منابع

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Accornero N, Li Voti P, La Riccia M, Gregori B. Visual evoked potentials modulation during direct current cortical polarization. Exp Brain Res. 2007;178(2):261–6.

Aldini G. Essai théorique et expérimental sur le Galvanisme. de Fournier Fils Paris. 1804.

Alzheimer's-Association. Alzheimer's disease facts and figures. Alzheimers Dement. 2026;11(3):332–84.

Ambrus GG, Al-Moyed H, Chaieb L, Sarp L, Antal A, Paulus W. The fade-in—short stimulation—fade out approach to sham tDCS--reliable at 1 mA for naïve and experienced subjects, but not investigators. Brain Stimul. 2012;5(4):499–504.

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th edition text revision. Arlington, VA: American Psychiatric Publishing; 2022.

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. Fifth Edition – text revision. © American Psychiatric Association, 2022.

Antal A, Kincses TZ, Nitsche MA, Bartfai O, Paulus W. Excitability changes induced in the human primary visual cortex by transcranial direct current stimulation: direct electrophysiological evidence. Invest Ophthalmol Vis Sci. 2004;45(2):702–7.

Appell CP. Effect of electrosleep: review of research. Goteborg Psychol Rep. 1972;2:1–24.

Ardnt R. Electricity. In: Tuke DH, editors. Dictionary of psychological medicine. London: J & A Churchill; 1892.

Augustin FL. Vom Galvanism. Berlin. 1801.

Baddeley AD, Hitch G. Working memory. In: Bower GA, editor. Recent advances in learning and motivation. New York, NY: Academic; 1974. p. 47–90. 77. Wheeler ME, Petersen SE, Buckner RL. Memory's echo: vivid remembering reactivates sensoryspecifi c cortex. Proc Natl Acad Sci U S A. 2000; 97(20):11125–9.

Baldwin DS, Anderson IM, Nutt DJ, Allgulander C, Bandelow B, den Boer JA, et al. Evidence-based pharmacological treatment of anxiety disorders, posttraumatic stress disorder and obsessive-compulsive disorder: a revision of the 2005 guidelines from the

Benassi E. Qualche documento sulla pratica delle cure elettriche agli albori della galvanoterapia. Atti Mem Accad Stor. 1950;16:92–101.

Beveridge AW, Renvoize EB. Electricity: a history of its use in the treatment of mental ilness in Britain during the second half of the 19th century. Br J Psychiatry. 1988;153:157–62.

Bikson M, Bestmann S, Edwards D. Neuroscience: transcranial devices are not playthings. Nature. 2013;501:167. doi: 10.1038/50ss67b

Bindman LJ, Lippold OC, Redfearn JW. The action of brief polarizing currents on the cerebral cortex of the rat (1) during current flow and (2) in the production of long-lasting after-effects. J Physiol (Lond). 1964;172:369–82.

Bischoff C. Commentatio de Usu galvanismi. Jena. 1801.

Brazier MAB. The emergence of electrophysiology as an aid to neurology. In: Aminoff MJL, editor. Electrodiagnosis in clinical neurology. London: Churchill Livingstone Inc.; 1980. First Edition

British Association for Psychopharmacology. J Psychopharmacol. 2014;28(5):403–39.

Cavallo T. A complete treatise of electricity in theory and practice: with original experiments. London: Printed for Edward and Charles Dilly; 1777.

Cecere R, Rees G, Romei V. Individual differences in alpha frequency drive crossmodal illusory perception. Curr Biol. 2015;25(2):231–5.

Coffman BA, Clark VP, Parasuraman R. Battery powered thought: enhancement of attention, learning, and memory in healthy adults using transcranial direct current stimulation. Neuroimage. 2014;85: 895–908.

Corradini E. L'elettroshock a bassa intensità. Rass Studi Psichiatr. 1950;18:22–39.

Cuypers K, Leenus DJF, van den Berg FE, Nitsche MA, Thijs H, Wenderoth N, et al. Is motor learning mediated by tDCS intensity? PLoS One. 2013;8(6), e67344.

Datta A, Elwassif M, Battaglia F, Bikson M. Transcranial current stimulation focality using disc and ring electrode confi gurations: FEM analysis. J Neural Eng. 2008;5(2):163–74.

Debru A. The power of torpedo fish as a pathological model to the understanding of nervous transmission in Antiquity. Colupte Rendus Biologies R Seances Comptes Rendus Biologies. 2006;329:298–302.

