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Biophysical and Biochemical Results of the Product from Bulgaria Gift from Garabitov®

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Abstract

I studied the mathematical model of interaction with water of Gift from Garabitov® (Bulgaria). In this report are submitted data about the interaction of Gift from Garabitov® with water, obtained by non-equilibrium (NES) and differential-equilibrium energy spectrum (DNES) of water. The average energy ($\Delta E_{H...O}$) of hydrogen H…O-bonds among individual molecules H_2O after treatment of Gift from Garabitov® with water measured by NES- and DNES-methods is ΔE=-0.0136±0.0011 eV. These results suggest the restructuring of $\Delta E_{H...O}$ values among H_2O molecules with a statistically reliable increase of local extremums in DNES-spectra. The research is performed for Gift from Garabitov®, with study of pH and oxidation reduction potential (ORP). There is review of the effects of the chemical composition of Gift from Garabitov® – anti-inflammatory, antioxidant effects, inhibition development of tumor cells. As results of these effects Gift from Garabitov® have detoxification and anti aging influence. The base of this influence is anti-inflammatory effect. There are effects on nervous system and muscle tissues.This article deals with the review of the basic biophysical-biochemical and biological processes underlying the Gift from Garabitov®. The author is studying their physical-chemical properties and biophysical and biological effects on human organism.

Keywords: Gift of Garabitov®, anti-inflammatory, antioxidant, anti-aging, mathematical model, NES, DNES.

1. Introduction

Water is the main substance of life. The human body of an adult person is composed from 50 to 55% of water. With aging, the percentage of water in the human body decreases. Hence, the factor of water quality and its amount in organism is an essential factor for the research (Pocock *et al*., 1981; Howard & Hopps, 1986). Water is present in the composition of the physiological fluids in the body and plays an important role as an inner environment in which the vital biochemical processes involving enzymes and nutrients take place. Water also is the main factor for metabolic processes and aging (Ignatov, 2012). Earlier studies conducted by us have demonstrated the role of water, its structure, the isotopic composition and physical-chemical properties (pH, temperature) on the growth and proliferation of prokaryotes and eukaryotes in water with different isotopic content (Mosin & Ignatov, 2012; Ignatov & Mosin, 2013). These factors, the structure and composition of water are of great importance in many biophysical studies. The peculiarities of the chemical structure of the H_2O molecule and weak bonds caused by electrostatic forces and donor-acceptor interaction between hydrogen and oxygen atoms in H_2O molecules create favorable conditions for formation of directed intermolecular hydrogen bonds (O–H…O) with neighboring H_2O molecules, binding them into complex intermolecular associates which composition represented by general formula $(H_2O)_n$, where n can vary from 3 to 50 (Keutsch & Saykally, 2011). The hydrogen bond is a form of association between the electronegative O-atom and a H-atom, covalently bound to another electronegative O-atom, is of vital importance in the chemistry of intermolecular interactions, based on weak electrostatic forces and donor-acceptor interactions with charge-transfer (Pauling, 1960). It results from interaction between electron-deficient H-atom of one H_2O molecule (hydrogen donor) and unshared electron pair of an electronegative O-atom (hydrogen acceptor) on the neighboring H_2O molecule.

The product Gift from Garabitov®. The research is with methods NES and DNES. There is research of ORP and pH and there are executing the conclusions from electrochemically activated waters – anolyte and catholyte for anti-inflammatory effects (Ignatov et al., 2014).

The aim of this research is to show the usefully of Gift from Garabitov® on the base of the following results and conclusions. The author also performed the research of 1% (v/v) solution of Gift from Garabitov® on the distribution of H_2O molecules according to the energies of hydrogen bonds, as well as studies of the NES and DNES spectrum and the biophysical effect of this type of water on human body. .

2. Materials and Methods

2.1. NES and DNES Spectral Analysis

The device for DNES spectral analysis was made by A. Antonov on an optical principle. For this was used a hermetic camera for evaporation of water drops under stable temperature (+22–24 ^{0}C) conditions. The water drops were placed on a water-proof transparent pad, which consists of thin maylar folio and a glass plate. The light was monochromatic with filter for yellow color with wavelength at $\lambda = 580 \pm 7$ nm. The device measures the angle of evaporation of water drops from 72.3^0 to 0^0. The DNES-spectrum was measured in the range of -0.08– -0.1387 eV or λ = 8.9–13.8 μm using a specially designed computer program. The main estimation criterion in these studies was the average energy ($\Delta E_{H...O}$) of hydrogen O...H-bonds between H_2O molecules in water samples and human blood serum.

2.2. Product Gift from Garabitov®

The product Gift from Garabitov consists honey, apple vinegar, garlic and ginger.

2.3. Studying the Human Blood Serum

1% (v/v) solution of human blood serum was studied with the methods of IR-spectroscopy, non-equilibrium (NES) and differential non-equilibrium (DNES) spectral analysis. The specimens were provided by Kalinka Naneva (Municipal Hospital, Bulgaria). Two groups of people between the ages of 50 to 70 were tested. The first group (control group) consisted of people in good clinical health. The second group included people in critical health or suffering from malignant diseases.

2.4. IR-spectroscopy

IR-spectra were registered on Brucker Vertex ("Brucker", Germany) IR spectrometer (a spectral range: average IR – 370–7800 cm^{-1}; visible – 2500–8000 cm^{-1}; the permission – 0,5 cm^{-1}; the accuracy of wave number – 0,1 cm^{-1} on 2000 cm^{-1}) and on Thermo Nicolet Avatar 360 Fourier-transform IR.

2.5. Statistical Processing of Experimental Data

Statistical processing of experimental data was performed using the statistical package STATISTISA 6.0 using the Student's *t*- criterion (at $p < 0.05$).

3. Results and Discussions

3.1. Clinical studies with human blood serum testing

A convenient method for studying of liquids is non-equilibrium differential spectrum. It was established experimentally that the process of evaporation of water drops, the wetting angle θ decreases discreetly to zero, and the diameter of the water drop basis is only slightly altered, that is a new physical effect (Antonov, 1995; Antonov & Yuskesselieva, 1983). Based on this effect, by means of the measurement of the wetting angle within equal intervals of time is determined the function of distribution of H_2O molecules according to the value of f(θ). The distribution function is denoted as the energy spectrum of the water state. The theoretical research established the dependence between the surface tension of water and the energy of hydrogen bonds among individual H_2O-molecules (Antonov, 1995).

