

# Long Space Missions and the Problem of Geomagnetic Deprivation of Human Population and Astronauts on the Earth, Moon and Mars

Alexander Trofimov\*

*International Scientific Research Institute of Cosmic Anthropoecology, Novosibirsk, Russia*

**Abstract:** According to the data of some geophysicists [1-4], from the end of the XXth century the full vector of the magnetic field of the Earth, following jerks, periodic secular excursions, is gradually weakening. Accordingly the buffering properties of the Earth magnetosphere, which protects biosystems from excess solar proton-electron beams, are decreasing. Using modeled weakening of the geomagnetic field we had to answer the question: what are the possible biotrophic consequences of heliophysical pressing for further human development?

The aim of the research was the prognostic evaluation of the possible genetically conditioned polyfunctional human reactions of healthy male volunteers (n-39) aged 18-20 years to repeated weakening of the magnetic field of the Earth and, if necessary, the development of preventive non-medicinal technologies.

Results. Significant differences ( $P < 0.05$ ) between volunteers in the experimental and control groups on the dynamics of electric, psychophysiological and other parameters, coupled with the appropriate genetic markers (genes D4, B1, TNF), and intensity of heliophysical factors at different stages of ontogeny of the examinees and their parents were showed.

The phenomenon of "heliophysical expression of genes", manifested at modeling of the short-term prolonged geomagnetic deprivation, was opened. It is shown, that drinking water "AquaHelios" has helioprotective properties and contributes to significant positive inversion of the functional dependence of many human functional systems on heliogeophysical impacts, increasing at geomagnetic deprivation. The necessity for the creation of a global system of geoeological human life support in conditions of spreading heliogeophysical changes of our biosphere and long space missions are scientifically substantiated.

**Keywords:** Geomagnetic fields (jerks and periodic excursions, long space missions, modeling of geomagnetic deprivation, heliophysical expression of genes, heliomagnetotropic human reactions, drinking water's prevention.

## INTRODUCTION

The magnetic field of the Earth and its extremely important role in the maintenance and evolution of life on our planet at the end of the XXth – beginning of the XXIth century became the main object of scientific attention by collective of International Institute of Cosmic Anthropoecology (Russia, Novosibirsk) as an Observer responsible for Future, from the position of the strong anthropic principle of Carter - Tsiolkovskii [5].

In the world scientific association the analysis of the secular variations of the geomagnetic field (GMF) is continued. One of the analytical schemes is represented in the work by Ron Chaar *et al.* [3], in which the distinct trend of geomagnetic induction weakening from the Xth century up to the modern period is seen.

There is a discussion of geophysical data on numerous jerks and excursions of the GMF, accompanied by a significant decrease in the intensity [1-3, 6-8], for example, with

Laschamp excursions, when it dropped by almost 10 times [9]. Discussion of the geophysical data concerning numerous jerks and excursions of the GMF, accompanied by a considerable decrease in its intensity [1-3, 6-8], as, for example in case of Laschamp excursions, when the intensity of the GMF decreased in almost 10 times [9], goes on.

The problem of the possible relationships between the magnetic inversions and the course of biological evolution is also discussed [4, 10-12]. With a decrease in the intensity of the GMF the buffer properties of the magnetosphere are reduced. It ceases to properly protect the biosphere from cosmic radiation: reinforced flows of cosmic rays start to penetrate into the atmosphere and cause a progressive increase in the number of secondary ionized particles that form the so called "broad atmospheric showers", reaching the biosphere.

Increased levels of radiation near the Earth's surface in the periods of geomagnetic excursions can cause numerous genetic changes in biosystems, leading to significant evolutionary consequences [13-15]. In this case, mutagenic hard radiation from flashes of supernovae stars is seen by some authors as a necessary condition for evolution; the GMF excursions can lead to mutations of regulatory genes (Tsakas,

\*Address correspondence to this author at the International Scientific Research Institute of Cosmic Anthropoecology, Novosibirsk, Russia; Tel/Fax: +7 (383)332-40-68; E-mail: [isrica2@rambler.ru](mailto:isrica2@rambler.ru)