Dhamne SC, Ekstein D, Zhuo Z, Gersner R, Zurakowski D, Loddenkemper T, et al. Acute seizure suppression by transcranial direct current stimulation in rats. Ann Clin Transl Neurol. 2015;2:843–56.

Dmochowski JP, Datta A, Bikson M, Su Y, Parra LC. Optimized multi-electrode stimulation increases focality and intensity at target. J Neural Eng. 2011;8(4):046011.
Dundas JE, Thickbroom GW, Mastaglia FL. Perception of comfort during transcranial DC stimulation: effect of NaCl solution concentration applied to sponge electrodes. Clin Neurophysiol. 2007; 118(5):1166–70.
Elliott P. Electricity and the brain: an historical evaluation. In: Kadosh RC, editor. The stimulated brain: Cognitive enhancement using non-invasive brain stimulation. London: Academic Press; 2014.
Feigin VL, Mensah GA, Norrving B, Murray CJ, Roth GA. Atlas of the global burden of stroke (1990–2013): the GBD 2013 study. Neuroepidemiology. 2015;45(3):230–6.
Feurra M, Bianco G, Santarnecchi E. Frequencydependent tuning of the human motor system induced by transcranial oscillatory potentials. J Neurosci. 2011;31(34):12165–70.
Finger S, Piccolino M. The shocking history of electric fishes: from ancient epochs to the birth of modern neurophysiology. New York, NY: Oxford University Press; 2011.
Finger S, Zaromb F. Benjamin Franklin and shock-induced amnesia. Am Psychol. 2006;61:240–8.
Finger S. Origins of neurosciences. A history of explorations into brain function. New York, NY: Oxford University Press; 1994. First Edition
Fodstad H, Hariz M. Electricity in the treatment of nervous system disease. Acta Neurochir Suppl. 2007;97:11–9.
Fregni F, Boggio PS, Nitsche M, Bermpohl F, Antal A, Feredoes E, et al. Anodal transcranial direct current stimulation of
Fresnoza S, Paulus W, Nitsche MA, Kuo MF. Nonlinear dose-dependent impact of D1 receptor activation on motor cortex plasticity in humans. J Neurosci. 2014;34(7):2744–53.
Fritsch B, Reis J, Martinowich K, Schambra HM, Ji Y, Cohen LG, et al. Direct current stimulation promotes BDNF-dependent synaptic plasticity: potential implications for motor learning. Neuron. 2010;66(2):198–204.
Gandiga PC, Hummel FC, Cohen LG. Transcranial DC stimulation (tDCS): a tool for double-blind sham-controlled clinical studies in brain stimulation. Clin Neurophysiol. 2006;117(4):845–50.
Gilman SL. Electrotherapy and mental illness: then and now. Hist Psychiatry. 2008;19:339–57.
Guleyupoglu B, Schestatsky P, Edwards D, Fregni F, Bikson M. Classifi cation of methods in transcranial electrical stimulation (tES) and evolving strategy from historical approaches to contemporary innovations. J Neurosci Methods. 2013;15:297–311.
Hasan A, Misewitsch K, Nitsche MA, Gruber O, Padberg F, Falkai P, et al. Impaired motor cortex responses in non-psychotic fi rst-degree relatives of schizophrenia patients: a cathodal tDCS pilot study. Brain Stimul. 2013;6:821–9.
Helfrich RF, Knepper H, Nolte G, Strüber D, Rach S, Herrmann CS, et al. Selective modulation of interhemispheric functional connectivity by HD-tACS shapes perception. PLoS Biol. 2014;12(12):e1002031.
Iyer MB, Mattu U, Grafman J, Lomarev M, Sato S, Wassermann EM. Safety and cognitive effect of frontal DC brain polarization in healthy individuals. Neurology. 2005;64(5):872–5.
Kabakov AY, Muller PA, Pascual-Leone A, Jensen FE, Rotenberg A. Contribution of axonal orientation to pathway-dependent modulation of excitatory transmission by direct current stimulation in isolated rat hippocampus. J Neurophysiol. 2012;107(7): 1881–9.
Kadosh RC, Elliott P. Neuroscience: Brain stimulation has a long history. Nature. 2013;500:529.
Kellaway P. The part played by electric fish in the early history of bioelectricity and electrotherapy. Bull Hist Med. 1946;20:112–37.
Kirimoto H, Ogata K, Onishi H, Oyama M, Goto Y, Tobimatsu S. Transcranial direct current stimulation over the motor association cortex induces plastic changes in ipsilateral primary motor and somatosensory cortices. Clin Neurophysiol. 2011;122(4): 777–83.
Kober H, Lacadie CM, Wexler BE, Malison RT, Sinha R, Potenza MN. Brain activity during cocaine craving and gambling urges: an fMRI study. Neuropsychopharmacology. 2016;41:628–37.
Koehler PJ, Boes CJ. A history of non-drug treatment in headache, particularly migrane. Brain. 2010;133:2489–500.
Leduc S. Production de sommeil et anesthésie generale et locale par courant intermittent de bas voltage. Arch Electron Med. 1902;10:617–21.
Licht S. History of electrotherapy. 3rd ed. Baltimore, MD: Williams & Wilkins; 1983.
Lin Y-N, Hu C-J, Chi J-Y, Lin L-F, Yen T-H, Lin Y-K, et al. Effects of repetitive transcranial magnetic stimulation of the unaffected hemisphere leg motor area in patients with subacute stroke and substantial leg impairment: a pilot study. J Rehabil Med. 2015;47(4):305–10.
Lolas F. Brain polarization: behavioural and therapeutic effects. Biol Psychiatry. 1977;12:37–47.
Matteucci C. Note sur un phénomène très curieux produit sur un malade affecté de paralysie, par un courant

