CREDITI DELLE ILLUSTRAZIONI

CAPITOLO 1 L'ORGANIZZAZIONE DEL SISTEMA NERVOSO

Immagine d'apertura Courtesy of Allen W. Song, Duke-UNC Brain Imaging and Analysis Center. **Figura 1.1A** Ramsköld, D., E. T. Wang, C. B. Burge and R. Sandberg (2009) An abundance of ubiquitously expressed genes revealed by tissue transcriptome sequence data. *PLoS* 5:12 e1000598. **Figura 1.1C** Bond, J. and 11 others (2002) ASPM is a major determinant of cerebral cortical size. *Nat. Genet.* 32: 316-320. **Figura 1.3** Peters, A., S. L. Palay and H. deF. Webster (1991) *The Fine Structure of the Nervous System: Neurons and Their Supporting Cells*, 3rd Edition Oxford University Press, New York. **Figura 1.4B** Kalil, K., G. Szebenyi and E.W. Dent (2000) Common mechanisms underlying growth cone guidance and axon branching. *Dev. Neurobio.* 44: 145-158. **Figure 1.4E,F** Matus, A. (2000) Actin dynamics and synaptic plasticity. *Science* 290: 754-758. **Figura 1.5A-C** Jones, E. G. and M. W. Cowan (1983) The nervous tissue. In *The Structural Basis of Neurobiology,* E. G. Jones (ed.). New York: Elsevier, Chapter 8. **Figura 1.5D,E** Nishiyama, A., M. Komitova, R. Suzuki and X. Zhu (2009) Polydendrocytes (NG2 cells): Multifunctional cells with lineage plasticity. *Nat. Rev. Neurosci.* 10: 9-22. **Figura 1.5H** Bhat, M.A. and 11 others (2001) Axon-Glia Interactions and the Domain Organization of Myelinated Axons Requires Neurexin IV/Caspr/Paranodin. *Neuron* 30: 369-383. **Figura 1.10A** Mank, M. and 12 others (2008) A genetically encoded calcium indicator for chronic in vivo two-photon imaging. *Nat. Meth.* 5: 805-811. **Figura 10B,C** Ohki, K., S. Chung, Y. H. Ch'ng, P. Kara and R. C. Reid (2005) Functional imaging with cellular resolution reveals precise micro-architecture in visual cortex. *Nature* 433: 597-603. **Figura 1.11A** Zhang, F. and 12 others (2011) The microbial opsin family of optogenetic tools. *Cell* 147: 1446-1457. **Figura 1.11C,D** Kravitz, A. V. and 6 others (2010) Regulation of parkinsonian motor behaviours by optogenetic control of basal ganglia circuitry. *Nature* 466: 622-626. **Figura 1.13A** Stewart, T. A. and B. Mintz (1981) Successive generations of mice produced from an established culture line of euploid teratocarcinoma cells. *Proc. Nat. Acad. Sci. USA* 78: 6314-6318. **Figura 1.15** Zylka, M. J., F. L. Rice and D. J. Anderson (2005) Topographically distinct epidermal nociceptive circuits revealed by axonal tracers targeted to Mrgprd. *Neuron* 46: 17-25. **Figura 1.17A** Hoeffner, E. G., S. K. Mukherji, A. Srinivasan and D. J. Quint. (2012) Neuroradiology back to the future: Brain imaging. *Am. J. Neuroradiol.* 33: 5-11. **Figura 1.19C** Khairy, S. and 5 others (2015) Duodenal obstruction as first presentation of metastatic breast cancer. *Case Reports in Surgery* 2015: 605719. **Figura 1.20B,C** Seiger, R. and 10 others (2015) Voxel-based morphometry at ultra-high fields. a comparison of 7T and 3T MRI data. *Neuroimage* 113: 207-216. **Figura 1.21** Goodyear, B., E. Liebenthal and V. Mosher (2014) Active and passive fMRI for presurgical mapping of motor and language cortex. In *Advanced Brain Neuroimaging Topics in Health and Disease – Methods and Applications*, D. Duric (Ed.), *InTech*. doi: 10.5772/58269

CAPITOLO 2 I SEGNALI ELETTRICI DELLE CELLULE NERVOSE

Immagine d'apertura, Unità 1 Structure of a chemical synapse within the cerebral cortex. A presynaptic terminal (top) forms a synapse with a dendritic spine of the postsynaptic neuron (bottom). Colors indicate different organelles found within these structures. Courtesy of Alain Burette and Richard Weinberg. **Figura 2.3** Hodgkin, A. L. and W. A. Rushton (1946) The electrical constants of a crustacean nerve fibre. *Proc. R. Soc. Lond. B* 133: 444-479. **Scheda Applicazioni cliniche Figura A** Scholz, A. (2002) Mechanisms of (local) anaesthetics on voltage-gated sodium and other ion channels. *Br. J. Anaesth.* 89: 52-61. **Scheda Applicazioni cliniche Figura B** Thomson, A. M., A. P. Bannister, D. I. Hughes and H. Pawelzik (2000) Differential sensitivity to Zolpidem of IPSPs activated by morphologically identified CA1 interneurons in slices of rat hippocampus. *Eur. J. Neurosci.* 12: 425-436. **Scheda Applicazioni cliniche Figura C** Lizarraga, I., J. P. Chambers and C. B. Johnson (2008) Synergistic depression of NMDA receptor-mediated transmission by ketamine, ketoprofen and L-NAME combinations in neonatal rat spinal cords in vitro. *Br. J. Pharmacol.* 153: 1030-1042. **Scheda Applicazioni cliniche Figura D** Sirois, J. E., J. J. Pancrazio, C. Lynch and D. A. Bayliss (1998) Multiple ionic mechanisms mediate inhibition of rat motoneurones by inhalation anaesthetics. *J. Physiol.* (*Lond.*) 512: 851-862. **Figure 2.8 e 2.9** Hodgkin, A. L. and B. Katz (1949) The effect of sodium ions on the electrical activity of the giant axon of the squid. *J. Physiol.* (*Lond.*) 108: 37-77. **Scheda 2B Figura A** Hodgkin, A. L. and A. F. Huxley (1939) Action potentials recorded from inside a nerve fibre. *Nature* 144: 710-711. **Scheda 2B Figura B** Dodge, F. A. and B. Frankenhaeuser (1958) Membrane currents in isolated frog nerve fibre under voltage clamp conditions. *J. Physiol.* (*Lond.*) 143: 76-90. **Scheda 2B Figura C** Barrett, E. F. and J. N. Barrett (1976) Separation of two voltage-sensitive potassium currents, and demonstration of a tetrodotoxin-resistant calcium current in frog motoneurones. *J. Physiol.* (*Lond.*) 255: 737-774. **Scheda 2B Figura D** Llinás, R. and Y. Yarom (1981) Electrophysiology of mammalian inferior olivary neurones in vitro. Different types of voltage-dependent ionic conductances. *J. Physiol.* (*Lond.*) 315: 549-567. **Scheda 2B Figura E** Chen, S., G. J. Augustine and P. Chadderton (2016) The cerebellum linearly encodes whisker position during voluntary movement. *eLife* 5: e10509.

CAPITOLO 3 LA PERMEABILITÀ VOLTAGGIO-DIPENDENTE DELLA MEMBRANA

Figure 3.1, 3.2 e 3.3 Hodgkin, A. L., A. F. Huxley and B. Katz (1952) Measurements of current-voltage relations in the membrane of the giant axon of *Loligo. J. Physiol.* 116: 424-448. **Figura 3.4** Hodgkin, A. L. and A. F. Huxley (1952a) Currents carried by sodium and potassium ions through the membrane of the giant axon of *Loligo. J. Physiol.* 116: 449-472. **Figura 3.5** Armstrong, C. M. and L. Binstock (1965) Anomalous rectification in the squid giant axon injected with tetraethylammonium chloride. *J. Gen. Physiol.* 48: 859-872; Moore, J. W., M. P. Blaustein, N. C. Anderson and T. Narahashi (1967) Basis of tetrodotoxin's selectivity in blockage of squid axons. *J. Gen. Physiol.* 50: 1401-1410. **Figure 3.6 e 3.7** Hodgkin, A. L. and A. F. Huxley (1952b) The components of membrane conductance in the giant axon of Loligo. *J. Physiol.* 116: 473-496. **Figura 3.8** Hodgkin, A. L. and A. F. Huxley (1952d) A quantitative description of membrane current and its application to conduction and excitation in nerve. *J. Physiol.* 116: 507-544. **Figura 3.11B** Chen, C. and 17 others (2004) Mice lacking sodium channel beta1 subunits display defects in neuronal excitability, sodium channel expression, and nodal architecture. *J. Neurosci.* 24: 4030-4042. **Scheda Applicazioni cliniche** Trapp, B. D and P.K. Stys (2009) Virtual hypoxia and chronic necrosis of demyelinated axons in multiple sclerosis. *Lancet Neurol.* 8: 280-291.

CAPITOLO 4 CANALI IONICI E TRASPORTATORI DI MEMBRANA

Figura 4.1B,C Bezanilla, F. and A. M. Correa (1995) Single-channel properties and gating of Na+ and K+ channels in the squid giant axon. In *Cephalopod Neurobiology*, N. J. Abbott, R. Williamson and L. Maddock (eds.). New York: Oxford University Press, pp. 131-151. **Figura 4.1D** Vanderberg, C. A. and F. Bezanilla (1991) A sodium channel model based on single channel, macroscopic ionic, and gating currents in the squid giant axon. *Biophys. J.* 60: 1511-1533. **Figura 4.1E** Correa, A. M. and F. Bezanilla (1994) Gating of the squid sodium channel at positive potentials. II. Single channels reveal two open states. *Biophys. J.* 66: 1864-1878. **Figura 4.2B-D** Augustine, C. K. and F. Bezanilla (1990) Phosphorylation modulates potassium conductance and gating current of perfused giant axons of squid. *J. Gen. Physiol.* 95: 245-271. **Figura 4.2E** Perozo, E., D. S. Jong and F. Bezanilla (1991) Single-channel studies of the phosphorylation of K+ channels in the squid giant axon. II. Nonstationary conditions. *J. Gen. Physiol.* 98: 19-34. **Figura 4.4A,B** Doyle, D. A. and 7 others (1998) The structure of the potassium channel: Molecular basis of K+ conduction and selectivity. *Science* 280: 69-77. **Scheda 4B Figura A** Schmidt, O. and H. Schmidt (1972) Influence of calcium ions on the ionic currents of nodes of Ranvier treated with scorpion venom. *Pflügers Arch.* 333: 51-61. **Scheda 4B Figura B** Cahalan, M. (1975) Modification of sodium channel gating in frog myelinated nerve fibers by Centruroides sculpturatus scorpion venom. *J. Physiol.* (*Lond.*) 244: 511-534. **Figure 4.5A,B** Long, S. B., E. B. Campbell and R. Mackinnon (2005b) Voltage sensor of Kv1.2: Structural basis of electromechanical coupling. *Science* 309: 903-908. **Figura 4.5C** Tao, X., A. Lee, W. Limapichat, D.A. Dougherty and R. MacKinnon (2010) A gating charge transfer center in voltage sensors. *Science* 328: 67-73. **Figura 4.5D** Lee, A. G. (2006) Ion channels: A paddle in oil. *Nature* 444: 697. **Figura 4.6A** Ahuja, S. and 34 others (2015) Structural basis of Nav1.7 inhibition by an isoform-selective small-molecule antagonist. *Science* 350: aac5464. **Figura 4.6B** Wu, J. and 6 others (2015) Structure of the voltage-gated calcium channel CaV1.1 complex. *Science* 350: aad2395. **Figura 4.6C** Long, S. B., E. B. Campbell and R. Mackinnon (2005) Crystal structure of a mammalian voltage-dependent Shaker family K+ channel. *Science* 309: 897-903. **Figura 4.6D** Dutzler, R., E. B. Campbell, M. Cadene, B. T. Chait and R. Mackinnon (2002) X-ray structure of a ClC chloride channel at 3.0 A reveals the molecular basis of anion selectivity. *Nature* 415: 287-294. **Scheda Applicazioni cliniche Figure A-C** Waxman, S. G and G. W. Zamponi (2014) Regulating excitability of peripheral afferents: emerging ion channel targets. *Nat. Neurosci.* 17: 153-163. **Figura 4.8A** Sobolevsky, A. I., M. P. Rosconi and E. Gouaux (2009) X-ray structure, symmetry and mechanism of an AMPA-subtype glutamate receptor. *Nature* 462: 745-756. **Figura 4.8B** Gonzalez, E. B., T. Kawate and Eric Gouaux (2009) Pore architecture and ion sites in acid sensing ion channels and P2X receptors. *Nature* 460: 599-604. **Figura 4.8C** Hite, R.K., X. Tao and R. MacKinnon (2017) Structural basis for gating the high-conductance Ca2+-activated K+ channel. *Nature* 541: 52-57. **Figura 4.8D** Li, M. and 8 others (2017) Structure of a eukaryotic cyclicnucleotide-gated channel. *Nature* doi: 10.1038/nature20819 **Figura 4.9A** Gao, Y., E. Cao, D. Julius and Y. Cheng (2016) TRPV1 structures in nanodiscs reveal mechanisms of ligand and lipid action. *Nature* 534: 347-351. **Figura 4.9B** Ge, J. and 9 others (2015) Architecture of the mammalian mechanosensitive Piezo1 channel. *Nature* 527: 64-69. **Figura 4.10A** Shinoda, T., H. Ogawa, F. Cornelius and C. Toyoshima (2009) Crystal structure of the sodium-potassium pump at 2.4 Å resolution. *Nature* 459: 446-450. **Figura 4.10B** Toyoshima, C., H. Nomura and T. Tsuda (2004) Luminal gating mechanism revealed in calcium pump crystal structures with phosphate analogues. *Nature* 432: 361-368. **Figura 4.11** Hodgkin, A. L. and R. D. Keynes (1955) Active transport of cations in giant axons from *Sepia* and *Loligo*. *J. Physiol.* 128: 28-60. **Figura 4.12A** Lingrel, J. B.and 5 others (1994) Structure-function studies of the Na, K-ATPase. *Kidney Internat. Suppl.* 44: S32-S39. **Figura 4.12B** Nyblom, M. and 7 others (2013) Crystal structure of Na+, K+-ATPase in the Na+-bound state. *Science* 342: 123-127.

