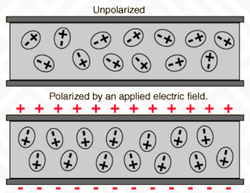
Electric Fields and Physiology

When we stand near plugged in electric motors, or near power lines, or use certain devices such as electric blankets, hair dryers, heaters, and more, we are being exposed to electric fields. The fields may not penetrate deeply into our bodies, but they have an effect. When we are exposed to magnetic fields, electric currents may be induced deeply inside of our bodies. It is difficult to study due to the electrical complexity of living tissue.

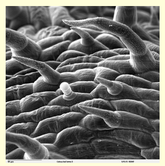
What happens to us when exposed to exogenous electric fields? Our voltage-sensitive cellular signaling mechanisms may be vulnerable. Also vulnerable are important ions, polar regions of molecules and dielectric membranes and organelles. Some mobile cells will reorient or translocate.

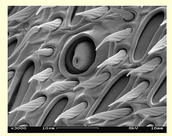
This map offers concepts and links that discuss this bioeffect.



The interaction of time-varying electric fields with the human body results in the flow of electric charges (electric current), the polarization of bound charge (formation of electric dipoles), and the reorientation of electric dipoles already present in tissue. ... Electrical conductivity and permittivity vary with the type of body tissue and also depend on the frequency of the applied field. Electric fields external to the body induce a surface charge on the body; this results in induced currents in the body, the distribution of which depends on exposure conditions, on the size and shape of the body, and on the body's position in the field.

ICNIRP Guidelines





ANTENNAE AND CILIA IN PLANTS, MAMMALS, INSECTS -- THEY HAVE EVOLVED OVER HUNDREDS OF MILLIONS OF YEARS TO GATHER INFORMATION ABOUT THE ENVIRONMENT AND DIRECT CELLULAR RESPONSES. ARE THEY SENSITIVE TO ARTIFICIAL ELECTRIC FIELDS?

Induced currents

- Numerical calculations
- Effect of induced currents
- ★ Currents induced in body

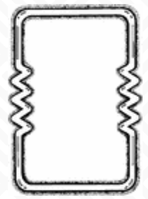
Videos

- Fluorescent tube in electric field
- Induced current, electric blanket
- Induced current, body, hair dryer
- Electric field, head, mobile phone
- Power line near houses, electric fields

Other links

- Cilia: Cellular antennae
- Intracellular electric fields
- Lightning bolts inside cells
- Calcium signaling overview
- House Wiring and EMFs
- AC Brochure Electric Fields
- ★ Testimony of Martin Blank
- ★ Phil Callahan publications
- Experiments in induced voltage
- Electrical properties of cancer cells
- Controlling cell behavior with magnets

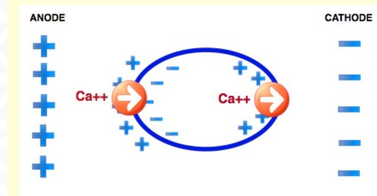
EF Tissue Studies



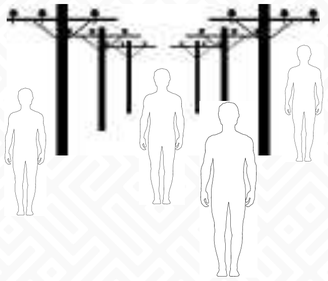
- Dielectric, water, DNA, RF
- ★ EF, bone marrow currents
- Calcium transduces EMF effect
- Fibroblasts align at angle to field
- LF EF and induced electric fields
- ★ EF, skin cell morphology changes
- Retinal cells in culture align in E fields
- Transients induce electric fields in body
- Membrane offers no shielding to interior
- ★ ALS: Induced or applied electric fields
- Electric fields, individualized microclimates
- Magnetic field induces electric field in body
- Weak electrical fields, polarization of neurons
- Electric polarization and viability of living systems
- Electric fields, power lines, disruption of melatonin
- ★ EF reduces cellular repair after ionizing rad. exposure

TISSUE REACTIONS TO ELECTRICAL FIELDS

Tyrosine kinase activity changes
Melatonin production is disrupted
Polar groups on DNA and other molecules are affected
Voltage gated Ca channels are perturbed
Fibroblasts and other cells reorient and/or migrate
Cell nuclei and other organelles reorient and migrate
Tissues are not electrically uniform
Charged pollutants more adherent to tissues



Calcium is probably the fastest signaling ion available in tissue physiology. Voltage gated calcium channels are vulnerable to polarizing fields.



EF Pollution Reports

- ★ Corona ions, avalanching
- ★ Pollutants cluster under power lines
- 2000 studies, 3X carcinogenic pollutants
- Charged pollutants "stick" more to tissues
- Increased exposure to pollutants under power lines
- Air surrounding power line ionized, charging pollutants
- Electric fields and ions, comments by industry experts
- ★ Downwind charged pollutants, respiratory deposition

Related maps

- Map on Body Voltage
- Map on Calcium Efflux
- ★ Map on EMF and Toxins
- ★ Map on Multiple-Hit Model

Although largely neglected in the emphasis on magnetic field bioeffects, there is also a body of laboratory evidence relating biologically significant effects, particularly in cerebral tissue calcium binding, to ELF electric field exposures in the range 10-100 V/m. Neurobehavioral effects, including a regulatory role in biological rhythms of man and animals, have been attributed to ELF environmental electric fields at intensities in the range 10-100 V/m.

Ross Adey, NCRP 1995

Home: Oscillatorium
Newest version this map
Date of this update: 10-23-14

★ **Effects of Power-Line Fields**

When the human body is exposed to the electromagnetic fields of a high-voltage transmission line, electric currents and fields are induced in the body since at extremely low frequencies (ELF) (50–60Hz) all the organs in the body are conductors.

King and Margetis