THE OPTICAL AND MAGNETIC INSTRUMENTS USED IN SURGERIES

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Introduction: Biophysics is an interdisciplinary science that applies the approaches and methods of physics to study biological systems. Biophysics covers all scales of biological organization, from molecular to organismic and populations. Biophysical research shares significant overlap with biochemistry, physical chemistry, nanotechnology, bioengineering, computational biology, biomechanics and systems biology.

The **aim** of this work is to know how to go over the optical & magnetic physical principals to biophysical ones, and its instruments used in surgery.

Materials and methods. Before starting, we have to understand how the magnetic & optical fields affects the body. First one is the magnetic field. Blood contains iron (ferrous hemoglobin), which is responsible for carrying both oxygen and carbon dioxide. As blood circulates through the lungs, magnetized ferrous hemoglobin is able to carry more oxygen to cell tissues, as well as take more carbon dioxide away from cells to the lungs for removal. This increases the efficiency of blood flow. When living tissue is exposed to magnetic fields, a secondary current is formed around the flux-lines within the cells. This causes ionization of the protoplasm and activates cell metabolism. Proper cell functions are then stimulated, as the cell metabolism reacts to the electrical current created by the magnetic field. This current can reduce the occurrence of muscle spasms and reduce tissue inflammation. This increase in the metabolism of the cell aids in new cell growth and existing cell regeneration. Negative-pole energy of a magnetic field may interfere with the ability of nerve cells to send pain impulses to the brain, where the sensation of pain is registered. When a negative magnetic field is placed near a nerve, the positively charged ions of the nerve's impulses are attracted to the negative magnetic field, resulting in a decrease in the flow of positively charged ions along the nerves to the brain. That's why Magnets have applications in non-invasive surgeries since they can attract and help to position magnetic devices inserted in the body through tissues and skin. One example is their use in treating hydrocephalus, a condition involving cerebrospinal fluid in the brain. This allows the physician to non-invasively adjust the flow performance level without radiographic confirmation by using magnetic adjustment tools to address changing.

Second one is optical field. Blood circulation function of peripheral blood vessels in skin dermis was evaluated employing an optical sensor with a pressurization mechanism using the blood outflow and reflow characteristics. The device contains a light source and an optical sensor. When applied to the skin surface, it first exerts the primary pressure (higher than the systolic blood pressure), causing an outflow of blood from the dermal peripheral blood vessels. After two heartbeats, the pressure is lowered (secondary pressure) and blood reflows into the peripheral blood vessels. Hemoglobin concentration, which changes during blood outflow and reflow, is derived from the received light intensity using the Beer–Lambert law: $A = \varepsilon c l$, where: A is absorbance, ε is molar extinction coefficient (m^{-1}, cm^{-1}), c is concentration (mol/l), l is pathlength (cm).

Results and discussion. In modern medicine technology, there are many tools used in surgeries, that work with optic magnetic principals, e.g. LASER is applied in medicine, as removing tattoos and applying in surgeries.

To understand how tattoo removal works, first you need to have an idea of how tattoo ink is embedded into the skin. Using a tattoo machine, tattoo ink is injected into the dermis – the second layer of skin. The tattoo ink becomes permanent, as the fragments injected into the dermis are too large for your body to break down – they can however reduce in size over time, which is what leads to tattoos fading and sometimes taking on a "blurred" appearance. The word 'laser' is actually an acronym Light Amplified by Simulated Emission Radiation. Light from a laser machine is collimated, which means it travels in one direction with little diversion. It is monochromatic (consisting of an attuned range of colors) and coherent which means it's able to move in a precise and controlled manner. Laser machines are designed to generate short, high intensity pulses of light into the dermis of the skin where the tattoo sits. These pulses travel

every Pico Second. Trained clinical technicians, can use varying wavelengths to target specific areas and colors on the skins surface. Different ink colors respond to different wavelengths, absorbing the light into the pigment and breaking it down. This light exchange causes a thermal reaction causing the ink to rapidly heat and combust into smaller particles. This process causes a 'frosting' effect on the skin, which is the break down of carbon from the ink and the releasing of carbon dioxide from the dermis. These particles are then eliminated from your body via your natural kick-ass immune system (white blood cells and lymph nodes) expelling them out of your body through your ordinary bodily functions like sweat, urination and excretion. Meaning that your technician is able to break the tattoo down for you, but it is up to your body to expel it.

Surgical removal of tissue with a laser is a physical process similar to industrial laser drilling. Carbon-dioxide lasers burn away tissue because their infrared beams are strongly absorbed by the water that makes up the bulk of living cells. A laser beam cauterizes the cuts, stopping bleeding in blood-rich tissues such as the female reproductive tract or the gums. Laser wavelengths near one micrometer can penetrate the eye, welding a detached retina back into place, or cutting internal membranes that often grow cloudy after cataract surgery. Less-intense laser pulses can destroy abnormal blood vessels that spread across the retina in patients suffering from diabetes, delaying the blindness often associated with the disease. Ophthalmologists surgically correct visual defects by removing tissue from the cornea, reshaping the transparent outer layer of the eye with intense ultraviolet pulses. Through the use of optical fibers similar to the tiny strands of glass that carry information in telephone systems, laser light can be delivered to places within the body that the beams could not otherwise reach. One important example involves threading a fiber through the urethra and into the kidney so that the end of the fiber can deliver intense laser pulses to kidney stones. The laser energy splits the stones into fragments small enough to pass through the urethra without requiring surgical incisions. Fibers also can be inserted through small incisions to deliver laser energy to precise spots in the knee joint during arthroscopic surgery.

Conclusions. Biophysics is aimed to promote professional integration in the field of biomedical visualization and physics used in biology, allowing for a better understanding of the physical principles of the methods used for diagnostic, therapeutic and basic medical and pharmaceutical research.

THE ELECTRONICS AND MAGNITICS FIELDS IN THE HUMAN BODY

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Introduction The adult body is comprised from more than 70 trillion individual cells, and that's not counting the millions of bacteria we carry in our gut. Each of those trillions of cells carries out several thousand metabolic processes every second. In order for that level of complexity to function smoothly, there must be a great deal of communication between and within these trillions of cells. Thankfully, our cells are programmed for this type of communication, and are able to make changes in a fraction of a second when necessary; which is called the electromagnetic field.

The **aim** of this work is to get knowing the electric and magnetic processes running in the body and its helping to have good health.

Materials and methods. Bioelectricity, electric potentials and currents produced by within living organisms. Bioelectric potentials are generated by a variety of biological processes and generally range in strength from one to a few hundred millivolts. Inside human body there are atoms that are made up of positively charged protons, negatively charged electrons, and neutrons (which are neutral). An atom with unbalanced charges will become either positively or negatively charged, and the switch from one charge to the other allows electrons to flow from one atom to another. Your cells generate electrical charges via electrolytes like sodium and potassium applying a mechanism known as the sodium-potassium gate. When the membrane gate opens, sodium and potassium ions move freely into and out of the cell. Negatively charged potassium ions leave the cell, attracted to the positivity outside the membrane, and positively charged sodium ions enter it, moving toward the negative charge. The result is a switch in the concentrations