CAPITOLO 5 LA TRASMISSIONE SINAPTICA

Figura 5.2A,B Sotelo, C., R. Llinas and R. Baker (1974) Structural study of inferior olivary nucleus of the cat: morphological correlates of electrotonic coupling. *J. Neurophysiol.* 37: 541-559. **Figura 5.2D** Maeda, S. and 6 others (2009) Structure of the connexin 26 gap junction channel at 3.5 Å resolution. *Nature* 458: 597-602. **Figura 5.3A** Furshpan, E. J. and D. D. Potter (1959) Transmission at the giant motor synapses of the crayfish. *J. Physiol.* (*Lond.*) 145: 289-324. **Figura 5.3B** Waxman, S. G and G. W. Zamponi (2014) Regulating excitability of peripheral afferents: emerging ion channel targets. *Nat. Neurosci.* 17: 153-163. **Figura 5.4A,B** Burette, A. C. and 6 others (2012) Electron tomographic analysis of synaptic ultrastructure. *J. Comp. Neurol.* 520: 2697-2711. **Figura 5.5** Fatt, P. and B. Katz (1952) Spontaneous subthreshold activity at motor nerve endings. *J. Physiol.* (*Lond.*) 117: 109-127. **Figura 5.6** Boyd, I. A. and A. R. Martin (1955) Spontaneous subthreshold activity at mammalian neuromuscular junctions. *J. Physiol.* 132: 61-73. **Figura 5.7C** Heuser, J. E. and 5 others (1979) Synaptic vesicle exocytosis captured by quick freezing and correlated with quantal transmitter release. *J. Cell Biol.* 81: 275-300. **Figura 5.8** Heuser, J. E. and T. S. Reese (1973) Evidence for recycling of synaptic vesicle

© 978-88-08-72049-8

membrane during transmitter release at the frog neuromuscular junction. *J. Cell Biol.* 57: 315-344. **Figura 5.9** Augustine, G. J. and R. Eckert (1984) Divalent cations differentially support transmitter release at the squid giant synapse. *J. Physiol.* 346: 257-271. **Figura 5.10A** Smith, S. J., J. Buchanan, L. R. Osses, M. P. Charlton and G. J. Augustine (1993) The spatial distribution of calcium signals in squid presynaptic terminals. *J. Physiol*. (*Lond*.) 472: 573-593. **Figura 5.10B** Miledi, R. (1973) Transmitter release induced by injection of calcium ions into nerve terminals. *Proc. R. Soc. Lond. B* 183: 421-424. **Figura 5.10C** Adler, E. M. Adler, G. J. Augustine, M. P. Charlton and S. N. Duffy (1991) Alien intracellular calcium chelators attenuate neurotransmitter release at the squid giant synapse. *J. Neurosci.* 11: 1496-1507. **Figura 5.11A** Takamori, S. and 21 others (2006) Molecular anatomy of a trafficking organelle. *Cell* 127: 831-846. **Figura 5.12A** Sutton, R. B., D. Fasshauer, R. Jahn and A. T. Brünger (1998) Crystal structure of a SNARE complex involved in synaptic exocytosis at 2.4 Å resolution. *Nature* 395: 347-353; Madej, T. and 6 others (2014) MMDB and VAST+: Tracking structural similarities between macromolecular complexes. *Nucleic Acids Res.* 42: D297-D303. **Figura 5.12B** Zhou, Q. and 19 others (2015) Architecture of the synaptotagmin-SNARE machinery for neuronal exocytosis. *Nature* 525: 62-67. **Scheda Applicazioni cliniche Figura B** Sutton, R. B., D. Fasshauer, R. Jahn and A. T. Brünger (1998) Crystal structure of a SNARE complex involved in synaptic exocytosis at 2.4 Å resolution. *Nature* 395: 347-353. **Figura 5.13A** Fotin, A. and 6 others (2004) Molecular model for a complete clathrin lattice from electron cryomicroscopy. *Nature* 432: 573-579. **Figura 5.13B** Reubold, T. F. and 12 others (2015) Crystal structure of the dynamin tetramer. *Nature* 525: 404-408. **Figura 5.13C** Shupliakov, O. and L. Brodin (2010) Recent insights into the building and cycling of synaptic vesicles. *Exp. Cell Res.* 316: 1344-1350. **Figure 5.16A-C e 5.17** Takeuchi, A. and N. Takeuchi (1960) On the permeability of end-plate membrane during the action of transmitter. *J. Physiol.* 154: 52-67. **Scheda 5A Figura A,B** Witcher, M. R., S. A. Kirov and K. M. Harris (2007). Plasticity of perisynaptic astroglia during synaptogenesis in the mature rat hippocampus. *Glia* 55: 13-23. **Scheda 5A Figura C** Cornell-Bell, A. H., S. M. Finkbeiner, M. S. Cooper, and S. J. Smith (1990). Glutamate induces calcium waves in cultured astrocytes: Long-range glial signaling. *Science* 247: 470-473. **Scheda 5A Figura D** Perea, G. and A. Araque (2007) Astrocytes potentiate transmitter release at single hippocampal synapses. *Science* 317: 1083-1086.

CAPITOLO 6 I NEUROTRASMETTITORI E I LORO RECETTORI

Scheda 6A Figura B Tsetlin, V. I. (2015) Three-finger snake neurotoxins and Ly6 proteins targeting nicotinic acetylcholine receptors: Pharmacological tools and endogenous modulators. *Trends Pharmacol. Sci*. 36: 109-123. **Scheda 6A Figura D** Lebbe, E. K. M., S. Peigneur, I. Wijesekara, and J. Tytgat (2014) Conotoxins targeting nicotinic acetylcholine receptors: An overview. *Marine Drugs* 12: 2970-3004. **Figura 6.3A-C** Unwin, N. (2005) Refined structure of the nicotinic acetylcholine receptor at 4 Å resolution. *J. Mol. Biol.* 346: 967-989. **Figura 6.3D,E** Miyazawa, A., Y. Fujiyoshi and N. Unwin (2003) Structure and gating mechanism of the acetylcholine receptor pore. *Nature* 423: 949-955. **Scheda Applicazioni cliniche Figura A** Harvey, A. M. and J. L. Lilienthal, Jr. and S. A. Talbot (1942) Observations on the nature of myasthenia gravis: The effect of thymectomy on neuromuscular transmission. *J. Clin. Invest.* 21: 579-588. **Scheda Applicazioni cliniche Figura B** Elmqvist, D., W. W. Hofmann, J. Kugelberg and D. M. J. Quastel (1964) An electrophysiological investigation of neuromuscular transmission in myasthenia gravis. *J. Physiol.* (*Lond*.) 174: 417-434. **Figura 6.4A,B** Haga, K. and 10 others (2012) Structure of the human M2 muscarinic acetylcholine receptor bound to an antagonist. *Nature* 482: 547-551. **Figura 6.6A** Watanabe, J., A. Rozov and L. P. Wollmuth (2005) Target-specific regulation of synaptic amplitudes in the neocortex. *J. Neurosci.* 25: 1024-1033. **Figura 6.6B** Mott, D. D., M. Benveniste and R. J. Dingledine (2008) pH-dependent inhibition of kainate receptors by zinc. *J. Neurosci.* 28: 1659-1671. **Figura 6.7A,E** Traynelis, S. F. and 9 others (2010) Glutamate receptor ion channels: Structure, regulation, and function. *Pharmacol. Rev.* 62: 405-496. **Figura 6.7B-D,F** Sobolevsky, A. I., M. P. Rosconi and E. Gouaux (2009) X-ray structure, symmetry and mechanism of an AMPA-subtype glutamate receptor. *Nature* 462: 745-756. **Figura 6.8 C-E** Karakas, E. and H. Furukawa (2014) Crystal structure of a heterotetrameric NMDA receptor ion channel. *Science* 344: 992-997. **Figura 6.8F** Zhu, S. and 6 others (2016) Mechanism of NMDA receptor inhibition and activation. *Cell* 165: 704-714. **Figura 6.9** Pin, J.-P. and B. Bettler (2016) Organization and functions of mGlu and GABAB receptor complexes. *Nature* 540: 60-68. **Figura 6.11A** Chavas, J. and A. Marty (2003) Coexistence of excitatory and inhibitory GABA synapses in the cerebellar interneuron network. *J. Neurosci.* 23: 2019-2030. **Figura 6.11B-C** Miller, P. S. and A. R. Aricescu (2014) Crystal structure of a human GABAA receptor. *Nature* 512: 270-275. **Figura 6.11D** Puthenkalam, R. and 6 others (2016) Structural studies of GABAA receptor binding sites: Which experimental structure tells us what? *Front. Mol. Neurosci.* 9: 44. **Scheda 6B Figura B** Berglund, K. and 8 others (2006) Imaging synaptic inhibition in transgenic mice expressing the chloride indicator, Clomeleon. *Brain Cell Biol.* 35: 207-228. **Scheda 6B Figura C** Obata, K., M. Oide and H. Tanaka (1978) Excitatory and inhibitory actions of GABA and glycine on embryonic chick spinal neurons in culture. *Brain Res.* 144: 179-184. **Figura 6.12** Pin, J.-P. and B. Bettler (2016) Organization and functions of mGlu and GABAB receptor complexes. *Nature* 540: 60-68. **Figura 6.13** Du, J., W. Lü, S. Wu, Y. Cheng and E. Gouaux (2015) Glycine receptor mechanism elucidated by electron cryo-microscopy. *Nature* 526: 224-229. **Figura 6.16A** Chien, E. Y. and 10 others (2010) Structure of the human dopamine D3 receptor in complex with a D2/D3 selective antagonist. *Science* 330: 1091-1095. **Figura 6.16B** Betke, K. M., C. A. Wells and H. E. Hamm (2012) GPCR mediated regulation of synaptic transmission. *Prog. Neurobiol.* 96: 304-321. **Figura 6.19A** Wacker D. and 12 others (2017) Crystal structure of an LSD-bound human serotonin receptor. *Cell* 168: 377-389. **Figura 6.19B** Hassaine, G, and 14 others (2014) X-ray structure of the mouse serotonin 5-HT3 receptor. *Nature* 512: 276-281. **Figura 6.20A-C** Kawate, T., J. C. Michel, W. T. Birdsong and E. Gouaux (2009) Crystal structure of the ATP-gated P2X(4) ion channel in the closed state. *Nature* 460: 592-598. **Figura 6.20D** Jaakola, V. P. and A. P. Ijzerman (2010) The crystallographic structure of the human adenosine A2A receptor in a high-affinity antagonist-bound state: Implications for GPCR drug screening and design. *Curr. Opin. Struct. Biol.* 20: 401-414. **Scheda 6C Figura C and Figura 6.23C** Iversen, L. (2003) Cannabis and the brain. *Brain* 126: 1252-1270. **Scheda 6C Figura D** Shao, Z. and 6 others (2016) High-resolution crystal structure of the human CB1 cannabinoid receptor. *Nature* 540: 602-606. **Figura 6.23A,B** Freund, T. F., I. Katona and D. Piomelli (2003) Role of endogenous cannabinoids in synaptic signaling. *Physiol Rev.* 83: 1017-1066. **Figura 6.24** Ohno-Shosaku, T., T. Maejima and M. Kano (2001) Endogenous cannabinoids mediate retrograde signals from depolarized postsynaptic neurons to presynaptic terminals. *Neuron* 29: 729-738.

CAPITOLO 7 LA TRASDUZIONE INTRACELLULARE DEL SEGNALE

Figura 7.9A The Protein Data Bank. H. M. Berman and 7 others (2000) *Nucleic Acids Research* 28: 235-242. doi:10.1093/nar/28.1.235; rcsb.org; https://pdb101.rcsb.org/motm/152. **Figura 7.9B** Craddock, T. J. A., J. A. Tuszynski, and S. Hameroff (2012) Cytoskeletal signaling: Is memory encoded in microtubule lattices by CaMKII phosphorylation? *PLoS Comput. Biol.* 8: e1002421. **Figura 7.9C** Leonard, T. A., B. Rózycki, L. F. Saidi, G. Hummer and J. H. Hurley (2011) Crystal structure and allosteric activation of protein kinase C âII. *Cell* 144: 55-66. **Figura 7.9D** Turk, B. E. (2007). Manipulation of host signalling pathways by anthrax toxins. *Biochem. J.* 402: 405-417. **Figura 7.10A** Bollen, M., W. Peti, M. J. Ragusa and M. Beullens (2010) The extended PP1 toolkit: Designed to create specificity. *Trends Bio-chem. Sci.* 35: 450-458. **Figura 7.10B** Cho, U. S. and W. Xu (2007) Crystal structure of a protein phosphatase 2A heterotrimeric holoenzyme. *Nature* 445: 53-57. **Figura 7.10C** Li, H., A. Rao and P.G. Hogan (2011) Interaction of calcineurin with substrates and targeting proteins. *Trends Cell Biol.* 21: 91-103. **Scheda 7A Figura A** Grynkiewicz, G., M. Poenie and R. Y. Tsien (1985) A new generation of Ca2+ indicators with greatly improved fluorescence properties. *J. Biol. Chem.* 260: 3440-3450. **Scheda 7A Figura B** Finch, E. A. and G. J. Augustine (1998) Local calcium signalling by inositol-1,4,5-trisphosphate in Purkinje cell dendrites. *Nature* 396: 753-756. **Scheda 7A Figura D** Vidal, G. S. M. Djurisic, K. Brown, R. W. Sapp and C. J. Shatz (2016) Cell-autonomous regulation of dendritic spine density by PirB. *eNeuro* 3: 1-15 ENEURO.0089-16.2016. **Scheda 7A Figura E** Livet, J. and 7 others (2007) Transgenic strategies for combinatorial expression of fluorescent proteins in the nervous system. *Nature* 450: 56-62. **Scheda 7B Figura B** Harris, K. M. and R. J. Weinberg (2012) Ultrastructure of synapses in the mammalian brain. *Cold Spring Harb. Perspect. Biol.* 4: a005587. **Scheda 7B Figura C** http://synapseweb.clm.utexas.edu/atlas; reprinted with permission from J. Spacek.

