Electric Vitamins

Doctor Redox's Tale

УДК 53
ББК 22.3
С-42

Author's note:
For a number of reasons, intellectual capital and that, which has nothing to do with intelligence, have entered the phase of antagonistic interrelation in Russia. What to do? We should unite intellectual capital, otherwise the other one will squander all our culture, since selling petroleum needs no power of Russian language.

Electric Vitamins Doctor Redox's tale is a manifesto of healthy habits. It is a fiction and at the same time true story of how mankind has been introduced to electric vitamins. In 2005, which has been declared The International Year of Physics by the UNESCO, this book was awarded special Prize of the Nobel Laureate V.L. Ginzburg's Physics Progress Foundation and published in the Intellect y Liderstvo (Intelligence and Leadership) Almanac No. 1, 2006.

«Redox» origins from Latin reductio (reduction) and oxydatio (oxidation). Oxidation-reduction process is a mechanism for energy generation required in all vital functions and defining dynamics of entropy in organisms.

www.redox.ru = Healthy Habits + Electric Vitamins®

This evolution formula makes physical laws work for the benefit of health and beauty every day.

Materials of two inventions serve as a basis for the tale:

- Electric Vitamins Arch, amusement attraction and a training device (Patent RST/RU 2004/000194 of 27.05.2003);
- Doctor Redox's Couch (Patent No. 2146122 of 17.03.1998).

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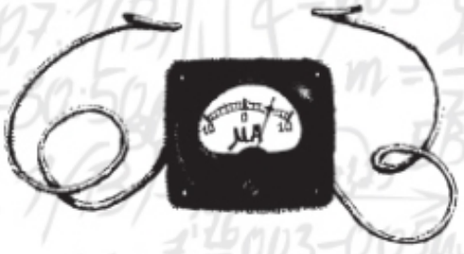
Electric Vitamin



Doctor Redox's Tale

«Redox», A.Lavrov, graphic drawing
36x45, 2002

Once there lived Redy-the-Physicist and Oxa-the-Painter. Like most of young people, they lived rather modestly. However, fortunately they had some non-material wealth. Redy was entirely absorbed with his beloved physics and inventions, and Oxa painted pictures. They didn't have time for each other, they rarely saw each other. Thus, they lived in harmony. If they discussed something in the morning, Oxa would create it by the evening; and things discussed in the evening would be created by the morning.

One day, they saw an advertisement posted by the Physics Progress Foundation[1]. They decided to participate in this competition and try make physics not just interesting but understandable.

REDY: Oxa, I believe it would be enough to illustrate how mankind was introduced to electric current.

OXA: But I don't understand a thing about your physics!

REDY: It's really easy! I can propose a topic for the first painting: the historical dispute between scientists Luigi Galvani[2] and Alessandro Volta[3]. Galvani

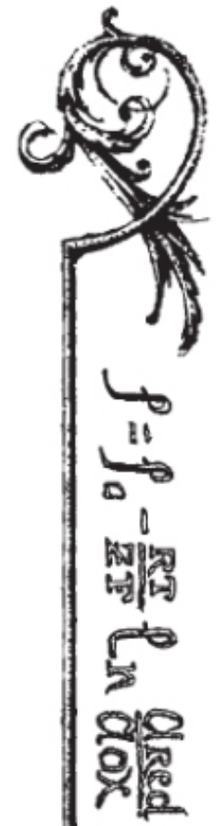
1 Physics Progress Foundation, V.L. Ginzburg's fund. Established in August 2004 by Vitaly Ginzburg, Nobel Laureate, Academician.

2 Luigi Galvani (September 9th, 1737 – December 4th, 1798) — Italian doctor, anatomist, physiologist, and physicist. He was among founders of electrophysiology and theory of electricity; the founder of experimental electrophysiology; he was first to study electric phenomena in muscular contraction ("animal electricity").

3 Alessandro Giuseppe Antonio Anastasio Volta (February 18th, 1745, Como, Italy – March 5th, 1827, Como, Italy) — Italian physicist, chemist, and physiologist. He was among founders of electricity theory.

Volta is demostrating his invention to Napoleon – Voltaic pile.
The artist is J.Bertini, 1801. The location is Volta Temple (Komo, Italy)

asserted that currents are of animal origin, while Volta insisted on their metal nature. By the way, they were both right, but this had been recognized later. The term «galvanic cell» (rechargeable battery, battery) is named after the first scientist. The volt, which is the electrical unit of voltage or potential difference, is named in honor of the second scientist. They both had great memory, but their fates were different. Galvani refused to swear allegiance to Napoleon occupational government. He had to leave his University, and soon died. Volta demonstrated his electric pile to Napoleon, and was honored and glorified for the rest of his life. He was even awarded a gold medal.



...Alessandro Volta had four people standing in line. Two of them would hold dissimilar metals with their wet hands: the first one would hold a zinc plate and the second one would hold a silver one. The first would touch the tongue of the second person with their finger, who, in turn, would touch the eyeball of a third person with their finger. The third and the fourth persons would hold a fresh frog leg with their wet hands. When the circuit is closed by touching the metal plates, the tongue feels a sour taste, there is light which appears in the eyes, and a frog leg would move.

In another experiment, Alessandro Volta had four people standing in line. Two of them would hold dissimilar metals with their wet hands: the first one would hold a zinc plate and the second one would hold a silver one. The first would touch the tongue of the second person with their finger, who, in turn, would touch the eyeball of a third person with their finger. The third and the fourth persons would hold a fresh frog leg with their wet hands. When the circuit is closed by touching the metal plates, the tongue feels a sour taste, there is light which appears in the eyes, and a frog leg would move.

Alessandro Volta´s
experiment.
A.Lavrov,
graphic drawing
60x90, 2002

«Another of these magicians, by means of a fluid that nobody ever yet saw, could make the corpses of his friends brandish their arms, kick out their legs, fight, or even get up and dance at his will»

Edgar Allan Poe

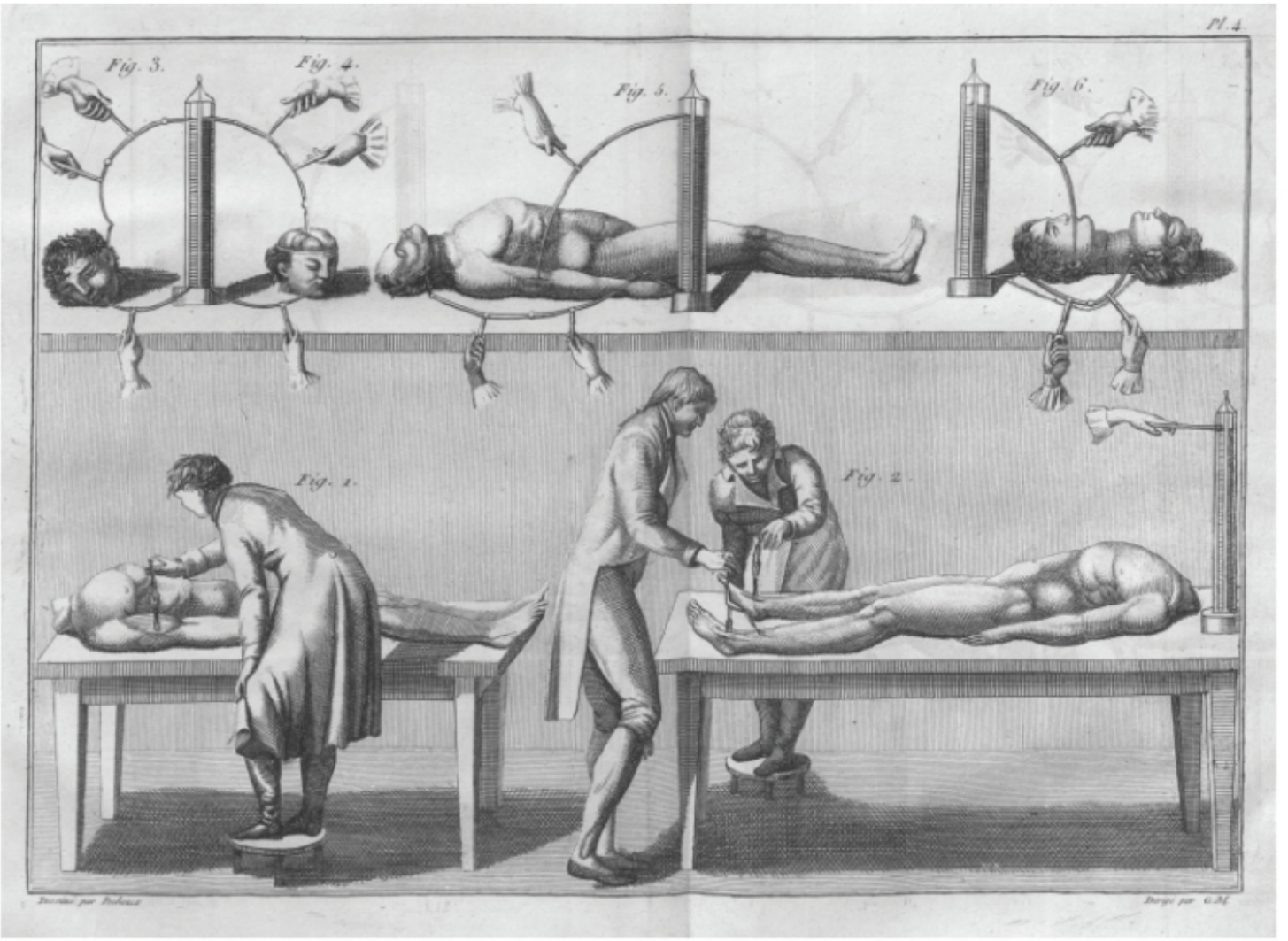
Electric currents history has been written by others as well. Giovanni Aldini[4], nephew of Luigi Galvani, started his human experiments by applying electricity to various parts of two decapitated heads of brigands. This produced movement of the eyelid to the great astonishment of those who were present. The world had the illusion that dead relatives and friends could be revived by applying electricity. These experiments inspired young Mary Shelley[5] to write her famous novel Frankenstein. Edgar Poe[6] in his Thousand-and-Second Tail of Scheherazade wrote: *«Another of these magicians, by means of a fluid that nobody ever yet saw, could make the corpses of his friends brandish their arms, kick out their legs, fight, or even get up and dance at his will»*. Thus, owing to electrical nature of sensations, mankind has been introduced to electric current. Thus, we might say that the current has been created by man, changed his life, and now governs him.

Luigi Galvani's animal microcurrents couldn't withstand the power of metallic electricity that was commercialized easier and developed much faster. But it seems to me, Oxa, we could prove that today these two evolutionary branches unite, and the animal electricity will outrun the

4 Giovanni Aldini (April 16th, 1762, Bologna – January 17th, 1834, Milano) — Luigi Galvani's nephew and follower. Became famous for mixing serious studies together with horror-freezing shows. He demonstrated the so called "electric dances" — experiments proving efficiency of electric excitement for obtaining spastic muscle movements - to the audience.

5 Mary Shelley, born Mary Wollstonecraft Godwin (August 30th, 1797, London – February 1st, 1851, London) — English writer. Known as the author of the Frankenstein, or The Modern Prometheus novel, and the wife of romantic poet Percy Shelley.

6 Edgar Allan Poe (January 19th, 1809 – October 7th, 1849) — American writer, poet, literary critic, and editor; a representative of American romanticism. Most of his reputation was gained due to his "gloomy" stories. Edgar Poe was among first American writers who wrote their compositions as short stories. Founder of contemporary detective story genre. Edgar Poe's works contributed to appearance of science fiction.



Reproduction of the plate IV (lower panel) in the Aldini's tractate «Theoretic and experimental studies of the galvanism» Paris, 1804. The location is the New York public library, New York (USA)

metallic one. After all, animal currents define our human personality. Thus, the rough power of inanimate nature is replaced by the fine, elegant, and beautiful one. Now go on, don't waste any time, paint your first picture of Volta's experiment, and I'll go to the library to study the history of physics.