For calculation of the function f(E) represented the energy spectrum of water, the experimental dependence between the wetting angle (θ) and the energy of hydrogen bonds (E) is established:

$$f(E) = \frac{14{,}33 f(\theta)}{[1-(1+bE)^2]^2} \qquad (1)$$

where $b = 14.33$ eV^{-1}

The relation between the wetting angle (θ) and the energy (E) of the hydrogen bonds between H_2O molecules is calculated by the formula:

$$\theta = arcos\ (-1 - 14.33E) \qquad (2)$$

The energy spectrum of water is characterized by a non-equilibrium process of water droplets evaporation, therefore, the term non-equilibrium spectrum (NES) of water is used.

The difference $\Delta f(E) = f$ (*Esamples of water*) – f (*Econtrol sample of water*) – is called the "differential non-equilibrium energy spectrum of water" (DNES).

Thus, the DNES spectrum is an indicator of structural changes in water, because the energy of hydrogen bonds in water samples differ due to the different number of hydrogen bonds in water samples, which may result from

the fact that different waters have different structures and composition and various intermolecular interactions – various associative elements etc (Ignatov et al, 2014; Ignatov et al., 2015). The redistribution of H_2O molecules in water samples according to the energy is a statistical process of dynamics.

Figure 1 shows the average NES-spectrum of deionised water. On the X-axis are depicted three scales. The energies of hydrogen bonds among H_2O molecules are calculated in eV. On the Y-axis is depicted the function of distribution of H_2O molecules according to energies f(E), measured in reciprocal unit eV^{-1}.

Arrow A designates the energy of hydrogen bonds among H_2O molecules, which is accepted as most reliable in spectroscopy.

Arrow B designates the energy of hydrogen bonds among H_2O molecules the value of which is calculated as:

$$\bar{E} = -0.1067 \pm 0.0011 \text{ eV} \qquad (3)$$

Arrow C designates the energy at which the thermal radiation of the human body, considered like an absolute black body (ABB) with a temperature +36.6 ^{0}C, is at its maximum.

A horizontal arrow designates the window of transparency of the Earth atmosphere for the electromagnetic radiation in the middle infrared range of the Sun toward the Earth and from the Earth toward the surrounding space. It can be seen that the atmosphere window of transparency almost covers the NES-spectrum of water.

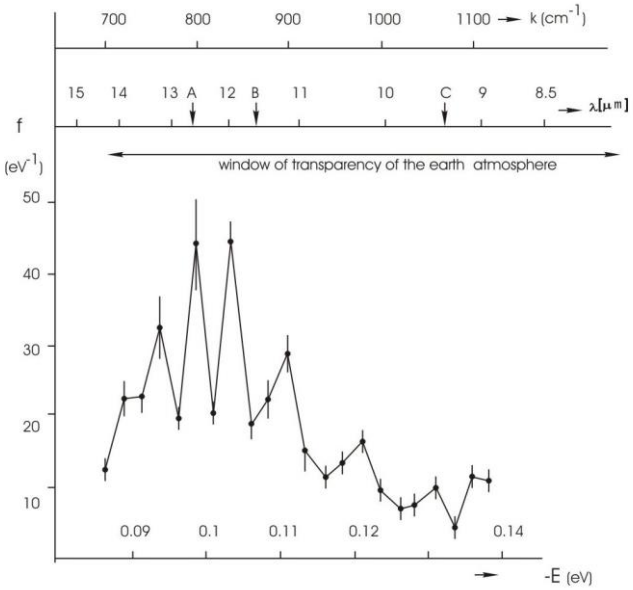

Figure 1: The NES-spectrum of deionized water (chemical purity – 99.99 %; pH – 6,5–7,5; total mineralization – 200 mg/l; electric conductivity – 10 μS/cm): the horizontal axis shows the energy of the H...O hydrogen bonds in the associates – E (eV); the vertical axis – the energy distribution function – f (eV^{-1}); *k* – the vibration frequency of the H–O–H atoms (cm^{-1}); λ – wavelength (μm)

We have conducted studies of 1% (v/v) solution of human blood serum taken from two groups of people between 50 and 70 years of age by IR, NES and DNES spectral analysis. The first group consisted of people in excellent health. The second group consisted of people in a critical state and patients with malignant tumors. The average energy of hydrogen bonds ($\Delta E_{H...O}$) between H_2O molecules in the blood serum was investigated as the main biophysical parameter. The result was registered as a difference between the NES-spectrum of 1% solution of human blood serum and the NES-spectrum of deionized water control sample – DNES-spectrum, measured as the difference Δf(E) = f (samples of water) – f (control sample of water). The DNES-spectrum obtained from the first group has a local extremum energy ($\Delta E_{H...O}$) at E = -9.1±1.1 meV and from the second group at E = -1.6±1.1 meV. The results between the two groups have a statistical difference in Student's criterion at $p < 0.05$. For the control group of healthy people the value of the largest local maximum in the DNES-spectrum was detected at E = -0.1387 eV, or at a wavelength λ = 8.95 μm. For the group of people in a critical health state and the patients with malignant tumors, the analogous values of the largest local maximums of the DNES-spectrum shifted to lower energies compared with the control group of people. For a group of people in critical health condition and patients with malignant tumors the greatest values of local extremum in the IR-spectrum are shifted to lower energies relative to the control group. In IR-spectrum of human blood serum are detected 8 local