CAPITOLO 8 LA PLASTICITÀ SINAPTICA

Figura 8.1A,B Charlton, M. P. and G. D. Bittner (1978) Presynaptic potentials and facilitation of transmitter release in the squid giant synapse. *J. Gen. Physiol.* 72: 487-511. **Figura 8.1C** Swandulla, D., M. Hans, K. Zipser and G. J. Augustine (1991) Role of residual calcium in synaptic depression and posttetanic potentiation: Fast and slow calcium signaling in nerve terminals. *Neuron* 7: 915-926. **Figura 8.1D** Betz, W.J. (1970) Depression of transmitter release at the neuromuscular junction of the frog. *J. Physiol.* (*Lond.*) 206: 629-644. **Figura 8.1E** Lev-Tov, A., M. J. Pinter and R. E. Burke (1983) Posttetanic potentiation of group Ia EPSPs: Possible mechanisms for differential distribution among medial gastrocnemius motoneurons. *J. Neurophysiol.* 50: 379-398. **Figura 8.2A** Katz, B. (1966) *Nerve, Muscle, and Synapse.* New York: McGraw-Hill. **Figura 8.2B** Malenka, R. C. and S. A. Siegelbaum (2001) Synaptic plasticity: Diverse targets and mechanisms for regulating synaptic efficacy. In *Synapses*. W. M. Cowan, T. C. Sudhof and C. F. Stevens (eds.). Baltimore: John Hopkins University Press, pp. 393-413. **Figure 8.3, 8.4 e 8.5** Squire, L. R. and E. R. Kandel (1999) *Memory: From Mind to Molecules*. New York: Scientific American Library. **Scheda 8A** Tully, T. (1996) Discovery of genes involved with learning and memory: An experimental synthesis of Hirshian and Benzerian perspectives. *Proc. Natl. Acad. Sci. USA* 93: 13460-13467. Copyright (1996) National Academy of Sciences, U.S.A. **Figura 8.7A-C** Malinow, R., H. Schulman, and R. W. Tsien (1989) Inhibition of postsynaptic PKC or CaMKII blocks induction but not expression of LTP. *Science* 245: 862-866. **Figura 8.7D** Abraham, W. C., B. Logan, J. M. Greenwood and M. Dragunow (2002) Induction and experience-dependent consolidation of stable long-term potentiation lasting months in the hippocampus. *J. Neurosci.* 22: 9626-9634. **Figura 8.8** Gustafsson, B., H. Wigstrom, W. C. Abraham, and Y. Y. Huang (1987) Long-term potentiation in the hippocampus using depolarizing current pulses as the conditioning stimulus to single volley synaptic potentials. *J. Neurosci.* 7: 774-780. **Figura 8.10** Nicoll, R. A., J. A. Kauer and R. C. Malenka (1988) The current excitement in long-term potentiation. *Neuron* 1: 97-103. **Figura 8.11A,B** Matsuzaki, M., N. Honkura, G.C. Ellis-Davies and H. Kasai (2004) Structural basis of long-term potentiation in single dendritic spines. *Nature* 429: 761-766. **Figura 8.11C e Scheda 8B Figura A** Liao, D., N. A. Hessler and R. Malinow (1995) Activation of postsynaptically silent synapses during pairing-induced LTP in CA1 region of hippocampal slice. *Nature* 375: 400-404. **Scheda 8B Figura C** Petralia, R. S. and 6 others (1999) Selective acquisition of AMPA receptors over post-natal development suggests a molecular basis for silent synapses. *Nat. Neurosci.* 2: 31-36. **Figura 8.12** Lee, S. J., Y. Escobedo-Lozoya, E. M. Szatmari and R. Yasuda (2009) Activation of CaMKII in single dendritic spines during long-term potentiation. *Nature* 458: 299-304. **Figura 8.14** Frey, U. and R. G. Morris (1997) Synaptic tagging and long-term potentiation. *Nature* 385: 533-536. **Figura 8.15A** Squire, L. R. and E. R. Kandel (1999) *Memory: From Mind to Molecules.* New York: Scientific American Library. **Figura 8.15B** Engert, F. and T. Bonhoeffer (1999) Dendritic spine changes associated with hippocampal long-term synaptic plasticity. *Nature* 399: 66-70. **Figura 8.16B** Mulkey, R. M., C. E. Herron and R. C. Malenka (1993) An essential role for protein phosphatases in hippocampal long-term depression. *Science* 261: 1051-1055. **Figura 8.17B** Sakurai, M. (1987) Synaptic modification of parallel fibre-Purkinje cell transmission in in vitro guinea-pig cerebellar slices. *J. Physiol.* (*Lond.*) 394: 463-480. **Figura 8.18** Bi, G. Q. and M. M. Poo (1998) Synaptic modifications in cultured hippocampal neurons: dependence on spike timing, synaptic strength, and postsynaptic cell type. *J. Neurosci.* 18: 10464-10472. **Scheda Applicazioni cliniche** Dyro, F. M. (1989) *The EEG Handbook*. Boston: Little, Brown.

CAPITOLO 9 IL SISTEMA DELLA SENSIBILITÀ SOMATICA: IL TATTO E LA PROPRIOCEZIONE

Immagine d'apertura, Unità 2 Scanning electron micrograph of outer hair cells (stereocilia) in the inner ear. © Steve Gschmeissner/Science Photo Library. **Scheda Applicazioni cliniche Figure A,C e Tabella 9.1** Rosenzweig, M. R., S. M. Breedlove and A. L. Leiman (2005) *Biological Psychology,* 4th Edition. Sunderland, MA: Sinauer Associates. **Scheda Applicazioni cliniche Figura B** Haymaker, W. and B. Woodhall (1967) *Peripheral Nerve Injuries: Principles of Diagnosis*. Philadelphia: W.B. Saunders. **Figura 9.3C** Weinstein, S. (1968) Intensive and extensive aspects of tactile sensitivity as a function of body part, sex, and laterality. In D.R. Kenshalo (Ed.), *The Skin Senses*. Springfield, IL: Charles C. Thomas, pp. 195-222. **Figura 9.5A** Johansson, R. S. and A. B. Vallbo (1983) Tactile sensory coding in the glabrous skin of the human. *Trends Neurosci.* 6: 27-32. **Figura 9.5B** Abraira, V. E. and D. D. Ginty (2013) The sensory neurons of touch. *Neuron* 79: 618-639. **Tabella 9.2** Johnson, K. O. (2002) Neural basis of hap-

© 978-88-08-72049-8

tic perception. In *Seven's Handbook of Experimental Psychology*, 3rd Edition. Vol 1: Sensation and Perception. H. Pashler and S. Yantis (eds.). New York: Wiley, pp. 537-583. **Figura 9.6** Phillips, J. R., R. S. Johansson and K. O. Johnson (1990) Representation of Braille characters in human nerve fibres. *Exp. Brain Res.* 81: 589-592. **Figura 9.7A** Matthews, P. B. C. (1964) Muscle spindles and their motor control. *Physiol. Rev.* 44: 219-289. **Figura 9.10** Brodal, P. (1992) *The Central Nervous System: Structure and Function*. New York: Oxford University Press, p. 151; Jones, E. G. and D. P. Friedman (1982) Projection pattern of functional components of thalamic ventrobasal complex on monkey somatosensory cortex. *J. Neurophys.* 48: 521-544. **Figura 9.11** Penfield, W. and T. Rasmussen (1950) *The Cerebral Cortex of Man: A Clinical Study of Localization of Function*. New York: Macmillan; Corsi, P. (1991) *The Enchanted Loom: Chapters in the History of Neuroscience*, P. Corsi (ed.). New York: Oxford University Press. **Scheda 9A** Purves, D., D. Riddle and A. LaMantia (1992) Iterated patterns of brain circuitry (or how the cortex gets its spots). *Trends Neurosci.* 15: 362-369. **Figura 9.13A** Kaas, J. H. (1993) The functional organization of somatosensory cortex in primates. *Ann. Anat.* 175: 509-518. **Figura 9.13C** Sur, M. (1980) Receptive fields of neurons in areas 3b and 1 of somatosensory cortex in monkeys. *Brain Res.*198: 465-471. **Figura 9.14** Merzenich, M. M., R. J. Nelson, M. P. Stryker, M. S. Cynader, A. Schoppmann and J. M. Zook (1984) Somatosensory cortical map changes following digit amputation in adult monkeys. *J. Comp. Neurol.* 224: 591-605. **Figura 9.15** Jenkins, W. M., M. M. Merzenich, M. T. Ochs, T. Allard and E. Guic-Robles (1990) Functional reorganization of primary somatosensory cortex in adult owl monkeys after behaviorally controlled tactile stimulation. *J. Neurophysiol.* 63: 82-104.

CAPITOLO 10 IL DOLORE

Figura 10.1 Fields, H. L. (1987) *Pain*. New York: McGraw-Hill. **Figura 10.2** Fields, H. L. (ed.) (1990) *Pain Syndromes in Neurology.* London: Butterworths. **Scheda 10C Figura B** Willis, W. D., E. D. Al-Chaer, M. J. Quast and K. N. Westlund (1999) A visceral pain pathway in the dorsal column of the spinal cord. *Proc. Natl. Acad. Sci. USA* 96: 7675-7679. **Scheda 10C Figura C** Hirshberg, R. M., E. D. Al-Chaer, N. B. Lawand, K. N. Westlund and W. D. Willis (1996) Is there a pathway in the posterior funiculus that signals visceral pain? *Pain* 67: 291-305; drawing after Nauta, H. J. W., E. Hewitt, K. N. Westlund and W. D. Willis, Jr. (1997) Surgical interruption of a midline dorsal column visceral pain pathway: Case report and review of the literature. *J. Neurosurg.* 86(3): 538-542. **Scheda Applicazioni cliniche** Solonen, K. A. (1962) The phantom phenomenon in amputated Finnish war veterans. *Acta Orthop. Scand. Suppl.* 54: 1-37.

CAPITOLO 11 LA FUNZIONE VISIVA: L'OCCHIO

Scheda 11A Figura D Westheimer, G. (1974) In *Medical Physiology,* 13th Edition V. B. Mountcastle (ed.) St. Louis: Mosby. **Figura 11.4A-C** Hilfer, S. R. and J. J. W. Yang (1980) Accumulation of CPC-precipitable material at apical cell surfaces during formation of the optic cup. *Anat. Rec.* 197: 423-433. **Figura 11.6A** Oyster, C. W. (1999) *The Human Eye*. Sunderland, MA: Sinauer Associates. **Figura 11.6B,C** Young, R. W. (1971) Shedding of discs from rod outer segments in the rhesus monkey. *J. Ultrastruc. Res.* 34: 190-203. **Scheda 11B** Hamel, C. (2006) Retinitis pigmentosa. *Orphanet Journal of Rare Diseases* 2006 1:40. CC-BY 2.0 https://creativecommons.org/licenses/by/2.0/. **Figura 11.7** Baylor, D. A. (1987) Photoreceptor signals and vision. *Invest. Ophthalmol. Vis. Sci.* 28: 34-49. **Figura 11.9A** Oyster, C. W. (1999) *The Human Eye*. Sunderland, MA: Sinauer Associates; Stryer, L. (1986) Cyclic GMP cascade of vision. *Annu. Rev. Neurosci.* 9: 87-119. **Figura 11.9B** Oyster, C. W. (1999) *The Human Eye*. Sunderland, MA: Sinauer Associates; Stryer, L. (1987) The molecules of visual excitation. *Sci. Am.* 257: 42-50. **Figura 11.12** Baylor, D. A. (1987) Photoreceptor signals and vision. Invest. *Ophthalmol. Vis. Sci.* 28: 34-49. **Figura 11.13A** Curcio, C.A., K. R. Sloan, R. E. Kalina, A. E. Hendrickson (1990) Human photoreceptor topography. *J. Comp. Neurol.* 292: 497-523; Purves, D. and R. B. Lotto (2011) *Why We See What We Do Redux: An Empirical Theory of Vision*, Appendix. Sunderland, MA: Sinauer Associates. **Figura 11.14A** Schnapf, J. L., T. W. Kraft, and D. A. Baylor (1987) Spectral sensitivity of human cone photoreceptors. *Nature* 325: 439-441. **Figura 11.14B** Hofer, H., J. Carroll, J. Neitz, M. Neitz and D. R. Williams (2005) Organization of the human trichromatic cone mosaic. *J. Neurosci.* 25: 9669-9679. **Scheda 11C** Purves, D. and R. B. Lotto (2011) *Why We See What We Do Redux: An Empirical Theory of Vision*, Chapter 3. Sunderland, MA: Sinauer Associates. **Figura 11.16A** Nathans, J. (1987) Molecular biology of visual pigments. *Annu. Rev. Neurosci.* 10: 163-194. **Figura 11.16B,C** Deeb, S. S. (2005) The molecular basis of variation in human color vision. *Clin. Genet.* 67: 369-377. **Figura 11.19** Sakmann, B. and O. D. Creutzfeldt (1969) Scotopic and mesopic light adaptation in the cat's retina. *Pflügers Arch.* 313: 168-185. **Figura 11.20B** Hubel, D. and T.N. Wiesel (1961) Integrative action in the cat's lateral geniculate body, *J. Physiol.* 155: 385-398.

CAPITOLO 12 LE VIE VISIVE CENTRALI

Figura 12.8A Hubel, 1988. *Eye, Brain, and Vision*. New York: Scientific American Library. **Figura 12.10B** Ohki, K., S. Ghung, P. Kara, M. Hubener, T. Bonhoeffer and R. C. Reid (2006) Highly ordered arrangement of single neurons in orientation pinwheels. *Nature* 442: 925-928. **Figura 12.11D** Horton and E. T. Hedley-Whyte (1984) Mapping of cytochrome oxidase patches and ocular dominance columns in human visual cortex. *Philos. Trans.* 304: 255-272. **Scheda 12A Figura A** Wandell, B. A. (1995) *Foundations of Vision*. Sunderland, MA: Sinauer Associates. **Scheda 12A Figura B** Julesz, B. (1964) Binocular depth perception without familiarity cues. *Science* 45: 356-362. **Figura 12.13A** Watanabe, M. and R. W. Rodieck (1989) Parasol and midget ganglion cells of the primate retina. *J. Comp. Neurol.* 289: 434-454. **Figura 12.13B** Andrews, T. J., S. D. Halpern and D. Purves (1997) Correlated size variations in human visual cortex, lateral geniculate nucleus, and optic tract. *J. Neurosci.* 17: 2859-2868. **Figura 12.14A** Maunsell, J. H. R. and W.T. Newsome (1987) Visual processing in monkey extrastriate cortex. *Annu. Rev. Neurosci.* 10: 363-401. **Figura 12.14B** Felleman, D. J. and D. C. Van Essen (1991) Distributed hierarchical processing in primate cerebral cortex. *Cereb. Cortex* 1: 1-47. **Figura 12.15** Sereno, M. I. and 7 others (1995) Borders of multiple visual areas in humans revealed by functional magnetic resonance imaging. *Science* 268: 889-893.