«Electricity, galvanism, magnetism it is all a great secret of the nature. I'm inclined to think that human brain, like a pump, can draw these currents from the air and turns them into a soul»

Napoleon I Bonaparte

Redy comes back at night.

Oxa asks Redy to her studio. After some time, he breaks out in laughter. Oxa is surprised, but soon she starts laughing too. They both laugh hard; Redy is laughing so hard, he can hardly talk.

REDY: But it wasn't this way!

OXA: Redy, I'm a painter, this is my own fantasy. This is how I see the Volta's experiment.

REDY: It's a madhouse not a fantasy! And what do you call it?

OXA: «Volta's Experiment».

REDY: «A heap of Napoleonic plans is ridiculous before permanent laws».

OXA: Great!

REDY: By the way, Napoleon[7] himself said brilliantly when he was in burned Moscow.

OXA: *«Tell me, uncle, had we a cause when Moscow, razed by fire, once was given up to Frenchman's blow?»*[8] And what he did say, Redy?

REDY: *«Electricity, galvanism, magnetism it is all a great secret of the nature. I'm inclined to think that human brain, like a pump, can draw these currents from the air and turns them into a soul».* When being in Moscow on September 21th, 1812,

7 Napoleon I Bonaparte (in Italian, Napoleone Buonaparte, in French, Napoléon Bonaparte); (August 15th, 1769, Ajaccio, Corsica – May 5th, 1821, Longwood, Saint Helena Island) — the Emperor of France in 1804–1815, great French war-lord and political figure who had founded modern French state.

8 The verse from the poem Borodino by Russian poet M.Y. Lermontov (1814–1841).

Galvani together with his wife and his assistant are conductin an experiment in the home laboratory.
A.Muzzi, 1862. Palazzo Poggi Museum, Bologna, Italy

«A dark room can be illuminated rather brightly»
Vasily Petrov

Napoleon appointed Volta President of Electoral Board. Two years before, he made him a count and a senator of the kingdom of Italy. It is providence, a moment of truth — do you understand? While in ruined and burned Moscow after his victory, Napoleon recollects about Volta, electric current and soul and decides to leave our country.

OXA: Now tell me about your adventures in the library.

REDY: I found an ancient book by Vasily Petrov[9] called Report of Galvani's and Volta's Experiments printed back in 1803. You wouldn't believe it, its pages were uncut! I cut them myself! Hence, I was the first to read it for 200 years after it was published. Look, Oxa (Redy shows her a copy): Petrov published a method for obtaining electric light and an idea of electric illumination a few years earlier than Davy[10]! He wrote: *«A dark room can be illuminated rather brightly»*. If only this book was published in Europe,

9 Vasily Vladimirovich Petrov (July 8th (now 19th), 1761, Oboyan, Belgorod Governorate – July 22th (now August 3th), 1834, Saint Petersburg) — Russian physics experimenter, self-educated electrician, Member of the Saint Petersburg Academy of Sciences since 1809; Corresponding Member of the Saint Petersburg Academy of Sciences since 1802.

10 Humphry Davy (December 17th, 1778, Penzance – May 29th, 1829, Geneva) — English chemist and physicist.

Ohm[11], Ampere[12], and Faraday's[13] laws might have had other names. Now, I can understand Pyotr Kapitsa's[14] words: *«Isolation of Lomonosov's[15] , Petrov's, and other scientists-loners' works from the world science was a tragedy, and it was explained by the fact that they couldn't participate in collective work of foreign scientists...»* I think I have a new name for the painting.

OXA: What is it?

REDY: The Portrait Which Wasn't There. Like Daniil Granin's[16] story of Petrov.

OXA: I wonder why?

REDY: Just because there are no portraits of Vasily Vladimirovich Petrov preserved! He was a Professor of Physics at the Medical Surgical Academy. He worked on Volta's and Galvani's experiments.

«Isolation of Lomonosov's , Petrov's, and other scientists-loners' works from the world science was a tragedy, and it was explained by the fact that they couldn't participate in collective work of foreign scientists...»
Pyotr Kapitsa

11 Georg Simon Ohm (March 16th, 1789, Erlangen – July 6th, 1854, Munich) — famous German physicist.

12 Andre-Marie Ampere (January 20th, 1775 – June 10th, 1836) — famous French physicist, mathematician and naturalist, Member of Paris Academy of Sciences (1814). Member of numerous academies of sciences, Honorary Foreign Member of the Saint Petersburg Academy of Sciences (1830). James Maxwell called Ampere "Newton of electricity".

13 Michael Faraday (September 22nd, 1791 – August 25th, 1867) — English physicist, chemist, and physico-chemist, the founder of electromagnetic field theory, Fellow of the Royal Society of London (1824).

14 Pyotr Leonidovich Kapitsa (June 26th (now July 8th), 1894, Kronstadt – April 8th, 1984, Moscow) — engineer, physicist, Member of Academy of Sciences of the USSR (1939).

15 Mikhail Vasilyevich Lomonosov (November 8th (now 19th), 1711, Mishaninskaya Village – April 4th (now 15), 1765, Saint Petersburg) — the first Russian world-scale universal scientist; naturalist, chemist, and physicist. He showed himself as the first chemist who gave a definition to physical chemistry very close to the modern one and foreordained an extended perspective for physicochemical research. His molecular-kinetic theory of heat has largely anticipated modern concept of substance structure. Astronomer, instrument-maker, geographer, metallurgist, geologist, and poet. Lomonosov was an advocate of development of Russian education, science, and economy.

16 Daniil Alexandrovich Granin (original last name German) (January 1st, 1919, either Volsk, Saratov Governorate or (according to other sources) Volyn, Kursk Region) — Russian writer and public activist.

He was a real fanatic, or as he wrote about himself «obsessed in searching for new physical knowledge.» He would apply electricity to various parts of his body after cutting skin on his fingers. He would apply electricity to the people touching each other with their noses or lips and even rabbits and roosters. He would put electrodes into a fish tank with fish, which caused their expressed shudder. However, Count Uvarov[17], the Minister of Education dismissed Petrov from managing physics laboratory. In 1833, he was discharged from the Medical Surgical Academy. Petrov's name was banned to be used in scientific works and physics textbooks. There are no portraits of him preserved. Is the painting subject clear to you? Here is the name. Go, create!

Next morning Redy wakes up, and the work is finished.

17 Sergey Semenovich Uvarov (August 25th (now September 5th), 1786, Moscow – September 4th (now September 16th), 1855, Moscow) — Russian state figure, Count, Member of Russian Academy (1831), Honorary Member (1811) and President (1818–1855) of the Saint Petersburg Academy of Sciences.

The portrait that doesn´t exist.
A.Lavrov 60x70, 2003

A doll which reacts to the emotional state and the physical activity level.
A. Ryabchevskaya, 60x70, 2005

OXA: Redy, when making this portrait I realized that all your inventions with galvanic pair are outright plagiarism?

REDY: Not at all. A small step forward or a different view on some event is a real invention, if not a discovery. You better draw me a doll with the ampere-meter instead of a head and hands made of dissimilar metals. Even if this doll for the purposes of studying physical laws is different than Petrov's experiments in terms of availability of the ampere-meter, I get a sense of accomplishment that it makes his expectations come true: *«I hope that educated and unprejudiced physicists, in any case, will appreciate my latter works due to their importance someday.»* Now let students answer the question of what these currents mean and why the stronger you squeeze the hand, the greater are currents.

OXA: So, what is the right answer?

REDY: Given that such conditions as age, squeeze strength, and hand humidity are equal, these currents are greater after physical exercise and when in a good mood. Oxa, one may say that this study doll combines Petrov's researches and galvanic skin response discovered

«I hope that educated and unprejudiced physicists, in any case, will appreciate my latter works due to their importance someday.»
Vasily Petrov

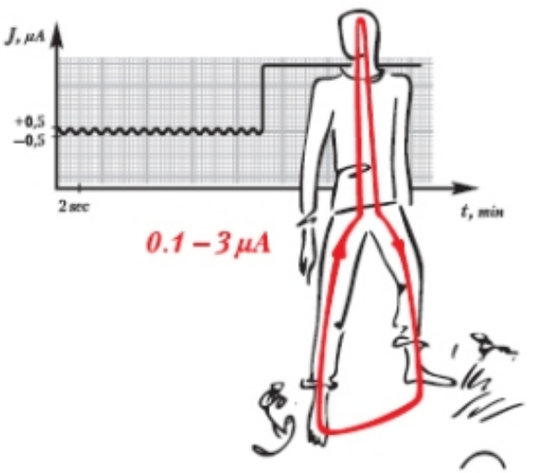
by Russian physiologist I.R. Tarkhanov[18], who described skin potential and its changes during emotional experience in 1889. In 1907, Carl Jung[19] and Frederick Peterson[20] were the first to show the relation between galvanic skin response and the degree of emotional condition that inspired the creation of a lie detector.

Oxa is making some sketches.

REDY: I like your works, they are lively.

OXA: What to do next?

REDY: Next, we need to pay tribute to Galvani due to his discovery of animal currents. I read somewhere about a phenomenon of electric current generation while walking barefoot in the grass [1]. As a matter of fact,



18 Ivan Romanovich Tarkhanov (Tarkhan-Mouravov) (June 3rd (now 15th), 1846 – August 24th (now September 6th), 1908) — Russian physiologist, translator, teacher, and advocate of science. Descended from the ancient Georgian noble family wof Tarkhan-Mouravi.

19 Carl Gustav Jung (July 26th, 1875, Kesswil, Thurgau, Switzerland – June 6th, 1961, Kusnacht, Zurich, Switzerland) — Swiss psychiatrist, follower of Sigmund Freud, initiator of analytic psychology which is a particular branch of deeper psychology.

20 Frederick Peterson (March 1st, 1859 – July 9th, 1938) — American neuropathologist and poet. Peterson pioneered the psychoanalysis study in the USA; he was among first publishers of Freud's and Jung's early works on free association theory in 1909. In 1907, together with Jung, he proved the relationship between the galvanic skin reaction and emotions.

this really is the very animal electricity, a kind of electric vitamins, or electric energy of sensations. If we use something spikier or some material with more electroconductive characteristics instead of the grass, currents will be stronger, as you may conclude. Today, after 200 years electricity was introduced, it is clear that the membrane potential calculated by Nernst's[21] equation is a source for this energy.

$$\varphi = \varphi_0 - \frac{RT}{zF} \ln \frac{a_{red}}{a_{ox}}$$

The most interesting thing is that this way of feet stimulation can evoke the stretching reflex which is a natural mechanism of spine stretching.
A simple experiment with body height measurements shows that after occurrence of stretching reflex, the height increases by 1 to 10 mm [2]. There is a hypothesis that this reflex is a response of a central nervous system to hypoxia. This hypothesis has been supported by an experiment with rats. Rats begin stretching themselves at high altitudes where oxygen partial pressure is reduced [3]. The stretching reflex wasn't socially adopted among people.

OXA: How so?

21 Walther Hermann Nernst (June 25th, 1864, Brisen – November 18th, 1941, Ober-Zibelle) — German chemist, laureate of the Nobel Prize in chemistry (1920) "acknowledging his works in thermodynamics".

$$m = \frac{A \cdot g}{z \cdot F} \qquad J = \frac{y}{R}$$

The legend about Atlantis,
A. Ryabchevskaya, oil on canvas, 100x180, 2006

REDY: Let's see. How can I explain it better? Imagine, for example, a president of some country who publicly sneezed??

And he answers instead of Oxa:

– They say «bless you». He yawns? It's not very polite, but if he covers his mouth with his hand, they are fine with it, they would think he's tired, had a sleepless night or something. And what if he stretches himself? What will they say? You can't even imagine something like that. So, my painter, now it is your new mission to ensure such a behavioral act, representing comfortable movements, but wrongly attributed to the category of social interdictions, is socially adopted.

OXA: You remember, Redy, I used to collect antique myths about Atlas? I believe that a tip is there somewhere. According to the myth, gods have bended their backs.

Oxa takes the book entitled Legends about Titans by Y.E. Golosovker[22] from the shelf and reads: *«Happy was Atlas, and so huge, and so mighty*

22 Yakov Emmanuilovich Golosovker (August 23th (now September 4th), 1890, Kiev – July 20th, 1967, Moscow) — Russian and Soviet philosopher, writer, and translator.

