, pp. 247–296.

Javel, E. and Shepherd, R. K. (2000). Electrical stimulation of the auditory nerve III. Response initiation sites and temporal fine structure, *Hearing Research* **140**: 45–76.

Javel, E., Tong, Y. C., Shepherd, R. K. and Clark, G. M. (1987). Responses of cat auditory nerve fibers to biphasic electrical current pulses, *Annals of Otology, Rhinology and Laryngology* **96**(Suppl. 128): 26–30.

Jolly, C. N., Spelman, F. A. and Clopton, B. M. (1996). Quadrupolar stimulation for cochlear prostheses: Modeling and experimental data, *IEEE Transactions on Biomedical Engineering* **43**(8): 857–865.

Jönsson, R., Hanekom, T. and Hanekom, J. J. (2008). Initial results from a model of ephaptic excitation in the electrically excited peripheral auditory nervous system, *Hearing Research* **237**: 49–56.

Kiang, N. Y. and Moxon, E. C. (1972). Physiological considerations in artificial stimulation of the inner ear, *Annals of Otology, Rhinology and Laryngology* **81**(5): 714–730.

Kiernan, M. C., Cikurel, K. and Bostock, H. (2001). Effects of temperature on the excitability properties of human motor axons, *Brain* **124**(4): 816–825.

Klinke, R. and Hartmann, R. (1997). Basic neurophysiology of cochlear-implants, *The American Journal of Otology* **18**(6 (Suppl)): S7–S10.

Kral, A., Hartmann, R., Mortazavi, D. and Klinke, R. (1998). Spatial resolution of cochlear implants: the electrical field and excitation of auditory afferents, *Hearing Research* **121**: 11–28.

Lai, W. K. and Dillier, N. (2000). A simple two-component model of the electrically evoked compound action potential in the human cochlea, *Audiology & Neuro-Otology* **5**: 333–345.

Lai, W. K. and Dillier, N. (2008). Comparing neural response telemetry amplitude growth functions with loudness growth functions: Preliminary results, *Ear & Hearing* **28**(2 (Suppl)): 42S–45S.

Lapicque, L. (1907). Recherches quantitatifs sur l'excitation electrique des nerfs traitee comme un polarisation, *Journal of Physiology* **9**: 620–635.

Leake, P. A. and Rebscher, S. J. (2004). Anatomical considerations of electrical stimulation, *in* F. G. Zeng, A. N. Popper and R. R. Fay (eds), *Cochlear Implants: Auditory prostheses and electric hearing*, Vol. 20 of *Springer handbook of audiory research*, Springer-Verlag, New York, chapter 4, pp. 101–148.

Liang, D. H., Lusted, H. S. and White, R. L. (1999). The nerve-electrode interface of the cochlear implant: current spread, *IEEE Transactions on Biomedical Engineering* **46**(1): 35–43.

Linthicum Jr, F. H. and Anderson, W. (1991). Cochlear implantation of totally deaf ears, *Acta Otolaryngology* **111**(2): 327–331.

Loeb, G. E., White, M. W. and Jenkins, W. M. (1983). Biophysical considerations in electrical stimulation of the auditory nervous system, *Annals of the New York Academy of Sciences* **405**: 123–136.

Loizou, P. C. (1998). Mimicking the human ear, *IEEE Signal Processing Magazine* **15**(5): 101–130.

Lowitzsch, K., Hopf, H. C. and Galland, J. (1977). Changes of sensory conduction velocity and refractory periods with decreasing tissue temperature in man, *Journal of Neurology* **216**(3): 181–188.

Macherey, O., Carlyon, R. P., van Wieringen, A. and Wouters, J. (2007). A dual-process integrator-resonator model of the electrically stimulated human auditory nerve, *Journal of the Association for Research in Otolaryngology* **8**(1): 84–104.

Macherey, O., van Wieringen, A., Carlyon, R. P., Deeks, J. M. and Wouters, J. (2006). Asymmetric pulses in cochlear implants: Effects of pulse shape, polarity, and rate, *Journal of the Association for Research in Otolaryngology* **7**(3): 253–266.

Matsuoka, A. J., Abbas, P. J., Rubinstein, J. T. and Miller, C. A. (2000a). The neuronal response to electrical constant-amplitude pulse train stimulation: additive Gaussian noise, *Hearing Research* **149**: 129–137.