CAPITOLO 13 IL SISTEMA UDITIVO

Figura 13.5 (inset) Kessel, R. G. and R. H. Kardon (1979) *Tissue and Organs: A Text-Atlas of Scanning Electron Microscopy.*

San Francisco: W.H. Freeman. **Figura 13.6** Dallos, P. (1992) The active cochlea. *J. Neurosci.* 12: 4575-4585; von Bèkèsy, G. (1960) *Experiments in Hearing.* New York: McGraw-Hill. **Figura 13.6** von Bekesy, G. (1960) *Experiments in Hearing.* New York: McGraw-Hill. (A collection of von Bekesy's original papers.) **Figura 13.8A** Hudspeth, A. J. (2014) Integrating the active process of hair cells with cochlear function. *Nat. Rev. Neurosci.* 15: 600-614. **Figura 13.8B** Hudspeth, A. J. (1983) The hair cells of the inner ear. *Sci. Amer.* 248: 54-64. **Figura 13.8D** Kachar, B., M. Parakkal, M. Kurc, Y. Zhao and P. G. Gillespie (2000) Highresolution structure of hair-cell tip links. *Proc. Natl. Acad. Sci. USA* 97: 13336-13341. Copyright (2000) National Academy of Sciences, U.S.A. **Figura 13.9** Lewis, R. S. and A. J. Hudspeth (1983) Voltage and iondependent conductances in solitary vertebrate hair cells. *Nature* 304: 538-541. **Figura 13.10A** Shotwell, S. L., R. Jacobs, and A. J. Hudspeth (1981) Directional sensitivity of individual vertebrate hair cells to controlled deflection of their hair bundles. *Ann. NY Acad. Sci.* 374: 1-10. **Figura 13.10B** Hudspeth, A. J. and D. P. Corey (1977) Sensitivity, polarity and conductance change in the response of vertebrate hair cells to controlled mechanical stimuli. *Proc. Natl. Acad. Sci. USA* 74: 2407-2411. **Figura 13.10C** Palmer, A. R. and I. J. Russell (1986) Phase-locking in the cochlear nerve of the guinea-pig and its relation to the receptor potential of inner hair cells. *Hear. Res.* 24: 1-14. **Figura 13.12A** Kiang, N. Y. and E. C. Moxon (1972) Physiological considerations in artificial stimulation of the inner ear. *Ann. Otol. Rhinol. Laryngol.* 81: 714-729. **Figura 13.12C** Kiang, N. Y. S. (1984) Peripheral neural processing of auditory information. In *Handbook of Physiology: A Critical, Comprehensive Presentation of Physiological Knowledge and Concepts,* Section 1: The Nervous System, Vol. III. Sensory Processes, Part 2, J. M. Brookhart, V. B. Mountcastle, I. Darian-Smith and S. R. Geiger (eds.). Bethesda, MD: American Physiological Society, pp. 639-674. **Figura 13.14** Jeffress, L. A. (1948) A place theory of sound localization. *J. Comp. Physiol. Psychol.* 41: 35-38.

CAPITOLO 14 IL SISTEMA VESTIBOLARE

Figura 14.3 Dickman, J. D., Huss, D., & Lowe, M. (2004). Morphometry of otoconia in the utricle and saccule of developing Japanese quail. *Hear. Res.* 188: 89-103. **Figura 14.6 e 14.9** Fernández, C. and J. M. Goldberg, J. M. and (1976) Physiology of peripheral neurons innervating otolith organs of the squirrel monkey, Parts 1, 2, 3. *J. Neurophys.* 39: 970-1008. **Scheda 14A Figura A** Eaton, R. C., R. A. Bombardieri and D. L. Meyer (1977) The Mauthner-initiated startle response in teleost fish. *J. Exp. Biol.* 66: 65-81. **Scheda 14A Figura C** Furshpan, E. J. and T. Furukawa (1962) Intracellular and extracellular responses of the several regions of the Mauthner cell of the goldfish. *J. Neurophysiol.* 25: 732-771.

CAPITOLO 15 I SENSI CHIMICI

Figure 15.1E e 15.4D Rolls, E. T., M. L. Kringelbach, and I. E. T. de Araujo, (2003) Different representations of pleasant and unpleasant odours in the human brain. *Eur. J. Neurosci.* 18: 695-703. **Figura 15.2A** Shier, D., J. Butler, and R. Lewis (2004) *Hole's Human Anatomy and Physiology.* Boston: McGraw-Hill. **Figura 15.3** Porter, J. and 8 others (2007) Mechanisms of scent-tracking in humans. *Nat. Neurosci.* 10: 27-29. **Figura 15.4A** Cain, W. S., R. Schmidt and P. Wolkoff (2007) Olfactory detection of ozone and d-limonene: Reactants in indoor spaces. *Indoor Air* 17: 337-347. **Figura 15.5A** Cain, W. S. and J. F. Gent (1986) Use of odor identification in clinical testing of olfaction. In *Clinical Measurement of Taste and Smell,* H. L. Meiselman and R. S. Rivlin (eds.). New York: Macmillan, pp. 170-186. **Figura 15.5B** Murphy, C. (1986) Taste and smell in the elderly. In *Clinical Measurement of Taste and Smell*, H. L. Meiselman and R. S. Rivlin (eds.). New York: Macmillan, pp. 343-371. **Figura 15.5C** Wang, J., P. Eslinger, M. B. Smith, and Q. X. Yang (2005) Functional magnetic resonance imaging study of human olfaction and normal aging. *J. Gerontol. Med. Sci.* 60A: 510-514. **Scheda Applicazioni cliniche** Lim, J. H. and 6 others (2009) Zicam-induced damage to mouse and human nasal tissue. *PLoS ONE* 4: e7647. **Figura 15.6A** Anholt, R. R. H. (1987) Primary events in olfactory reception. *Trends Biochem. Sci.* 12: 58-62. **Figura 15.6B** Rawson, N. E. and A.-S. LaMantia (2006) Once and again: Retinoic acid signaling in the developing and regenerating olfactory pathway. *J. Neurobiol.* 66: 653-676. **Figura 15.6C** Leung C. T., P. A. Coulombe and R. R. Reed (2007) Contribution of olfactory neural stem cells to tissue maintenance and regeneration. *Nat. Neurosci.* 10: 720-726. **Figura 15.7** Firestein, S., F. Zufall and G. M. Shepherd (1991) Single odor-sensitive channels in olfactory receptor neurons are also gated by cyclic nucleotides. *J. Neurosci.* 11: 3565-3572. **Figure 15.8A e 15.10A** Menini, A. (1999) Calcium signalling and regulation in olfactory neurons. *Curr. Opin. Neurobiol.* 9: 419-425. **Figura 15.8B** Dryer, L. (2000) Evolution of odorant receptors. *BioEssays* 22: 803-809. **Figura 15.9B-D** Bozza, T., P. Feinstein, C. Zheng and P. Mombaerts (2002) Odorant receptor expression defines functional units in the mouse olfactory system. *J. Neurosci.* 22: 3033-3043. **Figura 15.10B** Wong, S. T. and 8 others (2000) Disruption of the type III adenylyl cyclase gene leads to peripheral and behavioral anosmia in transgenic mice. *Neuron* 27: 487-497; Belluscio, L., G. H. Gold, A. Nemes, and R. Axel (1998) Mice deficient in Golf are anosmic. *Neuron* 20: 69-81; Brunet, L., G. H. Gold and J. Ngai (1996) General anosmia caused by a targeted disruption of the mouse olfactory cyclic nucleotide-gated cation channel. *Neuron* 17: 681-693. **Figura 15.11** Firestein S., G. M. Shepherd. Neurotransmitter antagonists block some odor responses in olfactory receptor neurons. *Neuroreport.* 3: 661-664. **Figura 15.12 graphs** Bozza, T., P. Firestein, C. Zheng and P. Mombaerts (2002) Odorant receptor expression defines functional units in the mouse olfactory system. *J. Neurosci.* 22: 3033-3043. **Figura 15.12 A micrograph** Bozza, T. and J. Kauer. Odorant response properties of convergent olfactory receptor neurons. *J. Neurosci.* 18.12 (1998): 4560-4569. **Figura 15.13A inset** Wang, J. W., A. M. Wong, J. Flores, L. B. Vosshall and R. Axel (2003) Two-photon calcium imaging reveals an odor-evoked map of activity in the fly brain. *Cell* 112: 271-282. **Figura 15.13C** Pomeroy, S. L., A.-S. LaMantia and D. Purves (1990) Postnatal construction of neural activity in the mouse olfactory bulb. *J. Neurosci.* 10: 1952-1966. **Figura 15.13E inset** Tadenev, A. L., Kulaga, H. M., May-Simera, H. L., Kelley, M. W., Katsanis, N., and Reed. R, R. 2011. Loss of Bardet-Biedl syndrome protein-8 (BBS8) perturbs olfactory function, protein localization, and axon targeting. *Proc. Natl. Acad. Sci. USA* 108: 10320-10325. **Figura 15.13E** Mombaerts, P. and 7 others (1996) Visualizing an olfactory sensory map. *Cell* 87: 675-686. **Figura 15.14A** Wang, J. W., A. M. Wong, J. Flores, L. B. Vosshall and R. Axel (2003) Two-photon calcium imaging reveals an odor-evoked map of activity in the fly brain. *Cell* 112: 271-282. **Figura 15.14B** Fleischmann, A. and 10 others (2008) Mice with a "monoclonal nose": Perturbations in an olfactory map impair odor discrimination. *Neuron* 60: 1068-1081. **Figura 15.15A** Sosulski, D. L., M. L. Bloom, T. Cutforth, R. Axel and S. R. Datta (2011) Distinct representations of olfactory information in different cortical centers. *Nature* 472: 213-216. **Figura**

© 978-88-08-72049-8

15.15B Zhan, C. and M. Luo (2010) Diverse patterns of odor representation by neurons in the anterior piriform cortex of awake mice. *J. Neurosci.* 30: 16662-16672. **Figura 15.16** Stettler, D. D. and R. Axel (2009) Representations of odor in the piriform cortex. *Neuron* 63: 854-864. **Figura 15.17B** Pantages, E. and C. Dulac (2000) A novel family of candidate pheromone receptors in mammals. *Neuron* 28: 835-845. **Figura 15.18** Savic, I., H. Berglund, B. Gulyas and P. Roland (2001) Smelling of odorous sex hormonelike compounds causes sex-differentiated hypothalamic activations in humans. *Neuron* 31: 661-668. **Figura 15.19A** Dulac, C. and A. T. Torello (2003) Molecular detection of pheromone signals in mammals: from genes to behaviour. *Nat. Rev. Neurosci.* 4: 551-562. **Figura 15.19B** Isogai, Y. and 5 others (2011) Molecular organization of vomeronasal chemoreception *Nature* 478: 241-245. **Figure 15.20C e 15.22B** Schoenfeld, M. A. and 6 others (2004) Functional magnetic resonance tomography correlates of taste perception in human primary taste cortex. *Neuroscience* 127: 347-353. **Figura 15.25A,B** Nelson, G. and 5 others (2001) Mammalian sweet taste receptors. *Cell* 106: 381-390. **Figura 15.25C** Adler, E. and 5 others (2000) A novel family of mammalian taste receptors. *Cell* 100: 693-702.

CAPITOLO 16 I CIRCUITI DEI MOTONEURONI INFERIORI E IL CONTROLLO MOTORIO

Immagine d'apertura, Unità 3 Corticospinal tract, DTI MRI scan. © Sherbrooke Connectivity Imaging Lab/Science Photo Library. **Figura 16.2** Burke, R. E., P. L. Strick, K. Kanda, C. C. Kim and B. Walmsley (1977) Anatomy of medial gastrocnemius and soleus motor nuclei in cat spinal cord. *J. Neurophys.* 40: 667-680. **Figura 16.6** Burke, R. E., D. N. Levine, P. Tsairis, and F. E., III, Zajac (1973) Physiological types and histochemical profiles in motor units of the cat gastrocnemius. *J. Physiol.* 234: 723-748. **Scheda 16A Figura B** Gordon, T., N. Tyreman, V. F. Rafuse and J. B. Munson (1997) Fast-to-slow conversion following chronic low-frequency activation of medial gastrocnemius muscle in cats. I. Muscle and motor unit properties. *J. Neurophysiol.* 77: 2585-2604. **Scheda 16A Figura C** Munson, J. B., R. C. Foehring, L. M. Mendell and T. Gordon (1997) Fast-to-slow conversion following chronic low-frequency activation of medial gastrocnemius muscle in cats. II. Motoneuron properties. *J. Neurophysiol.* 77: 2605-2615. **Scheda 16A Figura E** Van Cutsem, M., J. Duchateau and K. Hainaut (1998) Changes in single motor unit behaviour contribute to the increase in contraction speed after dynamic training in humans. *J. Physiol.* 513: 295-305. **Figura 16.7** Walmsley, B., J. A. Hodgson and R. E. Burke (1978) Forces produced by medical gastrocnemius and soleus muscles during locomotion in freely moving cats. *J. Neurophys.* 41: 1203-1216. **Figura 16.9** Monster, A. W. and H. Chan (1977) Isometric force production by motor units of extensor digitorum communis muscle in man. *J. Neurophys.* 40: 1432-1443. **Figura 16.11** Hunt, C. C. and S. W. Kuffler (1951) Stretch receptor discharges during muscle contraction. *J. Physiol.* (Lond.) 113: 298-314. **Figura 16.13** Patton, H. D. (1965) Reflex regulation of movement and posture. In *Physiology and Biophysics,* 19th Edition, T. C. Ruch and H. D. Patton (eds.). Philadelphia: Saunders, pp. 181-206. **Figura 16.15A-C** Pearson, K. (1976) The control of walking. *Sci. Amer.* 235: 72-86. **Figura 16.15D** Kiehn, O. (2016) Decoding the organization of spinal circuits that control locomotion. *Nat. Rev. Neurosci.* 17: 224-238. **Figura 16.16** Drew, T. and D. S. Marigold (2015) Taking the next step: cortical contributions to the control of locomotion. *Curr. Opin. Neurobiol.* 33: 25-33; Kiehn, O. (2016) Decoding the organization of spinal circuits that control locomotion. *Nat. Rev. Neurosci.* 17: 224-238. **Scheda Applicazioni cliniche Figura B** Geevasinga N., P. Menon, P. H. Özdinler, M. C. Kiernan and S. Vucic (2016) Pathophysiological and diagnostic implications of cortical dysfunction in ALS. *Nat. Rev. Neurol.*12: 651-661.