maxima at λ = 8.55, 8.58, 8.70, 8.77, 8.85, 9.10, 9.35 and 9.76 μm (Krasnov, Gordetsov, 2009). The resulting peak at λ = 8.95 μm in the IR-spectrum (Ignatov, 2012) approaching the peak at λ = 8.85 μm was monitored by Russian researchers. In the control group of healthy people the average value of the energy distribution function f(E) at λ = 8.95 μm compiles E = 75.3 eV, and in a group of people in critical condition – E = 24.1 eV. The norm has statistically reliable result for human blood serum for the control group of people having cancer at the local extremum of f(E) ~24.1 eV^{-1}. The level of reliability of the results is $p< 0.05$ according to the Student's t-test. In 1995 were performed DNES-experiments with an impact on tumor mice cells in water solutions containing Ca^{2+} (Antonov, 1995). There was a decrease in the DNES-spectrum compared with the control sample of cells from a healthy mouse. The decrease was also observed in the DNES-spectrum of human blood serum of terminally ill people relative to that of healthy people. With increasing of age of long-living blood relatives, the function of distribution of H_2O molecules according to energies at -0.1387 eV decreases. In this group of tested people the result was obtained by the DNES-method at E = -5.5±1.1 meV; the difference in age was of 20–25 years in relation to the control group. It should be noted that many of Bulgarian centenarians inhabit the Rhodopes Mountains areas. Among to the DNES-spectrum of mountain waters the similar to the DNES-spectrum of blood serum of healthy people at λ = 8.95 μm, was the DNES-spectrum of water in the Rhodopes. The mountain water from Teteven, Boyana and other Bulgarian provinces has similar parameters. Tables 1, 2 and 3 show the composition of mountain water springs in Teteven and Kuklen (Bulgaria) and local extremums in NES-spectra of water samples. The local extremums is water samples were detected at E = -0.11 eV and E = -0.1387 eV. The value measured at E = -0.11 eV is characteristic for the presence of Ca^{2+} in water. The value measured at E = -0.1387 eV is characteristic for inhibiting the growth of cancer cells. Experiments conducted by A. Antonov with cancer cells of mice in water with Ca^{2+} demonstrated a reduction of this local extremum to a negative value in spectra. Analysis by the DNES-method of aqueous solutions of natural mineral sorbent –zeolite (microporous crystalline aluminosilicate mineral from Most village, Bulgaria) showed the presence of a local extremum at E = -0.1387 eV for shungite and E = -0.11 eV for zeolite (Mosin & Ignatov, 2013, Ignatov & Mosin, 2014a). It should be noted that owing to the unique porous structures both the natural minerals shungite and zeolite are ideal natural water adsorbers effectively removing from water organochlorine compounds, phenols, dioxins, heavy metals, radionuclides, and color, and gives the water a good organoleptic qualities, additionally saturating water with micro-and macro-elements until the physiological levels (Mosin & Ignatov, 2013).

3.2. Results of 1% (v/v) solution in deionized water of Gift of Garabitov ®

The research with the NES method of water drops is received with 1% solution Gift from Garabitov®, and deionized water as control sample. The mathematical models of 1% (v/v) solution Gift from Garabitov® gives the valuable information for the possible number of hydrogen bonds as percent of H_2O molecules with different values of distribution of energies (Table 1 and Fig. 2). These distributions are basically connected with the restructuring of H_2O molecules having the same energies.

Table 1: The distribution (%, $(-E_{value})/(-E_{total\ value})$ of H_2O molecules in 1% water solution of Gift from Garabitov® and control deionized water

-E(eV) x-axis	1% water solution Gift from Garabitov® y-axis (%$((-E_{value})$ */ $(-E_{total\ value})$**	Control Sample Deionized water y-axis (%$((-E_{value})$*/ $(-E_{total\ value})$**	-E(eV) x-axis	1% water solution Gift from Garabitov® y-axis (%$((-E_{value})$ */ $(-E_{total\ value})$**	Control Sample Deionized water y-axis (%$((-E_{value})$*/ $(-E_{total\ value})$**
0.0937	0	0	0.1187	0	12.6
0.0962	0	0	0.1212	**23.5**[2]	0
0.0987	0	6.2	0.1237	0	0
0.1012	0	12.6	0.1262	0	0
0.1037	0	6.2	0.1287	0	6.2
0.1062	0	0	0.1312	4.3	6.2
0.1087	11.7	6.2	0.1337	4.3	0
0.1112	**28.4**[1]	6.2	0.1362	0	6.2
0.1137	0	12.6	0.1387	**23.5**[3]	6.2
0.1162	4.3	12.6	–	–	–

E= -0.1112 eV is the local extremum for effect on nervous system
E=-0.1212 eV is the local extremum for anti-inflammatory effect
E= -0.1387 eV is the local extremum for inhibition of development of tumor cells of molecular level

Notes:
* The result ($-E_{value}$) is the result of hydrogen bonds energy for one parameter of (-E)
** The result ($-E_{value}$) is the total result of hydrogen bonds energy

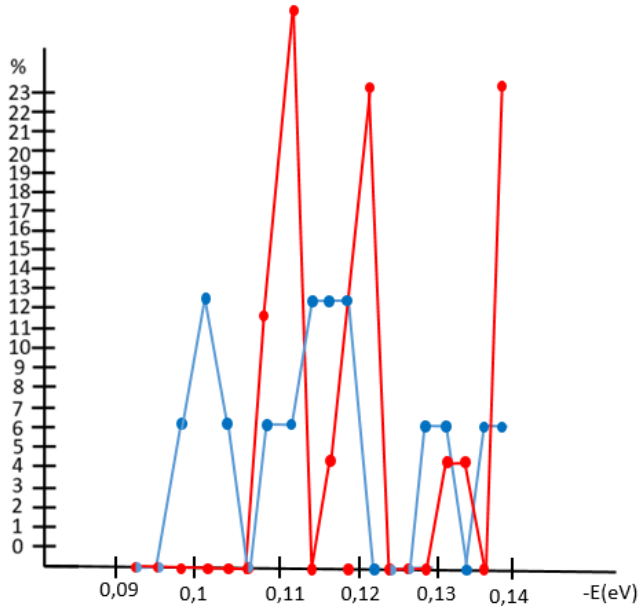

Figure 2: Mathematical model (Ignatov, Mosin, 2013) of 1% water solution of Gift from Garabitov

Notes:
E=-0.1112 eV is the local extremum for stimulating effect on nervous system and improvement of nervous conductivity
E=-0.1212 eV is the local extremum for anti-inflammatory effect
E= -0.1387 eV is the local extremum for inhibition of development of tumor cells of molecular level

The experimental data obtained testified the following conclusions from the mathematical model of in 1% water solution of Gift of Garabitov® and control deionized water. The distribution (%, ($-E_{value}$)/($-E_{total\ value}$) of water molecules in mathematical model of in 1% water solution of Gift of Garabitov® and control deionized water. The distribution (%, ($-E_{value}$)/($-E_{total\ value}$) of water molecules in Gift of Garabitov® according control sample is different. However, for the value E = -0.1387 eV or λ = 8.95 μm there is the bigger local extremum (23.5 (%, ($-E_{value}$)/($-E_{total\ value}$)) corresponding to the re-structuring of hydrogen bonds among H_2O molecules for inhibition of development of tumor cells of molecular level. This difference may indicate on the different number of hydrogen bonds in water samples, as well as their physical parameters (pH, ORP), resulting in different distribution of H_2O molecules and different values of H_2O molecules with ratios of ($-E_{value}$)/($-E_{total\ value}$). Particularly it was observed the statistical re-structuring of H_2O molecules in water samples according to the energies. The experimental data may prove that stipulates the restructuring of H_2O molecules on molecular level and may be used for the prophylaxis against of development of tumor cells. For the value E=-0.1212 eV or λ=10.23 μm there is the biggest local extremum (23.5 (%, ($-E_{value}$)/($-E_{total\ value}$)) corresponding to the re-structuring of hydrogen bonds among H_2O molecules for anti inflammatory effect.
The value for E = -0.1112 eV or λ = 11.15 μm is with biggest in local extremums or (28.4 (%, ($-E_{value}$)/($-E_{total\ value}$)). This valus is corresponding to the re-structuring of hydrogen bonds among H_2O molecules for stimulating effect on the nervous system and improvement of nervous conductivity. The high values of local extremum at E = -0.1112 eV is connected with effects for stimulation of muscle tissue.
The experimental data for Gift of Garabitov® may prove that stipulates the restructuring of H_2O molecules on molecular level and the biophysical effects are:
The local extremum at E=-0.1212 eV is indicator for anti inflammatory effect