«Happy was Atlas, and so huge, and so mighty that sometimes he would raise his hands to the sky and wash them in clouds, letting out fleecy clouds like a soap foam, speaking and laughing, «Oh hands, my hands, Titan's hands, I would raise the entire sky above my Marvel Mountain and Arcadia!»

Yakov Golosovker

that sometimes he would raise his hands to the sky and wash them in clouds, letting out fleecy clouds like a soap foam, speaking and laughing, «Oh hands, my hands, Titan's hands, I would raise the entire sky above my Marvel Mountain and Arcadia!»

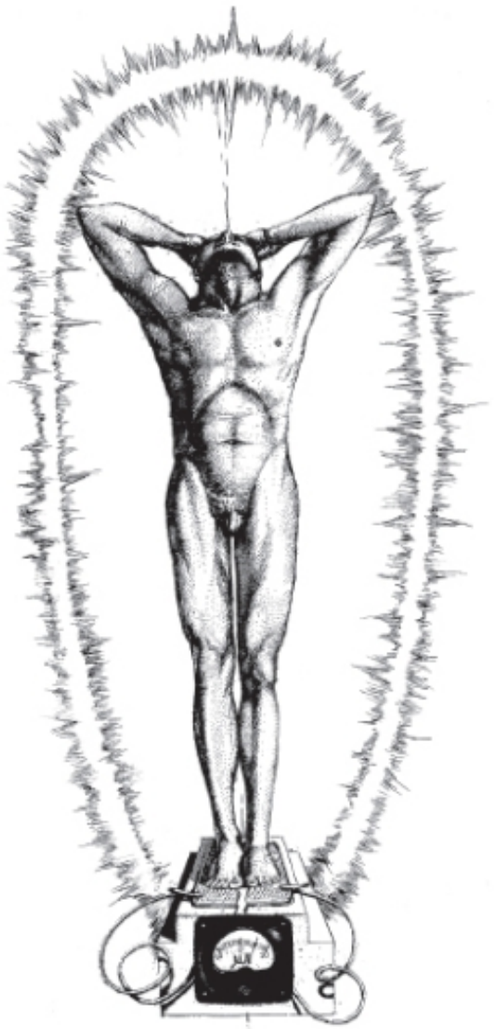
The legend about Atlantis. Dependence,
A. Ryabchevskaya, oil on canvas, 100x180, 2006

Zeus the Thunderer bended him with the lightning, depriving him of freedom placed the sky on his shoulders. Thus, ever since he is bent to submission. As it turns out, the stretching reflex may indeed become a Symbol of Freedom!

REDY: Well, Oxa, you should draw a man with spikes beneath his feet and with the amperemeter connected from one foot to another. He stretches himself and, according to Galvani, generates animal electricity like a power plant. Here, all laws of electrodynamics (Ohm's, Ampere's, and Lenz's[23]) act against the very Newton's[24] law because they all stimulate the stretching reflex, stretching the spine. This is some kind of a new law: Newton versus Newton.

OXA: But still I don't get it how Newton can act against Newton.

REDY: Simple, humans walk by shifting the body weight from one leg to another. Thus, «+» is generated on the loaded foot, while «–» is on



23 Emil Khristianovich Lenz (born Heinrich Friedrich Emil Lenz) (February 12th (now 24th) 1804, Derpt – January 29 (now February 10), 1865, Rome) — famous Russian physicist. Applying Newton's Law developed differential and integral calculus, theory of color, and many other mathematical and physical theories.

24 Sir Isaac Newton (December 25th, 1642 – March 20th, 1727, by the Julian Calendar, valid in England before 1752; or January 4th, 1643 – March 31th, 1727, by the Gregorian Calendar) — English physicist, mathematician, and astronomer, one of creators of classical physics. He wrote the comprehensive Philosophiae Naturalis Principia Mathematica in which the universal gravitation law and the three mechanics laws are set forth, which constituted a basis for classical mechanics.

the other foot. This is an electromotive force of sensations. Now, when a man walks barefoot on the electroconductive surface, the force can generate alternating currents. Hence, on the one hand, each step shortens the spine according to Newton's law,

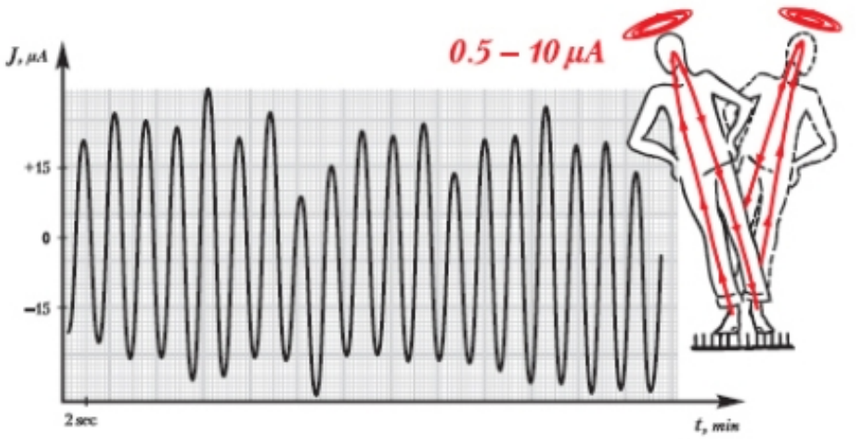
$$F = ma$$

and on the other hand, generation of the electric vitamins that stimulate the stretching reflex, stretching the spine occurs.

OXA: Is my drawing correct?

REDY: Yes, clever girl, now you understand the physics.

OXA: So, if there were electroconductive tights, people would stretch more often to compensate oppressive action of terrestrial attraction, and their back pain would disappear? Ha, ha! Guys would have to wear tights now?



REDY: Nothing is impossible. Stockings were part of male clothing ensemble up until the 13th century. Even Shakespeare's[25] Romeo wore them.

OXA: What's next, Redy?

REDY: Oxa, the topic of electric vitamins is endless. Please try to depict them using Chinese characters. I think this knowledge could lift the veil from origin of electric vitamins. A characters itself is only a word, a sign, an idea, or a symbol, but when it is drawn by a painter, the symbol comes alive under his brush. That is why the art of calligraphy is so popular in the East.

On the next day Oxa invites Redy to take a walk in the park. There Redy saw Old-Chinese characters on a branch of a big oak. Oxa says even before Redy gets to ask her.

OXA: There are five characters. This is how you write them in modern Chinese...

She draws with a stick on the ground.

电子维他命

25 William Shakespeare (1564, Stratford-on-Avon, England – April 23rd, 1616, Stratford-on-Avon, England) — great English playwright and poet, one of the world most famous playwrights. Author of at least 12 tragedies, 16 comedies, 6 historical chronicles, including ones in several parts, 4 long poems, and 154 sonnets.

«...Mother feeding a baby, love, father with children, conception, human development, all five characters are electric vitamins...»

– First two characters mean «electric», and the next three mean «vitamins». Since I have written these characters in the very old style, they should be read right to left or from bottom to top. You are quite right, all most important human life moments can be expressed with characters. Mother feeding a baby, love, father with children, conception, human development, all five characters are electric vitamins.

REDY: Oxa, you are a true philosopher! It is so smart to interpret the notion of electric vitamins.

Robert Burns, Of Wedding Ring

She asked, why wedding rings are made of gold;
I ventured this to instruct her:
Why, madam, love and lightning are the same,
On earth they glance, from Heaven they came,
Love is the soul's electric flame,
And gold its best conductor.

Oxa encouraged by praises, suddenly recalls a quotation from Avicenna[26]: *«Invisible, within the body contained everything that the Nature could bring together.»*

REDY: It is brilliant, Oxa! It is the subject for your next painting! Let's change one word, though, in Avicenna's dictum. It is already 1000 years old, but now instead of «Nature» one may easily use the word «Science». Modern civilized people can't see any boundaries between these concepts. We are all Nature's children, or to put it more exactly, we are all children of the electric force, since Robert Burns[27] have written that «Love is the soul's electric flame» being amazed by Volta's experiments.

26 Abu Ali al-Husayn ibn Abdullah ibn Sina (in Latin, Avicenna) (August 16th, 980, Afsona near Bukhara – June 18th, 1037, Hamadan) — mediaeval scientist, philosopher, and doctor; a figure of oriental Aristotelian science. He was a court physician of Samanid Emirs and Daleimit Sultans; he spent some time working at the ministry in Hamadan. Wrote more than 450 works in 29 fields of science, of which only 274 works have been preserved to see our days.

27 Robert Burns (1759 – 1796) — British (Scottish) poet, folklore collector, the author of numerous rhymes and poems written both in so called Lowlands Language and in English.

Man is a point in Universe where all laws of physics, both already known and not yet discovered, act.

Then he reads a quotation of Michael Faraday[28]: *«Wonderful as are the laws and phenomena of electricity when made evident to us in inorganic or dead matter, their interest can bear scarcely any comparison with that which attaches to the same force when connected with the nervous system and with life.»*

OXA: I wonder can you draw any example of the modern, revolutionary engineering approaches that can work within a human. I mean something concerning nuclear reactions, radio wave reception, or conversion of solar energy...

REDY: Let's talk about a hybrid vehicle, for example: there are functions both for intelligent management of energy flows in it and those for conversion of mechanical energy into electrical one. Owing to electric nature of human sensations and to possibility of generation of electric energy from these sensations, according to all physical laws, the human organism has similar mechanics. If we mention Chinese medicine, by the way, we can remember about numerous

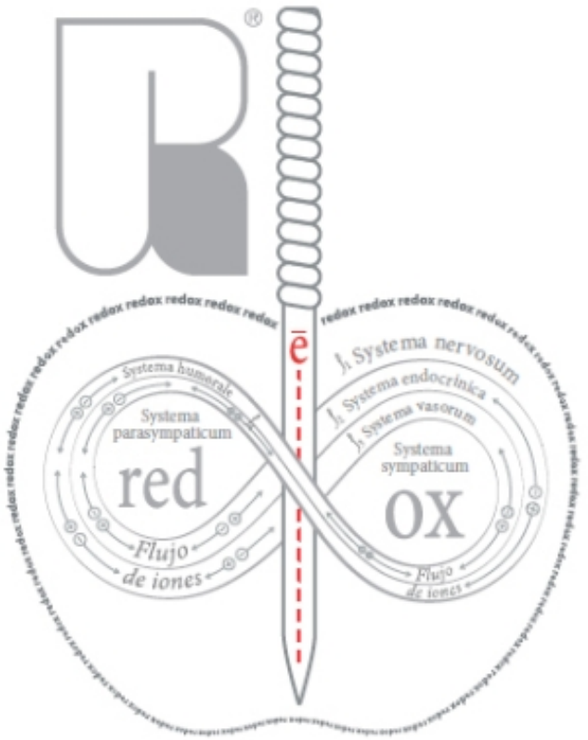
«Wonderful as are the laws and phenomena of electricity when made evident to us in inorganic or dead matter, their interest can bear scarcely any comparison with that which attaches to the same force when connected with the nervous system and with life.»

Michael Faraday

28 Michael Faraday (September 22nd, 1791 – August 25th, 1867) — English physicist, chemist, and physico-chemist, the founder of electromagnetic field theory, the Fellow of the Royal Society of London (1824).

Oriental legends of the acupuncture. One legend has it that extraterrestrial beings taught Earth dwellers how to use this medical procedure.

By the way, I would like to share some scientific news on Chinese medicine with you. A group of researchers has demonstrated that the needle, being an electronic conductor, could close all regulatory systems in the organism together, i.e. nervous, endocrine, lymphatic, and humoral ones. It turned out so that it conducts the very animal electricity or electric vitamins [4]. Volunteers measured the potential of the needle inserted into biologically active point. The blindfolded subject laid and didn't expect any unusual stimulation. During the experiment, such unexpected actions as screams, loud laughter, rattle of pans, tickling with feather, touch of ice, approaching ammonia vial, playing pleasant music occurred. The result exceeded any expectations. Each stimulus has been responded by changing the needle potential. The experiment led to the conclusion that electric vitamins were one of the acupuncture needle action mechanisms. It has been used in medicine for thousands of years. This is a very important conclusion since until now acupuncture therapy had no any physical ground. Let's call this work Two Hundred Years Later.



