

Table ST1: List of publications related to keratinocyte electrotaxis. PubMed search: "Keratinocytes AND (electrotaxis OR galvanotaxis OR electric field)

	Title	Year	Stimulation paradigm	EF in mV/mm	Cell type	Research type	Focus	Modified parameters	Reference
1	Parting the cellular sea: electrotaxis evoked directional separation of co-cultured keratinocytes and fibroblasts	2023	DC	50,100,200,400	Human Dermal Fibroblasts	Cell migration Co-culture with keratinocytes	Engineering/ Biology	EF strength EF direction Cell Media + co-culture with keratinocytes	This Manuscript
2	Bioelectronic microfluidic wound healing: a platform for investigating direct current stimulation of injured cell collectives.	2023	DC	200	Primary Human Keratinocytes - monolayer	Wound closure	Engineering	EF direction Media composition (diabetes)	Lab Chip. 2023 Mar 14;23(6):1531-1546. doi: 10.1039/d2lc01045c.
3	Engineering diabetic human skin equivalent for in vitro and in vivo applications.	2022	DC	20, 40	Diabetic Keratinocytes & Fibroblasts - engineered tissue	Cell activity & proliferation	Engineering	EF strength	Front Bioeng Biotechnol. 2022 Sep 30;10:989888. doi:10.3389/fbioe.2022.989888. eCollection 2022.
4	Come together: On-chip bioelectric wound closure	2021	DC	200	Primary Human Keratinocytes - monolayer	Wound closure	Engineering		Biosens Bioelectron. 2021 Nov 15;192:113479. doi: 10.1016/j.bios.2021.113479. Epub 2021 Jul 8.
5	Overriding native cell coordination enhances external programming of collective cell migration	2021	DC	200	Primary Mouse Keratinocytes - monolayer	Monolayer migration	Biology	Ca2+ concentration Anti-E Cadherin antibody (DECMA) BAPTA	Proc Natl Acad Sci U S A. 2021 Jul 20;118(29):e2101352118. doi: 10.1073/pnas.2101352118
6	SCHPEPDOG: Programming Electric Cues to Dynamically Herd Large-Scale Cell Migration	2020	DC	200	Primary Human Keratinocytes - monolayer	Cell control in EF	Engineering	EF direction in X and Y	Cell Syst. 2020 Jun 24;10(6):506-514.e3. doi: 10.1016/j.cels.2020.05.009. Epub 2020 Jun
7	Electric field down-regulates CD9 to promote keratinocytes migration through AMPK pathway.	2020	DC	200	HaCaT Keratinocytes - single cells	EF influence on genetics	Biology	CD9 overexpression	Int J Med Sci. 2020 Mar 15;17(7):865-873. doi: 10.7150/ijms.42840. eCollection 2020
8	Keratinocyte electrotaxis induced by physiological pulsed direct current electric fields.	2019	Pulsed DC	150	Primary Mouse Keratinocytes - single cells	EF influence on electrotaxis	Biology		Bioelectrochemistry. 2019 Jun;127:113-124. doi: 10.1016/j.bioelechem.2019.02.001. Epub 2019 Feb 14.
9	Electric field-induced migration and intercellular stress alignment in a collective epithelial monolayer.	2018	DC	50	HaCaT Keratinocytes - monolayer	Monolayer migration	Biology	EF directedness	Mol Biol Cell. 2018 Sep 15;29(19):2292-2302. doi: 10.1091/mbc.E18-01-0077. Epub 2018 Jul 25.
10	Electric field-induced suppression of PTEN drives epithelial-to-mesenchymal transition via mTORC1 activation.	2017	DC	100	Primary Human Keratinocytes - monolayer	Wound closure	Biology	Transfection with PTEN	J Dermatol Sci. 2017 Feb;85(2):96-105. doi:10.1016/j.jdermsci.2016.11.007. Epub 2016 Nov 18.
11	Kindlin-1 Regulates Keratinocyte Electrotaxis.	2016	DC	50, 100, 200	Immortalized Human Keratinocytes - FERMT1mutated	Influence of Kindlin 1 on EF sensing	Biology	Presence of Kindlin 1	J Invest Dermatol. 2016 Nov;136(11):2229-2239. doi:10.1016/j.jid.2016.05.129. Epub 2016 Jul 15.
12	Spontaneous and electric field-controlled front-rear polarization of human keratinocytes.	2015	DC	100	Immortalized Human Keratinocytes - single cells	Cell polarization	Biology	pH Suramin - Suramin, PTX, PPADS, Gallein	Mol Biol Cell. 2015 Dec 1;26(24):4373-86. doi: 10.1091/mbc.E14-12-1580. Epub 2015 Sep 30.