Matsuoka, A. J., Abbas, P. J., Rubinstein, J. T. and Miller, C. A. (2000b). The neuronal response to electrical constant-amplitude pulse train stimulation: evoked compound action potential recordings, *Hearing Research* **149**: 115–128.

Matsuoka, A. J., Rubinstein, J. T., Abbas, P. J. and Miller, C. A. (2001). The effects of interpulse interval on stochastic properties of electrical stimulation: models and measurements, *IEEE Transactions on Biomedical Engineering* **48**(4): 416–424.

McIntyre, C. C., Richardson, A. G. and Grill, W. M. (2002). Modeling the excitability of mammalian nerve fibers: Influence of afterpotentials on the recovery cycle, *Journal of Neurophysiology* **87**(2): 995–1006.

McNeal, D. R. (1976). Anaysis of a model for excitation of myelinated nerve, *IEEE Transactions on Biomedical Engineering* **23**(4): 329–337.

Miller, C. A., Abbas, P. J. and Brown, C. J. (1993). Electrically evoked auditory brainstem response to stimulation of different sites in the cochlea, *Hearing Research* **66**: 130–142.

Miller, C. A., Abbas, P. J. and Brown, C. J. (2000). An improved method of reducing stimulus artifact in the electrically evoked whole-nerve potential, *Ear & Hearing* **21**(4): 280–290.

Miller, C. A., Abbas, P. J. and Robinson, B. K. (2001a). Response properties of the refractory auditory nerve fibre, *Journal of the Association for Research in Otolaryngology* **2**(3): 216–232.

Miller, C. A., Abbas, P. J. and Rubinstein, J. T. (1999a). An empirically based model of the electrically evoked compound action potential, *Hearing Research* **135**: 1–18.

Miller, C. A., Abbas, P. J., Hay-McCutcheon, M. J., Robinson, B. K., Nourski, K. V. and Jeng, F. C. (2004). Intracochlear and extracochlear ECAPs suggest antidromic action potentials, *Hearing Research* **198**: 75–86.

Miller, C. A., Abbas, P. J., Nourski, K. V., Hu, N. and Robinson, B. K. (2003). Electrode configuration influences action potential initiation site and ensemble stochastic response properties, *Hearing Research* **175**: 200–214.

Miller, C. A., Abbas, P. J., Robinson, B. K., Rubinstein, J. T. and Matsuoka, A. J. (1999b). Electrically evoked single-fiber action potentials from cat: responses to monopolar, monophasic stimulation, *Hearing Research* **130**: 197–218.

Miller, C. A., Abbas, P. J., Rubinstein, J. T., Robinson, B. K., Matsuoka, A. J. and Woodworth, G. (1998). Electrically evoked compound action potentials of guinea pig and cat: responses to monopolar, monophasic stimulation, *Hearing Research* **119**: 142–154.

Miller, C. A., Robinson, B. K., Rubinstein, J. T., Abbas, P. J. and Runge-Samuelson, C. L. (2001b). Auditory nerve responses to monophasic and biphasic electric stimuli, *Hearing Research* **151**: 79–94.

Miller, C. A., Woodruff, K. E. and Pfingst, B. E. (1995). Functional responses from guinea pigs with cochlear implants. I. Electrophysiological and psychophysical measures, *Hearing Research* **92**: 85–99.

Mo, Z. L., Adamson, C. L. and Davis, R. L. (2002). Dendrotoxin-sensitive $K^+$ currents contribute to accomodation in murine spiral ganglion neurons, *Journal of Physiology* **542**(3): 763–778.

Mogyoros, I., Kiernan, M. C. and Burke, D. (1996). Strength-duration properties of human peripheral nerve, *Brain* **119**(2): 439–447.

Moore, J. W., Joyner, R. W., Brill, M. H., Waxman, S. D. and Najar-Joa, M. (1978). Simulations of conduction in uniform myelinated fibers. Relative sensitivity to changes in nodal and internodal parameters, *Biophysical Journal* **21**(2): 147–160.

Morse, R. P. and Evans, E. F. (2003). The sciatic nerve of the toad *Xenopus laevis* as a physiological model of the human cochlear nerve, *Hearing Research* **182**: 97–118.

