Supplement 2: Influence of different forms of cellular work on hallmarks of cancer.

Hallmarks of cancer cells	Synthesis/degradation catalysis	Concentration work	Electrical work	Mechanical work
Immortality	Cagatay Gunesb, Alush Irene Avilaa, K. Lenhard Rudolpha. **Telomeres in cancer.** Differentiation 99, 41–50 (2018). https://doi.org/10.1016/j.diff.2017.12.004 Lifeng Xu, Shang Li, Bradley A Stohr. **The Role of Telomere Biology in Cancer.** Annu Rev Pathol Mech Dis 8, 1, (2012). DOI: 10.1146/annurev-pathol-020712-164030	Natalia Prevarskaya, Roman Skryma, Yaroslav Shuba. **Ion channels and the hallmarks of cancer.** Trends Mol Med., 16(3):107-21 (2010). doi: 10.1016/j.molmed.2010.01.005. *Ion channels have a decisive influence on signal transmission and can simulate mutational effects in signaling cascades. They have an influence on **all** hallmarks and characteristics of cancer cells.*		
Continued proliferation	Weinberg Robert. **The biology of cancer.** Second Edition, Garland Science. (2014). ISBN: 978-0-0153-4219-9 Li-Hui Wanga Chun-Fu Wua Nirmal Rajasekaranb Young Kee Shinb. **Loss of Tumor Suppressor Gene Function in Human Cancer: An Overview.** Cell Physiol Biochem. 51:2647-2693 (2018). DOI: 10.1159/000495956 Gimple RC and Wang X. **RAS Striking at the Core of the Oncogenic Circuitry**. Front. Oncol. 9:965. (2019). doi: 10.3389/fonc.2019.00965 T. Zhan, N. Rindtorff and M. Boutros. **Wnt signaling in cancer.** Oncogene 36, 1461–1473, (2017). doi:10.1038/onc.2016.304	Donna Dang, RajiniRao. **Calcium-ATPases: Gene disorders and dysregulation in cancer.** Biochimica et Biophysica Acta (BBA) - Molecular Cell Research, Vol. 1863, 6, Part B, 1344-1350 (2016) https://doi.org/10.1016/j.bbamcr.2015.11.016 Litan A and Langhans SA. **Cancer as a channelopathy: ion channels and pumps in tumor development and progression.** Front. Cell. Neurosci. 9:86. (2015). doi: 10.3389/fncel.2015.00086 Litan A and Langhans SA. **Cancer as a channelopathy: ion channels and pumps in tumor development and progression.** Front. Cell. Neurosci. 9:86. (2015). doi: 10.3389/fncel.2015.00086 Swietach P, Vaughan-Jones, RD, Harris AL, Hulikova A. **The chemistry, physiology and pathology of pH in cancer.** Phil. Trans. R. Soc. B 369: 20130099. (2014). http://dx.doi.org/10.1098/rstb.2013.0099 Natalia Prevarskaya, Roman Skryma, Yaroslav Shuba. **Ion channels and the hallmarks of cancer.** Trends Mol Med., 16(3):107-21 (2010). doi: 10.1016/j.molmed.2010.01.005. Epub 2010 Feb 16. Zoltán Pethő, Karolina Najder, Etma rBulk, Albrecht Schwab. **Mechanosensitive ion channels push cancer progression.** Cell Calcium, Vol. 80, 79-90. (2019). doi.org/10.1016/j.ceca.2019.03.007	Chiara Galber, Manuel Jesus Acosta, Giovanni Minervini and Valentina Giorgio. **The role of mitochondrial ATP synthase in cancer.** Biological Chemistry, 401:11, 1199–1214 (2020). doi.org/10.1515/hsz-2020-0157 Laura Stransky, Kristina Cotter and Michael Forgac. **The Function of V-ATPases in Cancer.** Pysiol. Rev. Vol. 96, 3, 1071-1091 (2016). doi.org/10.1152/physrev.00035.2015	Sneeggen M, Guadagno NA and Progida C. **Intracellular Transport in Cancer Metabolic Reprogramming.** Front. Cell Dev. Biol. 8:597608 (2020). doi: 10.3389/fcell.2020.597608 Benjamin L Ricca, Gautham Venugopalan, Saori Furuta, Kandice Tanner, et al. **Transient external force induces phenotypic reversion of malignant epithelial structures via nitric oxide signaling.** eLIFE (2018). eLife 2018;7:e26161 doi: 10.7554/eLife.26161 Humphrey, J., Dufresne, E. & Schwartz, M. **Mechanotransduction and extracellular matrix homeostasis.