



Cancer: An Electrically Mediated Dysfunction in the Body

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Cancer is an electrical fault. The voltage across the membrane has to be corrected for the replication of mutating cells to be stopped. The only way to stop cancer is to change the behavior of the cells. Trying to kill cells is a haphazard process with drastic side effects. Like the several systems that exist in the human body, Cancer with its own boundaries may also be considered one such system. Fundamental to this is the cell membrane which separates the internal and external milieu of the cell and interacts with biomechanical, biochemical, and bioelectrical gradients, all of which affect the gene regulatory networks. While the mutation centered models of cancer have dominated our understanding, the importance of the cellular environment is now gaining ground. Cancer is now to be viewed as a developmental disorder of cell regulation, where there is a loss of the organizational capacity of the surrounding environment [1]. That Cancer is a result of bioelectric dysfunction had been proposed by several proponents during the Seventies and Eighties [2, 3]. The membrane potential is critical for many other processes including cell cycle, cell-volume control, proliferation, muscle contraction (even in the absence of an action potential), and wound healing [4] and is highly correlated with mitosis, DNA synthesis, cell cycle progression and overall proliferation in general [5, 6]. Cancer cells exhibit different electrochemical properties and a different distribution of electrical charges than normal tissues [7, 8] as the composition of the membrane proteins become different in cancer cells than normal cells. This directly influences the 'fluidity, permeability and conductivity of the membrane. Lipid peroxidation due to increased production of reactive oxygen species contributes to increased permeability and membrane degeneration which then result in compensatory increase in saturated fatty acids in the membrane [9, 10]. The altered membrane composition and structure of the cancer cells make it more permeable resulting in the moving out of potassium, magnesium and calcium and the corresponding inflow of sodium and



water [11] which produce biochemical changes inside of the cells. The result of these mineral movements, membrane composition changes, energy abnormalities, and membrane charge distribution abnormalities is a drop in the normal membrane potential and a change in membrane capacitance [12, 13, 14, 15]. Regulation of mineral ion concentrations on both sides is an important boundary function of the membrane [16]. The metabolic functions as well as the membrane potential of the cell are affected by the passage of these ions. The dielectric property of the membrane is the key to establish the presence of electric circuits in biological tissues. Membrane potentials play a central role in cellular proliferation. The electrical conductivity and permittivity of cancerous tissue have been found to be greater than that of normal tissue [17]. Most cancers possess an excess of fixed electronegative charges on their surfaces [2]. In fact, tumors were detected based on voltmeter readings [18, 19] and treated to a degree with micro electric currents given directly to the tumor areas [3]. External manipulation of the membrane potentials as possible treatment for cancers led to *in vitro* transformation of cervical squamous cells to pluripotent cells or stem cell like cells [20]. Semiconducting proteins and extracellular matrix proteoglycans and their associated electrical charges contribute to the innate conductivity of a tissue. The degree of tissue acidity, tissue hypoxia, availability of electron donors such as antioxidants, and the presence of electrophilic compounds on the cell membrane and in the extracellular matrix all affect the electrical properties of tissues. The increased conductivity of cancer cells can be attributed to all of the above. Negatively charged molecules such as phosphatidylserine, heparin sulfate and sialic acid are more abundant on cancer cell membrane surfaces compared to normal cells. The negative charge is also augmented because cancer cells have more microvilli creating a larger surface area than normal cells. These charges create an electrical defense shield, provide a protective barrier against

the immune system and facilitate migration and invasion [21]. Because immune defense cells such as NK cells and macrophages also have a negative surface charge, these cells are repulsed by the strong negative electrical field of cancer cells when they try to approach and terminate cancer cells [8, 22, 23]. Because cancerous cells demonstrate greater permittivity, which is the ability to resist the formation of an electrical field they will respond to external electrical fields differently from normal cells. Healthy cells have a membrane potential of about -60 to -100mV . When cancer cells begin cell division and DNA synthesis the membrane potential falls to around -15mv . Since the membrane potential in a cancer cell is consistently weaker than the membrane potential of a healthy cell, the electrical field across the membrane of a cancer cell will be reduced. The reduction in membrane electrical field strength will in turn cause alterations in the metabolic functions of the cell. Exposure to electric and electromagnetic fields affect the membrane potentials of cells and depending on the quantity of exposure, the field strength and frequency. The changes can be temporary or permanent to the cell resulting in alteration of the cell membrane composition, the ionic composition, biochemical influx and efflux and metabolic functions. The result is the abnormal cell and the conglomeration of diseases called CANCER.