The local extremum at E= -0.1387 eV is indicator for inhibition of development of tumor cells of molecular level As a result of different energies of hydrogen bonds, the surface tension of 1% solution of water sample with Gift of Garabitov® is increasing. The increasing of surface tension is regarding the control sample. This effect is connected with increasing and preservation of the energy in human body as result of biochemical process among water molecules and bio molecules.

3.3. Research of acidity and basicity (pH) and the oxidative redox potential (ORP) of 1% water solution of Gift of Garabitov®

There are valid the following results of pH as indicator for acid alkaline medium of 1% solution of Gift of Garabitov®. The results are for 1% of water solutions of Gift of Garabitov® This research is performed with Georgi Gluhchev from Bulgarian Academy of Science. Table 2 shows the results of pH and ORP.

Table 2. Results of 1% water solution of Gift of Garabitov®

Продукт	pH	ORP (mV)	Coordinates Fig.3
1% разтвор на Gift of Garabitov®	3.61 ±0.02	+160 ±0.20	Point 1 (3.61;160)

Figure 3 shows the dependence between the acidity and basicity (pH) of electrochemically activated solutions and the oxidation-reduction potential (ORP). The pH value within the interval from 3 to 10 units and the ORP within the interval from -400 mV to +900 mV characterize the area of the biosphere of microorganisms. Outside these ranges of pH and ORP the microorganisms will hardly survive.

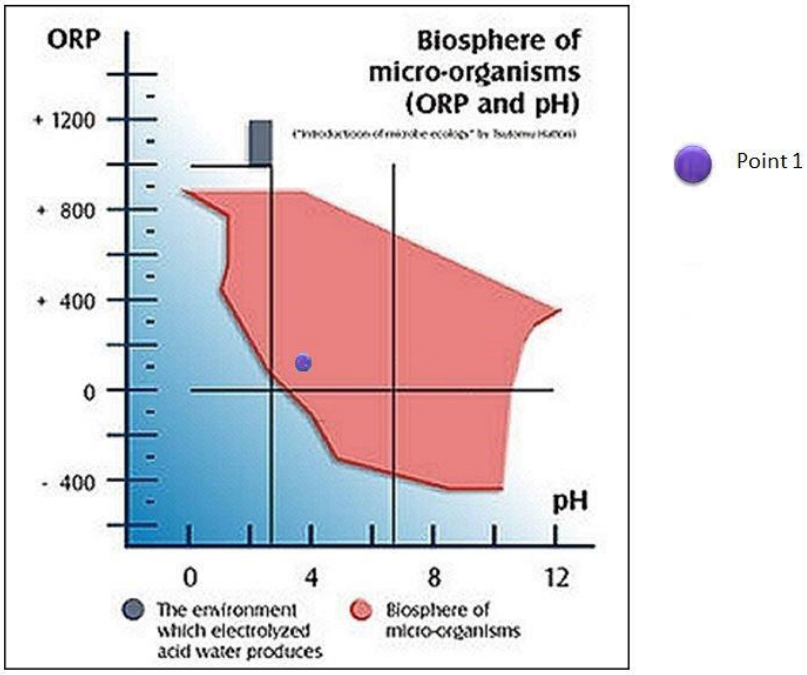

Figure 3. The dependence between acidity and basicity (pH) of solutions and the ORP on the biosphere of micro-organisms (point 1; Gift of Garabitov®)

The results from the Figure 3 show that the product Gift of Garabitov® is useful as medium for microorganisms, which are with positive effects on human health.

4. Conclusion

The interaction of Gift from Garabitov® with water is quiet complex and results the restructuring of energy values among H_2O molecules with a statistically reliable increase of local extremums in DNES-spectra after treatment of Gift from Garabitov® with water. The result with NES is E= -0.1291 eV for Gift from Garabitov®. The result for control sample (deionized water) is E= -0.1155 eV. The results with NES method were

recalculated by the DNES method. The result of Gift from Garabitov® with DNES method is $\Delta E = -0.0136 \pm 0.0011$ eV. From the NES and DNES spectrum and mathematical model of 1% solution of Gift from Garabitov® and deionized water as control sample are valid the following conclusions for biophysical effects for Gift from Garabitov®.

- Stimulating effect on nervous system and improvement of nervous conductivity
- anti-inflammatory effect;
- inhibition of development of tumor cells of molecular level;

The value for E = -0.1112 eV or $\lambda = 11.15$ μm is with biggest in local extremums. This valus is corresponding to the re-structuring of hydrogen bonds among H_2O molecules for stimulating effect on the nervous system and improvement of nervous conductivity. The high values of local extremum at E = -0.1112 eV is connected with effects for stimulation of muscle tissue.

The dependence between acidity and basicity (pH) of solutions and the oxidation-reduction potential (ORP) on the biosphere of micro-organisms (point 1; Gift from Garabitov®) on Figure 3 show the anti inflamatorry effects and that the two products are medium for microorganisms, which are with positive effects on human health.

References

Abdullah, A.M., Abdelsalam, E., Abdullah, B. & Khaled, A. (2012) Antioxidant Effects of Zamzam Water in Normal Rats and Those Under Induced-oxidant Stress, *Journal of Medicinal Plants Research*, **6**(42):5507-5512.

Adelman, R., Saul, R. & Ames, B. (1988) Oxidative damage to DNA: relation to species metabolic rate and life span, *PNAS*, **85**(8): 2706-2708.

Antonov, A. (1995) Research of the Non-equilibrium Processes in the Area in Allocated Systems. Dissertation thesis for degree "Doctor of physical sciences", Blagoevgrad, Sofia.

Antonov, A. & Yuskesselieva, L. (1985) Selective high frequency discharge (Kirlian effect). *Acta Hydrophysica*, **5**: 29.

