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Earthing the Human Organism Influences Bioelectrical Processes

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Abstract

Objectives: This article describes interaction of the Earth's mass—electrolytic conductor on the electrical environment of human organism—aqueous environment and skeleton. In this environment, bioelectrical and bioenergetical processes take place.
Methods and subjects: Measurements of electric potential on tongue, teeth, nails, and in venous blood in subjects earthed and unearthed were conducted in Faraday's cage with the use of an electrometer placed outside the cage. Measurements were performed in subjects in lying position and in movements of standing up and lying down.
Results: In the unearthed human organism in the lying position, electric potential measured in examined points is around 0 mV. Contact of the Earth by a copper conductor with a moistened surface of the human body evokes a rapid decrease of electrostatic potential on the body and in venous blood to the value of approximately −200 mV. This effect is immediate and general. Interruption of contact with the Earth causes a rapid return of the potential to its initial values in examined points. Changes in electric potential measured in venous blood and on mucosal membrane of the tongue reflect alterations in electric potential of the aqueous, electrical environment. Up-and-down movement of the insulated human organism causes transient changes in potential in the human electrical environment. During the same movement, values of potential in the electrical environment of an earthed human body remain constant.
Conclusions: These results indicate that up-and-down movement and the elimination of potentials in the electrical environment of the human organism by the Earth's mass may play a fundamental role in regulation of bioelectrical and bioenergetical processes. The Earth's electromagnetohydrodynamic potential is responsible for this phenomenon.

Introduction

The Earth generates natural electric and magnetic fields extending into space. Electric field gradients near the surface are approximately 200 V per meter, measured vertically from the surface of the Earth. The density of the negative charge of the surface of the Earth is $-1.1\,nC/m^2$ on average, but it varies depending on solar activity, time of the year, place, surface irregularities, and presence of nearby objects.[1,2] Near the surface of the Earth, the intensity of the field is directed downward, a metal conductor is polarized ("+" near the surface of the Earth and "−" in the highest point).[1] According to Feynamn and Ober, a human subject placed in electric field of the Earth presents a voltage difference of 350 V from head to toe. After earthing, the surface of the human is charged by the potential of the Earth and equals 0 V.[3,4] The summarized, total electric charge of the Earth insulated by outer space is constant in time according to the principle of charge conservation.[5]

Evolution of organisms has proceeded in an aqueous environment and in the presence of electric charge of the Earth. Thus, Earth's potential can play role in regulation of bioelectrical processes in living organisms. Isolation of a living organism from the potential of the Earth may lead to the development of mechanisms that modify bioelectrical processes and functioning of a whole organism. In the authors' opinion, alternations in electric potential of venous blood and mucous of the tongue reflect alternations of electric potential in the extracellular environment. Water molecules have a limited tendency to reversibly dissociate–ionize into a hydrogen ion and hydroxyl ion. The degree of autoionization depends on the temperature and electric field fluctuations.[6,7]

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A relative constancy in the concentration of dissolved substances, in the temperature, and in the pH is a basic requirement for the normal functioning of cells. Water is an almost incompressible dielectric. The membranes of eukaryotes compartmentalize and segregate intracellular events, separate cells from one another, and segregate organ functions. Therefore, the human organism can be considered as being composed of functional dielectrics (and semiconductors) in an aqueous environment.[8] Recorded action potential from the surface of the tongue can be referred to the water environment of the organism. Alternations in the electric potential of the aqueous, extracellular environment may have an effect in modulation of bioelectrical processes.

Membrane difference potential existing between the intracellular environment and extracellular environment is decisive in vital processes. The resting potential of nerve and muscle cells is determined by the concentrations gradients and membrane permeability for Na+ and K+ ions that is maintained by the Na+/K+ pump. When there is a change in the membrane conductance for ions, the membrane potential will be changed. Conversely, changing the membrane potential can change the permeability and conductance for ions. This relationship between membrane potential and permeability and conductance enables excitable tissues to produce an action potential.[9] This raises the question of whether natural forces of the Earth are capable of altering membrane potential of all or selected cells and thus modulating their function. Is the potential of the Earth transmitted via a copper conductor on the human organism able to play such a role?