**Table 1. Excursions, GMF inversions and events in human evolution**

Excursions and Inversions, Mln Years Ago	Events in Human Evolution, Mln Years Ago
0,033 – Mono Lake a	0,03 - disappearance of the Neanderthal men
0,041 – Laschamp a	0,042 –FOXP2 gene mutation 0,037 – microcephalin gene mutation c
0,070 – Norwegian – Greenland Sea a	0,070 - division of ancestral population into three races (according to the mtDNA) d
0,120 – Blake a	0,1 – age of the common ancestor of a modern man (according to Y - chromosome) e
0,211 – Jamaica – Pringle Falls a	0,23 – age of the common ancestor of a modern man (according to the mtDNA) e
0,56 – 0,58 – Big Lost a 0,67 – Stage 17 a 0,78 – Matuyama – Brunhes 0,797 – Brunhes precursor a	660,000±140,000 – division of the lines of a man and the Neanderthal men (according to the mtDNA) f
0,78 - Matuyama – Brunhes h	0,8 – age of the human ancestor according to beta-globin g
1,95 – 1,79 – Olduvai i	1,8 – appearance of <i>Homo erectus</i> j
2,6 – Gauss – Matuyama k	2,4±0,3 –mutation that provides an increase in brain volume among representatives of line <i>Homo</i> l 2,8 –mutation inactivating the gene, that encodes manufacturing of sucrose at the cell surface

1984). Russian geophysics N.D. Kuznetcova and V.V. Kuznetcov in their works presented for discussion the comparative chrono-evolutionary analytical assessment of the possible dependence of genetic mutations of different types on a variety of geomagnetic inversions [4] (Table 1).

With the continued decrease in the intensity of the GMF biogeophysical study of its possible functionally-genetic, evolutionary consequences for a modern man and the search for the effective preventive means seems to be especially actual. That was the main motive and the purpose of the study.

**OBJECTIVES**

1. To study the dynamics of association of human psychophysiological parameters with the gene B1, with the length of the gene D4 alleles and the heliogeophysical situation at different stages of ontogeny of the volunteers` organisms at modeling of repeated weakening of the total vector of geomagnetic induction and transformation of its inclination.
2. To develop and to test the means of non-medicinal prevention of excess heliomagnetotropic human reactions on the basis of drinking water exposed to the weakened geomagnetic field.

**STUDY DESIGN**

While solving the problem1, ISRICA, together with the laboratory of helioclimatopathology of Scientific Centre of Clinical and Experimental Medicine of SB RAMS, have used the original shielding installations of YA Zaitsev` de-

sign (patent of RF № 2012175 from 30.04.1994) with more than 500-fold weakening of the geomagnetic induction for the research [15]. In solving the 2nd problem small installations of the "TRODR" type weakening of the GMF more than 100 times (the authors: AV Trofimov, GI Druzhinin, 2011) [15, 16], used to exposure therein drinking water in order to give it heliomagnetoprotective properties broadcasted to a man (patent of RF № 2342149 from 27.12.2008), were created and tested.

The scheme of the works on the 1st stage of the study (2002 - 2005), held by "double blind" method, envisaged the 3-month course of the 10 weekly sessions of 30 minutes for the male subjects aged 18-20 years (n = 39 ) in the screening (1) and transforming (2) GMF installations.

At the 2nd stage (2001-2012), while solving the problem 2, volunteers of the same age (n = 24) were investigated in the mode of their testing: in the period of the solar eclipse on July 22, 2009, when there was a redistribution of the flows of solar and galactic protons reaching the Earth's environs. Hemodynamic parameters of the subjects were measured twice: before and after taking in the various phases of the eclipse of 150 ml of heliomagnetoprotective drinking water, prepared in a portable installation "TRODR", which, subsequently, became the prototype for a new generation of screening devices series "AquaHelios", intended for industrial production of helioprotective concentrate and water-based beverages "AquaHelios" certified in Russia (ROSS certificate RU.AG79.HO4276, № 1162814 from 06.05.2013).

On the stage of 2002-2005 years the genotyping test was applied on the length of the alleles of D4 dopamine receptor gene, as well as on the genes B1 and TNF by the methods of

PCP with primers flanking polymorphic regions of DNA (the joint fragment of work with the Institute of Therapy of SB RAS and the Institute of Cytology and Genetics of SB RAS, conducted under the direction of now academician MI Voevoda).