Atanasov, A., Karadzhov, S., Ivanova, E., Mosin, O.V. & Ignatov I. (2014) Study of the effects of electrochemical aqueous sodium chloride solution (anolite) on the virus of classical swine fever virus. Mathematical models of anolyte and catolyte as types of water. *Journal of Medicine, Physiology and Biophysics*, **4**: 1–26.

Begona, M. et al. (2000) Magnesium Status and Parameters of the Oxidant-Antioxidant Balance in Patients with Chronic Fatigue: Effects of Supplementation with Magnesium, Journal of American College for Nutrition, **19** (3): 374-382.

Balentine, D. et al. (1997) The chemistry of Tea Flavonoids, Food Science and Nutrition, 37 (8) 693-70

Bell, D. R.&Goshenaur, K. (2006) Direct Vasodilatative Properties of Anthocyanin-Rich Extract, *J. Appl. Physiol.*, **100:** (1164-1170).

Batista et al. (2009) Prospective Double-blind Crossover Study of Camellia Sinensis (Green tea) in Dyslipidemias, *Arq. Bras. Cardiol.*, **93** (2):128-134.

Berdishev, G.G. (1989) *Reality and Illusion of Immortality Longevity*, Moscow, *Politizdat*, 1-89 [in Russian].

Berdishev, G.G. (1989) Reality and Illusion of Immortality Longevity. – Moscow: Politizdat, 1989. [in Russian].

Bermudez –Soto et al. (2007) Stability of Polyphenols in Chokeberry (*Aronia melanocarpa*) Subjected to *in vitro* Gastric and Pancreatic Digestion, *Food Chemistry*, **102** (3): 865-874.

Borisova et al. (2004) Hepatoprotective Effect of the Natural Fruit Juice from Aronia melanocarpa on Carbon Tetrachloride-induced Acute Liver Damage in Rats, *Exp. Toxicol. Pathol.*. **56** (3): 195-201.

Brubach, J.B., Mermet, A., Filabozzi, A., Gerschel, A. & Roy, P. (2005) Signatures of the Hydrogen Bonding in the Infrared Bands of Water. *J. Chem. Phys.*, **122:** 184509.

Burger, O., Baudish, A. &Vaupel, J. W. (2012) Human Mortality Improvement in Evolutionary Context, *PNAS*, **109**(44): 18210–18214.

Chan E-V et al. (2011) Antioxidant and Antibacterial Properties of Green, Black, and Herbal Teas of *Camellia sinensis*, **3**(4): 266-272.

Chacko, S. et al. Beneficial Effects of Green Tea: A literature Review, Chinless Medicine, 5-13.

Choi et al. (2001) The Green Tea Polyphenol(-)-epigallocatechin Gallate Attenuates Beta-amyloid-induced Neurotoxicity in Cultured Hippocampal Neurons, *Life Sci*., **70** (5): 603-614.

Chan M-Y (1997) Inhibition of Inducible Nitric Oxide Synthase Gene Expression and Enzyme Activity by Epigallocatechin Gallate, a Natural Product from Green Tea, *Biochemical Pharmacology*, **54** (12): 1281–1286

Costa, S. et. al. (2009) In vitro Evaluation of the Chemoprotective Action Mechanisms of Leontopodic Acid Against Aflatoxin B1 and Deoxynivalenol-induced Cell Damage, *J Appl Toxicol.*, **29** (1):7-14.

Choi T.N. & Jordan K.D. (2010) Application of the SCC-DFTB Method to $H^+(H_2O)_6$, $H^+(H_2O)_{21}$, and $H^+(H_2O)_{22}$. *J. Phys. Chem. B*, 114, 6932–6936.

Davis, R.H. (1989) Wound Healing, Oral & Topical Activity of Aloe Vera, J. Am. *Podiatr. Med. Assoc.*, **79** (11): 559-562.