Experiment 1

Materials and methods

Investigations were carried out on 4 people (2 women, 2 men) aged 20–52 years with an average weight of 68 kg (standard deviation = 10) in a room on the ground floor with an insulated floor, in a recumbent position, in a temperature of 21°C and atmospheric pressure of 1012 hPa and temperature near of the surface of the Earth 8°C, and fine weather. Two (2) earthing connections were made: first for the examining electrode (EE in Fig. 1A and 1B), second for the earthing of a person. Earthing plates (EP in Fig.1A and 1B) (6 cm × 25-cm size of a foot) were placed on moistened earth. Both insulated conductors had diameters of 3 mm and length of 400 cm. An EE (5 mm × 40 mm) served for measurements on moistened skin, and a second electrode (EE) (4 mm × 30 mm) was used on mucous membranes, teeth, and nails. The earthing electrode (EG in Fig. 1B) was also a plate (30 mm × 80 mm). Plates and wire were made of copper. In determining the voltage in venous blood, an intravenous cannula with a sterile copper conductor (EE) (diameter of 0.2 mm) inside (to insulate it from the skin) was used. After subjects were in a recumbent position for 5 minutes, the values of the electrostatic potential were noted. Then, earthing was connected and the measurements were made after 5 minutes and again at 1 hour. Measurements were made after 5 minutes after the interruption of contact by means of an N3031 electrometer with its own resistance of 10^8 Ω.

Results

Results are presented in Figure 1A and 1B.

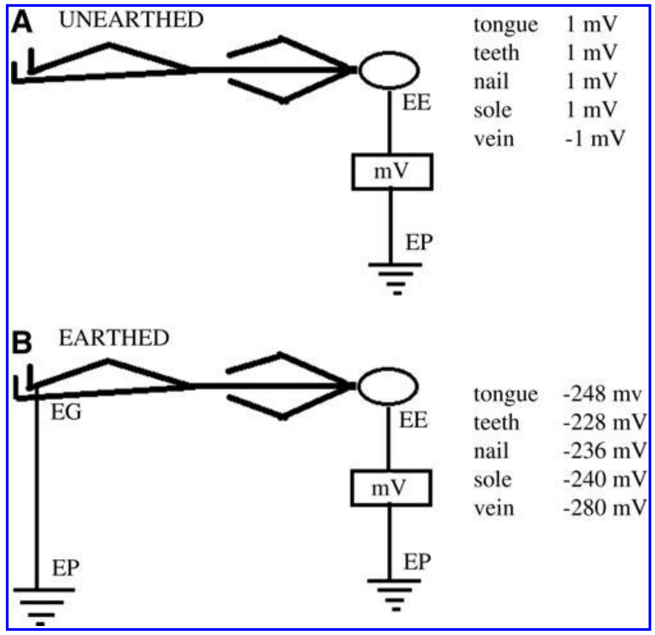

FIG. 1. **(A)** Values of potential measured in various points of the body of unearthed subject in a lying position. **(B)** Values of potential measured in various points of the body of earthed subject in a lying position. EE, examining electrode; EP, earthing plates; EG, earthing electrode.

Earthing the human organism evokes a rapid fall in potential in venous blood and other examined points. The effect is immediate and general. After 1 hour of constant earthing, values show no significant changes. Interruption of contact with the Earth causes a rapid return of potential to its initial value at examined points.

Experiment 2

Materials and methods

The measurements were taken inside a Faraday's cage. The cage (3 m × 2 m × 2 m) was located on the first floor of a