CAPITOLO 17 IL CONTROLLO CORTICALE DEL TRONCO DELL'ENCEFALO E DEL MIDOLLO SPINALE

Scheda 17A e Figura 17.7 Graziano, M. S. A., T. N. S. Aflalo and D. F. Cooke (2005) Arm movements evoked by electrical stimulation in the motor cortex of monkeys. *J. Neurophysiol.* 94: 4209-4223. **Figura 17.6** Porter, R. and R. Lemon (1993) *Corticospinal Function and Voluntary Movement.* Oxford: Oxford University Press. **Figura 17.8 A-C** Georgopoulos, A. P., J. F. Kalaska, R. Caminiti and J. T. Massey (1982) On the relations between the direction of two-dimensional arm movements and cell discharge in primate motor cortex. *J. Neurosci.* 2: 1527-1537. **Figura 17.8D** Georgopoulos, A. P., R. Caminit, J. F. Kalaska and J. T. Massey (1983) Spatial coding of movement: A hypothesis concerning the coding of movement direction by motor cortical populations. In *Neural Coding of Motor Performance,* J. Massion, J. Paillard, W. Schultz and M. Wiesendanger M (eds.). *Exp. Brain. Res.* (*Suppl.*) 7: 327-336. **Figura 17.9** Geyer, S., M. Matelli and G. Luppino (2000) Functional neuroanatomy of the primate isocortical motor system. *Anat. Embryol.* 202: 443-474. **Scheda 17B Figura A** Dr. Eric C. Leuthardt, Professor of Neurological Surgery, Washington University School of Medicine, Director of The Center for Innovation in Neuroscience and Technology. **Scheda 17B Figura B** Donati, A. and 19 others (2016) Long-term training with a brain-machine interfacebased gait protocol induces partial neurological recovery in paraplegic patients. *Sci. Rep.* 6: 30383. doi: 10.1038/srep30383 **Figura 17.10** Rizzolatti, G., L. Fadiga, V. Gallese and L. Fogassi (1996) Premotor cortex and the recognition of motor actions. *Cogn. Brain Res.* 3: 131-141. **Figura 17.11A** Rizzolatti, G. and C. Sinigaglia (2016) The mirror mechanism: a basic principle of brain function. *Nature Rev. Neurosci.* 17: 757-765. **Figura 17.14** Nashner, L. M. (1979). Organization and programming of motor activity during posture control. In *Progress in Brain Research, Volume 50, Reflex Control of Posture and Movement*, R. Granit and O. Pompeiano (eds.). Amsterdam: Elsevier/North Holland Biomedical Press, pp. 177-184.

CAPITOLO 18 LA MODULAZIONE DEL MOVIMENTO DA PARTE DEI GANGLI DELLA BASE

Figura 18.6A1 Hikosaka, O. and R. H. Wurtz (1986) Cell activity in monkey caudate nucleus preceding saccadic eye movements. *Exp. Brain Res.* 63: 659-662. **Figura 18.6A2-3,B** Hikosaka, O. and R. H. Wurtz (1983) Visual and oculomotor functions of monkey substantia nigra pars reticulata. IV. Relation of substantia nigra to superior colliculus. *J. Neurophysiol.* 49: 1285-1301. **Figure 18.9B e 18.10B** DeLong, M. R. (1990) Primate models of movement disorders of basal ganglia origin. *Trends Neurosci.* 13: 281-285. **Scheda 18A Figure A-C** Desrochers, T. M., K. Amemori and A. M. Graybiel (2015) Habit learning by naive macaques is marked by response sharpening of striatal neurons representing the cost

and outcome of acquired action sequences. *Neuron* 87: 853-868. **Scheda Applicazioni cliniche Figura B** Hashimoto, T., C. M. Elder, M. S. Okun, S. K. Patrick and J. L. Vitek (2003) Stimulation of the subthalamic nucleus changes the firing pattern of pallidal neurons. *J. Neurosci.* 23: 1916-1923. **Scheda Applicazioni cliniche Figura C** McIntyre, C. C. and R. W. Anderson (2016) Deep brain stimulation mechanisms: the control of network activity via neurochemistry modulation. *J. Neurochem.* 139 (Suppl. 1): 338-345.

CAPITOLO 19 LA MODULAZIONE DEL MOVIMENTO DA PARTE DEL CERVELLETTO

Figura 19.10A Stein, J. F. (1986) Role of the cerebellum in the visual guidance of movement. *Nature* 323: 217-220. **Figura 19.11** Cerminara, N. L., E. J. Lang, R. V. Sillitoe and R. Apps (2015) Redefining the cerebellar cortex as an assembly of non-uniform Purkinje cell microcircuits. *Nat. Rev. Neurosci.* 16: 79-93. **Figura 19.12** Thach, W. T. (1968) Discharge of Purkinje and cerebellar nuclear neurons during rapidly alternating arm movements in the monkey. *J. Neurophys.* 31: 785-797. **Figura 19.13** Optican, L. M. and D. A. Robinson (1980) Cerebellardependent adaptive control of primate saccadic system. *J. Neurophys.* 44: 1058-1076. **Scheda 19A** Caviness, V. S., Jr. and P. Rakic (1978) Mechanisms of cortical development: A view from mutations in mice. *Annu. Rev. Neurosci.* 1: 297-326.

CAPITOLO 20 I MOVIMENTI OCULARI E L'INTEGRAZIONE SENSORIMOTORIA

Figura 20.1 Yarbus, A. L. (1967) *Eye Movements and Vision*. Basil Haigh, trans. New York: Plenum Press. **Scheda 20A Figura A** Pritchard, R. M. (1961) Stabilized images on the retina. *Sci. Amer.* 204 (June): 72-78. **Scheda 20A Figura B** Riggs, L. A., F. Ratliff, J. C. Cornsweet and T. N. Cornsweet (1953) The disappearance of steadily fixated visual test objects. *J. Opt. Soc. Am.* 43: 495-501. **Figure 20.4 e 20.5** Fuchs, A. F. (1967) Saccadic and smooth pursuit eye movements in the monkey. *J. Physiol.* (*Lond.*) 191: 609-630. **Figura 20.6** Baarsma, E. and H. Collewijn (1974) Vestibulo-ocular and optokinetic reactions to rotation and their interaction in the rabbit. *J. Physiol.* 238: 603-625. **Scheda Applicazioni cliniche Figura C** Benson, P. J. and 5 others (2012) Simple viewing tests can detect eye movement abnormalities that distinguish schizophrenia cases from controls with exceptional accuracy. *Biol. Psychiat.* 72: 716-724. doi: 10.1016/j.biopsych.2012.04.019 **Figura 20.7** Fuchs, A. F. and E. S. Luschei (1970) Firing patterns of abducens neurons of alert monkeys in relationship to horizontal eye movements. *J. Neurophys.* 33: 382-392. **Figura 20.9** Schiller, P. H. and M. Stryker (1972) Single unit recording and stimulation in superior colliculus of the alert rhesus monkey. *J. Neurophys.* 35: 915-923. **Scheda 20B Figura B** Wurtz, R. H. and J. E. Albano (1980) Visual-motor function of the primate superior colliculus. *Annu. Rev. Neurosci.* 3: 189-226. **Scheda 20B Figura C** Ozen, G., G. J. Augustine and W. C. Hall (2000) Contribution of superficial layer neurons to premotor bursts in the superior col-liculus. *J. Neurophysiol.* 84: 460-471. **Figura 20.10** Sparks, D. L. and L. E. Mays (1983) Spatial localization of saccade targets. I. Compensation for stimulation-induced perturbations in eye position. *J. Neurophysiol.* 49: 45-63. **Scheda 20C Figura A** Sparks, D. L. (1975) Response properties of eye movement-related neurons in the monkey superior colliculus. *Brain Res.* 90: 147-152. **Scheda 20C Figura B** Fuchs, A. F. and E. S. Luschei (1970) Firing patterns of abducens neurons of alert monkeys in relationship to horizontal eye movement. *J. Neurophysiol.* 33: 382-392. **Figura 20.12** Schall, J. D. (1995) Neural basis of saccade target selection. *Rev. Neurosci.* 6: 63-85. **Figura 20.13** Krauzlis, R. J. (2005) The control of voluntary eye movements: New perspectives. *Neuroscientist* 11: 124-137.

CAPITOLO 21 IL SISTEMA MOTORIO VISCERALE

Scheda 21B Figura A Marx, J. (2003) Cellular warriors at the battle of the bulge. *Science* 299: 846-849; Morton, G. J., T. H. Meek and M. W. Schwartz (2014) Neurobiology of food intake in health and disease. *Nature Rev. Neurosci.* 15: 367-378. **Scheda 21B Figura B** Yaswen, L., N. Diehl, M. B. Brennan and U. Hochgeschwender (1999) Obesity in the mouse model of pro-opiomelanocortin deficiency responds to peripheral melanocortin. *Nat. Med.* 5: 1066-1070. **Scheda 21B Figura C** O'Rahilly, S., S. Farooqi, G. S. H. Yeo and B. G. Challis (2003) Human obesity: Lessons from monogenic disorders. *Endocrinology* 144: 3757-3764.

CAPITOLO 22 LE FASI INIZIALI DELLO SVILUPPO DEL SISTEMA NERVOSO

Immagine d'apertura, Unità 4 A trigeminal ganglion from an E10.5 mouse embryo grown in cell culture for 24 hours. The green is neuron-selective label (b-tubulin III), the red is a transcription factor marker (Six1) and the blue is a nuclear DNA label (DAPI). Courtesy of Anthony-Samuel LaMantia. **Scheda 22A Figura B** Wichterle, H., I. Lieberam, J. A. Porter and T. M. Jessell (2002) Directed differentiation of embryonic stem cells into motor neurons. *Cell* 110: 385-397. **Figura 22.2** Sanes, J. R. (1989) Extracellular matrix molecules that influence neural development. *Annu. Rev. Neurosci.* 12: 491-516. **Figura 22.4A** Gilbert, S. F. (1994) *Developmental Biology*, 4th Edition. Sunderland, MA: Sinauer Associates; Lawrence, P. A. (1992) *The Making of a Fly: The Genetics of Animal Design.* Oxford: Blackwell Scientific Publications. **Figura 22.4B** Ingham, P. (1988) The molecular genetics of embryonic pattern formation in *Drosophila*. *Nature* 335: 25-34. **Figura 22.4C** Veraksa, A. and W. McGinnis (2000) Developmental patterning genes and their conserved functions: From model organisms to humans. *Molec. Genet. Metab.* 69: 85-100. **Figura 22.7A** Dodd, J., T. M. Jessell and M. Placzek (1998) The when and where of floor plate induction. *Science* 282: 1654-1657. **Figura 22.7B** Fausett, S. R., L. J. Brunet and J. Klingensmith (2014) BMP antagonism by *Noggin* is required in presumptive notochord cells for mammalian foregut morphogenesis. *Dev. Biol.* 391: 111-124. **Scheda Applicazioni cliniche Figura A** Anchan, R. M., D. P. Drake, C. F. Haines, E. A. Gerwe and A. S. LaMantia (1997) Disruption of local retinoidmediated gene expression accompanies abnormal development in the mammalian olfactory pathway. *J. Comp. Neurol.* 379: 171-184. **Scheda Applicazioni cliniche Figura B** Linney, E. and A. S. LaMantia (1994) Retinoid signaling in mouse embryos. *Adv. Dev. Biol.* 3: 73-114. **Scheda Applicazioni cliniche Figura C** Monuki, E. S. and C. A. Walsh (2001) Mechanisms of cerebral cortical patterning in mice and humans. *Nat. Neurosci.* (Supp.) 4: 1199-1206. **Figura 22.8B** Noctor, S. C., V. A. Martinez-Cedeno and A. R. Krieg-

stein (2008) Distinct behaviors of neural stem and progenitor cells underlie cortical neurogenesis. *J. Comp. Neurol.* 508: 28-44. **Figura 22.9** Rakic, P. (1974) Neurons in rhesus monkey visual cortex: Systematic relation between time of origin and eventual disposition. *Science* 183: 425-427. **Figura 22.11** Kintner C. (2002) Neurogenesis in embryos and in adult neural stem cells. *J. Neurosci.* 22: 639-643. **Figure 22.13A e 22.14A** Cowan, W. M. (1979) The development of the brain. *Sci. Am.* 241(3): 112-133; Rakic, P. (1971) Guidance of neurons migrating to the fetal monkey neocortex. *Brain Res.* 33: 471-476. **Figura 22.13B** Noctor, S. C., A. C. Flint, T. A. Weissman, R. S. Dammerman and A. R. Kriegstein (2001) Neurons derived from radial glial cells establish radial units in neocortex. *Nature* 409: 714-720. **Figura 22.14B,C** Hong, S. E. and 7 others (2000) Autosomal recessive lissencephaly with cerebellar hypoplasia (LCH) is associated with human reelin gene mutations. *Nat. Genet.* 26: 93-96. **Figura 22.15** Lumsden, A. and R. Keynes (1989) Segmental patterns of neuronal development in the chick hindbrain. *Nature* 337: 424-428. **Figura 22.16C, sinistra** Carmona, F. D., R. Jiménez and J. M. Collinson (2008) The molecular basis of defective lens development in the Iberian mole. *BMC Biol.* 6: 44. doi: 10.1186/1741-7007-6-44. © Carmona et al; licensee BioMed Central Ltd. 2008. **Figura 22.16D, sinistra** Birol, O., T. Ohyama, R. K. Edlund, K. Drakou, P. Georgiades, A. K. Groves (2016) The mouse Foxi3 transcription factor is necessary for the development of posterior placodes *Dev. Biol.* 409(1): 139-151 **Figura 22.16D, destra** Hudspeth, A. J. (1985) The cellular basis of hearing: the biophysics of hair cells. *Science* 230: 745-752.