Dobner, M. et al. (2003) Antibacterial Activity of *Leontopodium alpinum* (*Edelweiss*), *Journal of Ethnopharmacology*, **89** (2-3): 301-303.
Druzhyak, N. G, (2005) Water for Health and Longevity, *Neva.* [in Russian].
Eisenberg, D. & Kauzmann, W. (1969) The Structure and Properties of Water. *Oxford University Press*, London.
Gluhchev, G., Ignatov, I. Karadzhov, S., Miloshev, G., Ivanov, N.& Mosin, O.V. (2015) Electrochemically Activited Water. Biophysical and Biological Effects of Anolyte and Catholyte as Types of Water, *Journal of Medicine, Physiology and Biophysics*, **10**: 1-17.
Goryainov S.V. (2012) A Model of Phase Transitions in Double-well Morse Potential: Application to Hydrogen Bond. *Physica B*, 407, 4233–4237.
Gluhchev, G., Ignatov, I., Karadzhov, S., Miloshev, G., Ivanov, N.&Mosin, O.V.(2015) Studying the Antimicrobial and Antiviral Effects of Electrochemically Activated Nacl Solutions of Anolyte and Catholyte on a Strain of E. Coli DH5 and Classical Swine Fever (CSF) Virus, *European Journal of Medicine*, **9** (3): 124-138.
Esua, M., Rauwald, J-W. (2006) Novel Bioactive Maloyl Glucans from Aloe vera Gel: Isolation, Structure Elucidation and in Vitro Bioassays, *Carbohydrate Research*, **341** (3); 355-364.
Gluhchev, G., Ignatov, I., Karadzhov, S., Miloshev, G., Ivanov, I. & Mosin, O. V. (2015) Studying of Virucidal and Biocidal Effects of Electrochemically Activated Anolyte and Catholyte Types of Water on Classical Swine Fever Virus (CSF) and Bacterium E. coli DH5, *Journal of Medicine, Physiology and Biophysics*, **13**:1-17.
Hollman, P., Tjiburg, L.&Yang, C. (1997) Bioavailability of Flavonoids from Tea, *Crit. Rev. Food Sci. Nutr.*, **37**: 719-738.
Howard, C. & Hopps (1986) Chemical Qualities of Water that Contribute to Human Health in a Positive Way, *Science of the Total Environment*, **54**: 207-216.
Ignatov, I., Mosin, O. V. & Naneva, K. (2012) Water in the Human Body is Information Bearer about Longevity. *Euromedica*, Hanover: 110-111.
Ignatov I. (2012) Conference on the Physics, Chemistry and Biology of Water, Water in the Human Body is Information Bearer about Longevity, NY, Vermont Photonics.
Ignatov I. & Mosin, O.V. (2013) Possible Processes for Origin of Life and Living Matter with Modeling of Physiological Processes of Bacterium *Bacillus subtilis* in Heavy Water as Model System. *Journal of Natural Sciences Research*, **3**(9): 65-76.
Ignatov, I. & Mosin, O.V. (2013) Modeling of Possible Processes for Origin of Life and Living Matter in Hot Mineral and Seawater with Deuterium. *Journal of Environment and Earth Science*, **3**(14): 103-118.
Ignatov, I. & Mosin, O.V. (2014) The Structure and Composition of Carbonaceous Fullerene Containing Mineral Shungite and Microporous Crystalline Aluminosilicate Mineral Zeolite. Mathematical Model of Interaction of Shungite and Zeolite with Water Molecules. *Advances in Physics Theories and Applications*, **28**: 10-21.
Ignatov, I. & Mosin, O.V. (2013) Structural Mathematical Models Describing Water Clusters. *Journal of Mathematical Theory and Modeling*, **3**(11): 72-87.
Ignatov, I., Mosin, O.V., Velikov, B., Bauer, E. & Tyminski, G. (2014) Longevity Factors and Mountain Water as a Factor. Research in Mountain and Field Areas in Bulgaria, *Civil and Environmental Research*, **6** (4): 51-60.
Ignatov, I., Mosin, O.V. & Velikov, B. (2014) Longevity Factors and Mountain Water of Bulgaria in Factorial Research of Longevity, *Journal of Medicine, Physiology, Biophysics*,**1**:13-33.
Ignatov, I., Mosin,O.V., Velikov, B., Bauer, E. & Tyminski, G. (2014) Research of Longevity Factors and Mountain Water as a Factor in Teteven Municipality, Bulgaria, *Journal of Medicine, Physiology and Biophysics*, **2**: 37-52.
Ignatov, I. & Mosin, O. V. (2014) Nature of Haydrogen Bonds in Liquids and Crystals. Ice Crystal Modifications and Their Physical Characteristics, *Journal of Medicine, Physiology and Biophysics*, **4:** 58-80.
Ignatov, I., Mosin, O.V., Velikov, B., Bauer, E. & Tyminski, G. (2014) Research of Longevity Factors and Mountain Water as a Factor in Teteven, Yablanitsa and Ugarchin Municipalities, Lovech Region, Bulgaria, *Journal of Health, Medicine and Nursing*, **4**: 21-36.
Ignatov, I. Mosin, O.V., Velikov, B. Bauer, E. & Tyminski, G. (2014) Mountain Water as Main Longevity Factor in Research of Phenomenon of Longevity in Mountain Areas in Bulgaria, *European Journal of Molecular Biotechnology*, **4** (2): 52-71.
Ignatov, I. & Mosin, O. V. (2014) Hydrogen Bonds among Molecules in Liquid and Solid State of Water. Modifications of Ice Crystals, *Journal of Health, Medicine and Nursing*, **5**: 56-79.
Ignatov, I. & Mosin, O.V. (2014b) Methods for Measurements of Water Spectrum. Differential Non-equilibrium Energy Spectrum Method (DNES), *Journal of Health, Medicine and Nursing* **6**: 50-72.
Ignatov, I. & Mosin, O.V. (2014) Isotopic Composition of Water as Main Factor for Longevity, *Drug Development and Registration*, **9** (4): 146-155. [in Russian].
Ignatov, I., Mosin, O. V., Velikov, B. & Bauer, E. (2014) Influence of Isotopic Composition of Water with Varying Deuterium Content in Composition with Mountain Water of Bulgaria on Human Longevity, *Journal of Medicine, Physiology and Biophysics*, **7**: 46-78.

Ignatov, I., Karadzhov, S., Atanasov, A., Ivanova, E. & Mosin, O.V. (2014) Electrochemical aqueous sodium chloride solution (anolyte and catholyte) as types of water. Mathematical models. Study of effects of anolyte on the virus of classical swine fever virus. *Journal of Health, Medicine and Nursing*, **8**: 1–28.

Ignatov, I., Mosin, O.V. & Velikov, B. (2015) Mountain Water as a Factor of Human Longevity. Local Extremum at 8.95 μm in Spectrum of Water as Indicator for Health and Longevity, *Journal of Medicine, Physiology and Biophysics*, 9: 51-81.

Ignatov, I. & Mosin, O.V. (2015a) Methods for Research of Mountain and Melt Water as Factor of Longevity. Chemical Composition, NES and DNES Methods for Spectral Analysis. Effects of Calcium, Magnesium, Zinc and Manganese, *Advances in Physics Theories and Applications*, **44**: 48-64.

Ignatov, I. & Mosin, O.V. (2015b) Water: Solid and Liquid Phases. Nano Structures in the Water in Solid and Liquid Phases, *Journal of Medicine, Physiology and Biophysics*, **9**: 82-109.

Ignatov, I., Mosin, O.V., Kirov, P. (2016) Mathematical Model of Kangen Water®. Biophysical and Biochemical Effects of Catholyte, *Advances in Physics Theories and Applications*, **20**: 33-55.

Ignatov, I., Gluhchev, G., Karadzhov, S., Miloshev, G., Ivanov, I.&Mosin, O. V. (2015) Preparation of Electrochemically Activated Water Solutions (Catholyte/Anolyte) and Studying of their Physical-Chemical Properties, *Journal of Medicine, Physiology and Biophysics*, **13**:18-38.

Ignatov, I.&Mosin,O.V. (2015) Nanostructures in Solid and Liquid Phases of Water, *Journal of Medicine, Physiology and Biophysics*, **12**:31-57.

Ignatov, I.&Mosin, O. V. (2014) Isotopic Composition of Water as Main Factor for Longevity, *Drug Development and Registration*, **9** (4): 146-155.

Ignatov, I. &Mosin, O.V. (2015) Methods for Research of Mountain and Melt Water as Factor of Longevity. Chemical Composition, NES and DNES Methods for Spectral Analysis. Effects of Calcium, Magnesium, Zinc and Manganese, *Advances in Physics Theories and Applications*, **44**:48-64.

Ignatov, I., Mosin, O.V. & Bauer, E.(2015) Vortex Power Spring Water: Physical-Chemical Qualities of this Water compared to Mountain and Melt Water from Bulgaria, Russia and Glacier Rosenlaui from Swiss Alps, *Advances in Physics Theories and Applications,* **45**:6-29 .

Gluhchev, G., , Ignatov, I., Karadzhov, S., Miloshev, G., Ivanov, N. & Mosin, O.V. (2015) Electrochemically Activited Water: Biophysical and Biological Effects of Anolyte and Catholyte Types of Water, **7**. (1): 12-26.