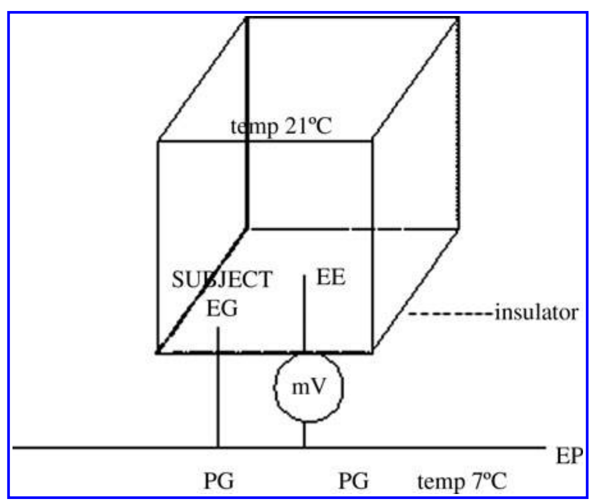

FIG. 2. The schema of the experiment. EE, examining electrode (copper 3 × 30 mm); EG, grounding electrode (30 × 80 mm); PG, grounding plate (60 × 250 mm). The cage, wire, and plates are made of copper.

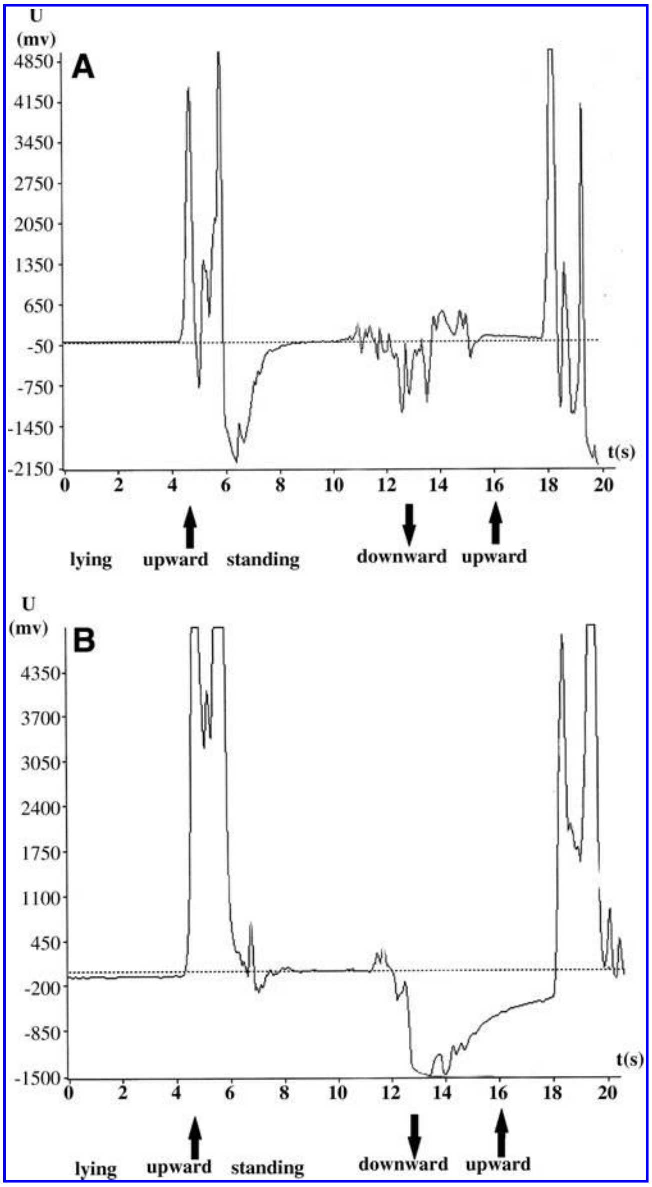

FIG. 3. **(A)** Measurement of alternating current (AC) on the tongue without earthing in a Faraday's cage. **(B)** Measurement of direct current (DC) on the hand without earthing in a Faraday's cage.

building. Construction of the building was of reinforced concrete. The cage was grounded. The cage was connected to an insulated copper conductor (diameter of 2 mm) attached to a copper plate (60 mm × 250 mm) placed on wet earth outdoors (PG in Fig. 2.). The temperature was 7°C near the surface of earth. Earthing the human body was accomplished via a copper plate (30 mm × 80 mm) placed on the lower part