électrique très faible. Ann Méd Psychol. 1843;2:128.
McWhirter L, Carson A, Stone J. The body electric: a long view of electrical therapy for functional neurological disorders. Brain. 2015;138:1113–20.
Meinzer M, Antonenko D, Lindenberg R, Hetzer S, Ulm L, Avirame K, et al. Electrical brain stimulation improves cognitive performance by modulating functional connectivity and task-specific activation. J Neurosci. 2012;32(5):1859–66.
Miranda PC, Faria P, Hallett M. What does the ratio of injected current to electrode area tell us about current density in the brain during tDCS? Clin Neurophysiol. 2009;120(6):1183–7.
Moliadze V, Schmanke T, Andreas S, Lyzhko E, Freitag CM, Siniatchkin M. Stimulation intensities of transcranial direct current stimulation have to be adjusted in children and adolescents. Clin Neurophysiol. 2015;126(7):1392–9.
Moreno-Duarte I, Morse LR, Alam M, Bikson M, Zafonte R, Fregni F. Targeted therapies using electrical and magnetic neural stimulation for the treatment of chronic pain in spinal cord injury. Neuroimage. 2014;85(Pt 3):1003–13.
Moret, B., Donato, R., Nucci, M. et al. Transcranial random noise stimulation (tRNS): a wide range of frequencies is needed for increasing cortical excitability. Sci Rep 9, 15150 (2019). https://doi.org/10.1038/s41598-019-51553-7
Nitsche MA, Nitsche MS, Klein CC, Tergau F, Rothwell JC, Paulus W. Level of action of cathodal DC polarisation induced inhibition of the human motor cortex. Clin Neurophysiol. 2003;114(4):600–4.
Nitsche MA, Paulus W. Excitability changes induced in the human motor cortex by weak transcranial direct current stimulation. J Physiol. 2000;527:633–9.
Nitsche MA, Paulus W. Transcranial direct current stimulation—update 2011. Restor Neurol Neurosci. 2011;29(6):463–92.
Oostendorp TF, Hengeveld YA, Wolters CH, Stinstra J, van Elswijk G, Stegeman DF. Modeling transcranial DC stimulation. Conf Proc IEEE Eng Med Biol Soc. 2008;2008:4226–9.
Parazzini M, Fiocchi S, Ravazzani P. Electric fi eld and current density distribution in an anatomical head model during transcranial direct current stimulation for tinnitus treatment. Bioelectromagnetics. 2012;33(6):476–87.
Parent A. Giovanni Aldini: from animal electricity to human brain stimulation. Can J Neurol Sci. 2004;31:576–84.
Parent A. Giovanni Aldini: from animal electricity to human brain stimulation. Can J Neurol Sci. 2004;31:576–84.
Passione R. Italian psychiatry in an international context: Ugo Cerletti and the case of electroshock. Hist Psychiatry. 2004;15:83–104
Peña-Gómez C, Sala-Lonch R, Junqué C, Clemente IC, Vidal D, Bargalló N, et al. Modulation of large-scale brain networks by transcranial direct current stimulation evidenced by resting-state functional MRI. Brain Stimul. 2012;5(3):252–63.
Piccolino M. Luigi Galvani and animal electricity: two centuries after the foundation of electrophysiology. Trends Neurosci. 1997;20:443–8.
prefrontal cortex enhances working memory. Exp Brain Res. 2005;166(1):23–30.
Priori A, Berardelli A, Rona S, Accornero N, Manfredi M. Polarization of the human motor cortex through the scalp. Neuroreport. 1998;9:2257–60.
Pulver SE. The fi rst electroconvulsive treatment given in the United States. Am J Psychiatry. 1961;117:845–6.
Purpura DP, McMurtry JG. Intracellular activities and evoked potential changes during polarization of motor cortex. J Neurophysiol. 1965;28:166–85.
Reato D, Rahman A, Bikson M, Parra LC. Lowintensity electrical stimulation affects network dynamics by modulating population rate and spike timing. J Neurosci. 2010;30:15067–79.
Redfearn JW, Lippold OC, Costain R. A preliminary account of the clinical effects of polarizing the brain in certain paychiatric disorders. Br J Psychiatry. 1964;110:773–85.
Romero Lauro LJ, Rosanova M, Mattavelli G, Convento S, Pisoni A, Opitz A, et al. TDCS increases cortical excitability: direct evidence from TMSEEG. Cortex. 2014;58:99–111.
Ruffi ni G, Wendling F, Merlet I, Molaee-Ardekani B, Mekonnen A, Salvador R, et al. Transcranial current brain stimulation (tCS): models and technologies. IEEE Trans Neural Syst Rehabil Eng. 2013;21(3):333–45.
Ruffini G, Fox MD, Ripolles O, Miranda PC, Pascual-Leone A. Optimization of multifocal transcranial current stimulation for weighted cortical pattern targeting from realistic modeling of electric fields. Neuroimage. 2014;89:216–25.
Schutter DJLG, Hortensius R. Brain oscillations and frequency-dependent modulation of cortical excitability.