13	ATP Release and P2 Y Receptor Signaling are Essential for Keratinocyte Galvanotaxis.	2016	DC	100	Primary Human Keratinocytes - single cells	Influence of ATP on EF sensing	Biology	Suramin P2Y receptor	J Cell Physiol. 2016 Jan;231(1):181-91. doi: 10.1002/jcp.25070.
14	The Galvanotactic Migration of Keratinocytes is Enhanced by Hypoxic Preconditioning.	2015	DC	25, 50, 100, 200	Primary Mouse Keratinocytes - single cells + monolayers	Influence of Oxygen + EF	Biology	oxygen saturation	Sci Rep. 2015 May 19;5:10289. doi: 10.1038/srep10289.
15	Improvement of human keratinocyte migration by a redox active bioelectric dressing.	2014	DC	≤ 270	HaCaT Keratinocytes - monolayer	Influence of EF on electrotaxis + H2O2	Engineering/ Biology	Number of Ag/Zn dots	PLoS One. 2014 Mar 3;9(3):e82939. doi: 10.1371/journal.pone.0089239. eCollection 2014.
16	The epithelial sodium channel mediates the directionality of galvanotaxis in human keratinocytes.	2013	DC	100	Human Keratinocytes Mouse Keratinocytes aENaC	Influence of ENaC on EF sensing	Biology	Suppression or expression of ENaC	J Cell Sci. 2013 May 1;126(Pt 9):1942-51. doi: 10.1242/jcs.113225. Epub 2013 Feb 27.
17	Keratinocyte galvanotaxis in combined DC and AC electric fields supports an electromechanical transduction sensing mechanism.	2013	DC + AC	100 (DC) 40 (AC) 1.6,160 Hz	Primary Human Keratinocytes - single cells	Electromechanical sensing of EF	Biology	AC frequency + AC-DC superposition	Bioelectromagnetics. 2013 Feb;34(2):85-94. doi: 10.1002/bem.21748. Epub 2012 Aug 21.
18	Human keratinocytes respond to direct current stimulation by increasing intracellular calcium: preferential response of poorly differentiated cells.	2012	DC	200 100,200,400,900	Primary Human Keratinocytes - monolayer	Influence of EF on intracellular Ca2+	Biology	Ca2+ concentration Voltage Gated Ca2+ Channels blockers	J Cell Physiol. 2012 Jun;227(6):2660-7. doi: 10.1002/jcp.23008.
19	Electrical signals control wound healing through phosphatidylinositol-3-OH kinase-γ and PTEN	2006	DC	100, 150, 200	Primary Mouse Keratinocytes - monolayer Ex vivo cornea cultures	Influence of EF on PI3K and PTEN on EF sensign	Biology		Nature. 2006 Jul 27;442(7101):457-60. doi: 10.1038/nature04925.
20	beta4 integrin and epidermal growth factor coordinately regulate electric field-mediated directional migration via Rac1.	2006	DC	100	Primary Human Keratinocytes - single cells Keratinocytes lacking beta4 integrin	Influence of beta4 integrin in EF sensing	Biology	Retroviral transduction to express or not beta 4	Mol Biol Cell. 2006 Nov;17(11):4925-35. doi: 10.1091/mbc.e06-05-0433. Epub 2006 Aug 16.
21	The Ras/Raf-1/MEK1/ERK signaling pathway coupled to integrin expression mediates cholinergic regulation of keratinocyte directional migration.	2005	DC	100	Human Keratinocytes - single cells	Influence of various signaling pathways on cellular orientation in an EF	Biology	Chemotaxis Galvanotropism Activated pathway	J Biol Chem. 2005 Nov 25;280(47):39220-8. doi: 10.1074/jbc.M504407200. Epub 2005 Sep 8.

22	Cyclic AMP mediates keratinocyte directional migration in an electric field.	2005	DC	100	Human Keratinocytes - single cells	Importance of cyclic AMP on electrotaxis	Biological	AMP agonists / antagonists beta2-AR, sp-cAMP, pertussis toxin, forskolin	J Cell Sci. 2005 May 1;118(Pt 9):2023-34. doi: 10.1242/jcs.02330. Epub 2005 Apr 19.
23	Calcium channel blockers inhibit galvanotaxis in human keratinocytes.	2002	DC	100	Human Keratinocytes - single cells	Influence of Ca ²⁺ in Electrotaxis	Biological	Ca ²⁺ channel blockers amiloride, verapamil, galdolinium chloride, strontium chloride, nickel chloride	J Cell Physiol. 2002 Oct;193(1):1-9. doi: 10.1002/jcp.10144.