In conclusion, Antoine Beauchamp "the biological terrain of the being is the cause of disease" is the view to go.

References

1. Chernet BT, Levin M. Transmembrane voltage potential is an essential cellular parameter for the detection and control of tumor development in a *Xenopus* model. *Dis Model Mech*. 2013; 6(3): 595–607. [\[crossref\]](#)

2. Nordenstrom BEW. Biologically closed electrical circuits: clinical, experimental and theoretical evidence for an additional circulatory system. *Stockholm. Nordic Medical Publications*. 1983.
3. Chouhan RS. Bioelectrography in detection of cancer. *Int Uro-Gyneacol Assoc Meet Ljubljana*. 1986.
4. Kadir LA, Stacey M, Barrett-Jolly R. Emerging roles of the membrane potential: Action beyond the action potential. *Front Physiol*. 2018; 9: 1661. [\[crossref\]](#)
5. Cone CD Jr. Unified theory on the basic mechanism of normal mitotic control and oncogenesis. *J Theor Biol*. 1971; 30(1): 151–181. [\[crossref\]](#)
6. Binggeli R, Weinstein RC. Membrane potentials and sodium channels: hypotheses for growth regulation and cancer formation based on changes in sodium channels and gap junctions. *J Theor Biol*. 1986; 123(4): 377–401. [\[crossref\]](#)
7. Cure JC. Cancer an electrical phenomenon. *Resonant*. 1991; 1(1).
8. Cure JC. On the electrical characteristics of cancer. The Second International Congress of Electrochemical Treatment of Cancer. 1995; Jupiter, Florida.
9. Dargel R. Lipid peroxidation: A common pathogenetic mechanism? *Exp Toxicol Pathol*. 1992; 44(4): 169–181. [\[crossref\]](#)
10. Skrzydlewska E, Sulkowski S, Koda M. Lipid peroxidation and antioxidant status in colorectal cancer. *World J Gastroenterol*. 2005; 11(3): 403–406. [\[crossref\]](#)
11. Nieper HA. Dr. Nieper's revolution in technology, medicine and society. Oldenburg, Germany: MIT Verlag; 1985.
12. Cone CD Jr. Variation of the transmembrane potential level as a basic mechanism of mitosis control. *Oncol*. 1970; 24(6): 438–470. [\[crossref\]](#)
13. Cope FW. A medical application of the ling association-induction hypothesis: the high potassium, low sodium diet of the Gerson cancer therapy. *Physiol Chem Phys*. 1978; 10(5): 465–468. [\[PMID\]](#)
14. Haltiwanger SG. Clinical use of mineral transporters and their effects on cell membrane capacitance. Second International Congress of BioEnergetic Medicine. *Instit Quant Mol Med*. 1998; Melbourne, FL.
15. Haltiwanger SG. The electrical properties of cancer cells. Rife 2003 International Health Conference. 2003; Seattle, WA. <http://www.royalrife.com/haltiwanger1>
16. Cho YS, Resasco D, Schaff J, Slepchenko B. Electrodifusion of ions inside living cells. *IMA J Appl Math*. 1999; 62(3): 207–226. [\[crossref\]](#)
17. Foster KR, Schepps JL. Dielectric properties of tumor and normal tissues at radio through microwave frequencies. *J Microwave Power*. 1981; 16(2): 107–119. [\[PMID\]](#)
18. Burr HS, Strong LC, Smith GM. Bio-electric correlates of methylcolanthrene-induced tumors in mice. *Yale J Biol Med*. 1938; 10(6): 539–544. [\[PMID\]](#)
19. Burr HS. Biologic organization and the cancer problem. *Yale J Biol Med*. 1940; 12(3): 277–282. [\[PMID\]](#)
20. Chouhan RS, Pagadala R. Bioelectrography in early detection of cancer. World Conference of Obstetrics and Gynaecology, Proceedings of FIGO-91, Singapore, 1991.
21. Riedl S, Zweytick D, Lohner K. Membrane-active host defense peptides – challenges and perspectives for the development of novel anticancer drugs. *Chem Phys Lipids*. 2011; 164(8): 766–781. [\[crossref\]](#)
22. Van Rinsum J, Smets LA, Van Rooy H, Van Den Eunden DH. Specific inhibition of human natural killer cell-mediated cytotoxicity by sialic acid and sialo-oligosaccharides. *Int J Canc*. 1986; 38(6): 915–922. [\[crossref\]](#)
23. Acevedo H, Gonzalez N, Moss R. Trophoblastic hormones and cancer: A breakthrough in treatment? Comprehensive Cancer Care Conference. 1998; Session 205: June 13.

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