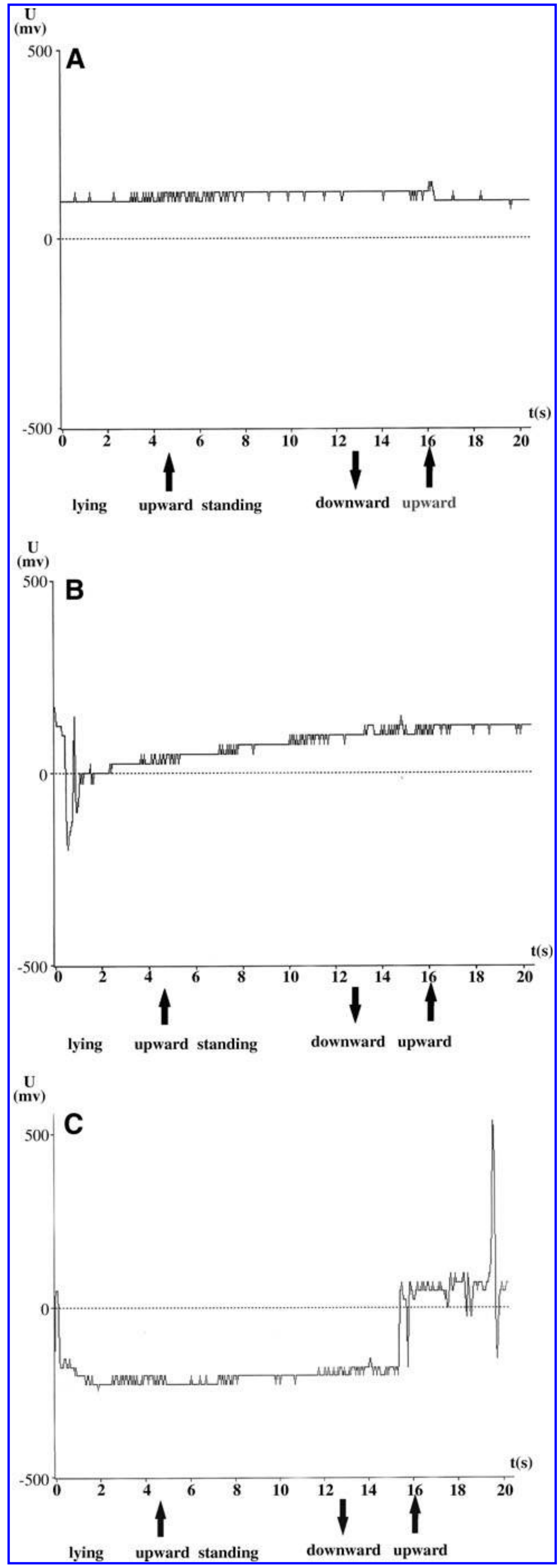

FIG. 4. **(A)** Measurement of alternating current (AC) on the hand with earthing to the leg in a Faraday's cage. **(B)** Measurement of alternating current (AC) on the tongue with earthing to the leg in a Faraday's cage. **(C)** Measurement of direct current (DC) on the tongue with earthing to the leg without Faraday's cage.

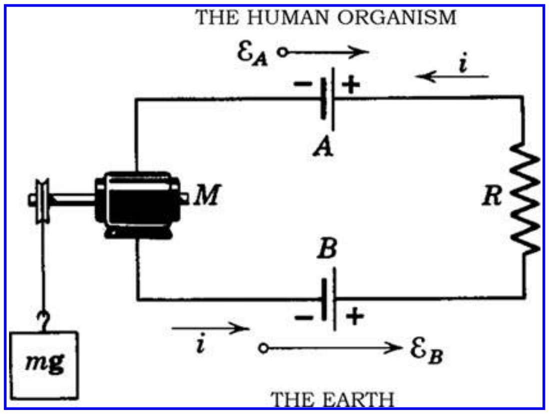

FIG. 5. Scheme presenting electrical relation between Earth and the organism. The diagram is modified from Halliday & Resnick's Principles of Physics, Ninth Edition, Walker J, ed. John Wiley & Sons, Inc., 2011. R, resistance of the air. Reprinted with permission of John Wiley & Sons, Inc.

of the leg (EG in Fig. 2.). The plate was connected to an insulated copper conductor (diameter of 1 mm) attached to the second plate (60 mm × 250 mm) placed on wet earth outdoors (PG). An EE used for measurements was made of copper (3 mm × 30 mm). It was placed on the wet surface of the tongue. The electrode was connected via an insulated copper conductor to the person (diameter of 1 mm) by means of a potential recorder (minutes error 1.5%) with resistance of 10^{16} Ω.