Moxon, E. C. (1971). *Neural and mechanical responses to electric stimulation of the cat's inner ear*, PhD thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Murray, J. A. H., Simpson, J. A. and Weiner, E. S. C. (eds) (1989). *The Oxford English Dictionary*, Second edn, Clarendon Press, Oxford.

Nadol Jr, J. B. (1988). Comparative anatomy of the cochlea and auditory nerve in mammals, *Hearing Research* **34**: 253–266.

Nadol Jr, J. B. (1990). Degeneration of cochlear neurons as seen in the spiral ganglion of man, *Hearing Research* **49**: 141–154.

Nadol Jr, J. B. (1997). Patterns of neural degeneration in the human cochlea and auditory nerve: Implications for cochlear implantation, *Otolaryngology - Head and Neck Surgery* **117**(3): 220–228.

Nadol Jr, J. B. and Xu, W. Z. (1992). Diameter of the cochlear nerve in deaf humans: Implications for cochlear implantation, *Annals of Otology, Rhinology and Laryngology* **101**(12): 988–993.

Nadol Jr, J. B., Burgess, B. J. and Reisser, C. (1990). Morphometric analysis of normal human spiral ganglion cells, *Annals of Otology, Rhinology and Laryngology* **99**(5I): 340–348.

Niparko, J. K. (2004). Cochlear implants: Clinical applications, *in* F. G. Zeng, A. N. Popper and R. R. Fay (eds), *Cochlear Implants: Auditory prostheses and electric hearing*, Vol. 20 of *Springer handbook of audiory research*, Springer-Verlag, New York, chapter 3, pp. 53–100.

Nygren, A. and Halter, J. A. (1999). A general approach to modeling conduction and concentration dynamics in excitable cells of concentric cylindrical geometry, *Journal of Theoretical Biology* **199**(3): 329–358.

O'Leary, S. J., Black, R. C. and Clark, G. M. (1985). Current distributions in the cat cochlea: a modelling and electrophysiological study, *Hearing Research* **18**: 273–281.

Paintal, A. S. (1965). Effects of temperature on conduction in single vagal and saphenous myelinated nerve fibres of the cat, *Journal of Physiology* **180**(1): 20–49.

Paintal, A. S. (1966). The influence of diameter of medullated nerve fibres of cats on the rising and falling phases of the spike and its recovery, *Journal of Physiology* **184**(4): 791–811.

Palti, Y. and Adelman Jr., W. J. (1969). Measurement of axonal membrane conductances and capacity by means of a varying potential control voltage clamp, *Journal of Membrane Biology* **1**(1): 431–458.

Pamulova, L., Linder, B. and Rask-Andersen, H. (2006). Innervation of the apical turn of the human cochlea: A light microscopic and transmission electron microscopic investigation, *Otology & Neurotology* **27**(2): 270–275.

Pfingst, B. E. and Sutton, D. (1983). Relation of cochlear implant function to histopathology in monkeys, *Annals of the New York Academy of Sciences* **405**: 224–239.

Polak, M., Hodges, A. V., King, J. E. and Balkany, T. J. (2004). Further prospective findings with compound action potentials from Nucleus 24 cochlear implants, *Hearing Research* **188**: 104–116.

Ragheb, T. and Geddes, L. A. (1990). Electrical properties of metallic electrodes, *Medical and Biological Engineering and Computing* **28**(2): 182–186.

Ranck Jr, J. B. (1975). Which elements are excited in electrical stimulation of mammalian central nervous system: a review, *Brain Research* **98**(3): 417–440.

Rasband, M. N. (2006). Neuron-glia interactions at the node of Ranvier, *in* E. Gundelfinger, C. Seidenbecher and B. Schraven (eds), *Cell Communication in Nervous and Immune System*, Results and Problems in Cell Differentiation, Springer Berlin / Heidelberg, pp. 129–149.

Rasband, M. N. and Trimmer, J. S. (2001). Developmental clustering of ion channels at and near the node of Ranvier, *Developmental Biology* **236**(1): 5–16.

Rask-Andersen, H., Tylstedt, S., Kinnefors, A. and Schrott-Fischer, A. (1997). Nerve fibre interaction with large ganglion cells in the human spiral ganglion: A TEM study, *Auris Nasus Larynx* **24**(1): 1–11.