Before-, in the middle and after the courses of the test, the computer registration of electroencephalographic, electro-light-psychophysiological, hemodynamic and gas discharge visualization's parameters of the volunteers, and also the assessment by the program "Helios" (Certificate of state registration in the Russian Federation № 970125 from 24.03.1997) of cosmic conditions in the period of prenatal development of the subjects, the so-called "phenomenon of heliogeophysical imprinting" largely determining the score of human health in his postnatal development, were conducted [17].

In the mathematical treatment the data of satellite monitoring (satellites «Goes» NACA, USA) of cosmic corpuscular proton-electron fluxes and multivariate correlation analysis on the program "Decision tree" (Institute of Mathematics of SB RAS, Berikov, 2002) (2) were used.

## RESULTS AND DISCUSSION

1. The features of the distribution of the brain electrical potentials of the volunteers in conditions of the repeated short-term geomagnetic deprivation were revealed; it was noted a significant increase in activity in the range of the alpha rhythm (3) and it was shown that the heliogeophysical matrix, imprinted at different stages of prenatal development of the subjects, with the weakening of the geomagnetic induction appeared to be activated and more demanded.

It was noted the disclosure of the brain functional reserves: improvement of memory, concentration, and development of intellectual abilities, in particular, to abstract from the usual associations. By the end of the course of the simulated geomagnetic deprivation the manifested significant direct dependence of the level of mental processes on the intensity of the solar electrons and neutrons flows, as well as the significant reverse link with the value of the solar protons flows were revealed.

The higher nervous activity is realized through a large number of neurotransmitter systems of the brain that play an important role in the psychomotor and cognitive functions that are disturbed in multifactor diseases and conditions with a hereditary predisposition, such as Parkinson's disease, schizophrenia, substance abuse and others. Among the genes involved in the formation of the neuro-chemical human reactions, researchers pay especial attention to B1 gene and D4 dopamine receptors gene, allelic variants of which contain variable number (from 2 to 10) of imperfect repeats of DNA in the 3-d exon.

The study showed that the volunteers – carriers of short and long alleles of D4 gene react differently to geomagnetic deprivation [18], showing unequal sensitivity of human genetic substrate to the gradients of the magnetic field of the Earth.

With the use of meaningful models identified according to the covariance analysis (2) it was showed that the reactions to the geomagnetic deprivation depended on structure-functional features of the genetic material (different length of the alleles of D4 gene, as well as genes B1 and TNF). According to these data, it can be assumed that with the weakening of the GMF, the increased genetic control over intellectual reserves of the brain not only neurophysiological, cardiovascular, hormonal et al. but cosmophysically dependent, stored in several related generations, occurs (Table 2).

We called this appearance opened for the first time as the phenomenon of "heliophysical expression" of genes [19], showing that the activation of previously "sleeping" genes is accompanied by a lowering of the thresholds of the human body's sensitivity to the weak information signals of cosmogonic content that have important evolutionary significance [12].

So, after a few sessions of the geomagnetic deprivation upon presentation of the information-holographic signals to the examinees (RF patent № 2239860 from 10.11.2004) it was noted a significant effect of the gene's expression on the spectrum of the EEG parameters (Table 3) and a significant effect of the D4 gene allele's length, in conjunction with the prenatally imprinted heliophysical impacts on the parameters of human magnetosensitivity, electroconductivity of TR (acupuncture points), the light absorption of the skin, the rheography parameters of the brain and on intellect, memory and creativity (Table 4) [19]. Later, in 2005-2007 studies we have noted other possible consequences of redistribution of the solar-functional dependencies in conditions of the weakening of the GMF: with the use of the same screening installation it has been shown that after a short term geomagnetic deprivation (in vitro) of blood samples of volunteers (healthy and patients with hypertension) significant associations of hemorheological and heliogeophysical parameters that increase the risk of cardiovascular catastrophes are revealed [20].

2. The results of the 1st stage of the research made even more urgent the search for such non-medicinal means that would ensure the protection of the biosphere, a man and the entire civilization in conditions of increasing onslaught of galactic and solar-corpuscular flows with the weakening of the protective magnetosphere cover. Unfortunately until recently there were no such effective means.

The development of the heliomagnetoprotective means on basis of water (RF patent № 2342149) in 2008 appeared to be perspective for this purpose. Drinking water treated in the weakened geomagnetic field, proved capable to protect the water structures of the human body, and, consequently, all its functional systems in the periods of solar-magnetospheric disturbances.