** Nat Rev Mol Cell Biol 15, 802–812 (2014). doi.org/10.1038/nrm3896 Elster JD, McGuire TF, Lu J, Prochownik EV. **Rapid In Vitro Derivation of Endothelium Directly from Human Cancer Cells.** PLoS ONE 8(10): e77675. (2013). doi:10.1371/journal.pone.0077675 Butcher DT, Alliston T, Weaver VM. **A tense situation: forcing tumour progression.** Nat Rev Cancer. 9(2):108-122. (2009) doi:10.1038/nrc2544 Sui Huang and Donald E. Ingber. **Cell tension, matrix mechanics, and cancer development.** Cancer Cell, Vol. 8, 3, 175-176 (2005). doi.org/10.1016/j.ccr.2005.08.009 Schwartz, L., da Veiga Moreira, J. and Jolicoeur, M. (2018), **Physical forces modulate cell differentiation and proliferation processes.** J. Cell. Mol. Med., 22: 738-745. https://doi.org/10.1111/jcmm.13417
Circumventing physiological cell death	Weinberg Robert. **The biology of cancer.** Second Edition, Garland Science. (2014) ISBN: 978-0-0153-4219-9 Li-Hui Wanga Chun-Fu Wua Nirmal Rajasekaranb Young Kee Shinb. **Loss of Tumor Suppressor Gene Function in Human Cancer: An Overview.** Cell Physiol Biochem. 51:2647-2693 (2018). DOI: 10.1159/000495956	Donna Dang, RajiniRao. **Calcium-ATPases: Gene disorders and dysregulation in cancer.** Biochimica et Biophysica Acta (BBA) - Molecular Cell Research, Vol. 1863, 6, Part B, 1344-1350 (2016) doi.org/10.1016/j.bbamcr.2015.11.016 Litan A and Langhans SA. **Cancer as a channelopathy: ion channels and pumps in tumor development and progression.** Front. Cell. Neurosci. 9:86 (2015). doi: 10.3389/fncel.2015.00086 Natalia Prevarskaya, Roman Skryma, Yaroslav Shuba. **Ion channels and the hallmarks of cancer.** Trends Mol Med., 16(3):107-21 (2010). doi: 10.1016/j.molmed.2010.01.005. Epub 2010 Feb 16.	Chiara Galber, Manuel Jesus Acosta, Giovanni Minervini and Valentina Giorgio. **The role of mitochondrial ATP synthase in cancer.** Biological Chemistry, 401:11, 1199–1214 (2020) DOI: https://doi.org/10.1515/hsz-2020-0157 Laura Stransky, Kristina Cotter and Michael Forgac. **The Function of V-ATPases in Cancer. Pysiol. Rev.** Vol. 96, 3, 1071-1091 (2016). doi.org/10.1152/physrev.00035.2015 Evangelos Giampazolias and Stephen W.G. Tait. **Mitochondria and the hallmarks of cancer.** FEBS Journal 283 803–814 (2016) doi:10.1111/febs.13603	Cheng G, Tse J, Jain RK, Munn LL. **Micro-Environmental Mechanical Stress Controls Tumor Spheroid Size and Morphology by Suppressing Proliferation and Inducing Apoptosis in Cancer Cells.** PLoS ONE 4(2): e4632 (2009). doi:10.1371/journal.pone.0004632 Chartier, N.T., Mukherjee, A., Pfanzelter, J. et al. **A hydraulic instability drives the cell death decision in the nematode germline.** Nat. Phys. 17, 920–925 (2021). https://doi.org/10.1038/s41567-021-01235-x
Circumventing growth suppression	Weinberg Robert. **The biology of cancer.** Second Edition, Garland Science. (2014). ISBN: 978-0-0153-4219-9 Li-Hui Wanga Chun-Fu Wua Nirmal Rajasekaranb Young Kee Shinb. **Loss of Tumor Suppressor Gene Function in Human Cancer: An Overview.** Cell Physiol Biochem. 51:2647-2693 (2018). DOI: 10.1159/000495956	Donna Dang, RajiniRao. **Calcium-ATPases: Gene disorders and dysregulation in cancer.** Biochimica et Biophysica Acta (BBA) - Molecular Cell Research. Vol. 1863, 6, Part B, 1344-1350 (2016). https://doi.org/10.1016/j.bbamcr.2015.11.016 Litan A and Langhans SA. **Cancer as a channelopathy: ion channels and pumps in tumor development and progression.** Front. Cell. Neurosci. 9:86. (2015). doi: 10.3389/fncel.2015.00086		
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Legend: Compilation of publications in which it is shown that the individual forms of cellular work are causally or indirectly involved in the development or manifestation of cancer indicators.