Understanding Earthing (Grounding)

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Summary

Many people notice that they feel better when they walk barefoot on the Earth. Recent research has explained why this happens. Our immune systems function optimally when our bodies have an adequate supply of electrons, which are easily and naturally obtained by barefoot contact with the Earth. Research indicates that electrons from the Earth have anti-oxidant effects that can protect the body from inflammation and its many well-documented health consequences. In situations where barefoot contact with the Earth is impractical, one can use various conductive systems that have been developed for the purpose of reconnecting people to the Earth; for example, an Earthing sheet on a bed or an Earthing mat placed under the bare feet or wrists while using a computer. As summarized in a 2010 book (Earthing: The Most Important Health Discovery Ever?), more than a decade of observation and research has shown that the more time people spend in conductive contact with the Earth, the better they feel.1

Such contact is known as Earthing or grounding. The purpose of this article is to explain why Earthing is both beneficial and completely safe. A discussion of safety is necessary because we receive many requests for clarification about whether Earthing increases one's exposure to so-called "electromagnetic pollution" or "dirty electricity." Earthing actually decreases one's exposure to these potentially disruptive fields, but we emphasize that this is not the most important effect of grounding.

Introduction

Many people notice that they feel better when they walk barefoot on the Earth. A worldwide ***Society for Barefoot Living*** promotes the benefits of removing shoes and socks and walking naturally on the Earth. On the basis of their experiences, and support from medical research in the field of biomechanics, barefoot enthusiasts are convinced that many foot and back problems are partly caused by stresses and

strains created by wearing shoes, which force us to stand and move in ways the human body was not designed for.2

More recent research has shown that the feeling of well-being that comes from walking barefoot on the Earth is associated with important physiological benefits. The Earth is a natural source of electrons and subtle electrical fields, which are essential for proper functioning of our immune systems, circulation, synchronization of biorhythms and other physiological processes. Of major importance is the fact that modern biomedical research has documented correlations between chronic inflammation and all of the chronic diseases, including the diseases of aging and the aging process itself. Inflammation is a condition that can be reduced or prevented by grounding our bodies to the Earth. 3

It has also been suggested that the modern epidemic of chronic and stress-related diseases began when the leather that was used to make the soles of shoes was replaced with rubber and plastics. When leather becomes moist, as a result of perspiration from the feet, a channel of conductivity for electron flow is created between the Earth and the feet. Rubber and plastics are electrical insulators and therefore block the beneficial flow of electrons from the Earth to our bodies.

The biological benefits of Earthing involve subtle electric currents and fields from the Earth. These subtle phenomena take place in the presence of a variety of fluctuating stronger and weaker fields produced by the wiring in homes and businesses and various electronic technologies such as cell phones.

Some people are concerned that Earthing may increase one's exposure to so-called "electromagnetic pollution" or "dirty electricity." Earthing actually decreases one's exposure to these potentially disruptive fields. To understand why this is so, one must look at the basic physics and biophysics of electricity and magnetism. Confusion about this topic is due in part to the fact that research on Earthing the human body is opening up new perspectives, and requires a fresh examination of the basics of electricity and magnetism as applied to physiology and medicine. Another source of confusion arises from a belief that the unnatural frequencies referred to as electromagnetic pollution and dirty electricity flow through the wiring of homes and can be removed with filters. The reality is that these signals are present virtually

everywhere in our environment as electromagnetic radiations, and cannot be completely removed with filters in the wiring. Earthing actually decreases one's exposure to these potentially disruptive electromagnetic fields, but we again emphasize that this is not the most important effect of Earthing.

Conductors and insulators

Materials such as metals are electrical conductors**.** They contain free or mobile electrons that can carry electrical energy from place to place. Turning on a light switch allows electrical energy to be conducted through wires to a bulb, which converts the electrical energy into light energy. Because we use alternating current (AC), electrical energy can be sent over long distances. The electrical energy flows extremely rapidly (close to the speed of light), but the electrons themselves actually move very little. They simply wiggle back and forth in the wires. The human body is somewhat conductive because it contains a large number of charged ions (called electrolytes) dissolved in water. Blood and other body fluids are therefore good conductors. Free or mobile electrons can also move about within the body.4

Other materials, called insulators**,** have very few free or mobile electrons. Plastic and rubber are good insulators and are used to cover electrical wires to keep the conductors from touching each other and from touching your skin, which could otherwise give you a shock.