CAPITOLO 23 LA FORMAZIONE DEI CIRCUITI NERVOSI

Figura 23.1D Shi, S. H., L. Y. Jan and Y. N. Jan (2003) Hippocampal neuronal polarity specified by spatially localized mPar3/mPar6 and PI 3-kinase activity. *Cell* 112: 63-75. **Figura 23.2A (1st part)** Takahashi, M., M. Narushima and Y. Oda (2002) In vivo imaging of functional inhibitory networks on the Mauthner cell of larval zebrafish. *J. Neurosci.* 22: 3929-3938. **Figura 23.2A (other 2 parts)** Jontes, J. D., J. Buchanan and S. Smith (2000) Growth cone and dendrite dynamics in zebrafish embryos: early events in synaptogenesis imaged in vivo. *Nat. Neurosci.* 3: 231-237. **Scheda 23A** Herrera, E. and 8 others (2003) Zic2 patterns binocular vision by specifying the uncrossed retinal projection. *Cell* 114: 545-557. **Figura 23.3A** Dent, E.W. and F.B. Gertler (2003) Cytoskeletal dynamics and transport in growth cone motility and axon guidance. *Neuron* 40 :209-227. **Figura 23.3B** Dent, E. W. and K. Kalil (2001) Axon branching requires interactions between dynamic microtubules and actin filaments. *J. Neurosci.* 21: 9757-9769. **Figura 23.23C** Huber, A. B., A. L. Kolodkin, D. D. Ginty and J.-F. Cloutier (2003) Signaling at the growth cone: Ligandreceptor complexes and the control of axon growth and guidance. *Ann. Rev. of Neurosci.* 26: 509-563. **Figura 23.3D** Gomez, T. M. and J. O. Zheng (2006) The molecular basis for calcium-dependent axon pathfinding. *Nat. Rev. Neurosci.* 7: 115-117. **Scheda Applicazioni cliniche Figure A,B** Wahl, M. and 6 others (2009) Variability of homotopic and heterotopic callosal connectivity in partial agenesis of the corpus callosum: A 3t diffusion tensor imaging and Q-ball tractography study. *Am. J. Neuroradiol.* 30: 282-289. **Scheda Applicazioni cliniche Figure C-E** Haller, S., S. G. Wetzel and J. Lütschg (2008) Functional MRI, DTI and neurophysiology in horizontal gaze palsy with progressivescoliosis. *Neuroradiology* 50: 453-459. **Figura 23.5A** Huber, A. B., A. L. Kolodkin, D. D. Ginty and J. F. Cloutier (2003) Signaling at the growth cone: Ligand-receptor complexes and the control of axon growth and guidance. *Annu. Rev. Neurosci.* 26: 509-563. **Figura 23.5D** Gomez, T. M. and J. O. Zheng (2006) The molecular basis for calcium-dependent axon pathfinding. *Nat. Rev. Neurosci.* 7: 115-117; Dontchev, V. D. and P. C. Letourneau (2002) Nerve growth factor and semaphorin 3A signaling pathways interact in regulating sensory neuronal growth cone motility. *J. Neurosci.* 22: 6659-6669. **Figura 23.6A** Serafini, T. and 5 others (1994) The netrins define a family of axon outgrowth-promoting proteins homologous to *C. elegans* UNC-6. *Cell* 78: 409-423. **Figura 23.6B** Dickinson, B. J. (2001) Moving on. *Science* 291: 1910-1911. **Figura 23.6C** Serafini, T. and 6 others (1996) Netrin-1 is required for commissural axon guidance in the developing vertebrate nervous system. *Cell* 87: 1001-1014. **Figure 23.7A,C** Whitford, K. L., P. Dijkhuizen, F. Polleux and A. Ghosh (2002) Molecular control of cortical dendrite development. *Ann. Rev. Neurosci.* 25: 127-149. **Figura 23.7B** Choi, J. H., M. Y. Law, C. B. Chien, B. A. Link, and R. O. Wong (2010) In vivo development of dendritic orientation in wild-type and mislocalized retinal ganglion cells. *Neural Dev.* 5: 29. © Choi et al.; licensee BioMed Central Ltd. 2010. **Figura 23.8A,B,D** Hattori, D., S. S. Millard, W. M. Wojtowicz and S. L. Zipursky (2008) Dscam-mediated cell recognition regulates neural circuit formation. *Annu. Rev. Cell Dev. Biol.* 24: 597-620. **Figura 23.8C** Lefebvre, J. L., J. R. Sanes and J. N. Kay (2015) Development of dendritic form and function. *Ann. Rev. Cell Dev. Biol.* 31: 741-777. **Figura 23.9A,B** Sperry, R. W. (1963) Chemoaffinity in the orderly growth of nerve fiber patterns and connections. *Proc. Natl. Acad. Sci. USA* 50: 703-710. **Figura 23.9C** Walter, J., S. Henke-Fahle and F. Bonhoeffer (1987) Avoidance of posterior tectal membranes by temporal retinal axons. *Development* 101: 909-913. **Figura 23.9D** Wilkinson, D. G. (2001) Multiple roles of EPH receptors and ephrins in neural development. *Nat. Rev. Neurosci.* 2: 155-164. **Figura 23.10A,B** Waites, C. L., A. M. Craig and C. C. Garner (2005) Mechanisms of vertebrates synaptogenesis. *Annu. Rev. Neurosci.* 28: 251-274. **Figura 23.10C** Dean, C. and T. Dresbach (2006) Neuroligins and neurexins: Linking cell adhesion, synapse formation, and cognitive function. *Trends Neurosci.* 29: 21-29 **Figura 23.11A** Wang, X., H. Su and A. Bradley (2002) Molecular mechanisms governing *Pcdh*-ã gene expression: Evidence for a multiple promoter and *cis*-alternative splicing model. *Genes Dev.* 16: 1890-1905; Hamada, S. and T. Yagi (2001) The cadherin-related receptor family: A novel diversified cadherin family at the synapse. *Neurosci. Res.* 41: 207-215. **Figura 23.11B** Phillips, G. R. and 6 others (2003) Gamma-protocadherins are targeted to subsets of synapses and intracellular organelles in neurons. *J. Neurosci.* 23: 5096-5104. **Figura 23.12** Hamburger, V. (1958) Regression versus peripheral controls of differentiation in motor hypoplasia. *Amer. J. Anat.* 102: 365-409; Hamburger, V. (1977) The developmental history of the motor neuron. The F. O. Schmitt Lecture in Neuroscience, 1976, *Neurosci. Res. Prog. Bull.* 15, Suppl. III: 1-37. Hollyday, M. and V. Hamburger (1976) Reduction of the naturally occurring motor neuron loss by enlargement of the periphery. *J. Comp. Neurol.* 170: 311-320. **Scheda 23B** Purves, D. and R. I. Hume (1981) The relation of postsynaptic geometry to the number of presynaptic axons that innervate autonomic ganglion cells. *J. Neurosci.* 1: 441-452. **Figura 23.13** Purves, D. and J. W. Lichtman (1980) Elimination of synapses in the developing nervous system. *Science* 210: 153-157. **Scheda 23C** Horch, H. W., A. Kruittgen, S. D. Portbury and L. C. Katz (1999) Destabilization of cortical dendrites and spines by BDNF. *Neuron* 23: 353-364.

Figura 23.14A Walsh, M. K. and J. W. Lichtman (2003) In vivo time-lapse imaging of synaptic takeover associated with naturally occurring synapse elimination. *Neuron* 37: 67-73. **Figura 23.14B** Hashimoto, K., R. Ichikawa, K. Kitamura, M. Watanabe and M. Kano (2009) Translocation of a "winner" climbing fiber to the Purkinje cell dendrite and subsequent elimination of "losers" from the soma in developing cerebellum. *Neuron* 63: 106-118. **Figura 23.15A,B** Purves, D. and J. W. Lichtman (1985) *Principles of Neural Development*. Sunderland, MA: Sinauer Associates. **Figura 23.15C** Chun, L. L. and P. H. Patterson (1977) Role of nerve growth factor in the development of rat sympathetic neurons in vitro. III; Effect on acetylcholine production. *J. Cell Biol.* 75: 712-718. **Figura 23.15D** Levi-Montalcini, R. (1972) The morphological effects of immunosympathectomy. In *Immonosympathectomy*, G. Steiner and E. Schönbaum (eds.). Amsterdam: Elsevier. **Figura 23.16A** Maisonpierre, P. C. and 6 others (1990) Neurotrophin-3: A neurotrophic factor related to NGF and BDNF. *Science* 247: 1446-1451. **Figura 23.16B** Bibel, M. and Y.-A. Barde (2000) Neurotrophins: Key regulators of cell fate and cell shape in the vertebrate nervous system. *Genes Dev.* 14: 2919-2937. **Figura 23.17A** Campenot, R. B. (1981) Regeneration of neurites on long-term cultures of sympatic neurons deprived of nerve growth factor. *Science* 214: 579-581. **Figura 23.17B** Li, Y. and 6 others (2005) Essential role of TRPC channels in the guidance of nerve grwoth cones by brainderived neurotrophic factor. *Nature* 434: 894-898. **Figura 23.17C** Zweifel, L. S., R. Kuruvilla and D. D. Ginty (2005) Functions and mechanisms of retrograde neurotrophin signalling. *Nat. Rev. Neurosci.* 6: 615-625.

CAPITOLO 24 SESSO, SESSUALITÀ E CERVELLO

Figura 24.2B Arnold, A. P. 1980. Sexual differences in the brain. *Am. Sci.* 68: 165-173. **Figura 24.2C** Grisham, W. and 6 others (2011) Using digital images of the zebra finch song system as a tool to teach organizational effects of steroid hormones: A free downloadable module. *CBE – Life Sciences Education* 10: 222-230. **Figura 24.3B** Moore, K. L. (1977) *The Developing Human*, 2nd Edition. Philadelphia: W. B. Saunders, p. 241. **Scheda 24A Figure A-C** Young, L. J. and Z. Wang (2004) The neurobiology of pair bonding. *Nat. Neurosci.* 7: 1048-1054. **Scheda 24A Figura D** Fisher, H. E., A. Aron, and L. L. Brown (2005) Romantic love: An fMRI study of neural mechanisms for mate choice. *J. Comp. Neurol.* 493: 58-62. **Scheda 24A Figura E** Bartels, A. and S. Zeki (2000) The neural basis of romantic love. *Neuroreport.* 11: 3829-3834. **Figura 24.4B** Gustafson, M. L. and P. K. Donahoe (1994) Male sex determination: Current concepts of male sexual differentiation. *Annu. Rev. Med.* 45: 505-524. **Figura 24.5A** McEwen, B. S., P. G. Davis, B. Parsons and D. W. Pfaff (1979) The brain as a target for steroid hormone action. *Annu. Rev. Neurosci.* 2: 65-112. **Figura 24.5B** McEwen, B. S. (1976) Interactions between hormones and nerve tissue. *Sci. Am.* 235: 48-58. **Figura 24.6A** Breedlove, S. M. and A. P. Arnold (1981) Sexually dimorphic motor nucleus in the rat lumbar spinal cord: Response to adult hormone manipulation, absence in androgen-insensitive rats. *Brain Res.* 225: 297-307. **Figura 24.6B** Diagram after Morris, J. A., C. L. Jordan and S. M. Breedlove (2004) Sexual differentiation of the vertebrate nervous system. Nat, Neurosci. 7: 1034-1039.; micrographs from Breedlove, S. M. and A. P. Arnold (1983) Hormonal control of a developing neuromuscular system. II. Sensitive periods for the androgen-induced masculinization of the rat spinal nucleus of the bulbocavernosus. *J. Neurosci.* 3: 424-432. **Figura 24.6C** Forger, N. G. and S. M. Breedlove (1986) Sexual dimorphism in human and canine spinal cord: Role of early androgen. *Proc. Natl. Acad. Sci. USA* 83: 7527-7530. **Figura 24.7B** Arnold, A. P. and R. A. Gorski (1984) Gonadal steroid induction of structural sex differences in the central nervous system. *Ann. Rev. Neurosci.* 7: 413-442; Gorski, R. A. (1983) Steroid-induced sexual characteristics in the brain. In *Neuroendocrine Perspectives, Vol. 2.* E. E. Muller and R. M. MacLeod (eds.), Amsterdam: Elsevier/North Holland. **Figura 24.8A** Toran-Allerand, C. D. (1976) Sex steroids and the development of the newborn mouse hypothalamus and preoptic area in vitro: Implications for sexual differentiation. *Brain Res.* 106: 407-412. **Figura 24.8B** Woolley, C. S. and B. S. McEwen (1993) Roles of estradiol and progesterone in regulation of hippocampal dendritic spine density during the estrous cycle in the rat. *J. Comp. Neurol.* 336: 293-306. **Figura 24.8C** Meusburger, S. M. and J. R. Keast (2001) Testosterone and nerve growth factor have distinct but interacting effects on neurotransmitter expression of adult pelvic ganglion cells in vitro. *Neuroscience* 108: 331-340. **Scheda Applicazioni cliniche** Meaney, M. J. and M. Szyf (2005) Maternal care as a model for experiencedependent chromatin plasticity? *Trends Neurosci.* 28: 456-463. **Figura 24.9** Wooley, C. (2007) Acute effects of estrogen on neuronal physiology. *Annu. Rev. Pharmacol. Toxicol.* 47: 5.1-5.24. **Figura 24.10** Patchev, V. K., J. Schroeder, F. Goetz, W. Rhode and A. V. Patchev (2004) Neurotropic actions of androgens: principles, mechanisms and novel targets. *Exp. Gerontol.* 39: 1651-1660. **Figura 24.11** Savic, I., H. Berglund and P. Lindström (2005) Brain response to putative pheromones in homosexual men. Proc. Nat. Acad. Sci. USA 102: 7356-7361. **Figura 24.12** Cahill, L. (2006) Why sex matters for neuroscience. *Nature Rev. Neurosci.* 7: 477-484. **Figura 24.13** Cahill, L., M. Uncapher, L. Kilpatrick, M. T. Aikire and J. Turner (2004) Sexrelated hemispheric lateralization of amygdala function in emotionaly influenced memory: An fMRI investitation. *Learn. Mem.* 11: 261-266.

CAPITOLO 25 PLASTICITÀ DURANTE LO SVILUPPO DEL CERVELLO

Figura 25.2B Conel, J. L. (1939-1967). *The Postnatal Development of the Human Cerebral Cortex: Vols. 1-8*. Cambridge, MA: Harvard University Press. **Figura 25.2C** Huttenlocher, P. R., C. De Courten, L. J. Garey and H. Van der Loos (1982) Synaptogeneis in human visual cortex: Evidence for synapse elimination during normal development. *Neurosci. Lett.* 33: 247-252. **Figura 25.3A,B** Feller, M. B., D. P. Wellis, D. Stellwagen, F. S. Werblin and C. J. Shatz (1996) Requirement for cholinergic synaptic transmission in the propagation of spontaneous retinal waves. *Science* 272: 1182-1187. **Figura 25.3C** Hanganu, I. L., Y. Ben-Ari and R. Khazipov (2006) Retinal waves trigger spindle bursts in the neonatal rat visual cortex. *J. Neurosci.* 26: 6728-6736. **Figura 25.4** LeVay, S., T. N. Wiesel and D. H. Hubel (1980) The development of ocular dominance columns in Sillnormal and visually deprived monkeys. *J. Comp. Neurol.* 191: 1-51. **Figura 25.5A** Hubel, D. H. and T. N. Wiesel (1962) Receptive fields, binocular interaction and functional architecture in the cat's visual cortex. *J. Physiol.* 160: 106-154. **Figura 25.5B** Wiesel, T. N and D. H. Hubel (1963) Single-cell responses in striate cortex of kittens deprived of vision in one eye. *J. Neurophysiol.* 26: 1003-1017. **Figure 25.5C e 25.6** Hubel, D. H. and T. N. Wiesel (1970) The period of susceptibility to the physiological effects of unilateral eye closure in kittens. *J. Physiol.* 206: 419-436. **Scheda Applicazioni cliniche Figura A**