Rattay, F. (1987). Ways to approximate current-distance relations for electrically stimulated fibers, *Journal of Theoretical Biology* **125**(3): 339–349.

Rattay, F. (1990). *Electrical nerve stimulation: theory, experiments and applications*, Springer Verlag, Wien, New York.

Rattay, F. and Aberham, M. (1993). Modeling axon membranes for functional electrical stimulation, *IEEE Transactions on Biomedical Engineering* **40**(12): 1201–1209.

Rattay, F., Leao, R. N. and Felix, H. (2001a). A model of the electrically excited human cochlear neuron. II. Influence of the three-dimensional cochlear structure on neural excitability, *Hearing Research* **153**: 64–79.

Rattay, F., Lutter, P. and Felix, H. (2001b). A model of the electrically excited human cochlear neuron I. Contribution of neural substructures to the generation and propagation of spikes, *Hearing Research* **153**: 43–63.

Rattay, F., Resatz, S., Lutter, P., Minassian, K., Jilge, B. and Dimitrijevic, M. R. (2003). Mechanisms of electrical stimulation with neural prostheses, *Neuromodulation* **6**(1): 42–56.

Rebscher, S. J., Snyder, R. L. and Leake, P. A. (2001). The effect of electrode configuration and duration of deafness on threshold and selectivity of responses to intracochlear electrical stimulation, *Journal of the Acoustical Society of America* **109**(5): 2035–2048.

Reid, G., Bostock, H. and Schwarz, J. R. (1993). Quantitative description of action potentials and membrane currents in human node of Ranvier, *Journal of Physiology* **467**: 247P.

Reid, G., Scholz, A., Bostock, H. and Vogel, W. (1999). Human axons contain at least five types of voltage-dependent potassium channel, *Journal of Physiology* **518**(3): 681–696.

Reid, M. A., Flores-Otero, J. and Davis, R. L. (2004). Firing patterns of Type II spiral ganglion neurons *in vitro*, *The Journal of Neuroscience* **24**(3): 733–742.

Röper, J. and Schwarz, J. R. (1989). Heterogeneous distribution of fast and slow potassium channels in myelinated rat nerve fibres, *Journal of Physiology* **416**: 93–110.

Rosbe, K. W., Burgess, B. J., Glynn, R. J. and Nadol Jr, J. B. (1996). Morphologic evidence for three cell types in the human spiral ganglion, *Hearing Research* **93**: 120–127.

Rubinstein, J. T. (1993). Axon termination conditions for electrical stimulation, *IEEE Transactions on Biomedical Engineering* **40**(7): 654–663.

Rubinstein, J. T. (1995). Threshold fluctuations in an $N$ sodium channel model of the node of Ranvier, *Biophysical Journal* **68**(3): 779–785.

Rubinstein, J. T., Miller, C. A., Mino, H. and Abbas, P. J. (2001). Analysis of monophasic and biphasic electrical stimulation of nerve, *IEEE Transactions on Biomedical Engineering* **48**(10): 1065–1070.

Rubinstein, J. T., Wilson, B. S., Finley, C. C. and Abbas, P. J. (1999). Pseudospontaneous activity: stochastic independence of auditory nerve fibers with electrical stimulation, *Hearing Research* **127**: 108–118.

Runge-Samuelson, C. L., Abbas, P. J., Rubinstein, J. T., Miller, C. A. and Robinson, B. K. (2004). Response of the auditory nerve to sinusoidal electrical stimulation: effects of high-rate pulse trains, *Hearing Research* **194**: 1–13.

Safronov, B. V., Kampe, K. and Vogel, W. (1993). Single voltage-dependent potassium channels in rat peripheral nerve membrane, *Journal of Physiology* **460**: 675–691.

Salzer, J. L. (1997). Clustering sodium channels at the node of Ranvier: Close encounters of the axon-glia kind, *Neuron* **18**(6): 843–846.

Saunders, E., Cohen, L. T., Aschendorff, A., Shapiro, W., Knight, M., Stecker, M., Richter, B., Waltzman, S., Tykocinski, M., Roland, T., Laszig, R. and Cowan, R. S. C. (2002). Threshold, comfortable level and impedance changes as a function of electrode-modiolar distance, *Ear & Hearing* **23**(1S): 28S–40S.