The news abou the Galvani and Volta´s experiments 200 years later.
Cristina Sampere. Barcelona. Oil on canvas, 120x90см, 2012

«Invisible, within the body contained everything that the Nature could bring together.»

Abu Ali al-Husayn ibn Abdullah ibn Sina

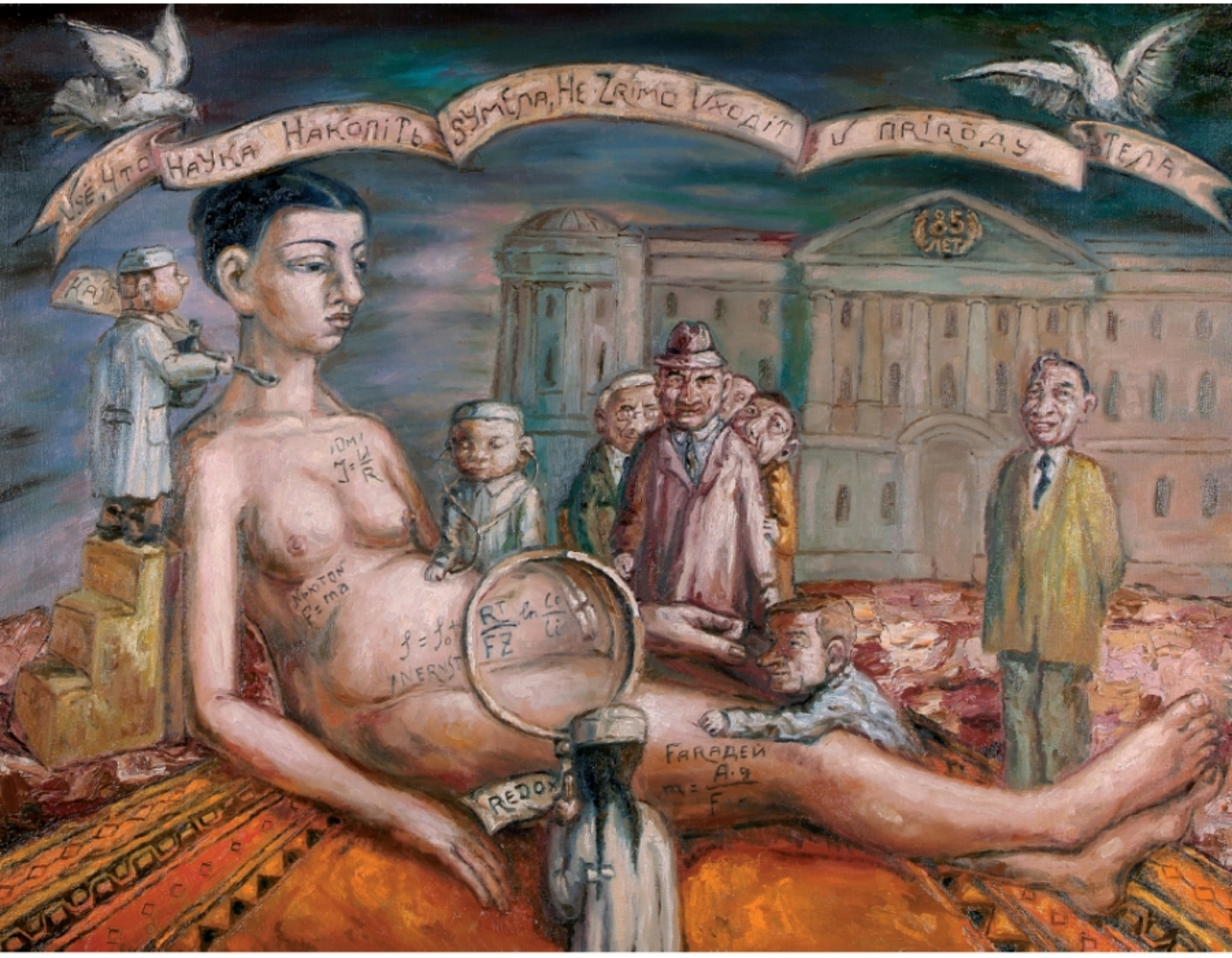
Next morning, inspired by new Oxa's paintings, Redy proposes to return to the Avicenna's dictum about the body and the nature.

OXA: Will this painting depict science?

REDY: Yes, and let's make the science naked on the painting! Let students study it in detail, let physical laws be inscribed on its body, and let's make it pregnant with new discoveries. By the way, let us give this painting to the Medical Academy as a new medicine development concept.

Next morning Redy wakes up, and the work is finished.

REDY: Oxa, please come up with a story so that two people would hold dissimilar metals in their hands and when they would kiss, the ampere-meter would read presence of currents. Maybe make two columns just like in Solomon's Porch at the entrance to the Temple that crowned the King's glory (consecrated in 960 year B.C.). One black column was called Boaz In Him Is Strength, and other white column was called Joachim He will/shall establish. They both symbolized the unity of the Reason and the Faith.



Minerva, goddess of science.
A.Lavrov, oil on canvas, 120x90, 2004

OXA: Redy, don't you think that history has mistaken 200 years ago? We have entered some temple passing through the same two columns: one of them «+» silver, another is «–» zinc, but we came in without love, without fine essence, without paying the tribute to the animal currents.

REDY: Excellent idea! It can help you create a new masterpiece.

Next morning, as usually, new painting was finished.

REDY: Hooray! The Love and the Science have never been so close to each other. It is the Electric Vitamins Arch; it is the connection between spiritual and material worlds. It is an entrance into the Temple of Science that opens the way to the philosophers' stone. These animal currents are some kind of an indicator in the search for the elixir of life. The more physical activity

The electric vitamins arc,
A.Lavrov, oil on canvas, 90x120, 2004

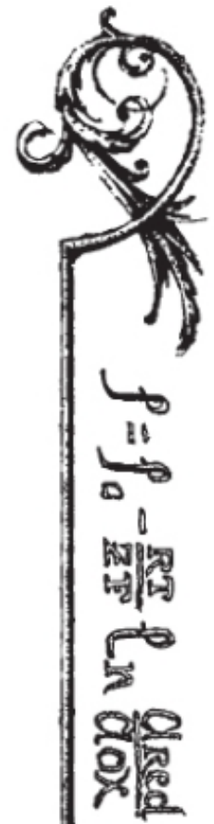
and the better mood, the more these currents are. Thus, the arch not only demonstrates physical laws, but also provokes physical activity in people, so that these laws act for the sake of health and beauty. Can you please draw people holding each other's hands in the arch and the ampere-meter reading the force of their friendship?

OXA: I have already done it.

REDY: Excellent! And how would you like an idea of a loving couples contest? One of them may be a physicist during the Year of Physics, and his sweetheart could be an artist, a musician, or a doctor, i.e. creative person, too. The best couple gets the world's best wedding. Just imagine, all physicists will support us. Best craftsmen will make the world's biggest ampere-meter and install the Arch of Electric Vitamins in the main square of the country!

It is the Electric Vitamins Arch; it is the connection between spiritual and material worlds. It is an entrance into the Temple of Science that opens the way to the philosophers' stone. These animal currents are some kind of an indicator in the search for the elixir of life.

The triumph of physics
on the Red Square,
A.Lavrov, oil on canvas,
89x120, 2004



TV broadcasting company arranges the wedding. For the first time since the mankind has been introduced to electric current, the newlyweds demonstrate to the world that «Love is the soul's electric flame.» Physicists propose magnificent toasts, the newlyweds are given a car, an apartment, a yacht, paid honeymoon, and a computer by famous brands. Celebrities perform their greatest hits. Best couturiers give them clothes. Best cooks serve them dinner and bake them a cake... In general, the history of how mankind is introduced to electric vitamins is depicted like a fairy tale. Please draw this painting, Oxa, but make sure to depict the following «I was there, Mead and wine I drank, I swear; Though my whiskers bathed in wine, Nothing passed these lips of mine»

Redy and Oxa called it a day and sent their work to the contest jury. It was published. The Minister read their work, he liked that people kissing each other were depicted and supported organize such festival. He also persuaded the inventor not to install these arches in any other countries, so that it would be the only arch in the world.

The ceremonial parade of the good habits,
A.Ryabchevskaya, oil on canvas, 120x140, 2006

...And then everything turned out just like in a fairy tale. The pregnant science rose from the Minin and Pozharsky Square and presented the liberation sword in the form of intellectual capital to a sovereign man

And then everything turned out just like in a fairy tale. The pregnant science rose from the Minin and Pozharsky Square[29] and presented the liberation sword in the form of intellectual capital to a sovereign man. And a new field in the physics — the study of rationally use laws of nature and of life - appeared. And a new tradition to organize a feast for the entire world in honor of a marriage between the science and the art was born. And, two hundred years later, metallic and animal electricity reunited once again. Historical arguments between Galvani and Volta, between faith and reason, and between religion and science were resolved. Dolls were distributed worldwide to help children learn physical laws and history of their discovery. And the world recollected such names as Mendeleyev, Jacobi[30], Lodygin[31], and Popov[32]. The world was convinced that Russia was the motherland of electric light.

29 Kuzma Minin (full name, Kuzma Minich Zakhariev-Sukhoruky) (late XVI Century – May 21th, 1616) — Russian national hero; organised and took part in command of the Land Army (1611 – 1612) during the struggle of Russian people against Polish and Swedish intervention.

30 Boris Semyonovich Jacobi (born Moritz Hermann von Jacobi) (September 21th, 1801, Potsdam – February 27th (now March 11th), 1874, Saint Petersburg) — Russian physicist, Member of the Imperial Saint Petersburg Academy of Sciences. Elder (3 years older) brother of prominent German mathematician Carl Jacobi.

31 Alexander Nikolaevich Lodygin (October 6th (now 18th) 1847, Stenshino Village, Lipetsky District, Tambov Governorate – March 16th, 1923, Brooklyn, New-York, USA) — Russian electrical engineer, inventor of Incandescent light bulb (July 11th, 1874).

32 Alexander Stepanovich Popov (March 4th (now 16th), 1859, Turyinskiye Rudniki, Perm Governorate – December 31th, 1905 (now January 13th, 1906), Saint Petersburg) — Russian physicist and electrical engineer, professor, inventor of radio.