Results

The measurements were performed with 12 people, under fine weather. Typical recordings are presented in Figure 3A, 3B and Figure 4A, 4B, 4C.

The human organism is unearthed (Fig. 3A and 3B). This is performed with the subject immobile, in the lying and also in the standing position. The electrode on the wet surface of the tongue does not detect potential in these conditions.

Action potentials

1. Upward movement of unearthed human organism: The movement upward causes the electrode to polarize; it is positively charged with respect to the voltage meter. When the entire body has been depolarized, the electrometer presents again in a horizontal line when subjects are in a standing position.
2. Downward movement of unearthed human organism: The downward movement causes the electrode to polarize. It is now negatively charged with respect to the electrometer. When the entire extracellular environment has been depolarized, the electrometer shows a horizontal line.

The effect of earthing the human body during up-and-down movement is presented in Figure 4A, 4B, and 4C. Contact via copper conductor with the Earth causes the electrode on the surface of the tongue to show elimination of potential.

Discussion

Presented results of the studies are used in this discussion for qualitative analysis only and for comprehension of this phenomenon. The coupling of the human body with the moistened surface of the Earth evokes a rapid fall in values of electrostatic potential in venous blood, tongue, nails, and teeth in the lying position. The effect is immediate and general. Interruption of contact with the Earth causes an increase of measured potential to around 0 V. Up-and-down movement of the unearthed human organism causes transient changes in potential in selected points of measurement. During the same movement, values of the potential in an earthed person remain constant. These changes of potential examined on selected points of measurement occur in a

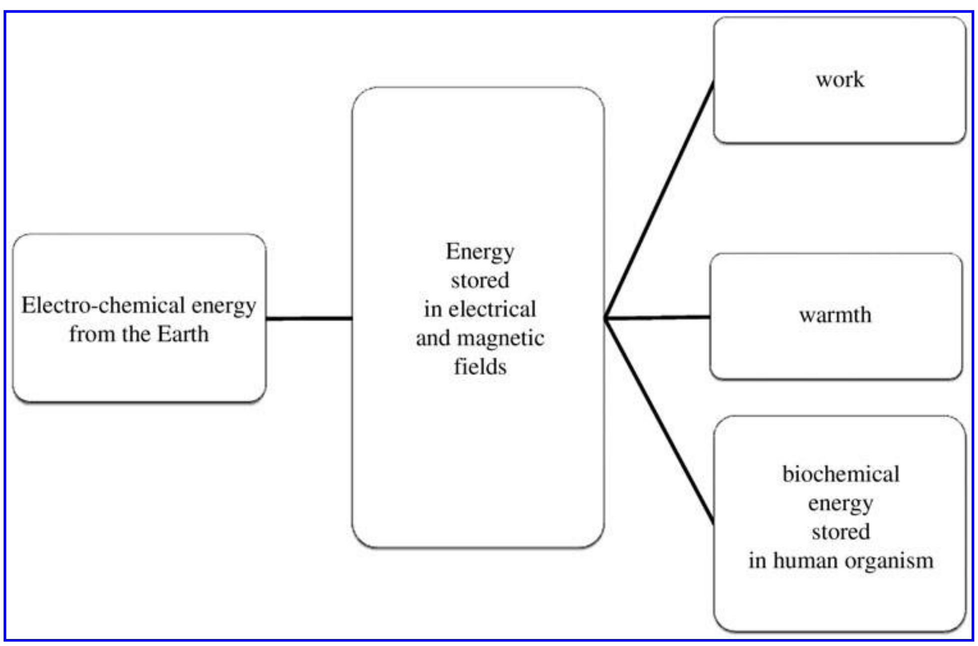

FIG. 6. Process of energy transition in the electric circuit containing two batteries: human organism and Earth. The diagram is modified from Halliday and Resnick's Principles of Physics, Ninth Edition, Walker J, ed. John Wiley & Sons, Inc., 2011. Reprinted with permission of John Wiley & Sons, Inc.