The first tests of helioprotective water were conducted in the period of extreme heliogeophysical situation - during one of the solar eclipses in 2009, under which generally component of galactic cosmic rays increases and solar proton flow, reflected by the moon decreases. Corpuscular flows, redistributed by the Moon subsequently reach the magnetosphere-ionosphere layer of the protective shell of our planet, where, usually, their energy is significantly reduced.

**Table 2. The impact of “heliotransparency” on the genetically conditioned dynamics of the physiological parameters in the conditions of the modeling preformation of the geomagnetic field (the weakening of the GMF, the change of the angle of its slope) during prenatal ontogenesis.**

Parameter Gene	1	2	3	4	5
	Prenatal Period				
D4	P28-1P 28_2P		28-1P 28_1,2,4,5,6,7,10P 28+1P		28_9P
TNF				28_1,2,5,7,9F 28+1F	
B1		28-1M 28_3,4,7,9M			
Note:	1 – EEG,			P – patient	
	2 – BPS,				
	3 – Gench’s sample,			M – patient’s mother	
	4 – hormones,				
	5 – GDV-parameters			F – patient’s father	

Notes: 1-electroencephalography (EEG), 2-blood pressure systolic (BPS), 3-Gench's sample,4-hormones, 5- gas discharge visualization (GDV), 28\_1,2...28+1: periods pre- postnatal development

**Table 3. Changes in the spectrum of EEG parameters at the prolonged geomagnetic deprivation, depending on the length of gene D4 alleles in the healthy examinees.**

Date	Load Type	Amplitude				Frequency			
		Delta	Teta	Alpha	Beta	Delta	Teta	Alpha	Beta
12-13.11. 2002	control	-	-	-	-	-	-	-	-
	Hologram 1	-	O2, Cz	-	-	Cz	-	-	-
	Hologram 2	T4	F3, T3, Cz	-	T3	-	T3, O1, Cz	-	-
3-4.12.2002	control hologram	-	-	-	-	-	-	-	-
	hologram 1	-	T3	Cz	T4	T3	T3, T4, O2, Cz	-	-

**Table 4. Peculiarities of covariative dependence of the geno-phenotypical signs, psychophysiological parameters of a man, and the cosmophysical environment (according to the data of Berikov V.B., 2002).**

№	Coupled Parameters		Cosmic Rays
1	gene B1	intellect	electrons
2	gene B1	memory	neutrons
3		digital test	neutrons
4	M-test (electroconductivity TR)	creative work	protons (Pr>1 keV ), (Pr>10 keV)

Table 4. contd...

№	Coupled Parameters		Cosmic Rays
5	M-test (electroconductivity TR)	memory	neutrons
6	operative memory	creative work	electrons
7	M-test (pauze, APs)		protons (Pr>1 keV ), (Pr>10 keV)
8	reographic index		alpha particles
9	Light absorption		protons (Pr>1 keV), (Pr>30 MeV)
10	tolerance to physical load		neutrons

Table 5. Correlation dependences of physiological parameters on the five-minute values of the electrons, protons, neutrons, and X-rays in the second group (Novosibirsk) in the 3rd metering.

	Pr > 1 MeV	Pr > 10 MeV	Pr > 100 MeV	El > 0,6 MeV	El > 2 MeV	Ne	X-Rays
systolic pressure	0,23	0,23	0,31	0,23	0	0,23	-0,25
diastolic pressure	0,53	0,53	0,54*	0,53	0	0,53	-0,26
IM	-0,03	-0,03	-0,08	-0,03	0	-0,03	-0,15
heart rate	0,13	0,13	0,29	0,13	0	0,13	-0,28
tone	-0,44	-0,44	-0,33	-0,44	0	-0,44	0,02
<i>Correlation dependences of physiological parameters on the five-minute values of the electrons, protons, neutrons, and X-rays in the second group (Novosibirsk) in the 4th metering.</i>							
	Pr > 1 MeV	Pr > 10 MeV	Pr > 100 MeV	El > 0,6 MeV	El > 2 MeV	Ne	X-Rays
systolic pressure	-0,16	-0,16	-0,12	-0,16	0,34	-0,06	0,17
diastolic pressure	-0,39	-0,39	-0,64*	-0,39	-0,13	-0,11	-0,32
IM	0,53	0,53	0,29	0,53	-0,30	0,34	0,52
heart rate	0,42	0,42	-0,03	0,42	-0,34	0,32	0,31
tone	0,60*	0,60*	0,27	0,60*	-0,45	0,14	0,29

\*The significance of the correlation coefficient (p<0,05).