How to lift?
A.Lavrov, oil on canvas,
130x200, 2005

And presidents and kings would visit the country and measure the force of their friendship. And the country became a fairytale for all world physicists. All this resulted from an appeal to scientific community and mass-media by of Nobel Laureate V.L. Ginzburg: *«Creativity and imagination are the major factors of progress. Intellectual leaders who combine creative potential, deep knowledge, talent to lead, and ability in achieving goals have become the main figures of swiftly rushing era of imagination».*

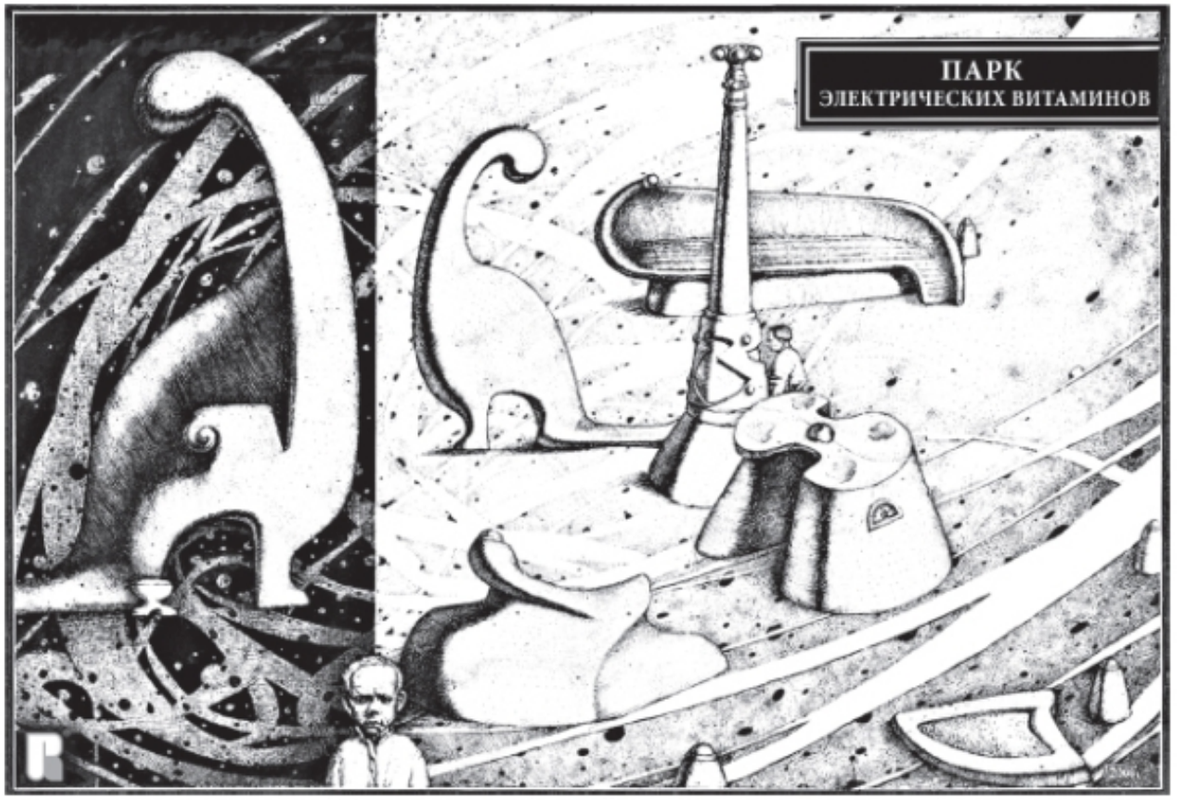
And the country lived happily ever after. One day, the hottest people gathered in this country, combined an intellectual capital, organized a parade of healthy habits, and constructed a park of electric vitamins. People understood that healthy habits made physical laws work daily for the sake of health and beauty and true. Atlases have straightened their shoulders. Less budgetary funds were spent on illnesses, to be used for science and education purposes. A new mighty, dashing generation— strong men, not us — appeared. And they lived happily ever after.

But some time later, the Earth became too crowded. Since there was a lot of money for the science, people found other planets, discovered new laws, and created new habits.

«Creativity and imagination are the major factors of progress. Intellectual leaders who combine creative potential, deep knowledge, talent to lead, and ability in achieving goals have become the main figures of swiftly rushing era of imagination».

V.L. Ginzburg

The most important wedding of the country.
A.Ryabchevskaya, oil on canvas, 140x120, 2005



The park of the electric vitamins, A.Lavrov, graphic drawing, 38x57, 2000

«The habit is the only human pleasure»
J.W. Goethe[33] .

THE END

33 Johann Wolfgang von Goethe (August 28th, 1749, Frankfurt am Main, Germany – March 22th, 1832, Weimar, Germany) — German poet, state figure, thinker, and naturalist.

Epilogue

redox – the natural science paradigm

the rest

redox

Redox (REDuction and Oxidation in latin): REDuction and Oxidation processes constitute the energy production mechanism, necessary for the processes of vital activity and determine the organism entropy dynamics

Redox = good habits + electric vitamins. This formula of evolution of the man makes physics laws work daily for the good health and beauty

redox science is a science of the intelligent and efficient use of the natural laws and the laws of existence

Известия о гальвани-вольтовских опытах двести лет спустя

DESCRIPTION OF THE CURRENT GENERATION PHENOMENON BY CLOSING FEET LOOP WITH THE STIMULATING ELECTROCONDUCTIVE PLATE, AND THE HYPOTHESIS ABOUT ITS PHYSIOLOGICAL SIGNIFICANCE

S.L. Bugrov, E.S. Bugrova, N.S. Vetrova.
Reflexologia Magazine, No. 1, 2005

This article is dedicated to the investigation of the electric current generation phenomenon by human while walking barefoot on wet ground.

The article contains and proves the hypothesis about possible consumption of generated energy by structures of limbic-reticular complex and hypothalamus.

The article also proves the physiological expediency of a new habit – brushing teeth while standing on the Dr. Redox's couch spiky metal plate which is becoming more popular in Russia and can compensate the deficiency of contact with the nature in a metropolis.

This article discusses the importance of the stretching reflex in spine sanogenesis, interrelation of this behavioral act with values of EMF and electric current registered in the experiment, as well as possible physiological stimulation of stretching through the new habit.

EXPERIMENT DESCRIPTION:

Instruments:

Potentiostate PI-50-1
X-Y recorder PDA-1
Micro-ammeter M95

Main working electrodes: Redox applicators – stainless steel plates with incused spiny pins - trapezoid electrodes [1], and similar plates coated with silver [1], as well as smooth silvered plates without pins.

Experiment Technique:

The experiment has been conducted in a group consisting of 30 virtually healthy subjects aged from 15 to 45.

The subjects stood barefoot on either spiky or smooth electrodes and shifted their body weight from one foot to another by the metronome rhythm keeping the circuit closed and leaving a slight contact of the unloaded foot with the electrode. A measuring instrument – a micro-ammeter or potentiostat, as shown on the magazine cover – has been connected to the circuit between two electrodes. X-Y recorder registered the instrument readings. Subjects experienced both mechanical and spiky stimulation in their feet alternately. Walking in place with circuit breaking was less informative; it complicates the registration of physical parameters and is not considered in this work.

EXPERIMENTAL DATA:

Curve 1 shows a chronoamperogram of walking barefoot on wet ground. At that, the silvered smooth plates served as analogue of conductive ground.

Curve 2 shows high currents when simulating walking barefoot on a spiky applicator, and increase of currents while doing the stretching reflex.

Curve 3 shows increase of currents on a spiky applicator after 40 minutes of physical exercises.

Curve 4 shows dynamics of changing the electromotive force (EMF) generated between two feet after losing tactile sensibility caused by local anesthesia of both feet with chloroethyl.
The curves show that reversal EMF and alternate current arise between feet while shifting body weight from one leg to the other, imitating a barefoot walk on wet ground.

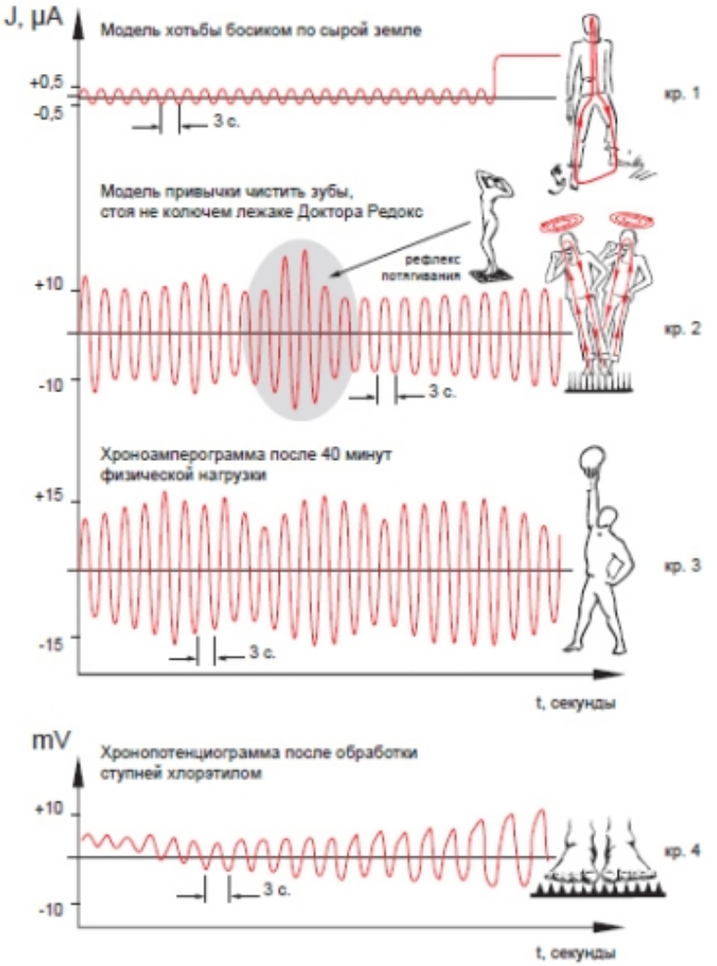
DISCUSSION OF EXPERIMENTAL DATA:

It can be assumed that the membrane potential of proprioceptive, tactile, and nociceptive feet receptors is the source of electric energy. During heavy and spiky contact with spiny electrodes, the receptors are stimulated, which means generation of the action potential on their membranes. By decreasing the load down to slight contact with spiky electrodes, feet feeling receptor membranes get a rest potential. By shifting the body weight from one foot to the other, the potentiostat (being in an opened circuit status) registers reversal EMF (Curve 4). The current is registered by closing the circuit (Curves 1, 2, 3).
When a subject stands on smooth plates, both EMF and electric current values, despite significantly larger area of contact with skin, show significantly less value than in the case when spiny plates are used. It can be explained by the correlation between the action potential module on receptor membrane and the stimulation force, and thus by generation of a higher potential difference by alternate feet stimulation.
The value of registered EMF drops significantly after the treatment of feet with chloroethyl (Curve 4) due to impairment of the process of action potential generation on the receptor membranes during anesthesia. EMF increases to its original values while tactile sensibility returns. This also indicates the correlation between the excitement force and the action potential value, resulting in a value of the generated current.
It is an interesting fact that currents increase after 40 minutes of physical exercises, as it indicates the role of galvanic skin reaction in generation of these currents that can be explained by increase of electroconductivity of the whole organism. This correlates with data by A.S. Osenniy and A.A. Putilov [2].

Justification of Physiological Character of the Processes Shown in the Experiment

As described earlier [3], the discovered mechanism of biological currents generation by the human is of physiological nature because it is reproduced in natural conditions. Walking barefoot on a conductor (e.g. wet grass or ground) closely corresponds to the described experiment [4]. Moreover, the traditional Russian medicine postulates extraordinary usefulness of such "procedure".

ХРОНАМПЕРМЕТРИЯ ПРИ РИТМИЧНОМ ПЕРЕНЕСЕНИИ ВЕСА ТЕЛА С ОДНОЙ НОГИ НА ДРУГУЮ



We have also obtained data of the survey conducted among the consumers utilizing the new habit – brushing teeth while standing on a metal applicator. This data convincingly prove a positive subjective perception of its cumulative effect [5]. The majority of customers noted improvement of health, mood, reduction in headache frequency or no headaches at all, and relief of meteopathic reactions. The most reliable data were that about the reduction of people's backaches with originally stated spine pathology or with previously non-differentiated dorsalgia of a possibly vertobrogenic character. Most patients from this group pointed out more frequent daily stretching urges in comparison with the period before getting into a habit of using spiky metal applicator.

Physiological Significance of the Described Phenomenon

One of the hypotheses explaining physiological significance of the mechanism of electric current generation by human body is possible consumption of the generated electric energy by central brain structures. This hypothesis is supported by the fact that nerve impulse is of electric nature and the electric circuit is formed by closure of the loop between the feet is probably large enough and includes perceptive structures of the central nervous system. These structures also form excitation focuses as a response to peripheral signal which is accompanied by the depolarization of neuronal membranes, generation of potential difference, EMF, and, as a result, microcurrents. It is quite logical that an electric energy of low modality has some significance for the nervous system because it uses neuron as the functional unit that generates the nerve impulse of electric nature. Such energy will be consumed by relevant structures. The most possible "consumers" include:

- **Reticular formation** which explains the fact that consumers point out the improvement of health, weakness relief, and better working ability;
- **Limbic structures** which correlate with the improvement of the emotional sphere and motivation increase by those using the applicator regularly;
- **Hypothalamic structures** which may cause effective relief of headaches associated with vascular dystonia and meteopathic vegetative reactions.