Ignatov, I., Mosin, O.V., Karadzhov, S., Miloshev, G.&Ivanov, N. (2015) The Evaluation of Mathematical Model of Interaction of Electrochemically Activated Water Solutions (Anolyte and Catholyte) with Water, *European Reviews of Chemical Research*, **2** (4): 72-86.

Ignatov, I. (2018) Research of the Factors of Health and Longevity for the Population in Bulgaria, *Bulgarian Journal of Public Health*, **10** (1): 52-85.

Isaacs E.D., Shukla A., Platzman P.M, et all. (2000) Compton scattering evidence for covalency of the hydrogen bond in ice, *J. Phys. Chem. Solids*, 61, 403–406.

Krastev, D., Ignatov, I., Mosin, O. V., Penkov, P. (2016) Research on the Effects of the 'Dance of the Spiral' Methodology, with Spectral Analysis of Water Extracts, upon the Physiological Parameters of Plants and the Essential Oil Content, *Advances in Physics Theories and Applications*, **52:** 47-55.

Keutsch F. & Saykally R. (2011) Water Clusters: Untangling the Mysteries of the Liquid, One Molecule at a Time. *PNAS*, 98(19), 105330–10540.

Krastev, D., Ignatov, I., Mosin, O.V.&Penkov, P. (2016) Research of the Effects of the "Dance of the Spiral Metrology" upon the Physiological Parameters of the Plants and the Essential Oil Content, *European Journal of Molecular Biotechnology*, **11**: 29-39.

Kokotkiewicz, A., Jaremicz, Z.&Luczkiewicz, M. (2010) Aronia Plants: A Review of Traditional Use, Biological Activities, and Perspectives for Modern Medicine, *Journal of Medicinal Food*, **13** (2):255-269.

Krasnov, V.V. & Gordetsov, A.S. (2009) Infrared spectral analysis of blood serum as level of disturbances of metabolic processes in infusion children pathology. *Clinical Medicine*: 83–94 [in Russian].

Kulling, S.E.&Rawel, H.M. (2008) Aronia Melanocarpa - A Review on the Characteristic Components and Potential Health Effects, *Planta Medica*, **74** (13):1625-34.

Kuriyama et al. (2006) Green Tea Consumption and Mortality due to Cardiovascular Disease, Cancer, and all Causes in Japan: The Ohsaki Study, *The Journal of the American Medical Association*, **296** (10): 1255–1265.

Lala, G. et al. (2006) Anthocyanin-rich Extracts Inhibit Multiple Biomarkers of Colon Cancer in rats, Nutr. Cancer, **54**: 84-93.

Lambert, J. D., Yang, C. S. (2003) Mechanism of Cancer Prevention by Tea Constituents, *Journal of Nutrition*, **133** (10): 3262S:3267S.

Lis, G., Wassenaar, L.I. & Hendry, M.J. (2008) High-precision laser spectroscopy D/H and $^{18}O/^{16}O$ Measurements of microliter natural water samples. *Anal. Chem*., **80**(1): 287-293.

Liu K., Cruzan J.D. & Saykally R.J. (1996) Water Clusters. *Science Magazine*, **271**(5251), 929–933.

Loboda O. & Goncharuk V. (2010) Theoretical Study on Icosahedral Water Clusters. *Chemical Physics Letters* , **484**(4–6), 144–147.
Lis, G., Wassenaar, L.I. & Hendry, M.J. (2008) High-precision Laser Spectroscopy D/H and $^{18}O/^{16}O$ Measurements of Microliter Natural Water Samples. Anal. Chem., **80**(1): 287–293.
Lv.J., Wang, W., Krafft, T., Li, Y., Zhang, F.&Yuan, F. (2011) Effects of Several Environmental Factors on Longevity and Health of the Human Population of Zhongxiang, Hubei, China, *Biol. Trace Elem. Res.*, **143** (2):702:716.
Lulli D et al. (2012) Anti-Inflammatory Effects of Concentrated Ethanol Extracts of Edelweiss (Leontopodium alpinum Cass.) Callus Cultures towards Human Keratinocytes and Endothelial Cells, *Hindawi Publishing Corporation Mediators of Inflammation*: 1-12.
Luck W., Schi öberg D. & Ulrich S. (1980) Infared Iinvestigation of Water Structure in Desalination Membranes. *J. Chem. Soc. Faraday Trans*., 2(76), 136–147.
Machlin, L. J., Bendich, A. (1988) Free Radical Tissue Damage: Protective Role of Antioxidant Nutrients, The FACEB journal, **1**(6): 441-445.
Maheshwary S., Patel N., Sathyamurthy N., Kulkarni A.D. & Gadre S.R. (2001) Structure and Stability of Water Clusters $(H_2O)_n$, n = 8-20: An Ab Initio Investigation. *J. Phys. Chem*., 105, 10525–10537.
Mariani, E. et al. (2006) Antioxidant Enzyme Activities in Healthy Old Subjects: Influence of Age, Gender and Zinc Status: *Results from the Zincage Project, Biogerentology*, **7** (5-6): 391:398.
Malhotra, A.,&Dhawan, D. K. (2008) Zinc Improves Antioxidative Enzymes in Red Blood Cells and Hematology in Lithium-Treated rats, Nutr. Res., **28**(1):43-50
Malik, M. et al. (2003) Anthocyanin-rich Extract from Aronia Meloncarpa Induces a Cell Cycle Block in Colon Cancer but not Normal Colonic Cells, *Nutr. Cancer*, **46**:186-196.
Matsumoto, M. et al. (2004) Gastroprotective Effect of Red Pigments in Black Chokeberry Fruit (Aronia melanocarpa Elliot) on Acute Gastric Hemorrhagic Lesions in Rats, *J. Agric. Food Chem*., 52 (8): 2226-2229.
Michaelides A. & Morgenstern K. (2007) Ice Nanoclusters at Hydrophobic Metal Surfaces. *Nat. Mat*., **6**: 597–599.
Mocchegiani, E. (2007) Zinc, Metallothioneins, and Longevity- Effect of Zinc Supplementation: Zincage Study, *Ann N. Y. Acad. Sci*, **1119**: 129-146.
Mosin, O.V. & Ignatov, I. (2012a) Isotope effects of deuterium in bacterial and microalgae cells at growth on heavy water (D_2O). *Voda: Himia i Ecologija*, **3**, 83–94 [in Russian].
Mosin, O.V. & Ignatov I. (2012b) Separation of heavy isotopes deuterium (D), tritium (T) and oxygen (^{18}O) in water treatment. *Clean Water: Problems and Decisions (Moscow*). 2012. № 3–4. 69-78 [in Russian].
Mosin, O.V. & Ignatov, I. (2013) The structure and composition of natural carbonaceous fullerene containing mineral shungite, *International Journal of Advanced Scientific and Technical Research*, **6**(11-12): 9-21.
Pasichnyk I. Everaers R. & Maggs A.C. (2008) Simulating van der Waals-interactions in water/hydrocarbon-based complex fluids. *J. Phys. Chem. B*, 112(6), 1761–1764.
Pauling L. (ed.) (1960) *The Nature of the Chemical Bond and the Structure of Molecules and Crystals*. New York: Cornell University Press.
Pimentel G.C. & McClellan A.L. (1960) *The hydrogen bond* (L. Pouling, Ed). New York: Reinhold Publishing Co.
Pocock, S.J, Shaper, A.G. & Packham, R.F. (1981) Studies of Water Quality and Cardiovascular Disease in the United Kingdom, *Sci. Total Environ*., **18**: 25–34.
Olas, B. et al. (2008) Comparative Anti-platelet and Antioxidant Properties of Polyphenol-rich Extracts from Berries of Aronia Melanocarpa, Seeds of Grape and Bark of Yucca Schidigera in vitro, Platelets, **19** (1):70-7.
Orgel, L. (1963) The maintenance of the accuracy of protein synthesis and its relevance to aging, *Biochemistry*, **49**: 517–521.
Reisinger, U. et al. (2009) Leogin, the Major Lignin from Edelweiss, Inhibits Intimal Hyperplasia of Venous Bypass Graphs, *Cardiovascular Research*, **82**: 524-549.
Ryszawa et al. (2006) Effects of Novel Plant Antioxidants on Platelet Supreoxide Production and Aggregation Atherosclerosis, *J Physiol Pharmacol*, **57:** 611-626
Saykally, R. (2005) Unified description of temperature-dependent hydrogen bond rearrangements in liquid water. *PNAS*, **102**(40): 14171–14174.
Simon, M. et al. (2006) How Much Calcium Is in Your Drinking Water? A Survey of Calcium Concentrations in Bottled and Tap Water and Their Significance for Medical Treatment and Drug Administration, *HSS Journal*, **2**(2): 130–135.
Shelton, R.M. (1991) Aloe Vera: Its Chemical and Therapeutic Properties, *Int. Journal Dermatol*, **30**: 679-683.
Schwalger, S. et al. (2005) Leontopodic acid—a Novel Highly Substituted Glucaric Acid Derivative from Edelweiss (*Leontopodium alpinum* Cass.) and its Antioxidative and DNA Protecting Properties, *Tetrahedron*, **61**(19): 4621-4630.