© 978-88-08-72049-8

Eaton, N. C., H. M. Sheehan and E. M. Quinlan (2016) Optimization of visual training for full recovery from severe amblyopia in adults. *Learn Mem.* 23: 99-103. **Scheda Applicazioni cliniche Figura B** Montey, K. L. and E. M. Quinlan (2011) Recovery from chronic monocular deprivation following reactivation of thalamocortical plasticity by dark exposure. *Nat. Comm.* 2: 317. **Figura 25.7A** Horton, J. C. and D. R. Hocking (1999) An adult-like pattern of ocular dominance columns in striate cortex of newborn monkeys prior to visual experience. *J. Neurosci.* 16: 1791-1807. **Figura 25.7B** Hubel, D. H., T. N. Wiesel and S. LeVay (1977) Plasticity of ocular dominance columns in monkey striate cortex. *Phil. Trans. R. Soc. Lond. B.* 278: 377-409. **Figura 25.8** Antonini, A. and M. P. Stryker (1993) Rapid remodeling of axonal arbors in the visual cortex. *Science* 260: 1819-1821. **Figura 25.9** Hubel, D. H. and T. N. Wiesel (1965) Binocular interaction in striate cortex of kittens reared with artificial squint. *J. Neurophysiol.* 28: 1041-1059. **Tabella 25.1** Hensch, T. K. (2004) Critical period regulation. *Annu. Rev. Neurosci.* 27: 549-579. **Figura 25.10** Wang, B.-S., R. Sarnaik and J. Cang (2010) Critical period plasticity matches binocular orientation preference in the visual cortex. *Neuron* 65: 246-256. **Figura 25.11A** Ebert, D. H. and M. E. Greenberg (2013) Activity-dependent neuronal signaling and autism spectrum disorder. *Nature* 493: 327-337. **Figura 25.11B,C** Wong, R. O. and A. Ghosh (2002) Activity-dependent regulation of dendritic growth and patterning. *Nat. Rev. Neurosci.* 3: 803-812. **Figura 25.12** Petitto, L. A. and P. F. Marentette (1991) Babbling in the manual mode: Evidence for the ontogeny of language. *Science* 251: 1493-1496. **Figura 25.13A** Johnson, J. S. and E. I. Newport (1989) Critical period effects in second language learning: the influences of maturational state on the acquisition of English as a second language. *Cog. Psychol.* 21. **Figura 25.13B** Schlaggar, B. L. and 5 others (2002) Functional neuroanatomical differences between adults and school-age children in the processing of single words. *Science* 296: 1476-1479. **Figura 25.14** Rakic, P. J. P. Bourgeois, M. F. Eckenhoff, N. Zecevic and P. S. Goldman-Rakic (1986) Concurrent overproduction of synapses in diverse regions of the primate cerebral cortex. *Science* 232: 232-235. **Figura 25.15A** Gogtay, N. and 11 others (2004) Dynamic mapping of human cortical development during childhood through early adulthood. *Proc. Natl. Acad. Sci. USA* 101: 8174-8179. **Figura 25.15B** Lenroot, R. K. and 11 others (2007) Sexual dimorphism of brain development trajectories during childhood and adolescence. *NeuroImage* 36: 1065-1073. **Figura 25.16A** Shaw, P. and 9 others (2007) Attention-deficit/hyperactivity disorder is characterized by a delay in cortical maturation. *Proc. Natl. Acad. Sci. USA* 104: 19649-19654. Copyright (2007) National Academy of Sciences, U.S.A. **Figura 25.16B** Shaw, P. and 8 others (2006) Longitudinal mapping of cortical thickness and clinical outcome in children and adolescents with attention-deficit/hyperactivity disorder. *Arch. Gen. Psychiatry* 63: 540-549.

CAPITOLO 26 RIPARAZIONE E RIGENERAZIONE NEL SISTEMA NERVOSO

Figura 26.1 Case, L. C. and M. Tessier-Lavigne (2005) Regeneration of the adult central nervous system. *Curr. Biol.* 15: R749-R753. **Figura 26.2** Ward, N. S., M. M. Brown, A. J. Thompson, and R. S. J. Frackowiak (2003a) Neural correlates of outcome after stroke: A cross-sectional fMRI study. *Brain* 126: 1430-1448; Ward, N. S., M. M. Brown, A. J. Thompson, and R. S. J. Frackowiak (2003b) Neural correlates of motor recovery after stroke: A longitudinal fMRI study. *Brain* 126: 2476-2496. **Figura 26.4** Head, H., W. H. R. Rivers and J. Sherren. (1905) The afferent nervous system from a new aspect. *Brain* 28: 99-111. **Figure 26.5B,C** Pan, Y. A., T. Misgeld, J. W. Lichtman and J. R. Sanes (2003) Effects of neurotoxic and neuroprotective agents on peripheral nerve regeneration assayed by time-lapse imaging in vivo *J. Neurosci.* 23: 11479-11488. **Figura 26.5D** Sabatier, M. J., N. Redmon, G. Schwartz and A. W. English (2008) Treadmill training promotes axon regrowth in injured peripheral neurons. *Exp. Neurol.* 211: 489-493. **Figura 26.7A** So, K. F. and A. J. Aguayo (1985) Lengthy regrowth of cut axons from ganglion cells after peripheral nerve transplantation into the retina of adult rats. *Brain Res.* 359: 402-406. **Figura 26.7B** Aguayo, A. J., D. A. Carter, T. Zwimpfer, M. Vidal-Sanz and G. M. Bray. 1990. Axonal regeneration and synapse formation in the injured CNS of adult mammals. In *Brain Repair.* A. Bjorklund, A. J. Aguayo and D. Ottoson (eds.). Wenner-Gren International Symposium Series. Vol. 56: 252-272. New York: Stockton Press. **Scheda 26A** Purves, D., W. Thompson and J. W. Yip (1981) Re-innervation of ganglia transplanted to the neck from different levels of the guinea-pig sympathetic chain. *J. Physiol.* (*Lond.*) 313: 49-63. **Figura 26.8B** Pitts, E. V., S. Potluri, D. M. Hess and R. J. Balice-Gordon (2006) Neurotrophin and Trk-mediated signaling in the neuromuscular system. *Int. Anesthes. Clin.* 44: 21-76. **Figura 26.8C** Nguyen, Q. T., J. R. Sanes and J. W. Lichtman (2002) Preexisting pathways promote precise projection patterns. *Nat. Neurosci.* 5: 861-867. **Figura 26.8D** Campanari, M.-L., M.-S. Garcia-Ayllon, S. Clura, J. Saez-Valero and E. Kabashi. (2016) Neuromuscular junction impairment in amyotrophic lateral sclerosis: Reassessing the role of acetylcholinesterase. *Front. Mol. Neurosci.* 9: article 160. **Scheda Applicazioni cliniche** McKee, A. C. and 9 others (2009) Chronic traumatic encephalopathy in athletes: Progressive tauopathy after repetitive head injury. *J. Neuropathol. Exp. Neurol.* 68: 709-735; Miller, G. (2009) A late hit for pro football players. *Science* 325: 670-672. **Figura 26.9A** Manabat, C. and 8 others (2003) Reperfusion differentially induces caspase-3 activation in ischemic core and penumbra after stroke in immature brain. *Stroke* 34: 207-213. **Figura 26.10 (in alto)** McGraw, J., G. W. Hiebert and J. D. Stevens (2001) Modulating astrogiosis after neurotrauma. *J. Neurosci. Res.* 63: 109-115. **Figura 26.10 (al centro)** Tan, A. M., W. Zhang and J. M. Levine (2005) NG2: A component of the glial scar that inhibits axon growth. *J. Anat.* 207: 717-725. **Figura 26.10 (in basso)** Ladeby, R. and 6 others (2005) Microglial cell population dynamics in the injured adult CNS. *Brain Res. Rev.* 48: 196-206. **Figura 26.11B** Kolodkin, A. L. and M. Tessier-Lavigne (2011) Mechanisms and molecules of neuronal wiring: A primer. *Cold Spring Harb. Perspect. Biol.* (epub) **Figura 26.12A,B** Waisman, A., R. S. Liblau and B. Becher (2015) Innate and adaptive immune responses in the CNS. *Lancet Neurol.* 14: 945-955. **Figura 26.12C e Tabella 26.1** Mckee, C. A. and J. R. Lukens (2016) Emerging roles for the immune system in traumatic brain injury. *Front. Immunol.* 7: 556. **Figura 26.13A** Otteson, D. C. and P. F. Hitchcock (2003) Stem cells in the teleost retina: Persistent neurogenesis and injury-induced regeneration. *Vis. Res.* 43: 927-936. **Figura 26.13B** Goldman, S. A. (1998) Adult neurogenesis: From canaries to the clinic. *Trends Neurosci.* 21: 107-114. **Figura 26.14A,B** Gage, F. H. (2000) Mammalian neural stem cells. *Science* 287: 1433-1438. **Figura 26.14C** Kelsch, W., S. Sim and C. Lois (2010) Watching synaptogenesis in the adult brain. *Annu. Rev. Neurosci.* 33: 131-149. **Figura 26.15A** Alvarez-Buylla, A. and D. A. Lim (2004) For the long run: maintaining germinal niches in the adult brain. *Neuron* 41: 683-686. **Figura 26.15B** Councill, E. S. and 7 others (2006) Limited influence of olanzapine on adult forebrain neural precursors in vitro. *Neuroscience* 140: 111-122.

Figura 26.16A Ghashghaei, H. T. and 9 others (2006) The role of neuregulin-ErbB4 interactions on the proliferation and organization of cells in the subventricular zone. *Proc. Natl. Acad. Sci. USA* 103: 1930-1935. Copyright © 2006 by The National Academy of Sciences of the USA. **Figura 26.16C** Peretto, P. A. Merighi, A. Fasolo and L. Bonfanti (1999) The subependymal layer in rodents: A site of structural plasticity and cell migration in the adult mammalian brain. *Brain Res. Bull.* 49: 221-243. **Figura 26.16B** Ghashghaei, H. T., C. Lai and E. S. Anton (2007) Neuronal migration in the adult brain: are we there yet? *Nat. Rev. Neurosci.* 8: 141-151. **Scheda 26B Figura A** Au, E. and G. Fishell (2006) Adult cortical neurogenesis: Nuanced, negligible, or nonexistent? *Nat. Neurosci.* 9: 1086-1088. **Scheda 26B Figura B,C** Bhardwaj, R. D. and 10 others (2006) Neocortical neurogenesis in humans is restricted to development. *Proc. Natl. Acad. Sci. USA* 103: 12564-12568. Copyright (2006) National Academy of Sciences, U.S.A.

CAPITOLO 27 LE FUNZIONI COGNITIVE E L'ORGANIZZAZIONE DELLA CORTECCIA CEREBRALE

Immagine d'apertura, Unità 5 Glasser, M. F. and 11 others (2016) A multi-modal parcellation of human cerebral cortex. *Nature* 536: 171-178 **Scheda 27B Figura C** Palmeri, T.J., R. B. Blake, R. Marois, M. A. Flanery and W. O. Whetsell (2002) The perceptual reality of synesthetic color. *Proc. Natl. Acad. Sci. USA* 99: 4127-4131. Copyright (2002) National Academy of Sciences, U.S.A. **Figura 27.5A** Lynch, J. C., V. B. Mountcastle, W. H. Talbot and T. C. Yin (1977) Parietal lobe mechanisms for directed visual attention. *J. Neurophys.* 40: 362-369. **Figura 27.5B** Platt, M. L. and P. W. Glimcher (1999) Neural correlates of decision variables in parietal cortex. *Nature* 400: 233-238. **Figura 27.6** McClure, S. M. and 5 others (2004) Neural correlates of behavioral preference for culturally familiar drinks. *Neuron* 44: 379-387. **Scheda Applicazioni cliniche** Moniz, E. (1937) Prefrontal leukotomy in the treatment of mental disorders. Amer. *J. Psychiatry* 93: 1379-1385. **Figura 27.7** Goldman-Rakic, P. S. (1987) Circuitry of the prefrontal cortex and the regulation of behavior by representational memory. In *Handbook of Physiology.* Section 1, The Nervous System. Vol. 5, Higher Functions of the Brain, Part I. F. Plum (ed.). Bethesda: American Physiological Society, pp. 373-417.

CAPITOLO 28 GLI STATI DI ATTIVITÀ CORTICALE

Figura 28.1A Aschoff, J. (1965) Circadian rhythms in man. *Science* 148: 1427-1432. **Figura 28.3** Okamura, H. and 8 others (1999) Photic induction of mPer1 and mPer2 in Cry-deficient mice lacking a biological clock. *Science* 276: 2531-2534. **Scheda 28A Figure B,C** Bear, M., M. A. Paradiso and B. Connors (2001) *Neuroscience: Exploring the Brain*, 2nd Ed. Philadelphia: Williams & Wilkins/Lippincott. **Figure 28.1B, 28.4, 28.5, 28.8, e 28.12** Hobson, J. A. (1989) *Sleep.* New York: Scientific American Library. **Figura 28.6A** Woods, R. and H. B. Greenhouse (1974) *The New World of Dreams.* New York: Macmillan. **Figura 28.6B,C** Funkhouser, A. (2014) funkhouser.dreamunit.net/ Dream-notes; Jovanovic, U. J. (1971) *Normal Sleep in Man.* Stuttgart: Hippocrates. **Figura 28.7** Magoun, H. W. (1952) An ascending reticular activating system in the brain stem. AMA Arch. *Neurol. Psychiat.* 67: 145-154. **Figura 28.10** McCormick, D. A. and H. C. Pape (1990) Properties of a hyperpolarization-activated cation current and its role in rhythmic oscillation in thalamic relay neurones. *J. Physiol.* 431: 291-318. **Figura 28.11** Steriade, M., D. A. McCormick and T. J. Sejnowski (1993) Thalamocortical oscillations in the sleeping and aroused brain. *Science* 262: 679-685. **Figura 28.14** Fox, M. D. and 5 others (2005) The human brain is intrinsically organized into dynamic, anticorrelated function networks. *Proc. Natl. Acad. Sci. USA* 102: 9673-9678.

CAPITOLO 29 L'ATTENZIONE

Figura 29.1 Cherry, E. C. (1953) Some experiments on the recognition of speech, with one and with two ears. *J. Acoust. Soc. Am.* 25: 975-979. **Figura 29.2** Posner, M. I., C. R. R. Snyder and B. J. Davidson (1980) Attention and the detection of signals. *J. Exp. Psychol. Gen.* 59: 160-174. **Figura 29.3** Klein, R. M. (2000) Inhibition of return. *Trends Cogn. Sci.* 4:138-147; Posner, M. I. and Y. Cohen (194) Componenets of visual orienting. In *Attention and Performance,* vol. 10: Control of Language Porcesses, H. Bouma and D. Bouwhuis (eds.). London: Erlbaum, pp. 531-556. **Figura 29.4** Heilman, H. and E. Valenstein (1985) *Clinical Neurospychology*, 2nd Edition. New York: Oxford University Press. **Figura 29.5A,C** Posner, M. I. and M. E. Raichle (1994) *Images of Mind*. New York: Scientific American Library. **Figura 29.5B** Blumenfeld, H. (2010) *Neuroanatomy through Clinical Cases,* 2nd Edition. Sunderland, MA: Sinauer. **Figura 29.5D** Grabowecky, M., L. C. Robertson and A. Treisman (1993) Preattentive processes guide visual search: Evidence from patients with unilateral visual neglect. *J. Cogn. Neurosci.* 5: 288-302. **Scheda 29A** Moore, T., K. M. Armstrong and M. Fallah (2003) Visuomotor origins of covert spatial attention. *Neuron* 40: 671-683. **Figura 29.6** Corbetta, M. and G. L. Shulman (2002) Control of goal-directed and stimulus-driven attention in the brain. *Nat. Rev. Neurosci.* 3: 201-215. **Figura 29.7** Moran, J. and R. Desimone (1985) Selective attention gates visual processing in the extrastriate cortex. *Science* 229: 782-784.