It was shown that a significant (P<0.05) direct dependence of the human vascular tone, estimated by the diastolic blood pressure value on the flow of electrons and protons of different energy occurring in the period after the eclipse (3<sup>rd</sup> metering, the Table 5), when receiving a small amount of helioprotective drinking water already in 20-30 minutes positively transformed. In the volunteers, who consumed the water, significant (P <0.05 for protons with energies above 100 meV) inverse correlation of diastolic blood pressure with corpuscular flows of high energies was revealed (4<sup>th</sup> metering, the Table 5).

Recent studies conducted in the Far North in regime of testing of healthy subjects [21] and volunteers with hypertension who expressed their consent to pass (by double "blind" method) 2-3 - week courses with the use of control and geomagnetically-deprived drinking water, confirmed our first observations [16, 17]. Helioprotective water, which is from July 2013 produced in Russia under the name of a drink "AquaHelios" can provide a long-term and effective protection of the functional systems of human body in the periods of solar-magnetospheric disturbances.

## CONCLUSION

1. In conditions of a simulated weakening of the geomagnetic field, more than 500 times, the phenomenon of "heliophysical gene expression" is revealed: significant associations of the parameters that reflect the functional activity of the brain, the state of psychophysiological, intellectual and creative processes with genetic markers (genes B1 and D4) and heliophysical situation in the pre-and postnatal ontogeny of the examinees.

2. The heliophysical gene expression, manifested at the prolonged short-term geomagnetic deprivation of a man contributes to lowering the threshold of his sensitivity to the information-holographic signals of the cosmogonic content associated with the dynamics of electrophysiological parameters and the length of D4 gene alleles.

3. Jerks and secular excursions of the geomagnetic field, accompanied by the weakening of its induction and the increased access to the biosphere of solar-galactic corpuscular flows, increasing the measure of openness of biological systems can have evolutionary consequences for a man.

4. The non-medicinal means on the basis of drinking water treated in the weakened geomagnetic field, which reduces the excess heliomagnetotropic reactions of a man and promotes prevention of crisis states (on an example of patients with hypertension) was developed and successfully tested.

5. The necessity of geo-ecological life support on the Earth and Space in conditions of changing heliogeophysical environment, the ongoing reduction of the geomagnetic induction and the increased access of solar-galactic corpuscular flows to the biosphere was scientifically based.

6. Treatment of drinking water in the weakened geomagnetic field, in our opinion, leads to such changes in its nano-clusteral structure, energy-information capacity and biocatalytic activity that provide helioprotective effect in relation to a man on the supramolecular, cellular, systemic and organism levels.

## SUGGESTIONS

1. It seems to be especially important to continue, in terms of new projects, multidisciplinary research of biotropic effects of the prolonged simulated geomagnetic deprivation of biosystems with the purpose to determine the range of possible evolutionary consequences of reducing the buffering properties of the geomagnetic field and the development of a global system of geo-ecological life-support of humanity and the astronauts in conditions of ongoing cosmoplanetary changes and long space missions to the Moon and Mars.

2. To approach this purpose it is promising to organize International Scientific Research Center "Cosmobiotron" that has large installations from new composite materials with varying degrees of screening the GMF and also a staff of highly qualified astrogeophysics, biologists, geneticists and physicians. Scientific research bases of the International Scientific Research Institute of Cosmic Anthropoecology in Russia, Novosibirsk and Krasnoyarsk may be the control points for the development of future project.

This material was presented on the 2-nd International Conference on Earth Science and Climate Change (July 23-24, 2013, Las Vegas, NV, USA/ The abstract of the report «Geomagnetic deprivation- Modeling, Prognosis, Prevention» was published by Journal of Earth Science and Climate Change (July 2013, volume 4, issue 4, p.20) and 2:798, doi: 10.4172/scientificreports.798

## CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

## ACKNOWLEDGEMENTS

Academician Veail Kaznacheev,

Academician M. Voevoda.

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Received: May 20, 2014

Revised: September 16, 2014

Accepted: September 16, 2014

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