The overall effect of the impact on these structures might increase the vigilance level (consciousness, attention, concentration ability, effective situational responses, etc.), activate adaptation mechanisms, and improve regulation of all organs and systems.

Stretching reflex

The fact that EMF increases by stretching is rather interesting. Moreover, when a subject pointed out the feeling of pleasure accompanied the stretching act, the graph read EMF higher than that in case when there was no such indication.

Taking into account the described facts, we can advance a working hypothesis about increasing conductivity of CNS structures included in the circuit formed during the experiment due to production of endorphins therein which represent biochemical analogues of subjective pleasure perception.

The EMF registration experiment during the stretching act of was based on the above mentioned data concerning the fact that the consumers utilizing the new habit point out increasing number of daily stretching due to using metal applicators as noted earlier [3].

The very act of stretching or the reflex (both terms are used in books) is typical not only for humans, but for many vertebrates as well. Authors consider it as rather interesting, little studied, and underestimated phenomenon in respect to its physiological significance. The hypothesis about the sanogenetic role of this behavioral act/reflex in relation to pathological and premorbid conditions of the spine seems quite believable. An experiment involving electrical stimulation of this reflex has been reported [6].

It is known that many physical therapy exercises developed in ancient times and nowadays include exercises for spine stretching by back muscles, just as it happens during the stretching act.

Different methods of dry and water extension are well-known. They are widely used and have already proved their efficiency in treatment of degenerative spine diseases.

We believe that the physiological basis of these adopted treatment techniques is the natural spine extension mechanism. It is a complex behavioral reflex and an act which is realized arbitrarily in response to impulsive urges. The cause of these urges is pulsation from hypoxia-sensitive receptors, presumably situated in paravertebral tissues. Its physiological effect is confirmed by "endorphin reward" expressed by the subjective perception of stretching as a pleasant act (similar "rewards" include eating, reproduction related behavior, and other most significant biological processes).

It is obvious that the natural spine extension mechanism by the back muscles is much less traumatic than the artificial extension used in neurology. It is quite probably that it will also turn out to be more effective. Thus, the question of the possibility of stretching stimulation by humans for the purposes of preventive and curative effects in relation to degenerative spine diseases arises.

The authors think that the above-mentioned situation in which the consumers who utilize the new habit of brushing teeth while standing on Redox's couch point out increased stretching frequency is a demonstration of such stimulation. There is a good probability that the reason of such effect on the stretching reflex is a reverse to the reason of this reflex extinction by humans as compared to many animals. Perhaps, the very increase of the chemoreceptor's sensitivity by paravertebral tissues to hypoxia as a response to the stimulation by microcurrents generated on the applicator is the reason of consumers stretching stimulation.

Diagnostic Value of the Described Phenomenon

The generated currents and EMF value represent functions of body weight, skin humidity, age, conductivity, emotional condition, pressure, temperature, neural activity, and other physiological parameters of humans. We will try to cover these issues in our further works.

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SPINE STRETCHING SANOGENETIC MECHANISM

S.L. Bugrov, E.S. Bugrova, V.V. Volkov, Redox JSC

Theses to the I Congress of Physiologists of CIS, Sochi, September 19–23, 2005.

Phenomenon of electric current generation by a human body during feet stimulation by the Redox' Applicator [1] spiky metal conductor, was taken as the basis for hypothesis that the generated current might possibly be consumed by structures of limbic-reticular complex and hypothalamus. Among all effects (improved condition, relief of headaches) achieved due to the use of the applicator, stretching reflex stimulation was particularly interesting to us. Measurements with ИЧ 10 micrometer on the test-bench have demonstrated that spine length increased by 1 to 10 mm after this behavioral act.

It is reasonable to assume that this unconditional reflex is the spine stretching sanogenetic mechanism. Stimulation of this reflex by electric currents generated during feet stimulation with a prickly applicator can probably be explained by increasing sensitivity of the receptors to hypoxia. It was revealed that electric currents, which are recorded during feet stimulation by the applicator, have statistically significant effect on the performance of bioelectrical activity of the brain [2].

Nevertheless, we cannot exclude a suggestion that the stretching reflex stimulation may be explained by the mechanical irritation and response of the limbic system to this habitual irritation, i.e. the conditioned reflex is stimulated by the conditional stimulus.

We assume that extinction of this reflex, both due to physiological reasons and its social unsuitability, takes a part in the pathogenesis of osteochondrosis. A new healthy habit to stimulate the stretching reflex is to brush your teeth while standing on the applicator. It is proposed as an alternative to traumatic techniques for artificial spinal traction and prevention of osteochondrosis. Mechanism of predicted central nervous system stimulation can act as a routine to increase body adaptation reserves which is daily anti-stress.

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REPORT

COMPARATIVE STUDY ON THE HYPOBARIC HYPOXIA EFFECT ON THE STRETCHING RESPONSE IN RATS AND MICE

S.L. Bugrov, E.S. Bugrova, A.A. Mironov, A.A. Palagina
First publication

This report presents the results of experimental studies on the stretching response during hypobaric hypoxia modeling.

As it was shown, hypobaric hypoxia modeling leads to a change in the ratio between basic behavioral responses of laboratory animals. Occasionally the stretching response in laboratory animals is observed.

MATERIALS AND METHODS

This study has been carried out in accordance with the following regulations:

Rukovodstvo po eksperimental'nomu (doklinicheskomu) izucheniyu novykh farmakologicheskikh veshchestv. Moscow, Meditsina Press, 2005. – 832 p.

Order of the Ministry of Health of the Russian Federation on approval of the rules of good laboratory practice in the Russian Federation number 267 from June 19th, 2003.

CHARACTERISTICS OF ANIMALS AND CONDITIONS OF THEIR HUSBANDRY

The following test-systems have been used in experiments:
sexually mature outbred white mice
males and females, body weight 20.25 ± 1.80 grams;
sexually mature Wistar rats,
males and females, body weight 180.0 ± 1.44 grams;
sexually immature Wistar rats,
males and females, body weight 120.0 ± 4.62 grams.
Animals supplied by Stolbovaia Farm, SI SC BMT RAMS (State Institution Scientific Center of Biomedical Technologies, Russian Academy of Medical Sciences), and Andreevka Farm, SI SC BMT RAMS, license No. 32006214.

Quarantine / Adaptation

Delivered animals have been placed in a separate room for the adaptation period (14 days) before starting experiments. During this period their health deviations were inspected according to the Acceptance, Quarantine, and Adaptation of Animals Laboratory Standard Operating Procedure (SOP).

Dividing by Groups

Animals have been randomly divided by groups based on their body weight criterion, so that each animal weight remained within ± 20 % of the mean weight value for each sex, according to the Laboratory SOP.

Identification

Individual number has been assigned to each animal. Each animal has been also tagged by either piercing of ear conch or by making a paint mark (with eosin and methylene blue) on the tail using coding scheme. Group name, animal number, tag, study reference, and manager's name have been indicated on cage label of a definite color according to the Laboratory SOP.

Husbandry and Care

General husbandry and care rules are in compliance with the standards set forth in the Guide for Care and Use of Laboratory Animals (ILAR Publication, 1996, National Academy Press) and agreed upon with the Ethics Committee at SEI HPE NizhSMA Roszdrav (State Educational Institution of Higher Professional Education of Nizhny Novgorod State Medical Academy of Federal Agency for Healthcare and Social Development of Russian Federation). All routine care procedures have been performed according to the Laboratory SOP.

Environmental conditions at an animal dwelling room have been kept as follows: room temperature 18–24°C; relative humidity 30–70%; 12-hour light period with automatic switching (06.00 a.m.–06.00 p.m. – day, 06.00 p.m.–06.00 a.m. – night); 100% ventilation without recirculation, but with air refreshment 7–12 room volumes per hour.

Mice have been kept in polycarbonate cages T3 (Manufactured by Plastic OJSC, Dzerzhinsk Town, specification TU (Technical Standard) 2297339057619102003, Sanitary and Epidemiological Conclusion No. 52НЦ.06.229.П.001222.06.03) on the substrate.

Rats have been kept in polycarbonate cages (Manufactured by: Plastic OJSC, Dzerzhinsk Town, specification TU 2297339057619102003, Sanitary and Epidemiological Conclusion No. 52НЦ.06.229.П.001222.06.03) on the substrate with the total area of 2150 square centimeters. About 7–8 animals per cage.

Sawdust of hardwood has been used as the substrate after sterilization in a drying oven.

ПК1201 complete feed for laboratory animals has been fed ad libitum into the feed depression of cage top (see Table 1). Complete feed produced by Informkorm LLC, Moscow.

The feed is balanced with amino acid composition, mineral substances, and vitamins. It is produced of high-quality components.

The ration included (grams/day): complete feed (ПК1201, Certificate: ROSS RU.ПН 16.В00467) – 11.0; vegetables – 10.0; corn – 5.0; hay – 50; table salt – 0.4; milk – 3.0.

Laboratory tests for toxicity have been conducted. The feed is non-toxic; ecologically clean product.

Filtered faucet water has been given in standard autoclaved drink vials.

There were no contaminations of the substrate, feed or water that might have affected the study results. Water, substrate and feed have been regularly analyzed for microbiological contamination in the laboratory.

SEASON DURING WHICH THE EXPERIMENTS WERE PERFORMED

Experiments were performed during autumn and winter seasons (November to January).

THE FEED INGREDIENTS	QUALITY INDICES	
1. Barley	1. Crude protein	22.8 %
2. Oat	2. Metabolic energy	272.3 kcal
3. Wheat	3. Crude fiber	3.9 %
4. Sunflower oil cake	4. Crude fat	3.87 %
5. Fish flour	5. Feed units	123.2
6. Meat and bone flour	6. P	0.76 %
7. Vegetable oil crude	7. Sodium chloride	0.34 %
8. Feed yeast	8. Lysine	1.31 %
9. Feed bone flour	9. Meth. + Cyst.	0.9 %
10. Table salt	10. Ca	1.2%
11. Mineral and vitamin premix	11. Copper	80.600 mg/kg
12. Wheat bran	12. Zinc	102.14 mg/kg
13. Dried milk	13. Cobalt	0.334 mg/kg
14. Endox (feed additive)	14. Iodine	1.050 mg/kg
	15. Manganese	600.14 mg/kg
	16. Iron	120.640 mg/kg

Table 1.

HYPOBARIC HYPOXIA MODELLING

In order to model hypobaric hypoxia, a flow-through vacuum altitude chamber equipped with a pressure gauge, safety valve, and an observation window has been used at room temperature of 20–22°C. Experimental animals have been exposed to conditions corresponding to those during the ascent to an altitude of 5000m at the rate of 25 m/s for 40 minutes.

BEHAVIORAL RESPONSE STUDY METHODS

Visual observation and recording methods have been used for main behavioral responses in mice and rats of both male and female sexes.

Experiments have been performed on 5 groups of animals (n=150):

Control: animals have been placed into the pressure chamber and remained there for 40 minutes (n= 30 males and 30 females);

Mice, sexually mature males and females have been placed into the pressure chamber in conditions corresponding to those during the ascent to an altitude of 5000m at the rate of 25 m/s for 40 minutes (n= 10 males and 10 females);

Rats, sexually mature males and females have been placed into the pressure chamber in conditions corresponding to those during the ascent to an altitude of 5000m at the rate of 25 m/s for 40 minutes (n= 10 males and 10 females);

Rats, sexually immature males and females have been placed into the pressure chamber in conditions corresponding to those during the ascent to an altitude of 5000mat the rate of 25 m/s for 40 minutes (n= 10 males and 10 females).

The following observations were recorded throughout the experiment:

General condition of animals;

Behavior of animals

(motional and exploratory activities).

Operating techniques

Body weight has been determined using the CAS AD05H balance (Korea). Accuracy of the balance was verified before the beginning of the study. Animals have been weighed according to the Laboratory SOP.

Functional status of the nervous system has been evaluated based on behavioral response.

The following indices have been used for evaluation of the rats' emotional state:

Standstill response duration, s;

Grooming response duration, s;

Sniffing response duration, s;

Stretching response duration, s.