24	Cyclic AMP-dependent protein kinase A plays a role in the directed migration of human keratinocytes in a DC electric field.	2001	DC	100	Human Keratinocytes - single cells	Influence of cyclic AMP on electrotaxis	Biological	Concentration of kinase inhibitor KTS720, W-7, Sphingosine, GF109203X, ML-7, H-7	Cell Motil Cytoskeleton. 2001 Dec;50(4):207-17. doi: 10.1002/cm.10009.
25	Epidermal growth factor receptor relocation and kinase activity are necessary for directional migration of keratinocytes in DC electric fields	1999	DC	100	Human Keratinocytes - single cells	Effects of protein tyrosine kinase inhibitors on electrotaxis	Biological	Type and concentration of kinase inhibitor PD158780, Genistein, Lavendustin A, Tyrphostin B4	J Cell Sci. 1999 Jun;112 (Pt 12):1967-78. doi: 10.1242/jcs.112.12.1967.
26	Involucrin-positive keratinocytes demonstrate decreased migration speed but sustained directional migration in a DC electric field.	1999	DC	100	Human Keratinocytes - single cells	Influence of involucrin expression on EF sensing	Biological	Involucrin positive vs negative	J Invest Dermatol. 1999 Nov;113(5):851-855. doi: 10.1046/j.1523-1747.1999.00763.x.
27	Migration of human keratinocytes in electric fields requires growth factors and extracellular calcium.	1998	DC	100	Human Keratinocytes - single cells	Influence of extracellular Ca ²⁺ and growth factors on electrotaxis	Biological	Concentration of: HKGS, EGF, Insulin, BPE	J Invest Dermatol. 1998 Nov;111(5):751-6. doi: 10.1046/j.1523-1747.1998.00366.x.
28	Imposition of a physiologic DC electric field alters the migratory response of human keratinocytes on extracellular matrix molecules.	1996	DC	100, 400	Human Keratinocytes - single cells	Influence of extracellular matrix on electrotaxis	Biological	Type of substrate coating collagen I, collagen IV, fibronectin, laminin, plastic	J Invest Dermatol. 1996 Apr;106(4):642-6. doi: 10.1111/1523-1747.ep12345456.
29	Human keratinocytes migrate to the negative pole in direct current electric fields comparable to those measured in mammalian wounds.	1996	DC	10,20,50,100,200,400	Human Keratinocytes - single cells	Influence of EF magnitude on cell migration	Biological	EF magnitude	J Cell Sci. 1996 Jan;109 (Pt 1):199-207. doi: 10.1242/jcs.109.1.199.

Table ST2: List of publications related to fibroblast electrotaxis. PubMed search: "Dermal Fibroblasts AND (electrotaxis OR galvanotaxis OR electric field)

	Title	Year	Stimulation paradigm	EF in mV/mm	Cell type	Research type	Focus	Modified parameters	Reference
1	Parting the cellular sea: electrotaxis evoked directional separation of co-cultured keratinocytes and fibroblasts	2023	DC	50,100,200,400	Human Dermal Fibroblasts	Cell migration Co-culture with keratinocytes	Engineering/ Biology	EF strength EF direction Cell Media + co-culture with keratinocytes	This Manuscript
2	Pulse Capacitive Coupling Electric Field Regulates Cell Migration, Proliferation, Polarization, and Vascularization to Accelerate Wound Healing.	2023	Pulsed capacitive coupling EF	54 @ 60Hz	Human Dermal Fibroblasts Primary Keratinocytes	Cell migration	Engineering		Adv Wound Care (New Rochelle). 2023 Jan 18. doi: 10.1089/wound.2021.0194. Online ahead of print.
3	Electrical Shunting Prevents the Decline of Galvanotaxis After Monophasic Pulsed Microcurrent Stimulation in Human Dermal Fibroblasts.	2022	DC with shunt	N/A	Primary Human Dermal Fibroblasts	Cell migration	Engineering	Stimulation current +100, 200, 400 µA	Eplasty, 22, e27.
4	A pulsed current electric field alters protein expression creating a wound healing phenotype in human skin cells.	2020	DC Pulsed DC	100 50 mA 128 Hz	Human Dermal Fibroblasts Normal Keratinocytes Microvascular Endothelial cells	Cell Migration Cell Proliferation Gene Expression	Engineering	DC vs Pulsed DC	Regen Med. 2020 May;15(5):1611-1623. doi: 10.2217/rme-2019-0087. Epub 2020 Jul 7.