Different forms of electricity

There are three different forms of electricity: direct current (DC) electricity, alternating current (AC) electricity and static electricity. All of these forms of electricity are present in our environment and can affect the way we feel. With a little knowledge about these phenomena, it is easy for us to create a much healthier environment without major expense and without having to undergo a major change in lifestyle. Here we focus on DC and AC electricity, while recognizing that static electricity can also affect us and that static charges can also be eliminated by Earthing.5

As an example of direct current, consider an ordinary flashlight with two type D batteries. When the light is switched on, a current created by chemical reactions in the

batteries causes electrons to flow to the bulb, which converts the electrical energy into light. The electric field travels to the bulb virtually instantaneously, while the electrons move slowly – about 3 inches per hour.6

Alternating current or AC is the type of electricity that is delivered to homes and businesses. Alternating current is produced by electric generators and is distributed throughout a community via wires that are overhead or buried under the ground. In contrast to direct current electricity, the actual flow of electrons in an alternating current circuit is virtually zero, as the electrons mainly go back and forth (60 times per second in North America and 50 times in Europe) without actually progressing along the wire. Therefore, for an AC current in a typical lamp cord, the electrons do not actually "flow." Instead they vibrate back and forth by a distance of about a hundred-thousandth of an inch. This means that the electrons in your household wiring are probably the same ones present when your house was built. In contrast to direct current, the electrons excited by a generator do not flow to your home and then return to the generator after delivering energy to your lights or appliances. The electrical energy flows at about the speed of light; the electrons only vibrate back and forth. This point is important because of confusion about the subject from statements such as this: “Every time an electron leaves a power plant to create electricity for our homes, schools and offices it must return to create more electricity - fundamental law of physics." 7 The statement is completely incorrect. There is absolutely no fundamental law of physics that requires the electron sent out from an alternating current generator to return to the generator to create more electricity.

It has also been asserted that power companies have begun using the Earth as one part of the alternating current circuit to save on the expense of wire needed to meet increasing demands for electricity. Again, this statement is completely inaccurate and misleading. It is a statement that leads some to believe that walking barefoot or using grounding devices will connect people to the electrical distribution system and thereby electrify their bodies with alternating current electricity. In fact, the U.S. National Electrical Code does not permit connecting an electrical system directly to the earth. Instead, the Code requires an arrangement such that the current produced by a short circuit of any kind (called a *fault*) is conducted back to the source of the current, so that it

can trip a circuit breaker or blow a fuse to prevent injury to people or damage appliances. The Electrical Code forbids the use of the Earth as a conductive pathway for this purpose.8 The Electrical Code does require that electrical systems have a ground connection to stabilize voltages in the presence of lightning, line surges, or accidental contact between regular power lines and high-voltage lines.9 The electrical Code is not a law, but it is followed closely because one can be successfully sued if they do not follow recommended practices.

In other words the Earth does <u>not</u> to carry a return current back to the generator. Instead electrical systems are grounded to protect against lightning and other extraordinary events.

The wiring in homes and buildings and the power distribution system acts as an antenna that can transmit and receive both natural and man-made electromagnetic fields. Many technologies add significantly to our electromagnetic environment: cell phone towers, Wi-Fi, wireless routers, satellite TV and cordless telephones. And a variety of devices introduces spikes or transients that distort the 60 cycle electric field in the wiring, particularly when appliances are switched on or off. Here are some common examples:

- ballasts used in fluorescent lighting
- high-efficiency lighting such as CFL (Compact-Fluorescent) bulbs
- computer hard drives
- electric heaters
- electric hair dryers
- refrigerators and air conditioners
- vacuum cleaners

To illustrate this phenomenon, we will use the example of a neighbor's refrigerator or air conditioner switching on or off. This produces a sudden electrical "spike" that travels through the power lines to your household electrical system. A signal is also radiated into the atmosphere because the wiring acts as an antenna. Taken together the various signals and distortions to the alternating current field create what some people refer to as "dirty electricity." Attempts have been made to link these phenomena to a variety of health effects. There has been considerable debate about

this issue. Some people appear to be very sensitive to electromagnetic fields and can become sick from exposure to them, whereas others are not sensitive.

Some have advocated the use of filters to remove what they refer to as dirty electricity flowing through home wiring. The problem is that alternating electric fields are present everywhere in the environment – they are radiated from wires, even when no current is flowing through them. It is therefore impossible for a filter to prevent exposure to electrical fields and the noise produced by appliances, as described above.

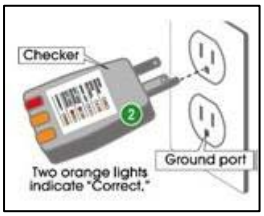
In a 2010 review, Frank De Vocht of the University of Manchester's Centre for Occupational and Environmental Health in the UK identified seven published studies supporting the claim that dirty electricity is a biologically active component of standard electromagnetic pollution. Each study, De Vocht concluded, had significant methodological flaws in its experimental design, assessment of exposure, and statistical analysis that prevented a valid assessment of any causal links between exposure and adverse effects.10 Moreover, several studies suggesting health benefits for using the filters were uncontrolled experiments involving only a few subjects.