Brain Stimul. 2011;4(2):97–103.
Schwalb JM, Hamani C. The history and future of deep brain stimulation. Neurotherapeutics. 2008;5:3–13.
Sela T, Lavidor M. High-level cognitive functions in healthy subjects. In: Sela T, Lavidor M, editors. The stimulated brain. New York, NY: Elsevier; 2014. p. 299–329.
Shin YI, Foerster A, Nitsche MA. Transcranial direct current stimulation (tDCS) – application in neuropsychology. Neuropsychologia. 2015;69:154–75.
Stainbrook E. The use of electricity in psychiatry treatment during the nineteenth century. Bull Hist Med. 1948;22:156–77.
Steinberg H. Transcranial direct current stimulation (tDCS) has a history reaching back to the 19th century. Psychol Med. 2013;43:669–71.
Stillings D. A survey of the history of electrical stimulation for pain to 1900. Med Instrum. 1975;9:255–9.
Stone DB, Tesche CD. Transcranial direct current stimulation modulates shifts in global/local attention. Neuroreport. 2009;20(12):1115–9.
Tatu L, Bogousslavsky J, Moulin T, Chopard JL. The 'torpillage' neurologists of World War I: electric therapy to send hysterics back to the front. Neurology. 2010;75:279–83.
Terzuolo CA, Bullock TH. Measurement of imposed voltage gradient adequate to modulate neuronal firing. Proc Natl Acad Sci U S A. 1956;42:687–94.
Thielscher A, Antunes A, et al. Field modeling for transcranial magnetic stimulation: a useful tool to understand the physiological effects of TMS? 2015 37th annual international conference of the IEEE engineering in medicine and biology society (EMBC). 2015.
Vincent A, Lahr BD, Wolfe F, Clauw DJ, Whipple MO, Oh TH, et al. Prevalence of fibromyalgia: a population- based study in Olmsted County, Minnesota, utilizing the Rochester Epidemiology Project. Arthritis Care Res (Hoboken). 2013;65(5):786–92.
Wach C, Krause V, Moliadze V, Paulus W, Schnitzler A, Pollok B. Effects of 10 Hz and 20 Hz transcranial alternating current stimulation (tACS) on motor functions and motor cortical excitability. Behav Brain Res. 2013;241:1–6.
Wesley, J. The Desideratum; or, Electricity Made Plain and Useful - By a Lover of Mankind, and of Common Sense.London, Balliére, Tindall & Cox, 1759.