5	Monophasic Pulsed 200-µA Current Promotes Galvanotaxis With Polarization of Actin Filament and Integrin α2β1 in Human Dermal Fibroblasts.	2016	Monophasic pulsed micro current	N/A	Human Dermal Fibroblasts	Cell Migration Cell Proliferation	Engineering/ Biology	Stimulation current +100, 200, 300 µA	Eplasty. 2016 Jan 19;16:e6. eCollection 2016.
6	Golgi polarization plays a role in the directional migration of neonatal dermal fibroblasts induced by the direct current electric fields.	2015	DC	100	Human Dermal Fibroblasts	Cell migration influence of Golgi polarization on EF sensing	Biology	Influence of Brefeldin A (BFA)	Biochem Biophys Res Commun. 2015 May 1;460(2):255-60. doi: 10.1016/j.bbrc.2015.03.021. Epub 2015 Mar 13
7	Correlation between cell migration and reactive oxygen species under electric field stimulation	2015	DC	100, 200, 400	NIH 3T3 fibroblasts	Cell migration influence of ROS	Engineering/ Biology	EF strength addition of beta-lapachone	Biomedfluidics. 2015 Oct 6;9(5):054120. doi: 10.1063/1.4932662.
8	Calcium Ion Flow Permeates Cells through SOCs to Promote Cathode-Directed Galvanotaxis	2015	DC Pulsed DC	500	Mouse Dermal Fibroblasts	Cell Migration Ca ²⁺ flow	Engineering/ Biology	Ion flow at different EF strengths Pulse frequency -0.1, 10, 1000 Hz Duty cycle - 50%, 75%	PLoS One. 2015 Oct 8;10(10):e0139865. doi: 10.1371/journal.pone.0139865.
9	Control of neonatal human dermal fibroblast migration on poly(lactic-co-glycolic acid)-coated surfaces by electrotaxis.	2015	DC	50, 100, 150, 200	Human Dermal Fibroblasts	Cell Migration	Biology	Coating of surface with PLGA EF intensity, EF direction	J. Tissue Eng Regen Med. 2017 Mar;11(3):862-868. doi: 10.1002/term.1986. Epub 2015 Jan 28.
10	Collaborative effects of electric field and fluid shear stress on fibroblast migration.	2013	DC	50, 100, 200	Human Dermal Fibroblasts	Cell Migration	Engineering	EF strength Fluid shear velocity	Lab Chip. 2013 Apr 21;13(8):1602-11. doi: 10.1039/c3lc41240g.
11	Regeneration and control of human fibroblast cell density by intermittently delivered pulsed electric fields.	2013	Pulsed DC	150 1 Hz	Human Dermal Fibroblasts	Cell Proliferation	Engineering/ Biology	Number of stimulation pulses	Biotechnol Bioeng. 2013 Jun;110(6):1759-68. doi: 10.1002/bit.24831. Epub 2013 Mar 4.
12	Optimum microcurrent stimulation intensity for galvanotaxis in human fibroblasts.	2012	Monophasic pulsed micro current	N/A	Human Dermal Fibroblasts	Cell Migration	Engineering/ Biology	Stimulation Current +50, 100 µA @ 0.3 Hz, 250 ms	J Wound Care. 2012 Jan;21(1):5-6, 8,10; discussion 10-1. doi: 10.12968/jowc.2012.21.Sup9.S5.
13	Effects of physiological electric fields on migration of human dermal fibroblasts.	2010	DC	50, 100, 400	Human Dermal Fibroblasts Primary Dermal Fibroblasts	Cell Migration	Biology	EF strength PI3K inhibition - LY294002	J Invest Dermatol. 2010 Sep;130(9):2320-7. doi: 10.1038/jid.2010.96. Epub 2010 Apr 22.
14	Human dermal fibroblasts do not exhibit directional migration on collagen I in direct-current electric fields of physiological strength.	2003	DC	100	Human Dermal Fibroblasts	Cell Migration	Biology	Cell media Keratinocyte Media, Serum containing media (SM), High Mg ²⁺ media (HM)	Exp Dermatol. 2003 Aug;12(4):396-402. doi: 10.1034/j.1600-0625.2002.120406.x.
15	Electric fields and proliferation in a chronic wound model.	1996	AC	0.02 - 1	Human Dermal Fibroblasts in collagen matrix (3D)	Cell Proliferation DNA changes	Biology	EF strength frequency - 10, 100 Hz	Bioelectromagnetics. 1996;17(6):450-7. doi: 10.1002/(SICI)1521-186X(1996)17:6<450::AID-BEM4>3.0.CO;2-2