CAPITOLO 30 LA MEMORIA

Scheda 30A Tinbergen, N. (1969) *Curious Naturalists.* Garden City, NY: Doubleday. Photo © Nina Leen/Getty Images. **Figura 30.4** Ericsson, K. A., W. G. Chase, and S. Faloon (1980) Acquisition of a memory skill. *Science.* 208: 1181-1182. **Figura 30.5** Chase W. G. and H. A. Simon (1973) *The Mind's Eye in Chess in Visual Information Processing,* W. G. Chase, ed. New York: Academic Press, pp. 215-281. **Figura 30.6** Morris, J. S. and R. J. Dolan (2001) Involvement of human amygdala and orbitofrontal cortex in hunger-enhanced memory for food stimuli. *J. Neurosci.* 21: 5304-5310. **Figura 30.8A** Rubin, D. C. and T. C. Kontis (1983) A schema for common cents. *Mem. Cog.* 11: 335-341. **Figura 30.8B** Squire, L. R. (1989) On the course of forgetting in very long-term memory. *J. Exp. Psychol.* 15: 241-245. **Scheda Applicazioni cliniche Figure A-D** Corkin, S., D. G. Amaral, R. G. Gonzalez, K. A. Johnson and B. T. Hyman (1997) H.M.'s medial temporal lobe lesion: Findings from MRI. *J. Neurosci.* 17: 3964-3979. **Scheda Applicazioni cliniche Figura E** Rosenbaum, R. S. and 6 others (2000) Remote spatial memory in amnesic person with extensive bilateral hippocampal lesions. *Nat. Neurosci.* 3: 1044-1048. **Scheda Applicazioni cliniche Figura F** Tulving, E. (2002) Episodic memory: From mind to brain. *Annu. Rev. Psychol.* 53: 1-25. **Figura 30.10B** Eichenbaum, H. (2000) A cortical-hippocampal

© 978-88-08-72049-8

system for declarative memory. *Nat. Rev. Neurosci.* 1: 41-50. **Figure 30.10C,D** Schenk, F. and R. G. Morris (1985) Dissociation between components of spatial memory in rats after recovery from the effects of retrohippocampal lesions. *Exp. Brain Res.* 58: 11-28. **Figura 30.11** Wagner, A. D. and 7 others (1998) Building memories: Remembering and forgetting of verbal experiences. *Science* 281: 1188. **Figura 30.12** Maguire, E. A. and 6 others (2000) Navigation-related structural change in the hippocampi of taxi drivers. *Proc. Natl. Acad. Sci. USA* 97: 4398-4403. Copyright (2000) National Academy of Sciences, U.S.A. **Scheda 30C Figura B** Blumenfeld, H. (2002) *Neuroanatomy through Clinical Cases.* Sunderland, MA: Sinauer Associates; Brun, A. and E. Englund (1981) Regional pattern of degeneration in Alzheimer's disease: Neuronal loss and histopathalogical grading. *Histopathology* 5: 459-564. **Scheda 30D** Moser, E. I., E. Kropff and M.-B. Moser (2008) Place cells, grid cells, and the brain's spatial representation system. *Annu. Rev. Neurosci.* 31: 69-89. **Figura 30.13** Lashley, K. S. and Wiley, L. E. (1933) Studies of cerebral function in learning IX. Mass action in relation to the number of elements in the problem to be learned. *J. Comp. Neurol.*, 57: 3-55. doi:10.1002/cne.900570102; Lashley, K. S. (1944) Studies of cerebral function in learning. XIII. Apparent absence of transcortical association in maze learning. *J. Comp. Neurol.*, 80: 257-281. doi:10.1002/cne.900800207; University of Rome Psychology Lab Website. **Figura 30.14** Van Hoesen, G. W. (1982) The parahippocampal gyrus. *Trends Neurosci.* 5: 345-350. **Figura 30.15** Buckner, R. L. And M. E. Wheeler (2001) The cognitive neuroscience of remembering. *Nat. Rev. Neurosci.* 2: 624-634. **Figura 30.16** Shohamy, D., C. E. Myers, S. Grossman, J. Sage and M. A. Gluck (2005) The role of dopamine in cognitive sequence learning: Evidence from Parkinson's disease. *Behav. Brain Res.* 156: 191-199. **Figura 30.18** Dekaban, A. S. and D. Sadowsky (1978) Changes in brain weights during the span of human life: Relation of brain weights to body heights and body weights. *Ann. Neurol.* 4: 345-356. **Figura 30.19** Cabeza, R., N. D. Anderson, J. K. Locantore and A. R. McIntosh (2002) Aging gracefully: compensatory brain activity in high-performing older adults. *Neuroimage* 17: 1394-1402.

CAPITOLO 31 L'EMOZIONE

Figura 31.2 LeDoux, J. E. (1987) Emotion. In *Handbook of Physiology*, Section 1, The Nervous System, vol. 5. F. Blum, S. R. Geiger, and V. B. Mountcastle (eds.). Bethesda, MD: American Physiological Society, pp. 419-459. **Scheda 31A Figura A** Part A (2,3) from Wellcome Library, London. http://wellcomeimages.org **Scheda 31A Figura B** Left photos: G. Holstege, R. Bandler and C.B. Saper (1996) The Emotional Motor System. In *Progress in Brain Research,* vol. 107. G. Holstege, R. Bandler and C. B. Saper (eds.). Amsterdam: Elsevier, pp. 3-6. Right photos: Trosch, R. M., G. Sze, L. M. Brass and S. G. Waxman (1990) Emotional facial paresis with striatocapsular infarction. *J. Neurol. Sci.* 98: 195-201. **Figura 31.7** Rolls, E. T. (1999) *The Brain and Emotion*. Oxford: Oxford University Press. **Scheda 31C Figure B,C** Adolphs, R., D. Tranel, H. Damasio and A. R. Damasio (1995) Fear and the human amygdala. *J. Neurosci.* 15: 5879-5891. **Scheda Applicazioni cliniche** Drevets, W. C. and M. E. Raichle (1994) PET imaging studies of human emotional disorders. In *The Cognitive Neurosciences,* M. S. Gazzaniga (ed.). Cambridge, MA: MIT Press, pp. 1153-1164. **Figura 31.8** Moscovitch, M. and J. Olds (1982) Asymmetries in spontaneous facial expressions and their possible relation to hemispheric specialization. *Neuropsychologia* 20: 71-81. **Figura 31.9** Winston, J. S., B. A. Strange, J. O'Doherty and R. J. Dolan (2002) Automatic and intentional brain responses during evaluation of trustworthiness of faces. *Nat. Neurosci.* 5: 277-283. **Figura 31.11** Nestler, E. J. (2005) Is there a common molecular pathway for addiction? *Nat. Neurosci.* 8: 1445-1449. **Figura 31.12** Schultz, W., P. Dayan and R. P. Montague (1997) A neural substrate of prediction and reward. *Science* 275: 1593-1599. **Figura 31.13A** Parsons, R. G. and K. J. Ressler (2013) Implications of memory modulation for post-traumatic stress and fear disorders. *Nat. Neurosci.* 16: 146-153; Carrión, V. G., B. W. Haas, A. Garrett, S. Song, and A. L. Reiss (2010) Reduced hippocampal activity in youth with posttraumatic stress symptoms: An fMRI study. *J. Ped. Psych.* 35: 559-569.

CAPITOLO 32 PENSIERO, PIANIFICAZIONE E DECISIONE

Figura 32.2B Brodmann, K. (1912) Neue Ergebnisse über die vergleichende histologische Lokalisation der Grosshirnrinde mit besonderer Berücksichtigung des Stirnhirns. *Anat. Anzeiger* 41: 157-216. **Figura 32.2C** Semendeferi, K., H. Damasio, R. Frankand G. W. Van Hoesen (1997) The evolution of the frontal lobes: A volumetric analysis based on three-dimensional reconstructions of magnetic resonance scans of human and ape brains. *J. Hum. Evol.* 32: 375-388; Semendeferi, K., A. Lu, N. Schenker and H. Damasio (2002) Humans and great apes share a large frontal cortex. *Nat. Neurosci.* 5: 272-276. **Figura 32.4** Wallis, J. D. (2007) Orbitofrontal cortex and its contribution to decision-making. *Annu. Rev Neurosci.* 30: 31-56. **Scheda 32A Figura B,C** Schultz, W., P. Dayan and P. R. Montague (1997) A neural substrate of prediction and reward. *Science* 275: 1593-1599. **Figura 32.5** Baxter, M. G. and E. A. Murray (2002) The amygdala and reward. *Nat. Rev. Neurosci.* 3:563-573. doi: 10.1038/ nrn875 **Figura 32.6** Miller, E. K. (2000) The prefrontal cortex and cognitive control. *Nat. Rev. Neurosci.* 1: 59-65. **Figura 32.7** Funahashi, S., C. J. Bruce and P. S. Goldman-Rakic (1989) Mnemonic coding of visual space in the monkey's dorsolateral prefrontal cortex. *J. Neurophysiol.* 61: 331-349. **Figura 32.8** Wallis, J. D., K. C. Anderson and E. K. Miller (2001) Single neurons in prefrontal cortex encode abstract rules. *Nature* 411: 953-956. **Figura 32.9B** Bush, G., P. J. Whalen, B. R. Rosen, M. A. Jenike, S. C. McInerney and S. L. Rauch (1998) The counting Stroop: An interference task specialized for functional neuroimaging – Validation study with functional MRI. *Hum. Brain Mapp.* 6: 270-282. **Figura 32.9C** Kerns, J. G., J. D. Cohen, A. W. MacDonald III, R. Y. Cho, V. A. Stenger and C. S. Carter (2004) Anterior cingulate conflict monitoring and adjustments in control. *Science* 303: 1023-1026. **Figura 32.10** Depue, B. E., T. Curran and M. T. Banich (2007) Prefrontal regions orchestrate suppression of emotional memories via a two-phase process. *Science* 317: 215-219. **Figura 32.11B** Bechara, A., A. R. Damasio, H. Damasio and S. W. Anderson (1994) Insensitivity to future consequences following damage to the human prefrontal cortex. *Cognition* 50: 7-15. **Figura 32.11C** Bechara, A., D. Tranel, H. Damasio and A. R. Damasio (1996) Failure to respond autonomically to anticipated future outcomes following damage to prefrontal cortex. *Cereb. Cortex* 6: 215-225. **Scheda 32B Figura B** Sirigu, A., E. Daprati, S. Ciancia, P. Giraux, N. Nighoghossian, A. Posada and P. Haggard (2003) Altered awareness of voluntary action after damage to the parietal cortex. *Nat. Neurosci.* 7: 80-84. **Figura 32.12** Naqvi, N. H., D. Rudrauf, H. Damasio and A. Bechara (2007) Damage to the insula disrupts addition to cigarette smoking. *Science* 315: 531-534. **Figura 32.13A,B** Gusnard, D. A. and M. E. Raichle (2001) Searching for a baseline: Functional

imaging and the resting human brain. *Nat. Rev. Neurosci.* 2: 685-694. **Figura 32.13C** Hayden, B. Y., D. Smith and M. L. Platt (2009) Electrophysiological correlates of default-mode processing in macaque posterior cingulate cortex. *Proc. Natl. Acad. Sci. USA* 106: 5948-5953. **Figura 32.14** Pearson, J. M., S. R. Heilbronner, D. L. Barack, B. Y. Hayden, and M. L. Platt (2011) Posterior cingulate cortex: Adampting behavior to a changing world. *Trends Cogn. Sci.* 15: 143-151.

CAPITOLO 33 LA PAROLA E IL LINGUAGGIO

Scheda 33A Figura B Miller, G. A. (1991) *The Science of Words*, chapter 4, The spoken word. New York: Scientific American Library. **Scheda 33B Figura B** Coren, S. (1992) *The Left-Hander Syndrome: The Causes and Consequence of Left-Handedness.* New York: The Free Press. **Figura 33.5A** Penfield, W. and L. Roberts (1959) *Speech and Brain Mechanisms.* Princeton, NJ: Princeton University Press. **Figura 33.5B** Ojemann, G. A., I. Fried and E. Lettich (1989) Electrocorticographic (EcoG) correlates of language. *Electroencephalo. Clin. Neurophys.* 73: 453-463. **Figura 33.6** Posner, M. I. and M. E. Raichle (1994) *Images of Mind*. New York: Scientific American Library. **Figura 33.7** Damasio, H., T. J. Grabowski, D. Tranel, R. D. Hichwa and A. Damasio (1996) A neural basis for lexical retrieval. *Nature* 380: 499-505. **Figura 33.8** Bellugi, U., H. Poizner and E. S. Klima (1989) Language, modality, and the brain. *Trends Neurosci.* 12: 380-388. **Figura 33.9 A** Johnson, J. S. and E. L. Newport (1989) Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cogn. Psychol.* 21: 60-99. **Figura 33.9B** Brown, T. T., H. M. Lugar, R. S. Coalson, F. M. Miezin, S. E. Peteresen and B. L. Schlagger (2005) Developmental changes in human cerebral functional organization for word generation. *Cereb. Cortex* 15: 275-290. **Figura 33.10** Vinckier, F. and 5 others (2007) Hierarchical coding of letter strings in the ventral stream: Dissecting the inner organization of the visual word-form system. *Neuron* 55: 143-156. **Figura 33.11** Savage-Rumbaugh, S., S. G. Shanker and T. J. Taylor (1998) *Apes, Language, and the Human Mind.* New York: Oxford University Press. **Figura 33.12** Gil-da-Costa, R. and 5 others (2006) Species-specific calls activate homologs of Broca's and Wernicke's areas in the macaque. *Nat. Neurosci.* 9: 1064-1070.

APPENDICE UNA RASSEGNA DELLA NEUROANATOMIA UMANA

Immagine d'apertura Copyright Max Delson/istockphoto.com. **Figura A13C** Rohen, J. W. and C. Yokochi (1993) *Color Atlas of Anatomy.* New York: Igaku-Shoin. **Figure A16, A17, A20A** Blumenfeld, H. (2010) *Neuroanatomy through Clinical Cases*, 2nd Edition. Sunderland, MA: Sinauer Associates. **Figura A26** Nedergaard, M. and S. A. Goldman (2016) Brain drain. *Sci. Am.* 314: 44-49.