STATISTICAL DATA PROCESSING METHODS

Group arithmetic mean values (M), standard error of mean (SEM), or mean square deviation (SD) have been calculated for all quantitative data. Results obtained have been processed on IBM PC/AT using the Statistica 5.5 software package. Probabilities of difference between mean values in groups have been determined using Student's t test, Fisher's exact test, and Mann-Whitney U Test. Differences have been regarded as significant at a confidence level of p=0.05.

RESULTS AND DISCUSSION

Acute toxicity testing

LD50 determination

Acute hypobaric hypoxia corresponding to the conditions during the ascent to an altitude of 5000m at the rate of 25 m/s has been modeled for outbred white sexually matured mice of both sex and sexually matured or sexually immature Wistar rats of both male and female sexes in order to detect the stretching response among other behavioral responses.

There were no any sex or species differences in behavioral responses to hypobaric hypoxia modeling detected in sexually mature animals as compared to the control. Occurrence of the stretching response during hypobaric hypoxia modeling has been observed in sexually immature rats of both male and female sexes (see Table 2).

CONCLUSION

The report presents the results of experimental studies to detect the stretching response in sexually mature mice and sexually mature or sexually immature rats of both male and female sexes during hypobaric hypoxia modeling. There were no any sex or species differences in behavioral responses to hypobaric hypoxia modeling detected in sexually mature animals as compared to the control. Occurrence of the stretching response during hypobaric hypoxia modeling has been observed in sexually immature rats of both male and female sexes. Further studies of the stretching response in animals of different age groups during modeling of different functional organism conditions are necessary.

Hypobaric Hypoxia Effect on the Stretching Response in Rats and Mice of both male and female sexes (M ± SEM)

ANIMAL GROUPS

Control	Mice	Sexually mature rats	Sexually immature rats				
M	F	M	F	M	F	M	F
0/10	0/10	0/10	0/10				
0/10	0/10			0/10	0/10		
0/10	0/10					3/10	3/10

Table 2.

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ELECTRIC VITAMINS – ONE OF PHYSICAL ESSENCES OF ACUPUNCTURE THERAPY

Authors: Borshchevskaya V.L., Bougrov S.L., Bougrova E.S., Volkov V.V., Pankov S.V., Saltcev S.G., Fedorov S.V., Fedotov V.D.

Abstract

For many years acupuncture procedures have been successfully applied to clinical practice. However, any universal opinion relative to mechanisms of acupuncture action was not achieved to the present day. Based on experiments carried out by Redox Laboratory, a concept for mechanisms of acupuncture action was proposed. A hypothesis was set up in the study that acupuncture needle, as electron (type 1) conducting electrode, can connect regulatory systems in living organism, as ion (type 2) conductors. Thereby, functional condition in an organism is changed and new regulation level is provided. Besides, the authors consider that signals obtained from acupuncture needle and processed by appropriate modern mathematical analysis tool can be used for diagnostics, primarily in premorbid states.

Keywords: acupuncture, chronopotentiometry, electric vitamins, sympathetic nervous system, parasympathetic nervous system, electrophysiology.

INTRODUCTION

At present, according to world and domestic statistical data, significant increase is observed in incidence of essential arterial hypertension [1], ischemic cardiac disease, diabetes mellitus, and several other nosologies, on the ground of metabolic disturbances and regulation disorders at different functional levels. These conditions are similar in their relations to genetical factors [2], and other disturbances caused by life style, social environment, etc. [3]. Besides, an issue is broadly discussed of influence from vegetative nervous system (VNS) on development of these conditions. For example, papers by the Academician A.N. Vein dedicated to VNS research issues, accentuate the most important role of vegetative deregulation in different pathogeneses [4].

Contemporary therapeutic approaches to the above mentioned abnormalities allow in most cases successful achievement of compensated state, but securing prolonged control in every patient seems impossible [5].

In this connection, an interest increases towards complex therapy applying non-medicamentous therapy procedures, particularly needle acupuncture (NAP).

This procedure displays multiple curative properties and, as a result, fixedly occupies one of the leading places in clinical practice [6]. Applying NAP within complex therapy has some expressed influences, such as analgesic, sedative, reparative, metabolic, and several other effects [6].

According to results of multiple experimental and clinical studies, general medicinal and preventive effects of NAP are related to its capacity for adjusting regulation processes in VNS and central nervous system (CNS), and enhancing adaptation responses in organism. In the whole, it may be stated that increasing stress resistance in organism after NAP is a common feature [6].

Despite numerous different theories for NAP action [7, 8, 9], NAP primary action mechanisms, though, at present are still obscure. Our present study was carried out in order to examine details of electrochemical processes during interaction between the needle and the tissue.

Objective: research on mechanism of acupuncture action employing chronopotentiometry of acupuncture needle depending on various external stimuli.

Materials and Methods

Three voluntary subjects were involved in the study: 25 to 30 year males without any acute or exacerbated chronic condition. Any great number of participants was not presumed considering phenomenological nature of the experiment.

Equipment

Equipment was employed in the study, as follows: potentiostate P-30s, acupuncture needles (Redox, Type 2, 0.3 50, gilded) gold-coated, and silver-chloride reference electrode (EVL-1 M3.1). The ice (temperature –4°C) was used as temperature and tactile sensitivity stimulus. 10% aqueous ammonia solution was used as olfactory analyser stimulus. Auditory analyzer was stimulated with shouting or kettle-drum.

Design of Experiment

The study was conducted in spacious room, under dimmed light, at the same time of day.

A subject was placed in relaxed recumbent position and blindfolded. The reference electrode was fixed on forearm inner surface via cotton wool wad soaked with KCl saturated solution.

The physician wearing rubber gloves (hands are insulated from the needle) introduced needles at points He Gu (the palm) and San Yin Jiao (the shin), firstly, in left extremities, and then in right ones. Recording potential on the needle started when the needle touched the skin.

After insertion of needles external stimuli were actuated sequentially and unexpectedly for the subject: loud sound (shout), ice

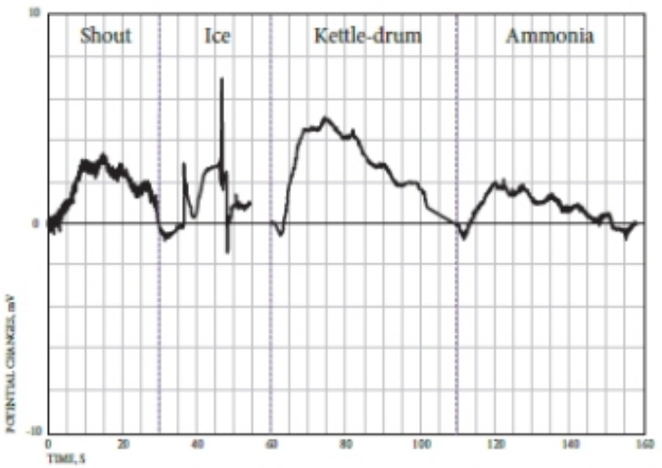

Figure 1.
Chronopotentiometry of Acupuncture Needles (Subject No. 1).

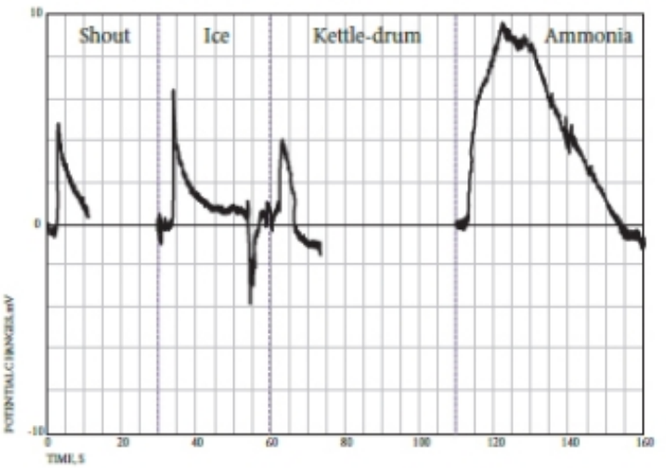

Figure 2.
Chronopotentiometry of Acupuncture Needles (Subject No. 2).

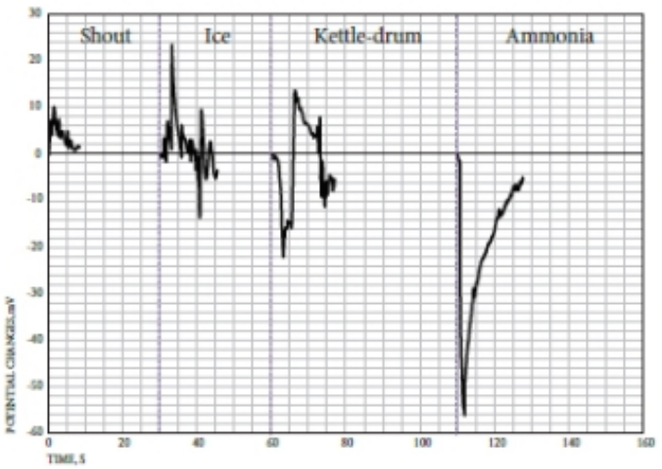

Figure 3.
Chronopotentiometry of Acupuncture Needles (Subject No. 3).

Number of observations, n	Time, s	Amplitude, mV
12	56 [44;70]	6 [4,5;10]

Table 1.
Characteristics of Recorded Potentials, Me [25p; 75p].

upon belly (10 seconds), loud sound (kettle-drum), wool wad soaked with ammonia drawn near nose (5 seconds).
Change in the potential amplitude (near maximal peak) and time from point of signal deviation from isoline till its returning to isoline were registered during the experiment.

RESULTS AND DISCUSSION

Figures 1, 2, and 3 show potential curves, recorded from acupuncture needles. Table 1 presents characteristics of these potentials.
Primarily, some apparent similarity of potentials in our experiment to galvanic skin response (GSR) should be noted. GSR, referred to as psychogalvanic reflex, or sympathetic skin reaction in English literature, is also called evoked skin vegetative potential (ESVP) in Russian scientific literature (Figure 4).
The GSR phenomenon, which was first described by Russian physiologist I.R. Tarkhanov, consists in short-time, more or less sharp, reflex change in skin electric conductivity. Nature of this potential is associated with change of skin vessel lumens and action of sweat glands; some of them being innervated by cholinergic sympathetic neural fibres, whereas others by adrenergic ones. It is the latter that largely contribute to GSR formation, as a number of authors suppose [10].
Normal GSR parameters obtained in healthy subjects, according to some other foreign research data are presented in Table 2.
As one can see in Table 2, GSR parameters significantly vary by their amplitudes (200 to 1000 mcV).
In Russian literature a different approach to GSR analysis is adopted (see Figure 4). In particular, intervals of galvanic skin potential phases are considered. Data by S.A. Kotelnikov are presented in Table 3.
The amplitude of first phase (A1) is associated with trophotropic centres activity in the hypothalamus, as supposed by Odinak M.M., Shustov, et al. These authors suggest that first phase duration (S1) reflects temporal delay in activating centres, which stimulate perspiration. Parameters of the first phase increase along with activation of trophotropic suprasegmental centres, parasympathicotonia; and decrease along with activation of ergotropic centres, sympathicotonia. The same authors suppose that the amplitude of second phase (A2) reflects activity of suprasegmental (in the first place, hypothalamic) ergotropic centres [14].
Main structures involved in signal processing and GSR formation are represented in the block diagram. It should be noted, that specialised parasympathetic or sympathetic nuclei are not defined in the hypothalamus. Nevertheless, anterior hypothala-

Table 2.
Normal GSR Parameters Obtained in Healthy Subjects, According to Kucera [11] and Goizueta-San Martín G. [12], M ± σ.

n	Upper extremities	Lower extremities	Author
	Amplitude (mcV)	Amplitude (mcV)	
40	912.8±605.5	480.28±283.82	Denislic
50	678±553	268±247	Aramaki
100	449±429	147±122	Drory
30	310±180	140±80	Elie
30	479±105	101±40	Knezevic
30	730±630	430±390	Zgur
45	228.1±103.3	–	Baba
50	563±424	–	Toyokura
35	914±372	441±214	Tzeng
32	444±167	203±87.4	Kucera
100	244 ± 184	–	Goizueta-San Martin G