subject placed in Faraday's cage, which isolates the subject from the ambient electric field of the Earth but does not protect against the magnetic field. While the human organism in relation to static magnetic field is in motion, electric currents arise in the conductor of the human body.[10] Alterations of potential measured on different points on an unearthed body during up-and-down movement in Faraday's cage reflect changes of the potential in relation to the electrometer high-resistance localized on the surface of the Earth.

The aqueous environment of the Earth as a dielectric is a universal acceptor and donor of electrons. Elimination of potentials on an earthed subject via a copper conductor coupled to earth is the result of the influence of electrochemical potential of the aqueous environment of the Earth, which is transmitted to the aqueous environment of the human organism. It is supposed that transmission of electric potential of Earth on skin of the human body causes simultaneously and generally the change of potential in the electrical environment of the human organism (i.e., fluids and skeleton). It is suggested that transmission of the Earth's potential has a direct impact on the density of negative charge in this electrical environment. In aqueous environment, dielectric electrons are associated with OH- groups. Negative OH- ions and neutral molecules of H_20, $O_{2,}$ and CO_2 may migrate into the cells through the cell membranes easily.[11] Electrobiochemical potential of the aqueous, electrical environment can change the electrochemical proton gradient across the cellular membranes.[11] Changes in membrane potential alternate permeability for various ions and substances, changing the function of targeted cells. Stabilization of function of cell membranes by proton potential has a crucial role, for instance, in the anti-inflammatory mechanism of earthing.[12] Chemio-osmotic theory states that the electron transport chain in mitochondria is coupled with the ATP synthesis by proton electrochemical potential established across the membranes transforming energy.[11] It is believed that earthing influences the proton gradient across the membrane.[13] Thus, the potential of the mass of electrical environment of human organism becomes the mass with the potential of aqueous environment of Earth. Contact of the human body with the Earth's potential establishes an electrostatic continuity with aqueous environment of the Earth by a metal conductor and leads to stabilization of hydrogen bonds. This contact is responsible for the physiologic and electrophysiologic effects observed in several studies.[14–18]

Up-and-down movement of the insulated human body causes transient changes in measured potentials of the electrical environment of human body as is shown in figures presenting alternating electric potentials in relation to the movement. Metabolism of intracellular environment is the source of potential in electrical environment inside an organism. Contact with the Earth causes elimination of potential in the tissues. The human body does not behave like a wire conductor with currents flowing on the surfaces. Under earthing, the charge does not merely remain on the surface and neutralize surface positive charge but also enters the tissues. In a wire conductor, a mobile negative charge is represented by electrons. In the aqueous environment of the human organism, which is a dielectric, the role of mobile negative charges is played by OH- groups. The mechanism of the interaction of the Earth's mass and the electromagnetic field of the Earth with the human organism is presented in Figure 5. This figure presents the electric circuit, which consists of two ideal batteries: A battery—the human organism, B battery—the Earth, R—resistance of the air in the unearthed human organism and resistance of a copper conductor in a case of the earthed human organism and (ideal) engine, which reflects the work of the human body necessary during up-movement. The batteries are connected in the way that causes the transmission of charges in both directions. Processes of energy transitions in this circuit are depicted in Figure 6. The neutralization of the positive charge spreading over the surface of the body is the result of the influence of the magnetic field of the Earth on the body, which is penetrated by this magnetic field.

Conclusions

Results of this study indicate that up-and-down movement and the elimination of potentials in the electrical environment of the human organism by the Earth's mass may play a fundamental role in regulation of bioelectrical and bioenergetical processes. The Earth's electromagnetohydrodynamic potential may be responsible for this phenomenon.

Disclosure Statement

No competing financial interests exist.

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