Measuring body voltage

A simple voltmeter can determine how much AC electricity is being radiated from common ambient electromagnetic fields (EMFs) and how much is being induced on your body. You can also use the voltmeter to demonstrate how that charge is reduced by grounding. You can test yourself anywhere, such as while lying in bed or sitting in a chair surrounded by different appliances, computer, monitor, phones, etc. Or you can test yourself outside, first wearing shoes, and then barefoot.

A number of inexpensive meters (such as the one below) are available from Radio Shack and other sources. One of the leads of the meter is held between the thumb and forefinger. The other lead connects to a ground rod in the Earth or to ground in the electrical system.

The device shown below, called a circuit checker, can determine if the grounding terminal of an electrical outlet is properly grounded.



First test yourself ungrounded and then grounded. Keep in mind that the electrical cords going, for instance, to the lamp next to your bed radiates an AC electric field even when the lamp is turned off.

As an example of a setting for a test, we will use a bedroom. You first measure the ambient voltage on your body. We'll pick a number and say, just for the sake of discussion here, that it reads 3.082 volts AC. In your case, the reading could be more or it could be less. That's how much voltage is being induced on your body from the surrounding electrical fields.

Now make bare skin contact (your hand, finger, foot) with an Earthing product (a sheet or mat, for instance) that is connected to a grounded outlet or a ground rod outside. When you make contact, the reading on your voltmeter will instantly drop down into the very low mini-volt (mV) range, very close to zero. This same effect would occur with any Earthing product. It is absolutely essential that both the Earthing product and the ground

lead of the voltmeter be connected to the same ground reference, whether it is an electrical outlet or a ground rod outside. If not, your reading will be skewed.

The following bedroom example shows how you can further test the strength of individual emanations from different sources of EMF. In this case, the room had a table behind the bed with two small lamps, an alarm clock, a radio, and a large overhead lamp. Measurements were made of the body voltage on a person lying ungrounded in the bed as we systematically disconnected these appliances, one by one, to see what effect it had. With the exception of the alarm clock, these appliances were turned off during the test. The person's body voltage was 3.082 volts. We then unplugged the appliances, one at a time, and watched the body voltage decrease with each disconnection as follows:

- 3.082 volts with all appliances connected
- 2.770 volts with radio disconnected
- 1.650 volts with two lamps disconnected
- 1.290 volts with the other small lamp disconnected
- 0.880 volts with the alarm clock disconnected

Some German researchers have suggested that the method of measurement of body voltage summarized above is not an accurate way to assess exposure to 50/60 cycle electric fields. In their experiments they used sophisticated "potential-free, 3D E-field" probes, also referred to as "cube sensors," to measure the fields above and below a person using an Earthing pad. They found an increase in the field strength in the space above the person, which they interpreted to mean that Earthing is "contraindicated." A problem with their experiment was that they placed the Earthing pad beneath the mattress, so there was no direct conductive contact between the Earthing system and the skin of the subject.11 Thus, the experiment and conclusions were not valid. The person on the bed was not, in fact, Earthed!

Research has shown that the sleeping area in many homes often has the highest electric field, from wiring in the walls, floors, and ceilings, and from cords to appliances. The possible biological effects of these electrical fields are very controversial. Some scientists are firmly convinced that both the magnetic and the electric fields found in home wiring can have health effects. Others are just as firmly

convinced that the evidence is not adequate to make such a statement. Until large-scale studies and mechanistic investigations are completed, many scientists and many electric utilities have suggested that those who use electrical appliances practice "prudent avoidance" meaning that they should minimize their exposure to sources of electric power until the scientific evidence is more definitive.

In the context of "prudent avoidance," some proponents of Earthing systems have emphasized the fact that Earthing greatly reduces one's exposure to fields from electrical wiring, using evidence provided by the body voltage meter as shown above. While this is probably correct, reducing exposure to power frequency fields (including dirty electromagnetic fields) is definitely not the most important consequence of Earthing. Far more significant for health is the ability of Earthing systems to deliver antioxidant electrons that stabilize the operation of the immune system and other physiological processes in the body.

Finally, we want to address two safety issues that have been frequently raised. The first relates to the safety of an Earthed person touching a metal fixture that is electrically "hot" because of a broken protective system in the wiring. It is actually impossible to get an electrical shock in such a situation due to the inclusion of a 100,000 ohm resistor in the cords of all Earthing systems. This resistance will not allow an unsafe level of current to flow through any of the personal Earthing systems. Secondly, many people ask about the risk of being struck by lightning when a person is grounded. The fact is that Earthing does not affect the chance of being electrocuted by lightning.