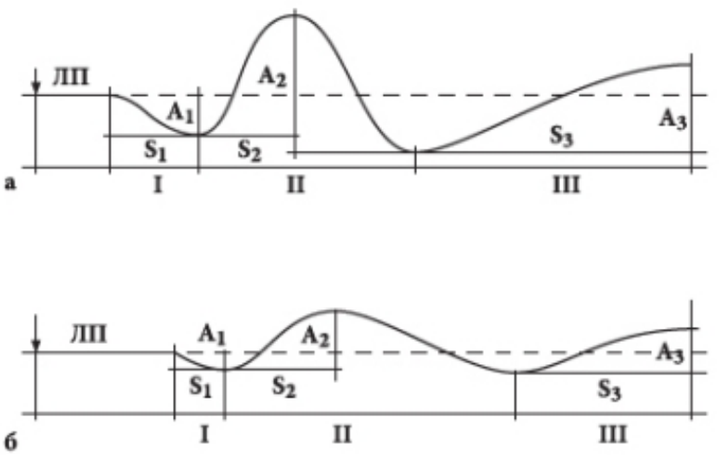

Figure 4.
ESVP Parameters: a – ESVP recorded from hand lead; b – ESVP recorded from foot lead. A1 – first phase amplitude, A2 – second phase amplitude, A3 – third phase amplitude; S1 – first phase duration, S2 – second phase duration, S3 – third phase duration [13].

mus is supposed to be responsible for parasympathetic responses, while posterior hypothalamus is for sympathetic responses. Sweat glands supporting thermoregulation are stimulated by parasympathetic hypothalamic zones (preoptic zone of anterior hypothalamus). Hence, the thermoregulation through perspiration may be regarded as parasympathetic function, despite the fact that it is regulated by neural fibres, which anatomically belong to sympathetic nervous system [14].

So, in accordance with data in Table 1, the potential obtained is inconsistent by its temporal or amplitude characteristics with either GSR, or neuronal action potential, or receptor potential, or motor units [14].

In our case, potentials with greater amplitudes and longer periods were observed, compared to that presented in Table 2 and 3.

We may note that Russian scientists V.G. Vogralik and M.V. Vogralik, and also some researchers abroad, have performed similar experiments, where injury potentials caused by acupuncture needle have been studied [7]. However, potential characteristics obtained there also differ from our findings [7].

In this connection, the following approach is suggested to analysis of response potential peaks recorded during acupuncture needle chronopotentiometry under stimulation with different factors.

It is necessary in first turn to dedicate some words to electrochemical processes occurring at the needle. Being the type 1 conductor, the needle inserted into the medium of different type 2 conductors, connects electrical chain with various electrolytes and supports electrochemical reactions upon itself. One might say that the induced potential wave, which was recorded from the needle, is nothing else, than result of electron transfer between different systems via the needle. We think this would be correctly compared with a similar phenomenon in non-animate nature, namely EMF dropping in an accumulator, when cathode is short cut with anode. It is appropriate to mention here that electromagnetic impulse velocity in metal is some orders higher than neural impulse transmission rate.

In our experiment the needle was inserted into vascularised tissue with both cholinergic, and adrenergic innervations [4]. As it is known, neural endings in skin vessels do not form typical synapses, but they release the mediator relatively far (more than 80 nm) from cells. So, the mediator gets into intercellular space and for some time stays there. Consider, that all biologically active substances being released have various life periods and their effects are continued. Hence, vessel wall smooth-muscle cells are influenced by complex mix of substances as mediators and other vasoactive factors.

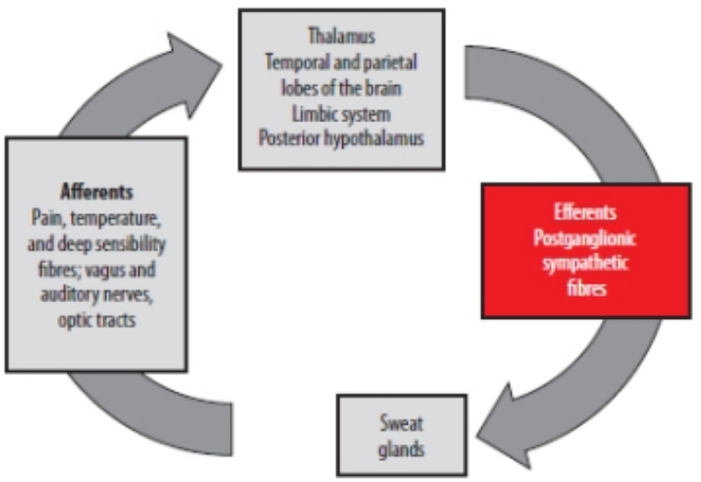

Figure 5.
Block Diagram of GSR.

Parameter	Right palm	Left palm
A1, mV	0,45±0,08	0,47±0,09
A2, mV	3,16±0,24	3,16±0,35
S1, s	0,63±0,06	0,67±0,09
S2, s	1,41±0,10	1,41±0,15
S3, s	1,46± 0, 35	5,5± 0,48
Parameter	**Right sole**	**Left sole**
A1, mV	0,40±0,10	0,28±0,08
A2, mV	1,37±0,26	1,40±0,27
S1, s	0,71±0,12	0,68±0,13
S2, s	1,56±0,17	1,55±0,19
S3,s	8,67± 0,92	8,33± 1,01

Table 3.
Normal ESVP Parameters, by S.A. Kotelnikov; M ± σ [13].

Changing vessel lumens due to reflex activation of VNS sympathetic part in response to a stimulus is reflected as the first (ascending) part of potential peak. Then, supposedly, the common result of interaction between mediators, vasoactive factors, and the biological system, is represented by the second part of recorded potential peak, characterized by slow needle potential change. Hence, the potential recorded from acupuncture needle may be regarded as a compromise index for several processes, as electrochemical interaction between needle and tissue, activity of VNS sympathetic part, and mental and emotional state of the subject.

VNS sympathetic part, most probably, perform needle polarizing function here, featured by quick potential change. This can indicate the level of VNS activity. There are many studies in clinical science dedicated to influence of NAP on functions of VNS sympathetic and parasympathetic parts. All authors agree in opinion that NAP can render beneficial effect on VNS activity by restoring equilibrium between its parts, or in other words eutonia [6, 7].

It is well-known that VNS sympathetic and parasympathetic parts do not relate to each other like scale-beam arms, where upward move of one arm means downward move of another arm. Both subsystems may have high or low tonicity irrespective of another subsystem. Common settings in the whole organism can be observed only under some conditions.

In this connection we would have proposed a model under a conventional name "communicating vessels", which can describe interrelation between VNS parts. A concept is introduced here of energy and information exchange channel between its parts, which takes into account the state of connection tube. The action of connection tube has a decisive importance in our model, since the tube may exist in three states: cut-off state, when no flow of "liquid" particles occurs, i.e. no exchange takes place; partially-open state, when exchange is weak between communicating vessels, and response will develop slowly; and wide-open state indicated by quick response. Hence, its state largely defines interaction rate between the two subsystems.

An appropriate question is put farther: how this connection can be influenced upon? Both VNS parts have their own afferent and efferent systems, but their effects are realised in close interaction; connections between VNS sympathetic and parasympathetic parts are regulated by central divisions of the nervous system.

We suppose that electron stream flowing through acupuncture needle may exert influence upon interaction between two these subsystems, and can be proposed for this role. We may assume that after insertion of needle into tissue a new "regulation contour" in body is formed, since the needle, the tissue, VNS subsystems, and CNS become organised within the common interaction complex. Beneficial changes being observed in an organism during NAP treatment can be explained by this "integration effect" of acupuncture needle.

The recorded curves allow a suggestion that acupuncture needle chronopotentiometry can be of some diagnostic value, e.g. for characteristics of body regulatory systems state, and showing presence or absence of any overstress.

In order to describe such an interaction and the resulting effect we have suggested the term "Electric Vitamins". The Electric Vitamins is an electrical current, which can be generated and consumed in human body during interaction with metals and other low-resistivity conductors. The electrical current can be produced by thermo-EMF [15], biopotential differences, piezo-EMF, galvanic effect, and, as in our example of acupuncture needle, the disbalance between sympathetic and parasympathetic subsystems.

CONCLUSION

The electrophysiology has gathered a wealth of experience in studying relations between living body and metals. The issue relates, primarily, electrocardiography, electroencephalography, and other non-invasive electrophysiological diagnostics procedures.

But options for invasive electrophysiological diagnostics procedures are rather poor. None of them has gained any wide recognition.

It should be also stressed here that not all existing diagnostic procedures, even more advanced ones, are able to reveal any abnormal process at early stage, but only when obvious symptoms already appear.

Thus, the procedure proposed has a number of advantages before standard GSR assessment procedure. Though our procedure is an invasive one, on the one hand, hazard of infectious complications is extremely low here; on the other hand, the procedure is remarkable for greater sensitivity and information. This can provide greater capability in premorbid diagnostics of abnormalities, mainly concerned with irregular lifestyle and impact of stressing factors. Returning to possible side-effects, low bad-case statistics accompanying NAP or needle functional electroneuromyography may be cited here.

Application of the procedure for evaluating NAP therapy, or pharmacological therapy being conducted, is also possible. E.g.: choice of hypotensive drugs, and so on.

Small number of observations and suddenness in applying stimuli may be regarded as disadvantages of our study.

Nevertheless, this procedure is promising by our opinion, and worthy for farther development.

The model of interaction between body systems and acupuncture needle is proposed on Figure 6.

Figure 6. The Model of Interaction between Body Systems and Acupuncture Needle.

In conclusion, we wish to express the following. The contemporary life raises new challenges of growing complexity before the human. Despite all advances in the medical science, premorbid diagnostics issue becomes sharper. In this context, some good habits may and should take a function of timely premorbid state diagnostics. Needle acupuncture, formatted as a pleasure, may potentially become a new good habit.

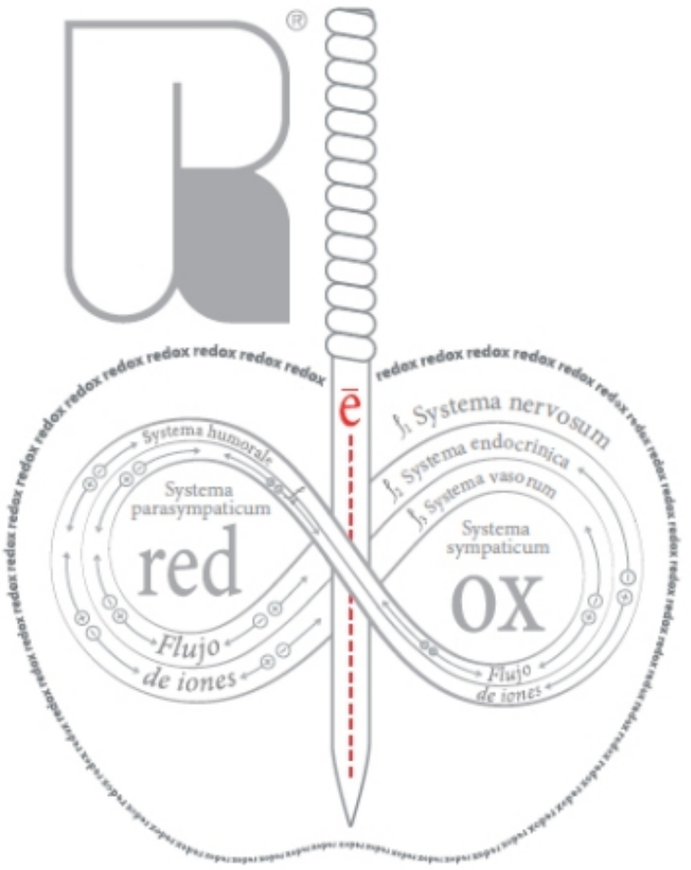

Figure 6.
The Model of Interaction between Body Systems and Acupuncture Needle.

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