Schwalger, S. et al. (2006) Development of an HPLC-PAD-MS Assay for the Identification and Quantification of Major Phenolic Edelweiss (*Leontopodium alpium* Cass., Phytochemical Analysis, 17 (5) 291:298.
Speroni et al. (2006) In Vivo Efficacy of Different Extracts of Edelweiss (*Leontopodium alpinum* Cass.) in animal models, Journal of Ethnopharmacology, 89 (2-3): 301-303.
Sykes M. (2007) Simulations of RNA Base Pairs in a Nanodroplet Reveal Solvation-Dependent Stability. *PNAS*, **104**(30), 12336–12340.
Tokmachev A.M., Tchougreeff A.L. & Dronskowski R. (2010) Hydrogen-Bond Networks in Water Clusters $(H_2O)_{20}$: An Exhaustive Quantum-Chemical. *European Journal of Chemical Physics and Physical Chemistry*, **11**(2), 384–388.
Tsai C.J. & Jordan K.D. (1993) Theoretical Study of the $(H_2O)_6$ Cluster. *Chem. Phys. Letters*, **213**, 181–188.
Valcheva-Kuzmanova, S.V.&Belcheva, A. (2006) Current Knowledge of Aronia Melanocarpa as a Medicinal *Plant. Folia Med.*, **48** (2):11-7.
Valcheva-Kuzmanova, S.V, et al. (2005) Effect of *Aronia Melanocarpa* Fruit Juice on indomethacin-induced Gastric Mucosal Damage and Oxidative stress in Rats, *Experimental and Toxicological Pathology*, **56** (6):385-392.
Vazquez, B. et al. (1996) Anti-inflammatory Activity of Extracts Aloe Vera Gel, J. Ethnopharmacol, **55**: 69-75.
Vogler, B.K., Ernst. E. (1999) Aloe Vera a Systematic Review of the Clinical Effectiveness, *Br. J. Gen*: 825-828.
Wang H. et al. (1997) Oxygen Radical Absorbing Capacity of Anthocyanins, J. *Agric. Food Chem*., **45**: 304-309.
Wang F & Jordan K.D. (2003) A Parallel Tempering Monte Carlo Investigation of $(H_2O)_6^-$. *J. Chem. Phys*., **119**, 11645–11653.
Wang et al. (2007) Leoligin, the Major Lignan from Edelweiss (*Leontopodium nivale* subsp. *alpinum*), Promotes Cholesterol Efflux from THP-1 Macrophages, *J. Nad. Prod.*, **79**(6): 1651–1657.
Woodhead, R. (1984) *Molecular Biology of Aging*. NY, Basic Life Science, **35**, pp. 34–37.
Yang DJ et al. (2007) Effects of Different Steeping Methods and Storage on Caffeine, Catechins and Gallic Acid in Bag Tea Infusions, *Journal of Chromatography A*, **1156**: 312–320.
Yuan, Y.&Shao, Y. (2002) Systematic Investigation of Alkali Metal Ion transfer Across the Micro-and-nano-water/1,2-dichloroethane interfaces facilated by dibenzo-18-crown-6, *The Journal of Physical Chemistry B*, **106** (32): 7809–7814.
Zink, A. et al. (2014) Outbreak of *Microsporum audouinii* in Munich – the Return of Infectious Fungi in Germany, *Mycose*, **57** (12): 765-770**.**
Zhao, C. et al. (2004) Effects of Commercial Anthocyanin-rich Extracts on Colonic Cancer and Nontumorigenic Colonic Cell Growth. *J Agric Food Chem*., **52** (20):6122-8.
Zheng, W., Wang, S. Y. (2003) Oxygen Radical Absorbing Capacity of Phenolics in Blueberries, Cranberries, Chokeberries, and Lingonberries, *J. Agric. Food Chem.*, 502-509.
Zheng, W., Wang, S.Y. (2003) Oxygen Radical Absorbing Capacity of Phenolics in Blueberries, Cranberries, Chokeberries and Lingonberries, J. Agric Food Chem., **51** (2) 502-509.