Schalow, G., Zäch, G. A. and Warzok, R. (1995). Classification of human peripheral nerve fibre groups by conduction velocity and nerve fibre diameter is preserved following spinal cord lesion, *Journal of the Autonomic Nervous System* **52**(2-3): 125–150.

Scherer, S. S. and Arroyo, E. J. (2002). Recent progress on the molecular organization of myelinated axons, *Journal of the Peripheral Nervous System* **7**(1): 1–12.

Scholz, A., Reid, G., Vogel, W. and Bostock, H. (1993). Ion channels in human axons, *Journal of Neurophysiology* **70**(3): 1274–1279.

Schuknecht, H. F. (1993). *Pathology of the ear*, Second edn, Lea and Febiger, Philadelphia.

Schwarz, J. R. and Eikhof, G. (1987). Na currents and action potentials in rat myelinated nerve fibres at 20 and 37 °C, *Pflügers Archiv: European Journal of Physiology* **409**: 569–577.

Schwarz, J. R., Glassmeier, G., Cooper, E. C., Kao, T. C., Nodera, H., Tabuena, D., Kaji, R. and Bostock, H. (2006). KCNQ channels mediate $I_{Ks}$, a slow $K^+$ current regulating excitability in the rat node of Ranvier, *Journal of Physiology* **573**(1): 17–34.

Schwarz, J. R., Reid, G. and Bostock, H. (1995). Action potentials and membrane currents in the human node of ranvier, *Pflügers Archiv: European Journal of Physiology* **430**(2): 283–292.

Shannon, R. V. (1985). Threshold and loudness functions for pulsatile stimulation of cochlear implants, *Hearing Research* **18**: 135–143.

Shannon, R. V. (1989). A model of threshold for pulsatile electrical stimulation of cochlear implants, *Hearing Research* **40**: 197–204.

Shannon, R. V., Fu, Q. J., Galvin III, J. J. and Friesen, L. (2004). Speech perception with cochlear implants, *in* F. G. Zeng, A. N. Popper and R. R. Fay (eds), *Cochlear Implants: Auditory prostheses and electric hearing*, Vol. 20 of *Springer handbook of audiory research*, Springer-Verlag, New York, chapter 8, pp. 334–376.

Shepherd, R. K. and Javel, E. (1997). Electrical stimulation of the auditory nerve. I. Correlation of physiological responses with cochlear status, *Hearing Research* **108**: 112–144.

Shepherd, R. K. and Javel, E. (1999). Electrical stimulation of the auditory nerve: II. Effect of stimulus waveshape on single fibre response properties, *Hearing Research* **130**: 171–188.

Shepherd, R. K., Hatshushika, S. and Clark, G. M. (1993). Electrical stimulation of the auditory nerve: the effect of electrode position on neural excitation, *Hearing Research* **66**: 108–120.

Smith, R. L. and Brachman, M. L. (1982). Adaptation in auditory-nerve fibers: A revised model, *Biological Cybernetics* **44**(2): 107–120.

Spelman, F. A., Clopton, B. M. and Pfingst, B. E. (1982). Tissue impedance and current flow in the implanted ear. Implications for the cochlear prosthesis, *The Annals of Otology, Rhinology & Laryngology. Supplement* **98**(91): 3–8.

Spoendlin, H. and Schrott, A. (1989). Analysis of the human auditory nerve, *Hearing Research* **43**: 25–38.

Stephanova, D. I. and Daskalova, M. (2005a). Differences in potentials and excitability properties in simulated cases of demyelinating neuropathies. Part II. Paranodal demyelination, *Clinical Neurophysiology* **116**(5): 1159–1166.

Stephanova, D. I. and Daskalova, M. (2005b). Differences in potentials and excitability properties in simulated cases of demyelinating neuropathies. Part III. Paranodal internodal demyelination, *Clinical Neurophysiology* **116**(10): 2334–2341.

Stephanova, D. I., Daskalova, M. and Alexandrov, A. S. (2005). Differences in potentials and excitability properties in simulated cases of demyelinating neuropathies. Part I, *Clinical Neurophysiology* **116**(5): 1153–1158.