Conclusions

The most important health benefit of Earthing is providing the body with abundant electrons from the Earth. The scientific research and hypotheses related to Earthing point to a major impact on the inflammatory process as a result of this electron transfer.

The human body has evolved a means to kill bacteria using reactive oxygen species (ROS) that are delivered to a site of injury by white blood cells. Although very effective at this task, ROS are also highly reactive biochemically and can damage healthy tissues. ROS are usually positively charged molecules that need to be neutralized

immediately to prevent them from diffusing into healthy tissues. For that purpose negative charges are needed. Nature has solved this problem by providing conductive systems within the human body that deliver electrons from the feet to all parts of the body. This has been the natural arrangement throughout most of human history. Negative charges have always been available, thanks to the Earth, to prevent the inflammatory process from damaging healthy tissues. All of this changed when we began to wear shoes with rubber and plastic soles, and no longer slept in contact with the earth.

A variety of measures of physiological stress show that the person who is grounded is less stressed and more relaxed. Earthing generates a shift from sympathetic to parasympathetic activation, reduction in muscle tension, and increased heart rate variability. Regardless of whether or not Earthing reduces exposure to environmental fields, these studies firmly demonstrate that Earthing does not stress the body; in fact, Earthing reduces every measure of stress we have used in our studies.

The Earthing book documents cases in which people who are hyper-sensitive to environmental energy fields have benefited from Earthing their bodies. 1 Observations over the years also include substantial relief from Earthing among many people who live in homes with very low levels of environmental fields and who developed crippling diseases such as rheumatoid arthritis.

Earthing is an overlooked factor in public health. We regard it as a missing link with broad and significant implications. When Earthing is restored, many people report major improvements in a wide range of ailments, including chronic fatigue. These changes often occur within 30 minutes. Individuals who reported that they had inflammatory issues have benefited from Earthing. This includes people with various severe autoimmune diseases.

We do not describe Earthing as a "treatment" or a "cure" for any disease or disorder. **Instead, it can be said without any equivocation that the human body evolved in contact with the Earth and needs to maintain this natural contact in order to function properly.**

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5. Static electricity is an example of a DC field that can build up around our bodies when we are not grounded. Normally the human body and the objects around us have exactly the same number of electrons and protons and are therefore electrically neutral. Static electricity arises when electric charge builds up on a surface and produce large DC fields around the body. For example, when the relative humidity is low, walking across a carpet can develop enough electric charge on your body to produce a potential

difference of 35,000 volts between the body and the ground. A urethane foam-padded chair can develop 18,000 volts and a vinyl floor can produce 12,000 volts. When your body becomes electrically charged in this way, you can experience a shock when you reach for a grounded object such as a door knob or light switch. Even though the voltages produced by static electricity can be very high, much higher than the 120 volts of our home electrical power outlet, we are not harmed by them because the number of electrons that are discharged during a static electric shock are very few, meaning the current is very small. While plastics were only invented in the 1950's, they are now in our clothing, shoes, bedding, and carpets—almost everything we touch. These fabrics readily generate static electricity. Conductive surfaces that are grounded to the Earth cannot build up static charges. Every day millions of workers in the electronics industry are grounded to prevent the build-up of static electricity that could otherwise discharge into sensitive electronics components.

6. http://amasci.com/miscon/speed.html; accessed 8-28-01

7. http://www.dirtyelectricity.ca/dirty_electricity_four_components.htm

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9. National Electrical Code, 2008 edition. National Fire Protection Association, page **70**-95.

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Environmental exposure to high-frequency voltage transients (HFVT), also termed dirty electricity, has been advocated among electro(hyper)sensitive interest groups as an important biological active component of standard electromagnetic pollution. A literature search was conducted in PubMed, in which only seven articles were identified. Exposure

to HFVT was associated with increased cancer risks, while preferential removal of 4–100kHZ HFVT from 50-60 ELF circuits was linked to a variety of improvements in health (plasma glucose levels in diabetic patients, symptoms of multiple sclerosis, asthma and other respiratory illnesses, and insomnia), well-being (tiredness, frustration, general health, irritation, sense of satisfaction, mood), and student behavior. However, all these published studies were subject to significant methodological flaws in the design of the studies, the assessment of exposure, and the statistical analysis, which prevented valid assessment of a causal link between this exposure metric and adverse effects. Environmental exposure to HFVT is an interesting EMF exposure metric, which might explain the spurious results from epidemiological studies using 'standard' ELF and RF exposure metrics. However, at present, methodological problems in published studies prohibit the valid assessment of its biological activity.

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