Taylor, J. T., Burke, D. and Heywood, J. (1992). Physiological evidence for a slow $K^+$ conductance in human cutaneous afferents, *Journal of Physiology* **453**: 575–589.

Townshend, B. and White, R. L. (1987). Reduction of electrical interaction in auditory prostheses, *IEEE Transactions on Biomedical Engineering* **34**(11): 891–897.

Tykocinski, M., Cohen, L. T., Pyman, B. C., Roland, T., Treaba, C., Palamara, J., Dahm, M. C., Shepherd, R. K., Xu, J., Cowan, R. S. C., Cohen, N. L. and Clark, G. M. (2000). Comparison of electrode position in the human cochlea using various perimodiolar electrode arrays, *The American Journal of Otology* **21**(2): 205–211.

Tylstedt, S. and Rask-Andersen, H. (2001). A 3-D model of membrane specializations between human auditory spiral ganglion cells, *Journal of Neurocytology* **30**(6): 465–473.

Vabnick, L. and Shrager, P. (1998). Ion channel redistribution and function during development of the myelinated axon, *Journal of Neurobiology* **37**(1): 80–96.

Vabnick, L., Trimmer, J. S., Schwarz, T. L., Levinson, S. R., Risal, D. and Shrager, P. (1999). Dynamic potassium channel distributions during axonal development prevent aberrant firing patterns, *Journal of Neuroscience* **19**(2): 747–758.

Van den Honert, C. and Stypulkowski, P. H. (1984). Physiological properties of the electrically stimulated auditory nerve. II. Single fiber recordings, *Hearing Research* **14**: 225–243.

Van den Honert, C. and Stypulkowski, P. H. (1987a). Single fiber mapping of spatial excitation patterns in the electrically stimulated auditory nerve, *Hearing Research* **29**: 195–206.

Van den Honert, C. and Stypulkowski, P. H. (1987b). Temporal response patterns of single auditory nerve fibers elicited by periodic electrical stimuli, *Hearing Research* **29**: 207–222.

van der Heijden, M. and Kohlrausch, A. (1994). Using an excitation-pattern model to predict auditory masking, *Hearing Research* **80**: 38–52.

Van Wieringen, A., Carlyon, R. P., Laneau, J. and Wouters, J. (2005). Effects of waveform shape on human sensitivity to electrical stimulation of the inner ear, *Hearing Research* **200**: 73–86.

Van Wieringen, A., Carlyon, R. P., Macherey, O. and Wouters, J. (2006). Effects of pulse rate on thresholds and loudness of biphasic and alternating monophasic pulse trains in electrical hearing, *Hearing Research* **220**: 49–60.

Vanpoucke, F. J., Zarowski, A. J. and Peeters, S. A. (2004). Identification of the impedance model of an implanted cochlear prosthesis from intracochlear potential measurements, *IEEE Transactions on Biomedical Engineering* **51**(12): 2174–2183.

Waxman, S. G. (2000). The neuron as a dynamic electrogenic machine: modulation of sodium-channel expression as a basis for functional plasticity in neurons, *Philo-*

*sophical Transactions of the Royal Society of London Series B Biological Sciences* **355**(1394): 199–213.

Weiss, G. (1901). Sur la possibilité de rendre comparables entre eux les appareils servant a l'excitation électrique, *Archives Italiennes de Biologie* **35**: 413–446.

Wesselink, W. A., Holsheimer, J. and Boom, H. B. K. (1999). A model of the electrical behaviour of myelinated sensory nerve fibres based on human data, *Medical and Biological Engineering and Computing* **37**(1): 228–235.

White, J. A., Rubinstein, J. T. and Kay, A. R. (2000). Channel noise in neurons, *Trends in Neurosciences* **23**(3): 131–137.

Zhang, X., Heinz, M. G., Bruce, I. C. and Carney, L. H. (2001). A phenomenological model for the responses of auditory-nerve fibers: I. Nonlinear tuning with compression and suppression, *Journal of the Acoustical Society of America* **109**(2): 648–670.

Zimmermann, C. E., Burgess, B. J. and Nadol Jr, J. B. (1995). Patterns of degeneration in the human cochlear nerve, *Hearing Research* **90**: 192–201.